



| an EnerSys® company

Cordex® CXPS-E3 Edge Power System

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Read this document carefully.

Learn how to protect your equipment from damage and fully understand its functions.

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1. Safety

Save these instructions

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

1.1 Safety symbols

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

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

1.2 General warning and cautions



WARNING

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

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

**WARNING**

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

Ce système est conçu pour être installé dans un endroit à accès restreint inaccessible au grand public.

**WARNING**

This equipment is not suitable for use in locations where children are likely to be present.

Cet équipement ne convient pas pour une utilisation dans des lieux où des enfants sont susceptibles d'être présents.

1.3 Electrical safety

**WARNING**

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

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

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

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

**WARNING**

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

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

**WARNING****High leakage current**

Earth connection is essential before connecting the power supply.

1.4 Battery safety



WARNING

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

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



ATTENTION

Battery safety data sheets

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

1.5 Installation and safety precautions

- Only qualified personnel should install and connect the power components within the power system.
- Make sure to connect the protective earthing (master grounding) terminal within the AC load center of the equipment to the earth point in the building installation or the site reference ground.
- Only install the power system using the mounting hardware provided by Alpha Technologies Ltd.

1.6 Lifting



CAUTION

Follow all local safety practices and guidelines while lifting the enclosure. All personnel involved with lifting and positioning the enclosure must wear head and eye protection, and gloves. Only properly trained and certified personnel should operate the crane. Only properly trained and certified personnel should operate the forklift.

Before lifting the power system into place:

- Ensure the modules are not installed.
- The distribution panel door is firmly affixed.
- Open and latch the enclosure front door.

2. Introduction

2.1 Document scope

This document covers the features, options, installation, and startup of the Cordex® CXPS-E3 edge power system. Images contained in this document are for illustrative purposes only and may not exactly match your installation. To assist with installation, refer to the drawings at the end of this document.

In addition to this document, the following may be included in the documentation package that ships with the power system:

- Cordex® HP System Controller Software Manual (ID: 0350058-J0)
- Cordex® HP 2.4/3.0kW Rectifier Module User Guide (ID: 0100037-J0)
- Cordex® HP 4.0/4.6kW Rectifier Module User Guide (ID: 9400000-J0)

2.2 Product overview

The Cordex® CXPS-E3 edge power system uses high-density rectifier modules, a front access distribution panel, and the advanced Cordex® HP system controller. The power system is the ideal solution for small to medium-sized 48VDC applications, providing up to 900 amps of output current. With universal 19-inch or 23-inch 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 panel provides up to 52 load breaker positions, integrated shunt, and optional low voltage battery disconnect (LVBD). All distribution connections and system controller I/O contacts are front accessible.

The Cordex® HP system controller includes a touchscreen display 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. Edge power systems can be easily integrated into customer provided relay racks or enclosures, or can be ordered factory installed into various Alpha® relay rack configurations, including power systems with pre-wired battery trays.

- Integrated 48V 300, 400, 600, or 900 amp power systems with front access distribution
- Industry leading power system density
- Up to 900 amps and 52 distribution positions
- Advanced Cordex® HP system controller with touchscreen display panel for full local control and a pre-wired Cordex® HP L-ADIO low voltage analog and digital input and output (ADIO) peripheral
- High temperature rated design for harsh outdoor applications
- Wide range AC input for flexible worldwide deployment

- 1 Front access distribution panel
- 2 System controller and ADIO module panel
- 3 High-density rectifier modules



Figure 1: Cordex® CXPS-E3 400A edge power system (19-inch)

2.3 System configurations

The following configurations are currently available for Cordex® CXPS-E3 edge power systems. For more ordering information, refer to the Cordex® CXPS-E3 Edge Power System Ordering Guide (ID: 0470209-00).

| Rack size | Current rating | Rectifier module capacity | Load breakers | Battery breakers | Shunts | LVBD | Height |
|-----------|----------------|---|---------------|------------------|----------|----------|--------|
| 19-inch | 300A | 4 × 2.4/3.0kW rectifier modules; 1 × shelf | 21 | 0 | Load | | 4RU |
| | | | 16 | 5 | Battery | Optional | |
| 23-inch | 300A | 5 × 2.4/3.0kW rectifier modules; 1 × shelf | 21 | 0 | Load | | 4RU |
| | | | 16 | 5 | Battery | Optional | |
| 19-inch | 400A | 8 × 2.4/3.0kW rectifier modules; 2 × shelves | 21 | 0 | Load | | 5RU |
| | | | 16 | 5 | Battery | Optional | |
| 19-inch | 400A | 5 × 4.0/4.6kW rectifier modules; 1 × shelf | 21 | 0 | Load | | 7RU |
| | | | 16 | 5 | Battery | Optional | |
| 23-inch | 400A | 6 × 4.0/4.6kW rectifier modules; 1 × shelf | 26 | 0 | Load | | 7RU |
| | | | 21 | 5 | Battery | Optional | |
| 23-inch | 600A | 10 × 2.4/3.0kW rectifier modules; 2 × shelves | 26 | 0 | Load | | 5RU |
| | | | 26 | | Battery | Optional | |
| 23-inch | 600A | 10 × 2.4/3.0kW rectifier modules; 2 × shelves | 52 | 0 | Load × 2 | | 10RU |
| | | | 52 | | Battery | Optional | |
| 23-inch | 900A | 15 × 2.4/3.0kW rectifier modules; 3 × shelves | 52 | 0 | Load × 2 | | 11RU |

2.3.1 300 amp power system (19-inch) with one 2.4/3.0 kW rectifier shelf

- Cordex® CXC HP system controller with color touchscreen LCD panel
- Cordex® HP L-ADIO low voltage smart peripheral with extensive I/O capability
- Cordex® HP 2.4/3.0kW rectifier shelf with up to four module positions; 4RU form factor
- **Current rating:** 300 amps
- 21 load breakers with load shunt or 16 load and five battery breakers with LVBD
- Option for battery LVD for battery breaker configuration

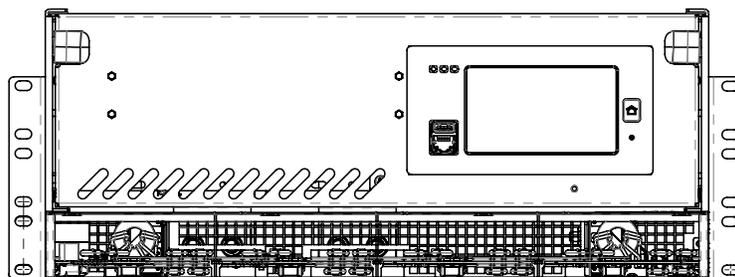


Figure 2: Cordex® CXPS-E3 300 A edge power system (19-inch) with one 2.4/3.0 kW rectifier shelf

2.3.2 300 amp power system (23-inch) with one 2.4/3.0 kW rectifier shelf

- Cordex® CXC HP system controller with color touchscreen LCD panel
- Cordex® HP L-ADIO low voltage smart peripheral with extensive I/O capability
- Cordex® HP 2.4/3.0 kW rectifier shelf with up to five module positions; 4RU form factor
- **Current rating:** 300 amps
- 21 load breakers with load shunt or 16 load and five battery breakers with LVBD
- Option for battery LVD for battery breaker configuration

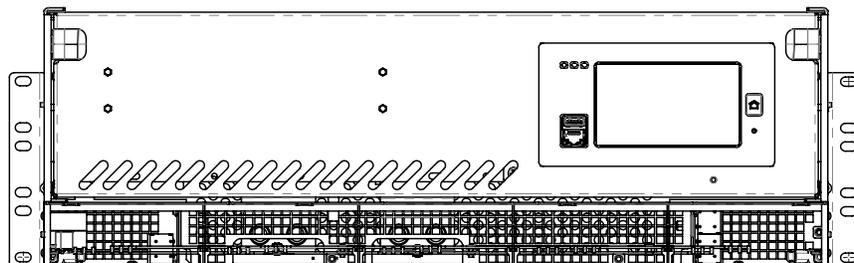


Figure 3: Cordex® CXPS-E3 300A edge power system (23-inch) with one 2.4/3.0 kW rectifier shelf

2.3.3 400 amp power system (19-inch) with two 2.4/3.0 kW rectifier shelves

- Cordex® CXC HP system controller with color touchscreen LCD panel
- Cordex® HP L-ADIO low voltage smart peripheral with extensive I/O capability
- Two Cordex® HP 2.4/3.0 kW rectifier shelves with up to eight module positions; 5RU form factor
- **Current rating:** 400 amps
- 21 load breakers with load shunt or 16 load and five battery breakers with LVBD
- Option for battery LVD for battery breaker configuration

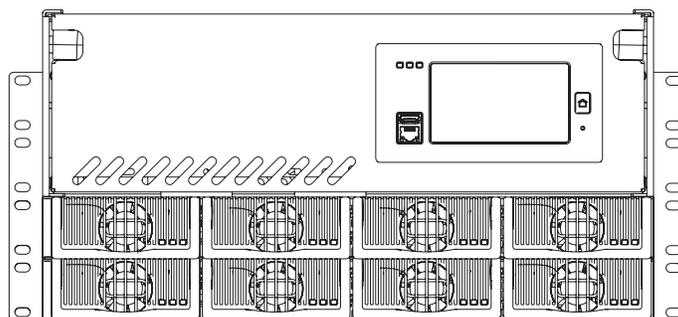


Figure 4: Cordex® CXPS-E3 400A edge power system (19-inch) with two 2.4/3.0 kW rectifier shelves

2.3.5 400 amp power system (23-inch) with two 2.4/3.0 kW rectifier shelves

- Cordex® CXC HP system controller with color touchscreen LCD panel
- Cordex® HP L-ADIO low voltage smart peripheral with extensive I/O capability
- Two Cordex® HP 2.4/3.0kW rectifier shelves with up to 10 module positions; 5RU form factor
- **Current rating:** 400 amp load
- 26 load breakers with load shunt or 21 load and five battery breakers with LVBD
- Option for battery LVD for battery breaker configuration

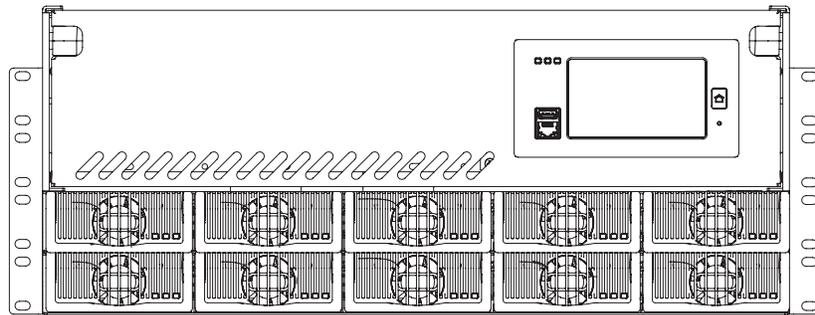


Figure 6: Cordex® CXPS-E3 400A edge power system (23-inch) with two 2.4/3.0kW rectifier shelves

2.3.4 400 amp power system (19-inch) with one 4.0/4.6 kW rectifier shelf

- Cordex® CXC HP system controller with color touchscreen LCD panel
- Cordex® HP L-ADIO low voltage smart peripheral with extensive I/O capability
- Cordex® HP 4.0/4.6kW rectifier shelf with up to five module positions; 7RU form factor
- **Current rating:** 400 amps
- 21 load breakers with load shunt or 16 load and five battery breakers with LVBD
- Option for battery LVD for battery breaker configuration

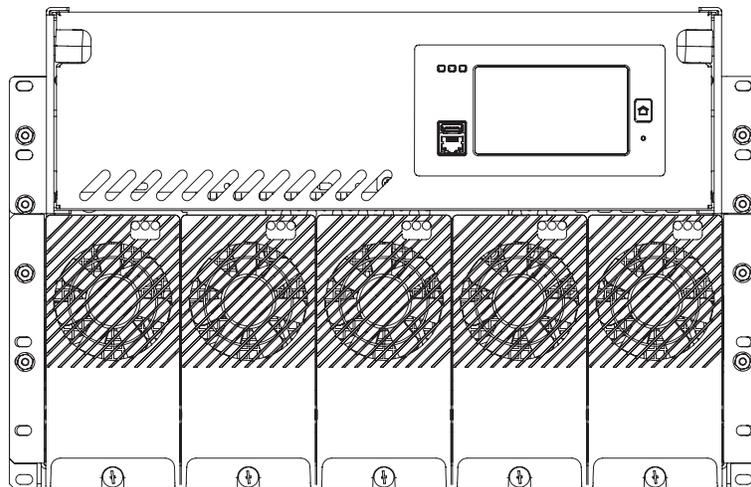


Figure 5: Cordex® CXPS-E3 400A edge power system (19-inch) with one 4.0/4.6kW rectifier shelf

2.3.6 400 amp power system (23-inch) with one 4.0/4.6 kW rectifier shelf

- Cordex® CXC HP system controller with color touchscreen LCD panel
- Cordex® HP L-ADIO low voltage smart peripheral with extensive I/O capability
- Cordex® HP 4.0/4.6kW rectifier shelf with up to six module positions; 7RU form factor
- **Current rating:** 400 amps
- 26 load breakers with load shunt or 21 load and five battery breakers with battery LVD
- Option for battery LVD for battery breaker configuration
- Option for different AC input configurations individual feed, 208VAC three phase or 480/277VAC three phase

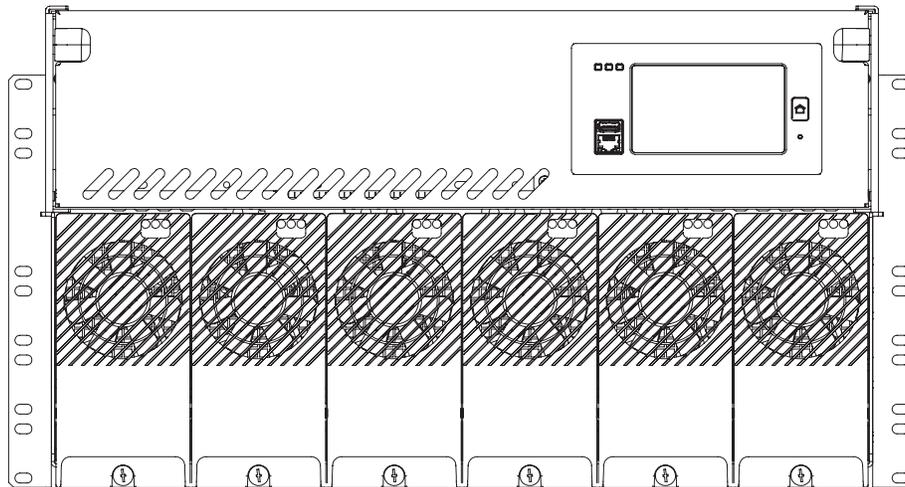


Figure 7: Cordex® CXPS-E3 400A edge power system (23-inch) with one 4.0/4.6 kW rectifier shelf

2.3.7 600 amp power system (23-inch) with two 2.4/3.0 kW rectifier shelves

- Cordex® CXC HP system controller with color touchscreen LCD panel
- Cordex® HP L-ADIO low voltage smart peripheral with extensive I/O capability
- Two Cordex® HP 2.4/3.0kW rectifier shelves with up to 10 module positions; 5RU form factor
- **Current rating:** 600 amps
- 26 load breakers with load shunt or 26 load breakers with battery shunt and battery LVD
- Choice of eight 2 AWG (35 mm²) battery landing busbars or two 350 MCM (185 mm²) battery landing busbars

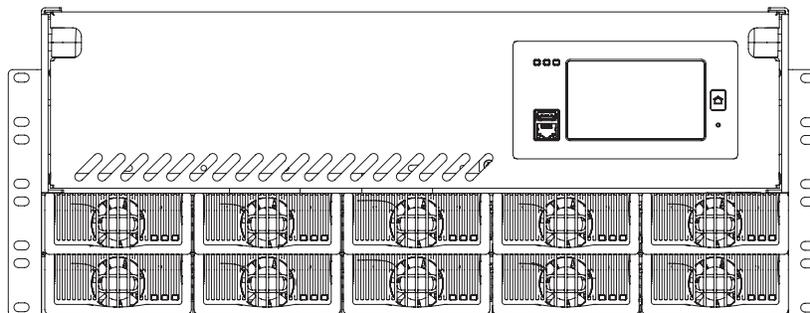


Figure 8: Cordex® CXPS-E3 600A edge power system (23-inch) with two 2.4/3.0 kW rectifier shelves

2.3.8 600 amp power system (23-inch) with double distribution and two 2.4/3.0 kW rectifier shelves

- Cordex® CXC HP system controller with color touchscreen LCD panel
- Cordex® HP L-ADIO low voltage smart peripheral with extensive I/O capability
- Two Cordex® HP 2.4/3.0 kW rectifier shelves with up to 10 module positions; 10RU form factor
- **Current rating:** 600 amps
- 52 load breakers with load shunt or 52 load breakers with battery shunt and battery LVD
- Busbar landings accommodate up to two 4/0 AWG (120 mm²) cables and up to four 2 AWG (35 mm²) cables

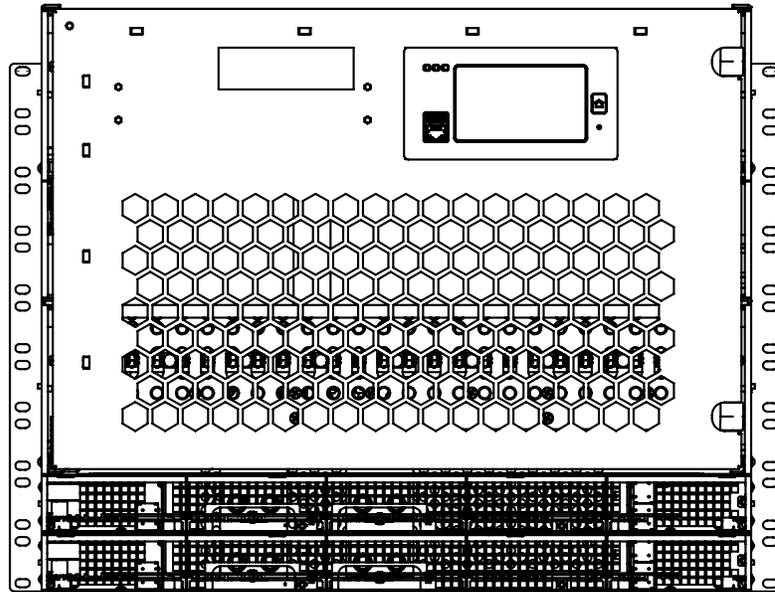


Figure 9: Cordex® CXPS-E3 600 A edge power system (23-inch) with two 2.4/3.0 kW rectifier shelves



NOTICE

This system can be equipped from factory with an optional 10 position 30 amp rated GMT fuse board.



NOTICE

There are three configurations for this power system:

- 2 × load LVD (one load LVD for each distribution tier with support for non-critical load shedding)
- 1 × latching battery LVD
- No LVD

2.3.9 900 amp power system (23-inch) with double distribution and three 2.4/3.0kW rectifier shelves

- Cordex® CXC HP system controller with color touchscreen LCD panel
- Cordex® HP L-ADIO low voltage smart peripheral with extensive I/O capability
- Three Cordex® HP 2.4/3.0kW rectifier shelves with up to 15 module positions; 11RU form factor
- **Current rating:** 900 amps (450 amps per distribution tier)
- 52 load breakers

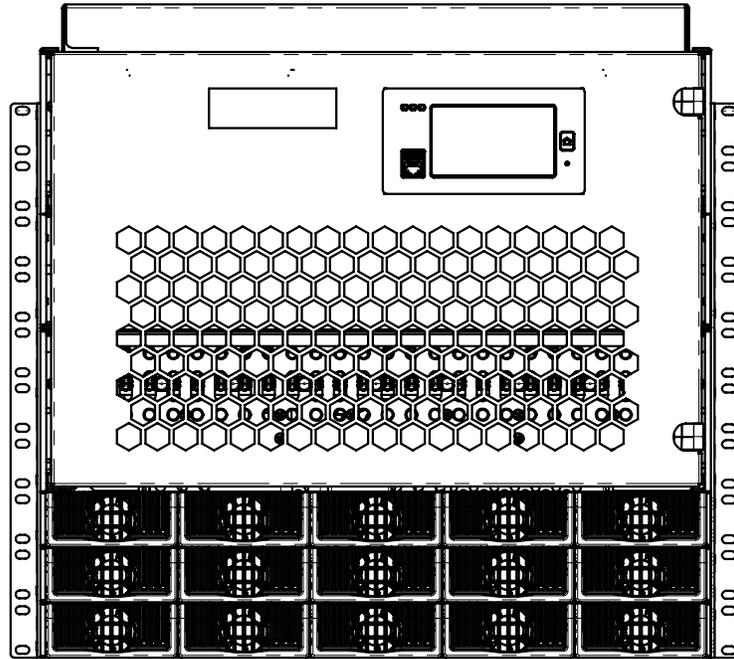


Figure 10: Cordex® CXPS-E3 900 A edge power system (23-inch) with three 2.4/3.0kW rectifier shelves

3. Specifications

3.1 Cordex® CXPS-E3 300A Edge Power System

Table B: 48V–3.0kW Cordex® CXPS-E3 300A edge power system

| Electrical | | |
|--------------------------------------|-----------------------------------|--|
| | | 48V-3.0kW rectifier system |
| System capacity (maximum) | | 300A |
| Input | Operating voltage | 208 to 277VAC (nominal) |
| | Extended (high) | 277 to 310VAC (derated output power) |
| | Extended (low) | 90 to 187VAC (derated output power) |
| | Recommended AC breakers | 19-inch system: Up to 4 × 20A feeds 23-inch system: Up to 2 × 40A feeds and 1 × 20A feeds |
| | Efficiency | >96.1% peak efficiency |
| Output | Current per module | 62.5A at 48VDC (nominal) 32A maximum at 48VDC (120VAC) |
| | Rectifier module positions | 19-inch system: Up to 4 rectifier modules |
| | | 23-inch system: Up to 5 rectifier modules |
| Mechanical | | |
| 19-inch system | Mounting | Flush or center mount |
| | Dimensions (H × W × D) | 7 × 19 × 17 in. (178 × 482 × 432 mm) |
| | Hot positions | 21 load breakers or 16 load and 5 battery breakers |
| | | 21 sets of ¼ inch studs on ⅝ inch centers |
| | Return positions | 21 sets of ¼ inch studs on ⅝ inch centers |
| Net weight (system) | 35.1 lb (15.9 kg) | |
| 23-inch system | Mounting | Flush or center mount |
| | Dimensions (H × W × D) | 8 × 23 × 17 in. (203 × 584.2 × 432 mm) |
| | Hot positions | 26 load breakers or 21 load and 5 battery breakers |
| | | 26 sets of ¼ inch studs on ⅝ inch centers |
| | Return positions | 26 sets of ¼ inch studs on ⅝ inch centers |
| Net weight (system) | 44.4 lb (20.1 kg) | |
| Net weight (rectifier module) | | 3.9 lb (1.76 kg) per module |
| System access | | Front access after initial installation |
| System controller | | Cordex® CXC HP system controller |
| Environmental | | |
| Operating temperature | | –40 to 131°F (–40 to 55°C); –40 to 149°F (55 to 65°C) derated at 104°F (40°C) |
| Storage temperature | | –40 to 185°F (–40 to 85°C) |
| Relative humidity | | 0 to 95% non-condensing |

| | |
|------------------------------|--|
| Elevation | Up to 6,600 ft (2,000 m) |
| | Up to 9,843 ft (3,000 m) with derated output |
| Cooling | Fan-cooled (front to rear) |
| Heat dissipation | 585 BTU/h (171 watts) per module maximum |
| Regulatory compliance | |
| Safety | CAN/CSA-C22.2 No. 60950-1-07 |
| | UL 60950-1 |

3.2 Cordex® CXPS-E3 400A Edge Power System

Table C: 48V-2.4/3.0kW, 4.0/4.6kW Cordex® CXPS-E3 400A edge power system

| Electrical | | | |
|----------------------------------|-----------------------------------|---|--|
| | | 48V-2.4/3.0kW rectifier system | 48V-4.0/4.6kW rectifier system |
| System capacity (maximum) | | 400A | |
| Input | Operating voltage | 208 to 277VAC (nominal) | 208 to 277VAC |
| | | | Three-phase 208 to 240VAC |
| | | | Three-phase 277/480VAC |
| | Extended (high) | 277 to 310VAC (derated output power) | |
| | Extended (low) | 90 to 187VAC (derated output power) | |
| | Recommended AC breakers | 19-inch system: Up to 8 × 20A feeds | 19-inch system: Up to 5 × 30A feeds (208 to 277VAC single phase) |
| | | 23-inch system: Up to 4 × 40A feeds and 2 × 20A feeds | 23-inch system: Up to 6 × 30A feeds (208 to 277VAC single phase) |
| | | | Up to 2 × 50A feeds (208VAC three-phase) |
| | | | Up to 2 × 30A feeds (480/277VAC three-phase) |
| Efficiency | >96.1% peak efficiency | >95% peak efficiency | |
| Output | Current per module | 2.4kW: 50A at 48VDC (nominal input) 25A maximum at 48VDC (120VAC) | 4.0kW: 83.3A at 48VDC (nominal input) |
| | | 3.0kW: 62.5A at 48VDC (nominal) 32A maximum at 48VDC (120VAC) | 4.6kW: 95.8A at 48VDC (nominal input) |
| | Rectifier module positions | 19-inch system: Up to 8 rectifier modules | 19-inch system: Up to 5 rectifier modules |
| | | 23-inch system: Up to 10 rectifier modules | 23-inch system: Up to 6 rectifier modules |

| Mechanical | | | |
|--------------------------------------|--|---|---|
| | | 48 V-2.4/3.0kW rectifier system | 48 V-4.0/4.6 kW rectifier system |
| 19-inch system | Mounting | Flush or center mount | |
| | Dimensions (H x W x D) | 8.75 x 19 x 17.4 in. (222.1 x 482.6 x 442 mm) | 12.25 x 19 x 16.6 in. (311 x 482.6 x 421.6 mm) |
| | Hot positions | 21 load breakers or 16 load and 5 battery breakers | |
| | | 21 sets of ¼ inch studs on ⅝ inch centers | |
| | Return positions | 21 sets of ¼ inch studs on ⅝ inch centers | |
| Net weight (system) | 45 lb (20.4 kg) | 44 lb (20 kg) | |
| 23-inch system | Mounting | Flush or center mount | |
| | Dimensions (H x W x D) | 8.75 x 23 x 17.4 in. (222.1 x 544.2 x 442 mm) | 12.25 x 23 x 17.5 in. (311 x 544.2 x 444.5 mm) |
| | Hot positions | 26 load breakers or 21 load and 5 battery breakers | |
| | | 26 sets of ¼ inch studs on ⅝ inch centers | |
| | Return positions | 26 sets of ¼ inch studs on ⅝ inch centers | |
| Net weight (system) | 57 lb (25.8 kg) | 50 lb (22.7 kg) | |
| Net weight (rectifier module) | | 3.9 lb (1.76 kg) per module | 8.6 lb (3.9 kg) per module |
| System access | | Front access after initial installation | |
| System controller | | Cordex® CXC HP system controller | |
| Environmental | | | |
| Operating temperature | | -40 to 131°F (-40 to 55°C); -40 to 149°F (55 to 65°C) 4.6kW derated at 104°F (40°C) | |
| Storage temperature | | -40 to 185°F (-40 to 85°C) | |
| Relative humidity | | 0 to 95% non-condensing | |
| Elevation | Up to 6,600 ft (2,000 m) | | Up to 6,600 ft (2,000 m) |
| | Up to 9,843 ft (3,000 m) with derated output | | Up to 13,100 ft (4,000 m) with derated output |
| Cooling | | Fan-cooled (front to rear) | |
| Heat dissipation | | 585 BTU/h (171 W) per module maximum | 1348 BTU/h (395 W) per module maximum |
| Regulatory compliance | | | |
| Safety | CAN/CSA-C22.2 No. 60950-1-07 | | |
| | UL 60950-1 | | |

3.3 Cordex® CXPS-E3 600A Edge Power System

Table D: 48V–3.0kW Cordex® CXPS-E3 600A edge power system

| Electrical | | |
|--------------------------------------|---|--|
| System capacity (maximum) | | |
| | System with battery LVD | System without battery LVD |
| Amperage | 600A total | 600A total |
| | 550A load | |
| | 550A battery | |
| | 400A maximum per tier | 400A maximum per tier |
| Input | Operating voltage | 208 to 277VAC (nominal) |
| | Extended (high) | 277 to 310VAC (derated output power) |
| | Extended (low) | 90 to 187VAC (derated output power) |
| | Recommended AC breakers | Up to 4 × 40A feeds and 2 × 20A feeds |
| | Efficiency | >96.1% peak efficiency |
| Output | Current per module (nominal input) | 62.5A at 48VDC |
| | | 55.5A at 54VDC |
| | Rectifier module positions | Up to 10 rectifier modules |
| Mechanical | | |
| Mounting | | Flush or center mount |
| Dimensions (H × W × D) | | 10.1 × 23 × 19.5 in. (256.5 × 544.2 × 495.3 mm) |
| Hot positions | | 26 load breakers 26 sets of ¼ inch studs on ⅝ inch centers |
| Return positions | | 26 sets of ¼ inch studs on ⅝ inch centers |
| Net weight (system) | | 60 lb (27.2 kg) |
| Net weight (rectifier module) | | 3.88 lb (1.76 kg) per module |
| System access | | Front access after initial installation |
| System controller | | Cordex® CXC HP system controller |
| Environmental | | |
| Operating temperature | | –40 to 131°F (–40 to 55°C); –40 to 149°F (55 to 65°C) derated output |
| Storage temperature | | –40 to 185°F (–40 to 85°C) |
| Relative humidity | | 0 to 95% non-condensing |
| Elevation | | Up to 6,600 ft (2,000 m) |
| Cooling | | Fan-cooled (front to rear) |
| Heat dissipation | | 585 BTU/h (171 W) per module maximum |
| Regulatory compliance | | |
| Safety | | CAN/CSA-C22.2 No. 62368-1 |
| | | UL 62368-1 |

3.5 Cordex® CXPS-E3 600A Edge Power System (Double Distribution)

Table F: 48V–3.0kW Cordex® CXPS-E3 600A edge power system (double distribution)

| Electrical | | |
|--------------------------------------|---|--|
| System capacity (maximum) | | |
| | System with battery LVD | System without battery LVD |
| Amperage | 600A total | 600A total |
| | 550A load | |
| | 550A battery | |
| | 400A maximum per tier | 400A maximum per tier |
| Input | Operating voltage | 208 to 277VAC (nominal) |
| | Extended (high) | 277 to 310VAC (derated output power) |
| | Extended (low) | 90 to 187VAC (derated output power) |
| | Recommended AC breakers | Up to 4 × 40A feeds and 2 × 20A feeds |
| | Efficiency | >96.1% peak efficiency |
| Output | Current per module (nominal input) | 62.5A at 48VDC |
| | | 55.5A at 54VDC |
| | Rectifier module positions | Up to 10 rectifier modules |
| Mechanical | | |
| Mounting | | Flush or center mount |
| Dimensions (H × W × D) | | 17.5 × 23 × 21 in. (444.5 × 584 × 533 mm) |
| Hot positions | | 52 load breakers 52 sets of ¼ inch studs on ⅝ inch centers |
| Return positions | | 52 sets of ¼ inch studs on ⅝ inch centers |
| Net weight (system) | | 100 lb (45.4 kg) |
| Net weight (rectifier module) | | 3.88 lb (1.76 kg) per module |
| System access | | Front access after initial installation |
| System controller | | Cordex® CXC HP system controller |
| Environmental | | |
| Operating temperature | | –40 to 131°F (–40 to 55°C); –40 to 149°F (55 to 65°C) derated output |
| Storage temperature | | –40 to 185°F (–40 to 85°C) |
| Relative humidity | | 0 to 95% non-condensing |
| Elevation | | Up to 6,600 ft (2,000 m) |
| Cooling | | Fan-cooled (front to rear) |
| Heat dissipation | | 585 BTU/h (171 W) per module maximum |
| Regulatory compliance | | |
| Safety | CAN/CSA-C22.2 No. 62368-1 | |
| | UL 62368-1 | |

3.4 Cordex® CXPS-E3 900A Edge Power System

Table E: 48V–2.4/3.0kW Cordex® CXPS-E3 900A edge power system

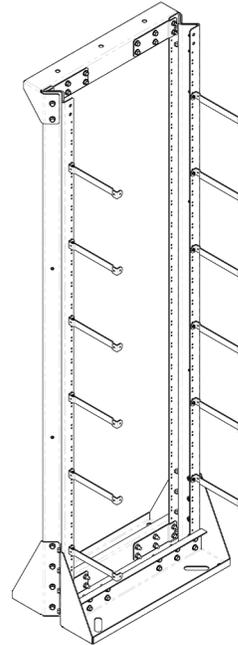
| Electrical | | | |
|--------------------------------------|---|---|-----------------------------------|
| | | 48V-2.4 kW rectifier system | 48V-3.0kW rectifier system |
| System capacity (maximum) | | | |
| Amperage | | 750A load total | 900A load total |
| | | 450A maximum per tier | 450A maximum per tier |
| Input | Operating voltage | 208 to 277VAC (nominal) | |
| | Extended (high) | 277 to 310VAC (derated output power) | |
| | Extended (low) | 90 to 187 VAC (derated output power) | |
| | Recommended AC breakers | Up to 6 × 40A feeds and 3 × 20A feeds | |
| | Efficiency | >96.2% peak efficiency | >96.1% peak efficiency |
| Output | Current | 900A maximum | |
| | Current per module (nominal input) | 50A at 48VDC | 62.5A at 48VDC |
| | | 44.4A at 54VDC | 55.5A at 54VDC |
| Rectifier module positions | Up to 15 rectifier modules | | |
| Mechanical | | | |
| Mounting | | Flush or center mount | |
| Dimensions (H × W × D) | | 19.25 × 23 × 21 in. (489 × 685 × 533 mm) | |
| Rack space | | 11RU | |
| Breaker positions | | 52 load breaker positions | |
| Hot (load) positions | | 52 sets of ¼ inch studs on ⅝ inch centers | |
| Return positions | | 52 sets of ¼ inch studs on ⅝ inch centers | |
| Net weight (system) | | 85 lb (38.7 kg) | |
| Net weight (rectifier module) | | 4.04 lb (1.83 kg) per module | |
| System access | | Front access after initial installation | |
| System controller | | Cordex® CXC HP system controller | |
| Environmental | | | |
| Operating temperature | | –40 to 131°F (–40 to 55°C) | |
| Storage temperature | | –40 to 185°F (–40 to 85°C) | |
| Relative humidity | | 0 to 95% non-condensing | |
| Elevation | | Up to 9,186 ft (2,800 m) | |
| Cooling | | Fan-cooled (front to rear) | |
| Heat dissipation | | 585 BTU/h (171 W) per module maximum | |
| Regulatory compliance | | | |
| Safety | | CAN/CSA-C22.2 No. 62368-1 | |
| | | UL 62368-1 | |

4. Features

4.1 Seismic racks

The Cordex® CXPS-E3 edge power system can be installed in a variety of Alpha® 19-inch and 23-inch seismic racks. These racks have been Z4 rated and NEBS L3 certified. The racks vary in their Z4 seismic capabilities from 500 to 2500 lb (227 to 1134 kg) and 3.5 to 9 feet in height (standard 7 foot racks are available as well). For more ordering information, refer to the Cordex® CXPS-E3 Edge Power System Ordering Guide (ID: 0470209-00).

19-inch or 23-inch seismic rack



4.2 Distribution panels

The power system has been designed with high density breaker or fuse count for use in 48V applications and is rated for a total ampacity of 300, 400, 600, or 900 amps. It is available either in a 19-inch or 23-inch configuration. All power systems include a back top cover for the protection of live customer connections.

4.2.1 300 and 400 amp 19-inch distribution panels

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 five battery breakers.

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

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

4.2.2 300 and 400 amp 23-inch distribution panels

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 five battery breakers.

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

The load and battery configuration has a shunt that monitors the total battery charge and discharge current and includes a low voltage battery disconnect (LVBD).

Both the hot and return connections are made on ¼ inch studs on ⅝ inch centers using narrow tongue lugs. Adapter kits for landing larger cables are available when higher capacity two or three pole breakers are required.

4.2.3 600 amp 23-inch distribution panel (single distribution panel)

Provides up to 26 load breakers with configurable battery landing outputs. The all load breaker configuration has a shunt that monitors the total load current supplied by the rectifier modules to the load. The low voltage battery disconnect configuration has a shunt that monitors the total battery charge and discharge current and includes a low voltage battery disconnect (LVBD).

Both the hot and return connections are made on ¼ inch studs on ⅝ inch centers using narrow tongue lugs. Adapter kits for landing larger cables are available when higher capacity two or three pole breakers are required.

Two battery landing busbar options are available for the 600 amp 23-inch distribution panel:

- 8 × 2 AWG (35 mm²) battery landings
- 2 × 350 MCM (185 mm²) battery landings

4.2.4 600 amp 23-inch distribution panel (double distribution panel)

Provides up to 52 load breakers with configurable battery landing outputs. The all load breaker configuration has a shunt that monitors the total load current supplied by the rectifier modules to the load. The low voltage battery disconnect configuration has a shunt that monitors the total battery charge and discharge current and includes a low voltage battery disconnect (LVBD). The 2 × LLVD configuration supports load shedding of non-critical loads.

Both the hot and return connections are made on ¼ inch studs on ⅝ inch centers using narrow tongue lugs. Adapter kits for landing larger cables are available when higher capacity two or three pole breakers are required.

Busbar landings accommodate up to two 4/0 AWG (120 mm²) cables and up to four 2 AWG (35 mm²) cables.

4.2.5 900 amp 23-inch distribution panel

Provides up to 52 load breakers with extensive battery landing outputs. This configuration has two 26 position distribution sections with separate load current and breaker sensing. The total load current and overall breaker status is available from the system controller interface providing both flexibility and simplicity. Both the hot and return connections are made on ¼ inch studs on ⅝ inch centers using narrow tongue lugs. Adapter kits for landing larger cables are available when higher capacity two or three pole breakers are required. Convenient battery landings allow wiring from side, above, or below, and per polarity have capacity for 10 each of ¼ inch studs on ⅝ inch spacing for 2 AWG (35 mm²) wire, or two each of ⅜ inch studs on 1 inch spacing for 3/0 AWG (96 mm²) cables.

4.3 Control and monitoring methods

The power system 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 following table for the details.

| Table G: Control and monitoring methods | |
|---|--|
| Features | |
| Cordex® HP L-ADIO low voltage peripheral | |
| Dedicated I/O | <ul style="list-style-type: none"> • Bus voltage monitoring × 2 • Breaker alarm monitoring × 2 • Dry contact breaker alarm × 2 • Bus voltage sense × 2 |
| Expansion I/O (customer use) | <ul style="list-style-type: none"> • Temperature sensor inputs × 4 • Form C relay outputs × 12 • Digital inputs × 6 • Voltage sense inputs × 2 • Current shunt inputs × 4 |
| Cordex® HP system controller | |
| | <ul style="list-style-type: none"> • Local connection to the Cordex® HP L-ADIO low voltage smart peripheral • Advanced user interface • Ethernet connection |

4.3.1 Breaker labelling

For power systems with load only outputs, the numbering goes from left one to right; 21 for 19-inch power systems or 26 for 23-inch systems. For systems with batteries and loads, the load numbering goes from left one to center/right; 16 for 19-inch systems or 21 for 23-inch systems and the battery labelling goes from right one to left five.

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).



NOTICE

For the 600 and 900 amp system, breaker labeling is not listed on the front door.

4.4 Front panel with system controller and ADIO peripheral

The front panel includes the Cordex® CXC HP system controller and a pre-wired Cordex® HP L-ADIO low voltage smart peripheral.

The Cordex® 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 system controller has a 4.3-inch, full color touchscreen display. The system controller provides dual Ethernet ports allowing for simultaneous network, LCD panel, and local laptop access to the system controller including both web and SNMP interfaces.

The system controller supports two CAN ports to allow up to 254 power or ADIO modules to be controlled and monitored. The system controller uses external ADIO peripherals to monitor electrical signals (for example temperature and voltage) and generate electrical signals through relays.

The most commonly used ADIO peripheral is the Cordex® HP 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

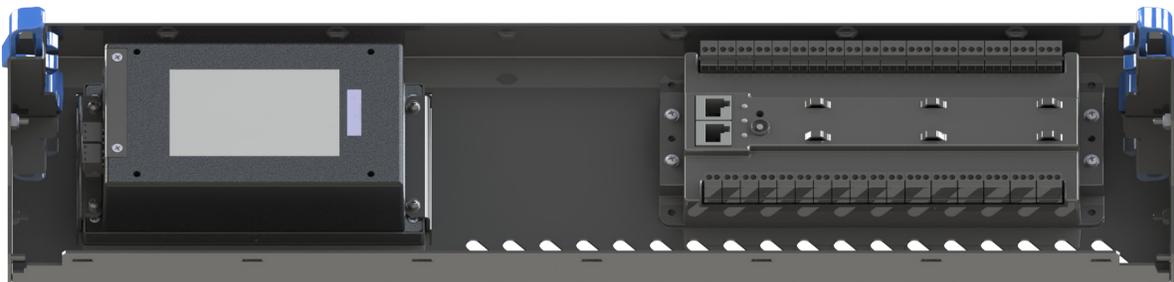


Figure 11: Front panel with Cordex® CXC HP system controller and Cordex® HP L-ADIO low voltage smart peripheral

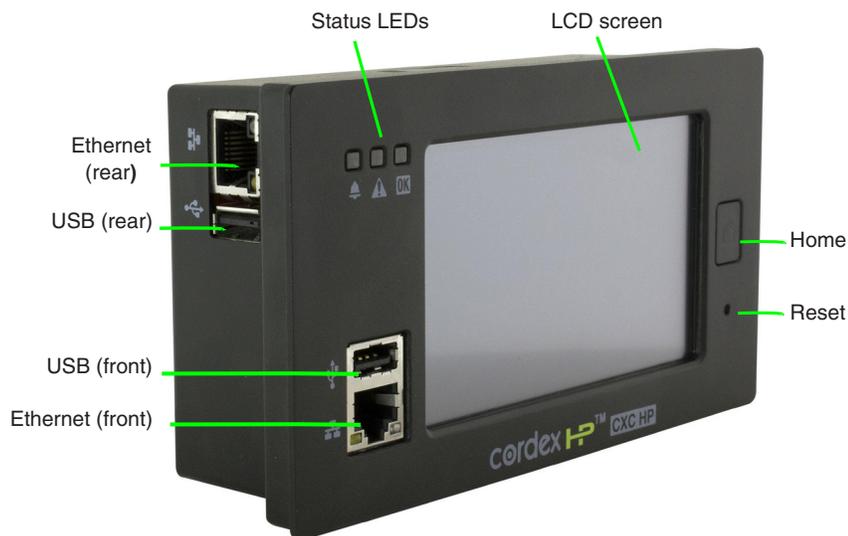


Figure 12: Cordex® CXC HP system controller

The Cordex® CXC HP system controller has the following features:

| | |
|--------------------------------|--|
| Front touchscreen | Full color touchscreen LCD panel, to access controls and menu items by using 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 system controller if the unit touchscreen 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. |
| Dual Ethernet ports | 10/100 BASE-T Ethernet connection on both the front and back of the system controller for remote or local communication. |
| USB | Two USB ports on both the front and back of the system controller for upgrades or file management via a standard USB drive. |
| CAN | Two independent CAN bus ports for communication with the Cordex® HP 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. |

4.4.1 Cordex® HP L-ADIO Low Voltage Smart Peripheral

Analog input channels

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

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 power systems and are available for customer use.

Temperature inputs

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

Digital input channels

The peripheral 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.

Alarm and control output relays

The peripheral 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. Some of the output relays are pre-configured for LVD control if equipped (K1, K5, or K6), minor alarm (K10), major alarm (K11), and critical alarm (K12).

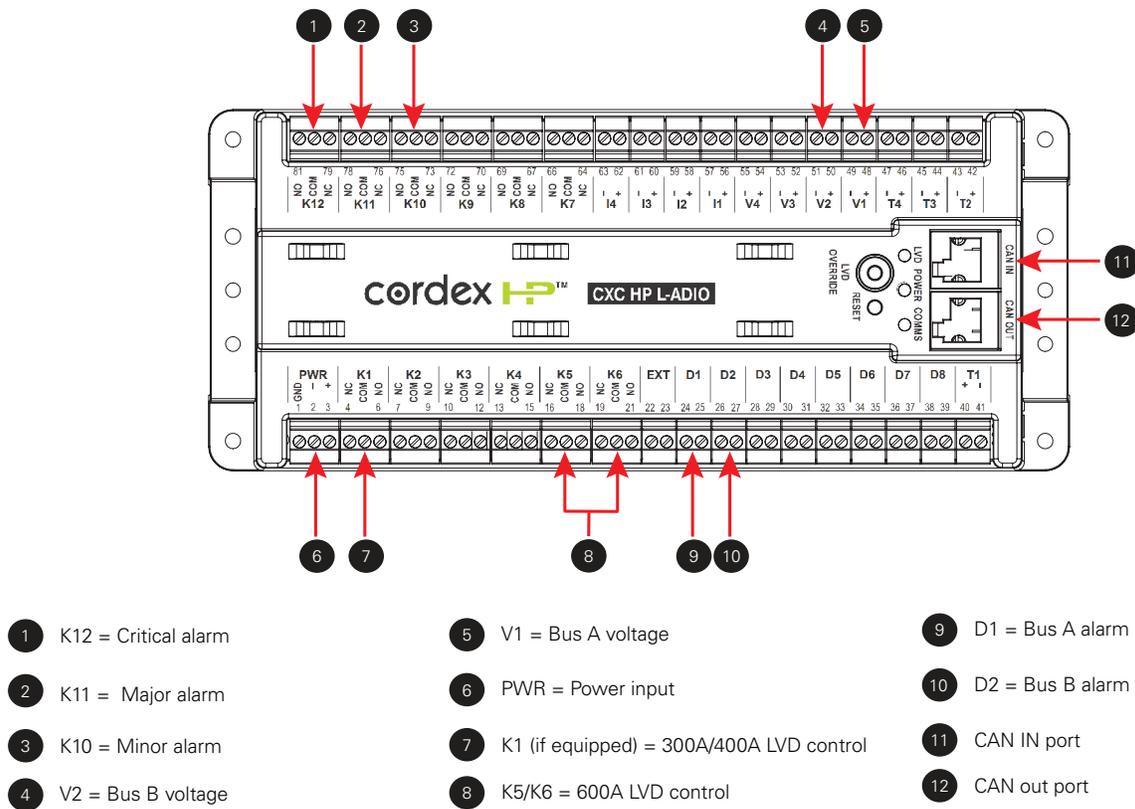


Figure 13: Cordex® HP L-ADIO low voltage smart peripheral

Network connection and remote communications

The system can be set up, monitored, and tested via an Ethernet IEEE 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 system controller and rectifier modules.

Refer to the software manual for operation of system controller.

Front panel wiring notes

The terminal blocks on the indicator boards are suitable for 26 to 16 AWG (0.14 to 1.5 mm²) wire. As both signals are low current, it is recommend to use thinner wire where possible to make routing easier and to minimize space consumed by in the system. This is especially important with the Cordex® HP L-ADIO low voltage smart peripheral 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 Cordex® HP L-ADIO low voltage smart peripheral 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 Cordex® HP 2.4 kW Rectifier Module

4.5.1 Features

- High performance compact 50 amp rectifier module for 48VDC telecom applications
- High efficiency for reduced operating expense and carbon footprint
- High temperature operating range for installation in non-controlled environments
- Multiple configurations providing up to 250 amps or 12 kW
- High power density (28 W/in³) yields more space for revenue generating equipment
- Wide AC input operating range for global installation requirements
- Extended operating temperature range for deployment in the harshest outdoor environments.

4.6 Cordex® HP 3.0 kW Rectifier Module

4.6.1 Features

- High performance compact 62.5 amp rectifier module for 48VDC telecom applications
- High efficiency for reduced operating expense and carbon footprint
- High temperature operating range for installation in non-controlled environments
- Multiple configurations providing up to 312.5 amps or 15 kW
- High power density (35 W/in³) yields more space for revenue generating equipment
- Wide AC input operating range for global installation requirements
- Extended operating temperature range for deployment in the harshest outdoor environments.

4.7 Cordex® HP 4.0 kW Rectifier Module

4.7.1 Features

- High performance 83.3 amp rectifier module for 48VDC telecom applications
- High efficiency for reduced operating expense and reduced carbon footprint
- High power density 4RU compact form factor delivering up to 24 kW per 23-inch shelf
- Power limiting and wide range AC input for global installation requirements
- Extended operating temperature range for deployment in the harshest outdoor environments.

4.8 Cordex® HP 4.6 kW Rectifier Module

4.8.1 Features

- High performance 95.8 amp rectifier module for 48VDC telecom applications
- High efficiency for reduced operating expense and reduced carbon footprint
- High power density 4RU compact form factor delivering up to 27.6 kW per 23-inch shelf
- Power limiting and wide range AC input for global installation requirements
- Extended operating temperature range for deployment in the harshest outdoor environments.

4.9 Rectifier module front panel LEDs

Each rectifier module has three LEDs for status indication. See the Troubleshooting section for LED states and meanings.

4.10 300, 400, and 600 amp LVD override

For systems with LVD, an override interface is provided, see [Figure 14](#). This interface board includes three LEDs to provide visual status indication, and two customer connections for remote control and monitoring:



NOTICE

The 600 amp double distribution system supports this feature.

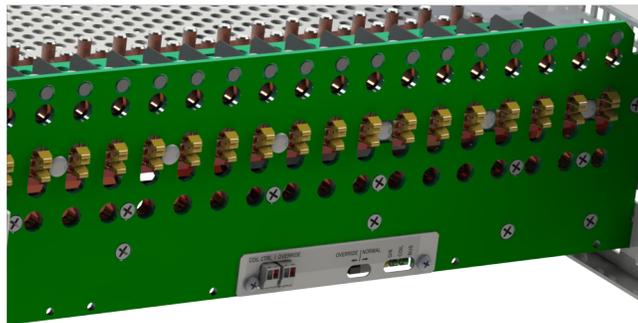


Figure 14: LVD override



Figure 15: LVD override interface

4.8.2 LVD override board LEDs

Each LVD override board has three LEDs for status indication. See the Troubleshooting section for LED states and meanings.

4.8.3 LVD override board connections

Connections

- **OVERRIDE:** 48V/5mA signal, active when override switch is in override 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 LVD override interface is configured for remote control by default for most systems.

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 power system by removing the two 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:
5. CTRL (normally open; NO) position: The COIL CTRL is configured for remote control.
6. ENBL (normally closed; NC), COIL CTRL position: For remote enable.
7. After the jumper is set check all cable connections (in case they were pulled loose when the board was removed).
8. Reinstall the board and labels using the original screws.

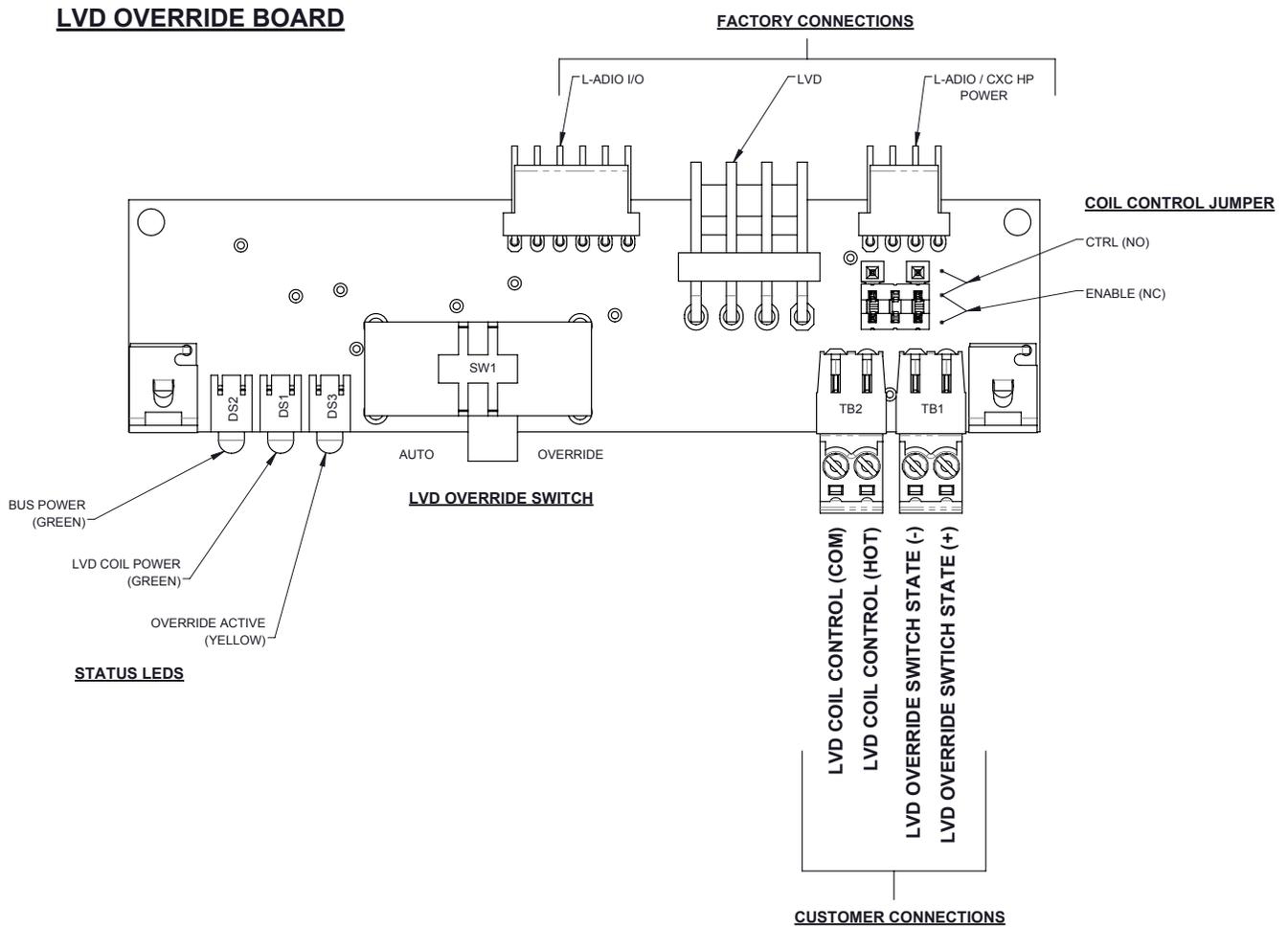


Figure 16: LVD override connections

4.11 600 amp LVD override

4.11.1 Introduction

Contactors are mechanical switches, which connect and disconnect high current power sources and electrical load, for example between rectifier modules and batteries or loads in a power system. The 600 amp edge power system takes advantage of the higher efficiency and smaller form factor of a latching contactor, along with heavier buswork, to enable a much higher current rating than 400 amp edge power systems in the same physical volume. For example, when combined with 3.0kW rectifier modules, it has a rating of 625 amps compared to 450 amps for 400 amp edge power systems with 2.4kW rectifier modules. To safely and reliably control the latching contactor, 600 amp edge power systems have a different LVD interface board than 400 amp edge power systems. While 400 amp edge power systems has an LVD override board, which enabled service to force the LVD on even if the system controller was removed, 600 amp edge power systems have an LVD control interface which buffers the ADIO peripheral control signals for the higher coil current and enables manual operation.

Traditionally the telecom industry has used non-latching contactors which have a simple operation: when power is provided to the contactor it closes and maintains closure (connecting two points electrically); if power is removed the contactor automatically opens. The advantage of these contactors is that if power is lost to the contactor they simply open, so called fail-safe operation, but the disadvantages are continuous heat losses in driving the coil closed and higher losses in the electrical contacts.

A latching contactor has a strong permanent magnet capable of holding the contacts closed and only a short pulse of current is needed to close it initially. Because coil operation is only temporary a much higher current can be allowed without concern of overheating, and this allows the closing force to be higher. The result is lower electrical losses in both the actuating coil and the load connections, overall providing a more compact and efficient design. The added complexity makes these contactors a little more expensive, but the more significant difference is that if power fails they do not automatically open. Depending on the application this might be viewed as an advantage or disadvantage; the inherent fail-safe operation is lost, but it is also less likely to unexpectedly drop a load by opening due to system controller failure.

4.11.2 Normal operation

Standard function

In a 600 amp edge power system, the latching contactor is used as a low voltage battery disconnect (LVBD) between a bulk feed input and the main bus where the load breakers connect. During normal operation the LVBD is closed, the battery bank is connected to the main bus, and the batteries are charging. The user will have to set a minimum voltage threshold, below which the batteries might be damaged if discharged. The user will also have to set a reconnection voltage above which the batteries should reconnect to the main bus. As per standard practice the reconnect voltage is above the battery open circuit voltage so it will not reconnect until AC power returns. From this state the system controller will use two control relays on the ADIO peripheral to control the contactor state as described.

Upon AC power failure, the batteries discharge to support the critical load. If the main voltage falls below the threshold where the batteries may be permanently damaged, the system controller opens the latching LVBD by energizing a relay on the ADIO peripheral, which is connected to the Latching Interface board. When the LVBD opens the batteries disconnect, and within a few seconds the system controller loses power and turns off and the control relay on the ADIO peripheral is disabled.

Upon return of AC power if the batteries are disconnected, the rectifier modules turn on and provide power to the load. Once the main bus voltage exceeds the reconnect threshold, the system controller closes the LVBD by energizing a relay on the ADIO peripheral (different than the one that is used to open the contactor). This connects the batteries to the main bus and returns the system to a normal operating state.

Fault recovery and alarms

The system controller monitors the state of the LVBD through a digital input on the ADIO peripheral board. If the system controller detects that the LVBD state is not as expected (closed when expected to be open or open when expected to be closed), it attempts to correct this by energizing the appropriate control relays. For example, if a service person opens the contactor using the manual controls (refer to Service operation) then the system controller attempts to reclose it within two to three seconds.

In the case where the state remains incorrect the system controller attempts to correct it up to three consecutive times. After those three attempts it generates a user alarm and waits 15 minutes before trying again. This overall cycle of three attempts followed by a 15 minute pause continues until the contactor changes state, is disabled, or serviced.

Contactor state

The contactor state is monitored through the ADIO peripheral on **Digital Input D3**. This can be seen on the system controller display or through the web interface.

Battery not present

The LVD control interface uses power from the battery side to drive the contactor coil. Therefore if a battery is not connected the contactor does not operate. Operation without a battery is described in the service section.

4.11.3 Service operation

The LVD interface board provides two manual control buttons for service use: close and open. To operate the contactor a pulse of current is sent to the contactor and for each of the operations there is a yellow LED and a push button switch. Each yellow LED turns on when and if the pulse generator is charged for the respective operation, that is, when it is ready.

| Close | | Open | | Control power |
|------------------|---------------|------------------|---------------|---------------|
| RDY (YELLOW LED) | CTRL (SWITCH) | RDY (YELLOW LED) | CTRL (SWITCH) | (GREEN LED) |

Note that the pulse generator charges through the normally closed (NC) terminal of the associated relay on the ADIO peripheral. Therefore the associated control wiring must be plugged into the ADIO peripheral for the manual operation to work, specifically K6 for close and K5 for open. This feature can be used to disable the system controller so that it cannot override manual operation; the specific options and operations are as follows:

Operation

1. Disable the LVD: From the system controller, go to **Systems > DC System > Inventory > Disconnects**:
2. Push the button to put the LVD in the desired state.
3. Unplug K5/K6 (optional).
4. Perform maintenance work.
5. Plug in K5/K6 if unplugged in step 3.
6. Push the button to put the LVD in the desired state (optional).
7. Enable the LVD. From the system controller, go to **Systems > DC System > Inventory > Disconnects**.

| Operation | K5 | K6 | Action |
|--|------------|------------|----------------------|
| Close contactor but allow system controller to re-open. | Any | Plugged in | Select Closed |
| Open contactor but allow system controller to re-close. | Plugged in | Any | Select Open |
| Close contactor and prevent system controller from re-opening. | Unplugged | Plugged in | Select Closed |
| Open contactor and prevent system controller from re-opening. | Plugged in | Unplugged | Select Open |

**NOTICE**

If the system controller is non-functioning, this table can be used for operation of the LVD.

Control power LED

The latching interface board also performs the ancillary function of combining the battery and rectifier module outputs for the system controller and ADIO peripheral control devices so they are powered when either source is present. The control power LED simply provides the status that either one of these sources is present.

Latching interface background

The LVD control interface translates the ADIO peripheral control relay state change into a fixed duration high current pulse to the contactor, thus preventing the contactor coil from being continuously powered in case of operator or system controller error. It does this by charging a capacitor in the pulse generator when a control relay is off, and then discharging it when the control relay is on. Therefore, it is necessary to have the control relay off for a short time period (<1 second) between actuation attempts. This recharging is done through the normally closed (NC) contacts of the control relay on the ADIO peripheral.

Troubleshooting

| Symptom | Possible cause |
|---|---|
| Manual operation does not work | Check if related LED is illuminated, if not check the ADIO peripheral connection. |
| Contactor closes after manual opening | Check system controller function, is it reconnecting due to high battery voltage? If so unplug K6. |
| Contactor opens after manual closing | Check system controller function, is it disconnecting due to low battery voltage? If so unplug K5. |
| Contactor won't operate and the green LED on LVD control interface board is not illuminated | Check if battery or rectifier module output is live. |
| Contactor won't operate but the green LED on LVD control interface board is illuminated | Check if the battery is disconnected. (If the rectifier module output is live the load bus will power the green LED.) |

4.12 Integrated battery trays

Edge power systems are designed to integrate battery trays below the power system. These battery trays can accept standard 12 volt monoblocks ranging in height from 6RU to 8RU. The battery trays are factory installed and pre-wired for ease of installation. They can be configured with or without battery breakers as overcurrent 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 100 to 250 amps.

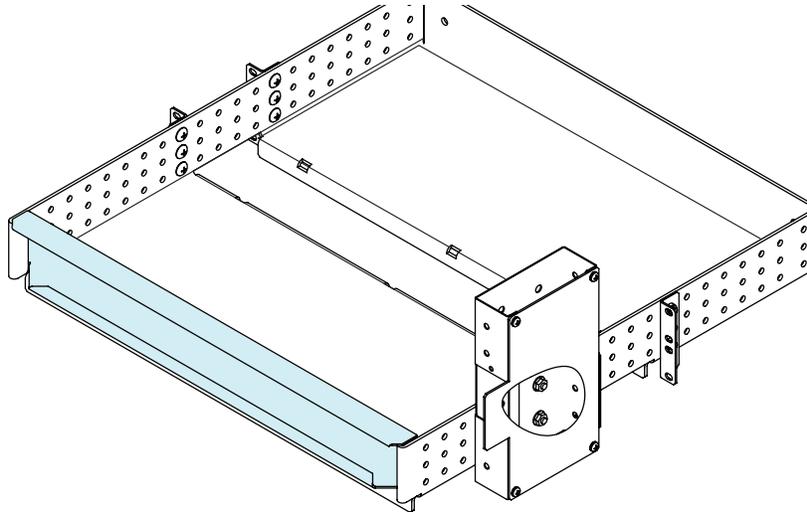


Figure 17: Integrated battery tray

When battery trays are ordered for systems without a low voltage battery disconnect (LVBD), the battery cable landing busbar 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.

4.13 Battery landing busbar kit

4.13.1 300 amp power system battery landing busbar kit

Cordex® CXPS-E3 300A edge power systems can be purchased with an optional battery landing busbar kit (PN: 0250030-550) which provides landing locations for three pairs of back-to-back cable lugs. This kit is customer installed at time of system installation.

4.13.2 400 amp power system battery landing busbar kit

Cordex® CXPS-E3 400A edge power systems can be purchased with an optional battery landing busbar kit (PN: 0250030-550) which provides landing locations for three pairs of back-to-back cable lugs. This kit is customer installed at time of system installation.

4.13.3 600 amp power system battery landing busbar kit (single distribution)

Cordex® CXPS-E3 600A edge power systems by default come with an extended battery landing busbar kit, either PN: 0250030-531 or PN: 0250030-532, which provides either eight 2 AWG (35 mm²) landing points or two 350 MCM (185 mm²) landing points. These kits are interchangeable and can be purchased separately and installed by the customer during system installation.

4.13.4 900 amp power system battery landing busbar kit

Cordex® CXPS-E3 900A edge power systems by default come with battery landings installed. It provides both four 4/0 AWG (120 mm²) landing locations and six 2 AWG (35 mm²) landing points all through back-to-back mounted connection pairs.

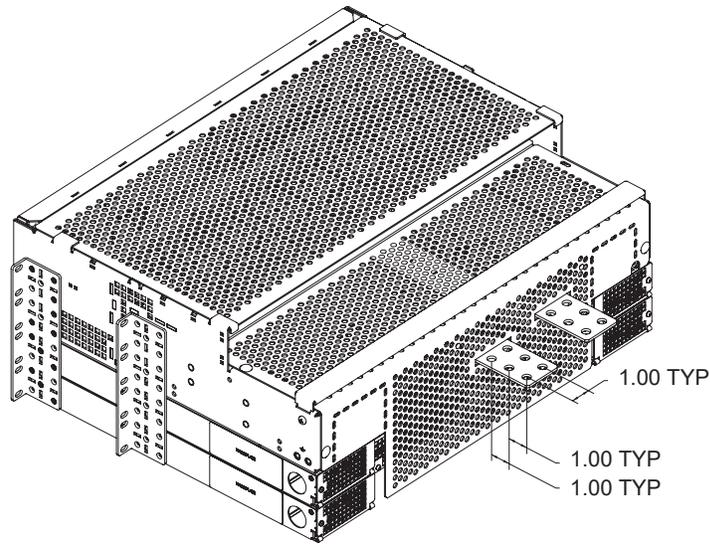


Figure 18: Battery landing busbar kit

5. Inspection

5.1 Packaging materials

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

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

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

5.2 Returns for service



NOTICE

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

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

5.3 Check for damage

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

5.4 General receipt of shipment

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

5.5 Miscellaneous small parts

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

6. Installation

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

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

6.1 Safety precautions

Refer to the [Safety](#) section near the beginning of this document.

6.2 Tools required

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.

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

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

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



WARNING

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

6.3.1 Installing 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 Sanchem Inc. NO-OX-ID® A-SPECIAL electrical grease, on all battery terminal connections.

1. If required, assemble the battery rack and the cells or mono-blocks as per the installation instructions supplied with the batteries.
2. Ensure that the battery output cabling can reach the positive [+] and negative [-] terminals of the series battery string and that the batteries are oriented correctly for easy installation of the inter-unit series connectors.
3. Remove any electrical 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 electrical grease to the terminal posts.
6. If lead plated inter-unit connectors are used, they should also be burnished and electrical 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 (11.4 Nm).

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

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



NOTICE

The power system requires at least 2RU (3.5 inches) 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 power system distribution. Some of this space may be consumed by the clear plastic cover of the power system in higher ambient temperature environments.

6.5.1 Floor mounted systems

Secure the system to a concrete floor using either heavy duty anchors (½ inch × 2½ inch), or for wooden floors, heavy-duty lag screws (⅝ inch × 2½ inch). 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 systems listed are approximate and exclude rectifier modules:

| System | Weight |
|---|-------------------|
| Cordex® CXPS-E3 300A edge power system 19-inch with 1 × 2.4/3.0kW rectifier shelf | 35.1 lb (15.9 kg) |
| Cordex® CXPS-E3 300A edge power system 23-inch with 1 × 2.4/3.0kW rectifier shelf | 44.4 lb (20.1 kg) |
| Cordex® CXPS-E3 400A edge power system 19-inch with 2 × 2.4/3.0kW rectifier shelves | 40 lb (18.2 kg) |
| Cordex® CXPS-E3 400A edge power system 19-inch with 1 × 4.0/4.6kW rectifier shelf | 56 lb (25.5 kg) |
| Cordex® CXPS-E3 400A edge power system 23-inch with 2 × 2.4/3.0kW rectifier shelves | 58 lb (26.4 kg) |
| Cordex® CXPS-E3 400A edge power system 23-inch with 2 × 4.0/4.6kW rectifier shelves | 60 lb (27.2 kg) |
| Cordex® CXPS-E3 600A edge power system 23-inch with 2 × 2.4/3.0kW rectifier shelves (single distribution panel) | 60 lb (27.2 kg) |
| Cordex® CXPS-E3 600A edge power system 23-inch with 2 × 2.4/3.0kW rectifier shelves (double distribution panel) | 100 lb (45.4 kg) |
| Cordex® CXPS-E3 900A edge power system 23-inch with 3 × 2.4/3.0kW rectifier shelves | 100 lb (45.4 kg) |

Refer to the drawings at the end of this document for system dimensions.

Dimensions in [Figure 19](#) and [Figure 20](#) are in inches.

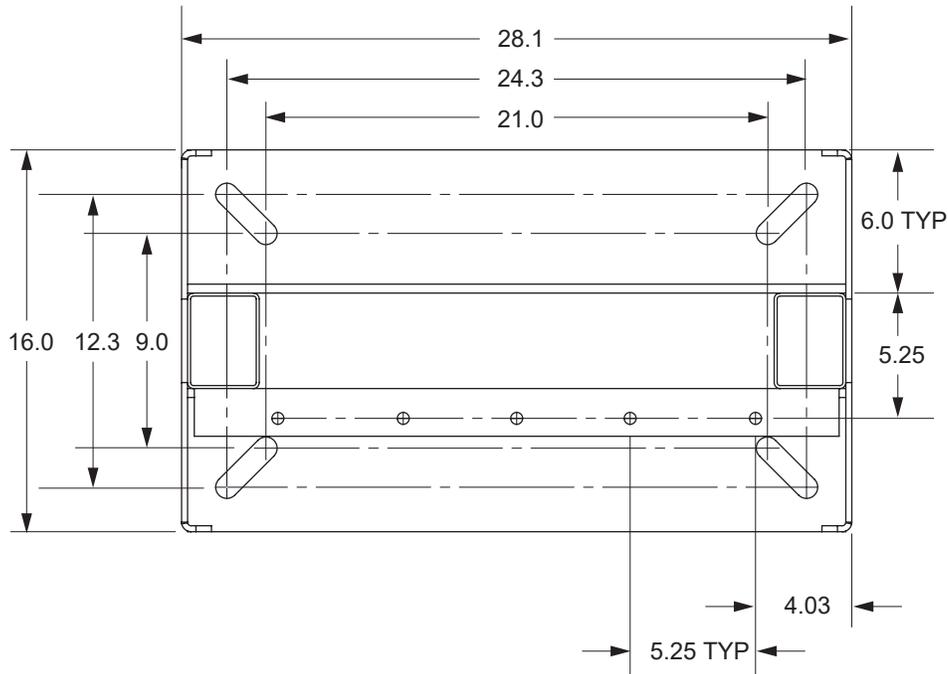


Figure 19: Rack mounting details (top view), welded rack

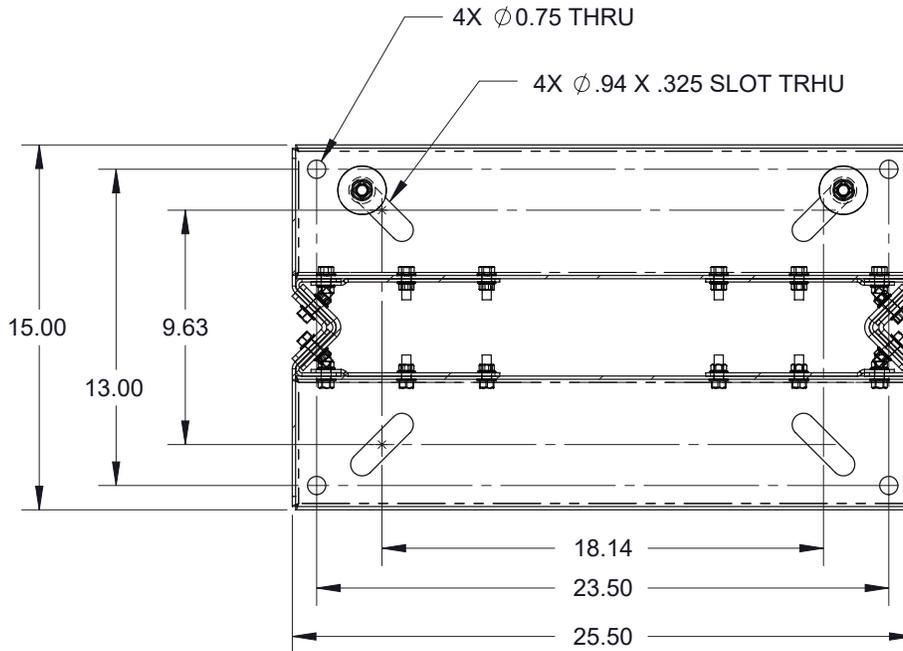


Figure 20: Rack mounting details (top view), bolted rack

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.

19-inch and 23-inch power systems may be either flush or center mounted in the relay rack.

6.5.3 Systems mounted in outdoor enclosures operated above 104°F (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. 19-inch and 23-inch power systems may be either flush or center mounted in the enclosure.

If the system will be operated in ambient temperatures above 104°F (40°C), these installation steps must also be followed:

1. The clear polycarbonate top cover must be removed, if applicable.
2. The enclosure design must prevent the operator from touching the output busbars/lug connections.
3. The battery breakers used must be rated 100 amp or lower, if applicable.
4. Air circulation within the enclosure must be sufficient to maintain the breaker bullets below 221°F (105°C) in all operation conditions.



NOTICE

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.

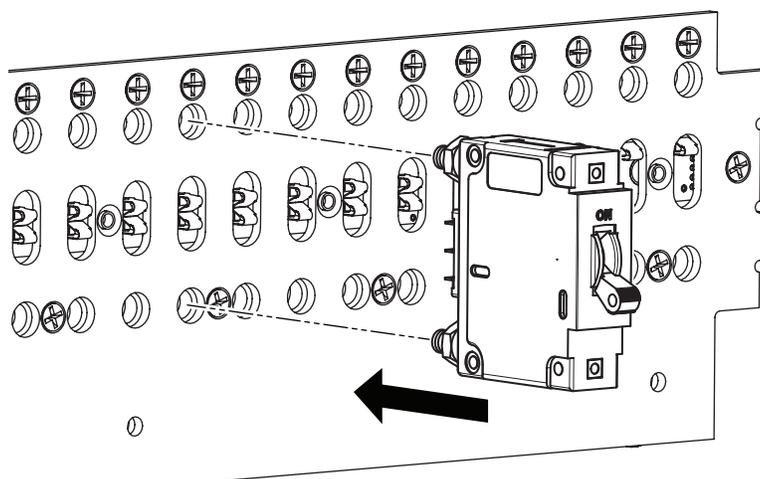


Figure 21: Breaker installation

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 rectifier modules 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



ATTENTION

Cordex® CXPS-E3 edge power systems must be installed above a non-combustible surface.

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

7.1.1 Calculating input and output wire size requirements

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

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

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

A = Ultimate drain in amps.

LF = Conductor loop feet.

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

AVD = Allowable voltage drop.

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

Refer to [Table I](#) for cable size equivalents.

Table I: Cable size equivalents (Imperial 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 |

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

7.1.2 Required torque values

[Table J](#) lists the recommended torque values for connection to the power system with the following hardware:

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

SAE Grade 5 rated hardware is required for these torque values. Use factory provided hardware or zinc-chromate. Stainless or other metals have a different torque specification.

| Size | Torque value |
|--------|-----------------------|
| ¼ inch | 8.8 ft-lb (11.93 Nm) |
| ⅜ inch | 32.5 ft-lb (44.06 Nm) |
| ½ inch | 73 ft-lb (98.97 Nm) |

7.2 Grounding

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

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

| Power system ampacity | Recommended ground reference conductor size |
|-----------------------|---|
| <30A | 10 AWG (6 mm ²) |
| 30A to 100A | 6 to 2 AWG (16 to 35 mm ²) |
| 100A to 400A | 0000 AWG (107 mm ²) |
| 400A to 800 A | 350 MCM (185 mm ²) |
| >800A | 750 MCM (400 mm ²) |

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

7.2.1 Frame ground

There are several options for connecting a frame ground to the power system (select just one option):

- The options highlighted on either side of the power system distribution.
- As highlighted in the Cordex® HP 2.4/3.0 kW Rectifier User Guide (ID: 0100037-J0), a back connection on the side of the AC termination box.
- If the frame that the power system is installed into is grounded, then it can also be grounded as a final option through the mounting ears on the side of the power system through the frame.

Connection to power system directly

Connect a cable (matched to maximum size breaker, usually 2 AWG (35 mm²) or less between one of the side panels of the power system to the master ground bus (MGB) or floor ground bus (FGB). This connection can be made using a 1/4 inch x 5/8 inch lug and two 1/4 inch x 20 bolts into the PEM nuts indicated in the following drawing.

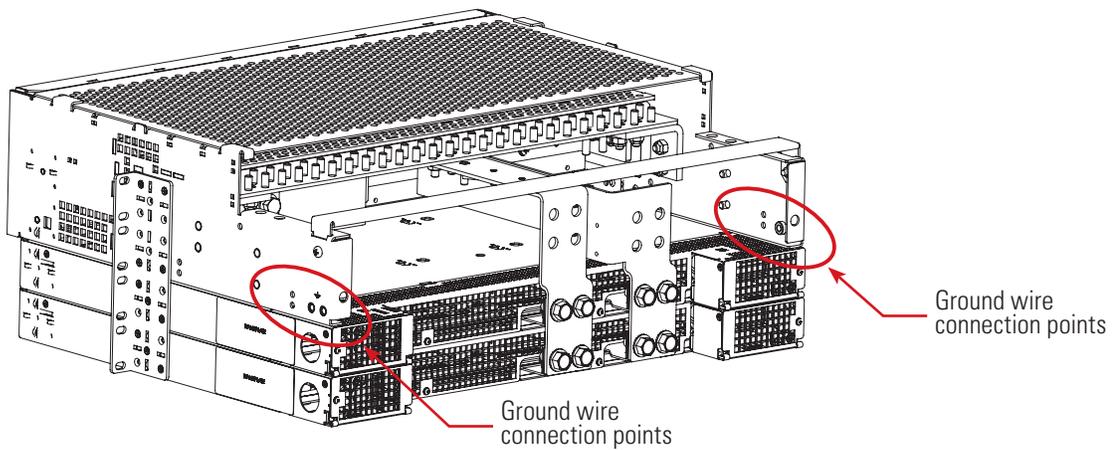


Figure 22: Connecting the frame ground to the power system

Connection to overhead trays

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

Connect a cable to the frame in which the power system is installed. The rack upper crossbar (Figure 23) has five 5/8 inch diameter holes to accommodate threaded rod attachment to the overhead trays. Connect the frame ground 3/8 inch on 1 inch centers and 1/4 inch on 5/8 inch centers. Remove paint in lug contact area to ensure a good electrical connection.

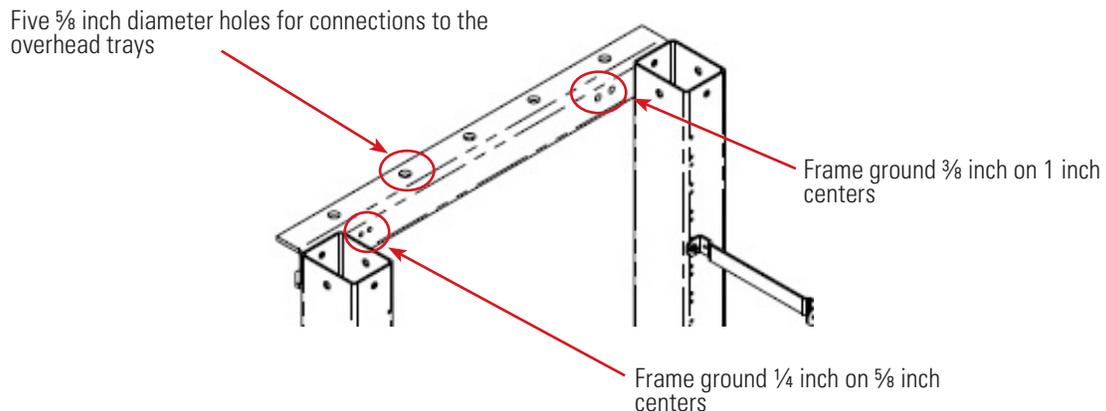


Figure 23: Connecting the frame ground to overhead trays

7.2.2 Reference ground

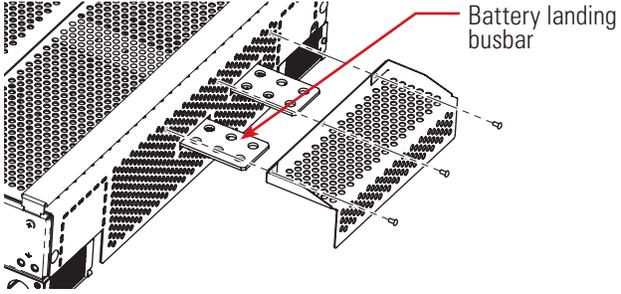
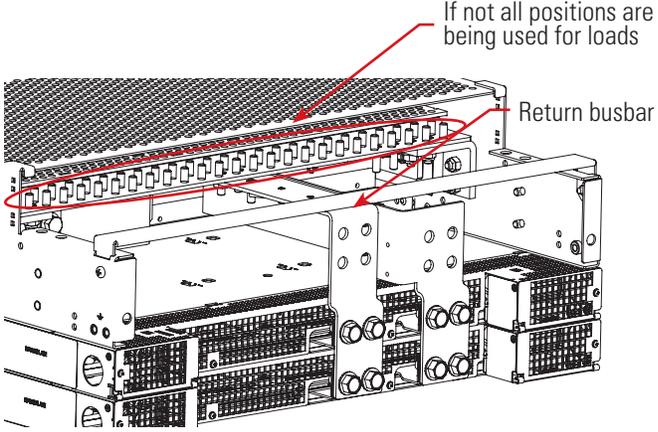
The reference ground should be connected between the building master ground bus (MGB) or floor ground bus (FGB) and the power system internal battery return bus (BRB) in **only one** location.



ATTENTION

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 an 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. |
| 3 | Battery landing busbar | If this option is included (extends out through back cover).  |
| 4 | 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.



NOTICE

Verify no rectifier modules are installed in the rectifier shelves at this time.

7.3.1 AC feeder protection and sizing



ATTENTION

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.

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.

7.3.2 AC wiring for Cordex® HP 2.4/3.0kW Rectifier Shelves

Cordex® HP 2.4/3.0kW rectifier shelves used within power systems are 19-inches 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 3/4 inch trade size knockout 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 |
|-----------------------------|---|---|
| Single phase, 208 to 277VAC | 23-inch breaker = 2 × 40 amp and 1 × 20 amp AC breakers | 8 AWG (10 mm ²) for 40 amp breakers |
| | 19-inch breakers = 4 × 20 amp AC breakers | 12 AWG (4 mm ²) for 20 amp breakers |



CAUTION

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

Refer to the [Specifications](#) for further details.

1. Ensure that all modules are removed from the shelf.
2. At the back 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 rectifier modules or one rectifier module as shown in [Figure 24](#).
3. The wire way is designed for two customer-supplied, 3/4 inch conduit fittings for the AC supplies located one on each side of the shelf. Attach the conduit retainers to the wire way holes 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 document.
5. Tighten the cable connector to the AC cable (conduit similar).
6. Replace back covers once all connections have been completed.

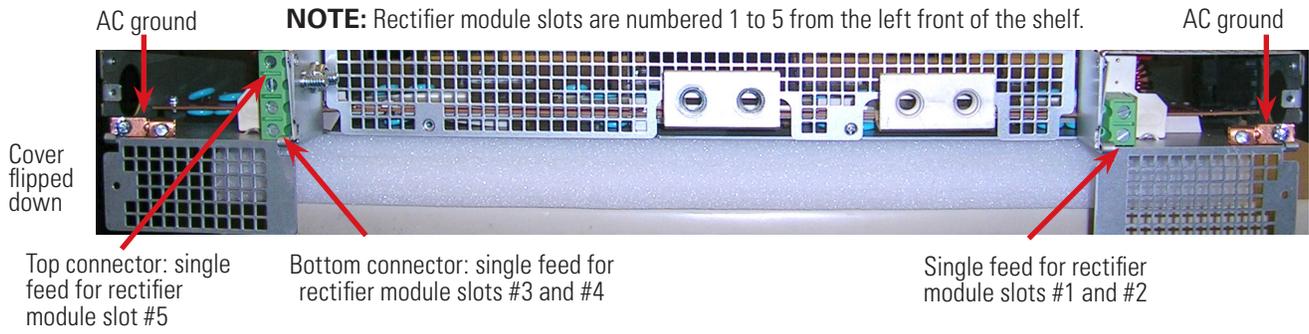


Figure 24: AC input and ground for 23-inch shelf

7.4.2 AC wiring for Cordex® HP 4.0/4.6 kW Rectifier Shelves

Cordex® HP 4.0/4.6 kW rectifier shelves used within power systems are 19-inches 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 1-inch trade size 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 | Recommended AC wire size |
|--|-----------------------------|-----------------------------|
| Single phase, 208 to 277VAC | 6 × 30 amp AC breakers | 10 AWG (6 mm ²) |
| Three phase, 208VAC (without neutral) | 2 × 50 amp AC breakers | 6 AWG (16 mm ²) |
| Three phase, 277/480VAC (with neutral) | 2 × 30 amp AC breakers | 10 AWG (6 mm ²) |

7.4.3 AC wiring for Cordex® HP 4.0 kW Rectifier Shelves

[Figure 25](#) shows the AC connections for one of the rectifier shelves. For other AC connection options (for example, single phase), refer to the rectifier shelf document that ships with your system.

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

AC wireway 1.313 inch
for 1 inch conduit



Figure 25: Shelf AC connection (three-phase, three-wire shown with back cover removed)

7.4 DC wiring



CAUTION

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 volt 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—connections are available for both hot and return.
2. Burnish the terminating points and apply a corrosion-inhibiting agent, such as Sanchem Inc. NO-OX-ID® A-SPECIAL electrical grease, 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 and breaker (fuse) spacing



CAUTION

For applications when the power system is subjected to ambient temperatures above 131°F (55°C) it must be installed inside equipment such that unintentional contact with the 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.



NOTICE

Connect breaker returns before hot connections.

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

For Cordex® CXPS-E3 300A Edge Power Systems

1. Any single pole overcurrent protection device (OCPD) rated at 125 amps can be mounted in pairs, but cannot have an OCPD installed on either side of the pair.
2. Any single pole OCPD rated at 100 amps and below can be mounted in any position without spacing.
3. The highest rated bullet fuse that can be used is 125 amps. The highest rated single pole breakers that can be used for a load is 100 amps. The highest rated single pole breaker that can be used for batteries is 125 amps at temperatures below 131°F (55°C) and 100 amps for temperatures above 131°F (55°C).

While these guidelines require some planning, they do not limit achieving the maximum 300 amp capacity for any breaker size combination (except if many small breakers are used).

For Cordex® CXPS-E3 400A Edge Power Systems

1. Any single pole overcurrent protection device (OCPD) rated at 125 amps can be mounted in pairs, but cannot have an OCPD installed on either side of the pair.
2. Any single pole OCPD rated at 100 amps and below can be mounted in any position without spacing.
3. The highest rated bullet fuse that can be used is 125 amp. The highest rated single pole breakers that can be used for a load is 100 amps. The highest rated single pole breaker that can be used for batteries is 125 amps at temperatures below 131°F (55°C) and 100 amps for temperatures above 131°F (55°C).

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

For Cordex® CXPS-E3 600A Edge Power Systems

1. The highest rated single position fuse holder is 125 amps.
2. The highest rated single pole breaker for a load is 100 amps.
3. Any single pole breaker rated above 90 amps must not have any overcurrent protection device (OCPD) installed in the positions on either side of it.
4. Any single pole breaker rated 90 amps and below can be mounted in any position without spacing.
5. The single position fuse holder can be mounted without spacing (except in reference to item 2).

For Cordex® CXPS-E3 900A Edge Power Systems

1. Any single pole overcurrent protection device (OCPD) rated at 125 amps can be mounted in pairs, but cannot have an OCPD installed on either side of the pair.
2. Any single pole OCPD rated at 100 amps and below can be mounted in any position without spacing.

3. The highest rated bullet fuse that can be used is 125 amps. The highest rated single pole breakers that can be used for a load is 100 amps. The highest rated single pole breaker that can be used for batteries is 125 amps at temperatures below 131°F (55°C) and 100 amps for temperatures above 131°F (55°C).

While these guidelines require some planning, they do not limit achieving the maximum 450 amp 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 ¼ inch to ⅝ inch center lugs for connecting to the power system distribution. Always make the return connection to the power system, 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 and battery breaker return connections

Secure cables with two hole lugs to the ¼ inch studs on ⅝ inch centers using the supplied hardware. Run cables directly out the back of the distribution panel.

Load and battery breaker hot connections

Secure cables with two hole lugs to the ¼ inch studs on ⅝ inch centers using the supplied hardware. Run cables directly out the back of the distribution panel above the breaker return cables.



NOTICE

The 600A double distribution system can accommodate ¾ inch studs on 1 inch centers for battery connections. For more information, refer to drawing 0250047-08 at the end of this document.

7.6 Alarm and signal connection

The I/O capabilities of the power 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 26 to 16 AWG (0.14 to 1.50 mm²) for the temperature range of 32°F to 167°F (0°C to 75°C) as per UL/CSA.



CAUTION

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

Route via wireways and use existing cable clamps or 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.

Terminal block connections for the ADIO peripheral should be routed along the left side of the power system (looking at unit from front). Connections to the system controller and ADIO peripheral should be routed along the right hand side of the power system. Refer to the customer connections (-08) drawing at the end of this document for details on terminal block assignments.

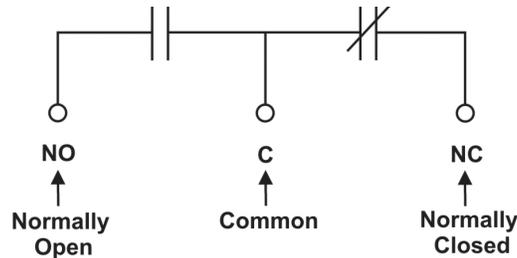


Figure 26: Alarm (relay) connections

7.6.1 Alarm (relay) outputs

Terminals provide contacts for extending various alarm or control signals. Each relay output can be wired for normally open (NO) or normally closed (NC) operation during an alarm or control condition. Relays can be programmed to energize or de-energize during an alarm condition. See the system 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 (negative or positive) DC signal directly.

7.6.3 Connection method

Typical Cordex® 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; for example, 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 27](#)) allows the digital input to receive (or not receive) a Ground signal on an alarm.

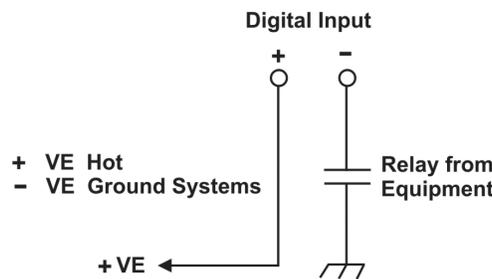


Figure 27: Digital input connection method

| Table L: Voltage level definitions for digital inputs | | |
|---|---------------------------------------|--------------------------------------|
| Voltage range | Voltage level considered as "0" (Off) | Voltage level considered as "1" (On) |
| -60 to +60VDC (system voltage setting) | -1 to +1VDC | -60 to -5 or +5 to +60VDC |

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 system controller software manual for detailed instruction on programming.



ATTENTION

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

7.6.5 Analog inputs

The analog input channels are used to monitor various types of electrical signals. The analog channels are labeled to receive specific signals. The input cables should be bundled together and routed through the entry holes.

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

7.7 Network and remote communication

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

Some standard scenarios are described:

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

7.8 Connecting battery temperature sensor

Locate the battery temperature sensors from the ADIO peripheral coiled below the distribution panel. Uncoil and connect the temperature sensors to a battery termination post negative in each battery tray.

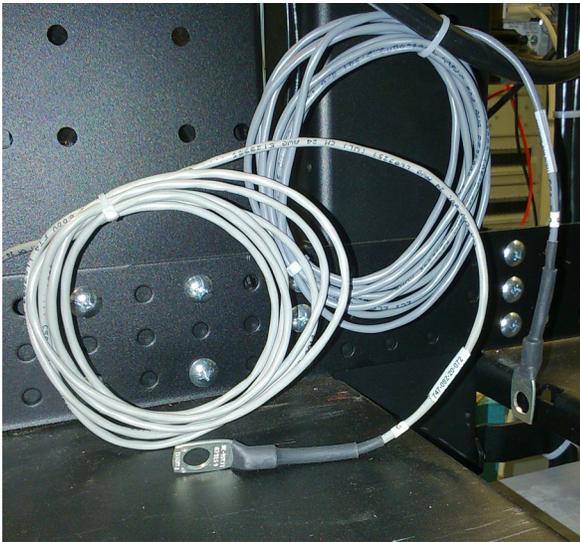


Figure 28: Battery temperature sensor



Figure 29: Battery temperature sensor, battery bay

7.8.1 Load distribution

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

7.9 Signal wiring

1. Use the Form C relay contacts on the ADIO low voltage peripheral to extend various alarm or control signals to an external site monitor. [Figure 31](#) shows the peripheral alarm relay pinouts. [Table M](#) lists the factory default settings.
2. Use 26 AWG (0.14 mm²) or larger wire.
3. Bundle signal wires together and route through the top of the bay.

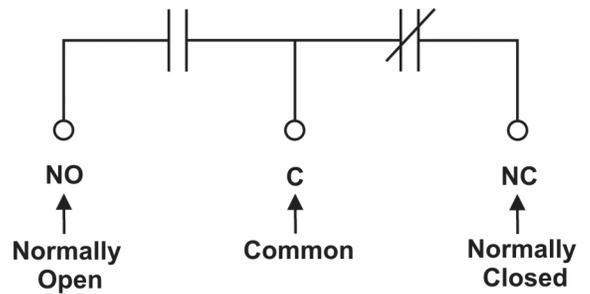


Figure 30: Relay connections, not energized state

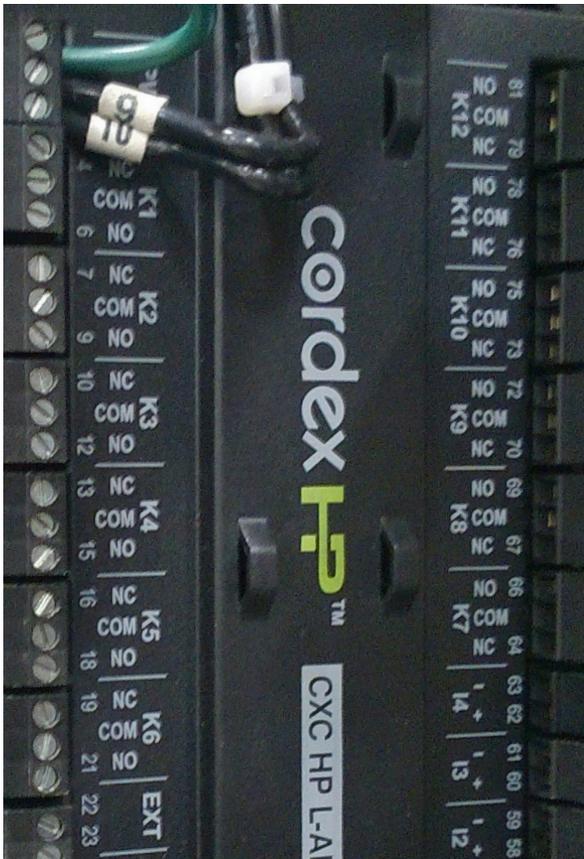


Figure 31: Alarm relay pinouts

| Channel description | Factory default designation |
|---------------------|-----------------------------|
| LCD fail alarm | Not configurable |
| Relay K1 to K5 | LVD1 or not used |
| Relay K6 to K8 | User configurable |
| Relay K9 | AC MAINS HIGH/LOW alarm |
| Relay K10 | SYSTEM MINOR alarm |
| Relay K11 | SYSTEM MAJOR alarm |
| Relay K12 | SYSTEM CRITICAL alarm |

7.9.1 Relays

Relays can be programmed to be energized or not energized during an alarm condition. See the system controller software manual for programming. Relays can be reassigned in the **Relays** table. From the system controller's main **Dashboard** go to **Modules**. In the **CAN Modules** table, select the module and select the **Go To** button.

For more information, refer to the ADIO peripheral 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.
 - Battery modules are disconnected.
 - All breakers are off and no grasshopper made for telecom (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.
 - Slide the module into the back connector inside the shelf.
 - Apply pressure on the module front panel to engage the back connector in the shelf receptacle.
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 system controller's built-in display 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 system controller software manual for detailed instructions on how to configure the batteries.
11. From the **Systems > DC System > System Functions > Equalize & Boost** menu of the system controller, set the float and equalize voltage to the levels specified by the battery manufacturer.
12. Use the system 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 **Systems > DC System > System Functions > Temperature Compensation** menu. Program the settings for slope and breakpoints (upper and lower) with respect to the specific batteries used.

8.9.1 Factory ranges and default values

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

| Table N: Rectifier module factory ranges and default values | | |
|---|----------------------------|---------|
| Setting | Range (minimum to maximum) | Default |
| Float (FL) voltage | 47.5 to 58.2V | 54V |
| Equalize (EQ) voltage | 49.8 to 60.2V | 55V |
| Battery test (BT) voltage | 44 to 52V | 46V |
| Overvoltage protection (OVP)¹ | 63V | 63V |
| Current limit (CL) | 23 to 100% | 100% |
| Power limit (PL) | 0 to 100% | 100% |
| Module start delay | 0 to 250 s | 1 s |
| System start delay | 0 to 600 s | 0 s |
| Low voltage alarm (LVA) | 42 to 52V | 44V |
| High voltage alarm (HVA) | 52 to 63V | 55.5V |
| EQ timeout | 1 to 2399 h | 30 h |
| BT timeout | 1 to 250 h | 8 h |
| Softstart ramp-rate | Normal/Fast | Normal |
| Current limit and power limit alarm | Enable/Disable | Enable |
| Remote shutdown | Enable/Disable | Enable |
| Ramp test | Enable/Disable | Enable |

¹The overvoltage protection value 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 Cordex® power 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 support or sales for all replacement parts.



WARNING

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



ATTENTION

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



ATTENTION

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

Table O: Sample maintenance log

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

9.1 System controller lithium battery replacement

A removable CR2032 lithium battery is located at the top of the system controller it is designed to be field replaceable and can be easily removed with no tools. The battery life is rated up to three years, but should be replaced if the panel does not maintain date and time during power interruption. It is also recommended to replace when the lithium battery voltage is less than 2.6VDC.

Depress the two front panel latches and tilt the front panel forward and down. Remove the battery from the slot and replace with the same type of battery observing the correct polarity.



NOTICE

If the system controller is powered off when the battery is replaced, time will be lost. Once the system controller is powered on, reset the time.



Figure 32: System controller battery replacement

9.2 300 and 400 amp LVD override operation



ATTENTION

Before removing a system controller from a live system or performing system 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 power system distribution panel below the breakers. The override bypasses the LVD auto control function.

Place the LVD control switch to the **OVERRIDE** position to keep the LVD contactor engaged.

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

9.3 600 amp LVD override operation

Refer to [4.11 600 amp LVD override on page 26](#) for more information.



ATTENTION

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.

10. Troubleshooting

Shelves and modules are designed for simple installation and reliable, trouble-free operation.

In most cases the modules will recover from minor alarms and faults automatically. However under certain conditions the modules may need remote control. And under very rare cases the module may need a manual reset (remove and reinsert the module). In the unlikely event of a module failure, it may need replacement.

A shelf can accommodate up to four or five modules depending on the model and shelf. The modules have various LED status indicators that provide information about the system.

When the shelf system is used in conjunction with a system controller, detailed system information and status can be easily obtained. Additional information can be obtained via the web interface using the Ethernet port.

The following tables provide a quick reference of the various LEDs and the corresponding states.

10.1 Cordex® HP Rectifier Module LEDs

Table P: Cordex® HP rectifier module LED states

| LED name | Color | State | Meaning |
|--------------|--------------|-----------------|--|
| Alarm | Red | Off | Indicates no failure or fault in the module. |
| | | Solid | Indicates the output has shutdown to protect property or personnel. |
| | | Flashing | Indicates a communication failure persisting for five minutes. Indicates the locate module command is active. |
| AC | Green | Off | Indicates output is in an off state. |
| | | Solid | Indicates output is driven. |
| | | Flashing | Indicates the locate module command is active. |
| DC | Green | Off | Indicates a failure or fault with input. |
| | | Solid | Indicates that input is functioning correctly. |
| | | Flashing | Indicates the locate module command is active. |

10.2 Cordex® CXC HP System Controller LEDs

Table Q: Cordex® CXC HP system controller LED states

| LED name | Color | State | Meaning |
|---|---------------|-----------------|---|
| Major/critical alarm (bell icon) | Red | Off | Indicates no active alarms. |
| | | Solid | Indicates one or more major/critical alarms. There can be minor alarms as well. |
| | | Flashing | All LEDs cycle on initial startup. |
| Minor alarm (caution icon) | Yellow | Off | Indicates no active alarms |
| | | Solid | Indicates one or more minor alarms. |
| | | Flashing | All LEDs cycle on initial startup. |

| | | | |
|---------------------|--------------|-----------------|-------------------------------------|
| OK (OK icon) | Green | Off | N/A |
| | | Solid | Indicates that there are no alarms. |
| | | Flashing | All LEDs cycle on initial startup. |

10.3 Cordex® HP L-ADIO Low Voltage Smart Peripheral LEDs

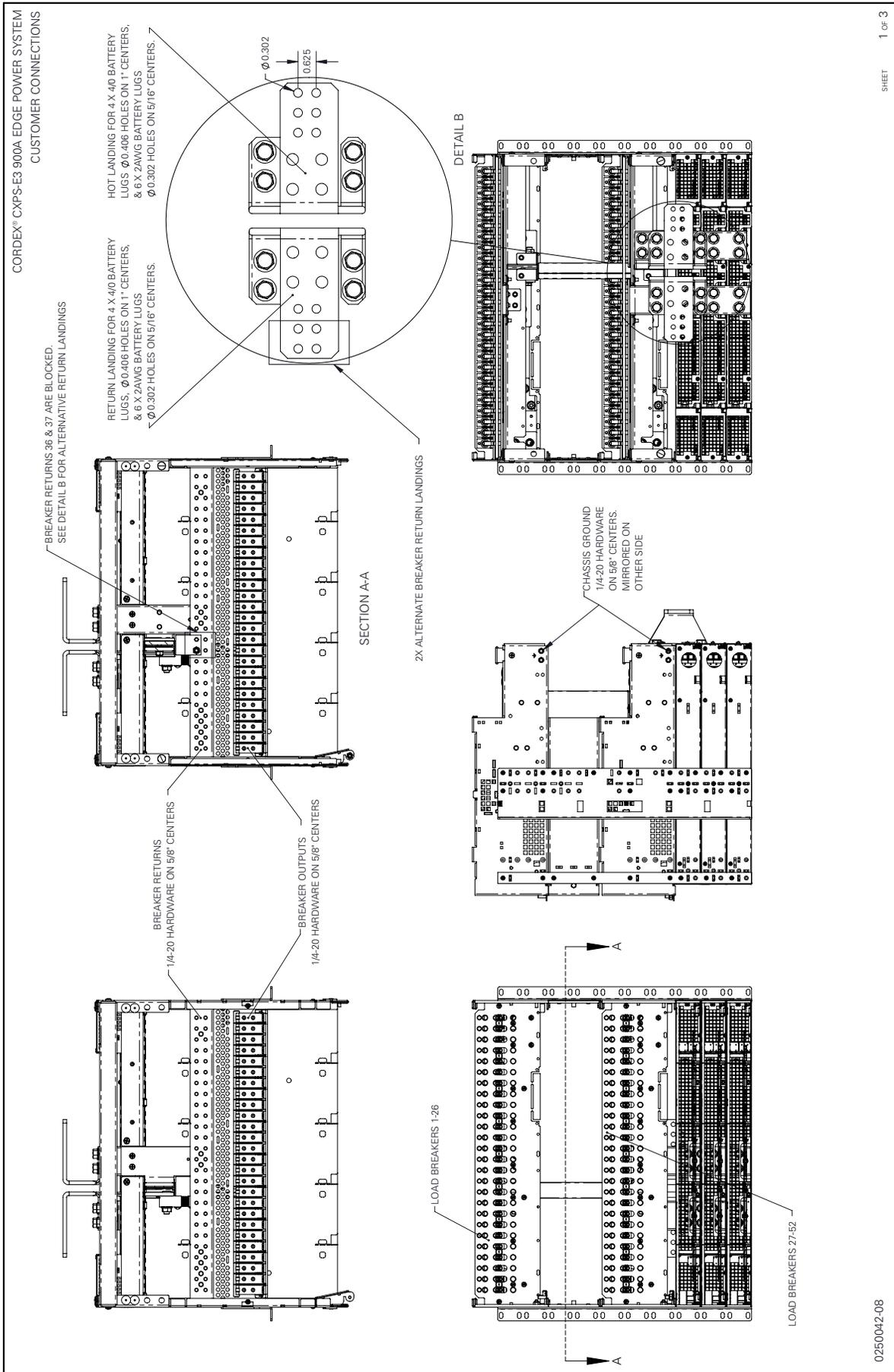
Table R: Cordex® HP L-ADIO smart peripheral LED states

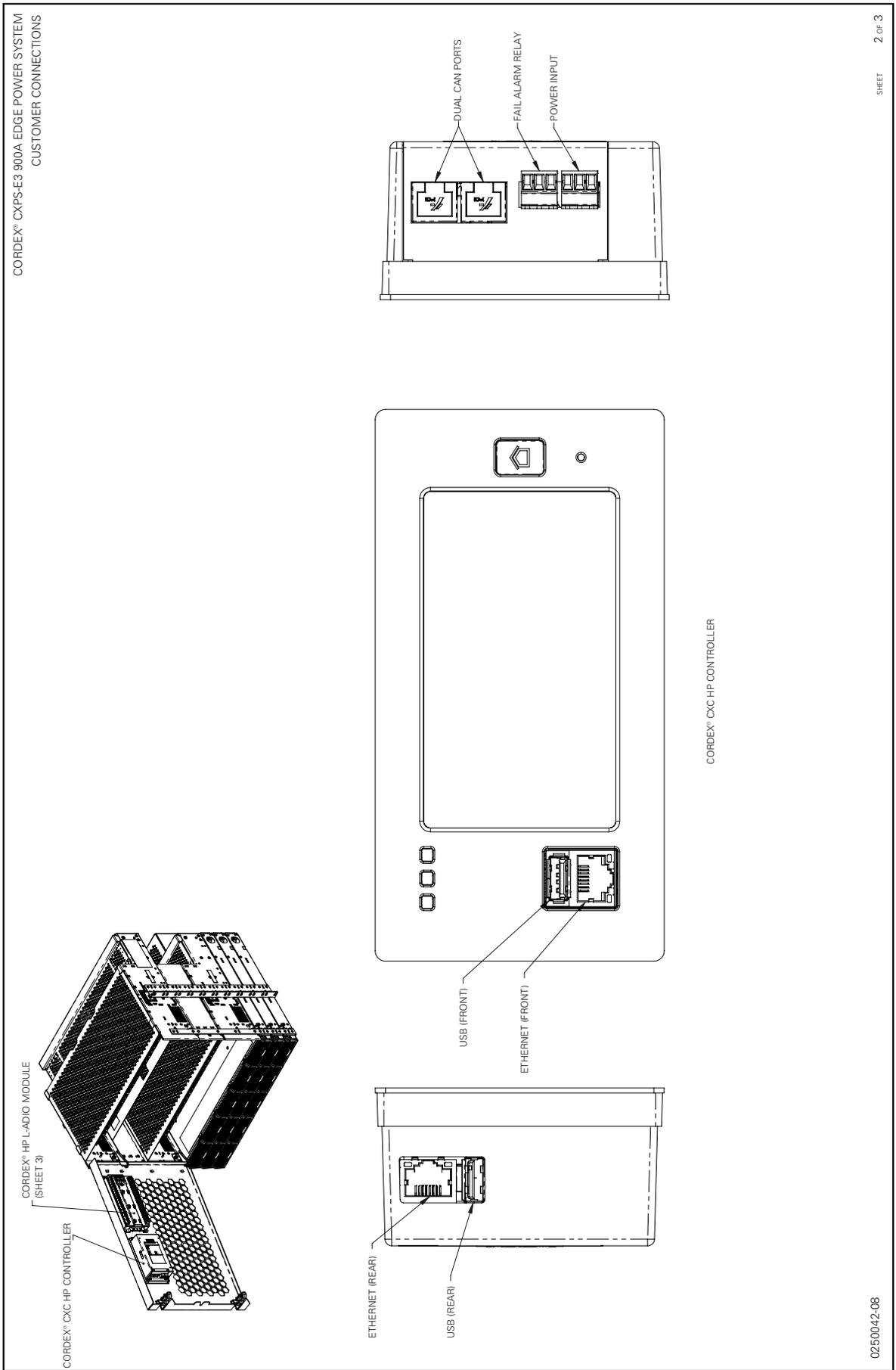
| LED name | Color | State | Meaning |
|-----------------|---------------|-----------------|--|
| LVD | Yellow | Off | Indicates the LVD override feature is disabled. |
| | | Solid | Indicates the LVD override button has been selected and the feature is enabled. |
| | | Flashing | N/A |
| Power | Blue | Off | Indicates no power to the device. |
| | | Solid | Indicates power is present. |
| | | Flashing | N/A |
| COMMS | Green | Off | Indicates no communication with the system controller. |
| | | Solid | Indicates the peripheral has been acquired by the system controller. |
| | | Flashing | The LED flashes in response to a module locate command from the system controller. |

10.4 LVD Override Board LEDs

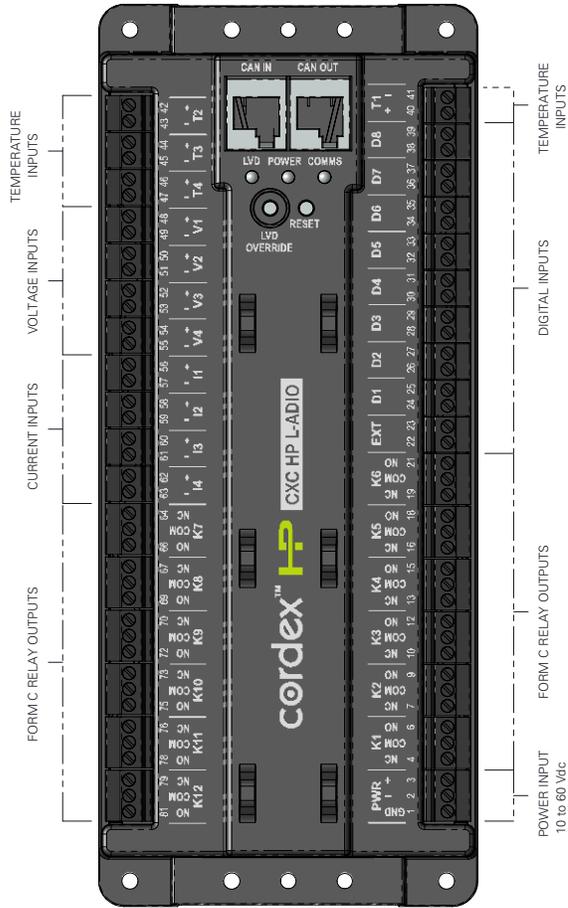
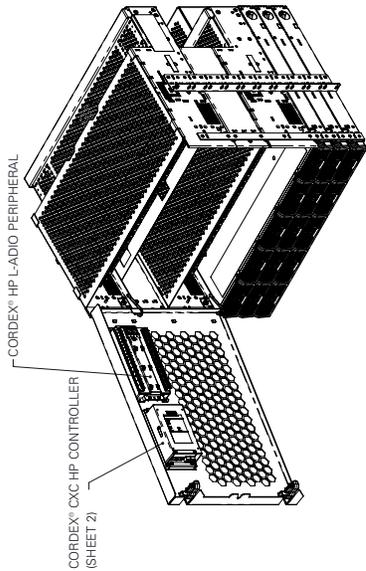
Table S: LVD override board LED states

| LED name | Color | State | Meaning |
|-----------------|---------------|-----------------|---|
| Bus | Green | Off | N/A |
| | | Solid | Indicates the bus is connected to the LVD and has power. |
| | | Flashing | N/A |
| Coil | Green | Off | N/A |
| | | Solid | Indicates the LVD coil is energized. This requires the bus to have power and one of the controls (L-ADIO , REMOTE , or LVD Override) to be active. |
| | | Flashing | N/A |
| O/R | Yellow | Off | N/A |
| | | Solid | Indicates the override switch is in the override position. This should only be on during maintenance. |
| | | Flashing | N/A |

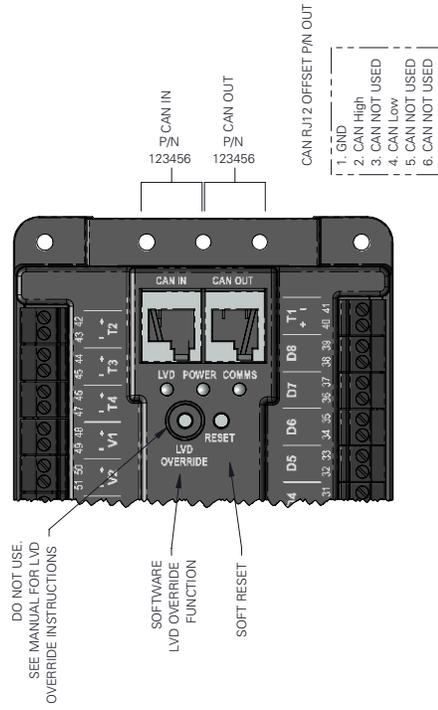




CORDEX® CXPS-E3 900A EDGE POWER SYSTEM
CUSTOMER CONNECTIONS



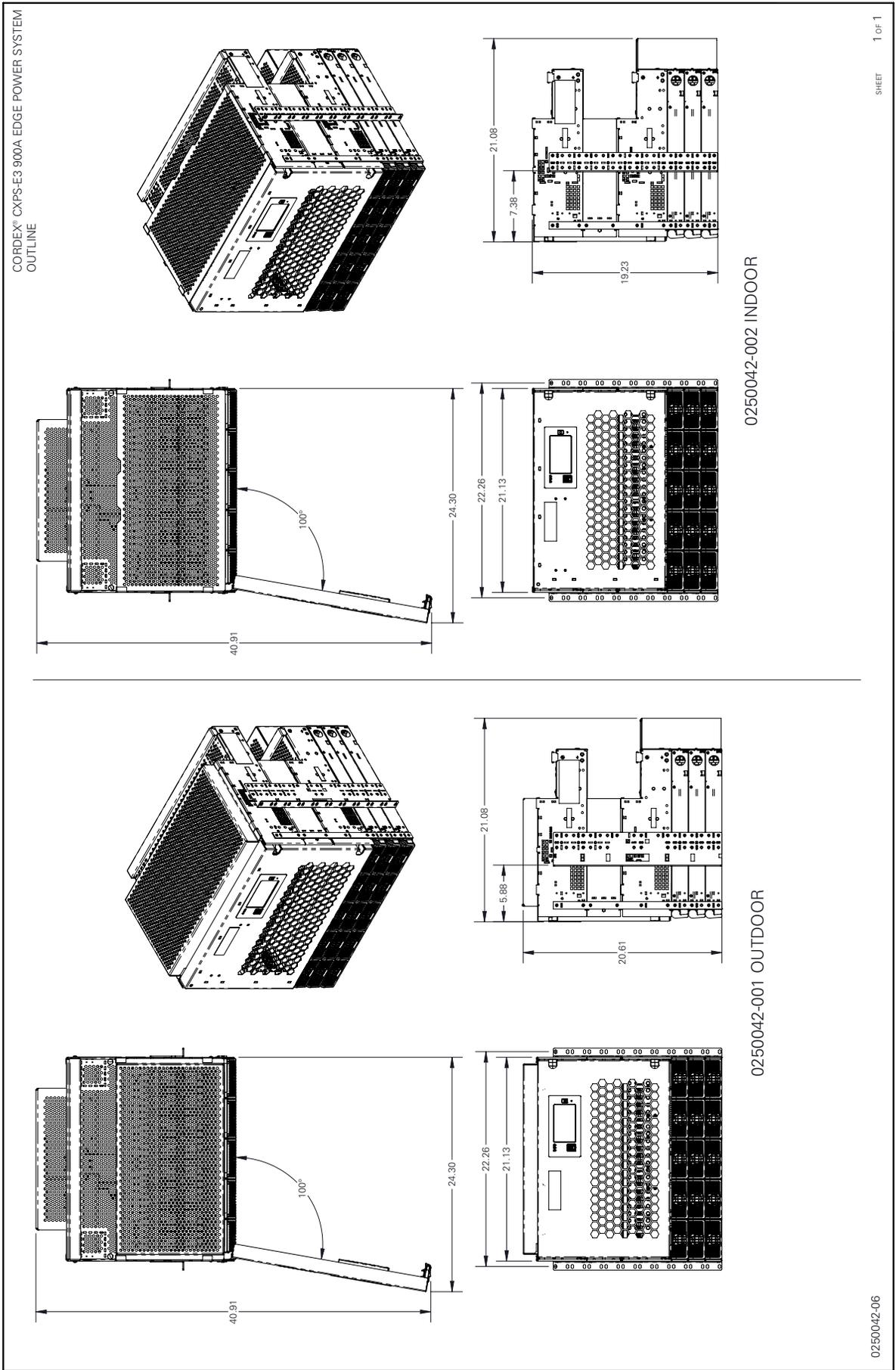
CORDEX® HP L-ADIO I/O SMART PERIPHERAL



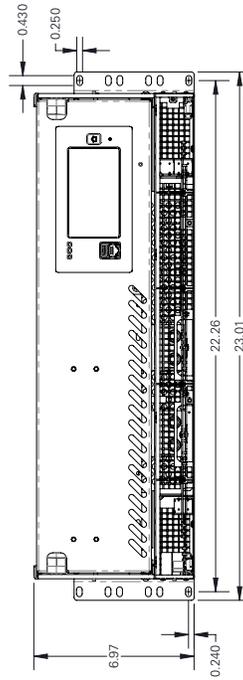
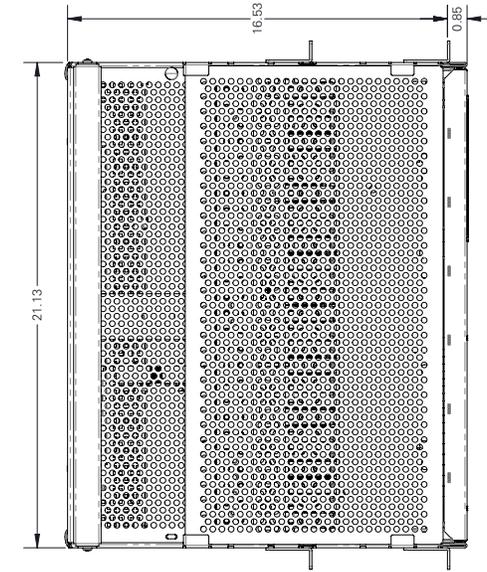
DO NOT USE.
SEE MANUAL FOR LVD
OVERRIDE INSTRUCTIONS

SOFTWARE
LVD OVERRIDE
FUNCTION

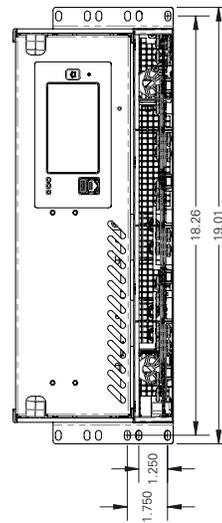
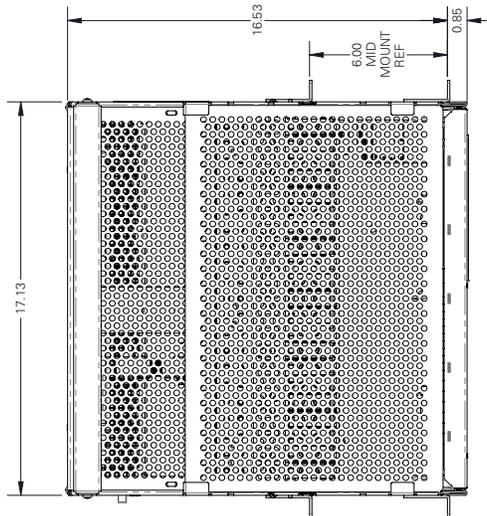
SOFT RESET



CORDEX® CXPS-E3 / CXDM-E3
EDGE POWER SYSTEM
OUTLINE DRAWING



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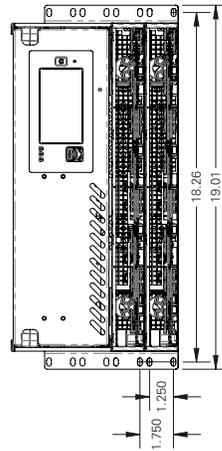
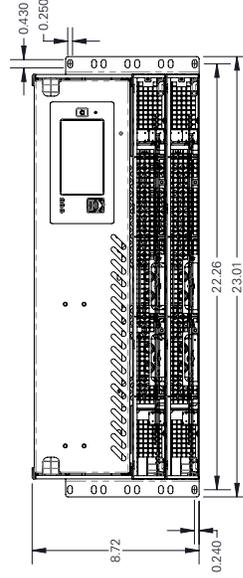
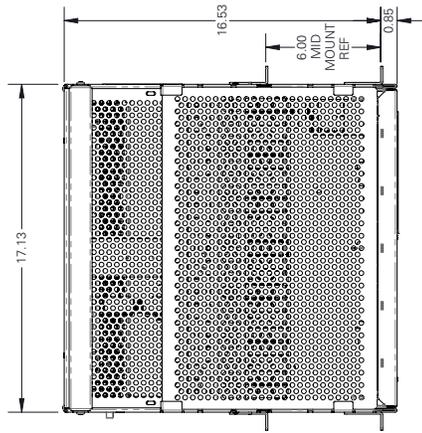
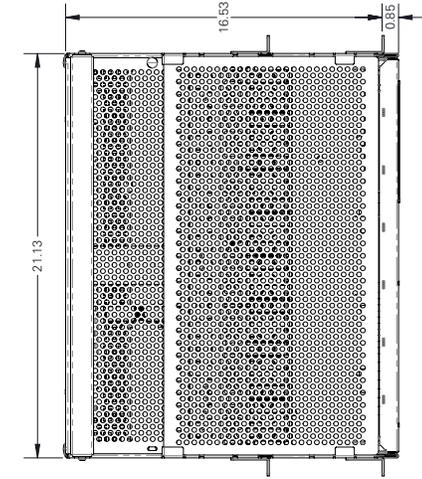


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EDGE POWER SYSTEM
OUTLINE DRAWING



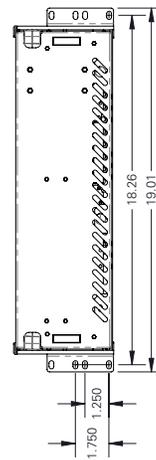
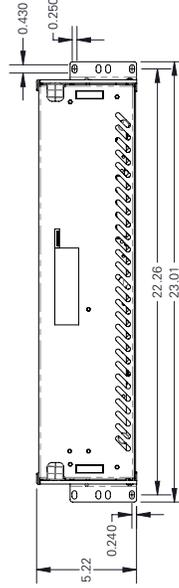
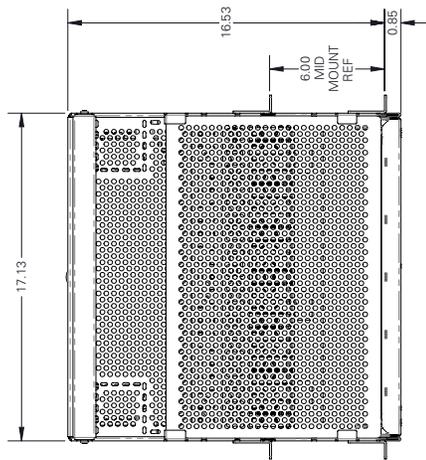
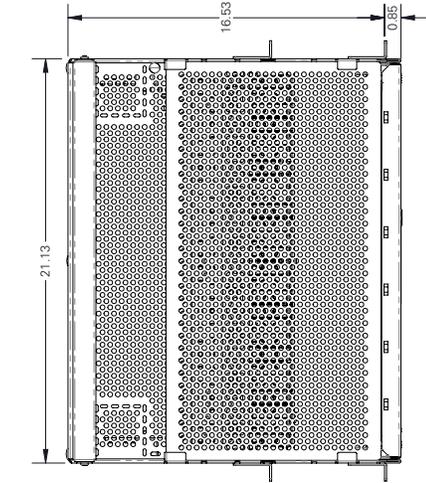
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EDGE POWER SYSTEM
OUTLINE DRAWING



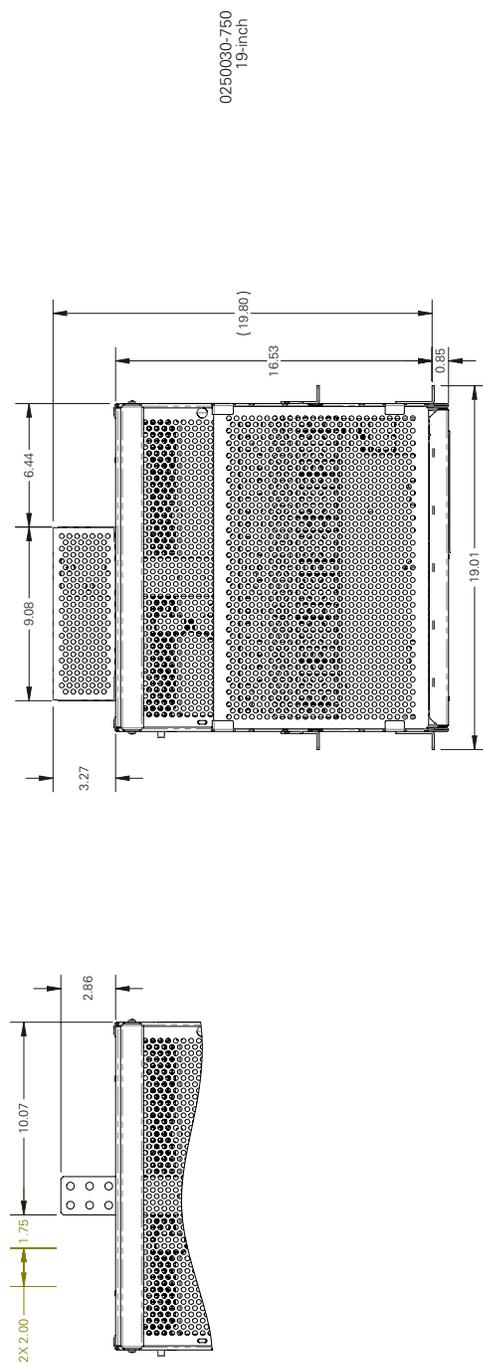
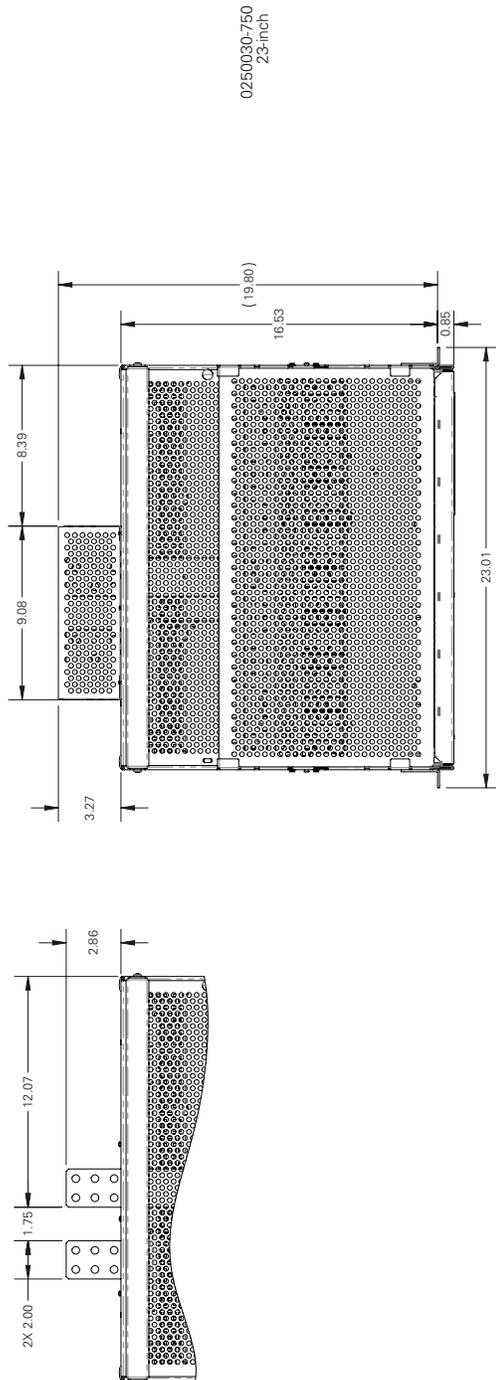
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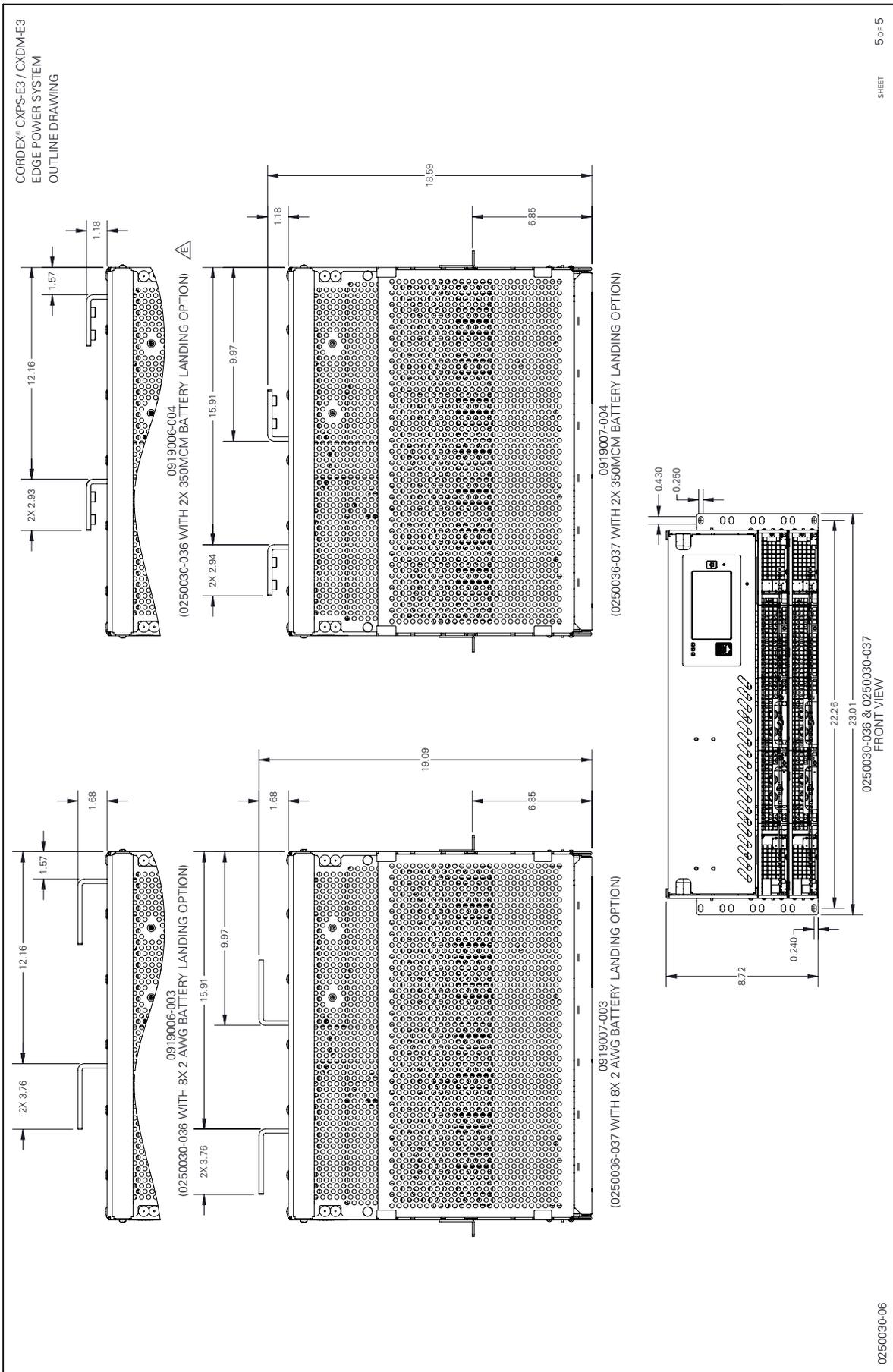
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CORDEX® CXPS-E3 / CXDM-E3
EDGE POWER SYSTEM
OUTLINE DRAWING



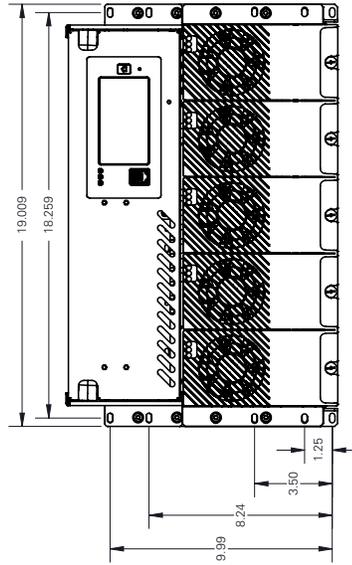
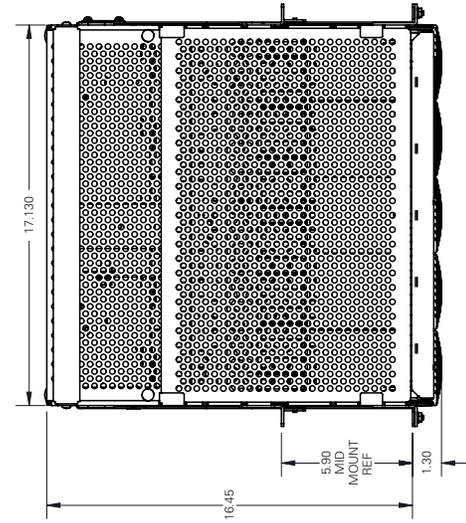
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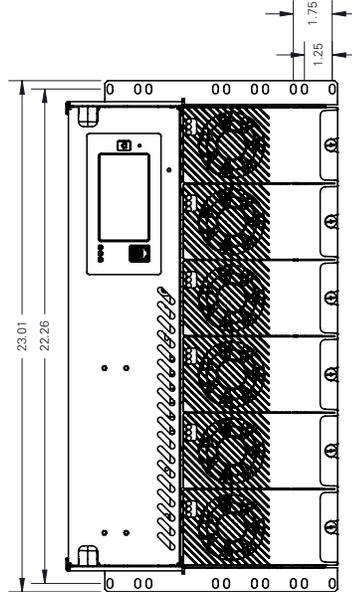
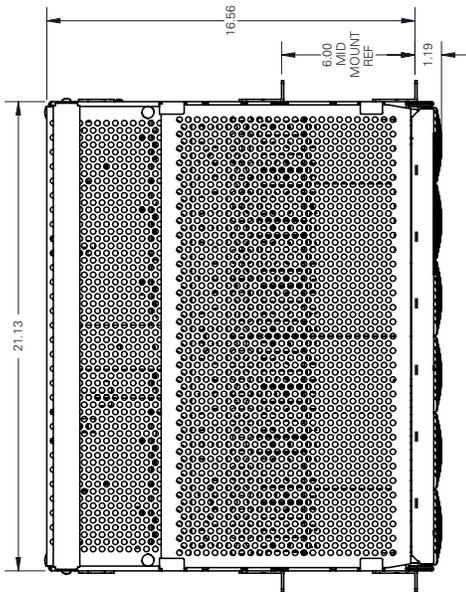


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CORDEX® CXPS-E3 (4 KW)
EDGE POWER SYSTEM
OUTLINE



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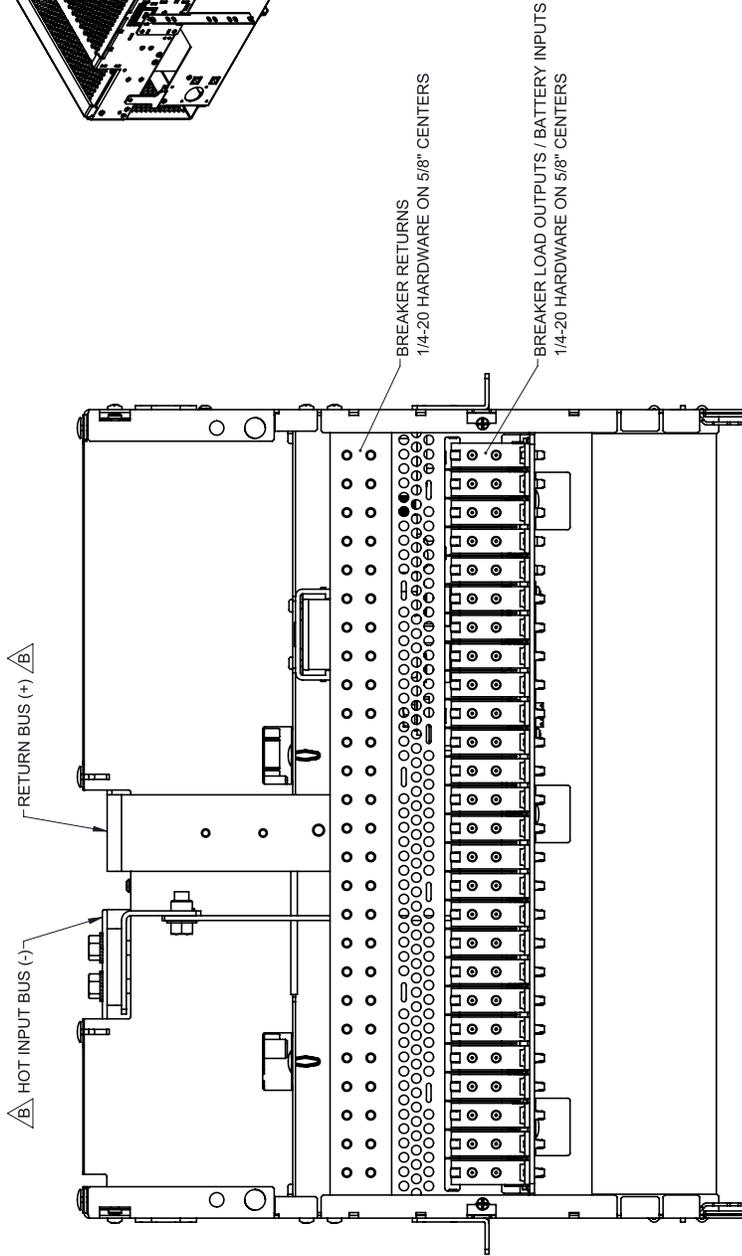
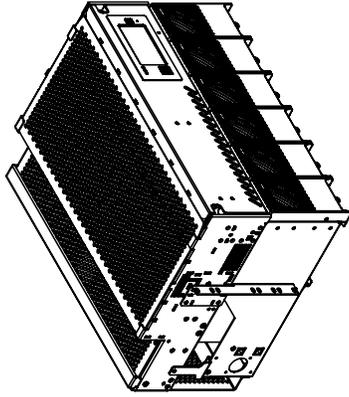


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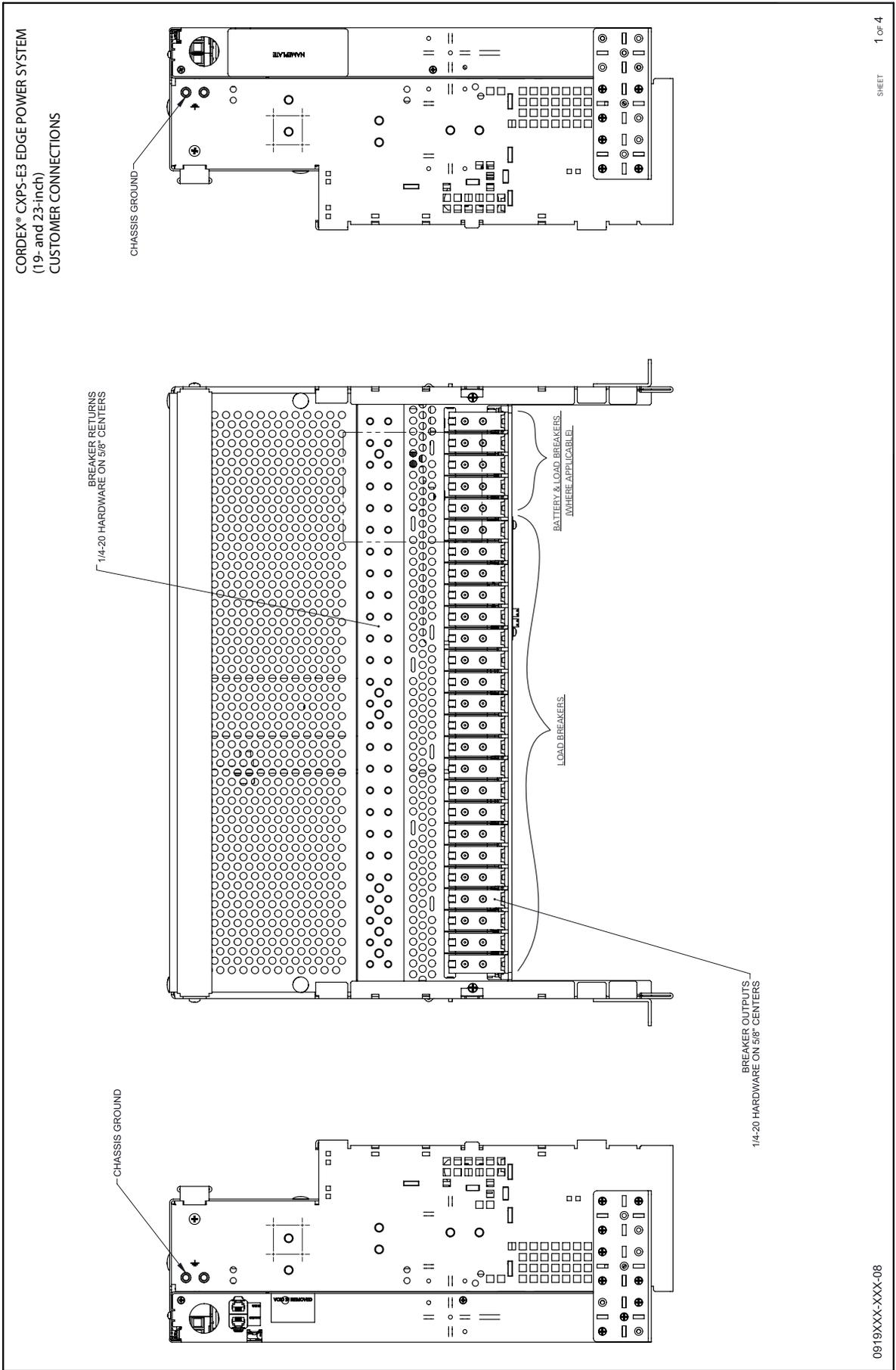
CORDEX® CXPS-E3 (4 KW)
EDGE POWER SYSTEM
CUSTOMER CONNECTIONS



TOP VIEW
DOOR, COVER AND DRESSER BAR REMOVED

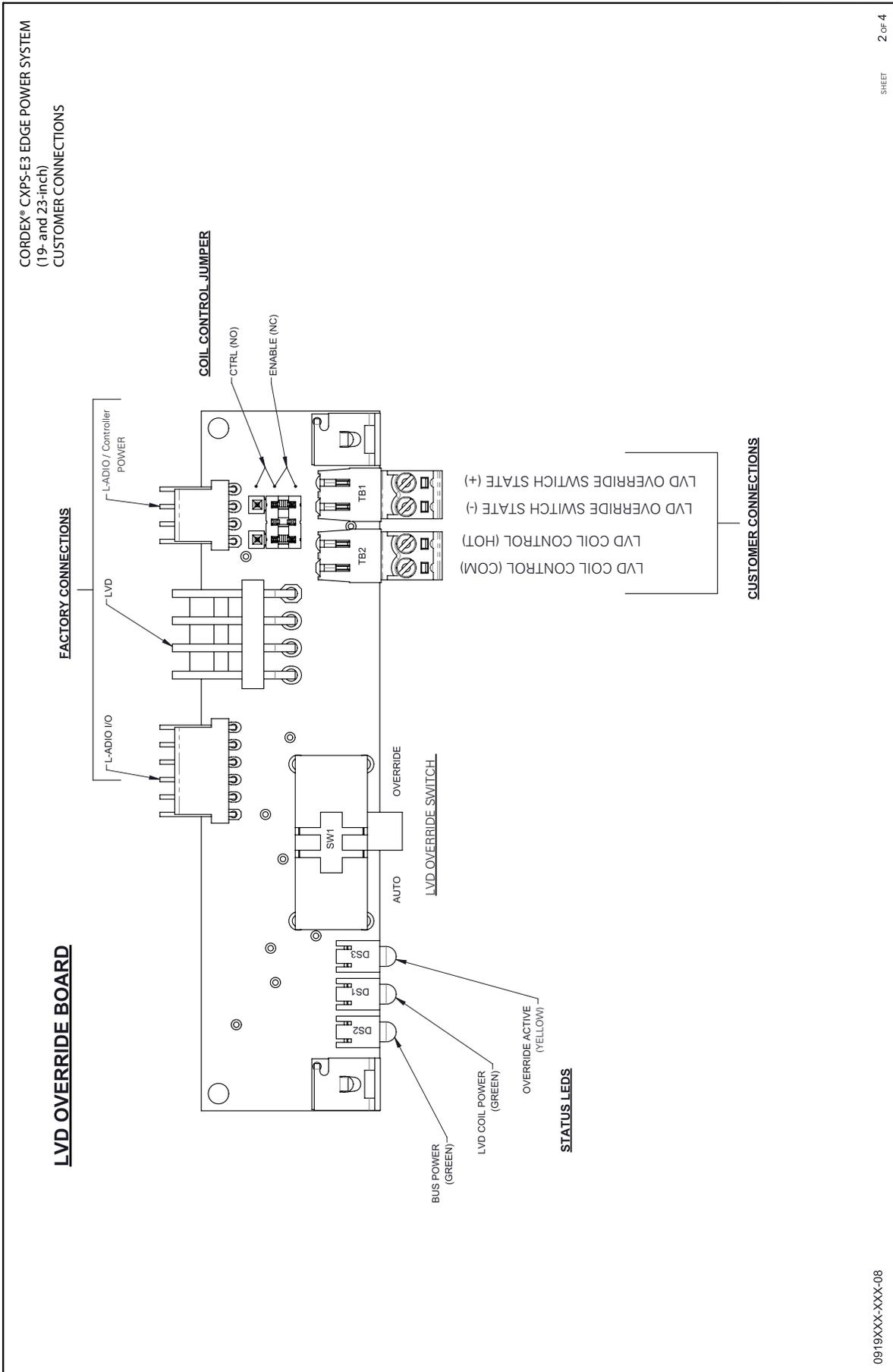
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SHEET 1 OF 4

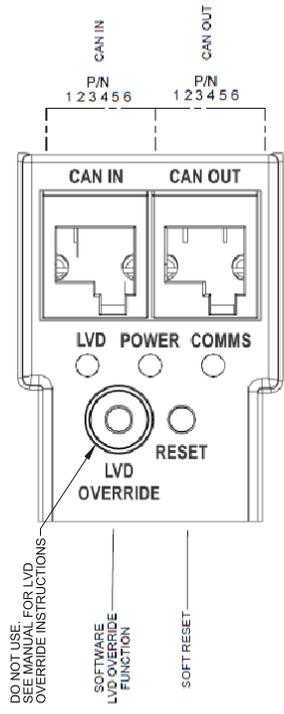
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0919XXX-XXX-08

CORDEX® CXPS-E3 (19- and 23-inch)
CUSTOMER CONNECTIONS



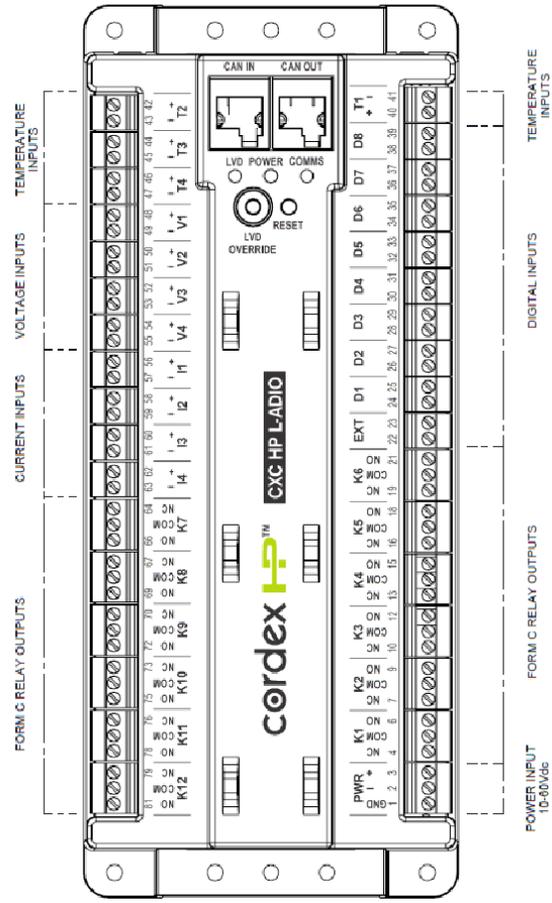
DO NOT USE. SEE MANUAL FOR LVD OVERRIDE INSTRUCTIONS

SOFTWARE LVD OVERRIDE FUNCTION

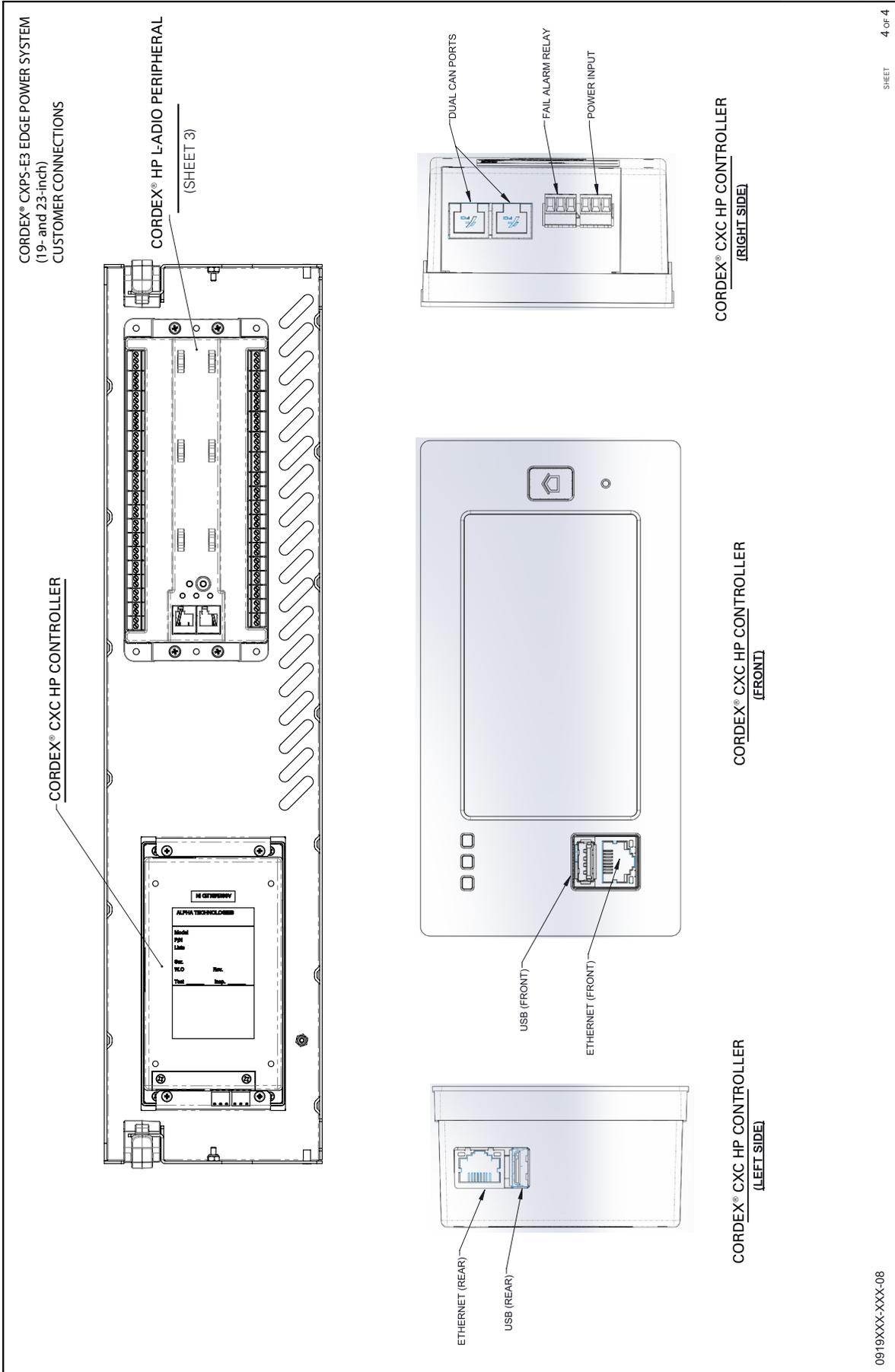
SOFT RESET



- 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.

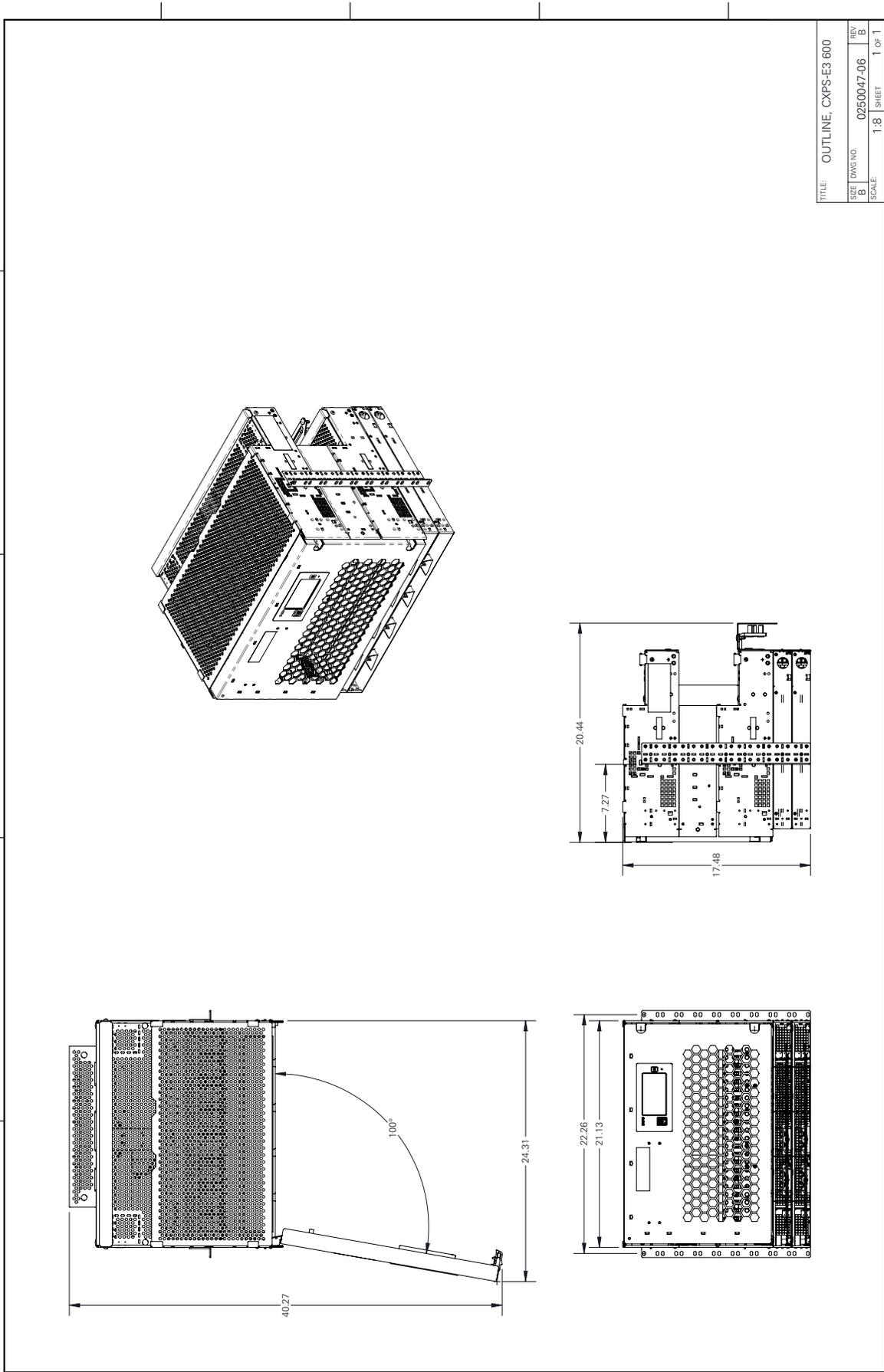


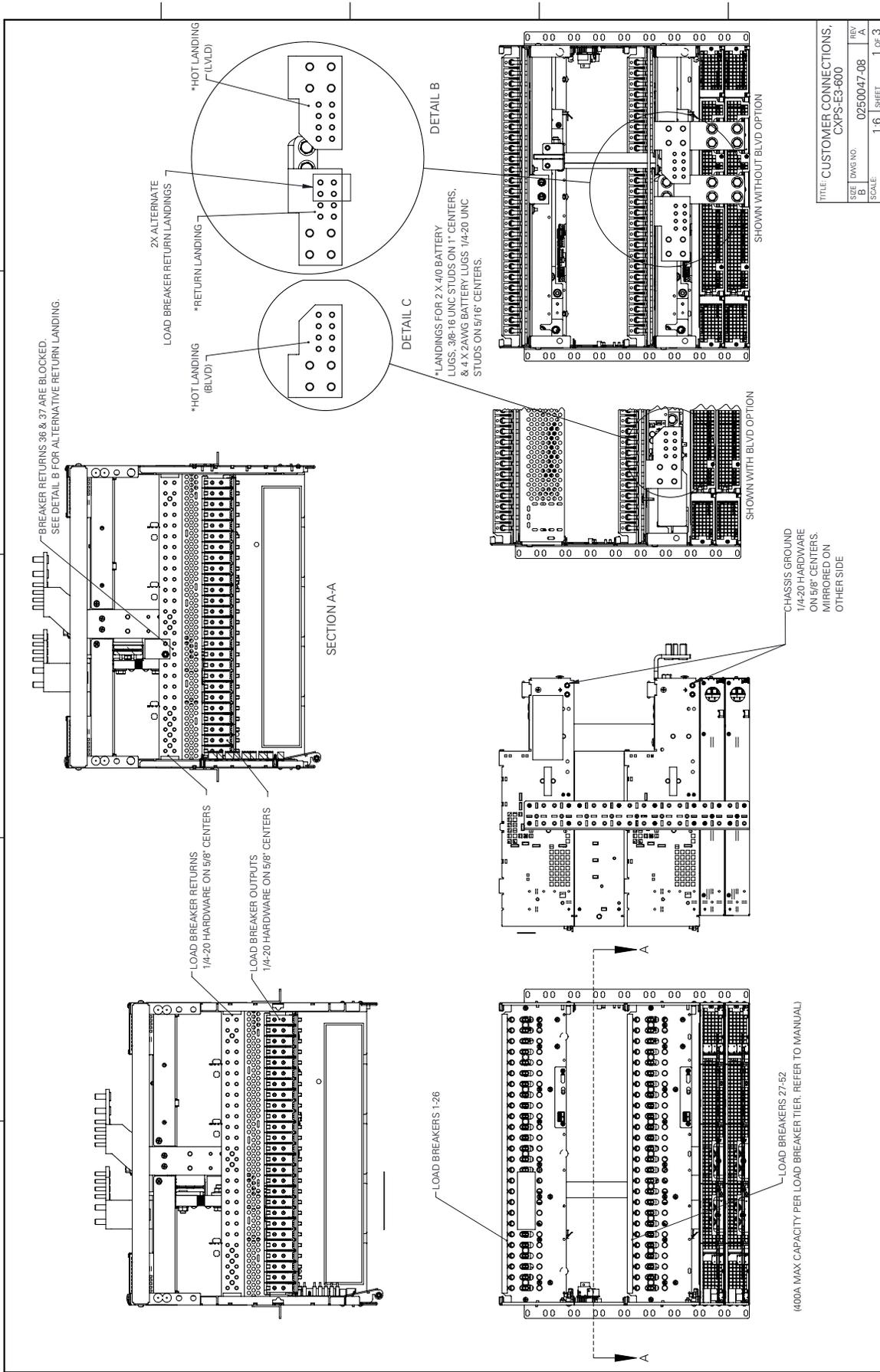
Cordex® HP L-ADIO I/O Peripheral



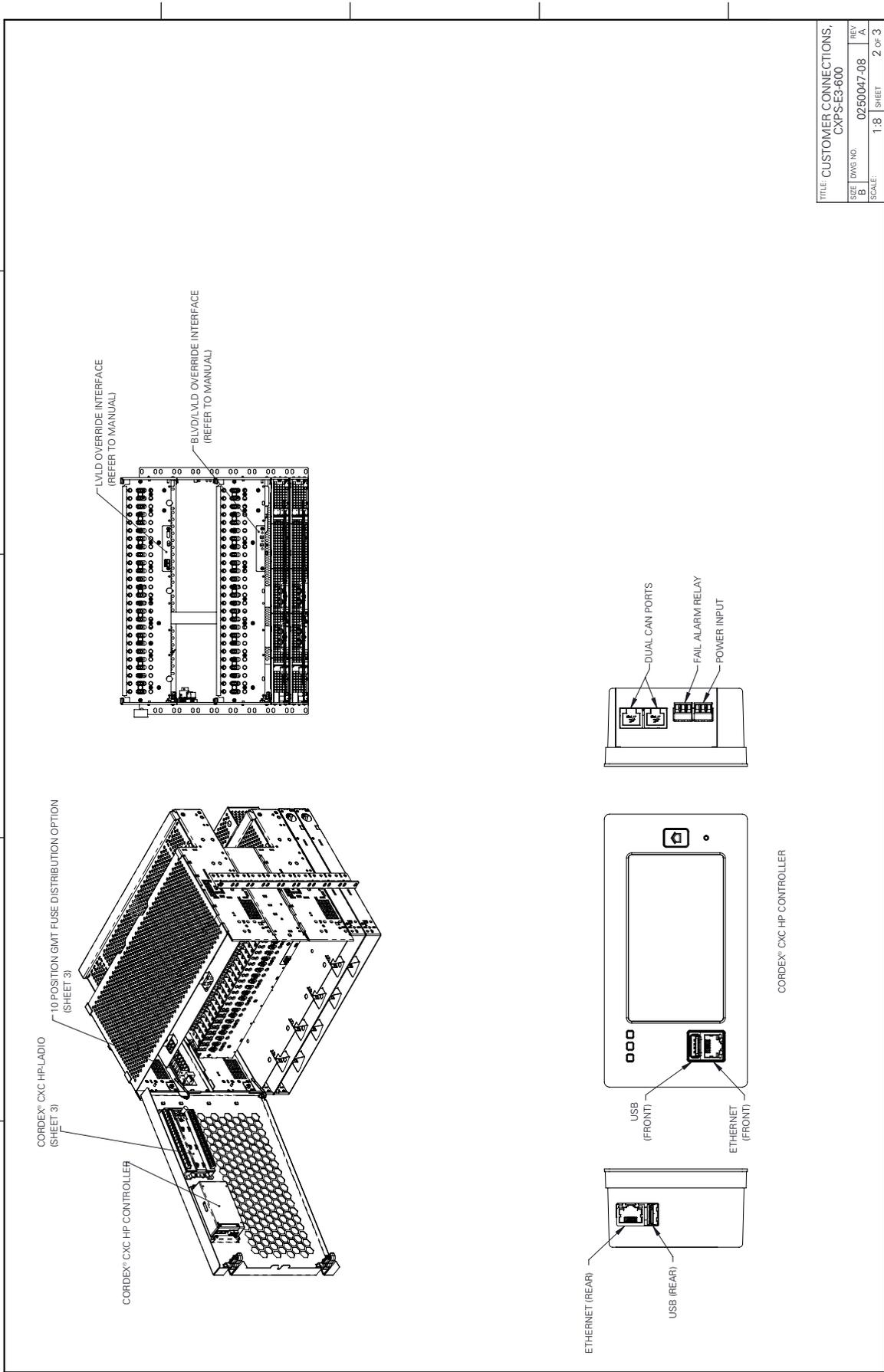
SHEET 4 OF 4

0919XXX-XXX-08

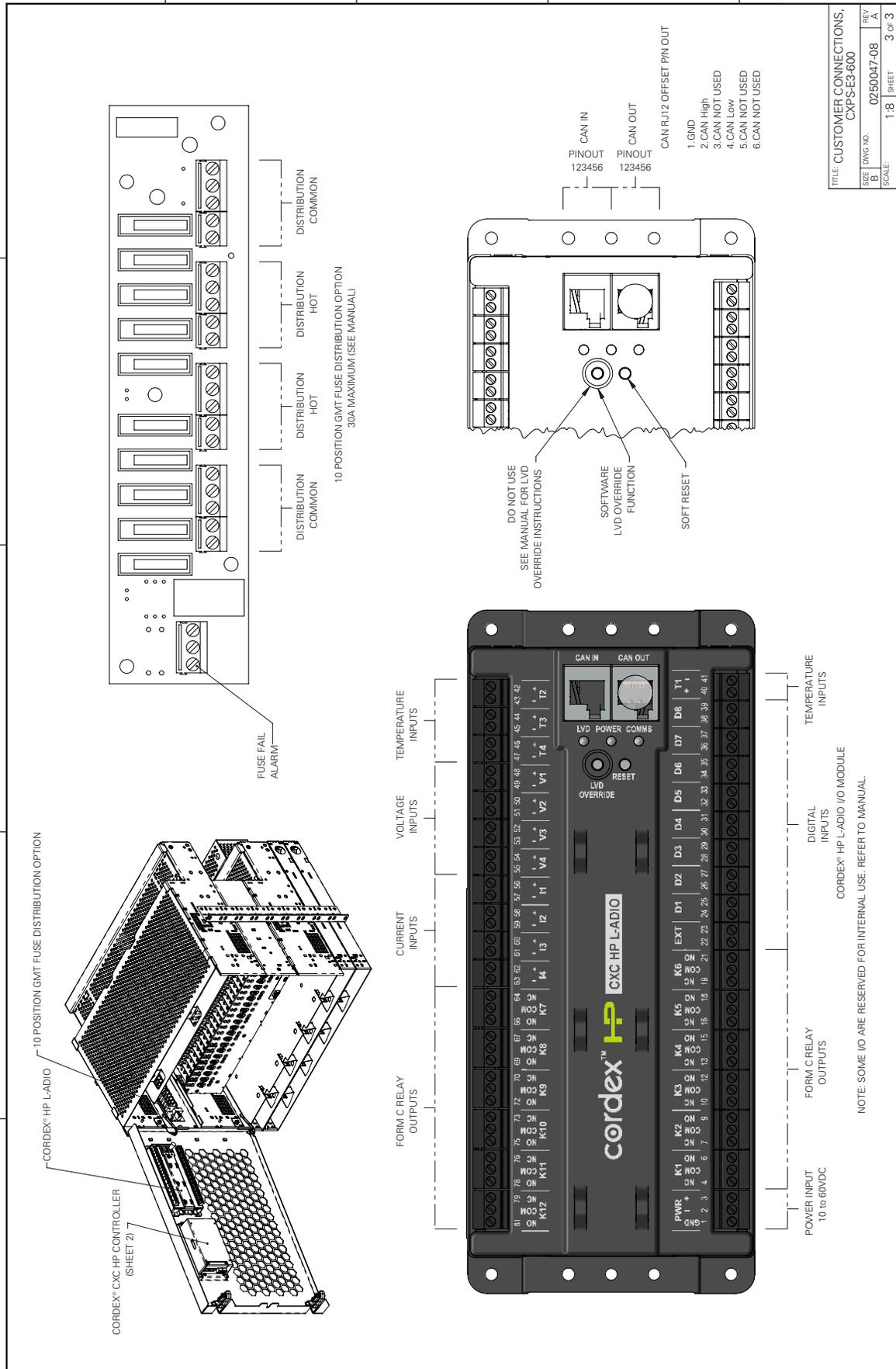




| | |
|--|--------------------|
| TITLE: CUSTOMER CONNECTIONS, CXPS-E3-600 | |
| SIZE: B | DWG NO: 0250047-08 |
| REV: A | SCALE: 1:6 |
| 1 OF 3 SHEET | |



| | | | |
|---|------------|-------|--------|
| TITLE: CUSTOMER CONNECTIONS, CXPS-E3-600 | | | |
| SIZE | DWG. NO. | REV. | A |
| B | 0250047-08 | | |
| SCALE: | 1:8 | SHEET | 2 OF 3 |





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Subject to revisions without prior notice. E. & O.E.