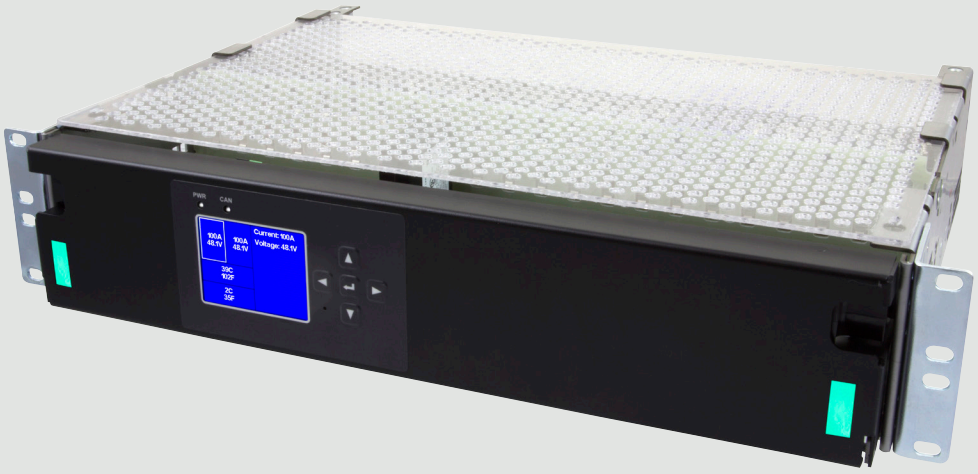
Smart E2
Distribution Panel

Technical Guide: 9400017-J0

Effective: 04/2019



Alpha Technologies Ltd.

an EnerSys company

Smart E2 Distribution Panel

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.

1.1 Safety Symbols

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

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

NOTE:

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

CAUTION!

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

WARNING!

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

HOT!

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

1.2 General Warning and Cautions

WARNING!

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

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

1.3 Electrical Safety

WARNING!

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

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

a. Remove all metallic jewelry, such as watches, rings, metal rimmed glasses, or necklaces.
b. Wear safety glasses with side shields at all times during the installation.
c. Use OSHA approved insulated hand tools. 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 240 Vac. Ensure that the utility power is disconnected and locked out before performing any installation or removal procedure.
- Ensure that no liquids or wet clothes come into contact with internal components.
- Hazardous electrically live parts inside this unit are energized from the batteries even when the AC input power is disconnected.
- The enclosure which contains the DC or AC power system along with customer installed radios must remain locked at all times, except when authorized service personnel are present.
- Always assume electrical connections or conductors are live. Turn off all circuit breakers and double-check with a voltmeter before performing installation or maintenance.
- Place a warning label on the utility panel to warn emergency personnel that a reserve battery source is present which will power the loads in a power outage condition or if the AC disconnect breaker is turned off.
- At high ambient temperature conditions, the internal temperature can be hot so use caution when touching the equipment.

1.4 Battery Safety

- Never transport an enclosure with batteries installed. Batteries must ONLY be installed after the enclosure has been securely set in place at its permanent installation location. Transporting the unit with batteries installed may cause a short circuit, fire, explosion, and/or damage to the battery pack, enclosure and installed equipment.
- Servicing and connection of batteries must be performed by, or under the direct supervision of, personnel knowledgeable of batteries and the required safety precautions.
- Batteries contain or emit chemicals known to cause cancer and birth defects or other reproductive harm. Battery post terminals and related accessories contain lead and lead compounds. Wash your hands after handling batteries.

WARNING!

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

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

2. Introduction

2.1 Scope of the Manual

This manual covers the features and installation of the Alpha's Smart E2 series 600A distribution panel.

2.2 Product Overview

Alpha's Smart E2 panel is a high density breaker panel used in central offices, cable headends and data centers for tertiary distribution applications. The 2 RU panel, designed with a split bus, offers the capacity for up to 22 plug-in breaker/ fuse positions in a 19" configuration. Individual 600A buses allow for maximum utilization of distribution capacity.

The Smart E2 offers the options of remote monitoring of alarms and analog parameters via a CAN bus to a centralized controller (CXC HP) or with IP/SNMP connectivity.

- High density remote distribution for Telecom CO's, MSC's, data center and cable headend facilities
- Industry leading system density
- High breaker density: 11x plug-in bullet breakers or TPS/TLS fuses per bus
- High current density: each bus is rated for a maximum amperage of 600A
- Split bus design provides redundant input feeds to network equipment
- 2 RU height recovers space in network bays for revenue generating equipment
- Front panel control options: standard, and advanced controller
- Adaptor kits available to accommodate vertical feeds
- Adaptor kits available for 2 pole and 3 pole breakers

Figure 1 — Smart E2 600A

3. Specifications

For the Smart E2 part numbers and list options go to the Alpha website.

Table A — Smart E2 Specifications		
Electrical		
	CAN Connected	**IP/SNMP**
Nominal Voltage	48V or 24V	48V or 24V
Bus Capacity	600A per Bus	600A per Bus
Mechanical		
Dimensions	3.7" (max.) H x 19" W x 13.5" D (94mm x 483mm, 334mm) (Excludes mounting brackets)	3.7" H x 19" W x 13.5" D (89mm x 483mm, 305mm) (Excludes mounting brackets)
Mounting	19"/23" (w/ 2 RU adaptor); flush or center(default)	19"/23" (w/ 2RU adaptor); flush or center
Weight	7kg (15.5lb)	7kg (15.5lb)
Connections		
Input (Hot and Return)	2 x 3/8" mounting holes on 1" centers*	2 x 3/8" mounting holes on 1" centers*
Positions	11 breakers per bus (22 positions per panel)	11 breakers per bus (22 positions per panel)
Output (Hot and Return)	22 x 1/4"-20 studs on 5/8" centers	22 x 1/4"-20 studs on 5/8" centers
Lug Adaptors (optional)	Double Pole: ⅜" Studs on 1" Centers**	Double Pole: ⅜" Studs on 1" Centers**
	Triple Pole: ⅜" Studs on 1" Centers***	Triple Pole: ⅜" Studs on 1" Centers***
Chassis Ground	1/4" studs on 5/8" centers	1/4" studs on 5/8" centers
Controls		
Alarms	Breaker/Fuse trip: Form C contacts	Breaker/Fuse trip: Form C contacts
Monitor	Breaker/Fuse trip and bus voltages via indicator LED and graphic display	Breaker/Fuse trip and bus voltages on CXC HP controller (IP/SNMP)
LED Indicators	System Ok (Green) Breaker/Fuse Trip (Red)	System Ok (Green) Breaker/Fuse Trip (Red)
Environmental		
Temperature	0 to 40°C (0 to 104°F)	0 to 40°C (0 to 104°F)
Humidity	5-95% non-condensing	5-95% non-condensing
Compliance		
CSA	CSA C22.2 No. 60950-1 UL 60950-1	CSA C22.2 No. 60950-1 UL 60950-1
The above information is valid at the time of publication. Consult factory for up-to-date ordering information. Specifications are subject to change without notice.		

For ordering information refer to datasheet #0470323-00.
* The vertical input connection is recommended when each bus is fuse at 400A and above. It is capable of accepting up to 2x 750MCM cables (back to back) on the hot and return connections.(For vertical input connections order kit)
** For double pole breakers order adapter kit
*** For triple pole breakers order adapter kit

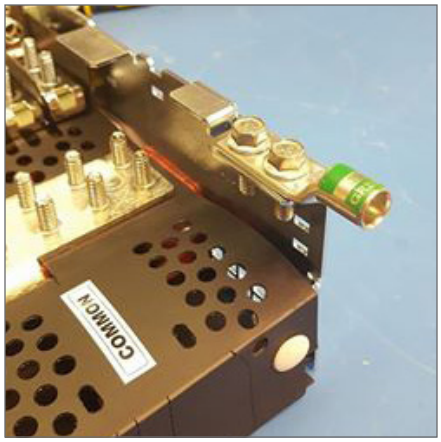
4. Features

4.1 Ground Connection

Each side panel of the Smart E2 has a lug landing for connection to earth ground. They may be vertically aligned PEM nuts for use with 1/4" bolts on 5/8" centers (included with system).

The Smart E2 grounds can either be connected to the frame in which the Smart E2 is mounted if the frame is grounded, or they can be connected directly to the ground bar in a remote location. Both connections must be made. A minimum #6 AWG wire is recommended.

Follow all local codes and company safety protocols for the ground connections. The above information should be used as a guide only.



Left Ground Connection

Right Ground Connection

Figure 2 — Ground Connections

4.2 Feed Connection

The E2 has two isolated hot and return input feeds. Each bus each can accommodate up to two (2) 750MCM cables (max. lug tongue width is 1.63 inches) in a back to back orientation. The landings are designed for the input feeder cables to be installed horizontally, optional adapters (recommended for any connection over 400A) are available for the input feeder cables to be installed vertically with a slot that allows the cables to be angled backwards up to 30 degrees. The base system cover opens easily to make connections, and can be re-closed using snap clips. Additional lug and adapter covers are included with the vertical adapter kits.

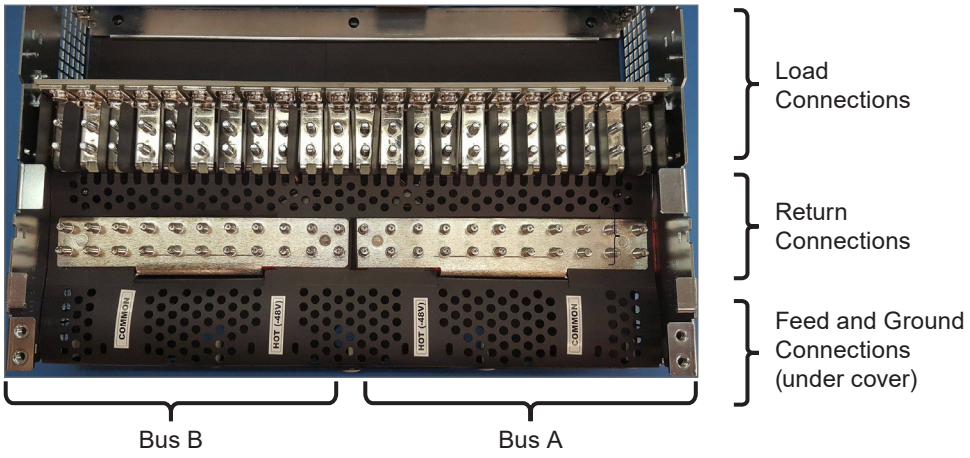


Figure 3 — Feed Connections

CAUTION!

The load connection being added should not have a breaker installed or be live when the cable is installed.

4.3 Load Connections

The system has a total of 22 load connections divided into a split bus for both hot and return. Both connections are front accessible when the unit is installed with a minimum of 2RU space above. The connections are protected by a cover to prevent objects from falling into connecting area. A separate cover also protects the breaker area and can be left in place while connections are made.

The load hot connections are located closest to the top for easy access and are separated by dividers to prevent accidental contact with potentially live connections.

The load return connections are located behind and below the load hot connections allowing the two cables to be routed together to minimize any current loops.

Studs are provided for both hot and return connections to simplify alignment. The insulation covers below the connection area prevent any dropped hardware from entering into the buswork area of the system.

The load positions are identified by a label located along the top of the breakers/fuses. There is also a second label located on the top of the front door for describing the load of each breaker/fuse and is accessible when the door is open.

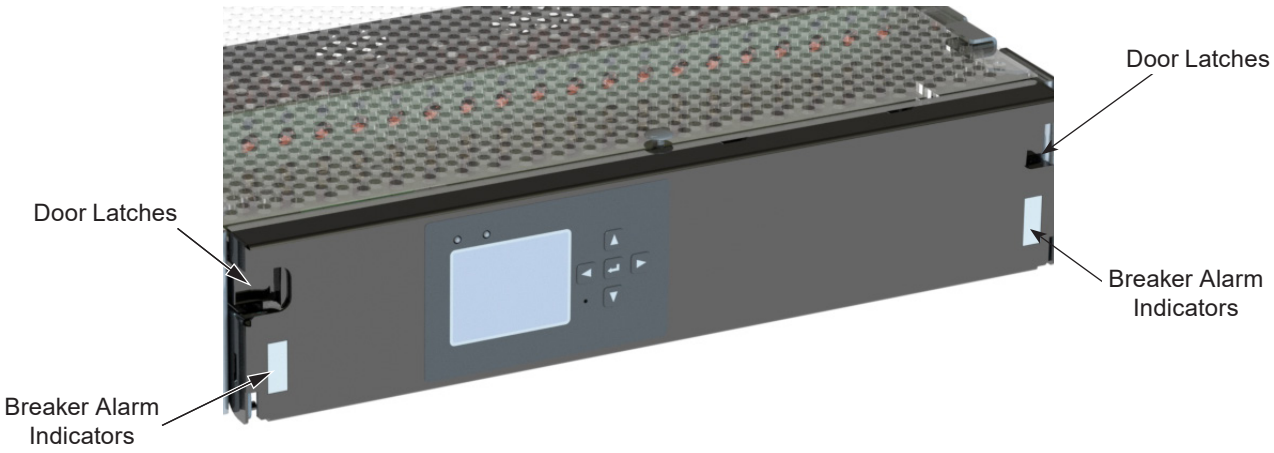


Figure 4 — Front Panel

4.4 Monitoring Methods

The Smart E2 is available with two different front panels that provide standard inputs and outputs (I/O) and control in a standard and advanced controller option. Both panels have the basic features such as, alarm indicators, door latches, graphic display, user interface buttons and top label as shown in Figure 4 below. The standard front panel includes two indicator lamps, located at either end of the panel. Each indicator board receives power and signals from the display board. The display board receives its power and alarm signals from a single cable which connects to the breaker alarm strip in the core of the Smart E2.

The monitoring methods for the CAN version of the Smart E2 are as follows:

- Alarm indicator LEDs
- Dry contacts for 4 predefined alarms
    - Loss of feed, based on the input voltage of either feed dropping below a reset threshold
    - Over current, based on a threshold set via the display panel
    - Over temperature, based on a threshold set via the display panel
    - Breaker Trip of any of the individually monitored breaker contacts
- Dedicated IO for:
    - Bus voltage monitoring of both input feeds (2)
    - Breaker trip status of each breaker (22)
    - Bus current monitoring of both input feeds (2)
- User defined IOs
    - Temperature sensors (2)

The IP/SNMP version of the Smart E2 has a CXC HP controller that provides:

- Advanced Alarm configuration of the local display board
- Web interface
- 2 Ethernet ports
- 2 USB ports
- Touch screen interface
- SNMP interface
- Remote monitoring capabilities

4.4.1 Breaker Labelling

Breakers are numbered starting from one near the side panel and going up to 11 near the center line. The labels for the Bus “A” breakers are indicated by black letters, labels for Bus “B” are indicated by white letters. The breaker position index label is a thin strip over the breakers and is visible from the front, while the breaker assignment label is located on the top of the front panel and has additional space for describing the use of the breaker. This label is visible from the front when the door is open, as well as from the top when the door is closed.

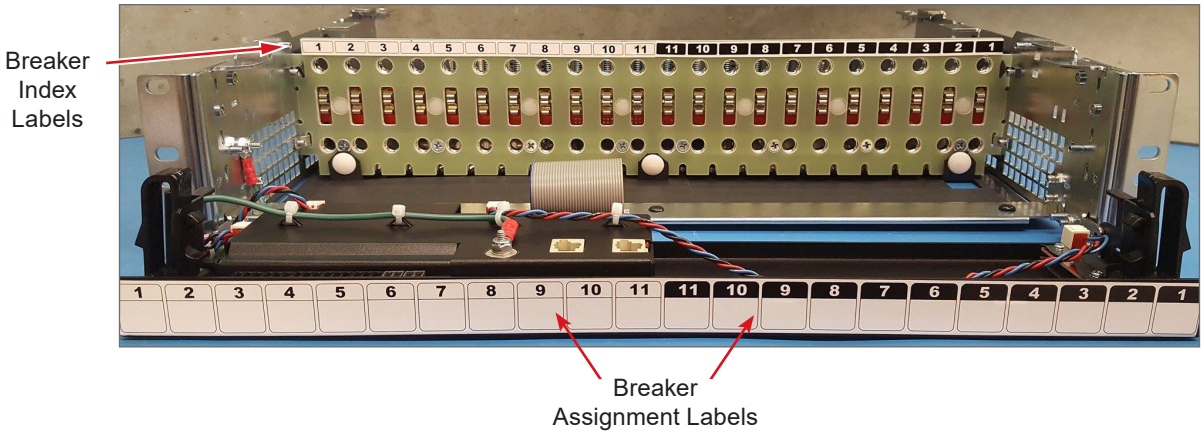


Figure 5 — Breaker Labelling

4.5 Front Panel

4.5.1 Status Indicators

All Smart E2 systems are equipped with four LED status indicators on the front panel, two of which indicate the status of alarms. The LED’s indicate the following on each corresponding bus:

- Power (Green): Power to the bus
- Alarm (Red): Any alarm threshold has been crossed

The other two are for VIM status: Green for CAN comms established, and Blue for Power.

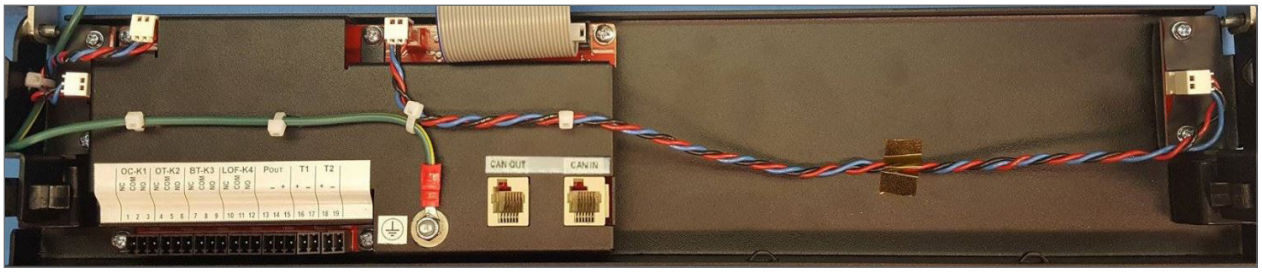
4.5.2 Volt and Amp Meter Display (VIM)

All Smart E2s are equipped with a graphical display board that monitors the voltage, current and alarm status of the Smart E2. The board contains four terminal block connectors that provide connections to four (4) Form C dry contacts (for the alarms) which can be wired to third party monitoring equipment. These terminal blocks can be accessed when the door is open.

The VIM monitors and displays breaker alarm status for each breaker position, the voltage level of each bus, and the current in each bus. This information can be read remotely by the CXC HP controller via a CAN bus connection.

The VIM also provides expanded I/O capability, including two temperature sensors (T1-T2). The VIM has a five button control interface for setting alarm thresholds and viewing events.

VI Meter



User Connections

CAN Communication

Figure 6 — VIM Connections

4.5.3 Analog Input Channels

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

4.5.4 Voltage Inputs

Two voltage input channels, V1 and V2, are used to monitor the BUS voltage. V1 for Bus A Voltage and V2 for Bus B Voltage. The Alarm thresholds are based on these two signals.

NOTE:

- **In a 24Vdc system, when the voltage falls below 19Vdc the system front panel displays "–––".**
- **In a 48Vdc system, when the voltage falls below 30Vdc the system front panel displays "–––".**

This "–––" indicator status will also be carried through to the CXC-HP controller, if connected.

4.5.5 Temperature Inputs

The Smart E2 panel can accept two temperature probes to monitor the surrounding ambient temperatures. These analog values can be used for high or low temperature alarms.

4.5.6 Alarm and Control Output Relays

The controller contains four Form C digital alarm output relays, that are used to extend alarms and control to external apparatus. Each internally generated alarm or control signal is mapped to a specific relay.

4.5.7 Network Connection and Remote Communication

CAN bus is used to transmit all alarm and control functions between the VIM and a remotely located Cordex HP controller.

4.5.8 Current Sensor Inputs (DCCTs)

Two current input channels are used to monitor the two DCCTs that are connected to the input bus bars. The alarm threshold can be set on the VIM screen interface.

The current sensors are factory calibrated and do not need calibrations during commissioning.

4.6 Front Panel with a CXC HP Controller

The front panel with CXC HP controller also includes the VIM module with all the features described in section 4.5.2. With this version, the VIM CAN Bus is pre-wired to the local CXC HP controller.

Detailed operation of the controller is provided in the CXC HP controller software manual (0350058-J0).

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

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

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

The ADIO peripheral used in the Smart E2 is the VIM Panel Module which includes:

- 22 digital inputs
- 2 voltage sensors
- 2 temperature sensors
- 2 DCCT current sensors
- 4 Form C relay outputs

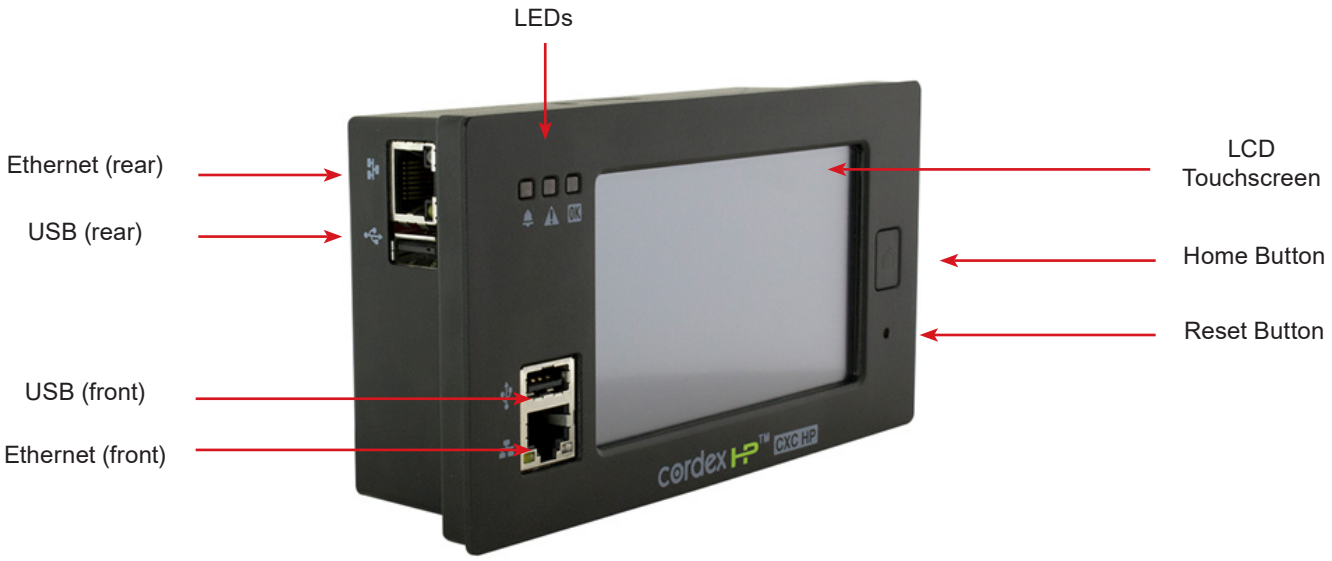


Figure 7 — CXC HP Controller, front left view

Figure 8 — CXC HP Controller, right / top view

The CXC HP has the following features:

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

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

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

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

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

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

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

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

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

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

Figure 9 — CXC HP Controller Touchscreen Display

4.6.1 Network Connection and Remote Communications

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

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

4.6.2 Front Panel Wiring Notes

The terminal blocks on the VIM are suitable for #26-16AWG wire. As all signals are low current, it is recommend to use thinner wire were possible to make routing easier and to minimize space consumed by the system.

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 VI meter to restrain the cables within the front panel, and use the cable tie features on the chassis side panels to guide the cabling to the back of the unit.

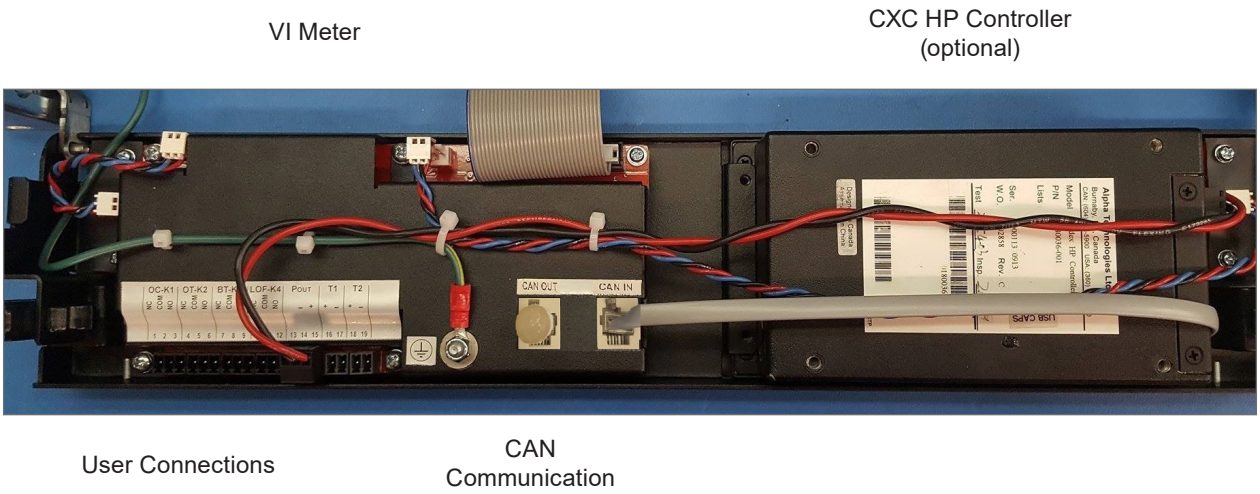


Figure 10 — VIM Connections with Optional CXC HP Controller

5. Site Evaluation and Pre-Installation

5.1 Packing Materials

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

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

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

5.1.1 Returns for Service

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

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

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

5.2 Check for Damage

Before unpacking the product, note any damage to the shipping container. Unpack the product and inspect the exterior for damage. If any damage is observed, contact the carrier immediately.

Continue the inspection for any internal damage. In the unlikely event of internal damage, inform the carrier and contact Alpha Technologies for advice on the impact of any damage.

5.3 General Receipt of Shipment

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

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

6. Installation

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

6.1 Safety Precautions

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

6.2 Tools Required

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

- Various crimping tools and dies to match lugs used in installation
- 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
- Cutters and wire strippers (#14 to #22 AWG) [2.5 to 0.34 mm^2]

6.3 Assembly and Mounting

The Smart E2 must be mounted in a clean and dry environment. Sufficient free space must be provided at the front and rear of the power system in order to meet the cooling requirements and to allow easy access to the power system components. This includes at least 2RU (3.5") of space above the unit to access connections points and provide adequate cooling/ventilation.

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

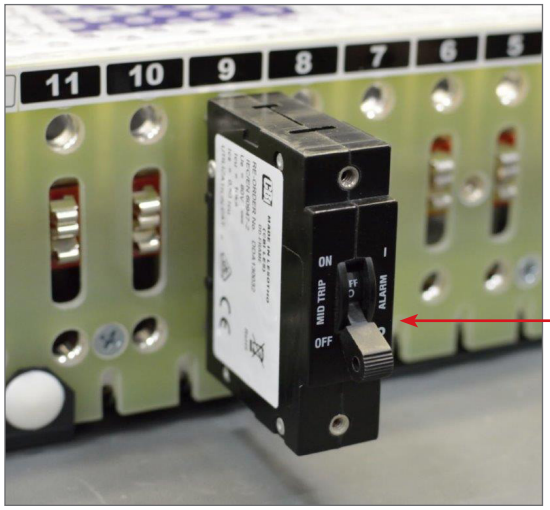
The system may be mounted into a 19" rack in a center mount position. The unit is shipped with the mounting brackets in the front mounted position. Move them to the center position as desired and attach 19"-23" the rack adapters when installed in a 23" rack.

6.4 Breaker Installation

CAUTION!

Adequate spacing must be provided between breakers for heat dissipation. Refer to section 7.4.1 for details. Failure to do so may result in equipment damage or fire.

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

7. Wiring

This chapter provides cabling details and notes on cable sizing for DC applications. All field-wired conductors shall be rated to a minimum 90° C.

WARNING!

Ensure that the power is removed by turning off rectifiers and removing battery line fuses or connections before attempting work on the wiring connections. Use a voltmeter to verify the absence of voltages. Clearly mark the correct polarity of the battery leads before working on DC connections.

NOTE:

When the Smart E2 panel is operated with only a single side being powered, a high impedance voltage can be measured on the opposing bus. The non-powered bus cannot supply power when a load is connected across it.

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 Figure 9 for cable size equivalents.

Table B — 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

Table B — Cable size equivalents (AWG to Metric)			
Cable size (see notes 1 and 2)	**Circular mils**	**Square millimeters**	**Equivalent metric cable**
12 AWG	6530	3.309	4
10 AWG	10380	5.261	6
8 AWG	16510	8.368	10
6 AWG	26250	13.30	16
4 AWG	41740	21.15	25
2 AWG	66370	33.63	35
0 AWG (or 1/0)	105600	53.48	50 or 70
00 AWG (or 2/0)	133100	67.42	70
0000 AWG (or 4/0)	211600	107.2	120
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 C 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 C — Recommended torque values	
1/4"	8.8 ft-lbs
3/8"	32.5 ft-lbs
1/2"	73 ft-lbs

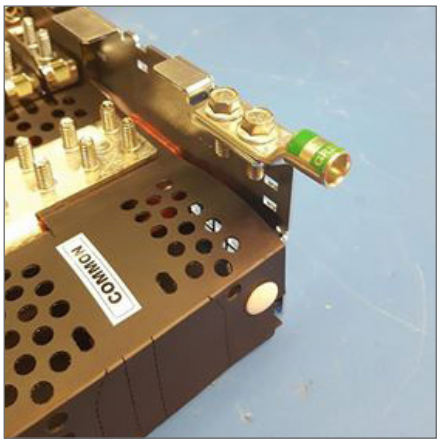
7.2 Chassis Ground

The Smart E2 frame must be connected to the Main Ground Bus (MGB) or Frame Ground Bus (FGB) for safety reasons and to meet standard Telco grounding requirements. This acts as a system reference and a low impedance ground path for surges, transients and noise. The FGB or MGB should have a direct low impedance path to the building grounding system.

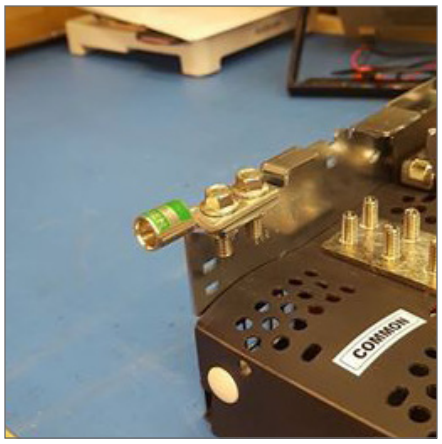
The cable from the distribution center to the MGB should be sized to provide sufficient ampacity to clear the largest fuse or breaker on the distribution center, excluding the battery protection fuse or circuit breaker. This is the minimum requirement; other factors including length of cable and special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

Use the two landings shown in Figure 11 to connect the chassis ground of the Smart E2 to the building MGB. Recommended wire size is a minimum of #6 AWG insulated cable.

The above should be used as a guide, follow local codes and company safety protocols for the ground connections.



Left Ground Connection



Right Ground Connection

Figure 11 — Ground Connections (horizontal alignment shown)

7.3 DC Output Connections

WARNING!

Leave the cables or bus bars disconnected at the load and verify the output polarity using a voltmeter. Make the connections only after this verification.

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

Terminate the cable leads with appropriate crimp lugs.

Secure the positive and negative DC output cables to the unit's output post of the correct polarity; i.e., +Vcable to +Vpost.

7.3.1 DC Input Connection

WARNING!

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

The Smart E2 is rated for a maximum 600A per bus and the input connections are sized to accept up to 2 x 750 MCM per bus. All cables should be routed carefully and secured to the ladder rack or frame so that there is limited stress on the Smart E2 connections themselves.

7.3.2 Standard Horizontal Feed Connections

Up to 2x 750 MCM sized lugs can be directly connected to each of the input bus bars of the Smart E2. These connections are accessible through the back cover and are arranged as shown in Figure 12.

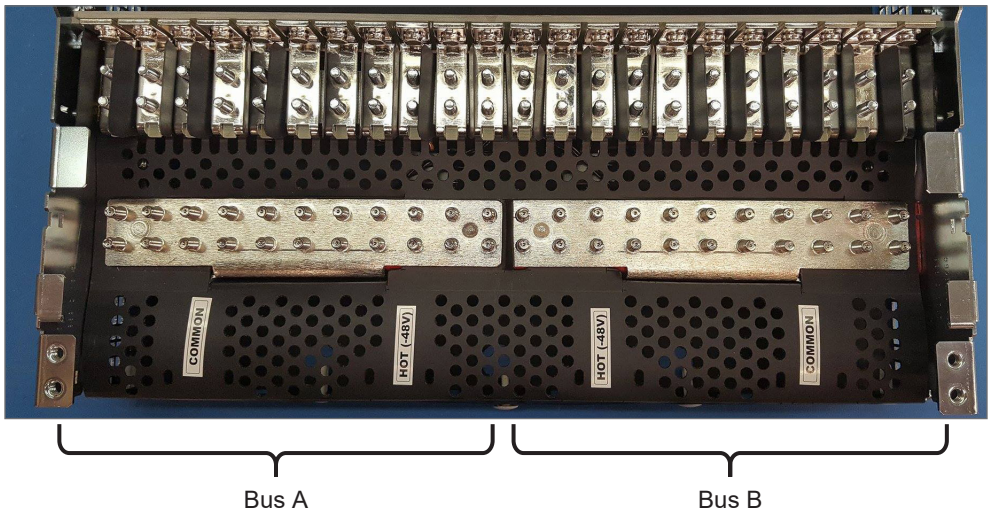


Figure 12 — Horizontal Feed Connections

1. Open the unit cover fully. With bottom cover hanging vertically there is maximum access to the connections. Although it is possible to make the connections with the bottom cover in place, it is recommended that the feed connections to the Smart E2 are made before adjacent equipment is installed.
2. With the cover open, mount the lugs back to back on the input bus bars.
3. Place the nuts on the side that provides the greatest access for a ratchet.
4. Tighten the self-locking nuts (rather than the bolt) - no separate washers necessary.
5. Remove the semi-ovular tear-out sections in the back cover to provide clearance for the lugs, as shown in Figure 13.
6. Once the lugs are connected, move the bottom cover into position and secure the middle of the cover first with a single push-clip, as shown on the right-side image of Figure 13.

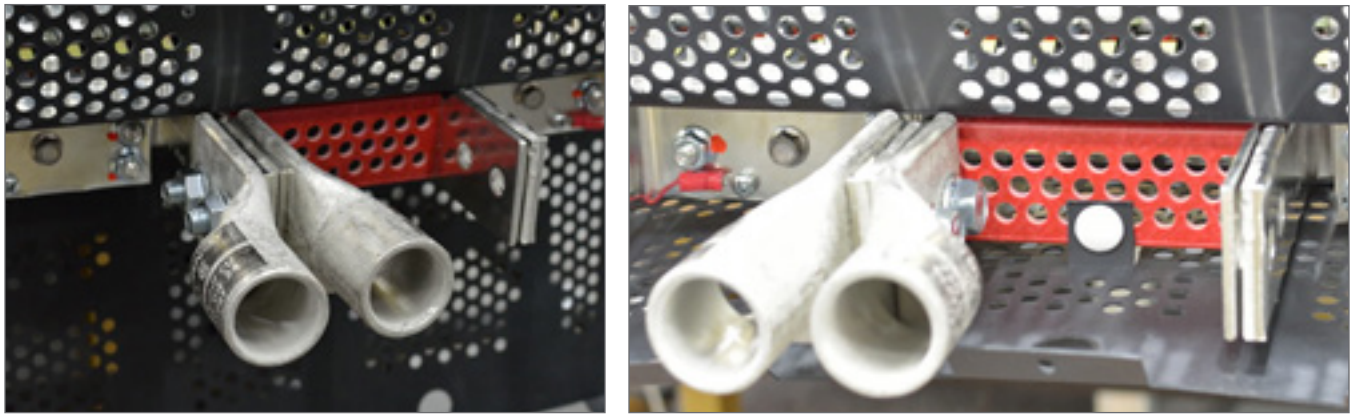


Figure 13 — Lug Connection, Middle Push-clip

7. The fasten both the top and bottom covers to each of the side panels using push-clips (2x total).
8. Connect the top cover to the bottom cover using the three (3) push-clips along the back.

Figure 14 — Back Cover Installation

7.3.3 Feed Connections using Vertical Adapter Kits

For feeds coming from above use the vertical adapter kits (P/N 0200235-521). These kits make it easier to dress the feed cables at varying angles while still maintaining clearance for attaching load cables.

1. Add the adapter plates to the input bus bars of the Smart E2. When deciding which side of the input bus bar to mount the adapter plates refer to the rectangular tear-out section of the top cover. When mounted correctly the tear out section is aligned with the adapter plate.

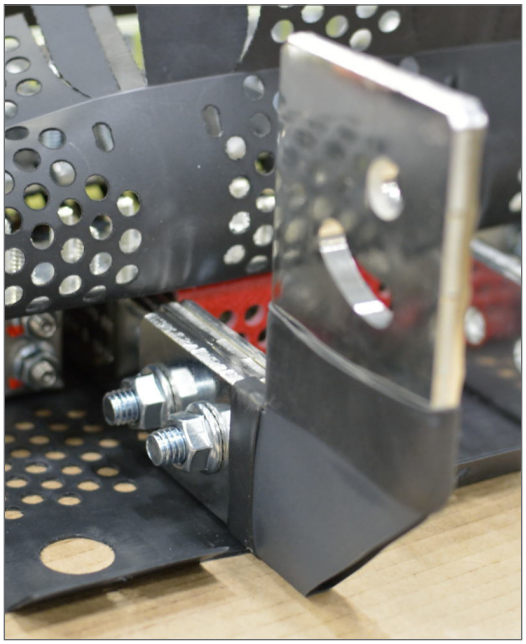


Figure 15 — Vertical Adapter Installation

2. Once the adapter plate is mounted, tear-out the narrow section of the top cover to fit around the adapter plate, and attach the top cover to the bottom cover and to the side panels using the instructions from 7.3.2. See Figure 16 for final detail.

NOTE:

Before applying power to the unit, ensure that the bottom of the adapter plate is insulated from any equipment that may be mounted below, and ensure that all covers are in place.

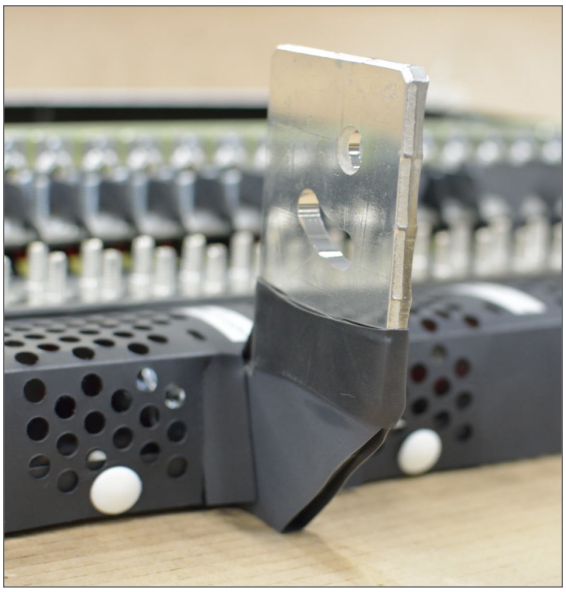


Figure 16 — Vertical Adaptor Closed

3. Once the cover is in place, connect the lugs to the adapter plate at an angle that is most convenient for cable routing.
4. Check that there is no excessive force from cable weight or stiffness to the input bus bars. Cables should be externally supported to avoid undue stress being transferred from the cable to the Smart E2.

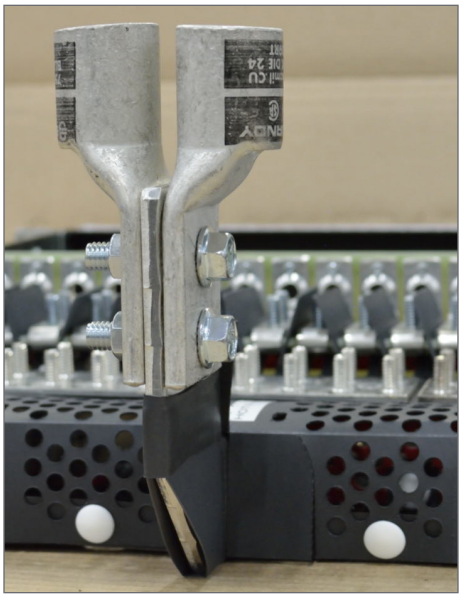


Figure 17 — Lugs Mounted to Vertical Adapter

7.4 Distribution Cabling

7.4.1 Load Planning/Breaker(fuse) Spacing

The Smart E2 current rating of 1200A (600A per bus) continuous enables very dense power distribution in a 2RU 19” rack volume. Effective management of heat is critical to such systems, and the Smart E2 buswork and ventilation is designed to both minimize heat generation, but also extract and dissipate the heat generated by the breakers or fuses.

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 100A and above 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 90A can be mounted in triples, but cannot have an OCPD installed on either side of the triple
3. Any single pole Over Current Protection Device (OCPD) rated at 80A and below can be mounted in any position without spacing

While these guidelines require some planning, they do not limit achieving the 600A/side capacity for any breaker size combination (except if many small breakers are used). Below are example layouts which may show how to best accomplish 600A capacity with the largest size of breakers.

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 Smart E2. Always make the return connection to the Smart E2, 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 load 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 load breaker hot connections.

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

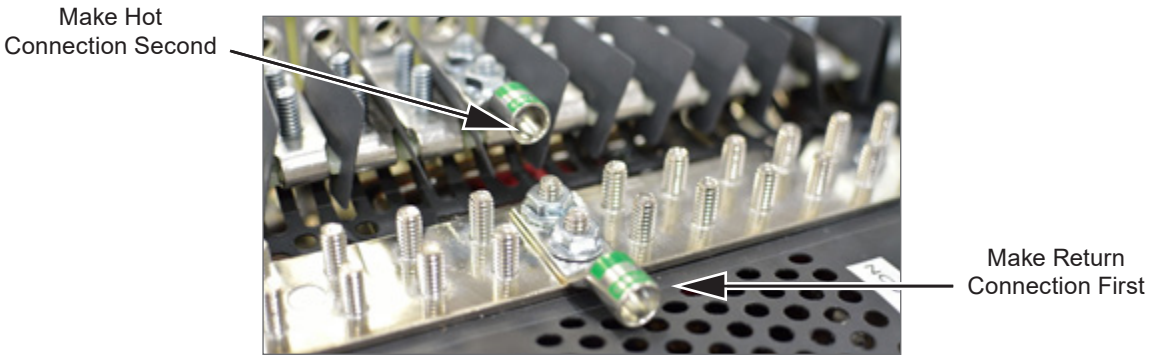


Figure 18 — Battery, Load, and Return Connection Locations

7.5 Alarm and Signal Connection

7.5.1 Breaker Alarm and Bus Voltage Connections

1. Locate the terminal block on the inside of the front panel. Refer to Figure 19 and the schematic drawing at the end of this manual for details on terminal block assignments.
2. Connect these alarms and signals to the local alarm-sending unit. Use wire sizes #20 to #26 AWG (0.518 to 0.14mm^2).

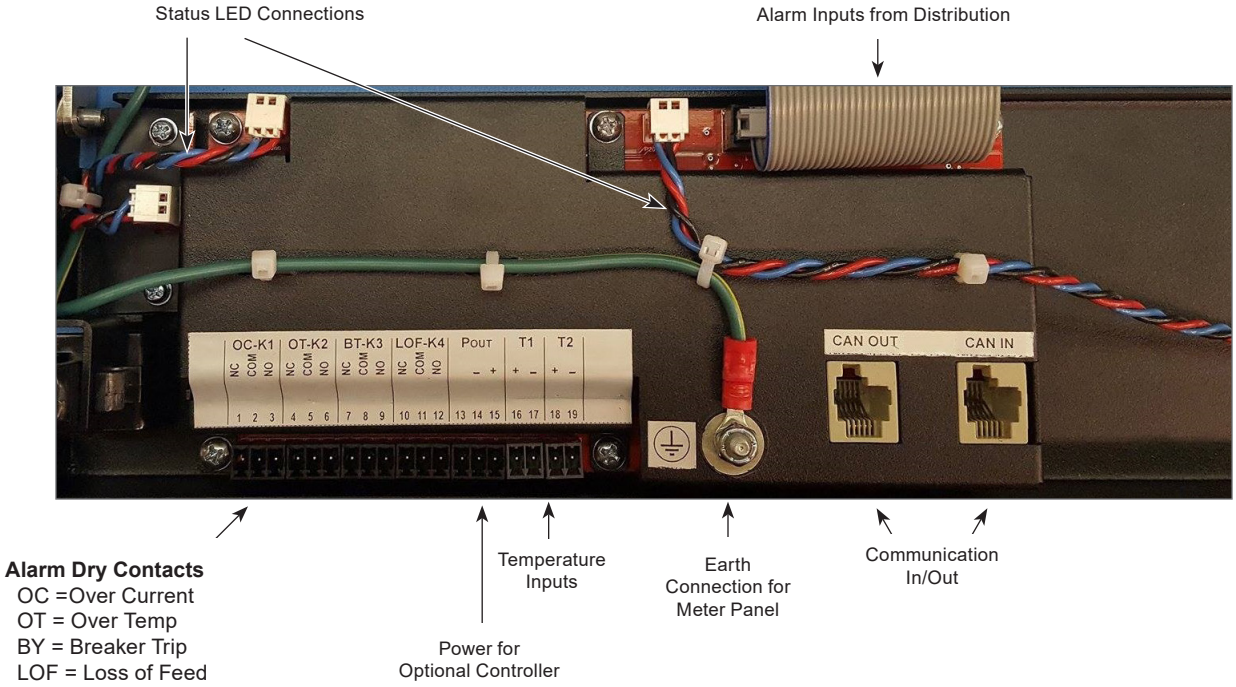


Figure 19 — VI Meter Wiring

The alarm dry contact relays are energized during normal operation and de-energized in the event of an alarm. They will indicate an alarm when power is removed or the VI meter is reset.

7.6 Smart E2 Smart VI Monitor

The new Smart VI monitor has a full color screen with easy navigation and features both a display mode for monitoring status, and a configuration mode for navigating menus and making adjustments. Additional features include, two temperature inputs, single point calibration, detailed breaker status and optional CAN communication.

Menus - The three main menu items are:

- Breaker Status
- Calibration
- Alarm Config

7.6.1 Monitor Display

When in display mode the Smart VI monitor has up and down as well as right and left arrow keys to scroll through the status of each panel and looks similar to Figure 20. The Smart VI monitor displays system status, panel selected, and panel status details and temperature status. Press any button to activate the display. By default the upper left panel is selected via white highlight.

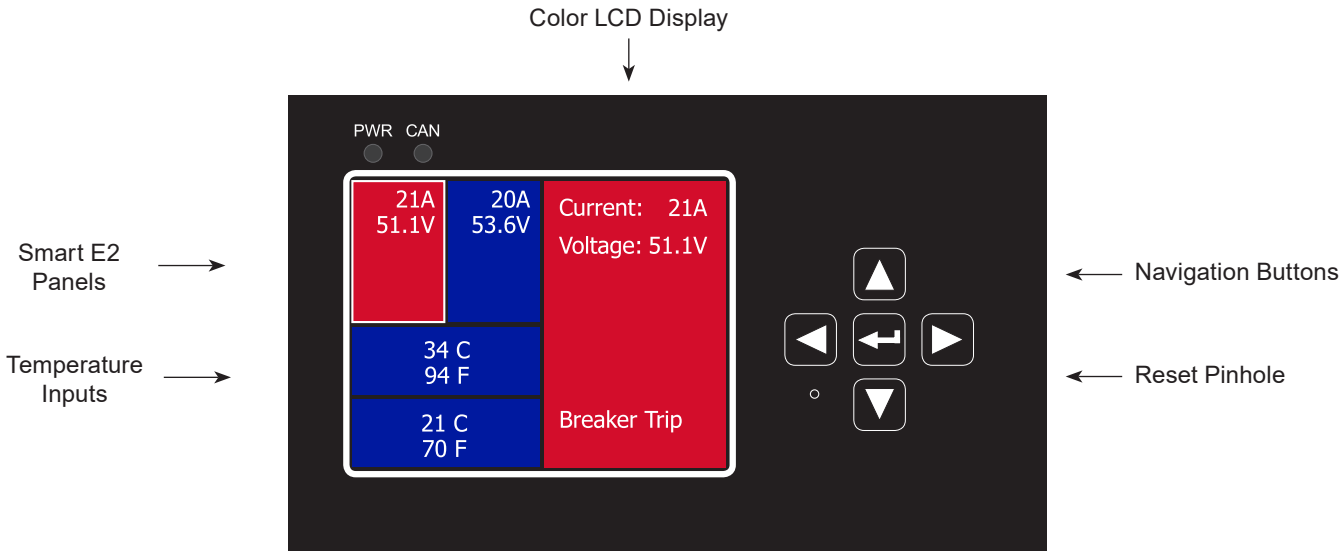


Figure 20 — Monitor Display

Below the LCD screen there are five navigation buttons. When in configuration mode, these buttons are used to navigate the menus, make selections and adjust parameters.

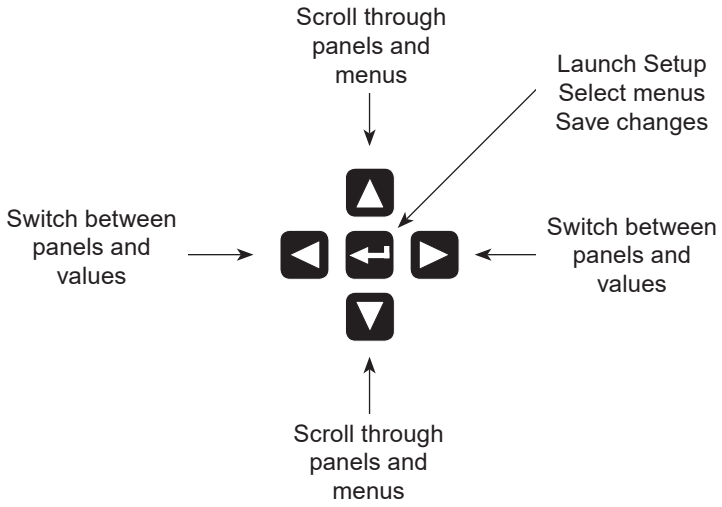


Figure 21 — Smart VI Monitor, Navigation Buttons

7.6.2 Display Mode

When in display mode, use the arrow buttons to scroll through the status of the panels and temperature inputs. The LCD screen is divided into two portions.

The left portion indicates which panel or temperature input is selected as well any alarms if applicable. Alarms display in red (see Figure 22).

The right portion of the display contains two lines: details of the selected panel or temperature input, with the measurements of the screen and status messages on the bottom of the screen if there are alarms.

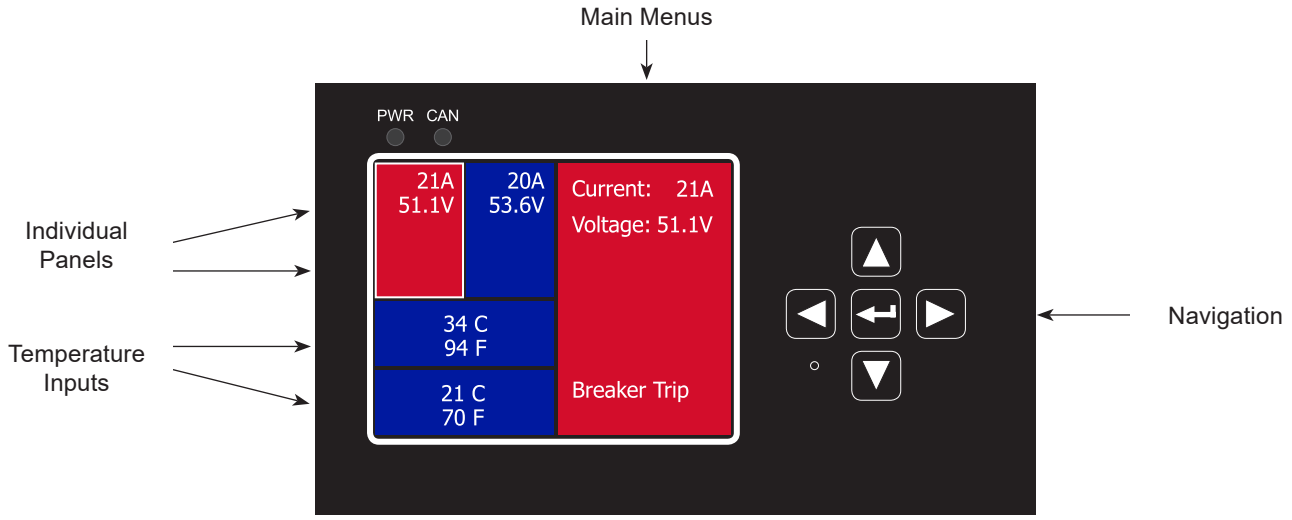


Figure 22 — Smart E2 VI Monitor, Display Mode

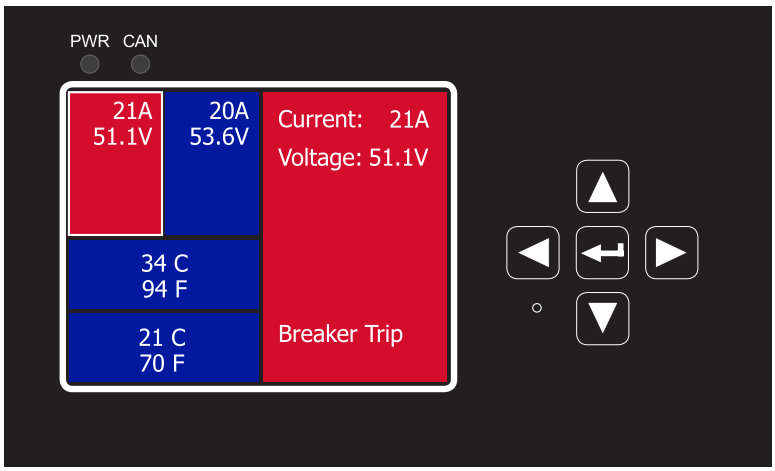
7.6.3 Alarm Message Display

When an alarm exists, both the panel (or temperature input) in alarm, and the main menu panel display as red.

The alarm error messages are as follows:

- Over Current
- Over Temperature
- Loss of Input Feed
- Breaker Trip

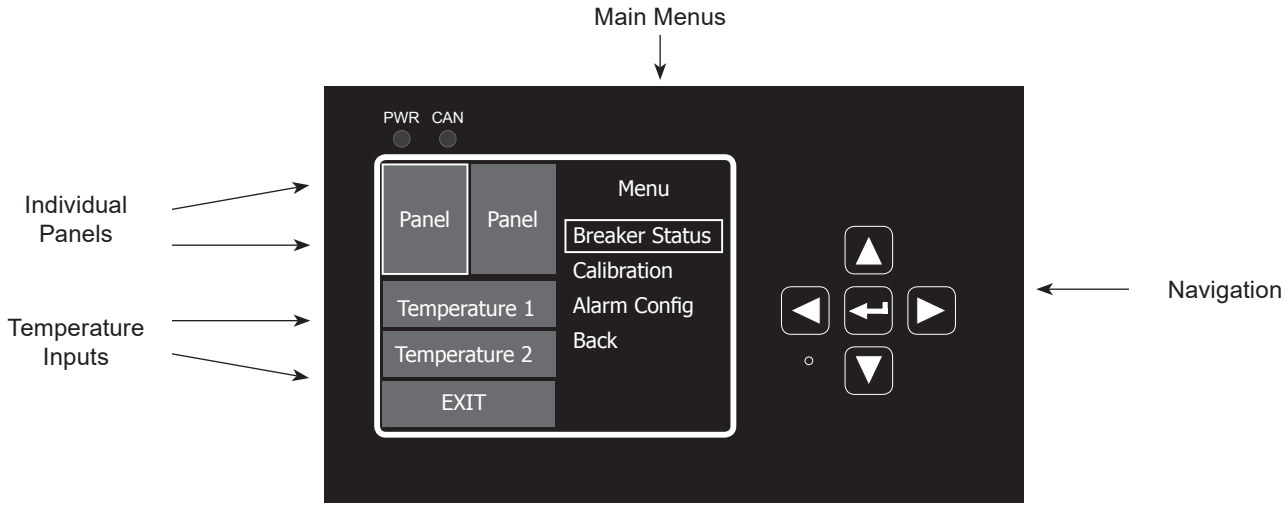
1. To view the alarm, use the arrow buttons to scroll through the individual panels.
2. Once the panel is highlighted, the alarm type displays on the main menu panel.



7.6.4 Breaker Status

The breaker Status menu provides more details about the breakers associated with a panel. The Display mode only shows that a breaker trip has occurred on a panel. There are eleven breakers associated with each panel. To see which breaker(s) tripped do the following:

1. Press the center button.



2. Press the center button again to go into the breaker status menu.
3. Use the arrow keys to select a panel.
4. The status shows none if there are no breakers tripped or will display the actual tripped breaker numbers if more than one is tripped.

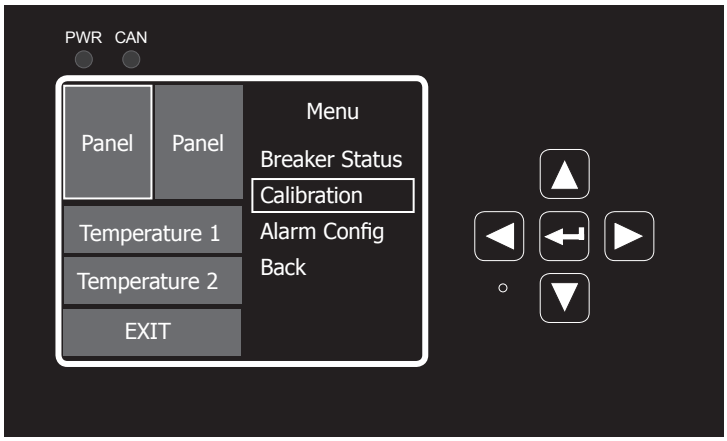
NOTE:

For temperature inputs the breaker status will always be "none."

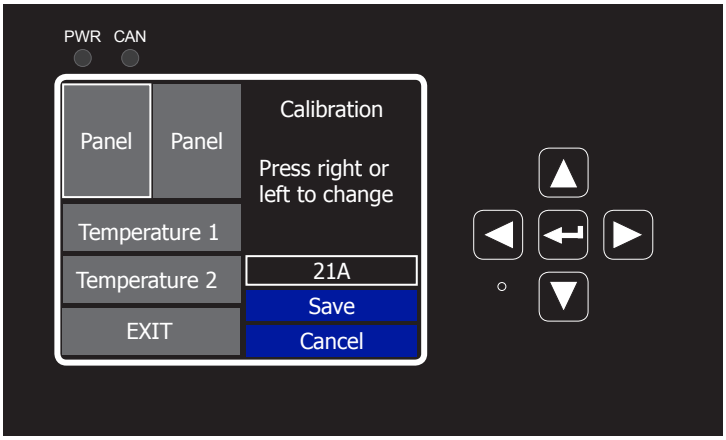
7.6.5 Calibration

The Smart E2 uses a 600A DCCT current measurement device. The Calibration menu can be used to do a single point calibration for either current or temperature measurements.

1. From the main menu, scroll to Calibration.
2. Select the panel or temperature input to be calibrated and then press the centre button to begin.



3. The screen displays the value of the reading for that current or temperature input.
4. Once the required reading is reached, press the down arrow to select the Save option.



5. Press the center button to save.

7.6.6 Alarm Configuration

The Alarm Config menu allows users to set the over current and over temperature threshold of an alarm. If the reading goes above the value, an alarm is generated.

The default current threshold is 240A, but the value can be adjusted in 10A increments from 0A up to 600A. The default temperature threshold is 40° C (104° F) and can be adjusted in 1 degree increments from -50° – 100° C (-58° – 248° F).

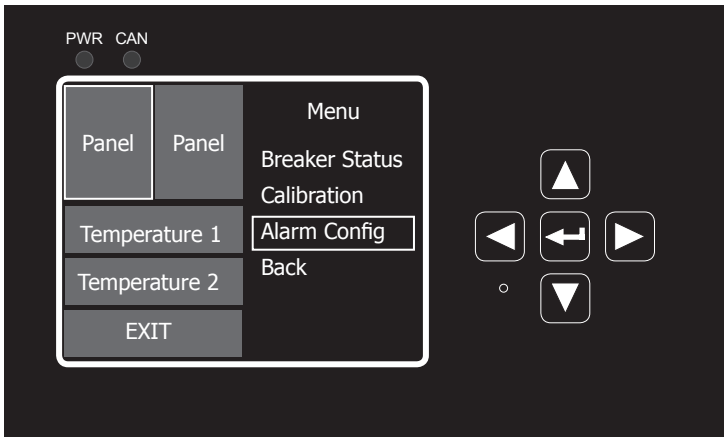
If no temperature probe cable is installed, the over temp alarm threshold can still be configured, however the alarm will never occur.

NOTE:

Temperatures measured above 100° C will produce "no probe" status.

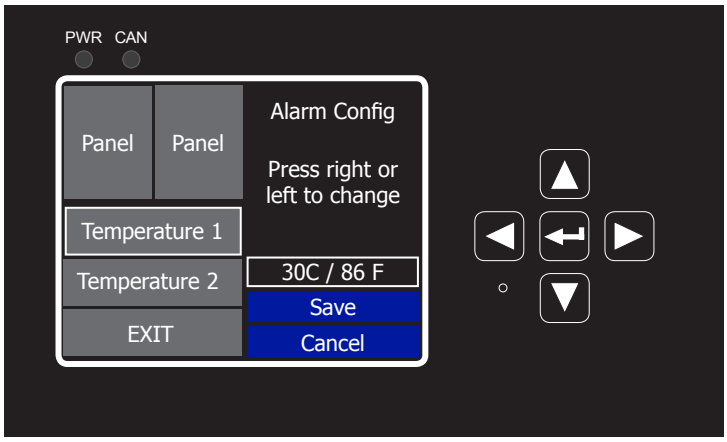
To configure alarms:

1. Press the center button to activate the main menu, scroll to the Alarm Config menu and select.



2. Scroll up/down/ left or right to highlight the threshold that requires configuration.

3. Press the left or right buttons to change the alarm threshold.



4. Scroll to Save, press the centre button to accept the changes.
5. Repeat from step two to configure the threshold of additional panels.
6. Once completed, scroll to Exit, and press the center button.

7.7 CAN Serial Ports

The CAN serial port(s) are located on the back of the VIM and on the side of the controller and are clearly labelled. CAN serial ports are modular jacks with offset latches that are used to communicate with the rectifiers and other CAN-enabled equipment (nodes) on the same system. For more detailed information on CAN, refer to the Reference section in the software manual (0350058-J0).

7.7.1 CAN Termination

A CAN termination jumper is required at the last node of a CAN network. See the CXC HP controller manual for system configuration.

7.8 Network and Remote Communication

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

Some standard scenarios are described below:

- Network Connection: The Ethernet port is designed to connect the controller to a user supplied network (TCP/IP supplied by the user) via a front panel RJ-45 jack. Use a standard network cable for this connection.
- Local Connection: The Ethernet port can also be used for local access such as using a laptop computer. Use a standard Ethernet cable for this connection.

7.9 Signal Wiring Connections for VIM

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

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

Bundle the signal cables together and route them through the entry holes of the shelf.

7.9.1 Alarm Outputs

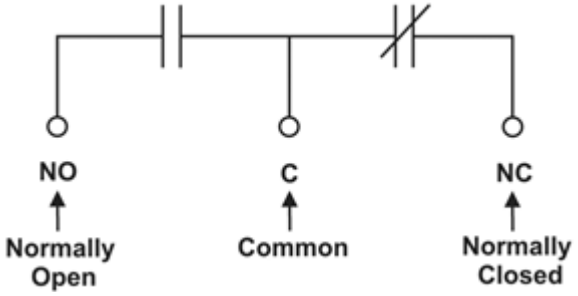
Terminals provide contacts for extending various alarm or control signals. Each relay output can be wired for NO or NC operation during an alarm or control condition.

Relays are a fixed function on the VIM and configure to their alarm function as described in section 7.5.1. All relays will de-energize when the VIM reset button is pressed or when the power is lost.

CAUTION!

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

K1 =	Over Current
K2 =	Over Temp
K3 =	Breaker Trip
K4 =	Loss of Feed



7.9.2 Analog Inputs

The analog input channels are used to monitor various types of electrical signals. Some of the analog channels are reserved for specific signals, while others are designated as general-purpose inputs that accommodate various types of analog signals.

Voltage/Temperature/Current Inputs

CAUTION!

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

See the front panel descriptions, under section "4. Features".

7.9.3 Voltage inputs

The bus voltage is monitored through connections tot he alarm board in the back of the breakers - this is factory wired.

7.9.4 Current Inputs

Current is monitored using two DCCT sensors in the bus bars - this is factory wired,

7.9.5 Digital Inputs

Are factory wired.

7.9.6 Temperature Sensors

Two terminal blocks, T1 and T2 are available for external sensors. Use Alpha supplied sensors only and ensure correct polarity.

8. 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.

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 semi-conductor devices, 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 D — Sample maintenance log

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

9. Warranty Statement and Service Information

Technical Support

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

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

Warranty Statement

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

Product Warranty

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

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

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

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

Battery Warranty

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

Warranty Claims

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

Claims must be made online at: www.alpha.ca.

Service Information

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

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. Certification

About CSA and NRTL

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

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

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

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

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

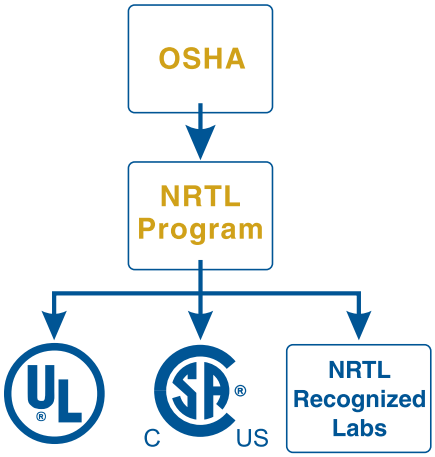
Only Underwriters Laboratories may grant a licence for the use of this mark, which indicates compliance with both Canadian and US requirements. (3)

NRTLs capabilities

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

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

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



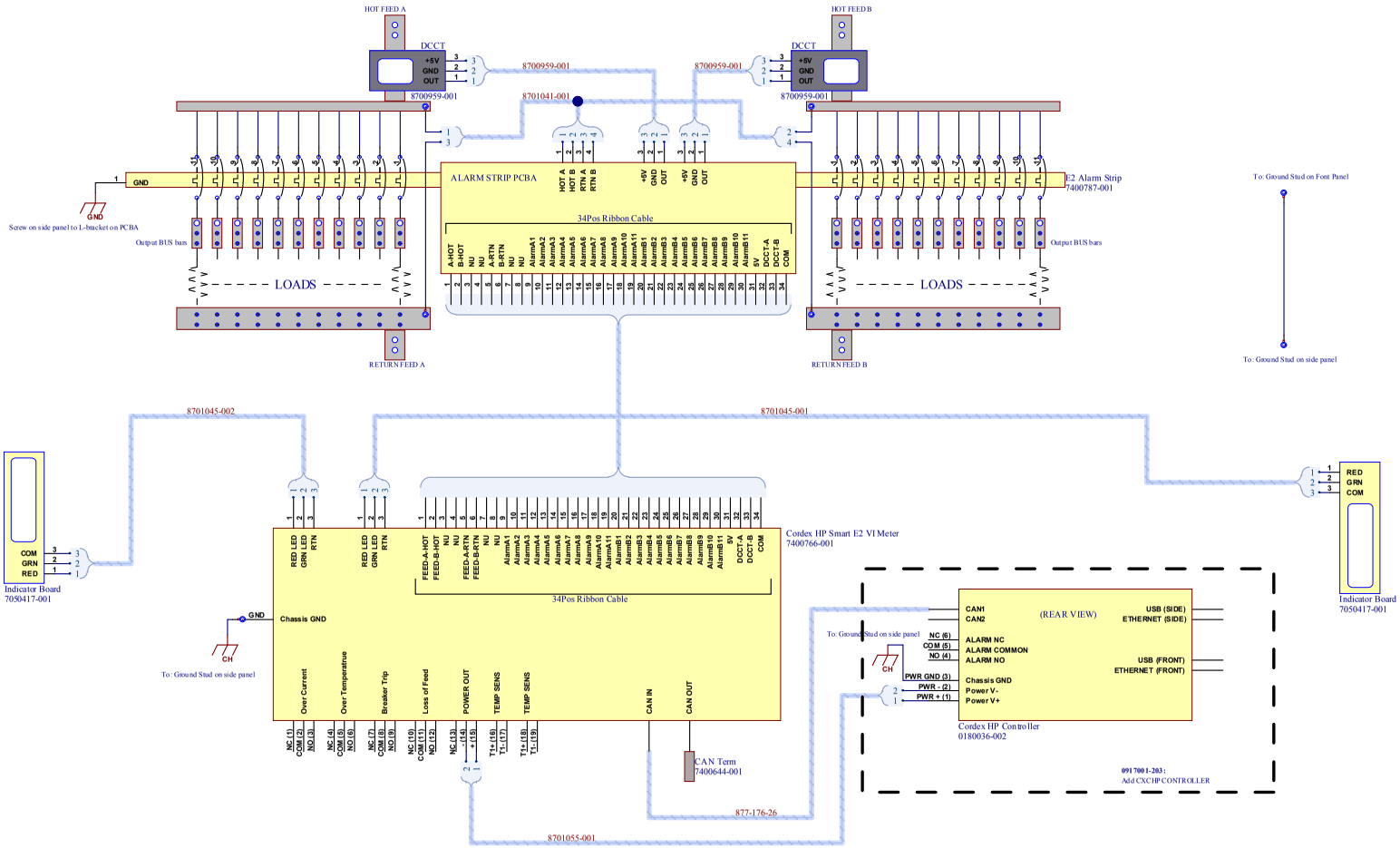
Governance of NRTL

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

(1)www.csagroup.org

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

REVISIONS					
LTR	DESCRIPTION	DRW	DATE	CHK	APP



DESIGN	LS	07JUN2017	CHECKED	DM	07JUN2017
DRAWN	LS	07JUN2017	APPROVED	FVH	07JUN2017

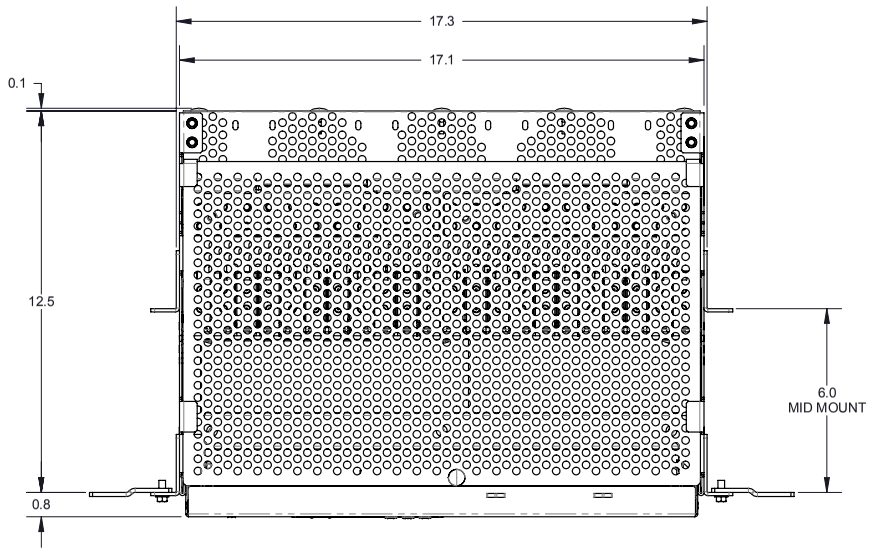
TITLE: SCHEMATIC, CXDS-E2 Distribution Center System Schematic

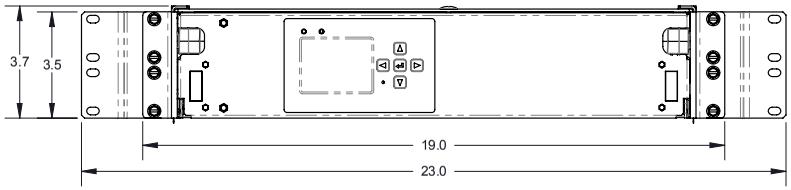
ISSUE DATE | SHEET 1 of 1

SIZE	TYPE	DWG NO.	REV
B	S5	0917001-05	A

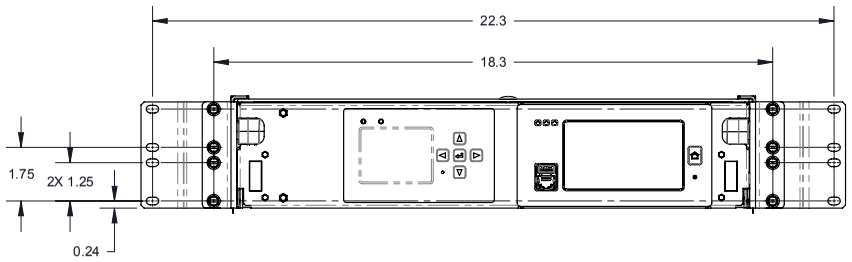
DO NOT SCALE DRAWING

REVISIONS				
LTR	DESCRIPTION	DWN	DATE	CHK





0200235-202



0200235-203

NOTES UNLESS OTHERWISE SPECIFIED:

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

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	L. SMYTH	2/23/2017
CHECKED	Z. LANDER	2/23/2017

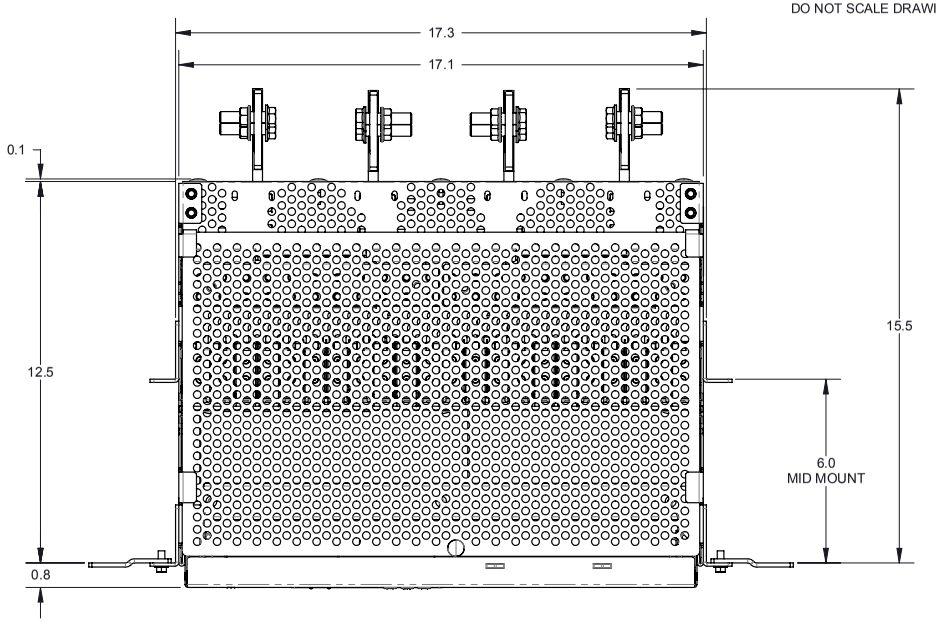
TITLE: OUTLINE DRAWING, SMART E2

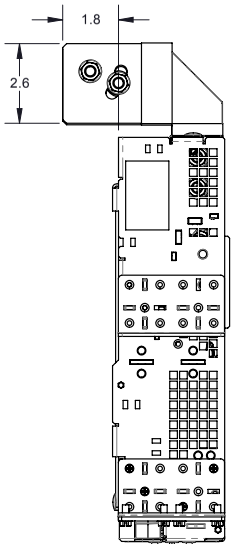
SIZE	DWG NO.	REV
B	0200235-06	A

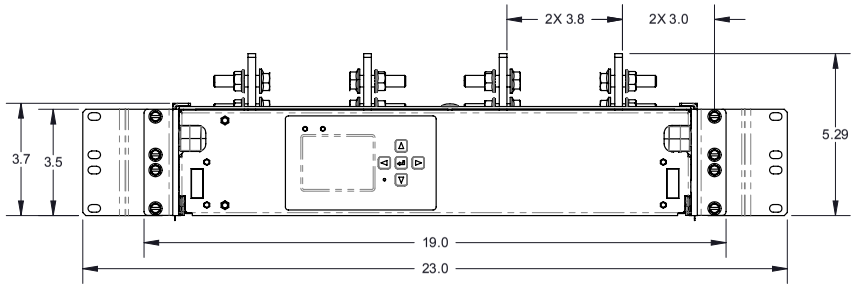
SCALE: 1:1 SHEET 1 OF 2

DO NOT SCALE DRAWING

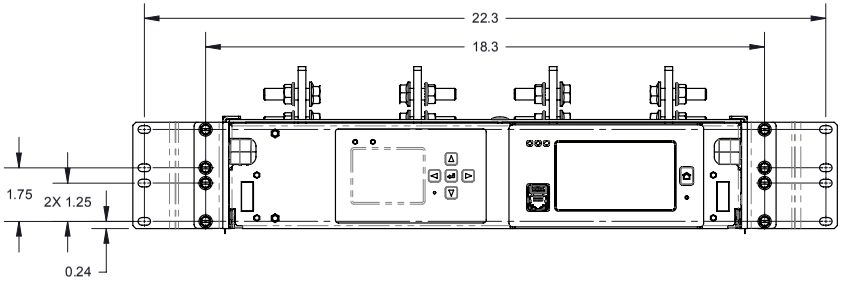
REVISIONS				
LTR	DESCRIPTION	DWN	DATE	CHK







0200235-302



0200235-303

NOTES UNLESS OTHERWISE SPECIFIED:

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

TITLE: OUTLINE DRAWING, SMART E2		
SIZE B	DWG NO. 0200235-06	REV A
SCALE: 1:1	SHEET 2 OF 2	

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For more information visit www.alpha.com

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