Cordex 12-250W 19" Integrated Shelf

Up to 1250W with CXCI/CXCI+ Installation & Operation Manual

Part # 030-818-B2
Effective: 10/2013

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Your Power Solutions Partner

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

1. Please read this manual prior to use to become familiar with the product's numerous features and operating procedures. To obtain a maximum degree of safety, follow the sequences as outlined.

2. This manual provides warnings and special notes for the user:
    a. Points that are vital to the proper operation of the product or the safety of the operator are indicated by the heading: **WARNING**.

    b. A notation that is in ***Bold Italic*** typeface covers points that are important to the performance or ease of use of the product.

3. Before using the product, read all instructions and cautionary markings on the product and any equipment connected to the product.

4. Do not expose the product to rain or snow; install only in a clean, dry environment.

5. **CAUTION** – Unless otherwise noted, use of an attachment not recommended or sold by the product manufacturer may result in a risk of fire, electric shock, or injury to persons.

6. **CAUTION** – Do not operate the product if it has received a sharp blow, it has been dropped, or otherwise damaged in any way – return it to a qualified service center for repair.

7. **CAUTION** – Do not disassemble the product – call our qualified service centers for servicing. Incorrect reassembling may result in a risk of electrical shock or fire.

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1 Introduction

1.1 Scope of the Manual

This instruction manual explains the installation, interconnection, and operation of Alpha Technologies Cordex 12-250W integrated 19" 2RU shelf with up to 1250W output power.

The following documents and drawings are included in this manual:

- Specifications, rectifier: 010-613-B1 (alt. 010-587-B1)
- Specifications, shelf: 030-818-B1
- Specifications, CXCI: 7400233-S0
- Schematic drawing: 030-783-05
- Outline drawing: 030-783-06
- Customer connections: 030-783-08

1.2 Product Overview

A complete Cordex rectifier system consists of a controller with one or more power modules in a common shelf enclosure. The shelf has connections for AC inputs, DC output, and system communications.

Cordex rectifier modules use a high frequency, switched mode conversion technique to provide a fully regulated and isolated DC output from the AC mains. The rectifier input is wide range to allow use on 120/208/220/240Vac 50/60Hz electrical service.

Rectifier power modules are “hot swappable” meaning they can be inserted or removed from the shelf without cutting power to or from the system or the load.

Additional power modules can be included with the system at the time of ordering or added after the shelf has been installed.

The rectifier shelf is designed to operate with the Alpha Cordex CXCI/CXCI+ (integrated version of the CXC controller); which is built into the rectifier shelf.
Details for installation and wiring are provided in the respective chapters of this documentation package.

All models of the CXC allow the user to set up, control and monitor the entire power system and ancillary components from one central, easy-to-use source: your web browser. The CXCI/CXCI+ models do not have a touch screen display; system setup and management is performed exclusively with the web interface.
Details of controller operation are provided in the current version software manual.

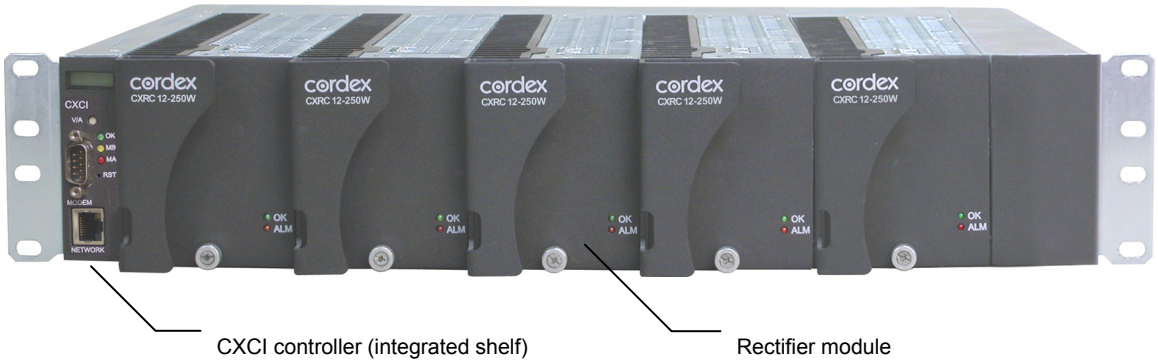


Figure 1–Cordex 12-250W integrated 19" 2RU shelf

1.3 Part Numbers and List Options

This product is available to order under the following part numbers and list options:

Description	Part Number/List Option
Cordex 12-250W 19" (flush mounting) 2RU shelf for systems up to 1250W (alt. #030-818-20)	030-783-20
[equipped to receive one CXCI/ CXCI+ controller and up to five CXRC 12-250W rectifiers]	*List 0
120Vac input	List 5
240Vac input	List 6
19" rack, 6" offset mounting	List 19
19" rack, flush mounting	List 21
23" rack, 6" offset mounting	List 23
23" rack, flush mounting	List 25
Charcoal finish with white (contrasting) silkscreen	*List 56
Temperature sensor, 1/4" lug, 12 ft.	List 72
Temperature sensor, 3/8" lug, 12 ft.	List 75
Bulk output	*List 80
Two line cords without plugs, 3m each	List 89
Rectifier blank plate	List 90
Controller blank plate	List 91
CXCI+ controller	*List 98
CXCI controller	List 99
Cordex 12-250W rectifier power module (alt. #010-587-20)	010-613-20
Basic module, 12Vdc output	*List 0
Charcoal finish with white (contrasting) silkscreen	*List 56
Paralleling diode (Oring MOSFET) for operation without battery	List 82

* Default option

The above information is valid at the time of publication. Consult factory for up-to-date ordering information.

2 Features

2.1 Cordex Integrated System Controller (CXCI/ CXCI+)

The CXCI/ CXCI+ controller is mounted in the rectifier system shelf and brings advanced monitoring technology to the Cordex series of rectifiers. This compact system controller is designed for seamless operation and set up of Alpha power systems and is equipped with the complete range of Cordex software features, including the following:

- Designed to communicate directly with Cordex rectifiers
- Includes battery temperature compensation charging
- Battery performance diagnostics
- Provides local and remote communications
- User definable alarms
- Daily logging of power system events and system statistics

The CXCI/ CXCI+ includes a web server for easy set up and monitoring using an Internet connection with the standard Windows Internet Explorer browser.

The data logging feature allows the user to capture data from multiple inputs, for AC/DC voltages, load/battery current, cell voltages and temperatures (automatically for up to 16 user defined logs). Typical applications of the CXCI logging include power system details, thermal performance of outdoor enclosures, battery cell specifics, or mains variations captured by an AC voltage watchdog.

A built-in audio speaker sounds an intermittent tone during active alarms.

The input/output (I/O) board houses a series of terminal connections; located at the back of the system shelf.

NOTE: *Customer settings for the CXCI/ CXCI+ is provided separately in the system documentation package.*

2.1.1 System Controller Front Panel

2.1.1.1 Display

The CXCI (Figure 2) and CXCI+ (Figure 3) controllers have a 4-digit display for monitoring system voltage (V) and current (A). A pushbutton switch toggles the display between the V and A readings.

Details of controller operation are provided in the current version software manual.

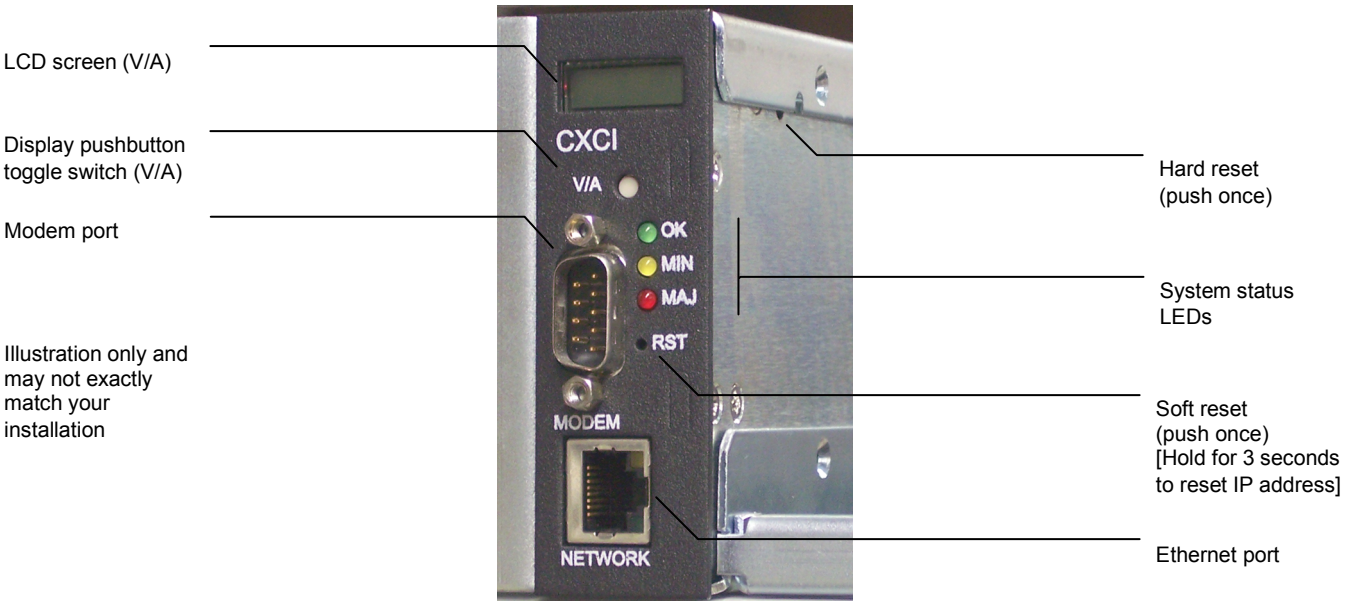


Figure 2–Cordex CXCI model system controller front panel

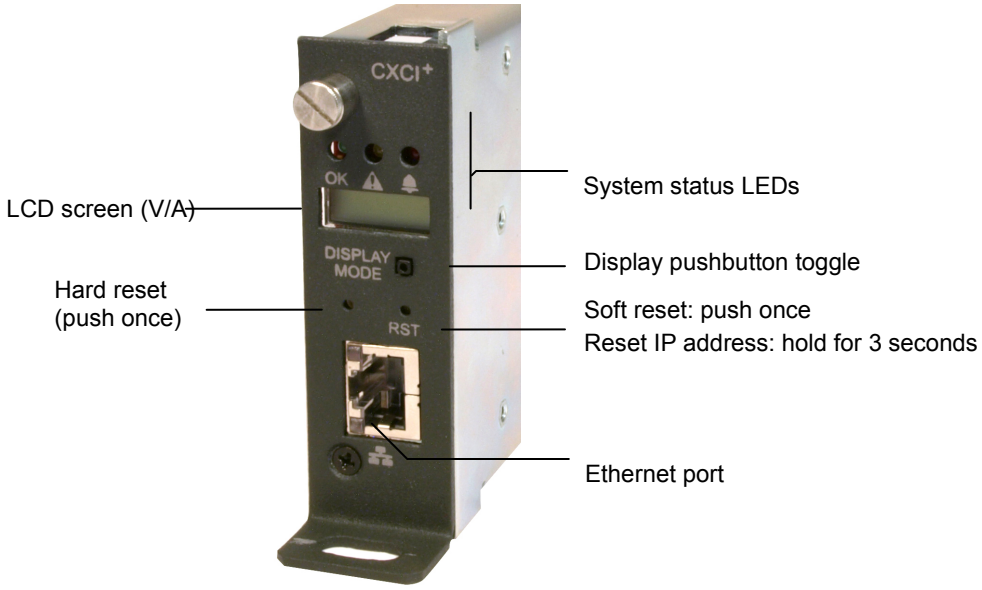


Figure 3–Cordex CXCI+ model system controller front panel

2.1.1.2 LEDs

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

Alarm Conditions

The controller illuminates the LED that corresponds to the system alarm status. The following show the corresponding alarm status for each LED color:

Green – OK, no alarms present
Yellow – Minor alarm is present (no major alarms)
Red – Major alarm is present.

Only one LED is illuminated at a time during alarm conditions.

Progress and Status Indication

The LEDs are also used in the following situations:

Base unit validation – all three LEDs are on at the same time.
File transfer – when recovering from invalid firmware application – the red LED is illuminated.
Lamp Test – all three LEDs flash on and off at the same time for 2 seconds.

2.1.1.3 Reset

A reset button is located on the front panel for restarting the CXC's microprocessor.

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

See Section 7.4 for more information on CXC Reset functions.

2.1.1.4 Modem Port (not available on the CXCI+, list 98)

The Modem port (front panel DB-9 connector, Figure 5) is designed for CXCI connection to the Alpha Cordex DC Modem #018-585-20 (complete with Alpha cable).

2.1.1.5 Ethernet Port

The Ethernet port is designed for CXCI/ CXCI+ connection to a user supplied network (TCP/IP secured by user) via a front panel RJ-45 jack (Figure 2) and a standard network cable.

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

2.1.2 Analog Input Channels

2.1.2.1 Voltage Inputs

Two voltage input channels, V1 and V2, provide monitoring of discharge and charge voltage. The CXC software is pre-configured to monitor V1 for load voltage and V2 for battery voltage. V2 (wired internally) is used as the system reference for rectifier float voltage, low voltage disconnect (LVD), system high voltage alarm, and system low voltage alarm.

2.1.2.2 Current Input

The CXC software is pre-configured to monitor I1 for load current wired externally to the system current shunt.

2.1.2.3 Temperature Inputs

Two temperature input channels, T1 and T2, provide monitoring of battery temperature and temperature compensation (temp comp) or room/ambient temperature. A voltage is supplied to these terminals to power the temperature sensors.

2.1.3 Digital Input Channels

The CXCI/ CXCI+can accommodate up to two channels and can monitor digital alarm/control signals from rectifiers, converters and many other types of equipment. See Section 5.10.2.

2.1.4 Alarm and Control Output Relays

The CXCI/ CXCI+contains four Form C digital alarm output relays to extend alarms and control external apparatus. Each internally generated alarm or control signal may be mapped to any one of the relays, or, several signals may be mapped to just one relay or none at all. See Section 5.10.3.

2.1.5 Network Connection and Remote Communications

The Cordex system can be set up, monitored and tested via ETHERNET 10/100 Base-T serial data connection. The communication protocol supports a web interface.

2.2 Rectifiers

Figure 4–Cordex 12-250W rectifier front panel

2.2.1 Front Panel LEDs

The front panel LEDs provide rectifier status summary and help to locate a specific module under CXC control.

2.2.1.1 OK

The top LED (green) is on when AC is within valid range and the rectifier is delivering power to the load.

The LED turns off when AC has failed or when the rectifier is off; e.g., when commanded via the CXC. AC voltage is invalid if the AC Mains Low or AC Mains High alarm is active.

2.2.1.2 ALARM

The bottom LED (red) is on continuously in the event of an active Module Fail alarm.

The LED will flash (~2Hz) when a minor alarm is detected.

The LED remains off in the absence of an alarm.

2.2.1.3 LED Activity During 'Locate Module' Command from CXC

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

This state is entered when commanded via the CXC. The LEDs will flash in a distinct pattern repeating every 2 seconds.

2.2.1.4 LED Activity During Firmware Upload

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

2.2.2 Mechanical

A thumbscrew is provided to secure the rectifier into the shelf. During normal operation the rectifier shall be locked into position. A handle (or grip) is incorporated into the front panel to facilitate the removal of the rectifier from the shelf. No special tools are required.

2.2.3 True Module Fail Alarm

The power modules have a "true" fail alarm. This provides a true indication of the power module's ability to source current. When the module's output current drops below 2.5% of the rated output a low output current condition is

detected and the Module Fail detection circuit is activated. This circuit momentarily ramps up the output voltage to determine if the module will source current. If no increase in current is detected, the Module Fail alarm is activated. The module will test once every 60 seconds for the condition until current is detected. Output voltage ramping will cease upon detection of current[1]. A minimum 2.5% load is required to avoid the Ramp Test Fail alarm; this can typically be provided with the parallel system battery. Activation of this alarm could indicate a failed module or a failed load.

NOTE: *For Cordex rectifier systems without batteries (or with a very light load; below 2.5% of rated output) it is recommended that the ramp test be disabled to avoid nuisance alarms. The Ramp Test feature is enabled/disabled via the CXC menu item: Rectifiers, Configure Settings.*

2.2.4 Heat Dissipation

Heat dissipation is achieved through natural (bottom to top) convection cooling.

2.2.5 Over Temperature Protection

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

2.2.6 Wide AC Range

A minor alarm is generated when the AC input voltage drops below specification. The unit will deliver derated output power down to 80Vac.

For voltages above 277Vac, power factor and total harmonic distortion may be derated. Up to 320Vac, the rectifier will be operational and shall not suffer any damage.

2.2.7 AC Inrush/Transient Suppression

The inrush current of the rectifier module is limited to the full load steady state line current to prevent surge on the AC line. Modules are also protected from input lightning and transient surges in accordance with IEEE/ANSI C62.41 Category B3.

2.3 Soft Start

To eliminate an instantaneous demand on the AC source, a soft start feature is employed. Soft Start, sometimes referred to as “current walk-in”, works by gradually (up to five seconds) ramping the current limit up from zero to the actual or defined customer setting. The rectifier output voltage is ramped up from the minimum voltage to the float voltage.

2.3.1 Start Delay

The rectifier modules are equipped with a delay timer in order to stagger start a series of modules to prevent excessive loading of generators upon start up. The built-in timer delays the turn on of the module depending on the value selected (up to 120 seconds) via the CXC. A minimum one-second delay is preset to allow charging of the input capacitors.

2.3.2 Current Limit/Short Circuit Protection

The current limit function determines the maximum output current limit of the rectifier module, regardless of output voltage or power. Maximum output current is limited to a constant value down to short circuit condition. Current limiting can be used to mate the rectifier output current ampacity to the needs of the load and parallel battery to minimize excessive battery recharge current.

The rectifier will sustain a short circuit at the output terminals indefinitely. The maximum short circuit current shall not exceed 105% of the rated full load current.

[1] Under normal conditions, a battery connected to the output of the rectifier will draw current when the voltage ramp occurs. Therefore the rectifier fail alarm will not be generated with a battery connected.

2.3.3 Power Limiting

Each rectifier module is designed to limit power output to the module specification. This enables more current to be supplied at lower output voltages, and allows matching of output to the demand of constant power loads, normally seen with telecom equipment.

This feature may also be used for a faster recharge of flooded batteries paralleled with the load.

NOTE: *Current limiting overrides the power-limiting feature.*

2.3.4 High Voltage Shutdown (HVSD)

This feature provides protection to the load from over voltage conditions originating from the rectifiers. It operates by shutting down the offending rectifier module when a high output voltage condition occurs. Indication is through the red Alarm (Module Fail) LED. Modules will restart automatically; however, if more than three over voltage conditions occur in one minute, the module will latch off and remain shut down until it is reset.

2.3.5 Battery Eliminator Operation

Rectifier modules maintain all specifications (except where indicated) with or without a battery attached in parallel to the output; however, if a battery or another module supplying DC voltage in parallel is not present, there will be no monitoring or control activity if there is an AC power failure or input fuse failure.

2.3.6 Paralleling Diode (optional)

An optional Oring MOSFET on the output prevents disruption of DC system output power in the event of a rectifier internal fault in systems without batteries.

NOTE: *Maximum output power of a 250W rectifier is reduced to 246W with this option.*

3 Inspection

3.1 Packing Materials

All Alpha products are shipped in rugged cardboard boxes and suspended via solid inserts to minimize shock that may occur during transportation. Packaging assemblies and methods are tested to International Safe Transit Association standards.

3.1.1 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 the product is packed with at least three inches of shock-absorbing material to prevent shipping damage.

NOTE: *Alpha Technologies is not responsible for damage caused by the improper packaging of returned products.*

3.2 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, please inform the carrier and contact Alpha Technologies for advice on the impact of any damage.

Verify that you have all the necessary parts per your order for proper assembly.

4 Installation

This chapter is provided for qualified personnel to install the shelf in a clean and dry environment.

NOTE: *To aid the user with installation, frequent reference is made to drawings located at the rear of the manual.*

4.1 Safety Precautions

WARNING
Hazardous voltages are present at the input of power systems. The DC output from the rectifiers and battery system, 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/distribution center, follow these precautions:

- Remove all metallic jewelry; e.g., watches, rings, metal rimmed glasses, necklaces.
- Wear safety glasses with side shields (and prescription lenses if necessary) at all times during installation.

Metallic tools must be insulated.

The installer should follow all applicable local rules and regulations for electrical and battery installations; e.g., CSA, UL, CEC, NEC, OSHA, and local fire codes.

4.2 Shelf Preparation/Mounting

The shelf has been designed for flush or 6” offset mounting in a 19” or 23” rack. See drawing 030-783-06.

NOTE: *The shelf shall be mounted in a clean and dry environment. Allow at least 1.75” of free space above and below the unit for unrestricted cooling airflow. 3.5” (2RU) is recommended.*

Mounting brackets accommodate either 1" or 1-3/4" rack spacing. The shelf should be mounted to the rack using at least two #12 – 24 x 1/2" screws in each bracket. Philips-type screws and screwdriver should be used to eliminate the possibility of slippage and scratching of the unit’s exterior. Washers (such as internal tooth) or special screws that are designed to cut through the painted surface should be used to ensure a good chassis ground.

4.3 Module Insertion/Removal

Insert by placing the module on the shelf bottom and sliding the module into the rear connector (inside of the shelf). Apply pressure on the module handle to engage the rear connector in the shelf receptacle.

NOTE: *It is recommended that the first module be inserted into the front leftmost position using the side of the shelf-mounted controller as a guide. The next module may be inserted using the previous module as a guide.*

Tighten the screw on the bottom of the faceplate to secure the module to the shelf.

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

To remove a module, loosen the screw on the bottom of the faceplate. Grasp handle and pull out, sliding the module away from the rear connector and out of the shelf.

5 Wiring and Connections

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

NOTE: *Refer also to foldout drawings located at the rear of the manual.*

5.1 Safety Precautions

WARNING
Hazardous AC voltages may be present. Ensure power at the AC service panel is off before attempting work on the AC connections. Use a voltmeter to verify the absence of voltage. Clearly mark the correct polarity of the battery leads before commencing work on DC connections.

Refer to the previous (Installation) chapter for additional safety precautions.

5.2 Tools Required

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

- Slot head screwdrivers (blade sizes: 1/4", 1/8", 1/16")
- Philips head screwdriver, #2 (tip size 3/16")
- Digital voltmeter equipped with test leads
- Adjustable 12Vdc load (optional)
- Cutters and wire strippers
- Crimping tool (optional for large gauge wire)
- Socket and rachet set (Imperial measure)
- Anti-static wrist strap
- Computer (laptop) with Microsoft® Internet Explorer 6 or greater
- Crossover cable RJ-45 (for access using the Ethernet port).

5.3 Power System Chassis Ground and DC Ground Reference

WARNING
For safety reasons, ensure the system is properly bonded to the building's ground grid.

Both the shelf chassis ground (via power system chassis ground) and common return shall be connected to the site ground to ensure correct operation of the system and to prevent drifting floating analog (especially current) readings.

5.4 AC Feeder Protection/Sizing

To maximize system reliability, a dual AC feed divides the rectifiers into two groups to be supplied by two separate feeds. See customer connections drawing (modules are numbered left to right). TB3 feeds modules 1 and 2. TB4 feeds modules 3, 4 and 5.

It is recommended for each feed to use a dedicated protection feeder breaker located at the AC distribution panel. The feeder breaker can also act as the disconnect device for the connected modules.

Number of Rectifiers on AC Feed	Circuit Breaker Exact Value to Use (A)	90 deg. C Wire Gauge to use at 30 deg. C ambient (AWG)
1	10	14
2	10	14
3	15	14

Table A–Recommended AC supply configuration

5.5 AC Input Connections

CAUTION: AC input wires should be routed in flexible or rigid conduit as far away as possible from the DC power wires to minimize EMI disturbances.

If the shelf is factory-equipped with a line cord, proceed to the next section.

Refer to customer connections drawing 030-783-08 (rear view – back cover removed).

Remove the metal cover from the rear of the shelf to expose the wireway for the input terminal blocks.

Attach the conduit retainers to the wireway hole(s) and route the AC cables through. Secure the wires to the AC input and chassis ground terminals as required. Tighten the cable connector to the AC cable (conduit similar).

Replace rear cover once all connections have been completed.

5.6 Calculating Output Wire Size Requirements

Wire size is calculated by first determining the appropriate maximum voltage drop requirement. Using the formula below calculate the CMA wire size requirement. Determine the size and number of conductors required to satisfy the CMA requirement.

CMA = (A x LF x K) / AVD, where:

CMA = Cross section of wire in circular MIL area
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.

5.7 DC Output Connections

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

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

Secure the positive and negative cable leads to the shelf output terminal blocks of the correct polarity; i.e., +Vcable to +Vpost.

Connect the common output leg of the rectifier system to ground. This connection is typically made at the load common termination point (negative bus bar for +12V systems).

Replace rear cover once all connections have been completed.

5.8 CAN Serial Ports

A CAN Out port (modular jack with offset latch), is provided for communications with Alpha Cordex rectifiers and other CAN-enabled equipment. A CAN In port is also provided for an external controller if this shelf does not have a CXCI (List 99) or a CXCI+ (List 98). These ports are located on the shelf backplane.

Daisy-chain from shelf to shelf (CAN OUT of one shelf to CAN IN of another) as necessary and ensure that only the last shelf is terminated. See drawing 030-783-08.

5.8.1 CAN Termination

A jumper (or switch depending on your configuration) allows setting of the CAN OUT to be open (to the next shelf in the system) or terminated. Termination must be enabled in final shelf on the CAN bus only.

5.9 Network Connection and Remote Communications via CXC

The Cordex system can be set up, monitored and tested via modem or ETHERNET 10/100 Base-T serial data connection. The communication protocol supports a web interface. Some standard scenarios are described below:

5.9.1 Modem Port (CXCI Controller Only)

The Modem port is designed for CXCI connection to a user supplied modem via a front panel DB-9 connector.

Connect to the CXCI from the modem with a straight through cable.

5.9.2 Ethernet Port for Network Connection (Standard Network Cable)

The Ethernet port is designed for CXCI/ CXCI+ connection to a user supplied network (TCP/IP secured by user) via a front panel RJ-45 jack.

Connect to the CXCI/ CXCI+using a standard network cable. Pinouts are shown in drawing 030-783-08.

5.9.3 Ethernet Port for Local Connection (Crossover Cable)

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

5.10 Signal Wiring Connections

For terminal block connections, the recommended wire sizes are 0.129 to 0.823mm^2 (#26 to #18AWG) for the temperature range of 0 to 50 deg. C (as per UL/CSA).

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

Terminal	Description	Default Name	Signal Type	Range
1, 2, 3*	LVD Control (internal)	K1, Relay 1	NO/COM/NC	60VDC / 1A
4, 5, 6*	Alarm Output 2	K2, Relay 2	NO/COM/NC	60VDC / 1A
7, 8, 9*	Alarm Output 3	K3, Relay 3	NO/COM/NC	60VDC / 1A
10, 11, 12*	Alarm Output 4	K4, Relay 4	NO/COM/NC	60VDC / 1A
13, 14**	Digital Input 1 (internal)	D1, Digital 1	Pos (+) or Neg (-)	0—60VDC
15, 16**	Digital Input 2	D2, Digital 2	Pos (+) or Neg (-)	0—60VDC
17, 18***	Voltage Input 1	V1, Load Voltage	Pos (+) / Neg (-)	0—60VDC
19, 20***	Temp Probe 1	T1, Analog Input T1	Pos (+) / Neg (-)	0—20VDC
21, 22***	Temp Probe 2	T2, Analog Input T2	Pos (+) / Neg (-)	0—20VDC
23	Battery +12V	Batt Hot	Neg (-)	20—60VDC
24, 25	Current Input 1 (internal)	I1, Load Current	Pos (+) / Neg (-)	±50mV

Table B–Wiring connections for CXCI

* NO and NC Form C contacts available. Can be configured to de-energize on alarm (DOA) or energize on alarm (EOA).
** See Table C for definitions of logic and system.
*** Voltage (Input) is 0—60VDC, Temp Probe is 0—20VDC with power source.

NOTE: *To aid the user with installation, frequent reference is made to drawings located at the rear of this manual. Custom configurations may be detailed within the Alpha power system documentation package.*

The input cables should be bundled together and routed through the entry holes of the shelf, if applicable.

5.10.1 Analog Inputs for CXCI/ CXCI+

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

The analog input channels are used to monitor various types of electrical signals.

5.10.1.1 Voltage

Voltage Input #1 (load voltage per CXC software) terminals on the shelf (V1 on TB12) provide connections to an optional secondary voltage input. For example, this can be terminated to the load side of an LVD contactor to monitor load voltage.

Voltage Input #2 (battery voltage per CXC software) is wired internally to the rectifier output voltage of the shelf. This is used as the reference for system alarming (such as high voltage) and control (such as LVD).

The Battery +12V should be connected at the battery system voltage terminal for CXCI/ CXCI+ reference when a battery disconnect device is used. It is critical to CXC operation as it ensures a source of power to the CXC should the disconnect device open the circuit.

5.10.1.2 Temperature Sensor

Temperature Probe input channels (T1 and T2 on TB12) provide connections for up to two temperature sensors. A voltage is supplied to these terminals for sensor measurements.

5.10.1.3 Current

Current Input #1 (load current per CXC software) is used for an external 50mV current shunt.

5.10.2 Digital Inputs for CXCI/ CXCI+

The digital input channels (factory-installed) 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.

D1 and D2 on TB12 are available for customer connections as required.

5.10.2.1 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., positive input for +12V 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 5) allows the digital input to receive (or not receive) a Ground signal on an alarm.

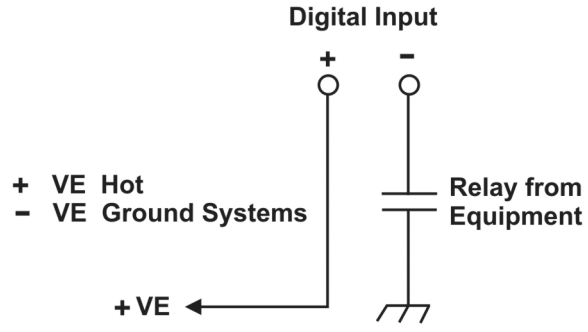


Figure 5–Showing digital input connection method

5.10.2.2 Programming the Digital Input

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

Voltage Range (VDC)	Voltage Level (VDC) Considered As “0” (Off)	Voltage Level (VDC) Considered As “1” (On)
0—60 (system voltage setting)	0—3	9—60

Table C–Voltage level definitions for digital inputs

5.10.3 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. See Figure 6.

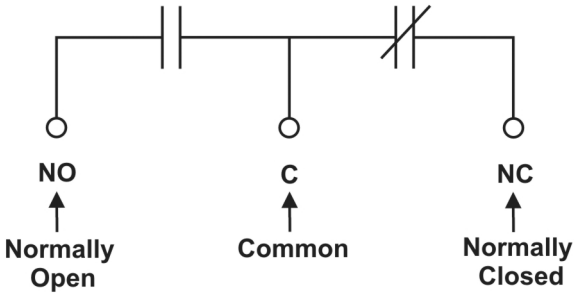


Figure 6–Showing relay connections

Relays can be programmed to energize or de-energize during an alarm condition (see CXC Software manual). When the CXCI/ CXCI+ reset button is pressed or power is lost, all relays de-energize.

These relays could be used for additional external LVD contactor control.

5.10.4 LVD Control Alternative

The LVD Control functions can be hardwired directly from an alarm output relay to an external LVD contactor (or panel). See Controls menu defaults (**Controls > Configure Controls**) in the CXC Software manual.

5.10.5 LVD Inhibit

Should it be necessary to remove the CXCI/ CXCI+, the customer connection board (on the back of the shelf) provides shorting pins (JP2) to inhibit (or override) the LVD Control function. Refer to CXCI/ CXCI+ replacement procedure in Section 8.1 on page 21.

6 Operation

6.1 Main Rectifier States

Rectifier operation can be broken up into five main states:

1. Off,
2. Start delay,
3. Soft start,
4. Normal operation,
5. Turning off.

Each state is characterized as being distinct and necessary for the operation of the rectifier. These states are briefly described below.

6.1.1 Off State

The rectifier will be in the Off state immediately after power is applied to the rectifier or after a rectifier shutdown. The shutdown source may be remote or local shutdown, AC shutdown, OVP or thermal shutdown.

When the rectifier is in this state the DC-DC converter is turned off and the CXC will be monitoring its inputs for the proper conditions to begin the start up sequence.

When the conditions have been met for the rectifier to start up, it will transition to the Start Delay state.

6.1.2 Start Delay State

When the rectifier is in the Start Delay state, the DC-DC converter is held off and still not sourcing power and is waiting for a given amount of time before transitioning to the next state.

When in this state, the CXC continues to monitor its inputs.

After the Start Delay state the rectifier will transition to the Soft Start state.

NOTE: *Soft start, or current walk-in, gradually increases the voltage and current output of the rectifier upon startup. This is done to reduce the instantaneous load on the AC source.*

6.1.3 Soft Start State

When the Soft Start state is entered, the rectifier will be turned on and the output voltage and output current will be gradually increased. If a load is present, the rectifier will begin to source power.

When the voltage and current limit ramps have finished, the rectifier will transition to the Normal Operation state.

6.1.4 Normal Operation State

The Normal Operation state is the state that the rectifier will be in performing all of the rectifier functions and features specified herein.

From this state, the only valid transition is to the Turning Off state. This transition will happen if the rectifier is required to shut down.

6.1.5 Turning Off State

The Turning Off state is entered because a short delay is required before the rectifier actually turns off to take care of any initialization requirements.

When this short delay has elapsed, a transition to the Off state is made.

6.2 Main Rectifier Modes

In addition to Main Rectifier States, there is a set of Main Rectifier Modes. These modes can be divided into two categories as follows:

6.2.1 Output Voltage Modes

Voltage modes can be thought of as modes that, under software control, can directly adjust the output voltage. The qualification of 'under software control' is made because there are processes that occur in the rectifier that can change the output voltage that do not adjust the output voltage directly (such as the rectifier being in current limit).

The following table lists the five Output Voltage Modes and a description of when they are active:

Output Voltage Modes	Active when…
Float	Output voltage is set to the float voltage setting.
Equalize	Output voltage is set to the equalize voltage setting.
Battery Test	Output voltage is set to the battery test voltage setting.
Safe	Output voltage is set to the safe mode voltage setting.
Manual Test	Output voltage can be manually adjusted outside of the standard adjustment ranges.

Table D–Output voltage modes

6.2.2 Output Current/Power Modes

These modes directly affect the output current and power.

The following table lists the four Output Current/Power Modes and a description of when they are active:

Output Current/Power Mode	Active when…
Temperature foldback mode	Output current and power limit have been reduced due to high temperature of the heatsink or internal ambient temperature sensor.
AC foldback mode	Output current and power limit have been reduced due to low AC input voltage. *Note: this will reduce the risk of tripping an AC breaker due to increased AC current draw as the AC voltage decreases.*
Short circuit foldback mode	Output current limit has been reduced due to a short circuit at the output.
Internal fault foldback mode	Output current limit has been reduced due to an internal fault.

Table E–Output current/power modes

6.3 Rectifier Factory Ranges and Defaults

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

Setting	Range (minimum to maximum)	Default
Float (FL) Voltage	11.88 – 14.50V	13.50V
Equalize (EQ) Voltage	12.45 – 14.50V	13.75V
Battery Test (BT) Voltage	11.00 – 13.00V	11.50V
OVP	See note below – 15.00V	14.25V
Current Limit (CL)	20 – 100%	100%
Power Limit (PL)	0 – 100%	100%
Module Start Delay	0 – 250s	1s
System Start Delay	0 – 600s	0s
Low Voltage Alarm (LVA)	10.50 – 13.00V	11.00V
High Voltage Alarm (HVA)	13.00 – 15.00V	14.00V
EQ Timeout	1 – 2399h	30h
BT Timeout	1 – 250h	8h
Softstart Ramp-rate	Normal/Fast	Normal
CL/PL Alarm	Enable/Disable	Enable
Remote Shutdown	Enable/Disable	Enable
Ramp Test	Enable/Disable	Enable

Table F–Cordex 12-250W factory ranges and defaults

NOTE: *OVP cannot be set below the present system/FL/EQ/BT voltage setting or the safe mode voltage of 12.85V.*

7 System Startup

After completing the shelf wiring and installation, perform the following startup and test procedure to ensure proper operation:

7.1 Check System Connections

- Ensure AC is off, battery is disconnected, and all power modules are removed from the shelf.
- Triple check the polarity of all connections.

7.2 Verify AC and Power the Shelf

1. Install one power module.
2. Verify AC input voltage is correct and turn on the corresponding AC input feeder breaker.
3. The power module OK LED should illuminate after a preset start delay.
4. Login to the controller as follows:
   a. Set the laptop IP Network settings (Start > Control Panel)
      - IP address: 10.10.10.202
      - Subnet mask:255.255.255.0
   b. Turn off Pop-up Blocker.
   c. Enter 10.10.10.201 in the web address bar of the laptop.
   d. Login to the CXC controller:
      - Username: your company name and your initials
      - Password: 1234
   e. Language selection: English
5. Use the CXC controller to test the functionality of various module alarms and controls.

7.3 Check Battery Polarity and Connect

1. Verify correct battery polarity using a voltmeter (ensuring no cells or batteries are reversed).
2. Connect battery as required to the output of the system or turn on battery breaker.
3. Install remaining power modules.
4. In the **Rectifiers > Configure Rectifiers** menu of the CXCI / CXCI+ (web browser), set Float and Equalize voltage to the levels specified by the battery manufacturer.
5. Using the CXCI/ CXCI+, test functionality of various module alarms and controls. In addition, perform a load test with the system using a resistive load box as needed.

7.4 CXC Reset

7.4.1 Soft Reset

The reset button located on the front panel of the CXCI/ CXCI+ restarts the microprocessor. When pressed momentarily, the unit beeps twice then resets. The front-panel LEDs will illuminate temporarily, but will extinguish after the system has finished its 15-second self-test.

CAUTION: During reset, the controller may need to run a defragmentation cycle. Cycling of the LEDs on the front panel indicate that defragmentation is in progress. A full defragmentation can take up to 20 minutes to perform. DO NOT POWER DOWN the CXC during this time.

7.4.2 IP Address Reset and Log-in to Controller

To reset the IP address, press and hold the front panel reset button for three seconds. The CXCI/ CXCI+ beeps three times The settings are saved and the unit then resets.

This reset allows local access; e.g., with a laptop and a standard network crossover cable. The IP address resets to 10.10.10.201 with DHCP disabled.

To login to the controller see 7.2.

7.4.3 Hard Reset

Refer to Figure 2 and Figure 3 on page 4 for the location of the hard reset button on the CXCI/ CXCI+. This can be used to restart the microprocessor in the event that the front panel (soft) reset button fails to operate as described in section 7.4.2.

CAUTION: Use of hard reset may cause loss of data.

Note:To access the hard reset button on the CXCI model, remove the rectifier module adjacent to the CXCI.

7.4.4 Time Settings

The CXCI/ CXCI+, upon startup*, will set the time based on the following:

- Attempt to synchcronize with the NTP server (see www.NTP.org).
- Retrieve the last time stamp from the Event Log.
- Retrieve the last time stamp from the Statistics Log.
- Set the time to 2005-01-01 midnight.

* Whenever the unit is reset or power has completely removed and restored.

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 repairs.

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

WARNING: HIGH VOLTAGE AND SHOCK HAZARD.

Use extreme care when working inside the shelf 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.

Procedure	Date Completed
Clean ventilation openings	
Inspect all system connections (re-torque as necessary)	
Verify alarm/control settings	
Verify alarm relay operation	

Table G–Sample maintenance log

8.1 CXCI/CXCI+ Replacement Procedure

8.1.1 Replacing a CXCI Controller

1. Write down the CXC communication information: dynamic or static IP, IP address, and gateway.
2. Connect a laptop to CXC per software manual; standard network crossover cable to Ethernet port.
3. Save the CXC configuration file (see software manual **Logs and Files > Manage Configuration File > Save Full Site Configuration**).
4. Save the CXC text file if necessary: **Logs and Files > Manage Editable Text Files > Save Dynamic Text File**.
5. If applicable, bypass the system LVD:
    - Locate JP2 on the back of CXCI system shelf (Figure 7)
    - If the LVD is controlled on NC contacts (factory default for LVD option), then JP2 pins 1 and 2 must be shorted together to maintain LVD operation.
    - If the LVD is controlled on NO contacts, then JP2 pins 2 and 3 must be shorted together.

NOTE: bypassing the LVD generates an alarm.

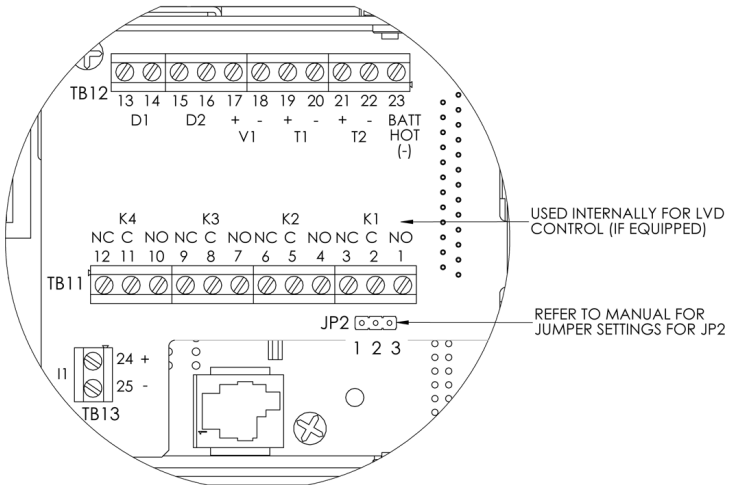


Figure 7–Location of LVD bypass jumper

6. Disconnect the DB signal connector from the CXCI.
7. Ensure a rectifier is in the right-most position. Remove the rectifier in the left-most position in order to access the side of the CXCI where the mounting screws are located.
8. Remove the three mounting screws shown in Figure 8.

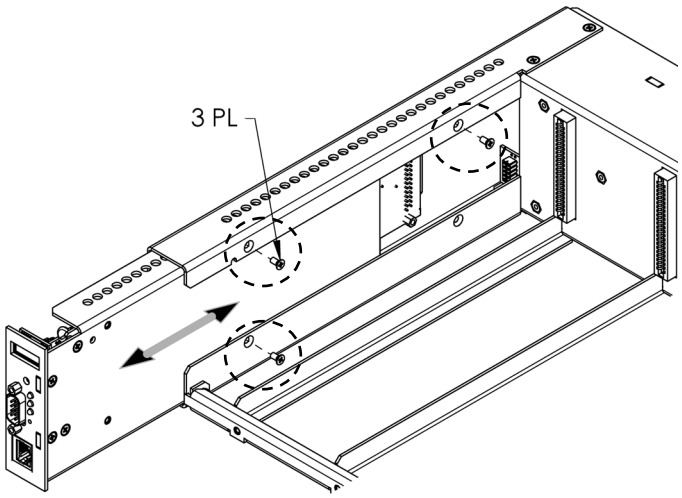


Figure 8–Showing CXCI removal and replacement

9. For CXCI removal/installation, two persons will be required for early revision CXCI I/O PCB (rev B or older). One person, at the back of the system shelf, should grip the terminal blocks on the PCB to prevent it from flexing as the other person, at the front of the CXCI, carefully pulls the controller module clear of the backplane/DB-25 connectors.
10. Install the new CXCI: one person must apply minimal pressure to the I/O PCB terminal blocks while the other person pushes the CXCI into the connectors. The front panel should not be removed and is used to grip (with thumb and index finger) along bottom and top edge for removal/insertion. CAUTION - Do not push on the LCD.
11. Reinstall the three mounting screws.
12. Replace the DB connector on the back of the CXCI.
13. Log on to the CXC and go to **Logs and Files > Manage Configuration File > Upload Site Configuration** and select the saved *.cfg file. After the upload do a **Submit Changes**. Make sure the site information is checked to save it, and click **Accept**.
14. Go to **Logs and Files > Manage Editable Text Files > Upload Dynamic Text File** and select the saved *.tfg file. You do not need to submit changes; it is already saved.
15. Use a meter to verify the bus voltage and current shunt. Recalibrate as required due to differences in the new CXCI.
16. Replace rectifiers and remove LVD bypass.

8.1.2 Replacing a CXCI+ Controller

1. Write down the CXC communication information: dynamic or static IP, IP address, and gateway.
2. Connect a laptop to CXC per software manual; standard network crossover cable to Ethernet port.
3. Save the CXC configuration file (see software manual **Logs and Files > Manage Configuration File > Save Full Site Configuration**).
4. Save the CXC text file if necessary: **Logs and Files > Manage Editable Text Files > Save Dynamic Text File**.

5. If applicable, bypass the system LVD:
    - Locate JP2 on the back of CXCI+ system shelf (Figure 7)
    - If the LVD is controlled on NC contacts (factory default for LVD option), then JP2 pins 1 and 2 must be shorted together to maintain LVD operation.
    - If the LVD is controlled on NO contacts, then JP2 pins 2 and 3 must be shorted together.

NOTE: bypassing the LVD generates an alarm.

Disconnect the DB signal connector from the CXCI+.

6. Disconnect the DB signal connector from the CXCI+.
7. Loosen the thumbscrew on the front panel and gently pull the controller from the slot.

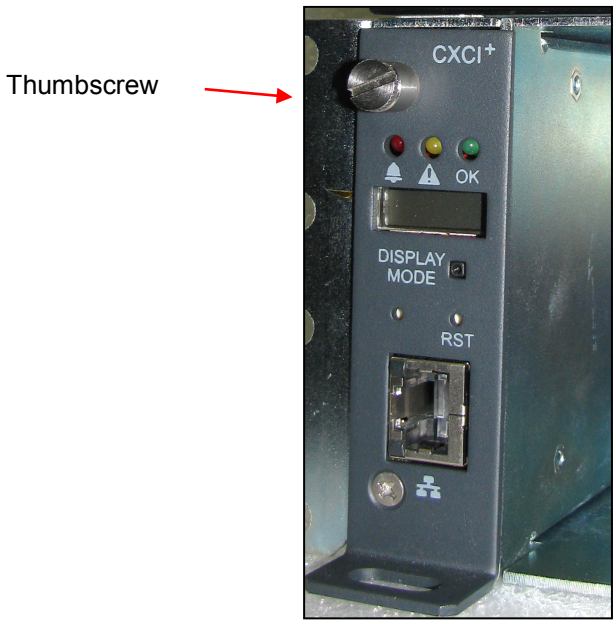


Figure 9 – CXCI Controller

8. Slide the new controller into the connector at the back of the slot.
9. Tighten the thumbscrew on the front panel.
10. Replace the DB connector on the back of the CXCI+.
11. Log on to the CXC and go to **Logs and Files > Manage Configuration File > Upload Site Configuration** and select the saved *.cfg file. After the upload do a **Submit Changes**. Make sure the site information is checked to save it, and click **Accept**.
12. Go to **Logs and Files > Manage Editable Text Files > Upload Dynamic Text File** and select the saved *.tfg file. You do not need to submit changes; it is already saved.
13. Use a meter to verify the bus voltage and current shunt. Recalibrate as required due to differences in the new CXCI+.
14. Replace rectifiers and remove LVD bypass.

9 9.2 Acronyms and Definitions

9.1 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)
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
MTBF	Mean time between failures
NC	Normally closed
NEC	National Electrical Code (for the USA)
NO	Normally open
OSHA	Occupational Safety and 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

Specifications for Alpha CXCI/CXCI+ Cordex Controller Integrated Model

Basic Unit, CXCI/CXCI+

CXCI Input Voltage: 17 to 65Vdc within rated limits
[9 to 65Vdc for shelf systems with 12V rectifiers (List 3)]

CXCI+ Input Voltage: 10 to 65Vdc within rated limits

Current: <100mA @ 48Vdc
<200mA @ 24Vdc

MTBF: CXCI: 472,000 hours @ 25°C (77°F)
CXCI+: 1,500,000 hrs @30°C ambient; test model Telcordia SR-332, Issue 2

EMC:

Radiated and Conducted Emissions

CXCI:
North America Regions:
CFR 47, Part 15 Subpart J, Class A
CXCI+:
North America Regions:
- CFR 47, Part 15 Subpart B, Class B
- ICES-003 Issue 2, Rev 1, Class

European Regions
- EN 55022 Class B
- EN 300 386-2
- EN61000-3-2; Harmonics
- EN61000-3-3; Flicker

Immunity
CXCI+:
- EN 300 386-2
- EN61000-4-2:2005, ESD ± 8 kV Air, ± 6 kV Contact
- EN61000-4-3:2005, RF Immunity 10 V/m
- EN61000-4-4:2005, EFT, 1kV/0.5kV
- EN61000-4-5:2005, Surge; 2 kV line to line, 1 kV line to earth
- EN61000-4-6:2005, Conducted Susceptibility, 10 Vrms
- EN61000-4-11: Voltage Dips and Interruptions

In accordance with FCC requirements, we provide the following statement as specified in the FCC guidelines for conformance to Part 15, Class B:

> **Warning:** *The CXCI+ has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:*
>
> - Reorient or relocate the receiving antenna.
> - Increase the separation between the equipment and receiver.
> - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
> - Consult the dealer or an experienced radio/TV technician for help.

In Accordance with FCC requirements, we provide the following statement as specified in the FCC guidelines for conformance to Part 15, Class A:

NOTE: *The CXCI has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely ot cause harmful interference in which case the user will be required to correct the interference at his own expense.*

Any changes or modifications to this equipment not expressly described in this manual could void the FCC compliance.

Environmental

Temperature:	-40 to 65°C standard @ 3000m derate to 55°C @ 4000m (-40 to 149°F derate to 131°F @ 13124ft)
Humidity:	0 to 95% non-condensing
Elevation:	-500 to +4000m (-1640 to 13124 ft)

Hardware Specifications, CXCI/CXCI+

CPU:	Coldfire
Display:	4 digit LCD
Front Panel Controls:	Display pushbutton toggle switch for voltage (V) or current (A) CXCI/CXCI+ reset switch (soft reset button; hold for 3 seconds to reset IP)
LEDs:	System OK (Green) Power System Minor Alarm (Yellow) Power System Major Alarm / Controller Fail (Red)
Audio:	Built-in speaker for alarm and popup message tones
Dimensions:	88mm H x 26mm W x 280mm D (3.5” H x 1” W x 11“ D)
Weight:	0.34 kg (0.75 lb.)
Mounting:	Integrated on Cordex 2RU series 19” and 23” shelves
Relay Outputs:	Four (4) Form C, 60Vdc 1A maximum
Digital Inputs:	Two (2), 0 to 60Vdc
Analog Inputs:	One (1) DC voltage, 0 to 60Vdc One (1) DC current, ±50mV Two (2) temperature, self-powered Alpha sensor (max 12Vdc)
CXCI Communication Ports:	Ethernet RJ-45, Alpha Modem DB-9, CAN [see shelf specifications]
CXCI+ Communication Ports:	Ethernet RJ-45, CAN [see shelf specifications]

Software Specifications, CXCI/CXCI+

CXCI	Software version: All
CXCI+	Software version: 2.10 minimum

Recommended Signal Wire Sizes (as per UL/CSA)

Wire Size Range:	0.14 to 1.50mm^2 (#26 to #16 AWG)
Temperature Range:	0 to 50°C (32 to 122°F)

CAUTION – TO REDUCE RISK OF FIRE, USE ONLY 0.14mm^2 (#26 AWG) OR LARGER WIRE.

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.

Specifications for Alpha Cordex 12-250W 19" Integrated Shelf

Basic Unit, Shelf

Maximum Output:	105A, 15Vdc
Recommended Feeder Breaker Single Phase:	15A, #14AWG

Mechanical

Dimensions:	88mm H x 444mm W x 307mm D (rectifier front panel 18mm D) [3.5" H x 17.5" W x 12.1" D (rectifier front panel 0.7" D)]
Mounting*:	19" or 23" rack (flush or 6" offset)
Weight:	8.5 kg (18.7 lb)

Connections

AC Input:	Dual feed terminal blocks 4 to 6mm^2 (#12 to #10AWG)
Chassis ground:	M4 studs
Communications:	CAN (bus) RJ-12 offset
DC Output:	1/4-20 x 5/8" studs
Signal wiring:	Terminal blocks 0.129 to 0.823mm^2 (#26 to #18AWG)

Safety

EN 60950	Rectifier output shall be rated SELV suitable for connection to TNV-1 circuits
UL	60950-1-2002
CSA	C22.2 No. 60950
CE	EN 60950, CB Scheme 73/23/EEC Low Voltage Directive with amendment 93/68/EEC
Telcordia (Bellcore)	GR-1089-CORE (requirements applicable to rectifier)

* See drawings at the end of this manual.

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.

Specifications for Alpha Switched Mode Rectifier Cordex 12-250W

Power Module Output

Voltage:	10.5 to 14.5Vdc within rated limits
Current:	18.5A @ 13.5Vdc nominal (20.8A maximum @ 12V)
Maximum Power:	250W continuous/module 246W continuous/module with paralleling diode
Static Load Regulation:	Better than ±1.5% for any load change within rated limits
Static Line Regulation:	Better than ±0.1% for any change in input voltage within rated limits
Dynamic Line Regulation:	Better than ±1% for any change in input voltage within rated limits (output voltage shall recover to static limits within 2ms)
Hold-up Time:	>15ms
Time Stability:	≤0.2% per year
Temperature Stability:	<100ppm/°C over the operating range
Heat Dissipation:	<152 BTU per hour (per rectifier module)
Electrical Noise:	<32dBrnC (voice band) <10mVrms 10kHz to 100MHz (wideband) <100mVp-p to 100MHz <1.0mV (psophometric)
Acoustic Noise:	<55dBa @ 1m (3ft.) @ 30°C (86°F)
EMI:	The unit meets requirements of EN55022 (see Standards for more EMC)

In accordance with FCC requirements, we provide the following statement as specified in the FCC guidelines for conformance to Part 15, Class B:

> **NOTE:** *This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:*
>
> - Reorient or relocate the receiving antenna.
> - Increase the separation between the equipment and receiver.
> - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
> - Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications to this equipment not expressly described in this manual could void the FCC compliance.

Power Module Input

Voltage:	90 to 320Vac
Frequency:	45 to 70Hz
Current:	2.5A @ 120Vac 1.2A @ 240Vac (maximum)
Power Factor:	>0.99 at nominal conditions and 50-100% load
Protection:	10kA-interrupting capacity fuses in active and neutral lines
Efficiency:	>85% @ 240Vac for 50-100% load (1% less with OR-ing MOSFET) >84% @ 120Vac for 50-100% load (1% less with OR-ing MOSFET)
Inrush Current:	≤ full load steady state current
Start-up Ready Time:	<5 seconds (excluding soft start)
Start-up Delay:	≤120 seconds (programmable)
Soft Start:	≤10 seconds (user adjustable, not including start-up)
Input Transient Suppression:	Meets ANSI/IEEE C62.41 Category B3
Input Leakage Current:	<3.5mA @ 265Vac 60Hz

Environmental

Operating Temperature:	-40 to +50°C, power derated up to 70°C (-40 to 122°F, power derated up to 158°F)
Storage Temperature:	-50 to +85°C (-58 to 185°F)
Humidity:	0 to 95% non-condensing
Elevation:	-500m to +3000m (-1640 feet to 9840 feet)

Miscellaneous

MTBF:	>405,000 hours ground benign, natural convection >530,000 hours ground benign, forced convection cooled
Dimensions:	88.4mm H x 71.6mm W x 242mm D, excluding connector (3.4" H x 2.8" W x 9.5" D)
Weight:	2.9 kg (6.4 lb.)

Referenced Standards

EN 300 386-2	EMC and ERM; Telecommunication Network Equipment
EN 55022 (CISPR 22): 1998	Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurement, Class B
EN 61000-3-2:2000	Harmonic Current Emissions
EN 61000-3-3:1995	Voltage Fluctuations and Flicker
EN 61000-4-2	ESD Immunity
EN 61000-4-3	Radiated Electromagnetic Immunity
EN 61000-4-4	Electrical Fast Transient/Burst Immunity
EN 61000-4-5	Power Line Surge Immunity
EN 61000-4-6	Conducted Electromagnetic Immunity
EN 61000-4-11	Voltage Dips, Short Interruptions and Variations
ETS 300 019-1-1	Environmental Conditions; Storage
ETS 300 019-1-2	Environmental Conditions; Transportation
ETS 300 132-2	Power Supply Interface at the Input to Telecommunications Equipment; Operated by Direct Current (DC)
ETS 300 753	Acoustic Noise Emissions
IEC 60950	Safety of Information Technology Equipment, Including Electrical Business Equipment (UL/CSA 60950)

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.

REVISION			
LTR	DESCRIPTION	DATE	APPD

PCB ASSY, CXCI, MOTHERBOARD
PART NUMBER: 707-420-20
SCHEMATIC: 707-420-05

BATTERY HOT
K1 (LVD1) COM NO NC
K2 (SYTEM MINOR) NO COM NC
K3 (SYSTEM MAJOR) NO COM NC
K4 (AC FAIL) NO COM NC
D1 (CB/FUSE TRIP)
D2
V1
T1
T2
I1 (LOAD CURRENT)
P12: CANL CANH +5VCAN CAN COM POWER + V2 + POWER - V2 -

PCB ASSY, I/O INTERFACE, 19" SHELF 2RU,
5 MDL, CORDEX CXRC
PART NUMBER: 707-479-20
SCHEMATIC: 707-479-05

LVD AUTO OVERRIDE JUMPER
JP2: NC C NO

TB11: K1 NO C NC; K2 NO C NC; K3 NO C NC; K4 NO C NC
TB12: D1 D2 V1 + - T1 + - T2 + - BATTERY HOT
TB13: I1 + -
CUSTOMER INTERFACE

CAN OUT
CAN IN (OPTIONAL)
J9: CANCOM CANH CANL +5VCAN
J10: CANCOM CANH CANL +5VCAN
J12: CANL CANH +5VCAN CANCOM (+) (+) (-) (-)
JP1: CAN TERMINATION JUMPER

PCB ASSY, 19" 2RU BACKPLANE,
5 MDL, POS GND, CORDEX CXRC
PART NUMBER: 707-461-20
SCHEMATIC: 707-461-05

TB1: AUX. OUTPUT POWER
TB2
E7

RECTIFIER #1 J2
RECTIFIER #2 J3
RECTIFIER #3 J4
RECTIFIER #4 J5
RECTIFIER #5 J6
AC (+) DC (-)
CANCOM CANL +5VCAN CANH FAN ENABLE INTLK (+) INTLK (-)

AC #2 TB4: L1 L2 GND — FEEDS MDLS 3 ,4 & 5
AC #1 TB3: L1 L2 GND — FEEDS MDLS 1 & 2

(+) E3 (+); E2 (+) — HOT FEEDS
(-) E6 (-); E5 (-) — COMMON

LIST 80

ARGUS®

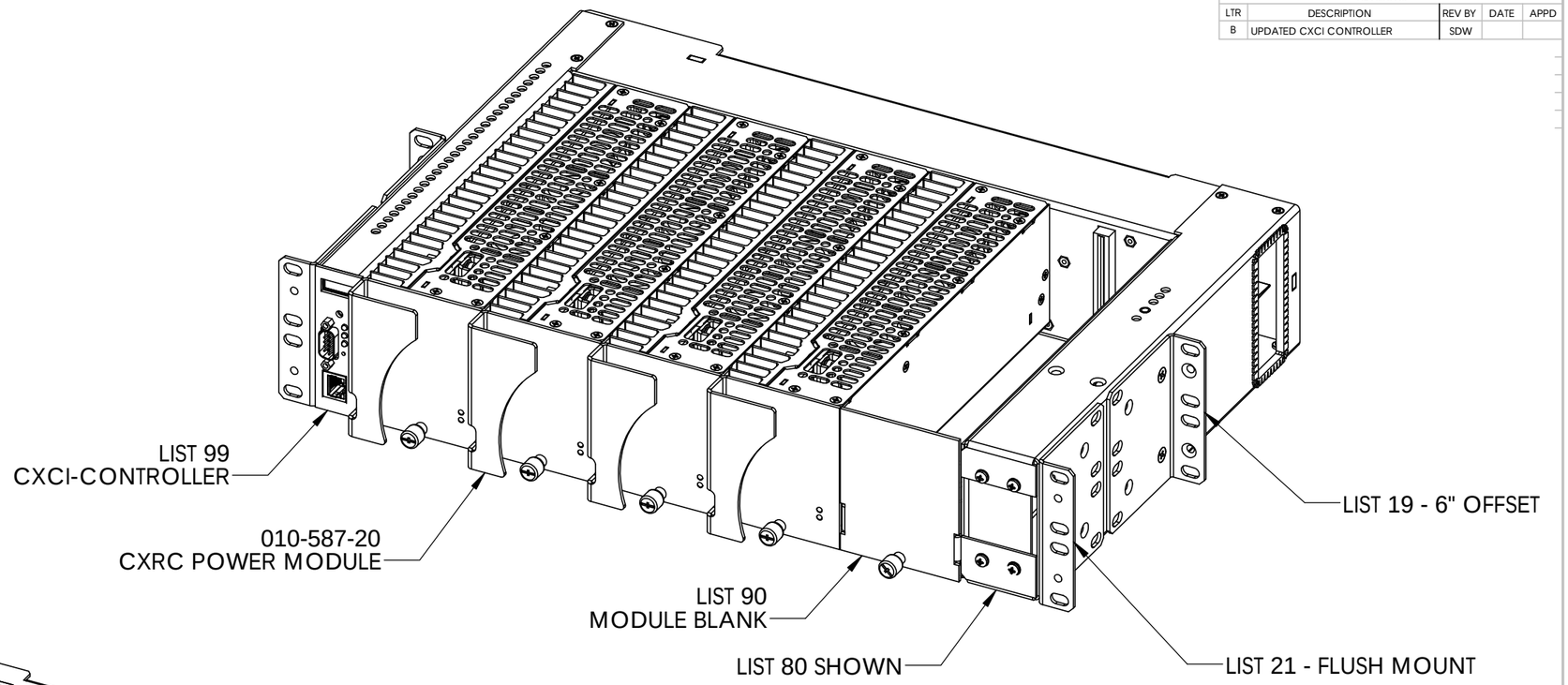
DESIGN	W.S	2006/01	MATERIAL
DRAWN	J.K	2006/07	
CHECKED		2006/07	
APPROVED		2006/07	FINISH
TOLERANCES			SCALE N/A

TITLE: SCHEMATIC, SHELF, 19", 5 MDL, CXCI, CXRC 12-250W

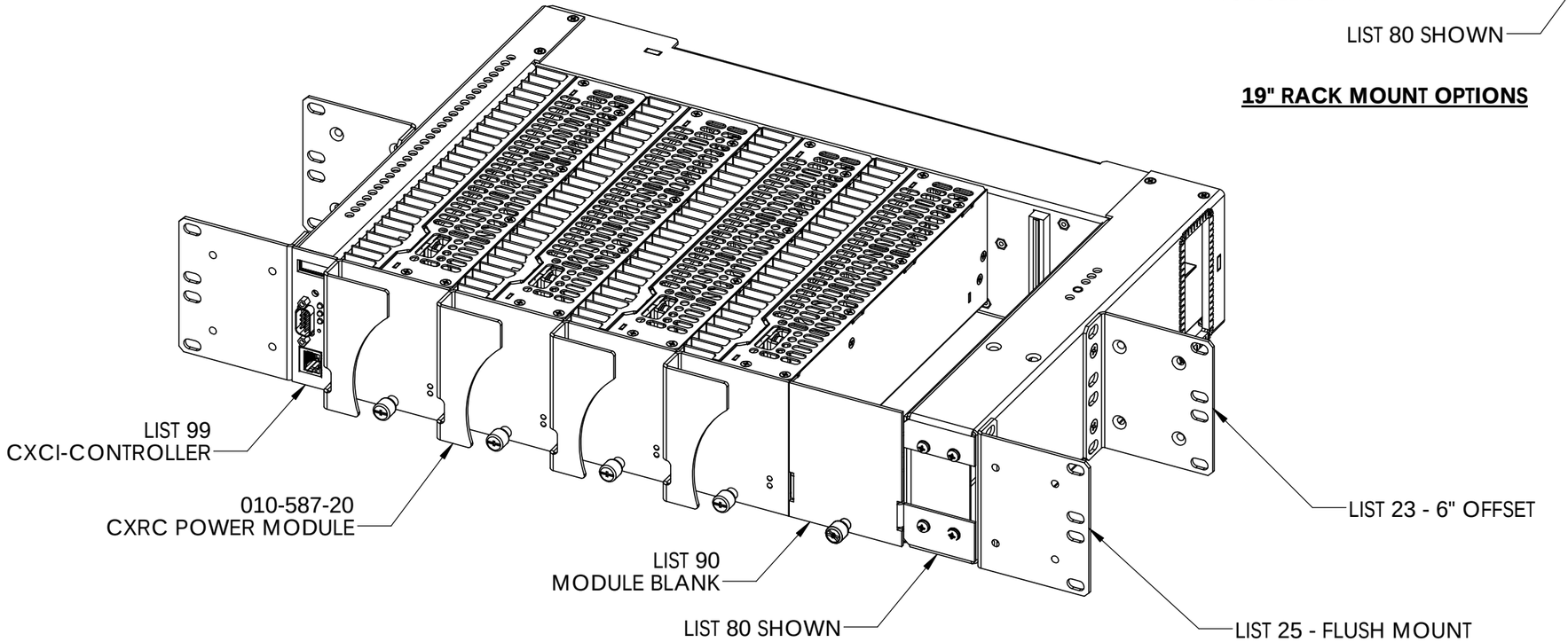
ISSUE DATE

SIZE	DWG NO.	REV
B S3	030-783-05	A

REVISIONS				
LTR	DESCRIPTION	REV BY	DATE	APPD
B	UPDATED CXCI CONTROLLER	SDW		



19" RACK MOUNT OPTIONS



23" RACK MOUNT OPTIONS

ARGUS

DESIGN	RP	2005/11	MATERIAL
DRAWN	RP/J.U.	2006/4	
CHECKED	JK	2006/4	
APPROVED	GS	2006/4	FINISH

TOLERANCES

X.X	±0.04"	[X]	±1mm
X.XX	±0.02"	[X.X]	±0.5mm
X.XXX	±0.01"	[X.XX]	±0.25mm

SCALE N.T.S.

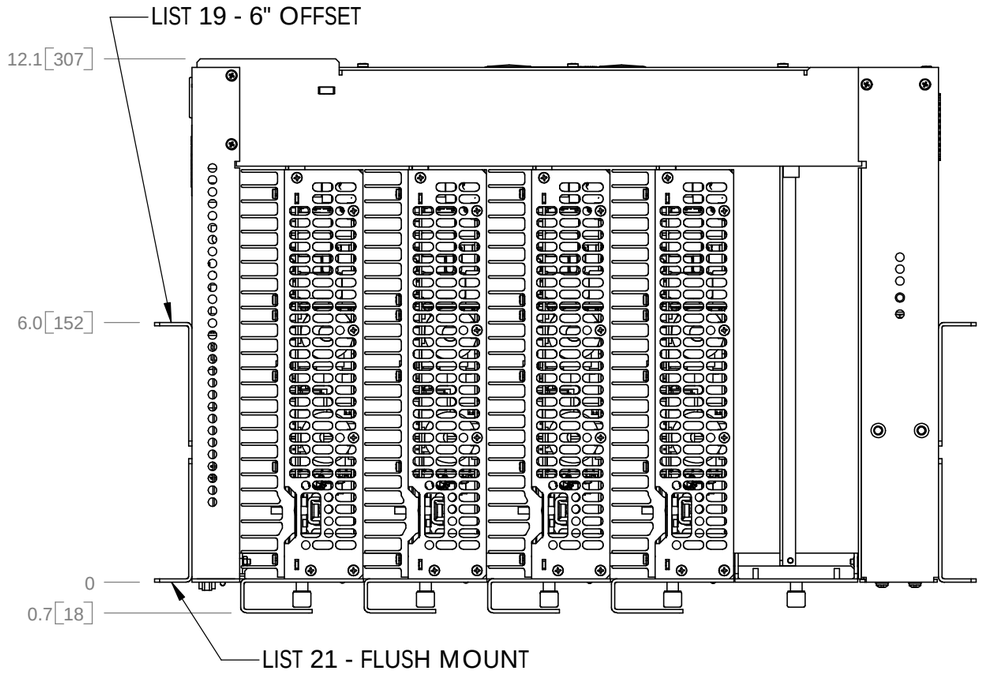
TITLE

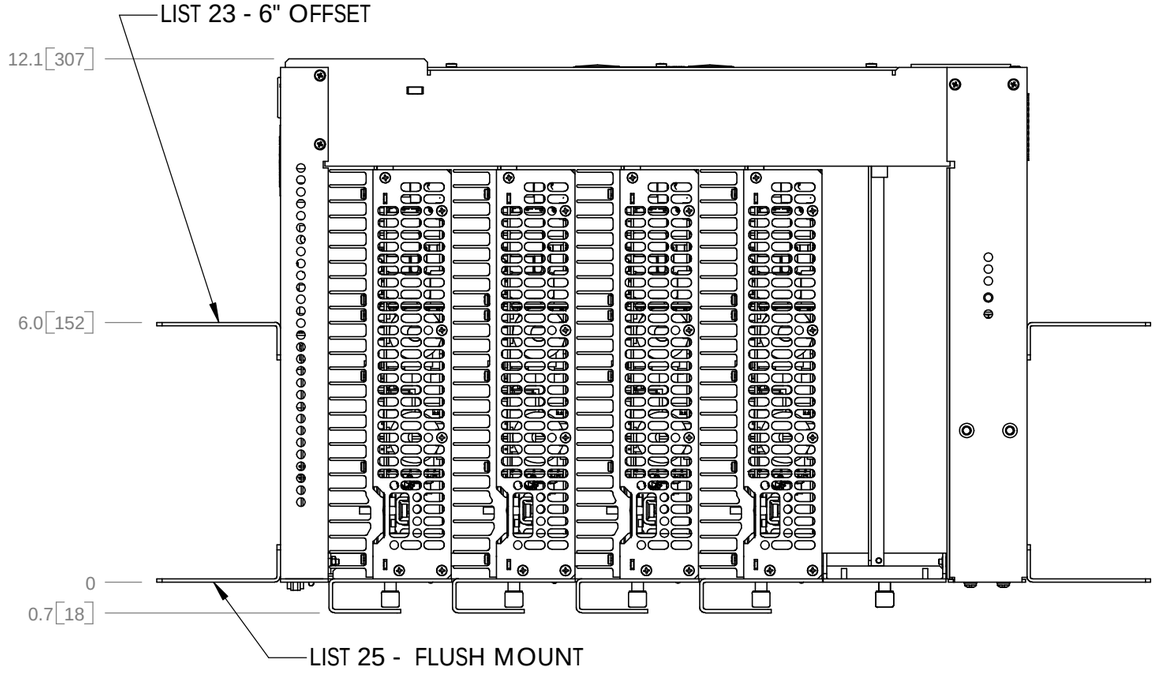
OUTLINE, SHELF,19",5 MDL, CXCI,CXRC 12-250W

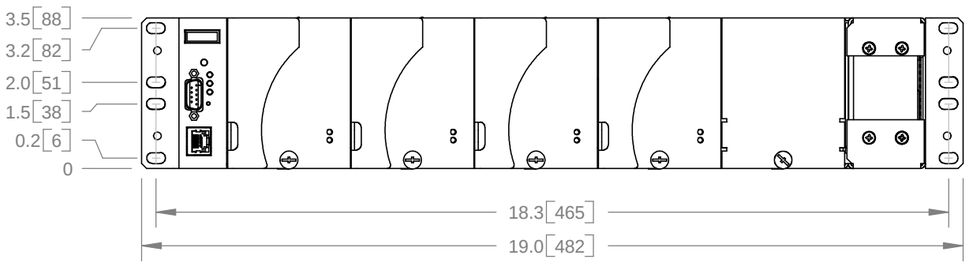
ISSUE DATE

SHEET 1 OF 2

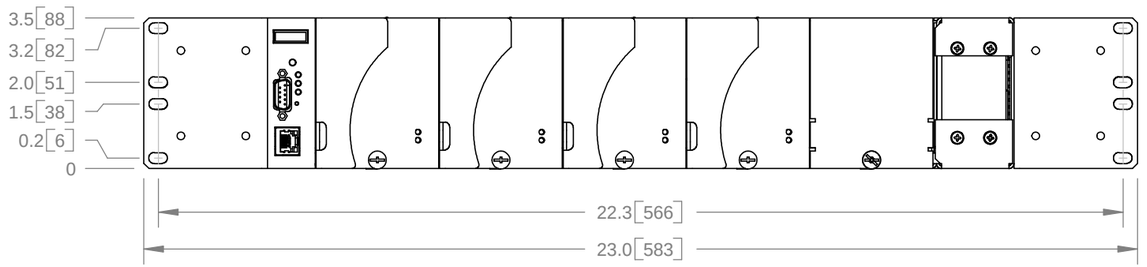
SIZE	TYPE	DWG NO.	REV
B	D2	030-783-06	B







19" RACK MOUNT OPTIONS



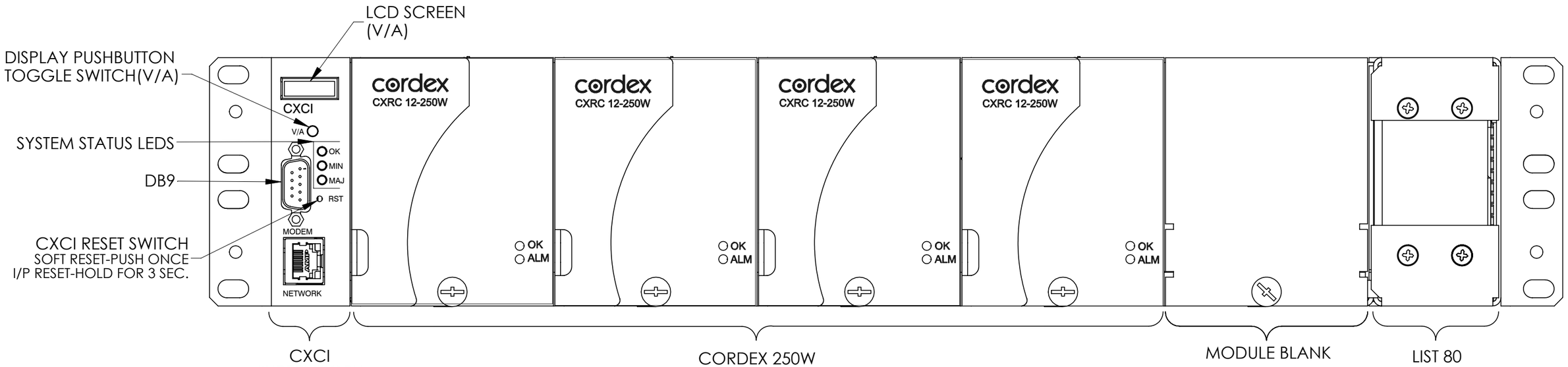
23" RACK MOUNT OPTIONS

DIMENSIONS ARE IN INCHES WITH METRIC (mm) IN BRACKETS: INCHES [mm]

ARGUS

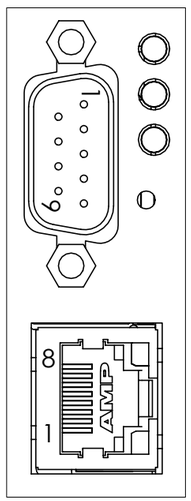
SCALE	N.T.S.
TITLE	OUTLINE, SHELF,19",5 MDL, CXCI,CXRC 12-250W
ISSUE DATE	
SHEET	2 OF 2
SIZE	B
TYPE	D2
DWG NO.	030-783-06
REV	B

REVISIONS				
LTR	DESCRIPTION	REV BY	DATE	APPD
B	UPDATED CXCI MODULE	SDW	2006/09	G.S.
C	DELETED NOTE FROM SHEET 3	SDW	2006/12	J.K.
D	CHANGED AC I/P FROM 'L2' TO 'L2/N'	MP	2007/04	J.K.
E	CORRECTED JP2 PINOUT (SHT. 3)	JK	2007/10	J.K.
F	UPDATED NOTES	SDW	2008/01	J.K.



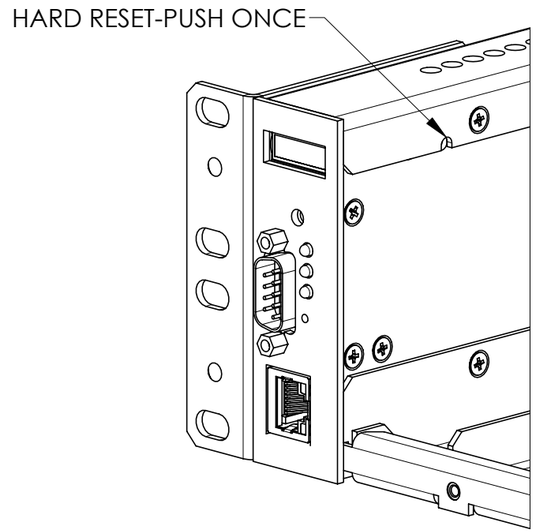
DB9
FOR ARGUS DC
MODEM USE ONLY

1. DCD
2. RX
3. TX
4. DTR
5. COM
6. DSR
7. RTS
8. CTS
9. RI



ETHERNET RJ45

1. TX+
2. TX-
3. RX+
4. NOT CONNECTED
5. NOT CONNECTED
6. RX-
7. NOT CONNECTED
8. NOT CONNECTED



ARGUS®

DESIGN	RP	2005/11	MATERIAL
DRAWN	RP/J.U.	2006/04	
CHECKED	JK	2006/04	
APPROVED	GS	2006/04	FINISH

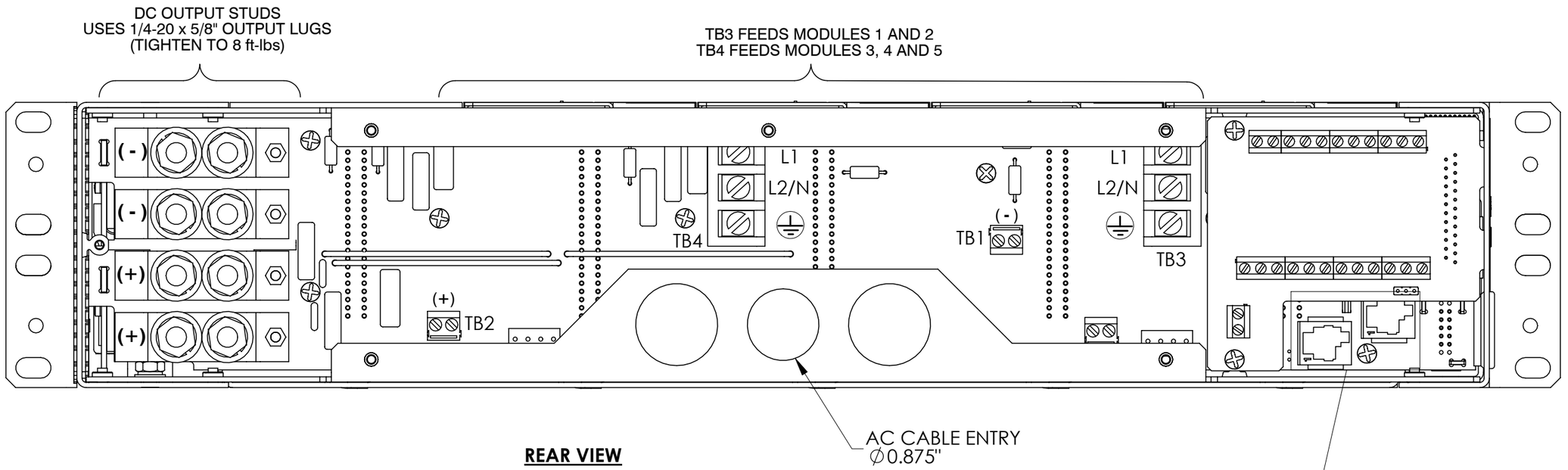
TOLERANCES
X.X ±0.04° [X] ±1mm
X.XX ±0.02° [X.X] ±0.5mm
X.XXX ±0.01° [X.XX] ±0.25mm

SCALE NTS

TITLE
CUSTOMER CONNECTION
19",5 MDL,CXCI,CXRC 12-250W

ISSUE DATE | SHEET 1 OF 3

SIZE	TYPE	DWG NO.	REV
B	D2	030-783-08	F

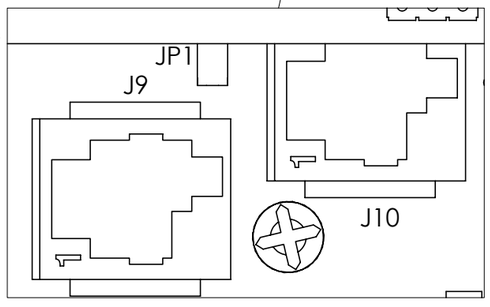


REAR VIEW

(BACK COVERS REMOVED)

LIST 0 - CAN OUT RJ12 PIN OUT (J9)

1. CAN COM
2. CAN H
3. NOT CONNECTED
4. CAN L
5. NOT CONNECTED
6. +5 V CAN



LIST 80 - CAN IN RJ12 PIN OUT (J10)

1. CAN COM
2. CAN H
3. NOT CONNECTED
4. CAN L
5. NOT CONNECTED
6. +5 V CAN

JUMPER SETTINGS FOR JP1

CAN TERMINATED

CAN UNTERMINATED

ARGUS®

SCALE NTS

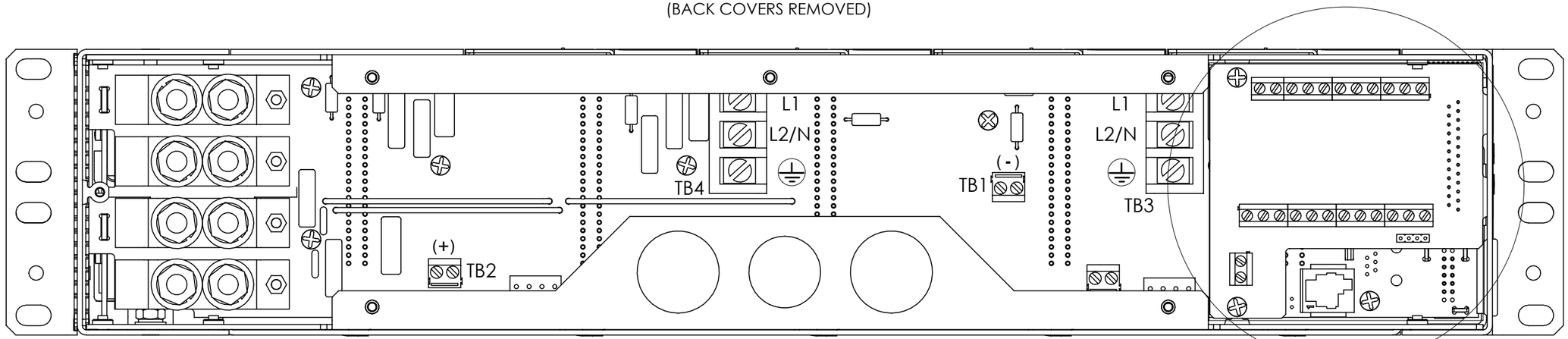
TITLE
CUSTOMER CONNECTION
19",5 MDL,CXCI,CXRC 12-250W

ISSUE DATE

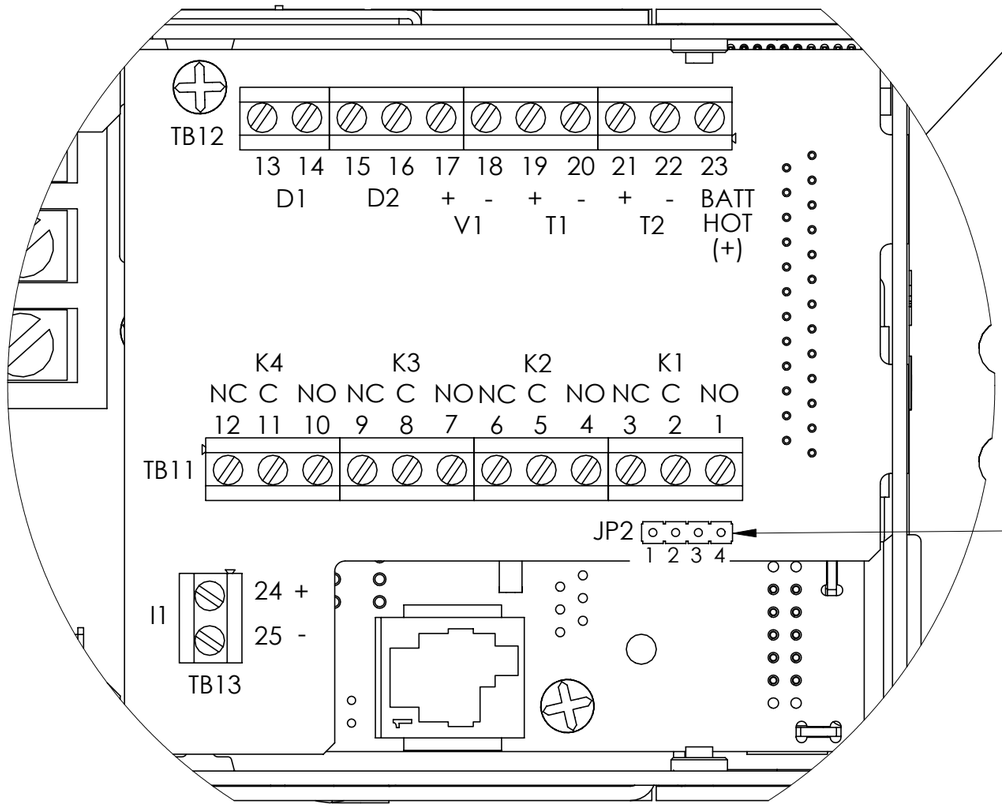
SIZE B | TYPE D2 | DWG NO. 030-783-08 | REV F

REAR VIEW

(BACK COVERS REMOVED)



CUSTOMER CONNECTION BOARD DETAIL



REFER TO MANUAL FOR
JUMPER SETTINGS FOR JP2

ARGUS®

SCALE NTS

TITLE
CUSTOMER CONNECTION
19",5 MDL,CXCI,CXRC 12-250W

ISSUE DATE

SHEET 3 OF 3

SIZE	TYPE	DWG NO.	REV
B	D2	030-783-08	F

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