CXPS-E101 Power Systems

Technical Guide: 0540569-J0

Effective: 08/2018

Alpha Technologies Ltd.

CXPS-E101
100A and 225A -48Vdc Power Systems

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:

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

For technical support, contact Alpha Technologies:

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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. Save this document for future reference.

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 Safety

WARNING!

This system is designed to be installed in a restricted access location that is inaccessible to the general public.

1.3 Mechanical Safety

- Keep hands and tools clear of fans. Fans are thermostatically controlled and switch on automatically.
- Power supplies can reach extreme temperatures under load.
- Use caution around sheet metal components and sharp edges.

1.4 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.

1.5 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 and installation of the Alpha Technologies CXPS-E101 series 100A and 225A 48Vdc power systems.

In addition to this manual, the following documents may be included in the documentation package that ships with the CXPS-E101:

- 0350058-J0 Cordex HP Controller Software Manual

2.2 Product Overview

The CXPS-E101 series power systems are complete integrated 48Vdc power systems available in either 100A or 225A capacities. Each system uses the advanced Cordex CXCM1 controller and HP 48V 1.2kW rectifier modules. The CXDM-E1 1RU 225A distribution panel provides front access for DC distribution circuit breakers.

Cordex 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 120/208/220/230/240/277 Vac, 50/60 Hz. The system has de-rated output below 176Vac input. See specifications in the next section.

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 Alpha Cordex CXCM1 modular controller.

This system uses the controller modular version, which is factory installed on the Cordex rectifier system shelf.

The CXCM1 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, e-mail 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 manual.

Figure 1 — Front view of the CXPS-E101 48V 225A

2.3 System Configurations

The following configurations are currently available for the CXPS-E101 power system. For more ordering information, refer to the CXPS-E101 Ordering Guide on the Alpha website.

Table A — Configuration

CXPS-E101 Configuration Table								
Rack Size	**Controller**	**Current Rating**	**Rectifier Capacity**	**Load Breakers**	**Battery Breakers**	**Shunt**	**LVBD**	**Height**
19"/ 23"	CXCM1+	100A	4x 1.2kW (1 shelves)	10	2	250A	225A	2 RU
19"/ 23"	CXCM1+	225A	9x 1.2kW (2 shelves)	10	2	250A	225A	3 RU
19"/ 23"	CXCM1 HP	225A	9x 1.2kW (2 shelves)	10	2	200A	225A	3 RU

2.3.1 100A Configuration - with CXCM1+ Controller (0540569-001)

- CXDM-E1 high density 1U 225A distribution center
- Cordex modular system controller (CXCM1+)
- One Cordex HP 48-1.2kW rectifier shelf (four positions total)
- Kydex rear cover
- User switchable 19" rack mount bracket for center mount
- 19" to 23" rack mount adaptors

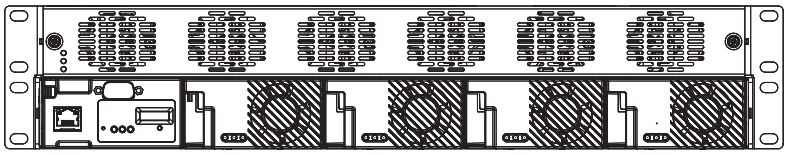


Figure 2 — CXPS-E101 100A Configuration

2.3.2 225A Configuration - with CXCM1+ Controller (0540570-001)

- CXDM-E1 high density 1U 225A distribution center
- Cordex modular system controller (CXCM1+)
- Two (2) Cordex HP 48-1.2kW rectifier shelves (nine positions total)
- Kydex rear cover
- User switchable 19" rack mount bracket for center mount
- 19" to 23" rack mount adaptors

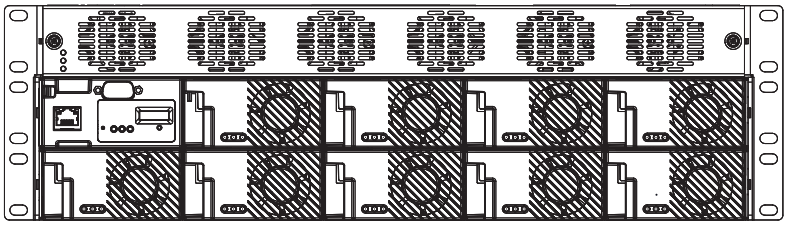


Figure 3 — CXPS-E101 225A Configuration

2.3.3 225A Configuration - with CXCM1 HP Controller (0540570-401)

- CXDM-E1 high density 1U 225A distribution center
- Cordex modular system controller (CXCM1 HP)
- Two (2) Cordex HP 48-1.2kW rectifier shelves (nine positions total)
- Kydex rear cover
- User switchable 19" rack mount bracket for center mount
- 19" to 23" rack mount adaptors

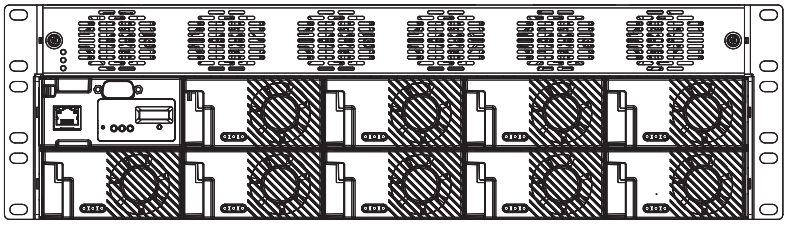


Figure 4 — CXPS-E101 225A (CXCM1 HP) Configuration

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

3. Specifications

Table B — CXPS-E101 Series - 48Vdc Power Systems			
Electrical			
Output			
Voltage:	48Vdc (nominal)		
	CXPS-E101 225A Capacity System:	**CXPS-E101 100A Capacity System:**	**1.2 kW Rectifier Module:**
Current:	225A max @ 48Vdc (nominal input)	100A max @ 48Vdc (nominal input)	25A max @ 48Vdc (nominal input) 12.5A max @ 48Vdc (115Vac input) (subject to additional de-rating below 110Vac input)
Power:	10800W max @ 48Vdc (nominal input)	4800W max @ 48Vdc (nominal input)	1200W max @ 48Vdc (nominal input) 600W max @ 48Vdc (115Vac input)
Heat Dissipation:	308 BTU per rectifier module		
Static Load Regulation:	Better than ±0.5% for any load change within rated limits		
Dynamic Load Regulation:	Better than ±2% for 10% to 90% load step (output shall recover to static limits within 10ms)		
Static Line Regulation:	Better than ±0.1% for any change in input voltage within rated limits		
Dynamic Line Regulation:	Better than ±1% for any change in input voltage within rated limits (output voltage should recover to static limits within 2ms)		
Electrical Noise:	< 38 dBrnC (voice band) < 30 mVrms 10kHz to 10MHz (wideband) < 150 mVp-p 10kHz to 100MHz < 2.0mV (psophometric)		
Acoustic Noise:	< 60 dBa @ 1m (3ft.) @ 30°C (86°F)		
Input			
Voltage:	Operating: 208/220/240/277 Vac (nominal) Operating Range: 90 to 320 Vac (continuous) 90 to 176 Vac (de-rated output power)		
Frequency:	45 to 66Hz		
Current:	7.5A max (176 to 320Vac) per module 6.0A max (90 to 176Vac) per module		
Efficiency:	> 93% (50 to 100% load at nominal input voltage)		
Power Factor:	> 0.99		
Recommended Feeder Breaker:	Single Phase 15A, 120Vac, #14 AWG for every two rectifier modules Single Phase 20A, 208/220/240Vac, #12 AWG for every two rectifier modules		
Electrical Noise:	< 38 dBrnC (voice band) < 10 mV_{RMS} 10 kHz to 10 MHz (wideband) < 150 mVp-p 10 kHz to 100 MHz		

Table B — CXPS-E101 Series - 48Vdc Power Systems			
Mechanical			
	CXPS-E101 100A Capacity System:	**CXPS-E101 225A Capacity System:**	**Rectifier:**
Dimensions, H x W x D	90 x 438 x 381mm (3.5 x 17.24 x 14.35in)	133 x 438 x 381mm (5.25 x 17.24 x 14.35in)	
Weight	18.3kg (40.4lbs)	21.3kg (47lbs)	1.2kg (2.7lbs) each
Mounting	19/23" universal mount (center)		
Environmental			
Temperature	-40 to +65°C (-40 to +149°F) -40 to +75°C (-40 to +167°F) de-rated output **NOTE:** For installations in ambient temperatures >30°C, ensure that there is an adequate level of internal air circulation.		
Relative Humidity	0 to 95% Relative Humidity non-condensing		
Elevation	-500 to +2800m, to 4000m with temperature de-rated to 40°C (-1640 to 9186ft, to 13124ft with temperature de-rated to 104°F) with de-rated output		
Connections			
Load Breaker	10x sets, ¼"-20 studs on ⅝" centers		
Battery Breaker	2x sets, ¼"-20 studs on ⅝" centers		
Return Bar	12x sets, ¼"-20 studs on ⅝" centers		
Alarm	Screw terminal 1.31 mm^2 to 0.128 mm^2 (#16 to #26 AWG)		
Compliance			
EN 60950	Designed to meet the following standards.		
UL			
CSA			
CE			
Telcordia (Bellcore)			
EN 300 386-2			
EN 55022 (CISPR 22)			
EN 61000-3-2			
EN 61000-3-3			
EN 61000-4-2			
EN 61000-4-3			
EN 61000-4-4			
EN 61000-4-6			
EN 61000-4-11			
ETS 300 019-1-1			
ETS 300 019-1-2			
ETS 300 132-2			
ETS 300 753			
IEC 60950			

4. Features

4.1 CXDM-E1 Distribution Panel

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

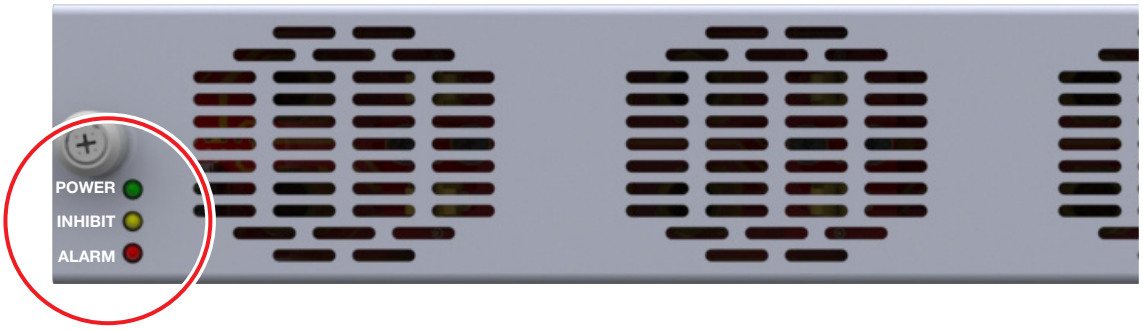


Figure 5 — Front Panel Status Indicators

The CXDM-E1 contains 12 total 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 as shown in Figure 6.

NOTE:

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

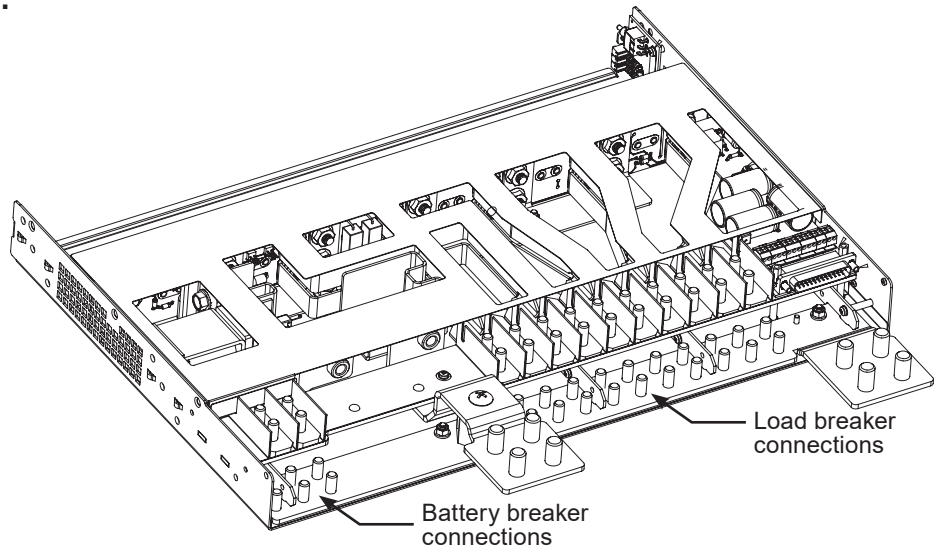


Figure 6 — CXDM-E1 Rear Output Connections

4.1.3 Low Voltage Battery Disconnect (LVBD)

A 225A 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.

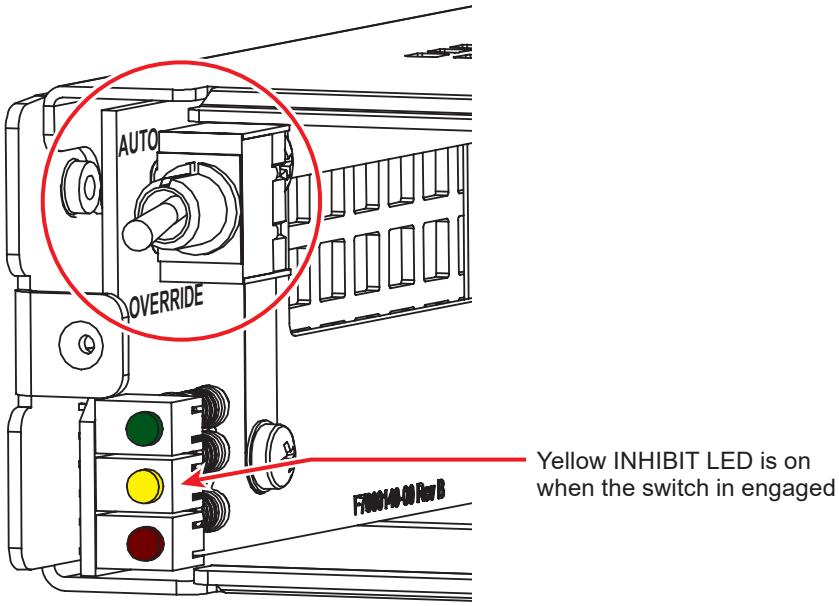


Figure 7 — LVBD Override Switch (front cover removed)

4.2 Overview of the CXCM1+ Controller

4.2.1 CXCM1+ Controller Front Panel

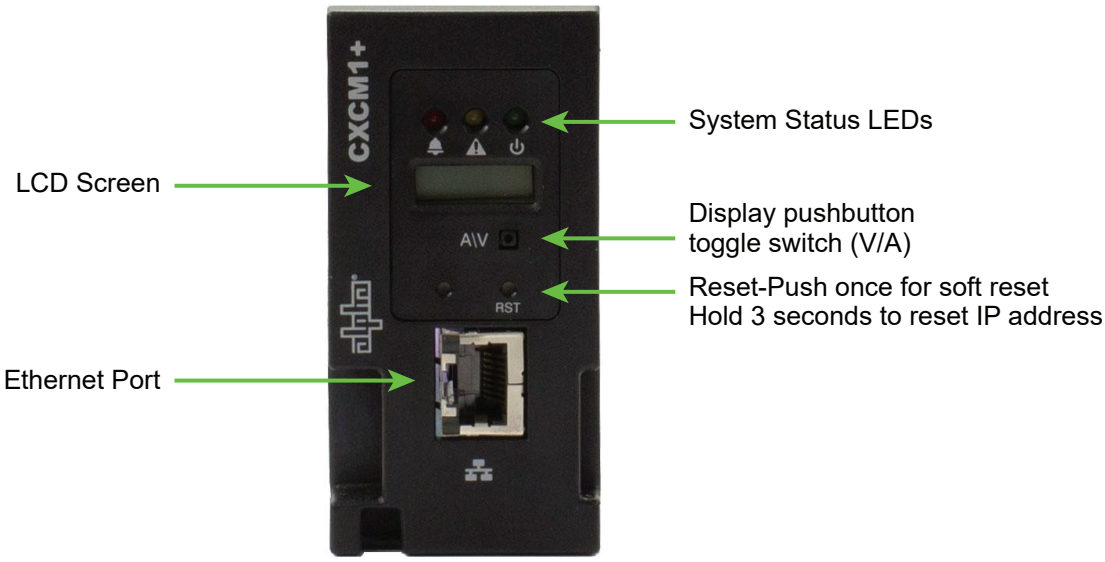


Figure 8 — CXCM1+ Controller Front Panel

4.2.2 LCD Screen

The controller front panel uses a 4-digit LCD screen to monitor the system voltage (V) and current (A). A push-button toggle switch allows the user to alternate the display reading.

4.2.3 LEDs

The controller has three LEDs located on the front panel. These are used to display the alarm status of the power system, controller progress and status during startup, file transfers and lamp tests.

Alarm Conditions

The CXC illuminates the LED that corresponds to the alarm status. Only one LED is illuminated at a time during alarm conditions:

- Green: OK, no alarms present
- Yellow: Minor alarm is present (no major alarms)
- Red: Major alarm is present

Progress and Status Indication

The LEDs are also used in the following situations:

- Base unit validation: All three LEDs on simultaneously
- File transfer: Red LED illuminates when recovering from invalid firmware application
- Lamp Test: All three LEDs flash in sync for two seconds

4.2.4 Reset

A reset button is located on the front panel for restarting the controller. During reset, the controller may occasionally need to run a defragmentation cycle. This can be recognized by the LEDs cycling on the front panel. A full defragmentation may take up to 20 minutes to perform, do not power down the controller during this time.

Note: Refer also to the software manual – always select the Reset menu item before pressing the reset button.

4.2.5 Ethernet Port

The Ethernet port is designed for connection to a user supplied network (TCP/IP secured by user) via a front panel

RJ-45 jack and a standard network cable.

Local access (e.g. laptop computer) is also possible from the Ethernet port connection using a standard network cable.

4.2.6 Analog Input Channels

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

Voltage Inputs

Two voltage input channels, V1 and V2, provide monitoring of discharge and charge voltage. The CXC software is preconfigured to monitor V1 for battery voltage and V2 for load voltage.

V2 is wired internally to the rectifier shelf to provide a reference for rectifier float voltage, low voltage disconnect (LVD), system high voltage alarm, and system low voltage alarm.

Wire V1 to battery to monitor battery voltage or change battery setting from V1 to V2 in **Signals > Configure Signals**.

Current Inputs

The CXC software is pre-configured to monitor I1 for battery current, wired internally to the battery current shunt.

Temperature Inputs

Two temperature input channels, T1 and T2, provide monitoring of battery temperature and temperature compensation (temp comp) or room/ambient temperature.

4.2.7 Digital Input Channels

The controller can accommodate up to two channels and can monitor digital alarm/control signals from rectifiers, converters and many other types of equipment.

4.2.8 Alarm and Control Output Relays

The controller contains four Form C digital alarm output relays to extend alarms and control external apparatus. Each internally generated alarm or control signal may be mapped to any one of the relays, or, several signals may be mapped to just one relay or none at all.

4.2.9 Network Connection and Remote Communication

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

A step-by-step connection wizard – provided to establish remote communications with your CXC – is available via the Alpha website (http://www.alpha.ca/downloads).

4.3 Overview of the CXCM1 HP Controller

4.3.1 CXCM1 HP Controller Front Panel

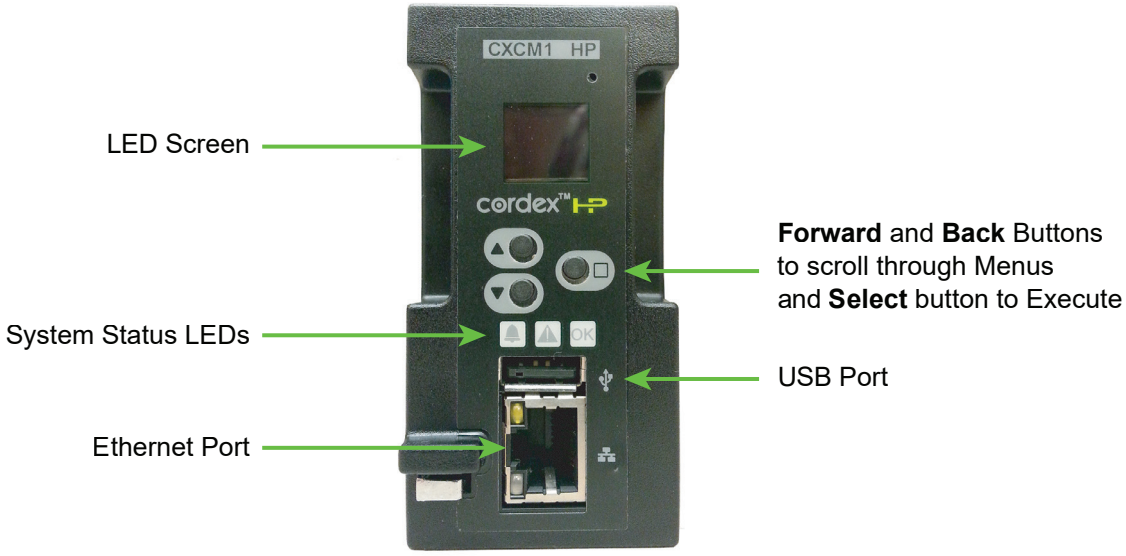


Figure 9 — CXCM1 HP Controller Front Panel

4.3.2 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.

The following figure below shows examples of the screens.

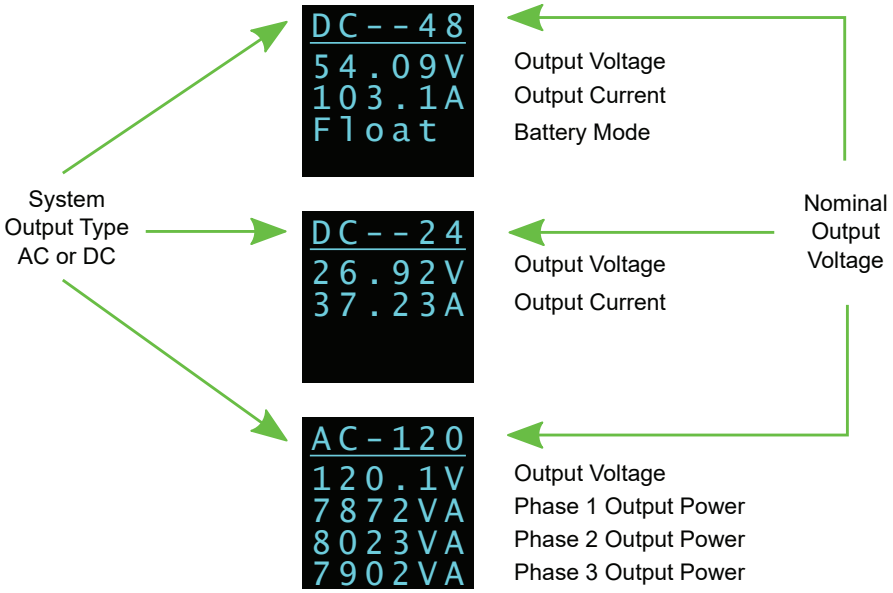


Figure 10 — In-Shelf Controller Dashboard Screens

4.3.3 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 screens on the CXC HP.

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, press the **Select** button.

To exit a menu and return to the main OLED dashboard, scroll to the **Back** command, and then press the **Select** button. The figure below shows an example of the menu screen. The following table provides a full list of menus available via the in-shelf display.

Figure 11 — In-Shelf Controller Full Menu

Table D — In-Shelf Controller Full Menu

Menu Label	Description
ALCO	Perform the alarm cut-off command
Reset	Perform a software reset of the controller
IPv4	Display the IPv4 address, subnet and gateway for this controller
IPv6	Display the IPv6 addresses assigned to this controller
Backup	Backup the controller application and configuration to a file on a USB device
Restore	Restore the controller application and configuration from a file on a USB device
Upgra...	Upgrade the controller application from a file on a USB device
OS Upg	Upgrade the controller's operating system from a file on a USB device
Info	Display controller information including serial number, part number, software and hardware version
Rotate	Rotate the in-shelf controller display information by 90 degrees
Back	Exit the menu and return to the OLED dashboard

4.3.4 In-Shelf Controller Buttons

The in-shelf controller can be mounted vertically or horizontally. The contents of the display can be rotated, but the buttons cannot be rotated. The following figures show how the buttons are interpreted for both mounting options.

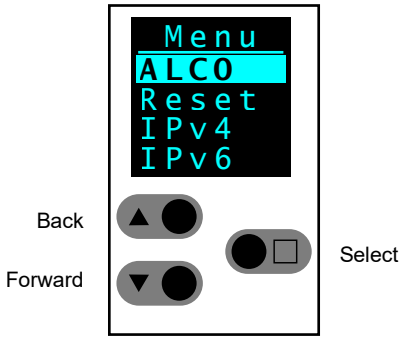


Figure 12 — In-Shelf Controller Buttons: Vertical Mount

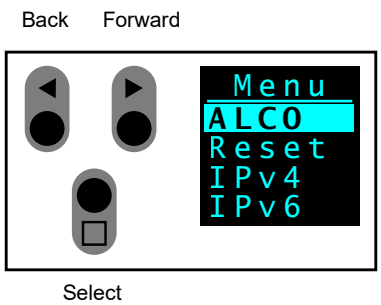


Figure 13 — In-Shelf Controller Buttons: Horizontal Mount

4.4 Cordex CXRF-HP Rectifier

The Cordex CXRF-HP series of 48V 1.2kW rectifier modules employ high frequency, switch mode technology featuring high power conversion efficiency. All internal semiconductor devices operate under “soft-switching” conditions and exhibit very low power loss. The reduced power loss leads to lower thermal stress on the semiconductors and thus improves reliability.

Sustaining low component temperatures is again the primary factor with meeting the three worst-case field scenarios: (1) 65°C ambient temperatures, (2) full output power, and (3) low AC input (176Vac). While meeting these specifications, Cordex rectifiers also offer roughly twice the reliability at 55°C and up to four times more at 45°C ambient temperature.

4.4.1 Rectifier Front Panel

Figure 14 — Rectifier Front Panel

4.4.2 LEDs

The front panel LEDs provide rectifier status summary and help to locate a specific module with the controller.

AC ⏻

The top LED (green) is on when AC is within valid range and the rectifier is delivering power to the load. The LED will flash (~2Hz) when AC is outside the nominal range – AC voltage is invalid if the AC Mains Low or AC Mains High alarm is active. The LED turns off when AC has failed (or no AC power is present).

DC ⎓

The middle LED (green) is on when the rectifier is delivering power to the load. The LED turns off when the rectifier is off; e.g., when commanded via the controller.

Alarm 🔔

The bottom LED (red) is on continuously in the event of an active Module Fail alarm. The LED flashes (~2Hz) when a minor alarm is detected. The LED remains off in the absence of an alarm. If the unit output is not connected to a battery or parallel rectifier, the LED extinguishes if no AC power is present.

LED Activity During “Locate Module” Command from Controller

When the “locate module” command has been received from the controller, the LEDs behave in a distinctly different way so that the rectifier is easier to visually identify among adjacent rectifiers.

This state is entered when commanded via the controller. The LEDs flash in a distinct pattern repeating every two seconds.

LED Activity During Firmware Upload

When a rectifier firmware upload is in progress, the LEDs behave in the same way as the locate module command described above.

4.4.3 Mechanical

A locking clip automatically secures the rectifier into the shelf.

4.4.4 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% 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[1].

A minimum 2.5% 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.

NOTE:

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

4.4.5 Heat Dissipation

Cooling of the module is front-to-rear with the exhaust air exiting at the back. The fan is variable speed; which is determined by heatsink temperature and load.

4.4.6 Over Temperature Protection

Each rectifier module is protected in the event of an excessive increase in temperature due to component failure or cooling airflow blockage. During over temperature conditions, the rectifier limits the output power as well as the output current. If temperature continues to increase, a shutdown of the rectifier is initiated. The rectifier shall restart automatically if the temperature has returned to a safe level.

4.4.7 Wide AC Range

A minor alarm is generated when the AC input voltage drops below specification.

- Output power is reduced linearly between 176Vac and 132Vac to 60% of the rated output power.
- Input current is limited to less than 6A for operation from 132Vac to 90Vac. Power is derated linearly between 132Vac (~700W) to 90Vac (~475W).
- At a lower voltage the module will shut down and will not restart until the AC is greater than 90Vac.
- For voltages above 277Vac, power factor and total harmonic distortion may be derated. Up to 320Vac, the rectifier may not be operational but shall not suffer any damage.

4.4.8 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.

4.4.9 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.

[1] 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.

4.4.10 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.

4.4.11 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 short circuit at the output terminals indefinitely. The maximum short circuit current cannot exceed 105% of the rated full load current.

4.4.12 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.

NOTE:

Current limiting overrides the power-limiting feature.

4.4.13 High Voltage Shutdown (HVSD)

This 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.

4.4.14 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 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.

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 Power System Assembly and Mounting

WARNING!

The E101 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 1RU (1¾") of space above the unit to access connections points and provide adequate cooling.

6.3.1 Rack Mounted Systems

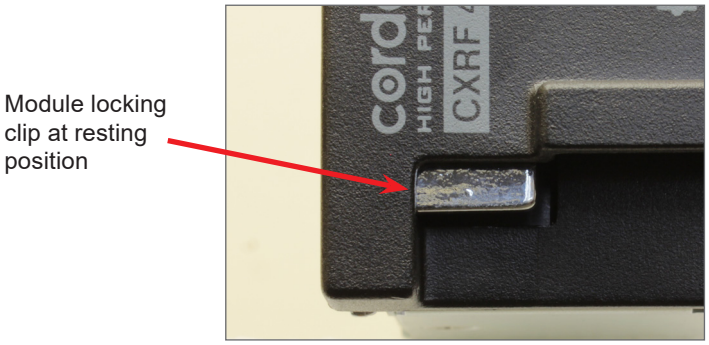
Attach the power system to the customer-provided relay rack using mounting screws and star washers. This will ensure an electrical bond between the system chassis and relay rack.

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

6.4 Rectifier Module Insertion/Removal

6.4.1 To Insert a Module

1. Place the module on the shelf bottom and slide it into the rear connector.
2. Apply pressure to the module to make it connects properly.
3. Use the locking clip to secure the rectifier into the shelf.



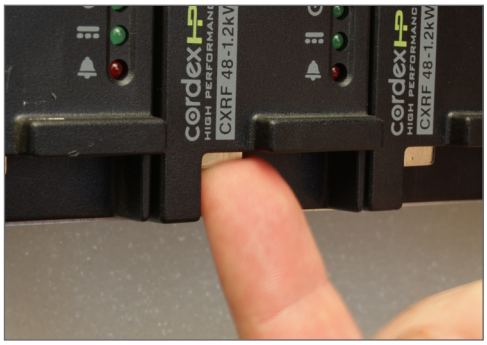
NOTE:

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

6.4.2 To Remove a Module

1. Insert a finger into the open slot of the rectifier.

2. Push up on the metal tab to unlock the locking clip.
3. With the other hand, pull the rectifier out of the shelf using the finger opening.



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.

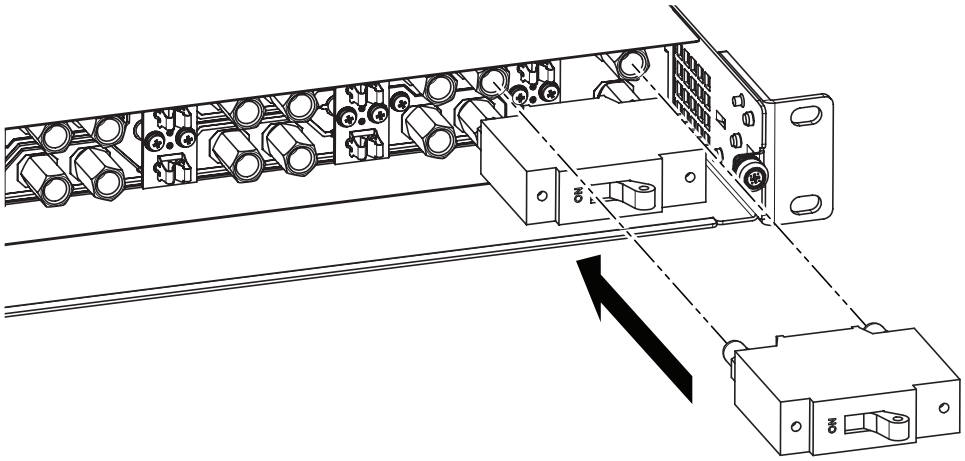


Figure 15 — Breaker Installation

6.5.2 To Remove a Breaker

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

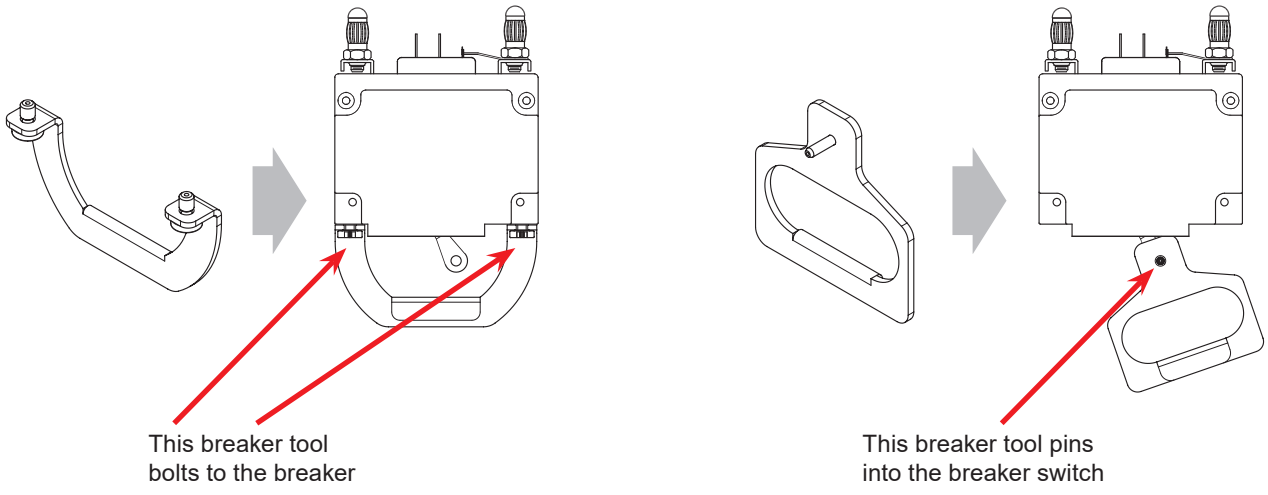


Figure 16 — Breaker Removal Tools

6.6 Battery Installation

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.

6.5.3 Preparation/Mounting

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

Provide adequate ventilation. VRLA batteries, though not requiring 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 as per the battery manufacturer's recommendations. First neutralize any acid with a baking soda and water solution, then wipe the cells with clean water.

6.5.4 Installation of Batteries

WARNING!

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-lbs).

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 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 E — Typical VRLA battery maintenance report

Cell #	Serial #	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 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

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 x LF x 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 F for cable size equivalents.

Table F — 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
00 AWG (or 2/0)	133100	67.42	70
0000 AWG (or 4/0)	211600	107.2	120

Table G — Cable size equivalents (AWG to Metric)			
Cable size	**Circular mils**	**Square millimeters**	**Equivalent metric cable**
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

7.4.1 Recommended Torque Values

Table H 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 bus bar)

Grade 5 rated hardware is required for these torque values.

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

7.2 Ground Sizing

Connect the isolated power system battery return bus (BRB) to the building master ground bus (MGB) or floor ground bus (FGB) in larger buildings. This acts as a system reference and a low impedance ground path for surges, transients, noise, etc. The MGB or FGB should have a direct low impedance path to the building grounding system. Size the cable between the power system and the MGB or FGB so that there is 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 be factored in. The insulated cable should be equipped with two-hole crimp type lugs and should not have any tight bends or kinks.

The power system frame must also be connected to the MGB or FGB for safety reasons and to meet standard Telco grounding requirements. Each bay must have its own frame or site ground connection. Refer to the customer connections drawing at the rear of this manual.

7.3 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.

7.4 AC Wiring

Ensure that all modules are removed from the shelf. Refer to customer connections drawing. The shelf incorporates IEC plug connections, which require line cords with C19R type receptacles. Contact Alpha for information on available cords.

7.5 DC Wiring

WARNING!

Leave the cables or bus bars 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; i.e., +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 V 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 V 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 Chassis Ground and Return Bus Bar Connections

The CXPS-E101 has two ground connections: one for chassis ground to the rack and the other to connect the return bus to the main grounding bus (MGB). The recommended wire size is #2 AWG (35mm²) insulated cable.

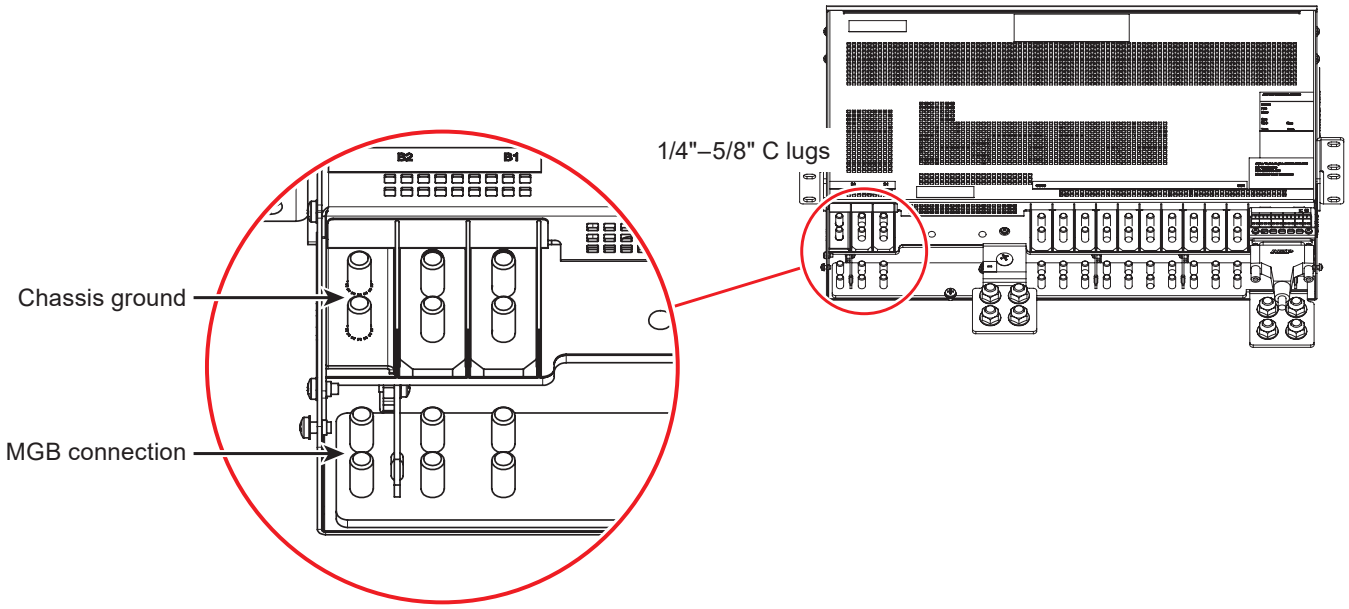


Figure 17 — Ground and Return Busbar Connections

1. Use the two studs shown in Figure 8 to connect the return bus (+) to the building master ground bus (MGB). Recommended wire size is #2 AWG (35mm²) insulated cable.
2. Connect chassis ground to the rack. Recommended wire size is #6 AWG (13.29 mm²).

7.7.1 Battery Connections

WARNING!

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

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

Prepare, route and connect cables from power system to battery termination details. Terminating points should be burnished and a corrosion-inhibiting agent, such as NO-OX-ID “A”™, should be applied to all battery terminal connections.

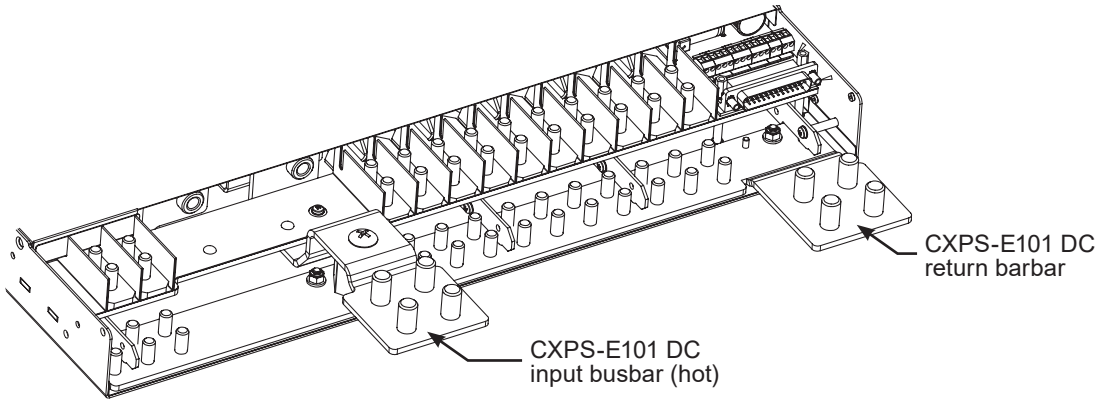


Figure 18 — Battery / Rectifier Bus Bar Connections

7.8 Distribution Cabling

7.8.1 Load Connections

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

Terminate distribution cabling with 1/4"–5/8" center lugs for connecting to CXPS-E101.

NOTE:

Connect load breaker returns before hot connections.

Connect Load Breaker Return 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 of the rear of the distribution center.
3. Secure cables to the cable tie brackets.

Connect Load 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.

7.8.2 Battery Breaker Connections

NOTE:

Final connection to battery live is not made until system startup—see "8. System Start-up". 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 center. Refer to Figure 19.

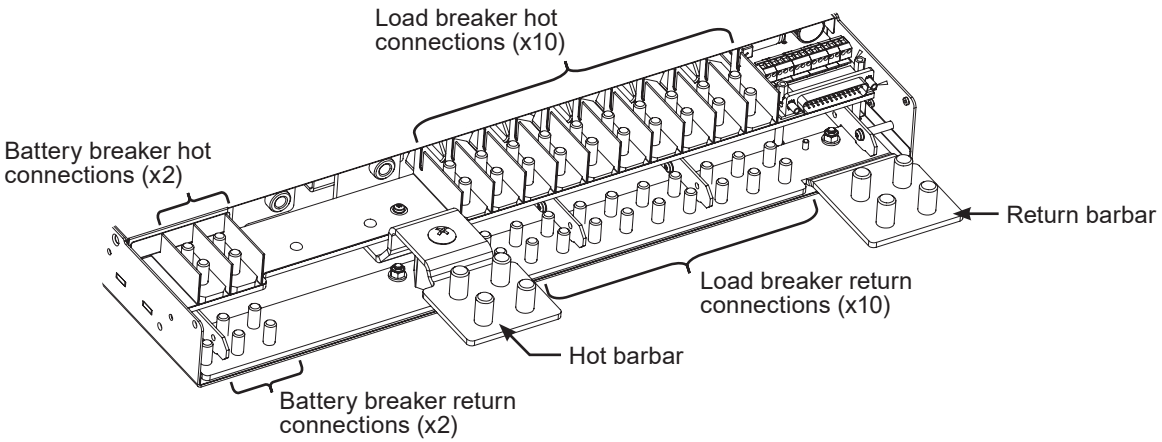


Figure 19 — Battery, Load, and Return Connection Locations

7.9 Alarm and Signal Connections

1. Locate the terminal block on the rear of the CXPS-E101. Refer to Figure 20 and the schematic drawing at the end of this manual for details on terminal block assignments.
2. Connect these alarms and signals to the local alarm-sending unit. Use wire sizes #20 to #26 AWG (0.518 to 0.14mm^2).

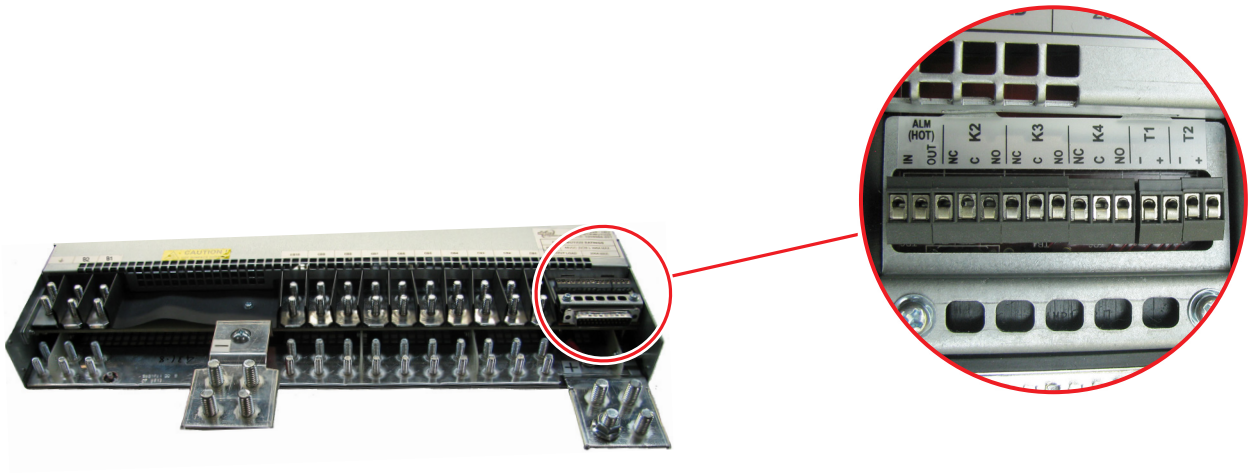


Figure 20 — Alarm and Signal Connections

7.10 Signal Wiring Connections for Controller

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

For terminal block connections, the recommended wire sizes are #16 - #26 AWG (1.5 - 0.129 mm^2) for the temperature range of 0 - 50°C (as per UL/CSA).

CAUTION!

To reduce risk of fire, use only 0.129 mm^2 (#26 AWG) or larger wire.

7.10.1 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. Figure 21.

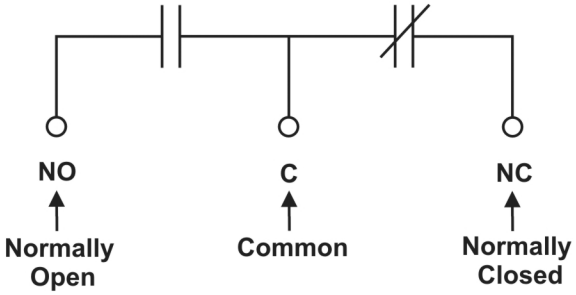


Figure 21 — Relay Connections

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.

7.10.2 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.

D1 and D2 are available for customer connections

Connection Method

Typical Alpha systems use a “reset with Hot and trigger with Ground” connection. The digital input is wired so that Hot is wired directly into one of the input terminals; e.g., negative input for -48 V systems. The other input terminal is wired to the common ground of the system through a relay, which is a dry contact usually located on the equipment that requires monitoring. This method allows the digital input to receive or not receive a Ground signal during an alarm. See Figure 22.

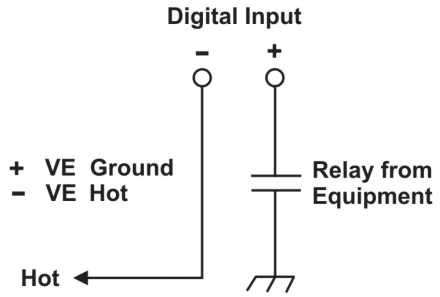


Figure 22 — Digital Input Connection Method

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 controller software manual for detailed instruction on programming.

Table I — Voltage level definitions for digital inputs

Voltage Range (Vdc)	Voltage Level (Vdc) considered as 0 or (Off)	Voltage Level (Vdc) considered as 1 (On)
0 – 60 (system voltage setting)	0–3	18–60

7.10.3 Analog inputs

WARNING!

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 that accommodate various types of analog signals.

The Battery Hot input terminal on the I/O board is factory wired to the battery system terminal. This is done so that the batteries will provide power to the controller when the main power circuit is disconnected from the batteries.

Voltage

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.

The Voltage Input #2 (V2) is wired internally to the rectifier output voltage of the shelf. This input is used as a reference for system alarms such as a high voltage, and for controls such as a low voltage disconnect.

Temperature sensor

The Temperature Probe input channels (T1 and T2) provide connections for temperature sensors. A voltage is supplied to these terminals for sensor measurements.

Current

The Current Input #1 terminal (I1) is factory wired to the battery shunt.

7.11 CAN Serial Ports

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

The CAN serial ports on this system are daisy-chained from one node to the next (CAN OUT of one shelf to CAN IN of the next). The system comes with the last shelf terminated and requires no further changes.

This system has a limit of nine 1.2 kW rectifiers installed. They do not have self-powered CAN bus nodes.

7.11.1 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.

7.12 Network Connection and Remote Communications via Controller

Network connection and remote communications via controller

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. Pin-outs are shown in the customer connections drawing.

Some standard scenarios are described below:

7.12.1 Ethernet Port for Network Connection (standard network cable)

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.

7.12.2 Ethernet Port for Local Connection (crossover cable)

The Ethernet port can be used for local access to a laptop computer. Use a standard network crossover 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. Use a web browser to access the adjustments menu of the controller. Set the float and equalize the 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 (Temp Comp) feature on the **Batteries** menu. Program the slope setting and the upper and lower breakpoints according to the specific battery requirements.

8.3.1 Controller Alarm Configuration for Nominal 120Vac Operation

The default setting for the low AC input alarm is 180Vac. For a nominal 120Vac input, reset this value to 100Vac.

1. Select **Alarms > Configure Alarms**. Under **Alarm Configuration**, select **Voltage Alarms**.
2. Select and modify the activation value for **AC Mains Low** to 100Vac.
3. Submit the changes to save the new configuration.

8.4 Controller Reset

CAUTION!

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.

8.4.1 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.

CAUTION!

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 defragmenation can take up to 20 minutes to perform DO NOT POWER DOWN the controller during this time

8.4.2 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 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; e.g., to a laptop via an ethernet cable. See the software manual for details.

8.4.3 Controller Hard Reset

There is a second reset button located to the right of the front panel on the side of the controller. This button is used to restart the microprocessor if the front panel (soft) reset button does not work.

CAUTION!

Use of the hard reset button may cause loss of data.

1. To access the hard reset button, remove the rectifier module adjacent to the controller.

8.5 LVD Control

CAUTION!

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.

CAUTION!

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.

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

8.5.1 Operation of the LVD Auto/Bypass Switch and Status LED

The LVD auto/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 Cordex 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 Cordex controller will disconnect the battery supply if the voltage falls to a preset voltage.

To manually bypass the Cordex controller and force the LVD to stay on regardless of the input from the Cordex 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 CXCM1 controller also illuminates and the alarm is logged in the event log.

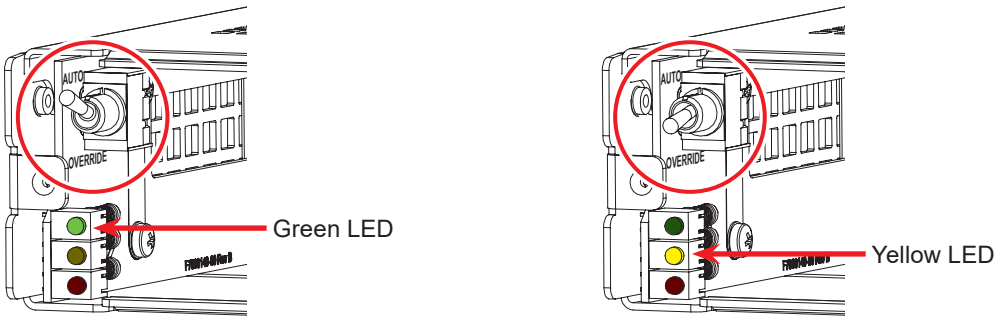


Figure 23 — LVD LED Status Indicators

9. Rectifier Modes and Factory Defaults

9.1 Rectifier Modes

There are two main rectifier modes: output voltage mode and the 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 five output voltage modes.

Table J — 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/Power Modes

These four output current/power modes directly affect the output current and power:

Table K — Output voltage 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. **Note:** Reduces the risk of tripping an AC breaker due to increased AC current draw as the AC voltage decreases.
Short circuit foldback mode	Short circuit at the output.
Internal fault foldback mode	Internal fault.

9.2 Factory Ranges and Defaults

The following table lists the rectifier settings/ranges/defaults; changes are made from the CXC:

Table L — Rectifier factory ranges and defaults

Setting	Range (minimum to maximum)	Default
Float (FL) Voltage	48 – 58V	54V
Equalize (EQ) Voltage	50 – 58V	55V
Battery Test (BT) Voltage	44 – 52V	46V
Over Voltage Protection (OVP)*	See note below – 59V	57V
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 – 59V	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

Note: 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 Alpha systems, routine checks and adjustments are recommended to ensure optimum system performance. Qualified service personnel should do the repairs. The following table lists a few maintenance procedures for this system. These procedures should be performed at least once a year.

WARNING!

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

Circuit cards, including 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 M — Sample maintenance log

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

10.1 Rectifiers

It is recommended that every five years MOV surge suppressors are replaced (especially in areas of high lightning activity). See Cordex HP rectifier manual for general maintenance information.

10.2 Batteries

It is recommended that checks are made every six months for battery voltage, conductance, temperature, impedance, connections, etc. See battery manufacturer's manual for general maintenance information.

10.3 Troubleshooting

Table N — Troubleshooting		
Symptom	**Reason**	**Solution**
Distribution is not communicating with the controller	DB 25 cable is not plugged in.	Plug in DB 25 cable.
	Distribution panel is turned off.	Slide the POWER on/off switch to the ON (up) position on the logic board.
No load/battery circuit breaker trip alarm in controller, but red trip alarm LED on distribution panel is on, when a breaker trips	DB 25 cable is not plugged in.	Plug in DB 25 cable.
Contactor doesn't close when LVD activation countdown is finished	DB 25 cable is not plugged in.	Plug in DB 25 cable.
Contactor doesn't close when LVD bypass switch is toggled to the right and LVD status LED turned from green to yellow	DB 25 cable is not plugged in.	Plug in DB 25 cable.
LVD bypass alarm is on when LVD bypass switch is in AUTO position (left) and off when it is in the BYPASS 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	DB 25 cable is not plugged in.	Plug in DB 25 cable.
	The breaker doesn't have an auxiliary switch.	Only use breaker with auxiliary switch.

11. Warranty Statement and Service Information

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.

Warranty Statement

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

Product Warranty

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

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

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

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

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.

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.

Service Information

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

12. Acronyms and Definitions

AC	Alternating current
ANSI	American National Standards Institute
AWG	American Wire Gauge
BRB	Battery return bus
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

13. Certification

About CSA and NRTL

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

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

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

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

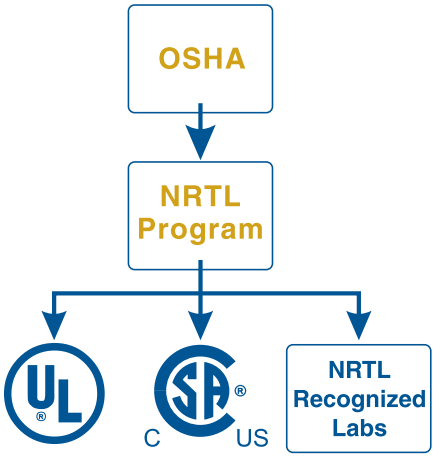
Only Underwriters Laboratories may grant a licence for the use of this mark, which indicates compliance with both Canadian and US requirements. (3)

NRTLs capabilities

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

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

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



Governance of NRTL

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

(1)www.csagroup.org

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

REVISIONS			
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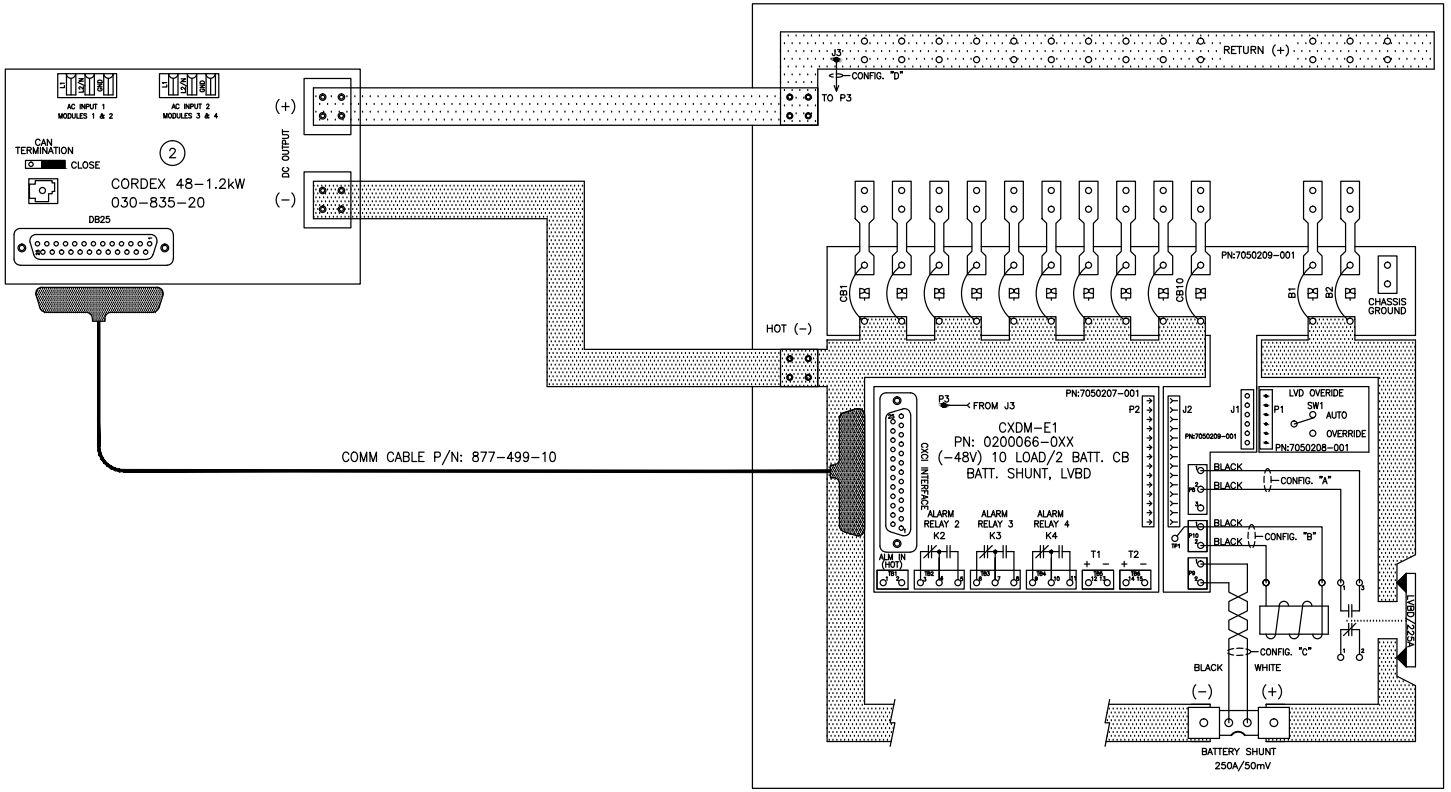

NOTES:

1) FOR CONTINUOUS OPERATION, IT IS RECOMMENDED THAT SHUNTS ARE NOT RUN AT MORE THAN 80% THE RATED CURRENT UNDER NORMAL CONDITIONS.
2) DASHED LINES DENOTE CUSTOMER WIRING.
3) ALL WIRES ARE #18-22 AWG EXCEPT AS NOTED.
4) NUMBERS IN BUBBLES REFER TO ITEM NUMBERS ON BILL OF MATERIALS.
5) " □ " REFERS TO WIRE TAG NUMBERS ON WIRES.

LTR	DESCRIPTION	QTY
	FINISHED HOLE LEGEND	

DESIGN	RW	13/12/23	MATERIAL
DRAWN	RW	13/12/23	
CHECKED	JK	14/01/24	
APPROVED	JK	14/01/24	FINISH
TOLERANCES (UNLESS OTHERWISE NOTED)			SCALE N/A

TITLE
CXPS-E101, -48V 100A,
1.2kW CXR, 10L/2B

ISSUE DATE | SHEET 1 OF 1

SIZE	TYPE	DWG NO.	REV
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DO NOT SCALE DRAWING

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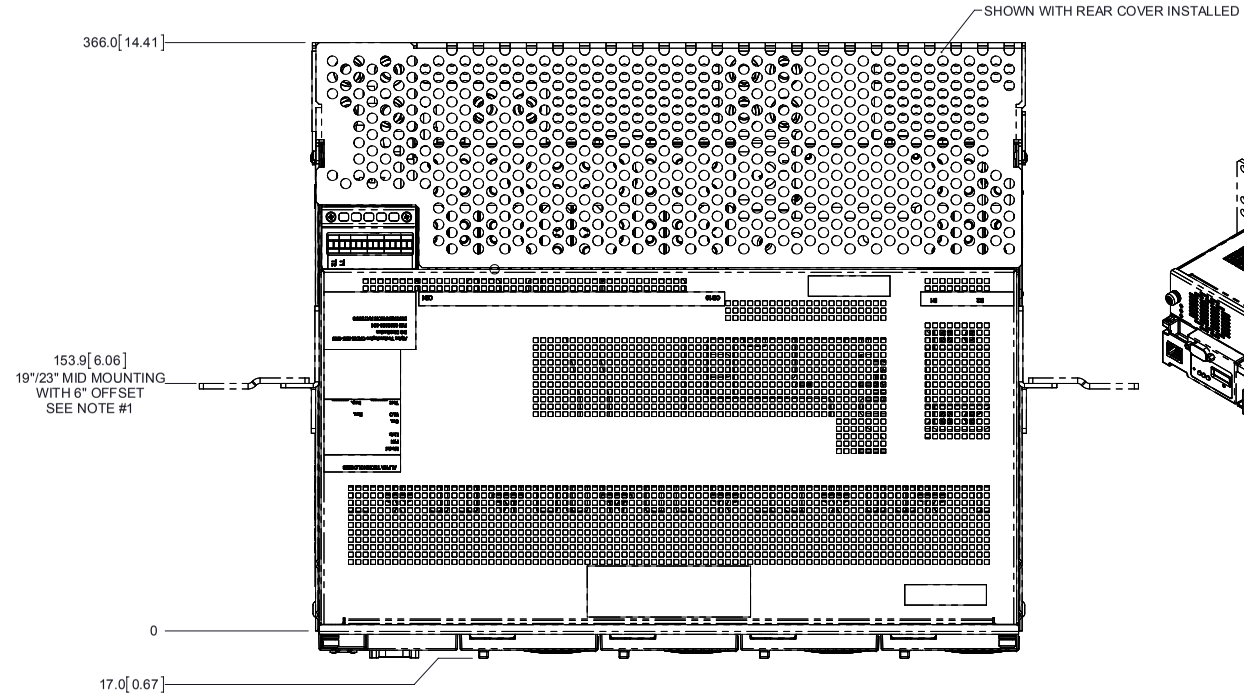

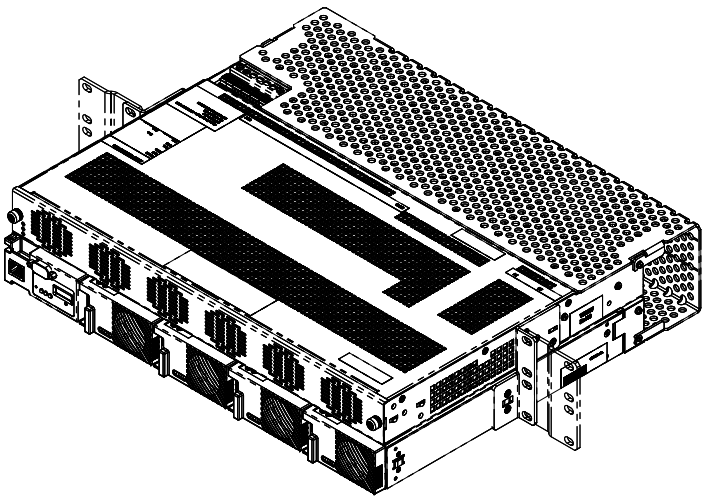

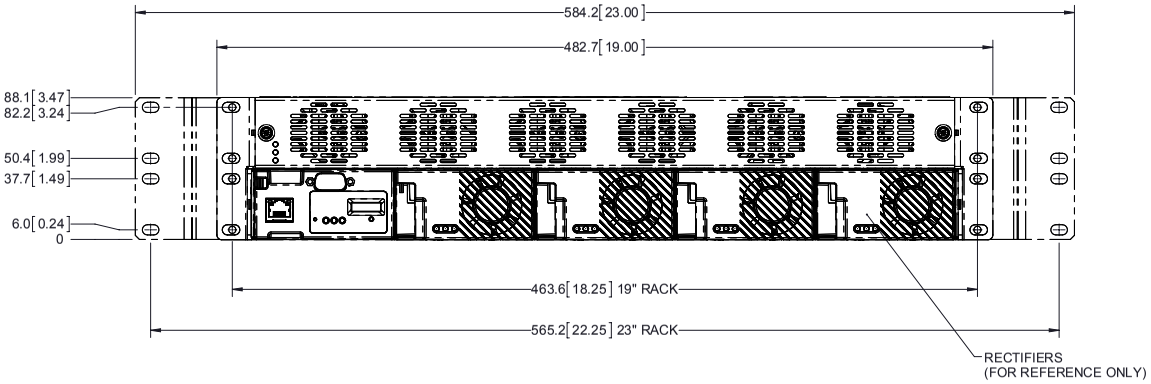

NOTES UNLESS OTHERWISE SPECIFIED:

1. SHOWN WITH 19" TO 23" MOUNTING ADAPTOR BRACKET
2. RECTIFIERS ARE SHOWN FOR REFERENCE ONLY, NOT INCLUDED IN SYSTEM

UNLESS OTHERWISE SPECIFIED DIM ARE IN MM	
X	1
X.X	0.5
X.XX	0.25
ANGULAR:	±1°
INTERPRET DIM AND TOL PER ASME Y14.5M-1994	
THIRD ANGLE PROJECTION	

APPROVALS		DATE
DRAWN	SY	01/17/04
CHECKED	RW	01/17/04

TITLE: OUTLINE DRAWING, CXPS-E101, 1.2kW

SIZE	DWG NO.	REV
B	0540569-06	B

SCALE: 1:1 SHEET 1 OF 1

DO NOT SCALE DRAWING

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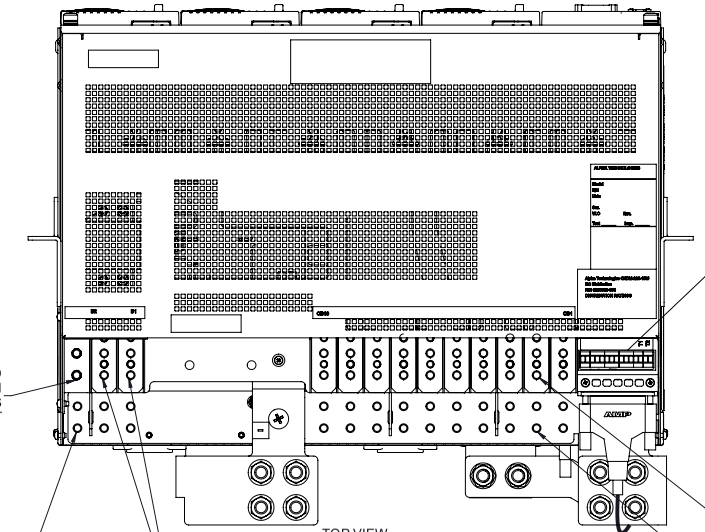

TOP VIEW
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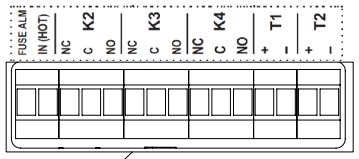
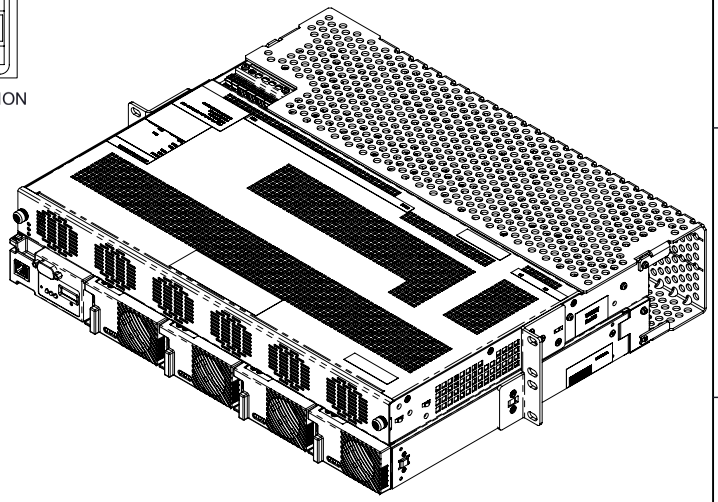


CUSTOMER I/O CONNECTION
TERMINAL BLOCKS

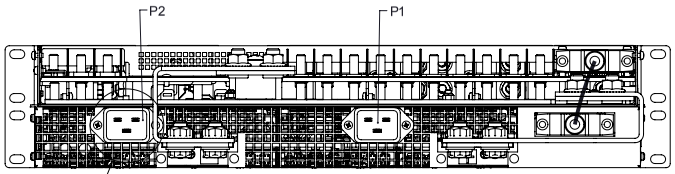
TERMINAL BLOCK NO.	SIGNAL NAME
1	FUSE ALARM IN (HOT)
2	
3	K2 - NC
4	K2 - COM
6	K3 - NC
7	K3 - COM
8	K3 - NO
9	K4 - NC
10	K4 - COM
11	K4 - NO
12	T1 +
13	T1 -
14	T2 +
15	T2 -
5	K2 - NO

LOAD BREAKER OUTPUT TERMINATIONS
1/4"-20 STUDS ON 5/8" CENTRES
10 SETS

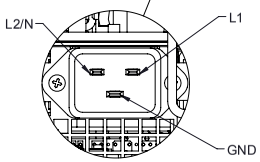
BREAKER RETURNS
1/4"-20 STUDS ON 5/8" CENTRES
10 SETS



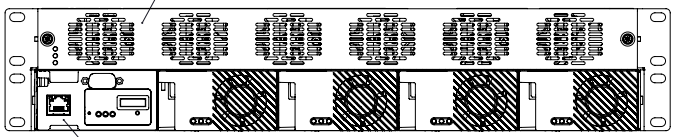
RECTIFIERS ARE SHOWN
FOR REFERENCE ONLY.
NOT INCLUDED IN THE SYSTEM



BACK VIEW
(SHOWN W/ REAR COVER REMOVED)
AC INPUT POWER LINE
CORD RECEPTACLES 2PL



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



FRONT VIEW

RECTIFIER SHELF W/ CXCM1 CONTROLLER
030-835-20

UNLESS OTHERWISE SPECIFIED DIM ARE IN MM	
X	1
X.X	0.5
X.XX	0.25
ANGULAR:	±1°
INTERPRET DIM AND TOL PER ASME Y14.5M-1994	
THIRD ANGLE PROJECTION	

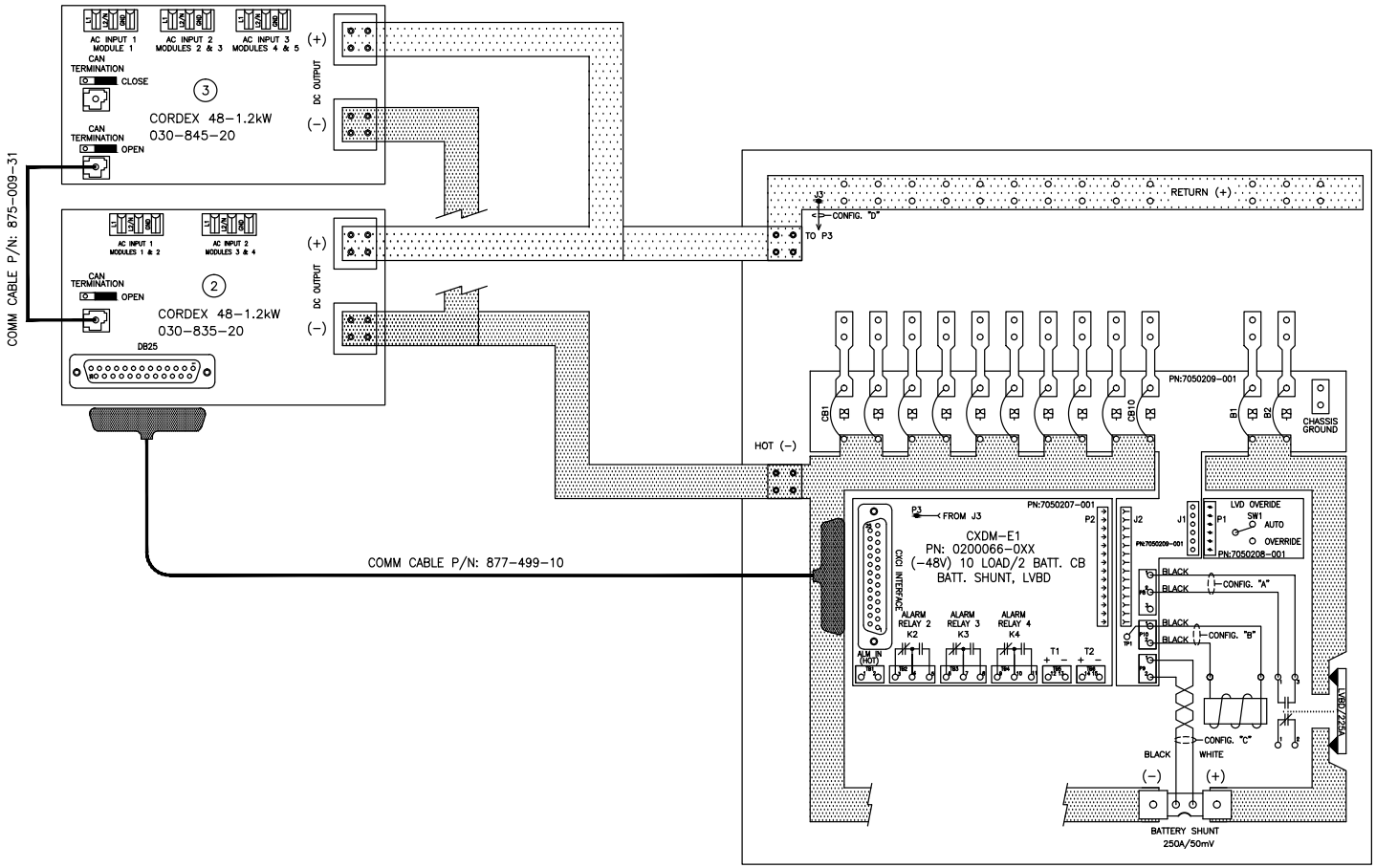
APPROVALS		DATE
DRAWN	SY	01/17/04
CHECKED	RW	01/17/04

ALPHA TECHNOLOGIES™

TITLE: CUSTOMER CONNECTION, CXPS-E101, 1.2kW

SIZE	DWG NO.	REV
B	0540569-08	B

SCALE: 1:1 SHEET 1 OF 1



NOTES:

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5) " □ " REFERS TO WIRE TAG NUMBERS ON WIRES.

REVISIONS			
LTR	DESCRIPTION	DATE	APPD
B	0200066 block updated per Rev D	03/14	RW

LTR	DESCRIPTION	QTY
	FINISHED HOLE LEGEND	

DESIGN	RW	13/12/23
DRAWN	RW	13/12/23
CHECKED	JK	14/01/24
APPROVED	JK	14/01/24

MATERIAL

FINISH

TOLERANCES (UNLESS OTHERWISE NOTED)

SCALE N/A

TITLE

CXPS-E101, -48V 225A, 1.2kW CXR, 10L/2B

ISSUE DATE

SHEET 1 OF 1

SIZE	TYPE	DWG NO.	REV
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DO NOT SCALE DRAWING

REVISIONS					
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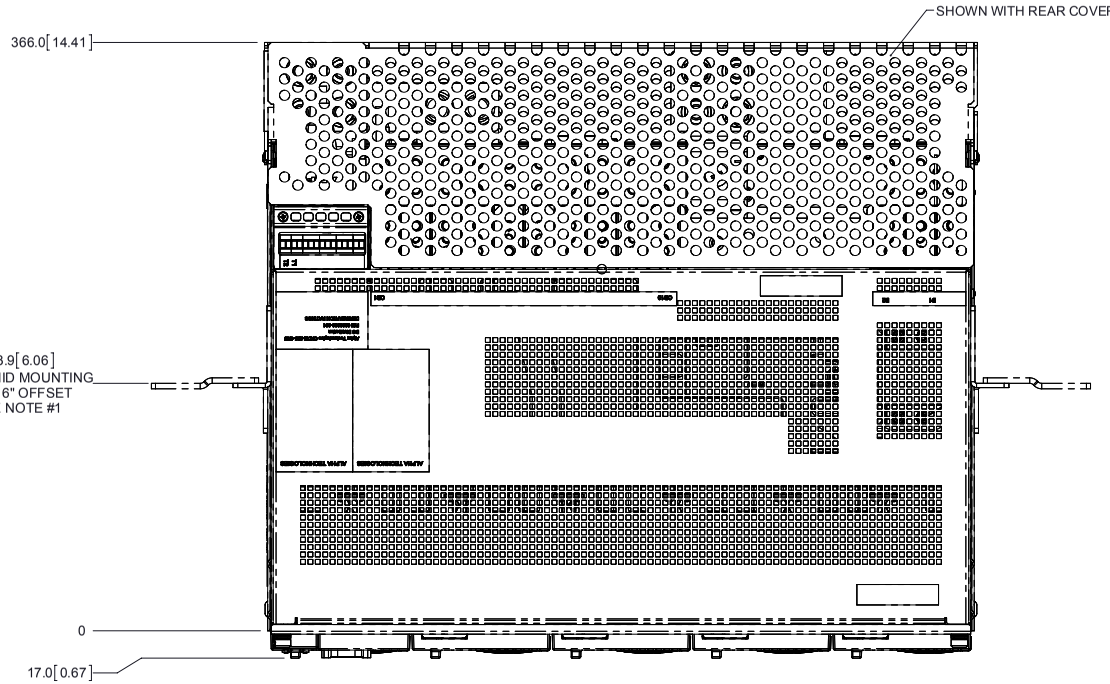

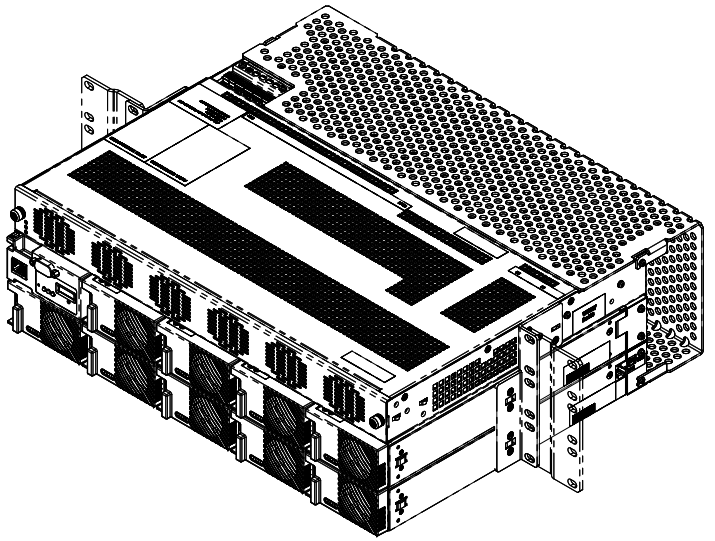

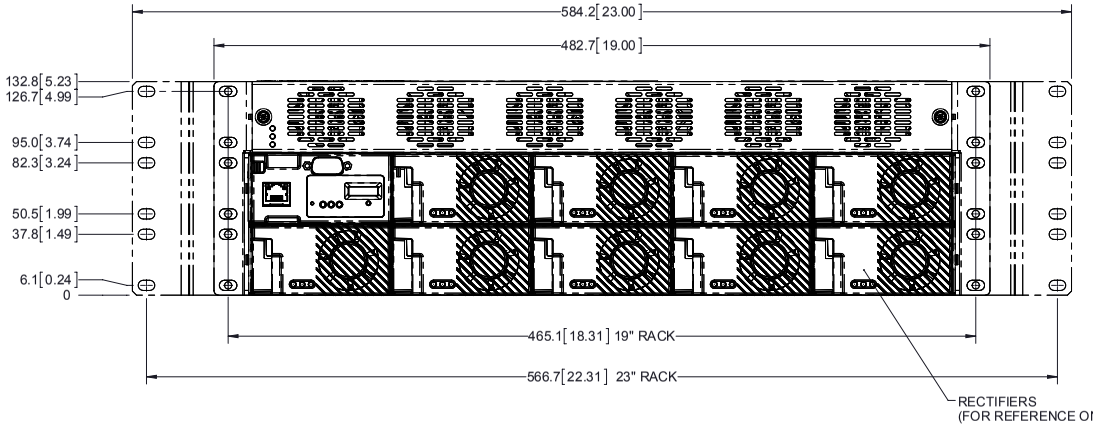

NOTES UNLESS OTHERWISE SPECIFIED:

1. SHOWN WITH 19" TO 23" MOUNTING ADAPTOR BRACKET
2. RECTIFIERS ARE SHOWN FOR REFERENCE ONLY, NOT INCLUDED IN SYSTEM

UNLESS OTHERWISE SPECIFIED
DIM ARE IN MM
X 1
X.X 0.5
X.XX 0.25
ANGULAR: ±1°
INTERPRET DIM AND TOL PER ASME Y14.5M-1994
THIRD ANGLE PROJECTION

APPROVALS		DATE
DRAWN	SY	01/17/04
CHECKED	RW	01/17/04

ALPHA TECHNOLOGIES™

TITLE: OUTLINE DRAWING, CXPS-E101, 1.2kW x2

SIZE	DWG NO.	REV
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SCALE: 1:1 SHEET 1 OF 1

DO NOT SCALE DRAWING

REVISIONS					
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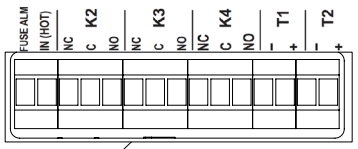
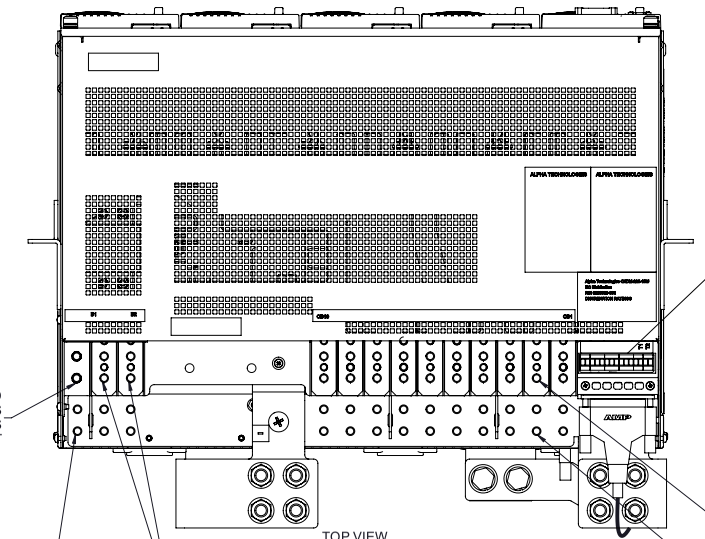
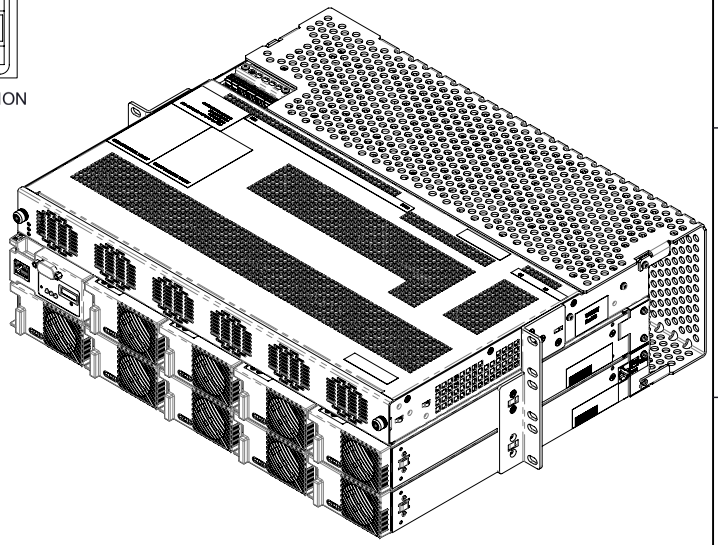


CUSTOMER I/O CONNECTION
TERMINAL BLOCKS

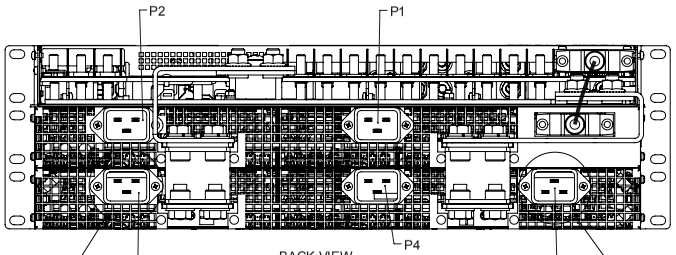
TERMINAL BLOCK NO.	SIGNAL NAME
1	FUSE ALARM IN (HOT)
2	
3	K2 - NC
4	K2 - COM
5	K2 - NO
6	K3 - NC
7	K3 - COM
8	K3 - NO
9	K4 - NC
10	K4 - COM
11	K4 - NO
12	T1 -
13	T1 +
14	T2 -
15	T2 +



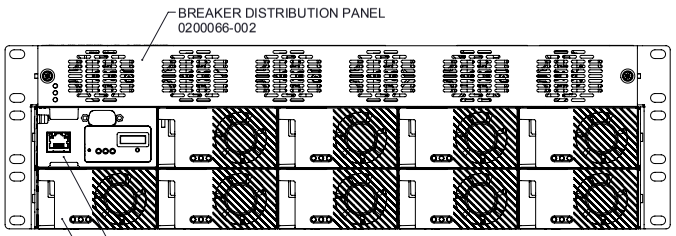
TOP VIEW
(SHOWN W/ REAR COVER REMOVED)



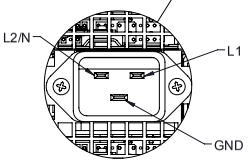
RECTIFIERS ARE SHOWN
FOR REFERENCE ONLY.
NOT INCLUDED IN THE SYSTEM

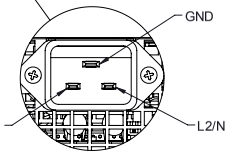


BACK VIEW
(SHOWN W/ REAR COVER REMOVED)
AC INPUT POWER LINE
CORD RECEPTACLES 5PL



FRONT VIEW





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

UNLESS OTHERWISE SPECIFIED
DIM ARE IN MM
X 1
X.X 0.5
X.XX 0.25
ANGULAR: ±1°
INTERPRET DIM AND TOL PER ASME Y14.5M-1994
THIRD ANGLE PROJECTION

APPROVALS		DATE
DRAWN	SY	01/17/04
CHECKED	RW	01/17/04

TITLE: CUSTOMER CONNECTION, CXPS-E101, 1.2kW x2

SIZE	DWG NO.	REV
B	0540570-08	A

SCALE: 1:1 SHEET 1 OF 1

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0540569-J0 (08/2018)