



Cordex 48-1kW 23" Shelf for Systems up to 4000W

with Distribution

Installation & Operation Manual

Part # 030-704-B2
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Cordex 48-1kW 23" Shelf For Systems Up To 4000W With Distribution

030-704-B2 Rev C

The following documents and drawings are included in this manual to provide the necessary information required for installation, operation and fault diagnosis of the unit:

- **Specifications, Rectifier:** **010-606-B1 (010-566-20 non-RoHS)**
- **CSA/NRTL Equivalence:** **048-554-10**
- **Outline Drawing, 23" Shelf:** **030-704-06**
- **Customer Connections:** **030-704-08**

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important safety and installation instructions for Alpha's Modular Switched Mode Rectifier System Cordex™ 48-1kW.

1. Please read this manual prior to use to become familiar with the system'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 system 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 system.
3. Before using the system, read all instructions and cautionary markings on the system and any equipment connected to the system.
4. Do not expose the system to rain or snow.
5. **CAUTION** – Unless otherwise noted, use of an attachment not recommended or sold by the system manufacturer may result in a risk of fire, electric shock, or injury to persons.
6. **CAUTION** – Do not operate the system 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 system – 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 and interconnection of Alpha Technologies' Cordex 48-1kW 23" Integrated Shelf System with up to 4000W Output Power and Distribution.

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

For systems ordered with the Cordex CXCM System Controller option, separate documentation will be provided detailing the software features, setup and operation Product Overview.

1.2 Product Overview

A complete Cordex rectifier system consists of a CXCM with one or more power modules in a common shelf enclosure. The shelf can be mid-mounted in a 23" rack and 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 208/220/240 50/60 Hz electrical services. 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. **See documents #010-606-B1 in this documentation package.**

The integrated shelf rectifier system is designed to operate with the Alpha Cordex CXCM (modular version of the CXC controller); which plugs directly into the rectifier system shelf. See Figure 1 below. **Details for installation and wiring are provided in the respective chapters of this documentation package.**

The CXCM allows the user to set up, control and monitor the entire power system and ancillary components from one central, easy-to-use source. **Details of controller operation are provided in the current version software manual.**

The distribution component features up to six AM-style bullet-type breakers with a capacity of 100A. A low voltage disconnect (LVD) is optional and has a capacity of 125A. Also available is a separate battery breaker with a capacity of 100A.

A fuse distribution option is available to provide up to ten GMT fuse positions in two feeds rated at 10A maximum per feed.



Figure 1—Cordex 4000W system with plug-in controller and distribution

1.3 Part Numbers and List Options

The shelf is available to order under the following part numbers and list options:

Description	Part Number/List Option
Cordex 48-1kW 23" Shelf for Systems up to 4000W with Distribution	030-704-20
[equipped to receive one CXCM controller and four CXRC 48-1kW rectifiers (Figure 1)]	*List 0
208/220/240Vac input (dual feeds).....	*List 6
Gray finish.....	*List 50
Cordex 48-1kW rectifier power module.....	010-566-20
Basic module.....	*List 0
Gray finish with blue silkscreen.....	*List 50
Temperature sensor, 1/4" lug, 12 ft.	List 72
Temperature sensor, 3/8" lug, 12 ft.	List 75
Circuit breaker distribution, AM-style, bullet-type, six load positions.....	**List 80
Circuit breaker distribution, AM-style, bullet-type, two load positions, four battery positions.....	**List 82
Circuit breaker distribution, AM-style, bullet-type, four load positions, two battery positions.....	**List 84
DC output adapters, dual 2-position, 5/8" centers	List 85
Load LVD	List 86
Battery LVD.....	List 87
Fuse distribution, ten-position GMT.....	List 88
Power module blank plate (includes List 50)	List 90
Side access (RJ-45) communications jack.....	List 93
Breaker, mid-trip, 5A.....	List 100
Breaker, mid-trip, 10A.....	List 101
Breaker, mid-trip, 20A.....	List 102
Breaker, mid-trip, 30A.....	List 103
Breaker, mid-trip, 40A.....	List 104
Breaker, mid-trip, 50A.....	List 105
Breaker, mid-trip, 60A.....	List 106
Breaker, mid-trip, 70A.....	List 107
Breaker, mid-trip, 80A.....	List 108
Breaker, mid-trip, 90A.....	List 109
Breaker, mid-trip, 100A.....	List 110
Breaker, series-trip, 60A.....	***List 156
Breaker, series-trip, 100A.....	***List 160

* Default option ** Must order one of List 80, 82, or 84 *** Recommended for battery breaker

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

2 Rectifier Features

2.1 Front Panel

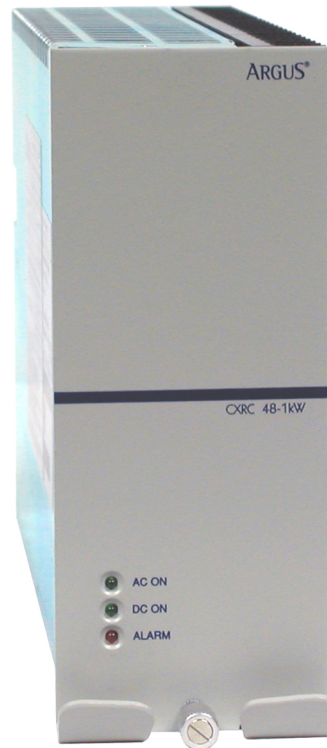


Figure 2–Cordex 48-1kW rectifier

2.1.1 LEDs

The front panel LEDs provide:

- Rectifier status summary,
- Rectifier software upgrade in progress indication,
- Locate module pattern.

Rectifier status summary will show the rectifier alarm status, communication fail status and rectifier on/off status.

2.1.1.1 AC ON

The top LED (green) is on when AC is within valid range. The LED will flash (~2Hz) when AC is outside the nominal range – **AC voltage is invalid if the AC Mains Low or AC Mains High alarm is active**. The LED turns off when AC has failed.

2.1.1.2 DC ON

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

2.1.1.3 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.

2.1.1.4 LED Activity During Software Upload

When a rectifier software upload is in progress, the LEDs will behave in a distinctly different way to indicate new rectifier software is being transferred from the CXC.

When a rectifier data transfer is in progress, all three LEDs will flash in a sequence lasting 1.5 seconds. When the last LED is lit, the sequence is repeated beginning at the first LED.

2.1.1.5 LED Activity During 'Locate Module' Command from CXC

When the 'locate module' command has been received from the CXC, the LEDs will behave in another distinct fashion 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 ping-pong pattern repeating every 2 seconds.

The ping-pong pattern lights each LED sequentially. After the last LED is lit, each LED is lit in reverse sequence. When the first LED is lit, the pattern repeats. The effect makes it appear as if the light is bouncing between the first and last LED.

2.1.2 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 Rear Panel

Located on the rear panel of the rectifier are connectors for shelf power and communications.

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 current¹. 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.*

2.4 Heat Dissipation

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

NOTE: *Some rectifier shelves incorporate fan aided cooling to increase the temperature rating of the module. See shelf manual supplied with your system.*

2.5 Over Temperature Protection

Each 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. **At 65°C output power and current limit are reduced to 70%.** 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.

¹ 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.

2.6 Wide AC Range

A minor alarm is generated when the AC input voltage drops below 180Vac. Output power is reduced linearly below 150Vac to 40% of the rated output power. At a lower voltage the module will shut down and will not restart until the AC is greater than or equal to 150Vac.

For voltages above 276Vac, power factor and total harmonic distortion may be derated. For voltages between 277Vac and 320Vac, the rectifier may not be operational but shall not suffer any damage.

2.7 AC Inrush/Transient Suppression

The modules' inrush current is limited to less than one times the nominal peak 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.

2.8 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 output voltage is ramped up from the minimum voltage to the float voltage.

2.9 Start Delay

The 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.

2.10 Current Limit/Short Circuit Protection

The current limit function determines the maximum output current limit of the 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.

2.11 Power Limiting

Each 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.*

2.12 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 via the CXC.

2.13 Battery Eliminator Operation

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.

3 CXCM Features

The optional CXCM (Cordex Controller, Modular) can be mounted in the rectifier system shelf and brings advanced monitoring technology to the Cordex series of rectifiers. This compact 4RU 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.

Behind the CXCM's front panel lies the main controller motherboard, which contains a microprocessor, memory, as well as numerous other electronic components.

The CXCM includes a web server providing 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 & temperatures (automatically for up to 16 user defined logs). Typical applications of the CXCM 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.

3.1 Front Panel

3.1.1 Display

Located on the front panel is a 160 x 160-pixel graphical LCD with touch screen similar to those used in PDAs. This graphical user interface (GUI) allows the operator to interact with screen selectable items using a fingertip.



Figure 3–Cordex CXCM model system controller front panel

3.1.2 LEDs

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

3.1.2.1 Alarm Conditions

The CXCM 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.

3.1.2.2 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.

3.1.3 Reset

A reset button is located on the front panel for restarting the CXCM's microprocessor. It takes approximately 15 seconds before the display reappears after pressing the reset button.

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

3.1.4 Ethernet Port

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

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

3.1.5 RS-232 Serial (Craft) Port

Local access to the CXCM is possible through a front panel RS-232 serial port; using a null modem cable. The communication protocol supports a web interface (via Microsoft® Internet Explorer 6 or greater). The remote screen display is an enhanced version of the CXC's front panel display.

3.2 Analog Input Channels

The CXCM has analog input channels for voltage, current, and temperature.

3.2.1 Voltage Inputs

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

3.2.2 Current Inputs

The CXCM software is pre-configured to monitor I1 for load current using an external 50mV current shunt.

3.2.3 General-Purpose

A set of terminals are provided to monitor a bi-voltage signal that may vary in either polarity from zero; e.g., +/-60Vdc.

3.2.4 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.

3.3 Digital Input Channels

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

3.4 Alarm and Control Output Relays

The CXCM contains eight 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.

3.4.1 LVD Control (External Option)

The LVD Control functions can be hardwired directly from the assigned relay output to an optional LVD override control and distribution alarm card. This provides a safety measure to protect against load disconnect during CXCM reset or replacement; e.g. when the controller is off-line. Operators may also perform test and maintenance procedures on the CXCM without disturbing the load.

3.5 System Fail Alarm/Relay

The CXCM system fail alarm (K0) activates because of a major internal failure. During such a condition, the unit will attempt to reset, but if this fails, an alarm condition will be extended to a relay and the red LED on the front panel will illuminate. This is a fail-safe signal to the remote monitoring equipment; i.e. alarm will be extended even if power to the unit is interrupted.

3.6 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. All alarming and control of Cordex rectifiers is accomplished with a CXC via a CAN bus.

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

4 Inspection

4.1 Packing Materials

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

4.1.1 Returns for Service

Save the original shipping container. If the unit needs to be returned for service, it should be packaged in its original shipping container. If the original container is unavailable, make sure the unit 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 units.*

4.2 Check for Damage

Prior to unpacking the equipment, note any damage to the shipping container. Unpack the equipment 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 the proper assembly of your system.

5 Installation

This chapter is provided for qualified personnel to install the shelf.

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

5.1 Safety Precautions



WARNING

Hazardous voltages are present at the input of power systems. The DC output from the rectifiers and the 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, the following precautions should be followed:

- Remove all metallic jewelry; e.g., watches, rings, eyeglasses, necklaces.
- Wear safety glasses with side shields at all times during installation. Insulated metallic tools shall be used.

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.

5.2 Shelf Preparation/Mounting

The shelf has been designed for mounting in a standard 23" relay rack. 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.

Note: *The shelf shall be mounted in a clean and dry environment. Allow at least 1.75" of free space around the unit for unrestricted convection cooling airflow.*

5.3 Module Insertion/Removal

Insert by placing the module on the shelf bottom and sliding the module into the rear connectors (inside of the shelf). Apply pressure on the handles to engage the rear connector in the shelf receptacle. 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 type is used.*

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

6 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 drawings at the rear of this manual.

6.1 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.

6.2 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 24/48VDC load (optional)
- Cutters and wire strippers
- Crimping tool (optional for large gauge wire)
- Socket and ratchet set (Imperial measure)
- Anti-static wrist strap
- Computer (laptop) with Microsoft® Internet Explorer 6 or up
- Crossover cable RJ-45 (for access using the Ethernet port)
- Null modem cable (for access using the RS-232 port).

6.3 Power System Chassis Ground

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.

6.4 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. 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.

Note: The recommended AC supply configuration for up to two rectifiers on AC feed is a 20A breaker with #12 AWG (90 deg. C) wire at 30 deg. C ambient.

6.5 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.

Ensure all modules are removed from the shelf. Remove the metal cover from the rear of the shelf to expose the wireway for input terminal blocks.

The wireway is designed for two customer-supplied 1" conduit fittings for AC supply located on the left side of the shelf and two 3/4" conduit fittings on the rear.

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 if all connections have been completed.

6.6 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.

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

6.7 DC Output Connections



WARNING

Leave cables or bus bars 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).

DC output cables can be connected through the side of the shelf. Without the distribution option, the side DC access is made toward the rear of the shelf.

Terminate cables leads with appropriate crimp lugs. Secure the positive and negative to the shelf output post of the correct polarity; i.e., +V_{cable} to +V_{post}. Ensure the washers are on the bolts in the same order in which they were shipped from the factory. Tighten the bolts as per Customer Connections drawing at the rear of this manual.

The common output leg of the rectifier system should be connected to ground. This is typically done at the load common termination point.

Replace rear cover if all connections have been completed.

6.7.1 DC Distribution Options

Consult the foldout drawings located at the rear of the manual.

6.7.1.1 Circuit Breaker Distribution Module

The shelf is factory-equipped with distribution of six AM-style bullet-type circuit breakers. See 1.3.

Remove the front panel of the distribution module to access the breaker positions and their associated terminals, see Figure 4 below:

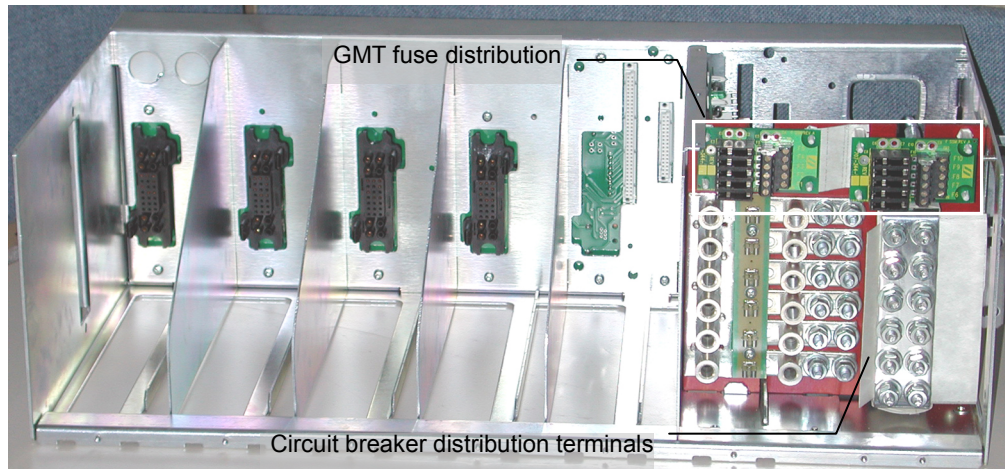


Figure 4–Front view of shelf with distribution (terminals exposed)

Caution: Battery breakers should be series-trip to achieve effective alarm operation. In the case where there is no power on rectifiers, and if only one battery breaker is used, when the breaker trips there will be no alarm.

6.7.1.2 Fuse Distribution (List Option 88)

The shelf may also be factory-equipped with ten GMT-style fuses as shown in Figure 4 above. Remove the front panel of the distribution module to access fuses and the associated terminal blocks.

6.8 CAN Serial Port

A single CAN Serial port, for communications with Alpha's Cordex rectifiers and other CAN-enabled equipment, is located on the shelf backplane. A jumper allows setting of the CAN OUT to be open or terminated.

6.9 Ethernet Side Access (List Option 93)

The Ethernet port can be ordered mounted on the side of the shelf for front access.

6.10 Network Connection and Remote Communications via CXCM

The Cordex 48-1kW system can be set up, monitored and tested via ETHERNET 10/100 Base-T or with a RS-232 serial data connection. Some standard scenarios are described below:

- Network (TCP/IP secured by user) to (rear shelf) Ethernet port.
- Laptop to CXC via direct Ethernet connection.
- Computer to CXC (front panel) Craft port via RS-232 serial data connection.

6.10.1 Ethernet Port for Network Connection

The Ethernet port is designed for CXCM connection to a user supplied network via an RJ-45 jack. Connect to the Cordex shelf using a standard network cable. Pinouts are shown in drawing 030-704-08.

6.10.2 Ethernet Port for Local Connection

Local access is also possible through the Ethernet port connection using a standard crossover cable.

6.10.3 RS-232 Serial (Craft) Port for Local Connection

Local access to the CXC is possible through the front panel RS-232 serial port using a null modem cable. See Figure 5 below. The communication protocol supports a web interface. The remote screen display is an enhanced version of the CXC's front panel display.

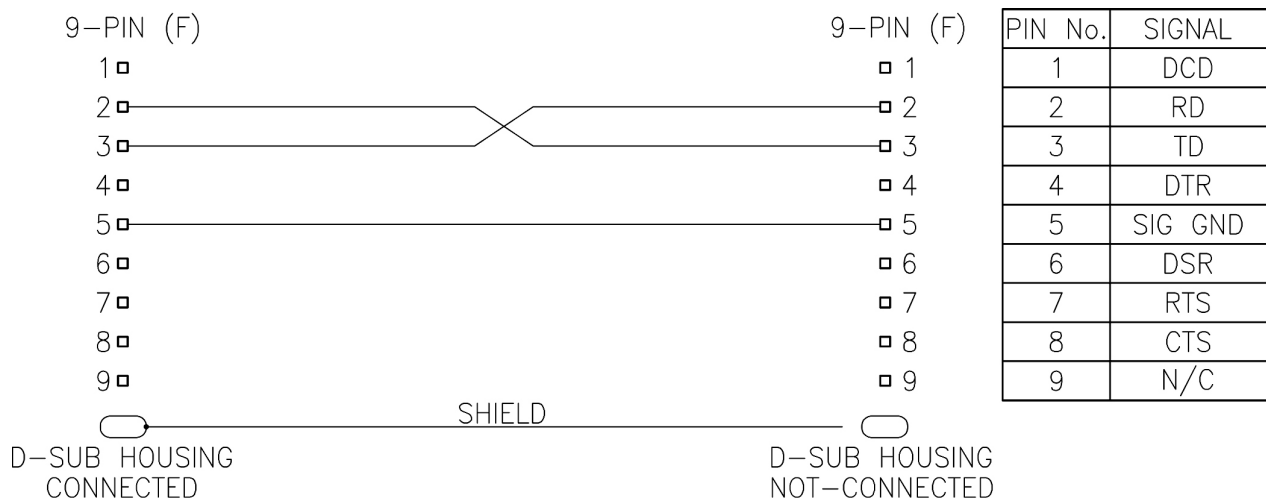


Figure 5–NULL modem pinouts

6.11 CXCM Battery –48V Connection

The Battery -48V should be connected at the battery system voltage terminal for CXCM reference when a battery disconnect device is used. It is critical to CXCM operation as it ensures a source of power to the CXCM should the disconnect device open the circuit. A 1/4" spade (quick connect) connector is provided on the CXCM portion of the shelf backplane. #18 AWG wire is recommended.

Note: This connection is factory-equipped for List 87.

6.12 Alarm and Signal Wiring Connections for CXCM

For terminal block connections, the recommended wire sizes are 0.823 to 0.129mm² (#18 to #26 AWG) for the temperature range of 0 to 50 deg. C (as per UL/CSA).

For insulation displacement receptacles, the recommended wire size is 0.823mm² (#18 AWG).



CAUTION: to reduce risk of fire, use only 0.129mm² (#26 AWG) or larger wire.



CAUTION: to reduce risk of fire, use only 0.129mm² (#26 AWG) or larger wire.

Terminal	Description	Default Name		Signal Type	Range	
21-22(common)*	Alarm Output 2	LVD2		NC/COM/NO (JP2)	60VDC / 1A	
19-20(common)*	Alarm Output 3	LVD3		NC/COM/NO (JP3)	60VDC / 1A	
17-18(common)*	Alarm Output 4	System Minor		NC/COM/NO (JP4)	60VDC / 1A	
15-16(common)*	Alarm Output 5	System Major		NC/COM/NO (JP5)	60VDC / 1A	
13-14(common)*	Alarm Output 6	AC Mains Hi-Low		NC/COM/NO (JP6)	60VDC / 1A	
11-12(common)*	Alarm Output 7	Not assigned		NC/COM/NO (JP7)	60VDC / 1A	
9-10(common)*	Alarm Output 8	Not assigned		NC/COM/NO (JP8)	60VDC / 1A	
23-25**	Alarm Output 0	System Fail Output		NO/COM/NC	60VDC / 1A	
E1	Battery -48V	Battery -48V		Neg (-)	20—60VDC	
J3	Ethernet Port	Ethernet Port		N/A	N/A	
P1	LVD Control	LVD Control		Polarized	0—60V / 1A	
P5, 1-2***	Digital Input 1	Distribution Fuse (Alarm)		Pos (+) or Neg (-)	0—60VDC	
P5-3, P6-1***	Digital Input 2	Distribution CB (Alarm)		Pos (+) or Neg (-)	0—60VDC	
P6, 2-3***	Digital Input 3	Battery CB (Alarm)		Pos (+) or Neg (-)	0—60VDC	
P7	Voltage Input 1	Discharge Voltage		Pos (+) or Neg (-)	0—100VDC	
P8	Current Input 1	Discharge Current		Pos (+) or Neg (-)	±50mV	
		L120	L124		L120	L124
1-2****	General Input 1	Temp Probe #1	Voltage #3	Pos (+) or Neg (-)	0-20VDC	0-60VDC
3-4****	General Input 2	Temp Probe #2	Voltage #4	Pos (+) or Neg (-)	0-20VDC	0-60VDC
5-6****	General Input 3	Not Used	Voltage #5	Pos (+) or Neg (-)	Not Used	0-60VDC
7-8****	General Input 4	Bipolar Voltage	Temp Probe #1	Pos (+) or Neg (-)	±60VDC	0-20VDC

Table 1 - Wiring connections for CXCM

- * Jumper selectable NO or NC Form C contacts. Can be configured to de-energize on alarm (DOA) or energize on alarm (EOA).
- ** System Fail output relay is fail-safe and will de-energize during an alarm condition.
- *** See Table 6 for definitions of logic and system.
- **** Bipolar (Voltage Input) is ±60VDC, Voltage (Input) is 0—60VDC, Temp Probe is 0—20VDC with power source.

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.

6.13 Analog Inputs for CXCM

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. Some of the analog channels are reserved for specific signals, while others are designated as general-purpose inputs, which accommodate various types of analog signals. The input cables should be bundled together and routed through the entry holes of the shelf, if applicable.

6.13.1 Voltage

Voltage Input #1 (discharge voltage per CXC software) terminals on the shelf 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 (charge 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 low voltage disconnect).

6.13.2 Current

Current Input #1 terminals provide connections (factory-installed) to the system current shunt normally used to monitor discharge (load) current.

6.13.3 General-Purpose

Terminals provide connection pairs for various analog inputs such as temperature sensors. These are configured at the time of ordering. The configuration determines whether the signals allowed are to be bipolar (may vary in either polarity from zero; e.g., +/-60VDC) or unipolar (may vary positive from zero; e.g., 0 to +60VDC). *The CXC software is pre-configured to monitor converter voltage through input channel GP1.*

6.13.3.1 Temperature Sensor

Terminals, of the general purpose grouping, may be configured as temperature input channels and provide connections for up to two temperature sensors. A voltage is supplied to these terminals for sensor measurements.

6.14 Digital Inputs for CXCM

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. The CXCM is programmed for the specific functions listed in Table 1.

6.14.1 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 +24V or negative for -48V systems. The other input terminal is wired to the Ground (common) of the system through a relay (dry contact – usually located on the equipment requiring monitoring). This method (see Figure 6) allows the digital input to receive (or not receive) a Ground signal on an alarm.

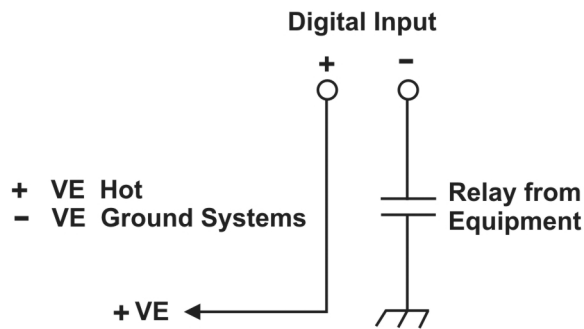


Figure 6—Showing digital input connection method

6.14.2 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	18—60

Table 2 – Voltage level definitions for digital inputs

6.15 Alarm (Relay) Outputs for CXCM

Terminals provide contacts for extending various alarm or control signals. Each relay output can be wired (jumper selectable) for NO or NC operation during an alarm or control condition. See Figure 7.

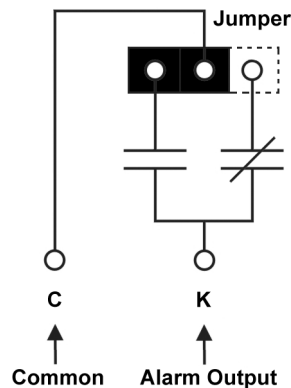


Figure 7—Showing relay connections

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

These relays could be used for additional external LVD contactor control; however, this would not provide the redundant LVD control as with the assigned output pins described below.

6.15.1 LVD Control

The LVD Control functions can be hardwired directly from the assigned output pins (+ and -) to an external LVD contactor (or panel). See Controls Menu Defaults in the CXC Software manual. **Note: this connection is factory-equipped for List 86 and List 87.**

6.15.1.1 Redundant LVD Control Circuit

The shelf backplane² provides circuitry to override the LVD Control function. This is a safety measure to protect against accidental load disconnect should the CXCM be removed from the shelf. This protection is also necessary during CXCM reset.

The OUT voltage is 46V and the IN voltage is 51V. Ensure the CXCM LVD voltages are set outside of this range. **Note: controller Relay 1 must be set to ENERGIZED for the LVD to operate properly.**

6.15.2 System Fail Output

Terminals provide connections for a system (controller) fail relay. This fail-safe relay (i.e. it is de-energized during an alarm condition) can be wired for NO or NC operation.

² Alpha #707-340-20 for the CXCM. See Customer Connections drawing at the rear of this manual.

7 Operation

7.1 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.

7.1.1 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.

7.1.2 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.*

7.1.3 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.

7.1.4 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.

7.1.5 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.

7.2 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:

7.2.1 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 3 - Output voltage modes

7.2.2 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:

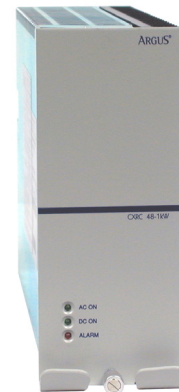
Output Current/Power Mode	Active when...
Temperature foldback mode	Output current and power limit have been reduced due to high temperature of the heatsink or internal ambient temperature sensor.
AC foldback mode	Output current and power limit have been reduced due to low AC input voltage. <i>Note: this will reduce the risk of tripping an AC breaker due to increased AC current draw as the AC voltage decreases.</i>
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 4 - Output current/power modes

7.3 Thermal Management

Heat dissipation of rectifiers is achieved through natural (bottom to top) convection cooling. Performance of the rectifiers may vary depending on the ambient temperature and whether the convection path of the exhaust air through the enclosure is hindered. A rectifier's specified performance may also be affected by adjacent rectifiers in the shelf.

Even with one or more Over-temperature and Current Limit alarms active, the shelf is typically able to supply the demanded power steadily. For example, the shelf can deliver 85% load at 40°C, with some alarms active. However, in higher ambient temperatures, load reduction may be necessary.



7.4 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	47.5 – 58.2V	54V
Equalize (EQ) Voltage	49.8 – 60.2V	55V
Battery Test (BT) Voltage	44 – 52V	46V
OVP	See note below – 63V	57V
Current Limit (CL)	23 – 100%	100%
Power Limit (PL)	0 – 100%	100%
Module Start Delay	0 – 250s	1s
System Start Delay	0 – 600s	0s
Low Voltage Alarm (LVA)	42 – 52V	44V
High Voltage Alarm (HVA)	52 – 63V	55.5V
EQ Timeout	1 – 2399h	30h
BT Timeout	1 – 250h	8h
Softstart Ramp-rate	Normal/Fast	Normal
CL/PL Alarm	Enable/Disable	Enable
Remote Shutdown	Enable/Disable	Enable
Ramp Test	Enable/Disable	Enable

Table 5 - Cordex 48-1kW rectifier factory ranges and defaults

NOTE: OVP cannot be set below the present system/FL/EQ/BT voltage setting or the safe mode voltage of 51.4V.

8 System Startup

Refer to Chapter 2 for module installation, rectifier states and modes of operation. After completing the shelf wiring and installation, perform the following startup and test procedure to ensure proper operation:

1. Ensure all power modules are removed from the shelf.
2. Verify correct battery polarity using a voltmeter, and connect battery (if required) to the output of the system.
3. Install one power module and verify that the Module Fail LED illuminates (assuming a battery is connected to the system providing backup power). This indicates correct output polarity.
4. Verify AC input voltage is correct and turn on the corresponding AC input feeder breaker. The AC and ON LED should illuminate after a preset start delay and system will begin charging batteries.
5. Install remaining power modules and CXCM. In the adjustments menu of the CXCM, set Float and Equalize voltage to the levels specified by the battery manufacturer.
6. Using the CXCM, test functionality of various module alarms and controls. In addition, perform a load test with the system using a resistive load box as needed.

8.1 CXCM Reset

A reset button is located on the front panel for restarting the CXCM's microprocessor. It takes approximately 15 seconds before the display reappears after pressing the reset button. To protect against accidental load disconnect, see 6.15.1.1.

9 Maintenance

Although very little maintenance is required with Alpha systems, routine checks and adjustments are recommended to ensure optimum system performance. Qualified service personnel shall 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 6 - Sample maintenance log

NOTE: There are no field replaceable parts.

10 Warranty

Alpha Technologies Ltd. warrants all equipment manufactured by it to be free from defects in parts and labor, for a period of two years from the date of shipment from the factory. 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.

Visit <http://www.alpha.ca> for full warranty information.

11 Acronyms and Definitions

AC	Alternating current
AWG	American wire gauge
CAN	Controller Area Network
CEC	Canadian Electrical Code
CEMF	Counter electro-motive force
CSA	Canadian Standards Association
CX	Cordex series; e.g., CXC for Cordex™ System Controller
DC	Direct current
EIA	Electronic Industries Alliance
HVSD	High voltage shutdown
LAN	Local area network
LED	Light emitting diode
LVD	Low voltage disconnect
NC	Normally closed
NEC	National Electrical Code (for the USA)
NO	Normally open
OSHA	Occupational Safety & Health Administration
UL	Underwriters Laboratories

Specifications for Apha's Switched Mode Rectifier Cordex 48-1kW

Power Module Output

Voltage:	40.5 to 58Vdc within rated limits
Current:	18.5A @ 54Vdc nominal (20.8A maximum @ 48V)
Maximum Power:	1000W continuous/module
Static Load Regulation:	Better than $\pm 0.5\%$ for any load change within rated limits
Dynamic Load Regulation:	Better than $\pm 2\%$ for 10% - 90% load step (output shall recover to static limits within 2ms)
Static Line Regulation:	Better than $\pm 0.1\%$ for any change in input voltage within rated limits
Dynamic Line Regulation:	Better than $\pm 1\%$ for any change in input voltage within rated limits (output voltage shall recover to static limits within 2ms)
Hold-up Time:	10ms
Time Stability:	$\leq 0.2\%$ per year
Temperature Stability:	$\leq 100\text{ppm}/^\circ\text{C}$ over the operating range
Heat Dissipation:	$< 340\text{BTU}$ per hour (per rectifier module)
Electrical Noise:	$< 26\text{dBnC}$ (voice band) without battery $\leq 22\text{dBnC}$ (voice band) with battery $< 5\text{mVrms}$ to 100MHz (wideband) $< 100\text{mVp-p}$ to 100MHz $< 2\text{mV}$ (psophometric)
Acoustic Noise:	$< 55\text{dBa}$ @ 1m (3ft.) @ 30°C (86°F) [individual module] $< 55\text{dBa}$ @ 1m (3ft.) @ 30°C (86°F) [four modules]
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.

Specifications for Apha's Switched Mode Rectifier Cordex 48-1kW Continued

Power Module Input

Voltage:	208 to 240Vac nominal
Extended Operation:	Low: 150 to 90Vac (power de-rated linearly to 40% output) High: 176 to 320Vac (de-rated power factor above 265Vac)
Frequency:	50/60Hz nominal (45 to 66Hz)
Current:	5.3 to 4.6A (nominal Vac) 7.4A maximum @ 150Vac
Power Factor:	>0.99 at nominal conditions and 50-100% load; >0.98 at nominal conditions and 30-100% load
Protection:	10kA-interrupting capacity fuses in active and neutral lines
Efficiency:	>91% at nominal conditions and 50-100% load
Inrush Current:	≤ full load steady state current of the rectifier within rated limits
Start-up Ready Time:	<5 seconds (excluding soft start) to complete inrush limit routine and ac measurement (for OK signal)
Start-up Delay:	Programmable up to 120 seconds to enable stagger-start of multiple rectifiers and to minimize the effect on a supply source
Soft Start:	User adjustable to at least 5 seconds (not including start-up delay time) and is determined by output current limit ramp-up
T.H.D. (Current):	<5% at 100% load
Input Transient Suppression:	Meets ANSI/IEEE C62.41 Category B3
Input Leakage Current:	<3.5mA @ 265Vac 60Hz

Miscellaneous

MTBF:	>400,000 hours
Dimensions:	177mm H x 71mm W x 250mm D (excluding connector) [6.9" H x 2.8" W x 9.8" D]
Weight:	2.9 kg (6.4 lb.)

Environmental

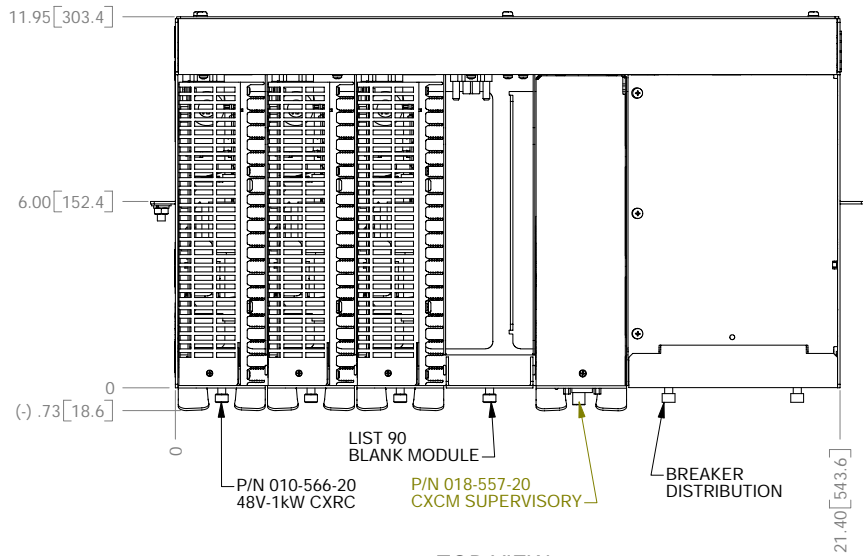
Temperature Operating:	-40 to +50°C (-40 to 122°F)
Extended:	400W @ +65°C (149°F)
Storage:	-50 to +85°C (-58 to 185°F)
Humidity:	0 to 95% non-condensing
Elevation:	-500 to +4000m; derate @ -4°C/1000m above sea level (-1640 feet to 13124 feet; derate @ -7.2°F/3281 feet above sea level)

Referenced Standards

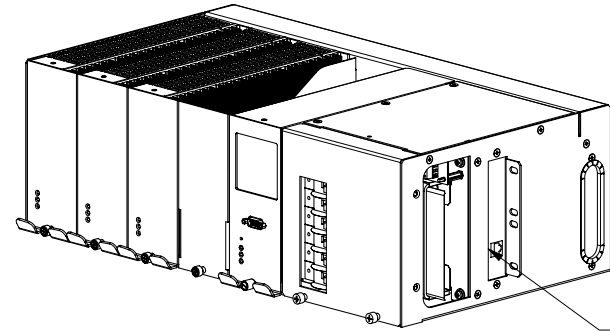
EN 300 386-2	EMC and ERM; Telecommunication Network Equipment
EN 55022 (CISPR 22): 1998	Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurement
EN 61000-3-2:2000	Harmonic Current Emissions
EN 61000-3-3:1995	Voltage Fluctuations and Flicker
EN 61000-4-2	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.

REVISIONS				
LTR	DESCRIPTION	REV BY	DATE	APPD

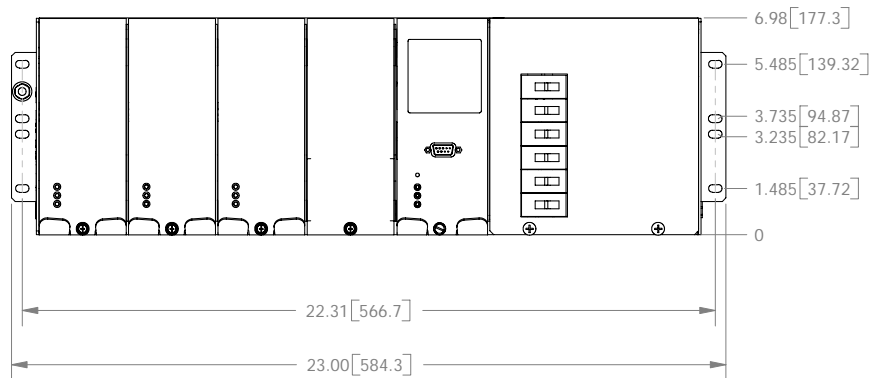


TOP VIEW

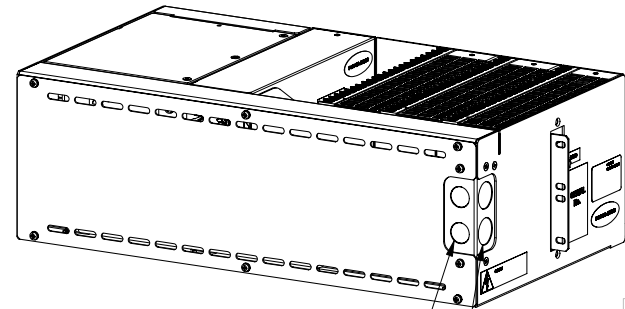


LIST 93
SIDE ACCESS RJ-45

ISOMETRIC VIEW



PLAN VIEW



.875 K.O ACCEPTS 3/4" CONDUIT
1.125 K.O ACCEPTS 1" CONDUIT

REAR ISOMETRIC VIEW

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DESIGN	DGW	2004/06	MATERIAL
DRAWN	DGW	2004/06	
CHECKED		2003/	
APPROVED		2003/	FINISH

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

PER P.O. and Doc. 070-024-83
SCALE NTS

TITLE
**OUTLINE,
 23" CABINET, 48V-1kW CXRC
 e/w DIST MODULE**

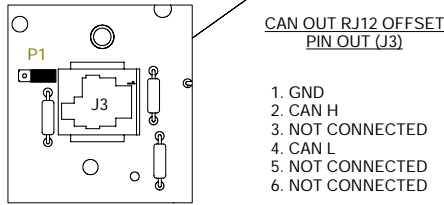
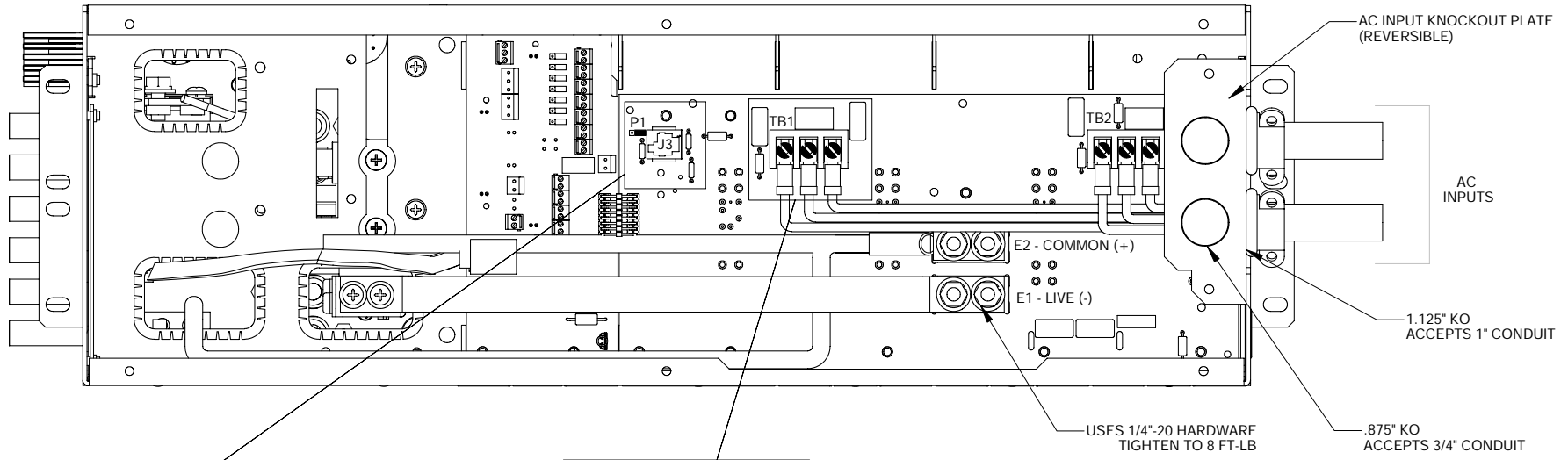
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ISSUE DATE	SHEET	1 of 1	REV
SIZE TYPE DWG NO.	030-704-06		A

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

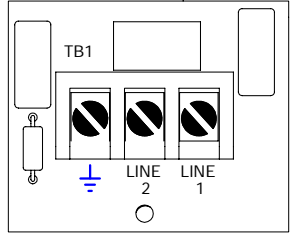
REVISIONS				
LTR	DESCRIPTION	REV BY	DATE	APPD
B	TO SHOW LIST OPTION CHANGES, AND A TITLE CHANGE.	DGW	04/06	

LIST 0,6 - 4 MODULE WITH CXC CONTROLLER & DISTRIBUTION



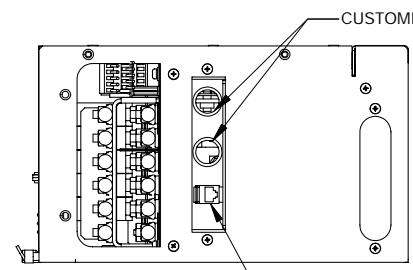
JUMPER SETTING FOR P1

- CAN TERMINATED
- CAN UNTERMINATED



TYPICAL AC INPUT TERMINAL BLOCK (TB1 SHOWN)

TB1 FEEDS RECTIFIERS 2,4
TB2 FEEDS RECTIFIERS 1,3



RIGHT SIDE VIEW

SCALE 1 : 4

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

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DESIGN	DGW	2004/06	MATERIAL	
DRAWN	DGW	2004/06		
CHECKED		2004/		
APPROVED		2004/	FINISH	

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

PER P.O. and Doc. 070-024-83
SCALE NTS

TITLE
CUSTOMER CONNECTION,
23" SHELF, 48V-1KW
CXRC e/w DIST. MODULE

ISSUE DATE		SHEET	1 of 4	REV	
SIZE	D2	DWG NO.	030-704-08	B	

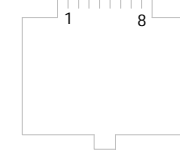
LIST 0 : 5 MDL e/w CXc

JUMPER SETTINGS FOR JP2-8

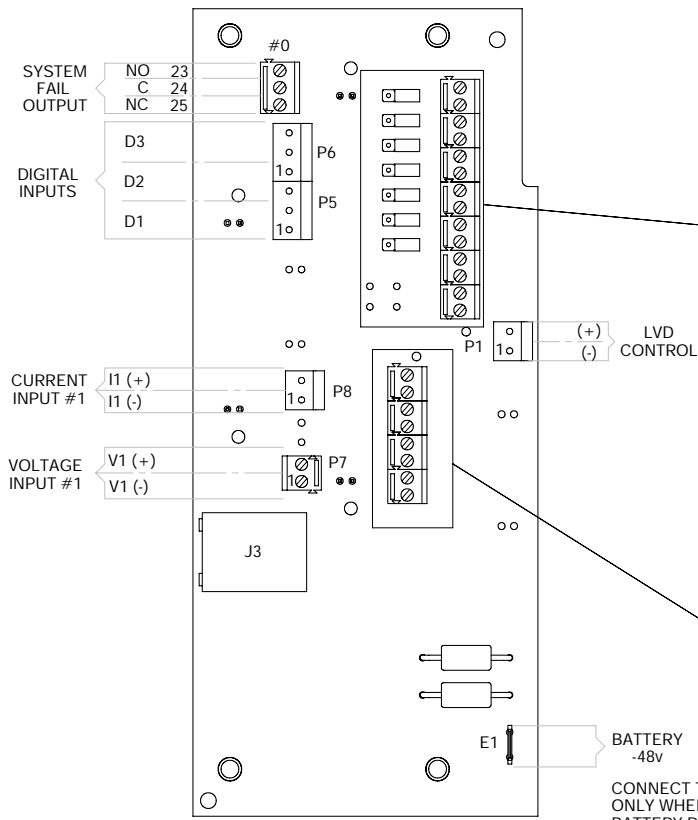
REVISIONS				
LTR	DESCRIPTION	REV BY	DATE	APPD



ETHERNET RJ45 PINOUT (J3)

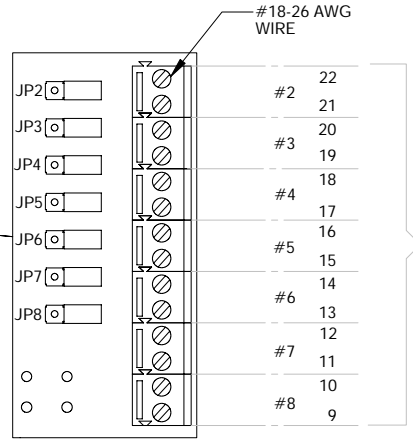


- 1. TX+
- 2. TX-
- 3. RX+
- 4. COM1
- 5. COM1
- 6. RX-
- 7. COM2
- 8. COM2

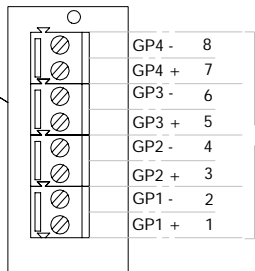


TOP VIEW - CXc BACKPLANE
(707-340-20)

SOME DETAILS OMITTED



ALARM OUTPUTS



GENERAL PURPOSE ANALOG INPUTS

GENERAL PURPOSE CONFIGURATION TABLE

INPUT	CXCM LIST OPTION	
	LIST 120	LIST 124
GP4	±60V	TEMP
GP3	N/A	0-60V
GP2	TEMP	0-60V
GP1	TEMP	0-60V

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CHECKED		2004/	
APPROVED		2004/	FINISH

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

PER P.O. and Doc. 070-024-83
 SCALE NTS

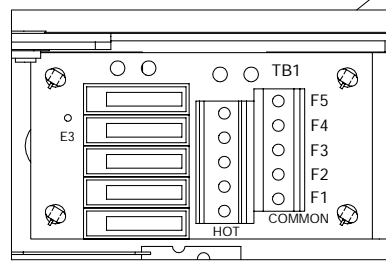
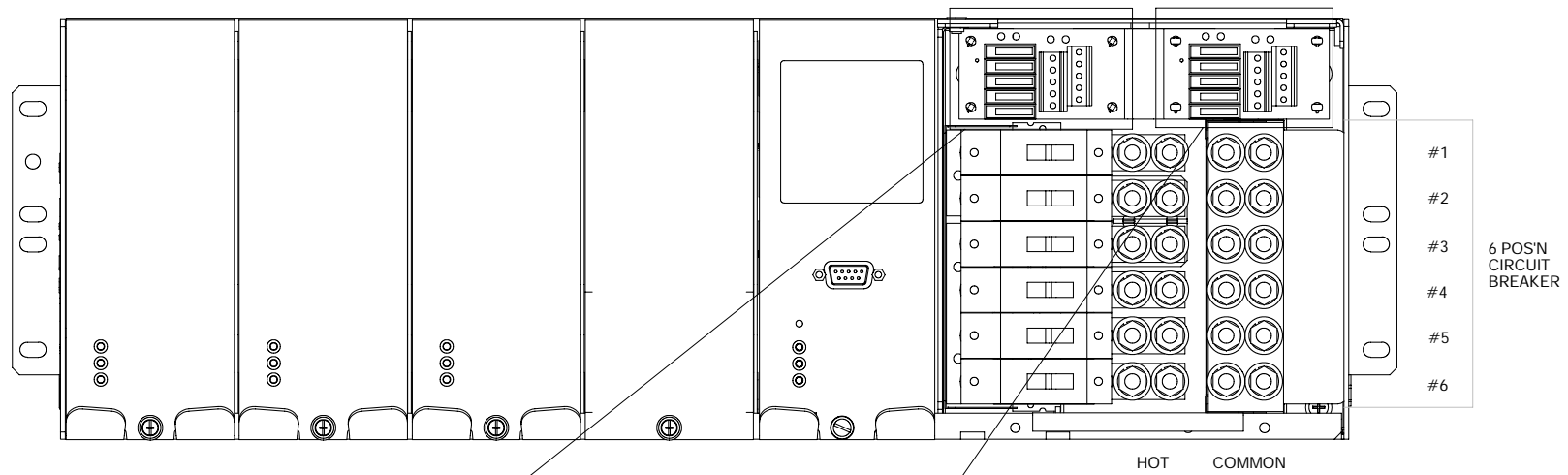
TITLE CUSTOMER CONNECTION,
 23" SHELF, 48V-1kW
 CXRC e/w DIST. MODULE

ISSUE DATE	SHEET 2 of 4	REV B
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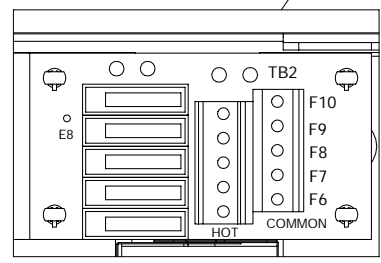
SIZE TYPE DWG NO. 030-704-08 B

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

REVISIONS				
LTR	DESCRIPTION	REV BY	DATE	APPD



**LIST 88
GMT FUSE BLOCK A**



**LIST 88
GMT FUSE BLOCK B**

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

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DESIGN	DGW	2004/06	MATERIAL
DRAWN	DGW	2004/06	
CHECKED		2004/	
APPROVED		2004/	FINISH

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

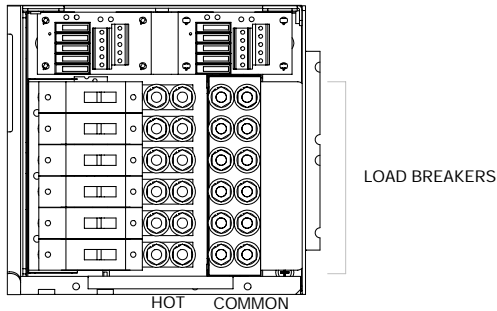
PER P.O. and Doc. 070-024-83
 SCALE NTS

TITLE
**CUSTOMER CONNECTION,
 23' SHELF, 48V-1kW
 CXRC e/w DIST. MODULE**

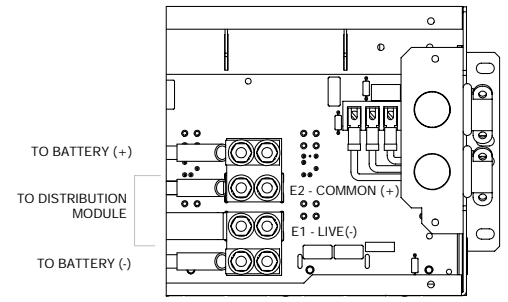
ISSUE DATE	SHEET	3 of 4
SIZE	TYPE	DWG NO.
B	D2	030-704-08

REV B

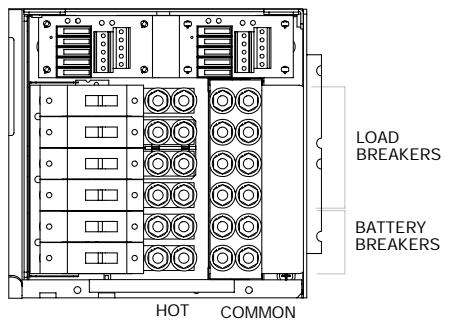
REVISIONS				
LTR	DESCRIPTION	REV BY	DATE	APPD



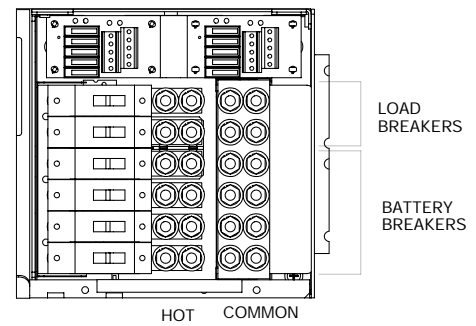
LIST 80 - 6 LOAD CB POS'N



LIST 85 - DUAL OUTPUT ADAPTERS
(TB1 A.C. WIRES HIDDEN)



LIST 82 - 4 LOAD CB POS'N & 2 BATTERY CB POS'N



LIST 84 - 2 LOAD CB POS'N & 4 BATTERY CB POS'N

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

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DRAWN	DGW	2004/06		
CHECKED		2004/		
APPROVED		2004/	FINISH	
TOLERANCES			PER P.O. and Doc. 070-024-83	
XX	±0.04"	[X]	±1mm	
XXX	±0.02"	[X.X]	±0.5mm	
XXXX	±0.01"	[X.XX]	±0.25mm	
TITLE			SCALE	
CUSTOMER CONNECTION, 23" SHELF, 48V-1kW CXRC e/w DIST. MODULE			NTS	
ISSUE	DATE		SHEET	4 of 4
SIZE	TYPE	DWG NO.		REV
B	D2	030-704-08		B

**Alpha Technologies Ltd.**

7700 Riverfront Gate
Burnaby, BC V5J 5M4
Canada
Tel: +1 604 436 5900
Fax: +1 604 436 1233
Toll Free: +1 800 667 8743

Outback Power

5917 195th St NE,
Arlington, WA 98223
United States
Tel: +1 360 435 6030
Fax: +1 360 435 6019

Alpha Technologies Europe Ltd.

Twyford House Thorley
Bishop's Stortford
Hertfordshire, CM22 7PA
United Kingdom
Tel: +44 1279 501110
Fax: +44 1279 659870

Alpha Technologies

Suite 1903, 191F., Tower 1,
33 Canton Rd. Tsim Sha Tsui
China, Hong Kong City,
Kowloon, Hong Kong
Tel: +852 2736 8663
Fax: +852 2199 7988

**Alpha Energy,
Alpha Technologies Inc.**

3767 Alpha Way
Bellingham, WA 98226
United States
Tel: +1 360 647 2360
Fax: +1 360 671 4936

Alpha Technologies GmbH

Hansastraße 8
D-91126
Schwabach, Germany
Tel: +49 9122 79889 0
Fax: +49 9122 79889 21

Alphatec Ltd.

339 St. Andrews St.
Suite 101 Andrea Chambers
P.O. Box 56468
3307 Limassol, Cyprus
Tel: +357 25 375 675
Fax: +357 25 359 595

Alpha Innovations Brasil

Rua Manuel Augusto
de Alvarenga, 155
São Paulo, SP - Brasil
Tel: +55 11 2476 0150
Fax: +55 11 2476 0150

Alpha Industrial Power Inc.

1075 Satellite Blvd NW,
Suite 400
Suwanee, GA 30024
United States
Tel: +1 678 475 3995
Fax: +1 678 584 9259

Alpha Technologies S.A.

131 Boulevard de l'Europe
1301 Wavre
Belgium
Tel: +32 10 438 510
Fax: +32 10 438 213

Alpha TEK ooo

Khokhlovskiy Pereulok 16
Stroenie 1, Office 403
Moscow, 109028
Russia
Tel: +7 495 916 1854
Fax: +7 495 916 1349

Alphatec Baltic

S. Konarskio Street 49-201
Vilnius, LT-03123
Lithuania
Tel: +370 5 210 5291
Fax: +370 5 210 5292

For technical support, contact Alpha Technologies:
Canada and USA: 1-888-462-7487
International: +1-604-436-5547

Visit us at www.alpha.ca

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