an EnerSys company

CXDM-E3 400A

Distribution Module

Technical Guide: 9400014-J0

Effective: 10/2019

CXDM-E3 Distribution Module
Models: 400A

NOTE:

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

NOTE:

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

NOTE:

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

For technical support, contact Alpha Technologies:

Canada and USA: **1-888-462-7487**
International: **+1-604-436-5547**

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1. Safety

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

1.1 Safety Symbols

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

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

NOTE:

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

CAUTION!

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

WARNING!

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

HOT!

HOT symbol indicates safety information to PREVENT BURNS to the technician or user.

1.2 General Safety

WARNING!

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

1.3 Mechanical Safety

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

1.4 Electrical Safety

WARNING!

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

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

WARNING!

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

- Do not work alone under hazardous conditions.
- A licensed electrician is required to install permanently wired equipment. Input voltages can range up to 277 Vac. Ensure the utility power is disconnected and locked out before performing any installation or removal procedure.
- Ensure that no liquids or wet clothes come into contact with internal components.
- Hazardous electrically live parts inside this unit are energized from the batteries even when the AC input power is disconnected.

WARNING!

HIGH LEAK CURRENT. Earth connection is essential before connecting the supply.

CAUTION! and HOT!

Internal DC breakers can be hot surfaces. Use a bullet socket removal tool for removal of circuit breakers.

1.5 Battery Safety

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

WARNING!

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

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

2. Introduction

2.1 Scope of the Manual

This manual covers the features, options, installation and startup of Alpha Technologies CXDM-E3 distribution module. To assist with installation reference may be made to the drawings at the rear of this manual.

2.2 Product Overview

Alpha's E3 is a front access distribution center, available with the L-ADIO expanded I/O module, is the ideal solution for small to medium-sized 48Vdc or 24Vdc applications, handling up to 400 Amps of output current. With 23" or universal 19"/23" widths, high temperature operation and high power density, it is the perfect solution for a wide variety of installation scenarios. The distribution center provides up to 26 load breaker positions, integrated shunt and LVD. All distribution connections and controller I/O contacts are front accessible.

The E3 can be easily integrated into customer-provided relay racks or enclosures, or can be ordered factory installed into various Alpha relay rack configurations, including systems with pre-wired battery trays.

- 400A, 26 distribution positions in 3RU size
- Industry leading power system density

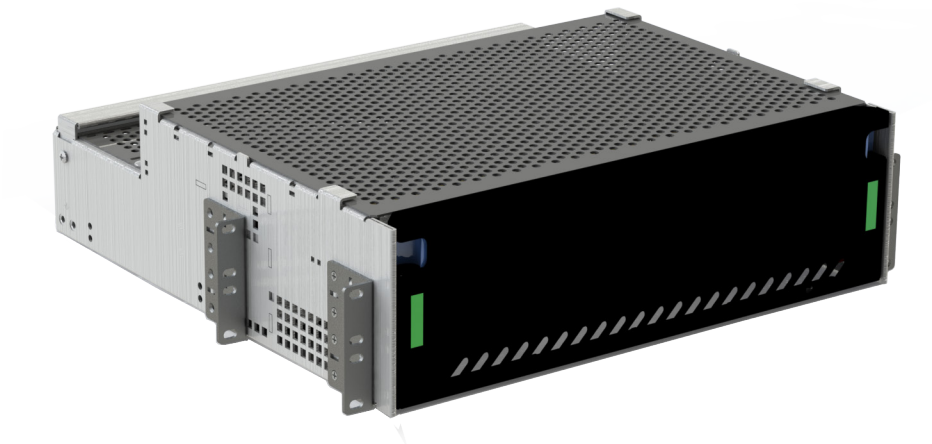


Figure 1 — Front view of the CXDM-E3

2.3 Module Configurations

The following four configurations are currently available for the CXDM-E3 distribution module.

CXDM-E3 Configuration Table					
Rack Size	**Expanded I/O (Optional)**	**Current Rating**	**Load Breakers**	**Low Voltage Load Disconnect**	**Height**
19"	L-ADIO	400A	21	Yes	3RU
			21	No	3RU
23"	L-ADIO	400A	26	Yes	3RU
			26	No	3RU

2.3.1 CXDM-E3 19"/23" Distribution Module

- Rated for 400A
- 3RU
- 21 load breakers with load shunt or 21 load breakers with load shunt and LVLD
- Option for L-ADIO board for expanded I/O capability

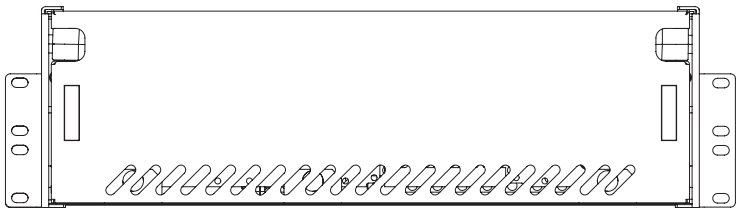


Figure 2 — 19" CXDM-E3

2.3.2 CXDM-E3 23" Distribution Module

- Rated for 400A
- 3RU
- 26 load breakers with load shunt or 26 load breakers with load shunt and LVLD
- Optional L-ADIO module with expanded I/O capability

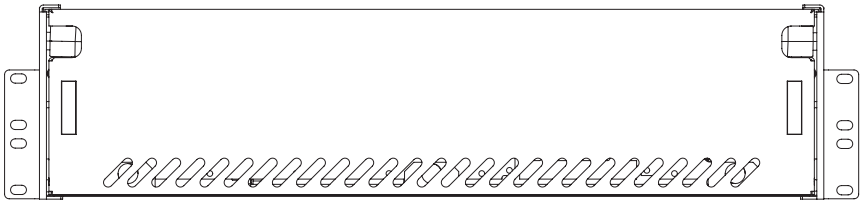


Figure 3 — 23" CXDM-E3

3. Specifications

Table A — Specifications CXDM-E3 400A		
Mechanical		
19" System	**Mounting**	Flush/Center
	Dimensions	5.25"H x 19"W x 17.4"D
	Hot Positions	21x Load Breakers
		21x sets of 1/4" Studs on 5/8" Centers
	Return Positions	21x sets of 1/4" Studs on 5/8" Centers
	Weight (System)	31lbs
23" System	**Mounting**	Flush/Center
	Dimensions	5.25"H x 23"W x 17.4"D
	Hot Positions	26x Load Breakers
		26x sets of 1/4" Studs on 5/8" Centers
	Return Positions	26x sets of 1/4" Studs on 5/8" Centers
	Weight (System)	37lbs
System Access		Front access after initial installation
Environmental		
Temperature: natural convection cooled (rack application)		-40 to 65°C (-40 to 149°F)
Humidity		0 to 95% RH non-condensing
Elevation		-500 to 4000m (-1640 to 13100ft)
Compliance		
Safety		CSA C22.2 No. 60950-1 UL 60950-1

4. Features

4.1 Product Overview

4.1.1 Distribution Center Configurations

The E3 distribution has been designed with high density breaker/fuse count for use in ±48Vdc or ±24Vdc applications with a total ampacity of 400A. It is available either in a 19" or 23" configuration. All systems include a rear top polycarbonate cover for the protection of live customer connections.

4.1.2 19" Distribution Module

Provides up to 21 breakers which is configured as all load breakers (21 load breakers).

The all load breaker configurations have a shunt that monitors the total load current supplied by the rectifiers to the load and has an option for a 600A Low Voltage Load Disconnect (LVLD).

Automatic control of the LVLD can be bypassed using the LVD override feature when necessary such as during maintenance intervals.

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

4.1.3 23" Distribution Module

Provides up to 26 breakers which is configured as all load breakers (26 load breakers).

The all load breaker configuration has a shunt that monitors the total load current supplied by the rectifiers to the load and has an option for a 600A Low Voltage Load Disconnect (LVLD).

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

4.1.4 Control and Monitoring Methods

The E3 is available with two different front panels that provide increasing levels of inputs and outputs (I/O). Either connector breakouts for I/O or enhanced I/O interface with CAN Bus connectivity. All panels have the basic features such as, alarm indicators, door latches, and top label as shown in Figure 4.

The standard front panel includes two indicator circuit boards, one for each bus located at the corresponding end of the panel. Each indicator board receives power and signals through a single cable which connects to the breaker alarm strip in the core of the E3. The indicator boards also act as an interface to the L-ADIO module in the more advanced panel version.

Feature	Standard	CAN Bus Monitoring
LED indicator – Bus Power Present/Breaker Alarm (2	•	•
Dry Contact– Breaker Alarm (2)	•	•
Bus Voltage Sense (2)	•	•
Dedicated I/O: Bus Voltage Monitoring (2) Breaker Alarm Monitoring (2)		•
Expansion I/O (Customer Use): Temperature Sensor Inputs (4) Form C Relay Outputs (12) Digital Inputs (6) Voltage Sense Inputs (2) Current Shunt Inputs (4)		•

4.1.5 Breaker Labelling

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

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

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

4.2 Standard Front Panel

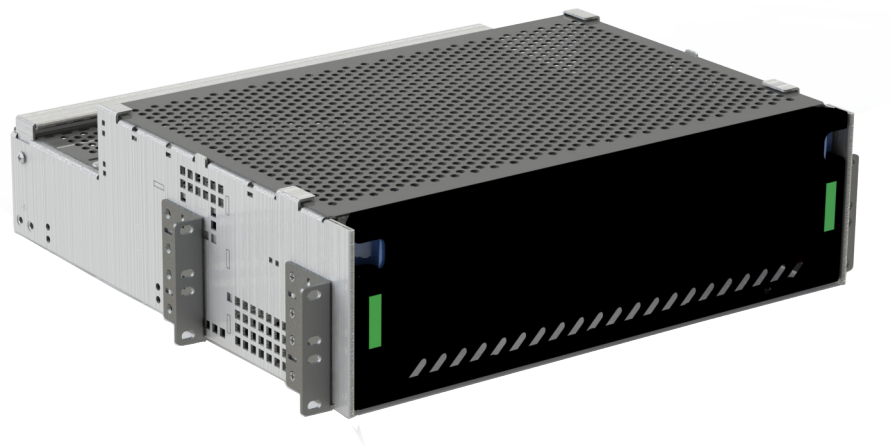


Figure 4 — Standard front panel

4.2.1 Status Indicators

All E3 front panels have two LED indicators that indicate the breaker status for each bus. On single bus (load only) systems, both indicators are green when the bus is powered and turn red when any breaker trips.

4.2.2 Basic Status Outputs

Each indicator board has two terminal block connectors that provide connections to a Form C dry contact for the breaker alarm, and to connect. The right-hand board has terminals for monitoring bus voltage, which can be wired to 3rd party monitoring equipment. The left-hand board has current sense. The terminal blocks can be accessed when the door is open.

This is a non-isolated fused signal intended for connection to a high impedance input. A three-position screw type terminal connector makes the breaker status available through connection to a dry contact relay.

Output signals, current sense, voltage sense *for each bus, breaker alarm *for each bus.

Refer to the customer connection drawings at the back of this manual for PIN outs.

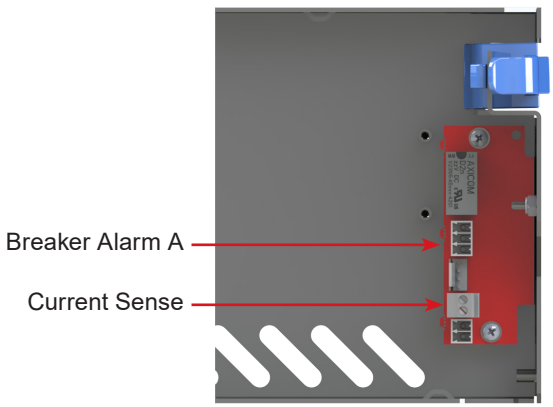


Figure 5 — Left-side Connections

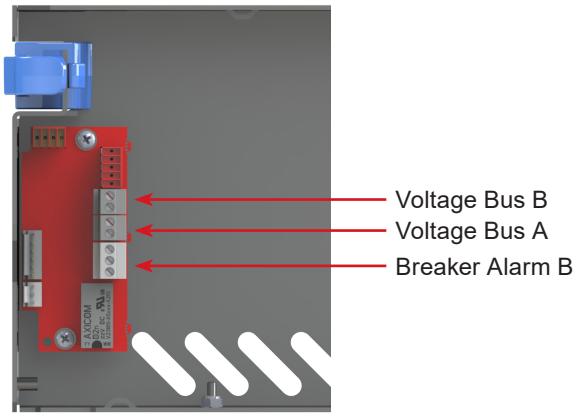


Figure 6 — Right-side Connections

4.3 Front Panel with Enhanced I/O

The front panel with enhanced I/O includes the components and functionality of the standard front panel with the addition of a Large Analog /Digital Input and Output (L-ADIO) module and a cable harness that connects it to the indicator boards. The L-ADIO module is powered by both the A and B bus via the indicator boards and will continue to operate even if one of the bus is not powered. The breaker alarm status and voltage level of each bus is monitored by the L-ADIO and can be read by a remote CXC HP controller through the CAN bus connection.

The L-ADIO also provides expansion I/O capability, including two analog voltages (V3-V4), four thermocouples (T1-T4), 12 dry contact relays (K1-K12), six digital inputs (D3-D8). Please refer to the hardware manual (0180036-J0) for specifications of these inputs, as well as the front panel wiring notes below for guidance on L-ADIO wire routing.

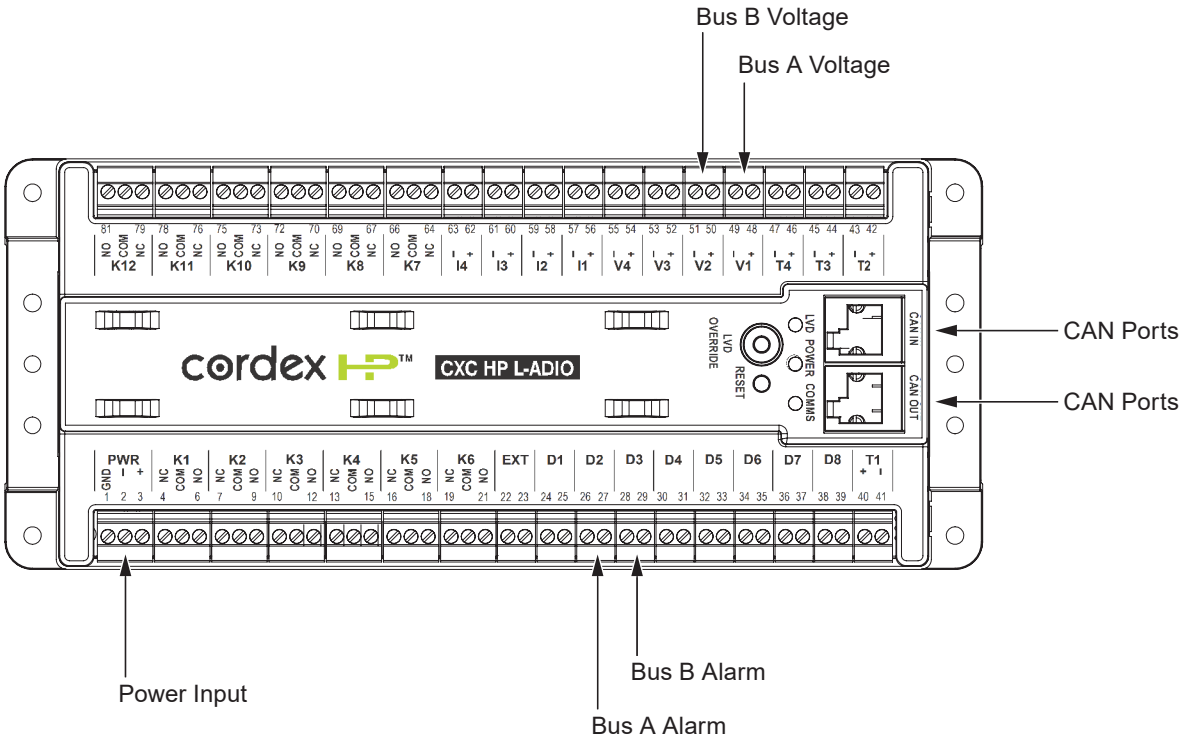


Figure 7 — L-ADIO I/O Peripheral

4.3.1 Analog Input Channels

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

4.3.2 Voltage Inputs

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

4.3.3 Temperature Inputs

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

4.3.4 Digital Input Channels

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

4.3.5 Alarm and Control Output Relays

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

4.3.6 Network Connection and Remote Communication

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

4.4 LVD Override

For systems with LVLD, an over-ride interface is provided, see Figure 8 and Figure 9. This interface board includes 3 LEDs indicators to provide visual status indication, and two customer connections for remote control/monitoring:

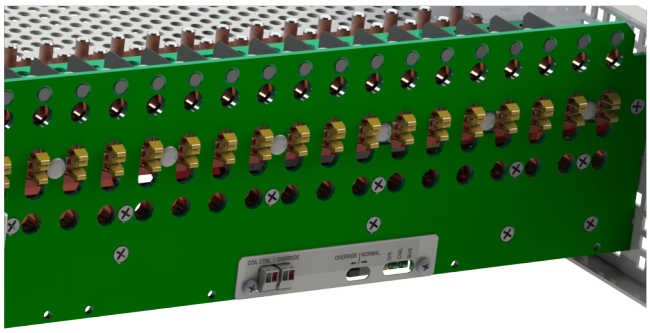


Figure 8 — LVD Override

LEDs

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

Connections

- OVERRIDE 48V/5mA or 24V/5mA signal, active when over-ride switch is in over-ride position.
    - » COIL CTRL Control input for LVBD/LVLD 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 LVLD 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 LVLD override interface is configured for remote control by default for most systems.

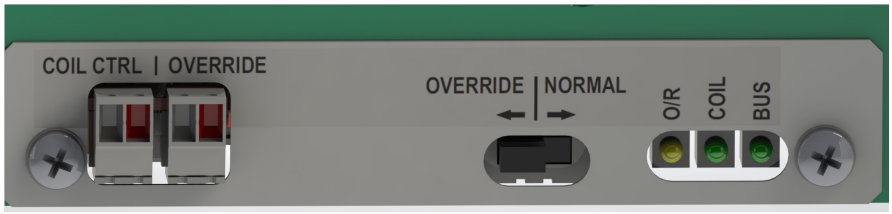


Figure 9 — LVD Override Interface

To change configuration:

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

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

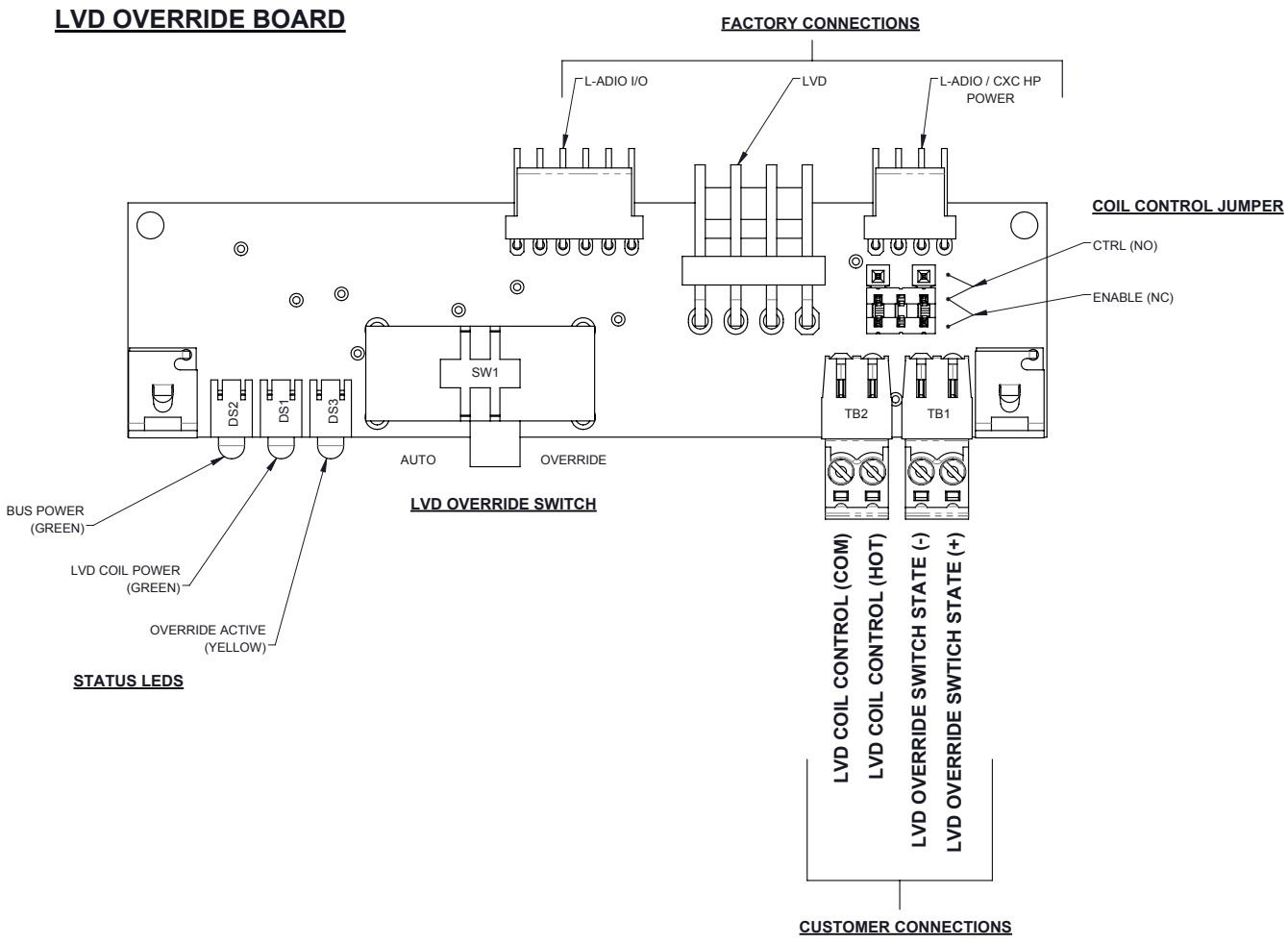


Figure 10 — LVD Override Connections

5. Inspection

5.1 Packing Materials

Alpha is committed to providing products and services that meet our customers' needs and expectations in a sustainable manner, while complying with all relevant regulatory requirements. As such Alpha strives to follow our quality and environmental objectives from product supply and development through to the packaging for our products. Rectifiers and batteries are shipped on individual pallets and are packaged according to the manufacturer's guidelines.

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

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

5.1.1 Returns for Service

Save the original shipping container. If the product needs to be returned for service, it should be packaged in its original shipping container. If the original container is unavailable, make sure that the product is packed with at least three inches of shock-absorbing material to prevent shipping damage. Alpha Technologies is not responsible for damage caused by improper packaging of returned products.

5.2 Check for Damage

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

5.3 General Receipt of Shipment

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

5.3.1 Racks

Consult the packing slip and power system bill of materials to verify that you have the correct number of racks per your order.

5.3.2 Rectifiers (Purchased Separately)

Consult the packing slip to verify that you have received the correct number of rectifiers per your order.

5.3.3 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.

5.3.4 Batteries (Purchased Separately)

Verify that you have the correct number of batteries if applicable. Refer to the packing list. Verify that you have all the necessary parts per your order.
Call Alpha Technologies if you have any questions before you proceed: 1 888 462-7487.

6. Installation

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

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

6.1 Safety Precautions

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

6.2 Tools Required

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

- Battery lifting apparatus if required
- Electric drill with hammer action, 1/2" capacity
- Various crimping tools and dies to match lugs used in installation
- Load bank of sufficient capacity to load largest rectifier to its current limit
- Digital voltmeter equipped with test leads
- Cable cutters
- Torque wrench: 1/4" drive, 0 - 150 in-lb
- Torque wrench: 3/8" drive, 0 - 100 ft-lb
- Insulating canvases as required (2' x 2', 1' x 1', 3' x 3', etc.)
- Various insulated hand tools including:
    - Combination wrenches
    - Ratchet and socket set
    - Various screwdrivers
    - Electricians knife
- Battery safety spill kit required for wet cells only:
    - Protective clothing
    - Face shields
    - Gloves
    - Baking soda
    - Eye wash equipment
- Cutters and wire strippers (#14 to #22 AWG) [2.5 to 0.34 mm^2]

6.3 Installation of External Batteries

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

WARNING!

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

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

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

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

6.3.1 Installation

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

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

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

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

6.4 Battery Maintenance Report

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

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

Table B — Typical VRLA battery maintenance report

Cell #	Serial #	Voltage	Specific	Ohms	Mhos	Observations

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

6.5 Breaker Installation

1. Ensure mid-trip breakers are used for load 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.

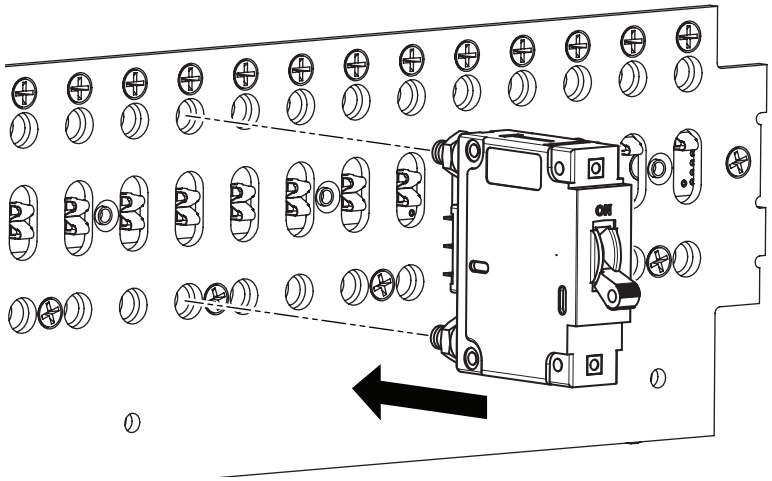


Figure 11 — Breaker Installation

CAUTION!

Caution: Breaker terminals can be hot. Allow breaker to cool before removal or use a breaker removal tool to prevent risk of injury.

6.5.1 Breaker Removal

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

7. Wiring

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

WARNING!

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

WARNING!

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

7.1 Installation Notes

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

7.1.1 Calculating Output Wire Size Requirements

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

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

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

A = Ultimate drain in amps.

LF = Conductor loop feet.

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

AVD = Allowable voltage drop.

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

Refer to Table C for cable size equivalents.

Table C — Cable size equivalents (AWG to Metric)

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

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

7.1.2 Recommended Torque Values

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

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

Grade 5 rated hardware is required for these torque values.

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

7.2 Grounding

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

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

Table E — Typical ground reference conductor selection	
Power system ampacity	**Recommended ground reference conductor size**
< 30A	#10
30 – 100A	#6-2
100 – 400A	0000
400 – 800A	350 MCM
>800A	700 MCM

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

7.2.1 Frame Ground

The distribution frame must be connected to the MGB or FGB. This connection is necessary for personnel safety and to meet many telco-grounding requirements.

Use #2/0 for frame ground. Connect both sides of the chassis using connecting studs provided.

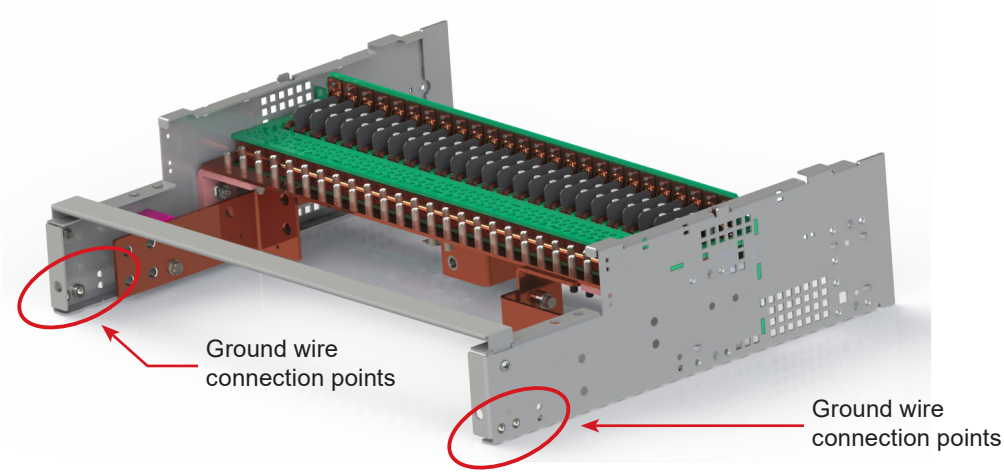


Figure 12 — Connecting the frame ground

7.3 DC Wiring

WARNING!

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

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

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

7.3.1 Terminate Input Connections

1. Terminate load cabling with 3/8" holes on 1" center lugs for input connections to the E3 distribution.
2. Always make the return connection to the E3, and then verify the nut torque before installing the hot connection.
3. Always use the supplied hardware for attaching the lugs.

7.4 Distribution Cabling

7.4.1 Load Planning/Breaker (fuse) Spacing

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

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

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

7.4.2 Load Connections

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

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

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

Load / Breaker Return Connections

NOTE: Connect breaker returns before hot connections.

1. Secure cables with two hole lugs to the 1/4" studs on 5/8" centers using the supplied hardware.

2. Run cables directly out the rear of the distribution center.

Load / Breaker Hot Connections

Connect breaker hot connections.

1. Secure cables with two hole lugs to the 1/4" studs on 5/8" centers using the supplied hardware.

2. Run cables directly out the rear of the distribution center above the breaker return cables.

7.4.3 Load Distribution

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

7.5 Alarm and Signal Connection (Interface Board)

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

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

CAUTION!

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

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

7.5.1 Alarm (Relay) Outputs

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

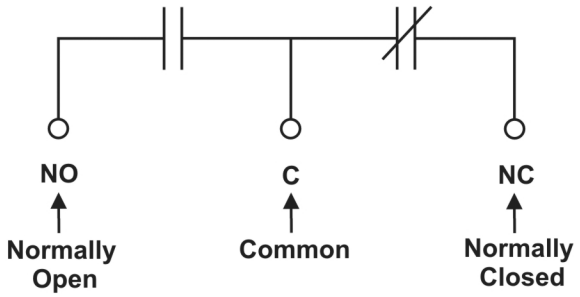


Figure 13 — Alarm (Relay) connections

7.5.2 Connection Method

Typical Alpha systems use the "reset with Hot and trigger with Ground" connection. The digital input is wired in such a way that the Hot is wired directly into one of the input terminals; e.g., negative input for -48V systems. The other input terminal is wired to the Ground (common) of the system through a relay (dry contact – usually located on the equipment requiring monitoring). This method (see Figure 14) allows the digital input to receive (or not receive) a Ground signal on an alarm.

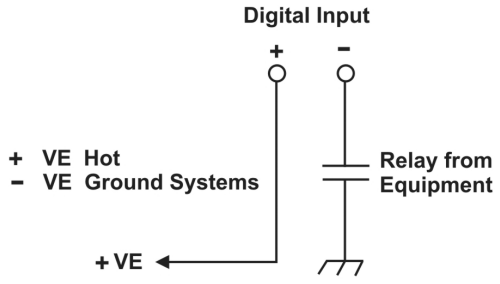


Figure 14 — Digital input connection method

Table F — Voltage level definitions for digital inputs

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

CAUTION!

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

7.6 Signal Wiring (L-ADIO)

Terminal block connections for the L-ADIO should be routed along the left side of the E3 (looking at unit from front). Refer to the customer connections ("–08") drawing at the rear of this manual for details on terminal block assignments.

1. Use the Form C relay contacts on the L-ADIO to extend various alarm or control signals to an external site monitor. Figure 15 shows the L-ADIO module layout table F lists the factory default settings.
2. Use 0.129 mm² (#26 AWG) or larger wire.
3. Bundle signal wires together and route through the top of the shelf.

7.6.1 Relays

Relays can be programmed to be energized or not energized during an alarm condition (see Figure 13 and the controller software manual). Relays can be reassigned in the Relays table. From the controller's main dashboard go to **Modules >ADIOs> L-ADIO**.

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

7.6.2 Digital Inputs

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

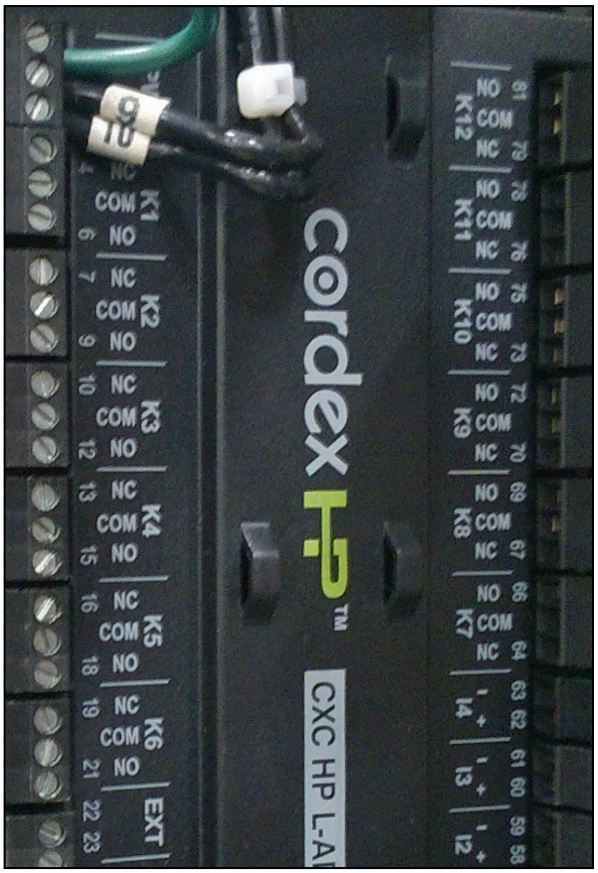


Figure 15 — Alarm relay pinouts

8. System Startup

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

1. Visually inspect the installation thoroughly.
2. Verify:
    - » Batteries are disconnected.
    - » All breakers are off and no GMT fuses installed if any loads are connected.
3. Triple-check the polarity of all connections.
4. Power up the rectifier systems (DC power) in a step-wise manner.
    - » The power module OK LED will illuminate after a preset start delay.
5. Test the functionality of various module alarms and controls using the controller's LCD screen or web interface.
6. Verify the correct battery polarity using a voltmeter. Ensure that no cells or batteries are reversed.
7. Connect the batteries to the output of the system.
8. Use the controller to test the functionality of various module alarms and controls especially the battery breaker alarm test. Verify alarms are transmitted to site monitor.
9. Perform a load test with the system using a resistive load box.

9. Maintenance

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

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

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

WARNING!

Consult factory for all replacement parts.

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

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

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

Table G — Sample maintenance log

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

10. Acronyms and Definitions

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

11. Warranty and Service Information

11.1 Technical Support

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

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

11.2 Warranty Statement

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

11.3 Limited Hardware Warranty

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

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

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

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

11.4 Battery Warranty

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

11.5 Warranty Claims

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

11.6 Service Centers

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

12. Certification

11.6.2.1 About CSA and NRTL

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

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

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

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

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

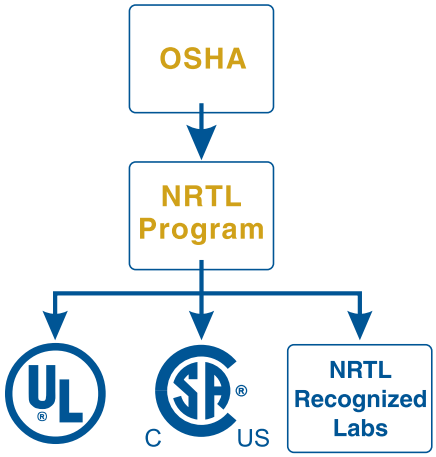
Only Underwriters Laboratories may grant a licence for the use of this mark, which indicates compliance with both Canadian and US requirements. (3)

11.6.2.2 NRTLs capabilities

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

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

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



11.6.2.3 Governance of NRTL

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

(1)www.csagroup.org

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

DO NOT SCALE DRAWING

REVISIONS				
LTR	DESCRIPTION	DWN	DATE	CHK
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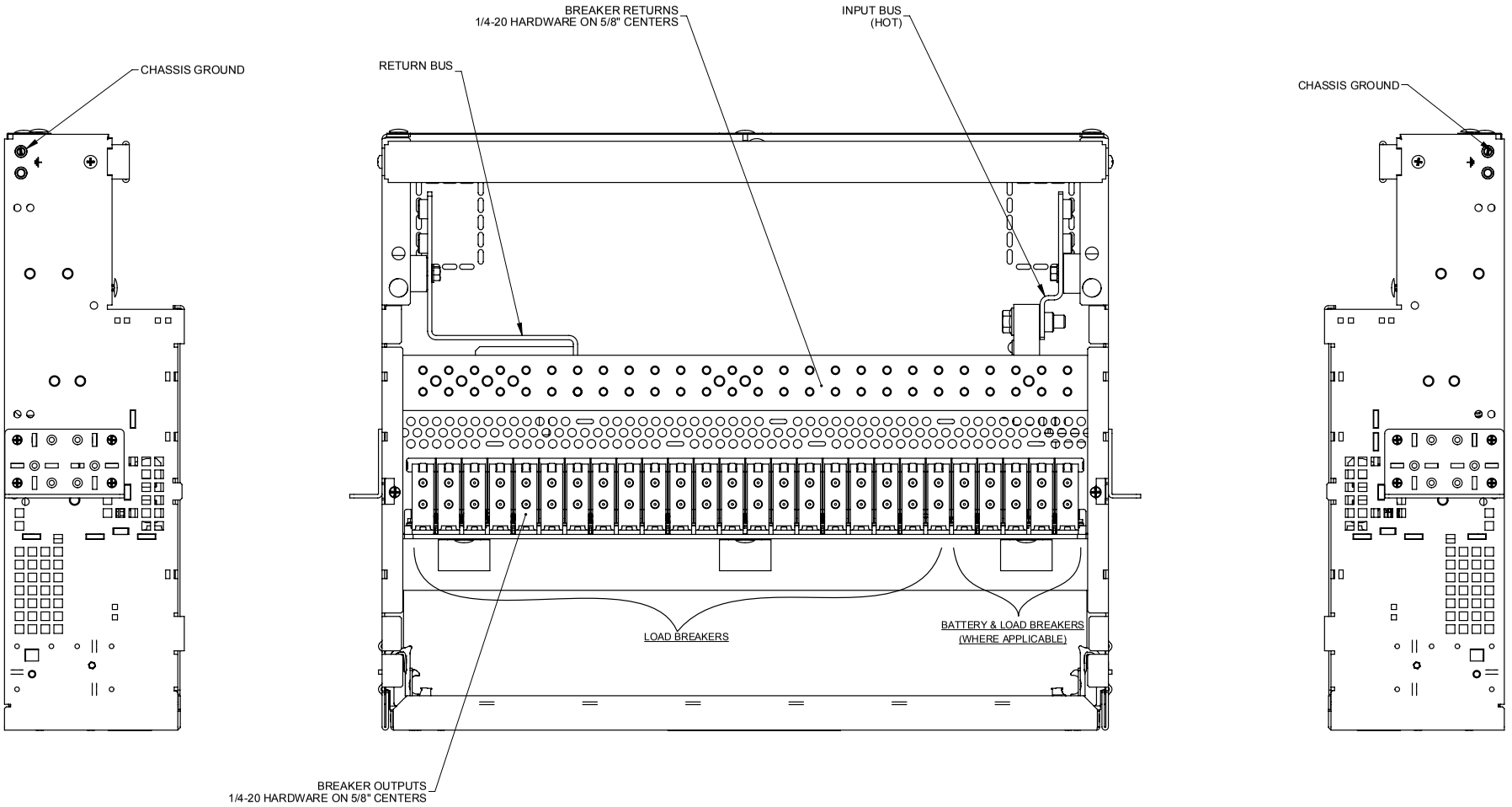
C	SHEETS 3,4 & 5 ADDED	EJ	3/20/2018	DM



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

APPROVALS		DATE
DRAWN	E.JONES	2/3/2017
CHECKED	D.MANNESS	2/3/2017

TECHNOLOGIES™

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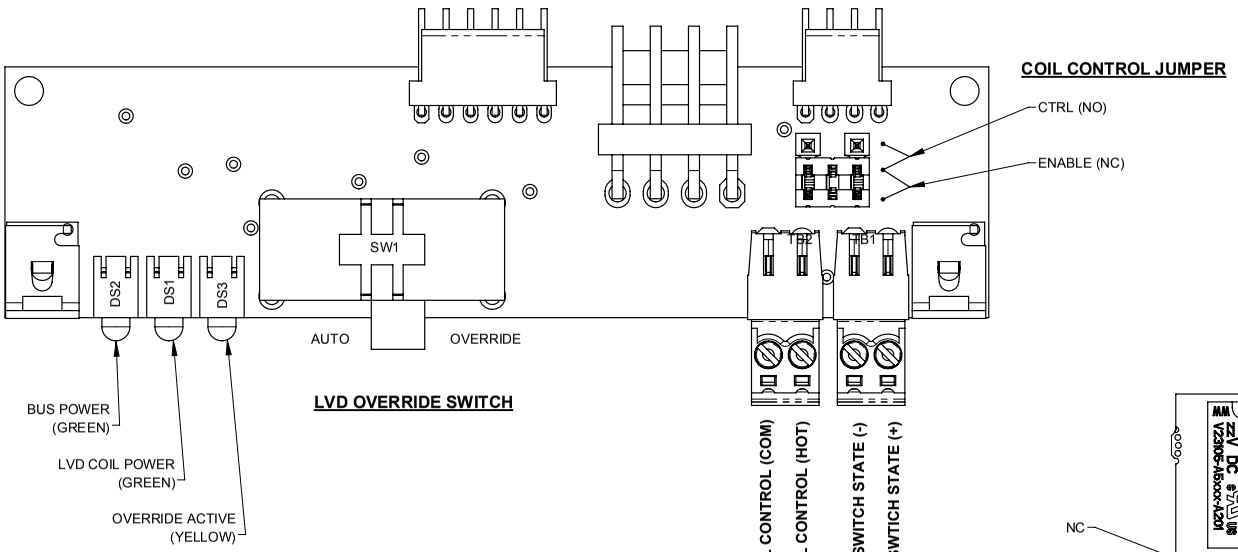
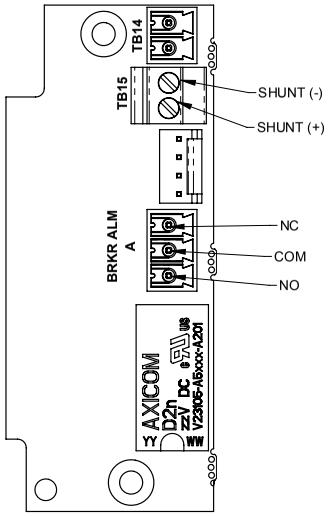
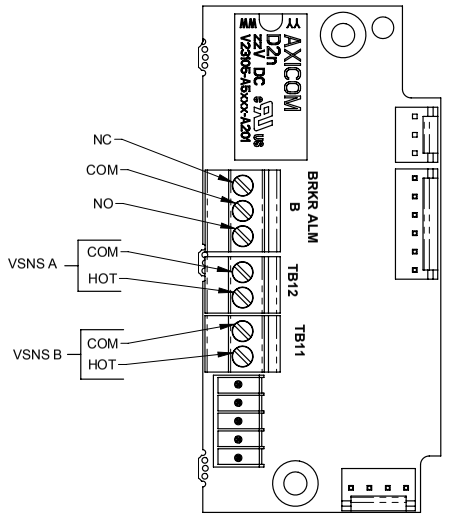
LVD OVERRIDE BOARD





LEFT INDICATOR BOARD



RIGHT INDICATOR BOARD

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REVISIONS				
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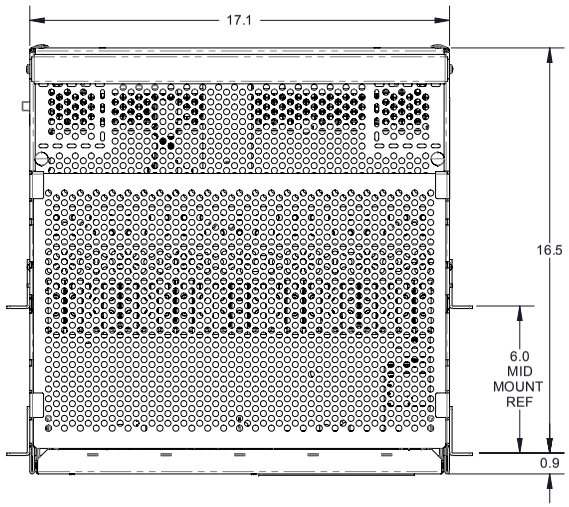

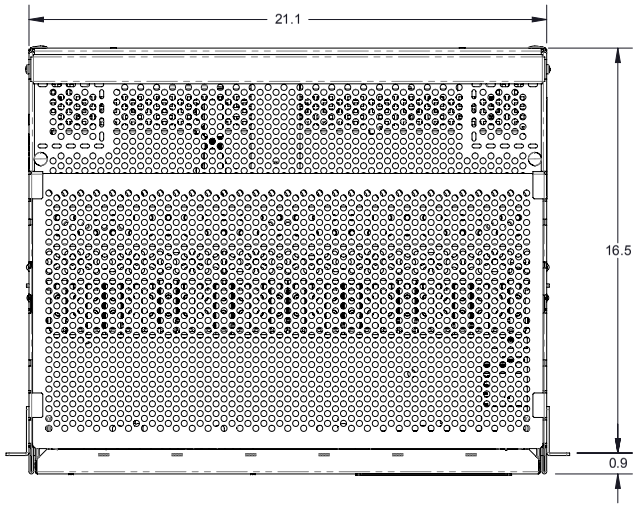

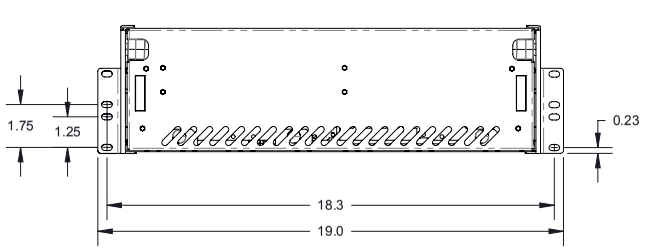

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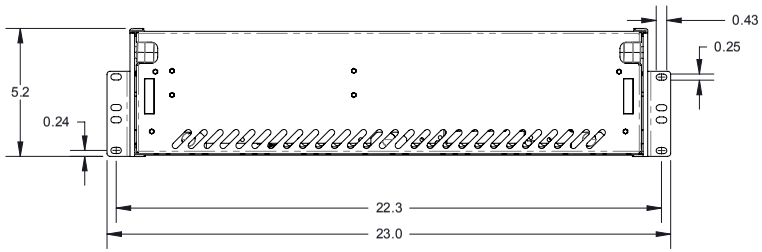

0250030-017
0250030-019

NOTES UNLESS OTHERWISE SPECIFIED:

1. PRODUCT TO BE FABRICATED ACCORDING TO ATL PRODUCTION STANDARD 0700001

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TITLE:	OUTLINE DRAWING CXPS-E3 / CXDM-E3	
SIZE: B	DWG NO. 0250030-06	REV A
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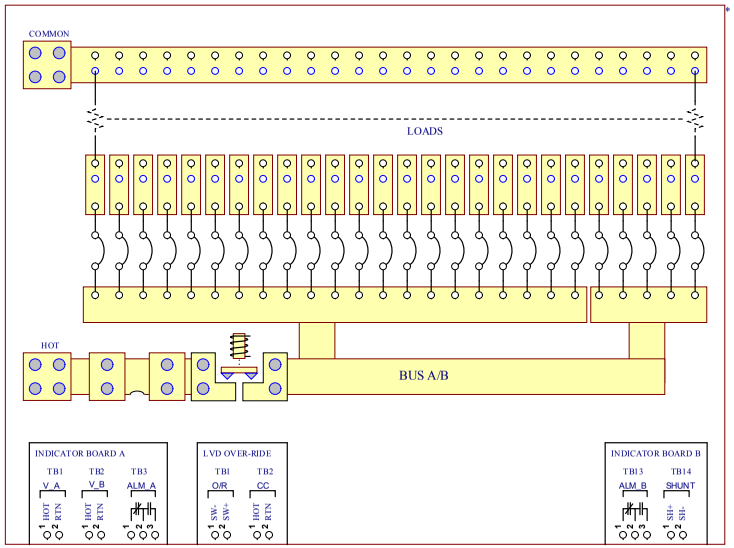
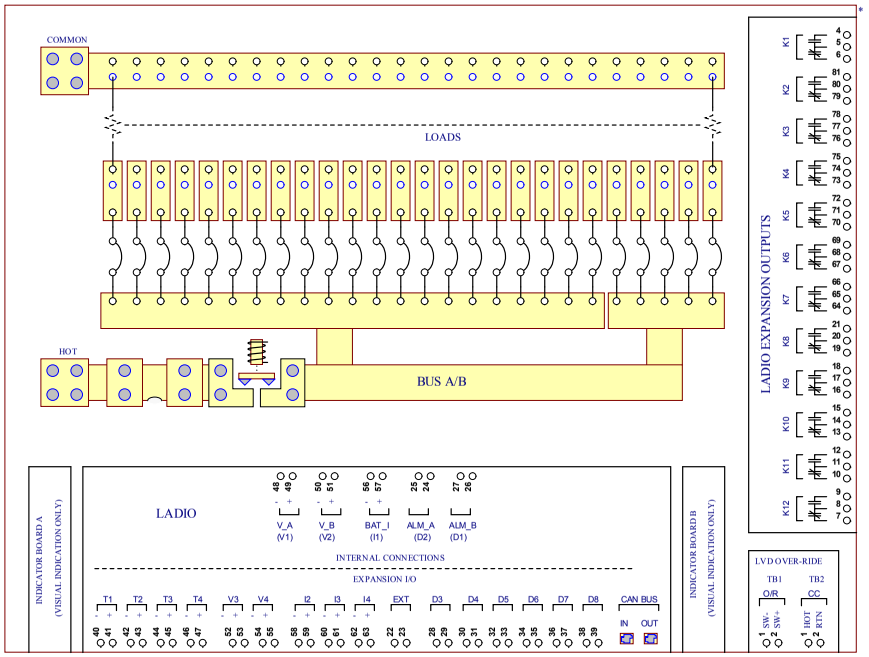
0918301-700 / 0250030-019



E3G2,Single Bus,23",CXDM,LVLD

0918301-700 / 0250030-019 with 8700988-001 LADIO Upgrade Kit



E3G2,Single Bus,23",CXDM,LVLD,LADIO

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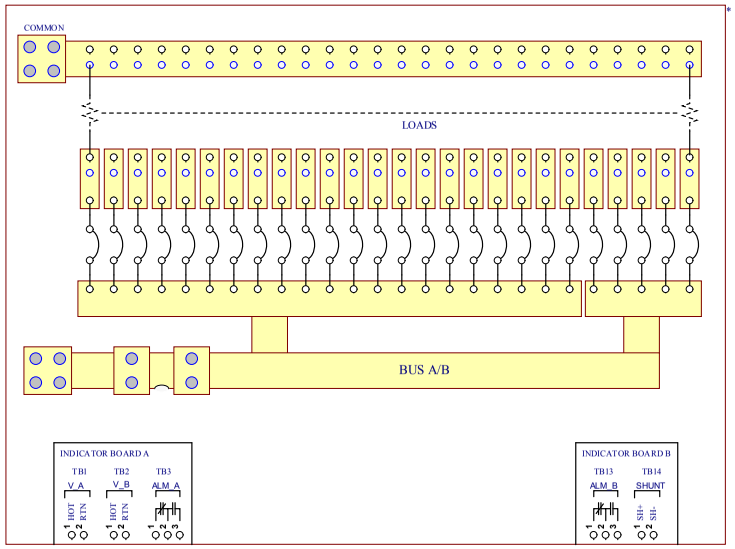
TITLE	CXDM-E3 Distribution Module 19",-48V,3RU 21 Load Breakers, LVLD
ISSUE DATE	SHEET 1 of 1
SIZE B / TYPE S5 / DWG NO. 0918201-100-05 / REV A	

0918301-300 / 0250030-017



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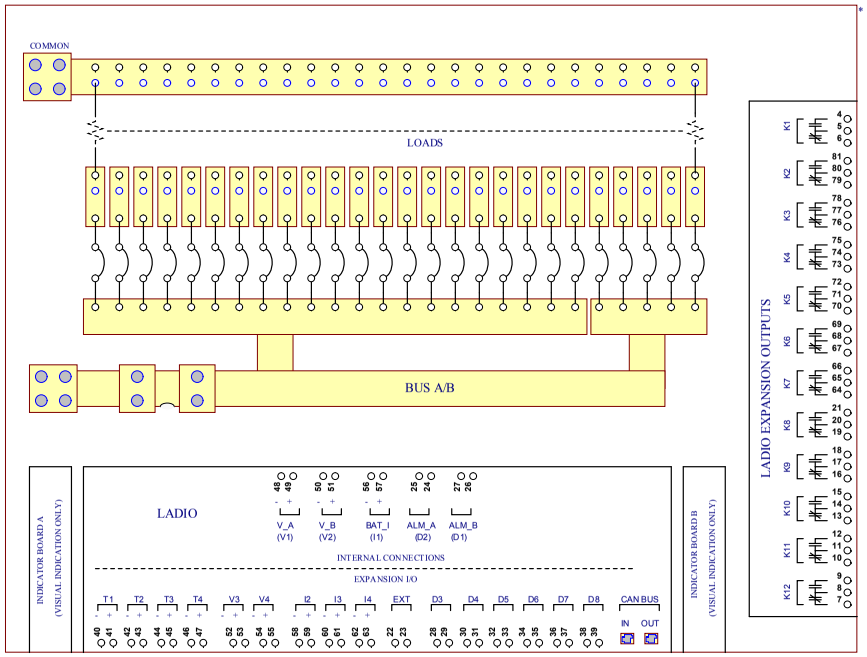
0918301-300 / 0250030-017 with 8700988-001 LADIO Upgrade Kit



E3G2,Single Bus,23",CXDM,LADIO

ALPHA TECHNOLOGIES™

TITLE	CXDM-E3 Distribution Module 23",-48V,3RU 26 Load Breakers
ISSUE DATE	SHEET 1 of 1
SIZE B / TYPE S5 / DWG NO. 0918301-300-05 / REV A	

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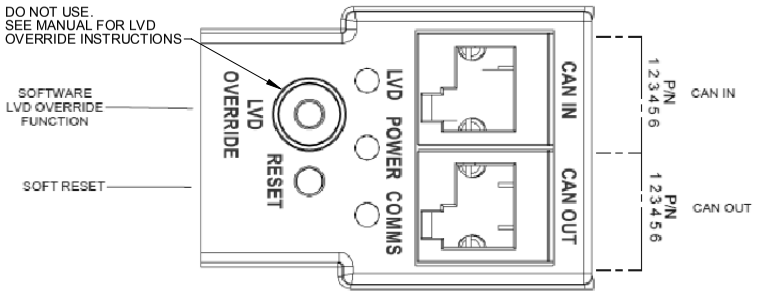
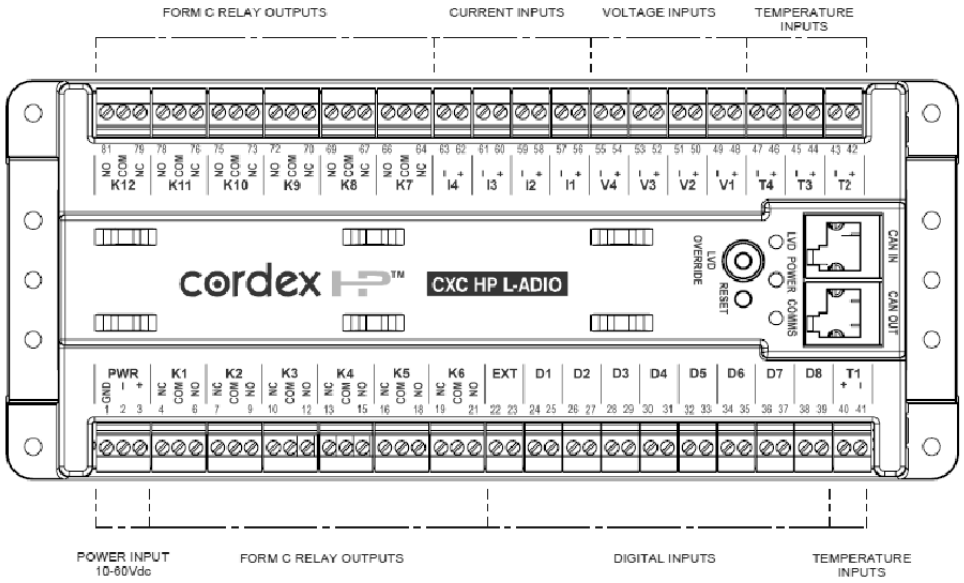
NOTES:

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





CAN RJ12 OFFSET P/N OUT

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

CXC-HP L-ADIO I/O MODULE

TECHNOLOGIES™			
TITLE:	CXDM, CUSTOMER CONNECTION, 19" & 23"		
SIZE: B	DWG NO. 0918XXX-XXX-08		REV: C
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