Alpha Modular Switched Mode Rectifier System

Rectifier Models: Cordex CXRF 48-3.6kW
Cordex HP CXRF 48-4kW
Cordex HP CXRF 48-12kW

Installation and Operation Manual

Part #9400000-J0

Effective 01/2017

Modular Switched Mode Rectifier System
Models: Cordex CXRF HP 48-12kW
Cordex CXRF HP 48-4.0kW
Cordex CXRF 48-3.6kW

NOTE:

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

NOTE:

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

NOTE:

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For technical support, contact Alpha Technologies:

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1. Safety

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

1.1 Safety Symbols

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

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

NOTE:

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

CAUTION!

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

WARNING!

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

HOT!

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

1.2 General Safety

WARNING!

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

1.3 Mechanical Safety

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

1.4 Electrical Safety

WARNING!

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

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

WARNING!

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

- Do not work alone under hazardous conditions.
- A licensed electrician is required to install permanently wired equipment. Input voltages can range up to 240 Vac. Ensure that the utility power is disconnected and locked out before performing any installation or removal procedure.
- Ensure that no liquids or wet clothes come into contact with internal components.
- Hazardous electrically live parts inside this unit are energized from the batteries even when the AC input power is disconnected.

1.5 Battery Safety

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

WARNING!

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

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

2. Introduction

2.1 Scope of the Manual

This instruction manual explains the installation, interconnection, and operation of the Alpha Cordex 48-3.6kW, 48-4.0kW and 48-12kW modular switched mode rectifier systems.

2.2 Product Overview

A complete Cordex rectifier system consists of 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 208/220/240 Vac 50/60 Hz electrical service.

Rectifier power modules are “hot swappable”—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 shelf rectifier system is designed to operate with the Alpha Cordex System Controller (CXC). The CXC controller allows the user to configure, monitor and control the entire DC power system from its touch screen display including temperature compensation, auto equalization, remote access, dial out on alarm, battery diagnostics, as well as Web server and SNMP support for configuration and monitoring. Details of controller operation are provided in the current version software manual.

There are two options for the Alpha CXC

- External CXC models of the system controller communicate with the shelf via offset RJ-12 shelf connectors. The CXCR is mounted in a rack and the CXCP is (factory) mounted in a panel.
- The CXCM4, a 4 RU model designed for integrated use with the rectifier shelf, requires a connection interface (adapter) for modular installation and uses the shelf space of the leftmost rectifier position (as viewed from the front). This CXC model also has a touch screen display.

(a) (b) (c)

Figure 1 — (a) Cordex 48-3.6kW (b)Cordex 48-4kW (c) Cordex 48-12kW switched mode rectifier

2.3 Part Numbers and List Options

The product, options, and accessories can be ordered by using the following part numbers:

Description	List Option
Cordex 48-12kW rectifier power module	0100002-002
Basic module	*List 0
Fan, spare for Cordex 48-12kW	747-679-20
Fan filter, spare for Cordex 48-12kW	747-652-20-060
MOV assembly, spare for Cordex 48-12kWt	707-813-20
Cordex 48-3.6kW rectifier power module (pre-RoHS # 010-567-20)	010-600-20
Basic module	*List 0
Gray finish with blue silkscreen	*List 50
1 x 420Vac and 2 x 660Vac MOVs	List 81
Fan assembly, (spare for Cordex 48-3.6kW) (pre-RoHS # 747-212-20)	747-359-20
MOV assembly, (spare for Cordex 48-3.6kW)	707-374-20
Cordex 48-4kW rectifier power module	010-623-20
Basic module	*List 0
Gray finish with blue silkscreen	List 50
Black finish with gray silkscreen	*List 58
Fan assembly, spare for Cordex 48-4kW	747-679-20
Fan filter, spare for Cordex 48-12kW	747-652-20-060
MOV assembly, spare for Cordex 48-4kW	707-813-20
Cordex 48-3.6/4.0/12kW 23" shelf, flush or mid-mounting (pre-RoHS # 030-716-20)	030-801-20
Basic shelf, can be equipped with up to six Cordex 48-3.6kW or 48-4kW modules**	*List 0
Mid-mounting	*List 23
Flush mounting	List 25
DC output, bus bar adapters, 20" deep	List 81
DC output, bus bar adapters, 16" deep	List 82
AC input, dual three phase (no neutral required)	List 83
AC input, dual three phase (neutral required, Wye source)	List 84
AC input, single phase	*List 85
Kydex rear cover	List 89
Module blank	List 90
Cordex 48-3.6/4.0/12kW 19" shelf, flush mounting, AC input, single phase (pre-RoHS # 030-717-20)	030-802-20
Basic shelf, may be equipped with up to five Cordex 48-3.6kW or 48-4kW modules**	*List 0
Mid-mounting, 19" rack	List 19
Mid-mounting, 23" rack	List 23
DC output, bus bar adapters, 16" deep	List 82

Description	List Option
Kydex rear cover	List 89
Module blank	List 90
CXCM4 Cordex Controller, Modular, 4RU, takes the space of one rectifier (pre-RoHS # 018-574-20)	018-586-20
Basic unit	*List 0
48 V system [requires a connection interface (747-271-20) for modular installation]	List 2
Standard temperature (0 to 65ºC)	List 40
Extended temperature (-40 to 65ºC)	*List 42
Gray finish with blue silkscreen	*List 50
Charcoal finish with gray silkscreen	List 56
Expanded Flash memory	List 110
Analog input configuration: two voltage, four temperature, two current, no bi-voltage	List 121
Analog input configuration: two voltage, two temperature, four current, two bi-voltage	*List 125
CXCM4 connection interface, CXRF 48V, necessary for CXCM4 installation in the shelf	747-271-20
LVD override control and distribution alarm card	707-307-20

* Default option

3. Rectifier Features

3.1 Front Panel

The three LEDs on the rectifier front panel indicate status:

- AC ON (1)
- DC ON (2)
- Alarm (3)

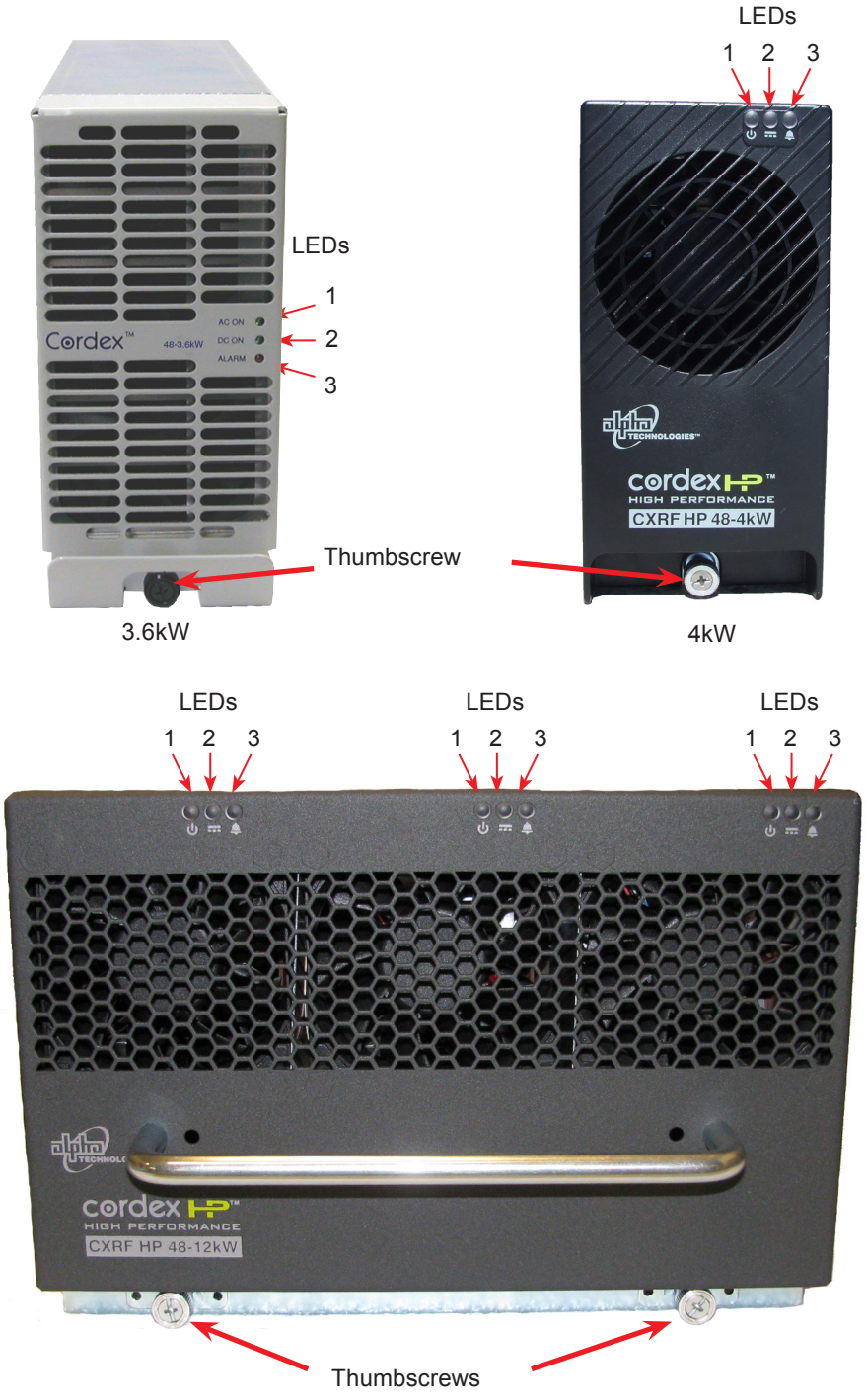

Figure 2 — Rectifier front panel LEDs

3.1.1 Rectifier LEDs

The front panel LEDs indicate:

- Rectifier status summary
- Rectifier software upgrade in progress
- Patterned response to Locate Module command

The rectifier status summary shows the rectifier alarm status, communication fail status, and rectifier on/off status.

AC ON (1)

The green LED is illuminated when the AC input voltage is within its allowable range. The LED flashes (~2Hz) when input voltage is outside the allowable range. The AC input voltage is invalid if the AC Mains Low or AC Mains High alarm is active. This LED extinguishes if the AC input fails.

DC ON (2)

The green LED is illuminated when the rectifier is delivering power to the load. The LED flashes when communication is lost. The LED extinguishes when the rectifier is off, e.g., when commanded via the CXC.

ALARM (3)

The red LED is illuminated during an active Module Fail alarm if the module is unable to source power because of the following conditions:

Output fuse blown	AC mains input fail	Module fail (ramp test fail) Local shutdown
High voltage (Over voltage protection (OVP)) shutdown	Thermal shutdown	
UPF fail	No output power	Fan (1 and 2) fail

The LED flashes (~2Hz) when a minor alarm is detected if the modules output capability has been reduced or a minor component failure is detected during the following conditions:

VAC meter fail	AC foldback	Remote equalize
Fan fail	Low output voltage	High output voltage
Current limit (programmable option)	Power limit (programmable option)	High temperature foldback
Temperature sense fail	Soft start operation	Communications lost

The LED remains extinguished in the absence of an alarm.

LED Activity During Software Upload

When a rectifier software upload is in progress, the LEDs flash in a distinct pattern to indicate new rectifier software is being transferred from the CXC. All three LEDs flash in a sequence lasting 1.5 seconds. When the last LED is lit, the sequence is repeated beginning at the first LED.

LED Activity During the ‘Locate Module’ Command from CXC

The ‘Locate Module’ command from the CXC, causes the target rectifier LEDs to flash in a ping-pong pattern that repeats every 2 seconds. Each LED illuminates sequentially and after the last LED illuminates, the sequence is reversed. When the first LED is illuminated, the pattern repeats. This effect makes it appear that the light bounces between the first and last LED.

Mechanical

A thumbscrew is provided to secure the rectifier into the shelf. During normal operation, the rectifier must be locked into position. A handle or grip on the front panel helps to remove the rectifier from the shelf. No special tools are required.

3.2 Rectifier Rear Panel

A single connector for shelf power and communications is located on the rear panel of each rectifier. The 12kW rectifier has three connectors.

3.3 True Module Fail Alarm

The power modules have a “true” fail alarm that 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 a current is detected. The output voltage ramping ceases upon detection of Current1. A minimum 2.5% load is required to avoid the Ramp Test Fail alarm. This can be provided with the parallel system battery. Activation of this alarm could indicate a failed module or a failed load.

For Cordex rectifier systems without batteries, or with a very light load below 2.5% of the rated output, the ramp test should be disabled to avoid nuisance alarms. The Ramp Test feature is enabled/disabled from the CXC menu: Rectifiers > Configure Settings.

3.4 Heat Dissipation

Each rectifier module is equipped with at least one front-mounted fan. The fan runs when temperatures are above 0°C (32°F). The air flow is front-to-rear with the exhaust air exiting at the back. The fan is a variable speed fan; the speed is determined by the heatsink temperature and the load.

3.5 Over Temperature Protection

Component failure or a cooling airflow blockage can result in an excessive increase in temperature. During over-temperature conditions, the rectifier limits the output power and the output current. If the temperature continues to increase, the rectifier is shutdown. The rectifier restarts automatically when the temperature returns to a safe level.

3.6 Wide AC Range

A minor alarm is generated when the AC input voltage drops below its allowable limit.

3.6.1 4.0kW and 12kW

The rectifier output power is reduced linearly between 187 Vac and 150 Vac to 67% of the rated output power. The unit delivers derated output power down to 90 Vac.

At 90 Vac, the module shuts down and does not restart until the AC voltage is greater than or equal to 150 Vac. The restart voltage depends on the load current. A reduced load current may allow a restart input voltage as low as 100 Vac.

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

3.6.2 3.6kW

Rectifier output power is reduced linearly between 176Vac and 150Vac to 75% of the rated output power (the unit will deliver derated output power down to 80Vac).

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

3.7 AC Inrush/Transient Suppression

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

3.8 Soft Start

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

3.9 Start Delay

The rectifier modules are equipped with a delay timer to stagger-start a series of modules to prevent excessive loading of generators upon start up. The built-in timer delays the switching on of the module by an interval (up to 120 seconds), which is set in the CXC. A minimum one-second delay is preset to allow the input capacitors to charge.

3.10 Current Limit/Short Circuit Protection

The current limit function determines the maximum output current limit of the rectifier module, regardless of the output voltage or power. The maximum output current is limited to a constant value down to a 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 currents.

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

3.11 Power Limiting

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

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

NOTE:

The current limiting feature overrides the power-limiting feature.

3.12 High Voltage Shutdown (HVSD)

This feature protects the load from over-voltages originating in the rectifiers. The offending rectifier module is shut down when a high output voltage condition occurs. The red Alarm (Module Fail) LED will illuminate. The module will restart automatically. However, if more than three over-voltage conditions occur within one minute, the module will latch off and remain shut down until it is reset by restarting the rectifier via the CXC.

3.13 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 during an AC power failure or input fuse failure.

4. Cordex System Controller (CXC)

4.1 CXCM4 Features

The CXCM4 (Cordex Controller, Modular, 4RU) 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 for Alpha power systems. It is equipped with a complete range of Cordex software features:

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

The main controller motherboard, behind the CXCM4 front panel, contains a microprocessor, memory, and other electronic components.

The CXCM4 includes a web server that provides easy set up and monitoring via an Internet connection that uses a 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 for CXCM4 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.

4.2 Controller Front Panel

Display

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

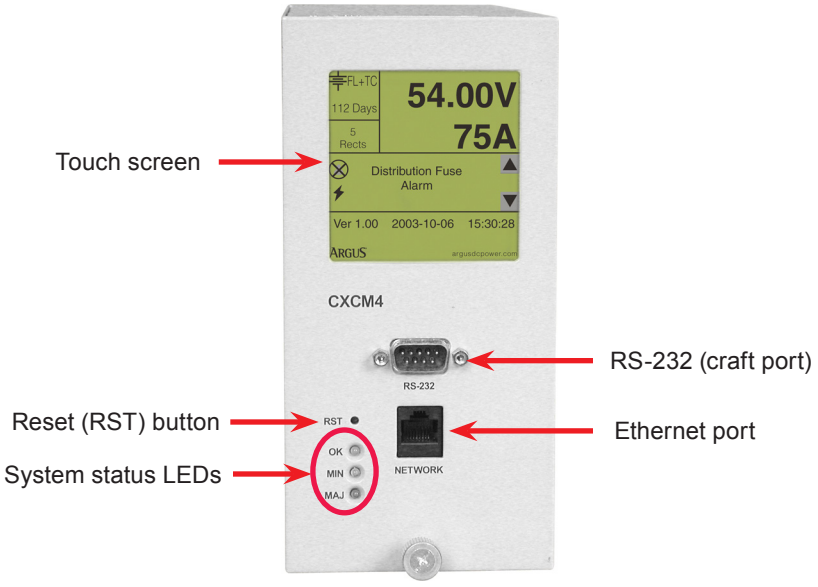

Figure 3 — Cordex CXCM4 model system controller front panel

LEDs

The three LEDs, located on the CXCM4 front panel, display the alarm status of the power system, CXCM4 progress and status during startup, and file transfers.

Alarm Conditions

The CXCM4 illuminates the LED that corresponds to the system alarm status. Each LED color corresponds to a specific alarm status (only one LED is illuminated at a time during alarm conditions.)

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

Progress and Status Indications

Base unit validation	All three LEDs are illuminated at the same time.
File transfer	The red LED is illuminated when recovering from an invalid firmware application.

Reset Button

A reset button is located on the front panel to restart the CXCM4 microprocessor. The display reappears approximately 15 seconds after pressing the reset button. Refer to the software manual for more information.

NOTE:

Always select the shutdown menu item on the LCD before pressing the reset button.

Ethernet Port

The RJ-45 jack and a standard network cable can be used to connect the CXCM4 to a user supplied network (TCP/IP secured by user) .

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

RS-232 Serial (Craft) Port

Local access to the CXCM4 is possible through the front panel RS-232 serial port with a null modem cable. The communication protocol also supports a web interface (Microsoft Internet Explorer 7 or greater). The remote screen display is an enhanced version of the CXC front panel display.

4.3 Rectifier Report from Controller Display

To display the installed rectifiers and their status, logon through the controller interface.

From the **Main Menu**, select **Rectifiers > Rectifier Report** to generate the report screen for all acquired modules in the system (Figure 4). Tapping on a rectifier in the screen generates a **Rectifier Locate** command that causes the rectifier's LEDs to flash briefly.

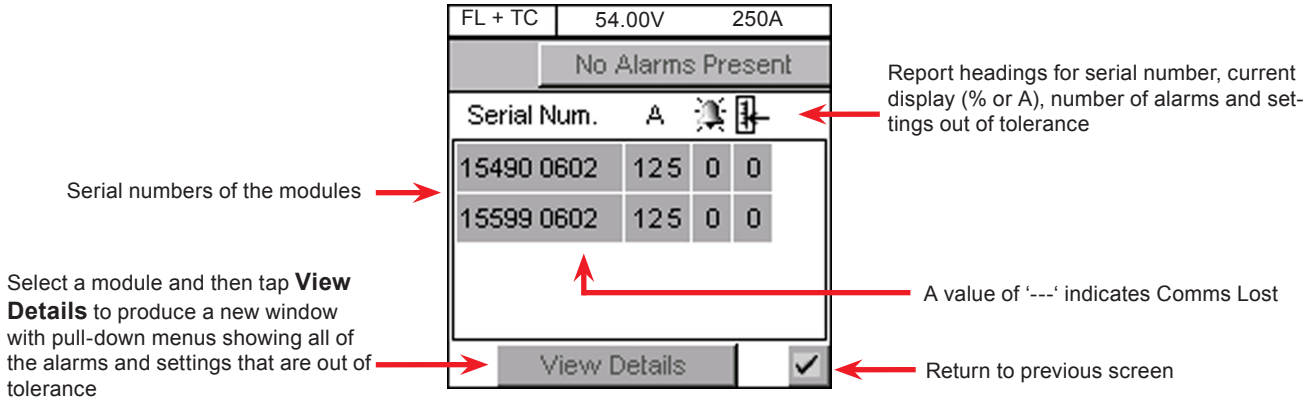

Figure 4 — Rectifier (or Converter) report screen

4.3.1 Rectifier Report for 12kW Rectifiers

The 12kW rectifier report contains three separate serial numbers. These serial numbers are derived from the top level serial number located on the rectifier label. For example, if the label serial number is N300020/1210, then the rectifier report screen displays three serial numbers 300021/1210, N300022/1210, and N300023/1210.

4.4 Analog Input Channels

The CXCM4 is equipped with analog input channels for voltage, current, and temperature.

Voltage Inputs

Two voltage input channels, V1 and V2, provide monitoring of discharge and charge voltage. The CXCM4 software is pre-configured to monitor V1 for load voltage and V2 for 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.

Current Inputs

The CXCM4 software is pre-configured to monitor load current using an external 50 mV current shunt.

Temperature Inputs

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

4.5 Digital Input Channels

The CXCM4 can accommodate up to four channels and can monitor digital alarm/control signals from rectifiers, converters, and other types of equipment.

4.6 Alarm and Control Output Relays

The CXCM4 contains eight Form-C digital alarm output relays that are used to extend alarms and to control external apparatus. Each internally generated alarm or control signal can be mapped to any one of the relays, or several signals can be mapped to just one relay or none at all.

4.6.1 LVD Control (External Option)

The LVD control functions can be hard-wired directly from the assigned relay output to an optional LVD override control and distribution alarm card. This protects against a load disconnect during a CXCM4 reset or replacement; when the controller is off-line for example. Operators can perform test and maintenance procedures on the CXCM4 without disturbing the load.

4.7 System Fail Alarm/Relay

The CXCM4 system fail alarm activates during 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, which means that the alarm will be extended even if the power to the unit is interrupted.

5. Inspection

5.1 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 International Safe Transit Association standards.

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

5.1.1 Returns for Service

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

NOTE:

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

5.2 Check for Damage

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

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

5.3 General Receipt of Shipment

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

5.3.1 Shelves

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

5.3.2 Rectifiers (Purchased Separately)

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

5.3.3 Miscellaneous Small Parts

Review the packing slip and bill of materials to determine the part number of the "configuration kits" included with your system.

Review the bill of materials to verify that all the small parts are included.

6. Installation

The equipment is suitable for installation in Network Telecommunication Facilities.

WARNING!

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

The following procedure is written for qualified personnel to install this product in a clean and dry environment. For the battery installation, refer primarily to the manufacturer's manual.

6.1 Safety Precautions

Refer to the Safety section near the front of this manual before beginning this installation.

6.2 Tools Required

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

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

6.3 Power System Assembly and Mounting

6.3.1 Shelf Preparation/Mounting

NOTE:

Mount the shelf in a clean and dry environment. Allow at least 1.75” of free space in front of the unit for unrestricted cooling airflow. Sufficient free space must be provided at the front and rear of the power system. This is to meet the cooling requirements of the rectifiers and to allow easy access to the power system components.

The 19” shelf has been designed for flush mounting in a standard EIA relay rack. Options for mid-mounting in a 19” or 23” rack are also available. The 23” shelf can be flush or mid-mounted in a 23” relay rack.

Mounting brackets accommodate either 1" or 1-3/4" rack spacing. Mount the shelf to the rack using at least two #12 – 24 x 1/2" screws in each bracket. Use Philips-type screws and screwdriver to eliminate the possibility of slippage and scratching of the unit’s exterior.

An electrical conducting path must exist between the shelf chassis and the metalwork of the enclosure in which it is mounted or a grounding conductor. This electrical continuity requirement can be met by the use of thread-forming type unit mounting screws and star washers that remove any paint or non-conductive coatings and establish metal-to-metal contact.

6.3.2 Rack Mounted Systems

Attach the power system to the customer-provided relay rack using the mounting screws and star washers. Ensure a proper electrical bond between the system chassis and the relay rack.

6.3.3 Floor Mounted Systems

Secure the system to a concrete floor using either heavy duty anchors (½" x 2½"), or for wooden floors, heavy-duty lag screws (5/8" x 2½"). Use appropriately sized flat washers.

If required, use isolating kits to isolate system from the floor.

Secure the relay rack to the overhead cable tray. Alpha does not supply the mechanical details necessary for overhead support.

7. Wiring

This chapter provides cabling details and notes on cable sizing for DC applications using the Cordex 48-3.6kW, 4.0kW and 12kW modular switched mode rectifier systems.

Refer to the Safety section on page 5 for safety precautions.

WARNING!

Ensure that the power at the AC service panel is off is switched off. Remove battery line fuses or connections before attempting work on the wiring. Use a voltmeter to verify the absence of a voltage. Clearly mark the correct polarity of the battery leads before starting work on DC connections.

7.1 Grounding

This power system is suitable for installation as part of a Common Bonding Network (CBN) and is intended to be used in a DC-C configuration (common DC return).

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

The cable from the power system to the MGB or FGB must be sized to provide sufficient ampacity to clear the largest fuse or breaker on the power system, excluding the battery protection fuse or circuit breaker. 750 MCM is recommended. This is the minimum requirement. Other factors including the length of the cable and special grounding requirements of the load must also be factored in. The insulated cable must be equipped with two-hole crimp type lugs and must not have any tight bends or kinks.

Table A — Typical ground reference conductor selection

Power system ampacity	Ground reference conductor size
< 30A	#10
30 – 100A	#6-2
100 – 400A	0000
400 – 800A	350 MCM
> 800A	750 MCM

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

7.2 AC Feeder Protection/Sizing

To maximize system reliability, each power module should be fed from a dedicated protection feeder breaker located at the AC distribution panel. The feeder breaker can also act as the disconnect device for the connected module. Refer to the specifications for Alpha recommendations.

7.3 AC Input Connections

CAUTION!

To minimize EMI disturbances, route the AC input wires in flexible or rigid conduit and located as far away as possible from the DC power wires.

WARNING!

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

1. Ensure that all modules are removed from the shelf.
2. Remove the covers (two places) from the rear of the shelf to expose the AC input terminal blocks, L1 and L2 for each rectifier. (Refer to the customer connections drawing towards the end of the manual for AC terminal block location.) Each terminal pair corresponds to an individual power module as marked.
3. The wire way is designed for two customer-supplied, 1" conduit fittings for the AC supplies located on each side of the shelf. Attach the conduit retainers to the wire way hole(s) and route the AC cables through them.
4. Secure the wires to the AC input and chassis ground terminals.
5. Tighten the cable connector to the AC cable (conduit similar).
6. Replace rear cover(s) once all connections have been completed.

7.4 DC Output Connections

WARNING!

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

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

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

7.4.1 Cable

Terminate cable leads with appropriate crimp lugs for 3/8" holes on 1" centers.

Secure the positive and negative to the shelf output post of the correct polarity; i.e., +Vcable to +Vpost. 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.

7.4.2 Bus Bar

Do not complete the final live connections to the battery. Leave open and insulate the final connections or remove the battery fuses. Switch off the battery contacts if used. Refer to the system startup procedure before connecting the batteries online.

Bus bar adapters may be factory-installed, for the option selected, to easily accommodate direct connections to customers' vertical bus bars.

Secure the positive and negative to the shelf output post of the correct polarity; i.e., +Vcable to +Vpost. 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 towards the end of this manual.

7.5 CAN Serial Ports (Rectifier Shelf)

Two CAN Serial ports (modular jacks with offset latches), are provided for communications with Alpha' Cordex rectifiers and other CAN-enabled equipment. These are located on the left side of the rectifier shelf as viewed from the front.

Daisy-chain from shelf to shelf (CAN OUT of one shelf to CAN IN of another) and ensure that only the last shelf is terminated.

7.5.1 CAN Termination

A jumper, or switch depending on your configuration, allows setting 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. Access the termination selection inside the shelf by removing the left most rectifier #1 (MDL 1).

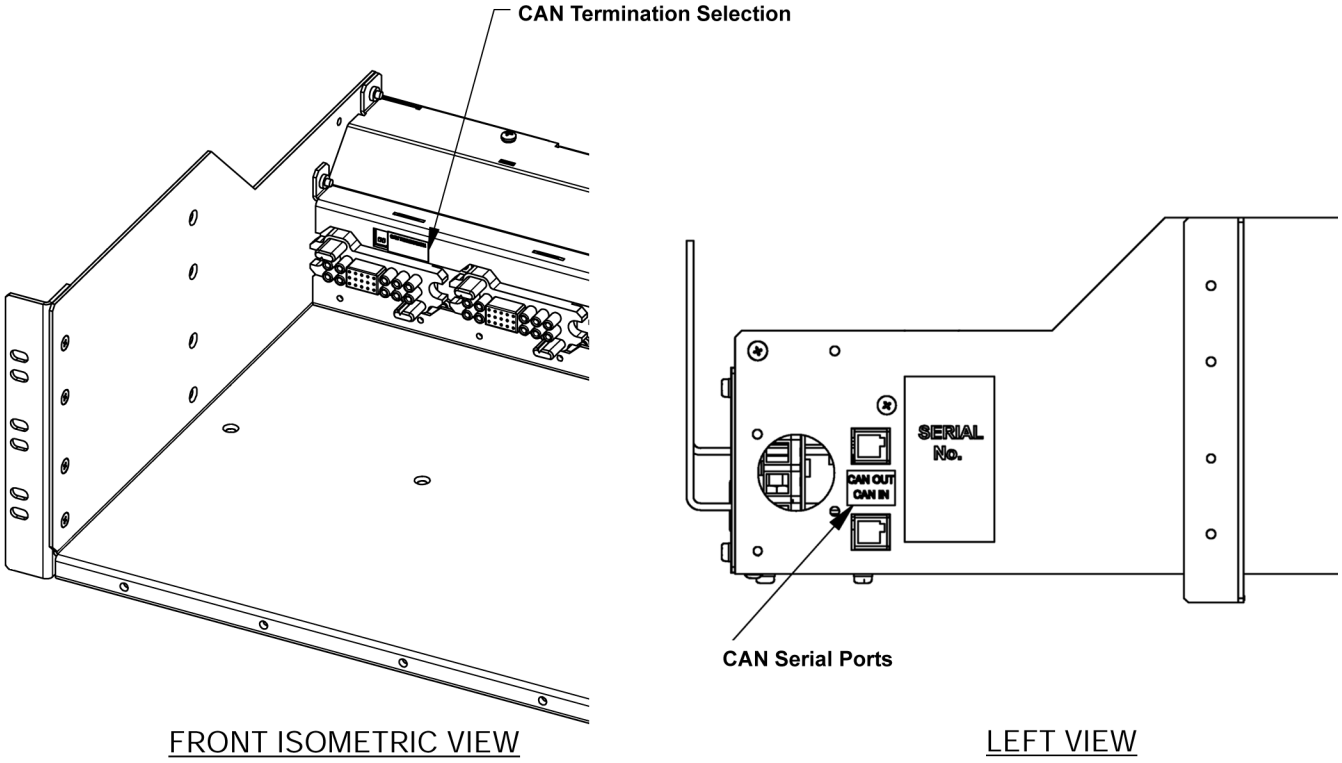

Figure 5 — CAN termination selection and serial ports

7.6 Inserting the CXCM4 Module

NOTE:

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

1. Insert by placing the controller on the shelf bottom and sliding the module into the CXCM4 connection interface (inside of the shelf, see drawing 747-271-08).
2. Apply pressure on the metal faceplate to engage the rear connectors.
3. Tighten the screw on the bottom of the faceplate to secure the module to the shelf.

7.7 Signal Wiring Connections for CXCM4

The CXCM4 (specifications 018-586-B1) requires an adapter for modular installation (drawing 747-271-08).

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).

CAUTION!

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

7.7.1 Relay Outputs

Terminals provide contacts for extending various alarm or control signals. Each relay output can be wired for NO or NC operation during an alarm or control condition (Figure 12).

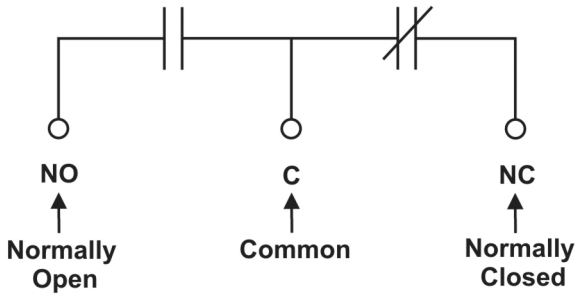

Figure 6 — Relay connections in the de-energized state

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.

System Fail Relay

The System Fail output relay (K0) is fail-safe and will de-energize during an alarm condition.

Low Voltage Disconnect (LVD) Control

The LVD control functions can be hard wired directly from the assigned relay output to an optional LVD override control and distribution alarm card. This safety measure protects against load disconnect during CXCM4 reset or replacement (see Section 10.3), e.g. when the controller is off-line. Operators can also perform test and maintenance procedures on the CXCM4 without disturbing the load. See the Controls Menu defaults in the CXC Software manual.

7.7.2 Digital Inputs

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

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. For example, the positive input for +24 V systems. The other input terminal is wired to the Ground (common) of the system through a dry contact relay usually located on the equipment requiring monitoring. This method allows the digital input to receive or not receive a Ground signal on an alarm.

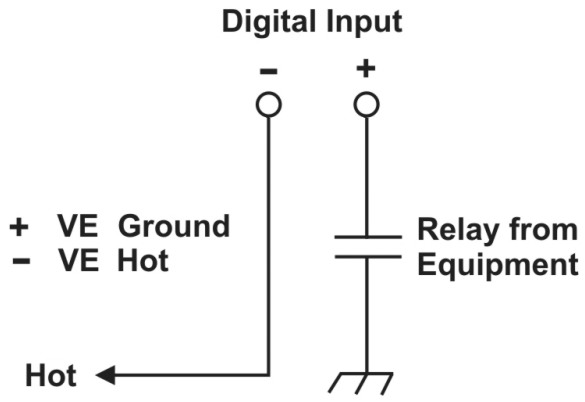

Figure 7 — Digital input connection method

Voltage level definitions for digital inputs

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

7.7.3 Analog Inputs

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 Battery -48V should be connected at the battery system voltage terminal for CXC 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.

Voltage

Voltage Input #1 (load voltage per CXC software) terminals (V1) 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 (battery voltage per CXC software) is wired internally (V2) 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).

Temperature Sensing

Temperature Probe input channels provide connections for temperature sensors. A voltage is supplied to these terminals for sensor measurements.

Current

Current Input #1 (discharge or load current per CXC software) terminals (I1) are available for customer connection as required.

Current Input #2 (charge or battery current per CXC software) terminals (I2) are available for customer connection as required.

7.8 Network Connection and Remote Communications via CXC

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

Some standard scenarios are described below:

7.8.1 Ethernet Port for Network Connection (Standard Network Cable)

The Ethernet port is designed for CXC connection to a user supplied network (TCP/IP secured by user) via a front panel RJ-45 jack. Connect to the Cordex shelf using a standard network cable.

7.8.2 Ethernet Port for Local Connection (Crossover Cable)

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

8. System Startup

Visually inspect the installation thoroughly.

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

8.1 Check System Connections

1. Make sure that the AC input power is switched off, the batteries are disconnected, and all the power modules are removed from the shelf.
2. Triple-check the polarity of all connections.

8.2 Verify AC and Power the Rectifier Shelf

NOTE:

Insert the first module into the front left most position using the side of the shelf (or the optional shelf-mounted controller) as a guide. Subsequent modules can be inserted using the previous module as a guide.

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

1. Install one power module.
   a. Place the rectifier module on the shelf bottom and slide the module into the rear connector (inside the shelf).
   b. Apply pressure on the module handle to engage the rear connector in the shelf receptacle.
   c. Tighten the screw on the bottom of the faceplate to secure the module to the shelf.
2. Verify that the AC input voltage is correct and switch on the corresponding feeder breaker. The power module **AC ON** LED illuminates after a preset start delay. (See 3.1.1 for a description of the LEDs.)
3. Using the CXC, test the functionality of various module alarms and controls.

8.3 Triple Check Battery Polarity and Connections

1. Use a voltmeter to verify that the battery polarity is correct. Ensure that no cells or batteries are reversed.
2. Connect the batteries to the output of the system.
3. Install the remaining power modules.
4. In the adjustments menu of the CXC, set the float and equalize voltages to the levels specified by the battery manufacturer.
5. Using the CXC, test the functionality of the various module alarms and controls. Perform a load test with the system using a resistive load box.
6. Enable the temperature compensation (temp comp) feature in the batteries menu. Program the settings for slope and breakpoints (upper and lower) according to the specific batteries used.

8.4 CXC Reset

The reset button located on the front panel of the optional CXC is used to restart the microprocessor. When pressed momentarily, the unit beeps twice then resets. The front-panel LEDs illuminate temporarily but extinguish after the system has finished its 15-second self-test.

9. Rectifier States, Modes and Factory Defaults

9.1 Main Rectifier States

The rectifier operation can be broken up into five main states:

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

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

9.1.1 Off State

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

When the rectifier is in the Off state, the DC-DC converter is switched off and the CXC is monitoring its inputs for the proper conditions to begin the start up sequence.

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

9.1.2 Start Delay State

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

When the rectifier is in the Start Delay state, the CXC continues to monitor its inputs.

After the Start Delay state, the rectifier transitions to the Soft Start state.

9.1.3 Soft Start State

When the rectifier is in the Soft Start state, it is switched on. The output voltage and output current are gradually increased. If a load is present, the rectifier begins to source power. This gradual increase reduces the instantaneous load on the AC source.

When the voltage and current limit ramp ups have finished, the rectifier transitions to the Normal Operation state.

9.1.4 Normal Operation State

During the Normal Operation state, the rectifier performs all of the rectifier functions and features.

From the Normal Operation state, the only valid transition is to the Switching Off state. This transition happens if the rectifier is required to shut down.

9.1.5 Switching Off State

The Switching Off state is entered because a short delay is required before the rectifier actually switches off. The short delay takes care of any initialization requirements.

When this short delay has elapsed, the rectifier transitions to the Off state.

9.2 Main Rectifier Modes

In addition to the main rectifier states, there is a set of main rectifier modes. These modes can be divided into two categories, the output voltage mode and the output current/power mode.

9.2.1 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, for example, if the rectifier has reached the current limit.

Table B lists four output voltage modes and a description of when they are active.

Table B — Output voltage modes

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.

9.2.2 Output Current/Power Modes

These modes directly affect the output current and power. Table C lists the four output current/power modes and a description of when they are active.

Table C — Output current/power modes

Output Voltage Modes	Active when…
Temperature foldback mode	Output current and power limit have been reduced because a high temperature has been detected on the heatsink or internal ambient temperature sensor.
AC foldback mode	Output current and power limits have been reduced because the AC input voltage is low. 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.

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9.3 Factory Ranges and Defaults

Table D shows the rectifier settings/ranges/defaults. Changes are made through the CXC interface.

Table D — Rectifier factory ranges and defaults

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

*The OVP cannot be set below the present system/FL/EQ/BT voltage setting or the safe mode voltage of 51.0 V.

10. Maintenance

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

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

WARNING!

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

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

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

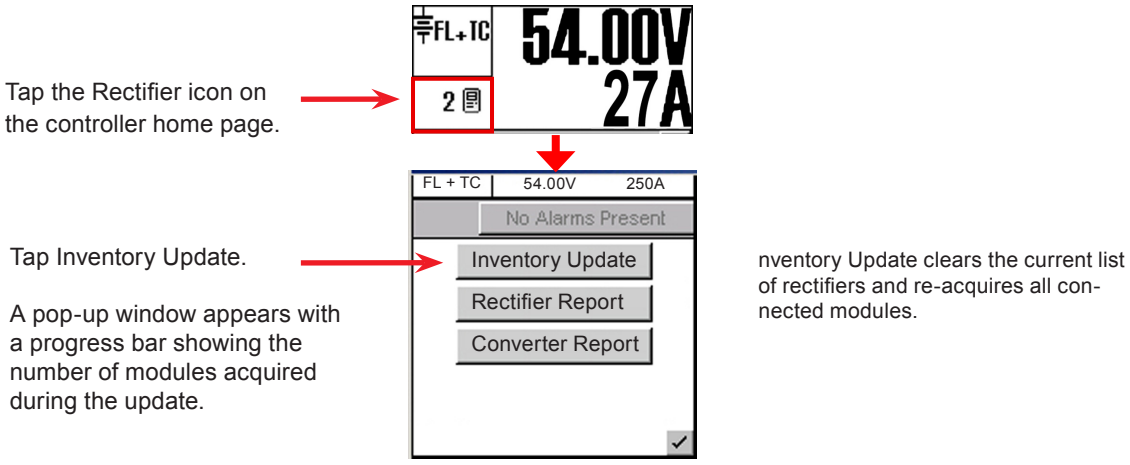
Table E — Sample maintenance log

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

10.2 Replacing a Rectifier Module

The Cordex Converter (CXD) Rectifier (CXR) series modules are plug and play. When a rectifier module is added to the system, the CXC will detect and update the inventory automatically. Replacing an installed rectifier requires a manual Inventory Update at the controller to clear the removed rectifier from its current list of rectifiers.

1. To remove a module, loosen the screw on the bottom of the faceplate. Grasp the handle and pull it out, sliding the module away from the rear connector and out of the shelf.
2. At the controller LCD initiate an Inventory Update as follows (or **Main Menu > Rectifiers > Inventory Update** for the web interface):



3. Place the new rectifier module on the shelf bottom and slide the module into the rear connector (inside the shelf). Apply pressure on the module handle to engage the rear connector in the shelf receptacle.
4. Tighten the screw on the bottom of the faceplate to secure the module to the shelf.

10.3 Replacing the CXCM4 Module

WARNING!

Before removing a CXCM4 from a live system, an external LVD override is required to avoid a disruption of service.

Figure 8 — LVD override control and distribution alarm card

The LVD Control functions can be hardwired directly from the assigned relay output to an optional LVD override control and distribution alarm card (707-307-20).

1. Place the LVD Control switch to the **OVERRIDE IN** position to keep the LVD contactor engaged.
2. To remove a module, loosen the screw on the bottom of the faceplate. Slide the module away from the rear connectors and out of the shelf.
3. Place the new controller on the shelf bottom and slide the module into the CXCM4 connection interface (inside of the shelf, see drawing 747-271-08). Do not force the module into position if it does not seat properly. All modules are keyed to ensure that the correct module (voltage/polarity) type is used.
4. Apply pressure on the metal faceplate to engage the rear connectors.
5. Tighten the screw on the bottom of the faceplate to secure the module to the shelf.

WARNING!

Do not leave the switch in the OVERRIDE IN position. Doing so may result in a complete discharge of the batteries during a power failure.

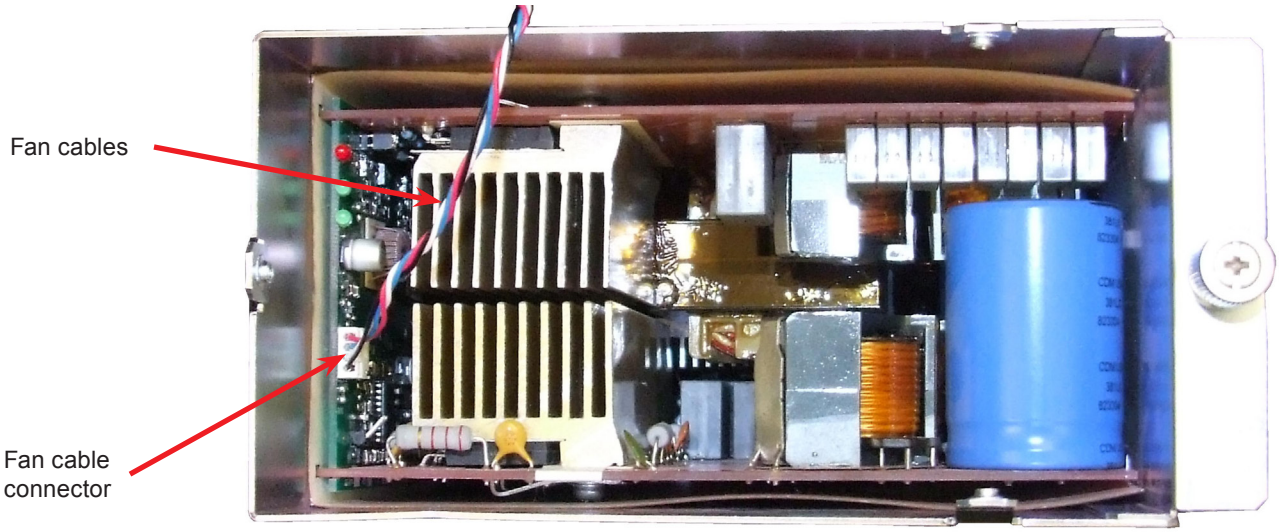
6. To allow the CXC to resume automatic control of the LVD contactor, check that the green **AUTO IN** LED is illuminated confirming that the CXC will keep the LVD contactor engaged.
7. Switch the LVD control switch back to the **AUTO IN** position.

10.4 Fan and Fan Filter Replacement

10.4.1 4.0kW Rectifier Fan and Filter Replacement

Refer to "2.3 Part Numbers and List Options" on page 8 for the part number of the replacement fan assembly and filter.

1. Switch off the unit and unscrew the front fastener that secures the power module to the shelf.
2. Slide the module 10 cm (4") out of the shelf and wait ten minutes for the module capacitors to discharge.
3. Remove the three screws that secure the front panel to the module chassis. Slide the front panel out.



4. Disconnect the fan cables from the module by pulling out the fan cable connector.
5. Remove the two screws that secure the fan to the front panel.
6. Note the direction of the airflow and remove the fan from the front panel.

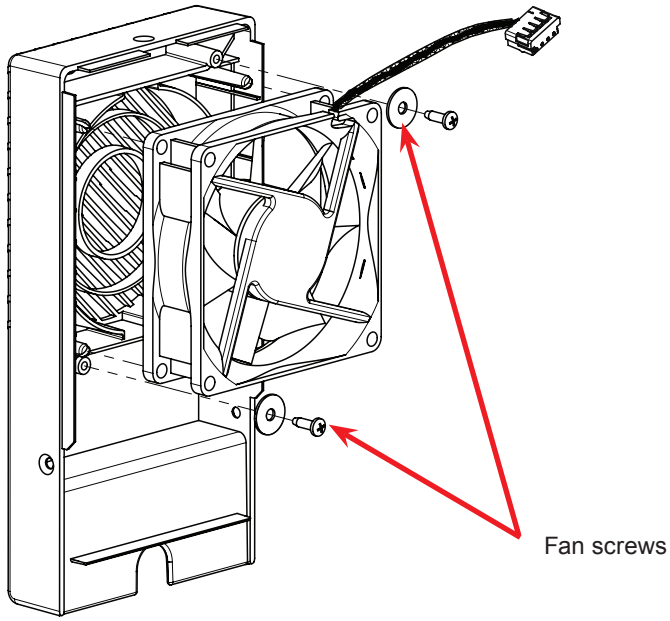


Figure 9 — 4kW rectifier fan removal

7. Inspect the fan filter and replace if necessary.

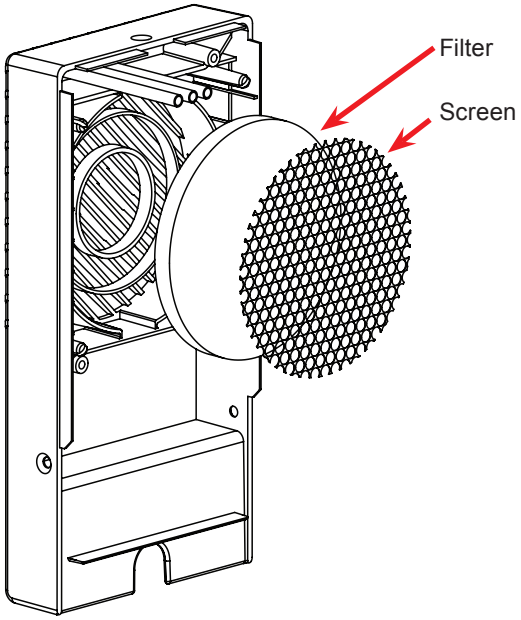


Figure 10 — 4kW rectifier fan filter removal

8. Install the replacement fan following the preceding steps in reverse order.

10.4.2 12kW Rectifier Fan Replacement

Refer to "2.3 Part Numbers and List Options" on page 8 for the part number of the replacement fan.

1. Switch off the unit and unscrew the front fastener that secures the power module to the shelf.
2. Remove the eight screws shown in Figure 11

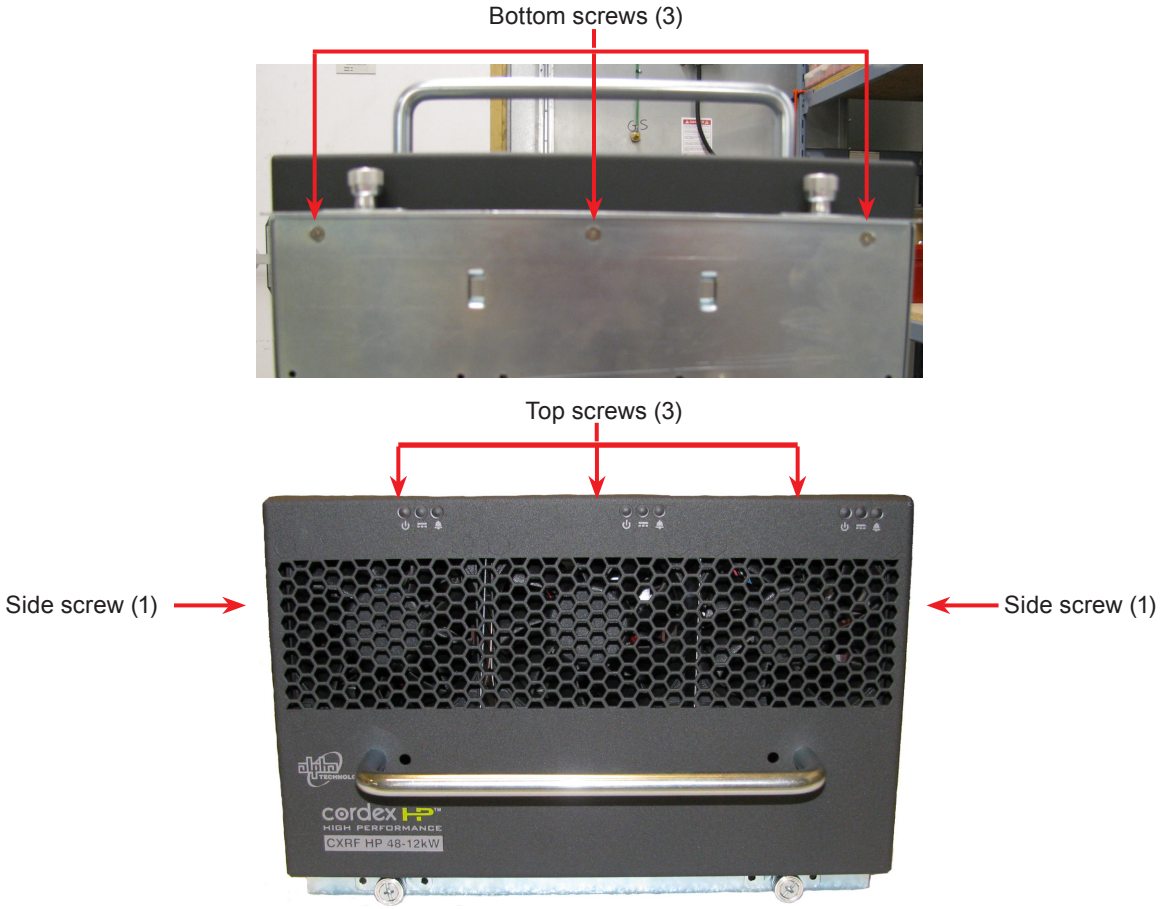


Figure 11 — Fan assembly - screw removal

3. Disconnect the fan cables and remove the fan assembly from the rectifier.

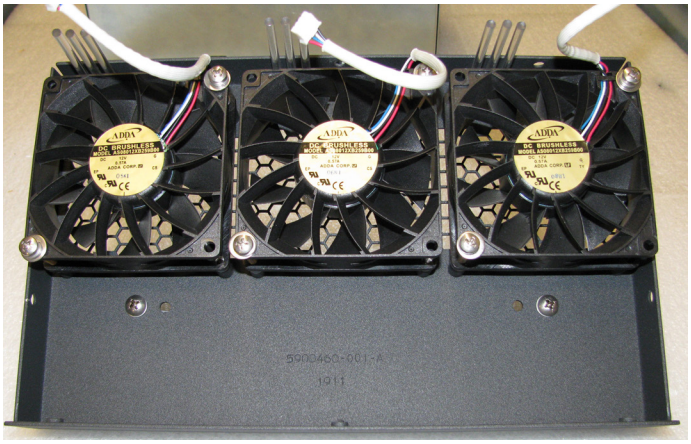
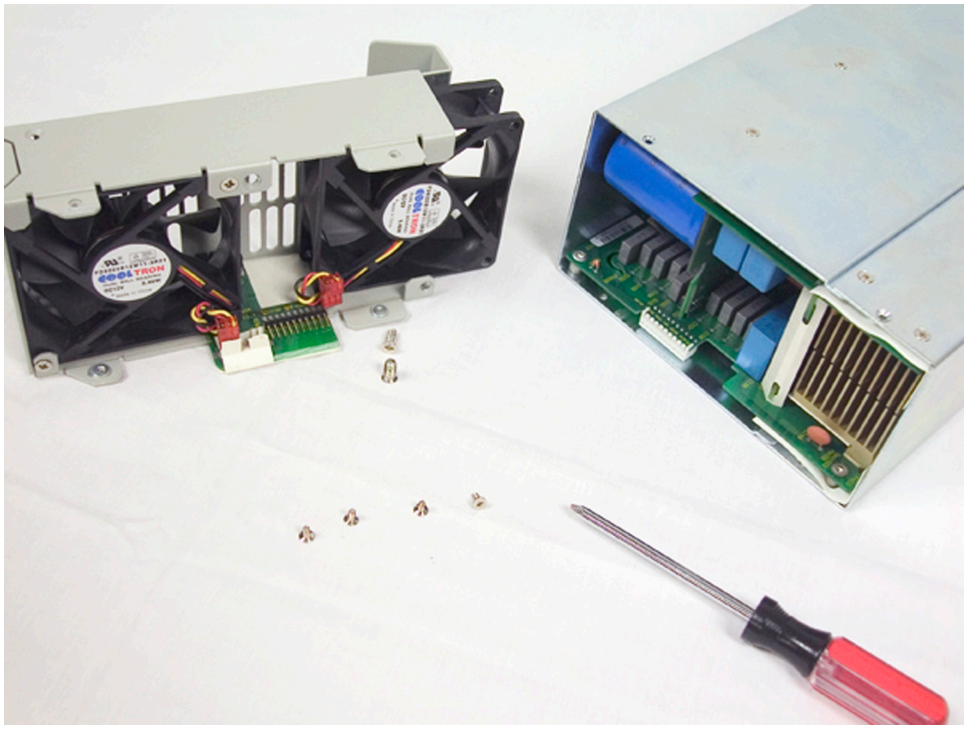


Figure 12 — Fan assembly

4. Remove the two screws that secure the failed fan to the panel.
5. Note the direction of the airflow and remove the fan.
6. Inspect the fan filter and replace if necessary.- see Figure 10
7. Install the replacement fans following the preceding steps in reverse order.

10.4.3 3.6kW Rectifier Fan or Filter Replacement

Refer to "2.3 Part Numbers and List Options" on page 8 for the part number of the replacement fan.



1. Shut off the unit and unscrew the front fastener that secures the power module to the shelf.
2. Slide the module 10 cm (4") out of the shelf and wait two minutes for module capacitors to discharge.
3. Remove the four screws (two each side) that secure the front panel to the module chassis.
4. Slide the front panel out.
5. Disconnect the fan power lead wires (one set per fan) and front panel ribbon cable from the module.
6. Remove the screws that secure the fans to the front panel.
7. Note the direction of airflow and remove the fans (or filters) from the front panel.
8. Install the replacement fans (or filters) following the preceding steps in reverse order.

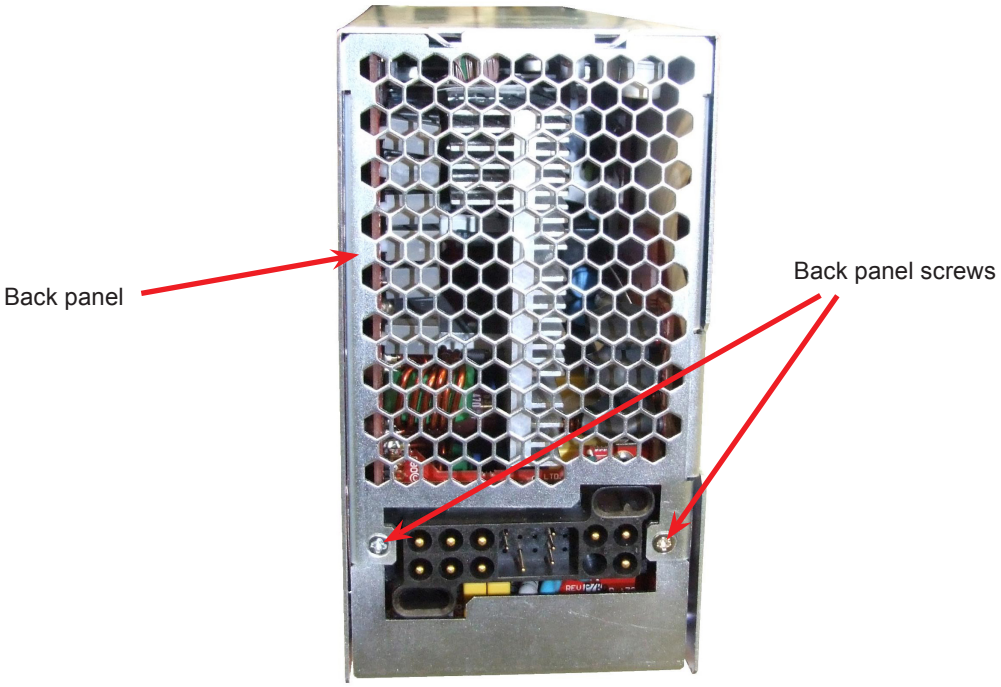
10.5 MOV Replacement

10.5.1 4.0kW Rectifier MOV Replacement

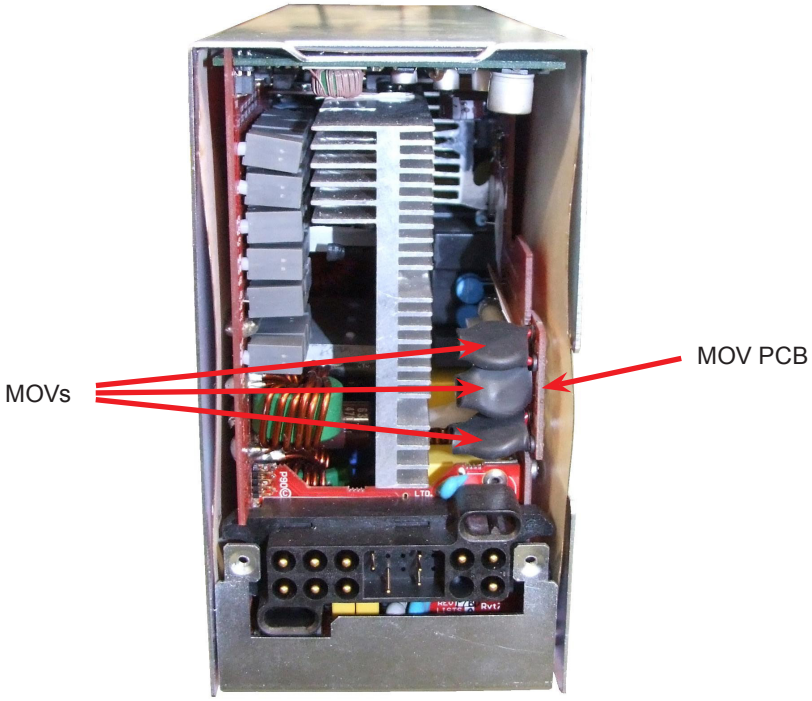
Refer to "2.3 Part Numbers and List Options" on page 8 for the part number of the replacement MOV.

The MOVs (metal oxide varistor) are used to protect the power modules from power line surges and surges caused by lightning strikes. High capacity surges may permanently damage MOVs but they are easily replaced in the field using the following procedure:

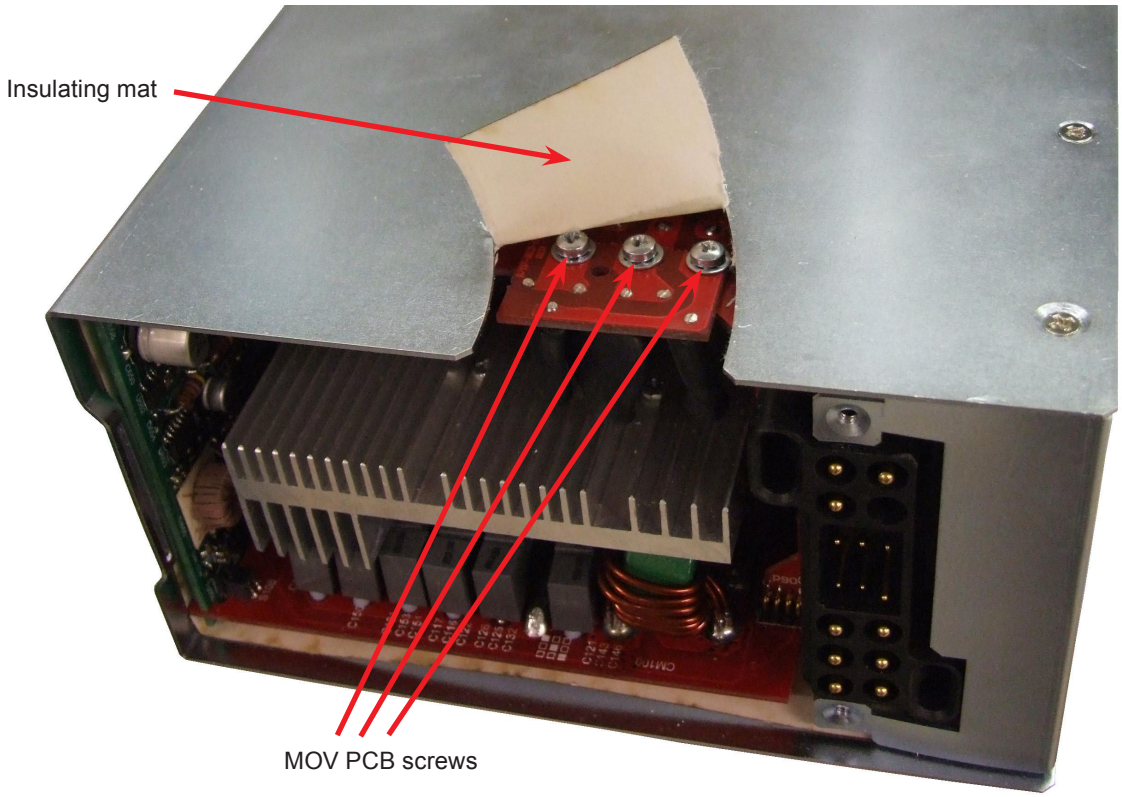
1. Shut off the unit and unscrew the front fastener that secures the power module to the shelf.
2. Slide the module 10 cm (4") out of the shelf and wait ten minutes for the module capacitors to discharge.



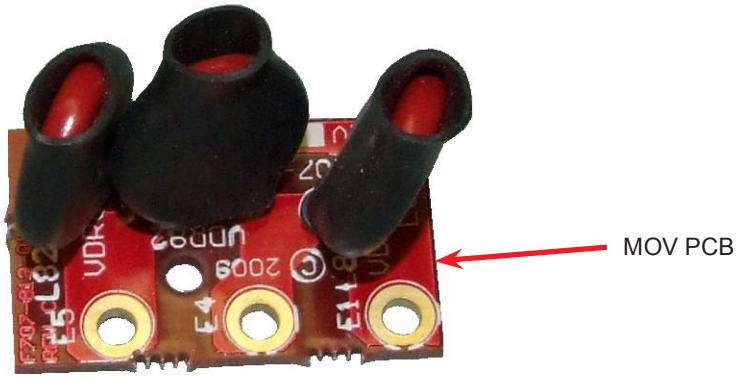
3. Remove the two screws that secure the back panel to the module.



4. Remove the cover and find the MOV printed circuit board (PCB).



5. Fold the insulating mat out of the way and remove the three screws that secure the MOV PCB to the module.



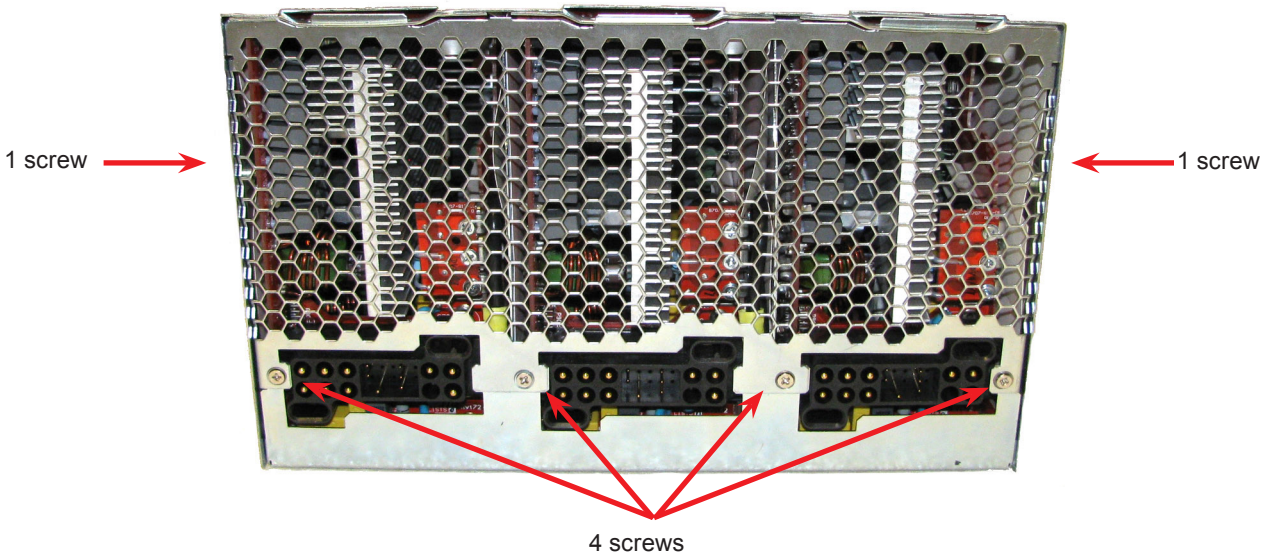
6. Remove the MOV PCB.
7. Decontaminate the area and unit with a flux remover or similar cleaning compound. This is done to remove any metallic particles or carbon that may have been deposited when the MOV failed.
8. Install the replacement MOV PCB following the preceding steps in reverse order.

10.5.2 12kW Rectifier MOV Replacement

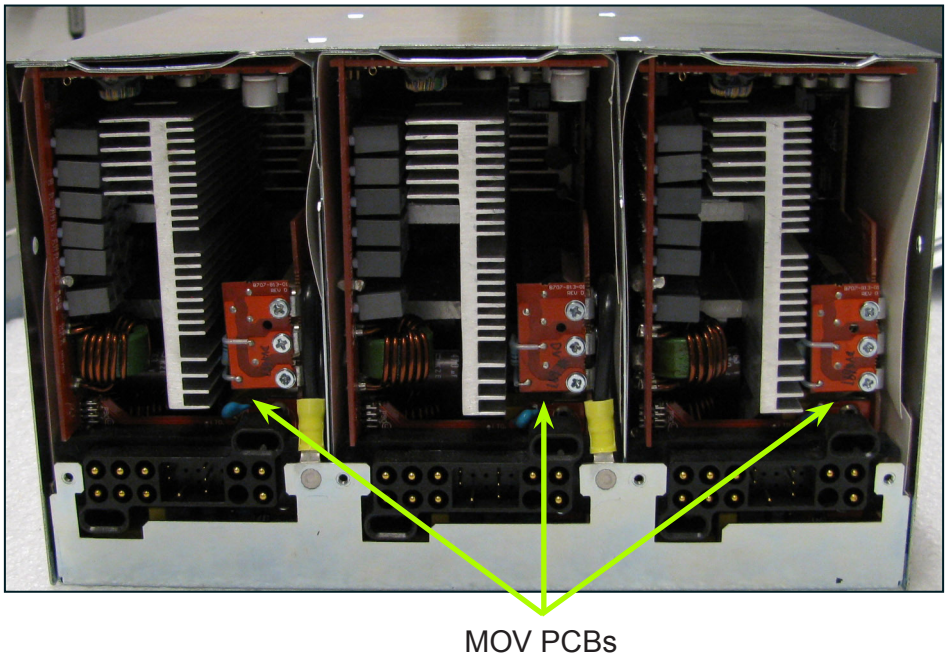
Refer to "2.3 Part Numbers and List Options" on page 8 for the part number of the replacement MOV.

The MOVs (metal oxide varistor) are used to protect the power modules from power line surges and surges caused by lightning strikes. High capacity surges may permanently damage MOVs but they are easily replaced in the field using the following procedure:

1. Shut off the unit and unscrew the front fastener that secures the 12kW power module to the shelf.
2. Slide the module out of the shelf and wait ten minutes for the module capacitors to discharge.
3. Remove the six screws that secure the back panel to the module.
4. Slide the back panel downwards to release it from the top of the chassis.



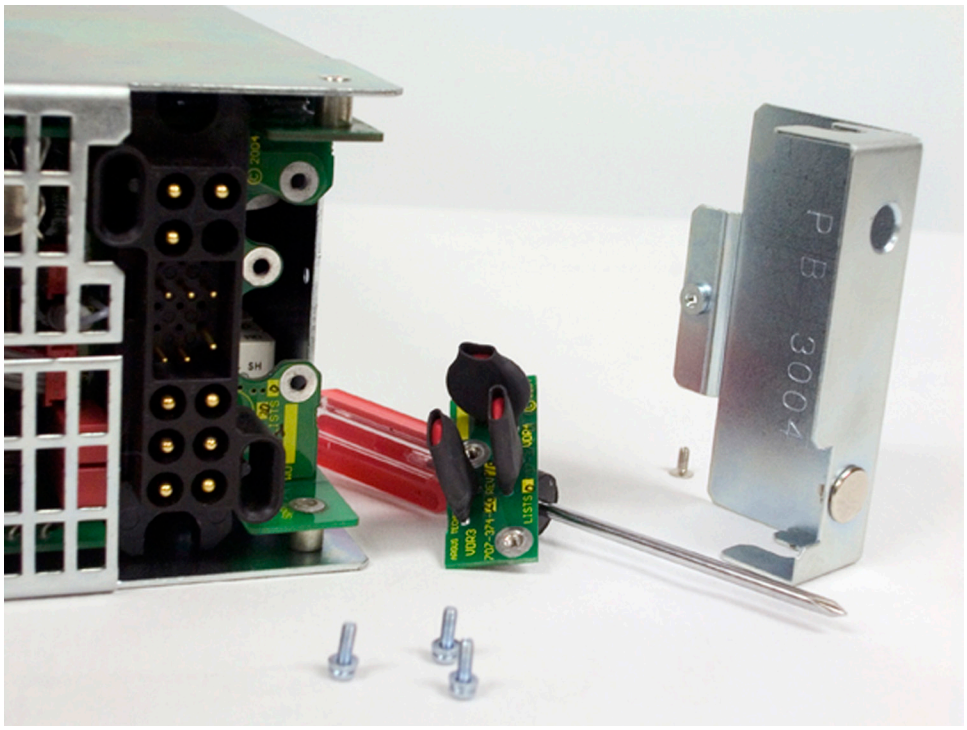
5. Unscrew and remove the defective MOV board.



6. Decontaminate the area and unit with a flux remover or similar cleaning compound. This is done to remove any metallic particles or carbon that may have been deposited when the MOV failed.
7. Install the replacement MOV PCB following the preceding steps in reverse order.

10.5.3 3.6kW Rectifier MOV Replacement

Refer to "2.3 Part Numbers and List Options" on page 8 for the part number of the replacement MOV.



The MOVs (metal oxide varistor) are used to protect the power modules from power line surges and the surges caused by lightning strikes. High capacity surges may permanently damage MOVs but they are easily replaced in the field using the following procedure:

1. Shut off the unit and unscrew the front fastener that secures the power module to the shelf.
2. Slide the module 10 cm (4") out of the shelf and wait two minutes for module capacitors to discharge.
3. Turn the module around to face the back of the unit and remove the one screw (module bottom toward the rear) securing the MOV cover.
4. Remove the cover and locate the MOV printed circuit board (PCB).
5. Remove the three screws that secure the MOV PCB.
6. Decontaminate the area and unit with flux remover or a similar cleaning compound. This is to remove any metallic particles or carbon, which may have been deposited when the MOV failed.
7. Install the replacement MOV PCB following the preceding steps in reverse order.

11. Acronyms and Definitions

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

12. Warranty and Service Information

12.1 Technical Support

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

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

12.2 Warranty Statement

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

12.3 Product Warranty

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

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

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

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

12.4 Battery Warranty

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

12.5 Warranty Claims

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

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

12.6 Service Information

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

13. Certification

About CSA and NRTL

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

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

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

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

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

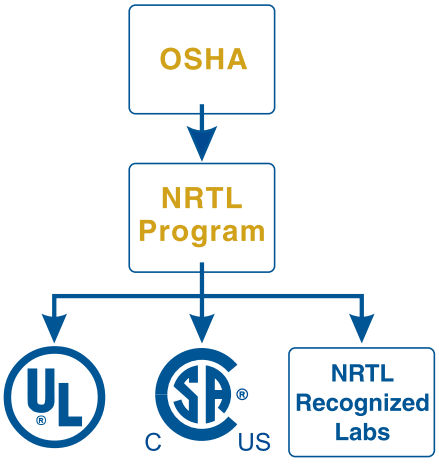
Only Underwriters Laboratories may grant a licence for the use of this mark, which indicates compliance with both Canadian and US requirements. (3)

NRTLs capabilities

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

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

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



Governance of NRTL

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

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

Specifications for Alpha Switched Mode Rectifier Cordex 48-4kW

Power Module Output

Voltage:	44 to 60 Vdc within rated limits
Current:	74 A @ 54 Vdc nominal (83 A maximum @ 48 V)
Maximum Power:	4000 W continuous/module
Static Load Regulation:	Better than ±0.5% for any load change within rated limits
Dynamic Load Regulation:	Better than ±2% for 40% - 90% load step (output shall recover to static limits within 10 ms)
Static Line Regulation:	Better than ±0.1% for any change in input voltage within rated limits
Hold-up Time:	>10 ms
Time Stability:	≤ 0.5% per year
Temperature Stability:	< 300 ppm/°C over the operating range
Heat Dissipation:	< 1415 BTU per hour
Electrical Noise:	< 38 dBrnC (voice band) < 20 mVrms 10 kHz to 10 MHz (wideband) < 150 mVp-p 10 kHz to 100 MHz < 2 mV (psophometric)
Acoustic Noise:	< 60 dBa @ 1 m (3 ft) @ 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.

To comply with regulations in terms of radiated emissions, the CAN communication cable shall be wound in 3 loops around a ferrite p/n 417-401-10/19 (Fair-Rite p/n 0443167251), placed close to the socket in the shelf.

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

Power Module Input

Voltage:	208, 220, 230, 240, 277 Vac nominal
Operational Range:	187 to 320 Vac
Extended Operation:	Low: 187 to 90 Vac (derated power)
Frequency:	45 to 66 Hz
Current:	17.5 A @ 240 Vac 21.5 A @ 208 Vac 23.5 A @ 176 Vac (maximum)
Recommended Feeder Breaker	
Single Phase:	30 A, #10 AWG
Three Phase:	50 A, #6 AWG delta connection 30 A, #10 AWG wye connection
Power Factor:	> 0.99 at nominal conditions and 50-100% load
Protection:	10 kA-interrupting capacity fuses in active and neutral lines
Efficiency:	95% (peak), >94.5% from 25 to 80% load
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:	< 3.5 mA @ 265 Vac 60 Hz

Environmental

Operating Temperature:	-40 to +75°C, power derated above 55°C (131°F) (-40 to 167°F)
Storage Temperature:	-40 to +85°C (-40 to 185°F)
Humidity:	0 to 95% non-condensing
Elevation:	-500 m to 2800 m; to 4000 m with temperature derated to 40°C (-1640 feet to 9186 feet; to 13124 feet with temperature derated to 104°F)

Miscellaneous

MTBF:	> 479,000 hours ground benign @ 30°C (86°F)
Dimensions (in)	W3.4 x H6.3 x D13 (W3.4 x H7 x D13 including front panel)
Dimensions (mm)	W87 x H160 x D330 (W87 x H177 x D331 including front panel)

Weight:	Module: 3.9 kg (8.6 lb) 23" Shelf: 14.5 kg (32 lb) 19" Shelf: 12.7 kg (28 lb)

Safety

EN 60950-1: 2006	Rectifier output shall be rated SELV suitable for connection to TNV-1 circuits
UL	60950-1: 2nd Ed.
CSA	C22.2 No. 60950-1-07
CE	EN 60950-1: 2006 CB Scheme 2006/95/EC Low Voltage Directive
Telcordia (Bellcore)	GR-1089-CORE (requirements applicable to rectifier)

Other Referenced Standards

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

Specifications for Alpha Switched Mode Rectifier Cordex 48-12kW

Power Module Output

Voltage:	44 to 60 Vdc within rated limits
Current:	222 A @ 54 Vdc nominal (249 A maximum @ 48 V)
Maximum Power:	12kW continuous/module
Static Load Regulation:	Better than ±0.5% for any load change within rated limits, under control of Cordex Controller
Dynamic Load Regulation:	Better than ±2% for 40% - 90% load step (output shall recover to static limits within 10 ms)
Static Line Regulation:	Better than ±0.1% for any change in input voltage within rated limits, under control of Cordex Controller
Hold-up Time:	>9.5 ms
Time Stability:	≤ 0.5% per year, under control of Cordex Controller
Temperature Stability:	< 300 ppm/°C over the operating range
Heat Dissipation:	< 3570 BTU per hour @ 208Vac
Electrical Noise:	< 38 dBrnC (voice band) < 20 mVrms 10 kHz to 10 MHz (wideband) < 150 mVp-p 10 kHz to 100 MHz < 2 mV (psophometric)
Acoustic Noise:	< 60 dBa @ 1 m (3 ft) @ 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.

To comply with regulations in terms of radiated emissions, the CAN communication cable shall be wound in 3 loops around a ferrite p/n 417-401-10/19 (Fair-Rite p/n 0443167251), placed close to the socket in the shelf.

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

Power Module Input

Voltage:	208-240 Vac (3Φ – 3 Wire + PE) Nominal 360-480Vac (3Φ – 3 Wire + N + PE) Nominal 208-277Vac (1Φ) Nominal
Operational Range:	187 to 320 Vac (Per Connector AC Input on Module)
Extended Operation:	Low: 187 to 95 Vac (Per Connector AC Input on Module, Derated Power)
Frequency:	45 to 66 Hz
Current:	39-30A/Feed (3Φ – 3 Wire + PE) 22-15A/Feed (3Φ – 3 Wire + N + PE) 22-15A/Feed (1Φ)
Recommended Feeder Breaker	
Single Phase:	30 A, #10 AWG
Three Phase:	50 A, #6 AWG delta connection 30 A, #10 AWG wye connection
Power Factor:	> 0.99 at nominal conditions and 50-100% load
Protection:	10 kA-interrupting capacity fuses in active and neutral lines
Efficiency:	> 94% at nominal conditions and 25-75% load > 92.5% at nominal conditions and 100% load
Inrush Current:	≤ full load steady state current
Start-up Ready Time:	< 5 seconds (excluding soft start)
Start-up Delay:	≤ 120 seconds (programmable)
Soft Start:	≤ 8 seconds (user adjustable, not including start-up)
Input Transient Suppression:	Meets ANSI/IEEE C62.41 Category B3
Input Leakage Current:	< 3.5 mA @ 265 Vac 60 Hz

Environmental

Operating Temperature:	-40 to +75°C, power derated above 55°C (131°F) (-40 to 167°F)
Storage Temperature:	-40 to +85°C (-40 to 185°F)
Humidity:	0 to 95% non-condensing
Elevation:	-500 m to 2800 m; to 4000 m with temperature derated to 40°C (-1640 feet to 9186 feet; to 13124 feet with temperature derated to 104°F)

Miscellaneous

MTBF:	> 160,000 hours ground benign @ 30°C (86°F)

Dimensions (inches):	W10.3 x H6.25 x D11.8 (W10.3 x H7 x D14.38 including front panel and handle)
Dimensions (mm):	W261 x H160 x D300 (W261 x H177 x D365 including front panel and handle)
Weight:	Module: 12 kg (27 lb) 23" Shelf: 14.5 kg (32 lb) 19" Shelf: 12.7 kg (28 lb)

Safety

EN 60950-1: 2006	Rectifier output shall be rated SELV suitable for connection to TNV-1 circuits
UL	60950-1: 2nd Ed.
CSA	C22.2 No. 60950-1-07
CE	EN 60950-1: 2006 CB Scheme 2006/95/EC Low Voltage Directive
Telcordia (Bellcore)	GR-1089-CORE (requirements applicable to rectifier)

Other Referenced Standards

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

Specifications for Alpha Switched Mode Rectifier Cordex 48-3.6kW

Power Module Output

Voltage:	42 to 60Vdc within rated limits
Current:	66.5A @ 54Vdc nominal (75A maximum @ 48V)
Maximum Power:	3600W continuous/module
Static Load Regulation:	Better than ±0.5% for any load change within rated limits
Dynamic Load Regulation:	Better than ±2% for 40% - 90% load step (output shall recover to static limits within 30ms)
Static Line Regulation:	Better than ±0.1% for any change in input voltage within rated limits
Hold-up Time:	>10ms
Time Stability:	≤0.5% per year
Temperature Stability:	<300ppm/°C over the operating range
Heat Dissipation:	<1415 BTU per hour
Electrical Noise:	<32dBrnC (voice band) <20mVrms 10kHz to 10MHz (wideband) <100mVp-p 10kHz to 100MHz <1.0mV (psophometric)
Acoustic Noise:	<60dBa @ 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:	208, 220, 230, 240, 277Vac nominal
Operational Range:	176 to 320Vac
Extended Operation:	Low: 176 to 90Vac (derated power)
Frequency:	45 to 66Hz
Current:	16.8A @ 240Vac 19.4A @ 208Vac 22.8A @ 176Vac (maximum)
Recommended Feeder Breaker	
Single Phase:	30A, #10AWG
Three Phase:	50A, #6AWG delta connection 30A, #10AWG wye connection
Power Factor:	>0.99 at nominal conditions and 50-100% load
Protection:	10kA-interrupting capacity fuses in active and neutral lines
Efficiency:	>92% at nominal conditions and 50-90% load >91.5% at nominal conditions and 100% load
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 +75°C, power derated above 65°C (149°F) (-40 to 167°F)
Storage Temperature:	-40 to +85°C (-40 to 185°F)
Humidity:	0 to 95% non-condensing
Elevation:	-500m to 2800m; to 4000m with temperature derated to 40°C (-1640 feet to 9186 feet; to 13124 feet with temperature derated to 104°F)

Miscellaneous

MTBF:	>350,000 hours ground benign @ 30°C (86°F)
Dimensions (in)	W3.4 x H6.3 x D11.8 (W3.4 x H7 x D12.8 including front panel)
Dimensions (mm)	W87 x H160 x D300 (W87 x H177 x D326 including front panel)

Weight:	Module: 4.6 kg (10.1 lb.) 23” Shelf: 14.5 kg (32 lb.) 19” Shelf: 12.7 kg (28 lb.)

Safety

EN 60950-1: 2006	Rectifier output shall be rated SELV suitable for connection to TNV-1 circuits
UL	60950-1: 2nd Ed.
CSA	C22.2 No. 60950-1-07
CE	EN 60950-1: 2006 CB Scheme 2006/95/EC Low Voltage Directive
Telcordia (Bellcore)	GR-1089-CORE (requirements applicable to rectifier)

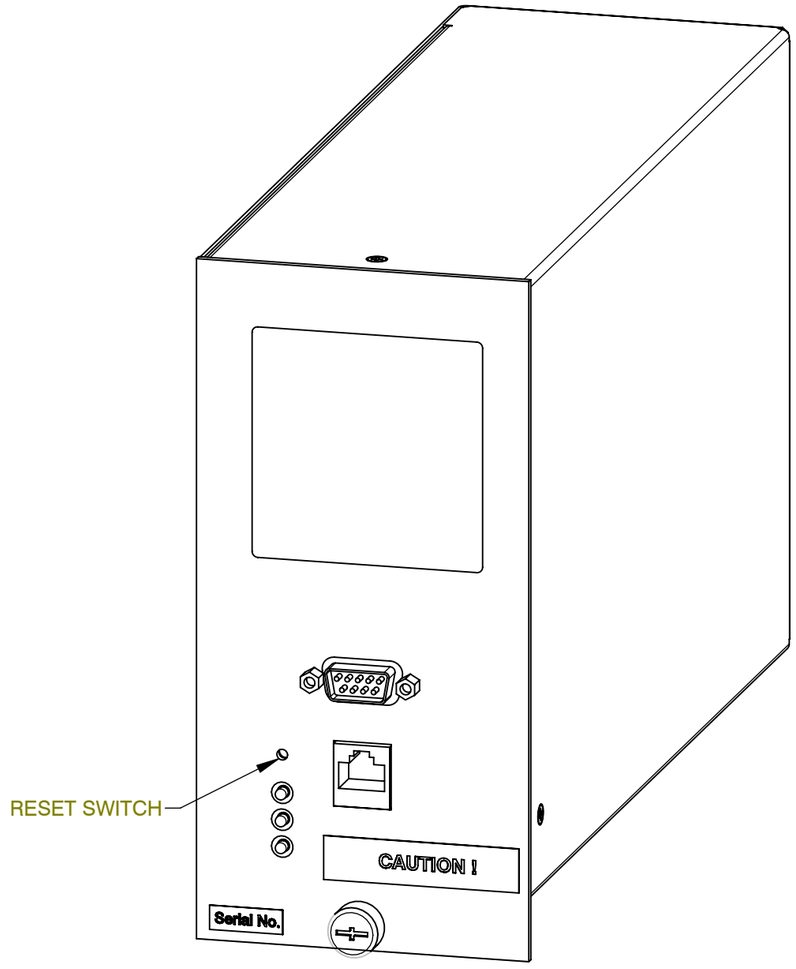
Other Referenced Standards

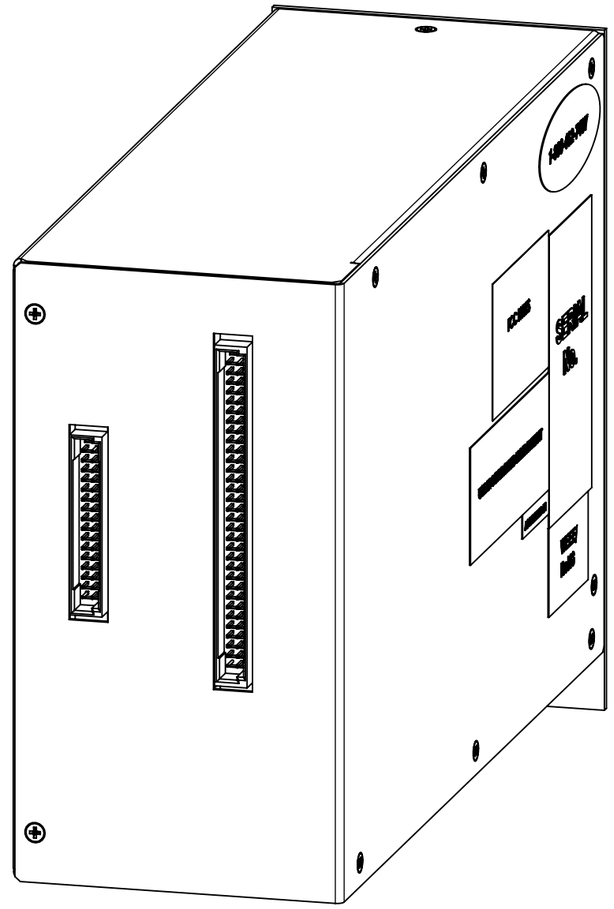
EN 300 386-2	EMC and ERM; Telecommunication Network Equipment
EN 55022 (CISPR 22)	Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurement
EN 61000-3-2	Harmonic Current Emissions
EN 61000-3-3	Voltage Fluctuations and Flicker
EN 61000-4-2	ESD Immunity
EN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

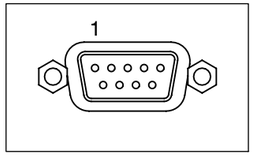
DO NOT SCALE DRAWING

REVISIONS				
LTR	DESCRIPTION	DWN	DATE	CHKD
B	REVISED FOR INTEGRATIOn	JL	2013/03	FV



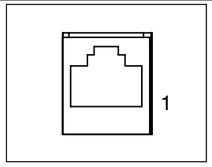


DB-9 PIN OUT



1. NOT CONNECTED
2. RXD
3. TXD
4. NOT CONNECTED
5. GROUND
6. NOT CONNECTED
7. NOT CONNECTED
8. NOT CONNECTED
9. NOT CONNECTED

ETHERNET RJ-45 PIN OUT



1. TX +
2. TX -
3. RX +
4. ECOM1
5. ECOM1
6. RX -
7. ECOM1
8. ECOM1
9. LED 2 - 1
10. LED 2 RIGHT
11. LED 1 - 1
12. LED 1 LEFT
13. LED 2 - 1
14. LED 1 - 1
15. COMMON
16. COMMON

32 PIN CONNECTOR PIN OUT

A16 B16

+5V	RS485 DIR
RS485 -	RS485 +
DTR	R1
TXD	CTS
RXD	RTS
DCD	BDSR
GROUND	GROUND
CAN H1	CAN L1
CAN H2	CAN L2
SYSTEM FAIL	DFSC2
E LED1 - 1	E LED1 - 2
E LED2 - 1	E LED2 - 2
NOT CONNECTED	NOT CONNECTED
E RX +	E TX +
E RX -	E TX -
E COM 2	E COM1

A1 B1
PIN

64 PIN CONNECTOR PIN OUT

A32 B32

K1 - COM	K1 - NO
K2 - NO	K1 - NC
K2 - NC	K2 - COM
K3 - COM	K3 - NO
K4 - NO	K3 - NC
K4 - NC	K4 - COM
K5 - COM	K5 - NO
K6 - NO	K5 - NC
K6 - NC	K6 - COM
K7 - COM	K7 - NO
K8 - NO	K7 - NC
K8 - NC	K8 - COM
K0 - COM	K0 - NO
D4 - 2	K0 - NC
D3 - 2	D4 - 1
D2 - 2	D3 - 1
D1 - 2	D2 - 1
NOT CONNECTED	D1 - 1
-15V DCCT	NOT CONNECTED
DGND	+15V DCCT
GP4 +	GP4 -
GP3 +	GP3 -
GP2 +	GP2 -
GP1 +	GP1 -
I1 +	I1 -
I2 +	I2 -
I3 +	I3 -
I4 +	I4 -
V1 +	V1 -
V2 +	V2 -
NOT CONNECTED	NOT CONNECTED
PWA +	PWA -

A1 B1
PIN

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

APPROVALS		DATE
DRAWN	SDW	2005/07
CHECKED	XX	MMM-DD-YY

ALPHA TECHNOLOGIES™

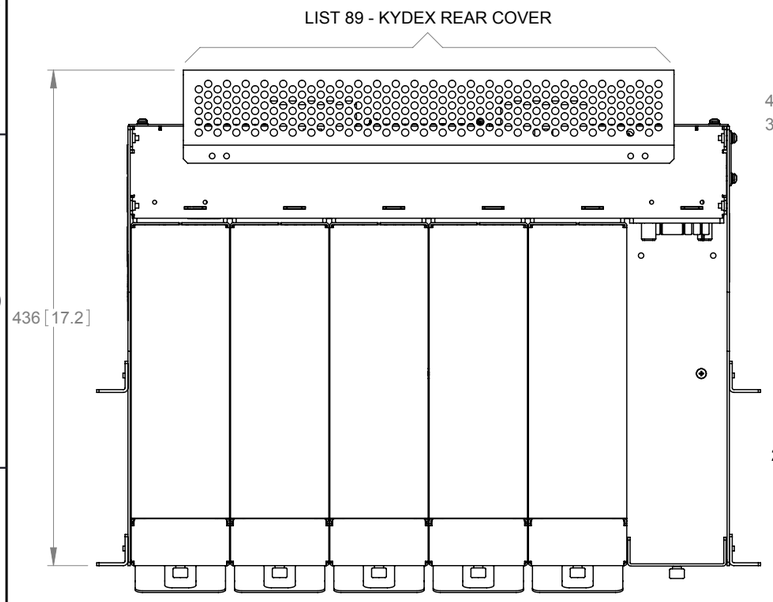
TITLE: CUSTOMER CONNECTION, CORDEX CXCM4

SIZE	DWG NO.	REV
B	018-574-08	B

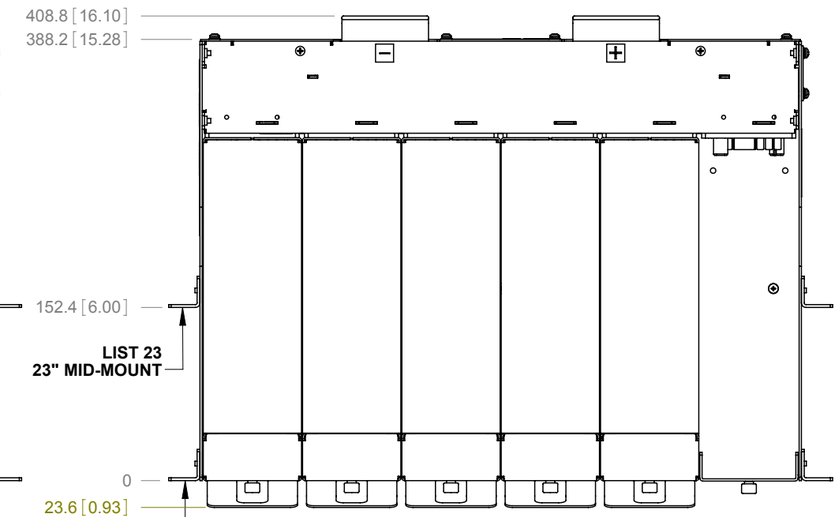
SCALE: NTS SHEET 1 OF 1

DO NOT SCALE DRAWING

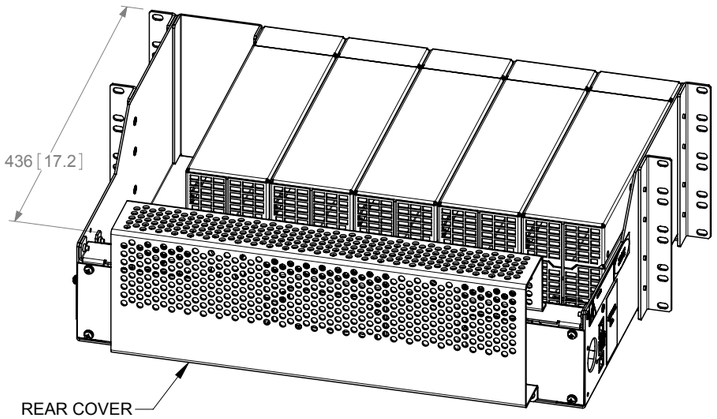
REVISIONS				
LTR	DESCRIPTION	DRW	DATE	CHKD
B	CORRECTED NO OF MODULES	EOF	'04/06	WES
C	INCORPORATED EOs A1-A9	JU	'05/02	GS
D	LIST 81 UPDATED	MP/JU	'05/10	WES
E	CORRECTED VIEWS DESCRIPTION	MP	'05/10	WES
F	REVISED FOR SOLIDWORKS INTEGRATION	JL	'12/10	SY



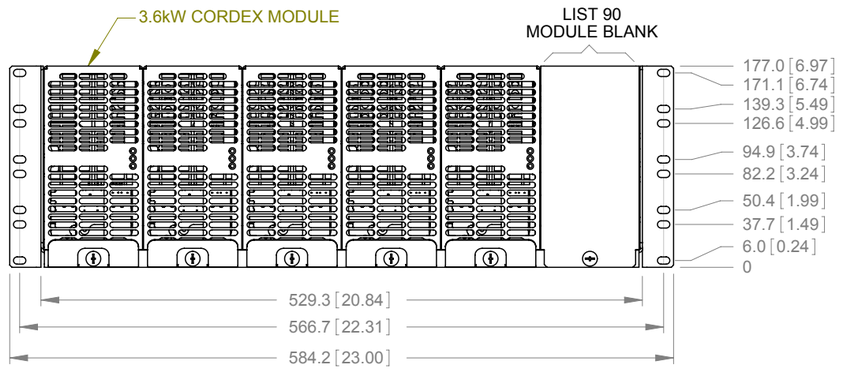
TOP VIEW



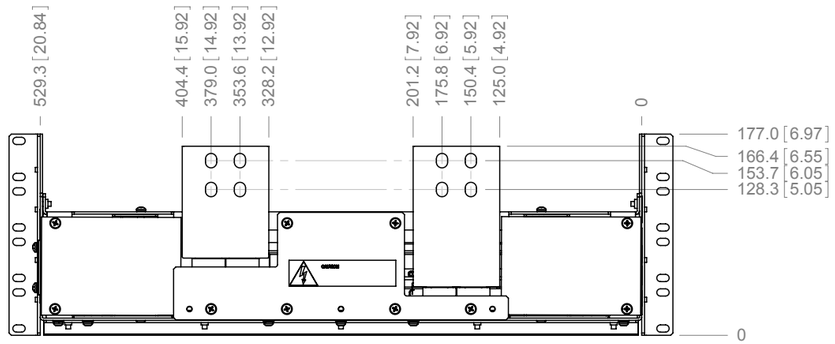
TOP VIEW - REAR COVER NOT SHOWN
(LIST 82 - OUTPUT BARS)



REAR ISOMETRIC VIEW



FRONT VIEW



REAR VIEW - MODULES NOT SHOWN
(LIST 82 - OUTPUT BARS)

UNLESS OTHERWISE SPECIFIED DIM ARE IN MM
X ±1
X.X ±0.5
X.XX ±0.25
ANGULAR: ±1°
INTERPRET DIM AND TOL PER ASME Y14.5M -1994
THIRD ANGLE PROJECTION

APPROVALS		DATE
DRAWN	EOF	MAR-04
CHECKED	WS	MAR-04

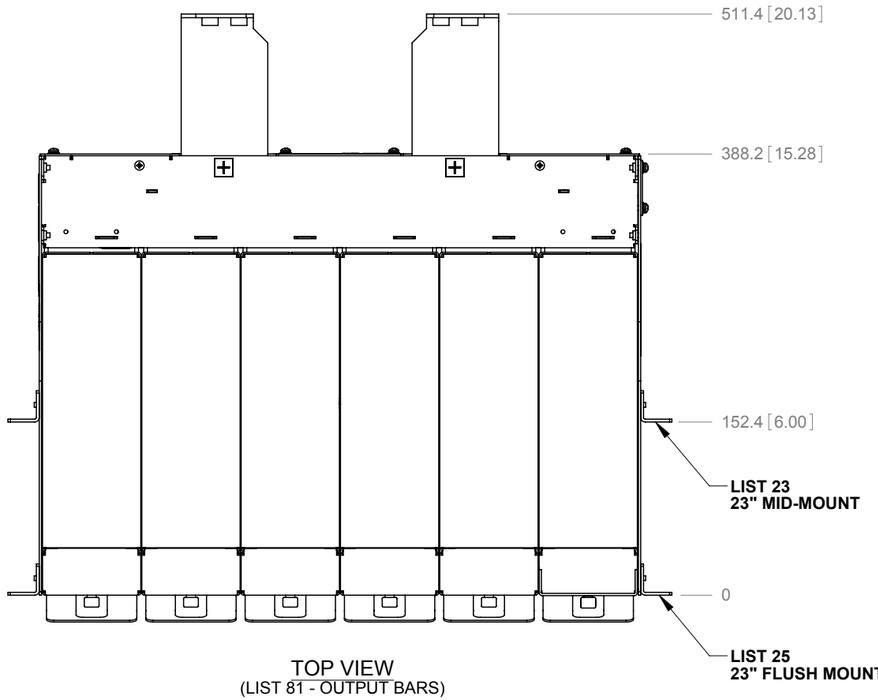
ALPHA TECHNOLOGIES™

TITLE: OUTLINE, 23" SHELF, 3.6kW CORDEX

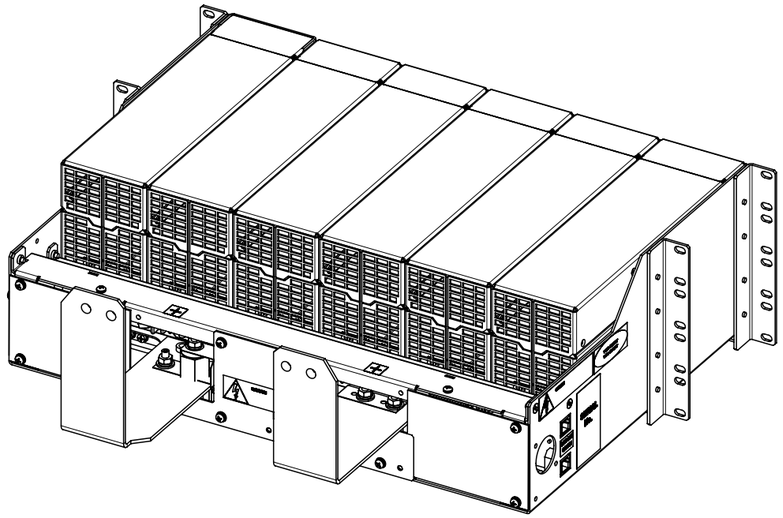
SIZE	DWG NO.	REV
B	030-716-06	F

SCALE: NTS SHEET 1 OF 2

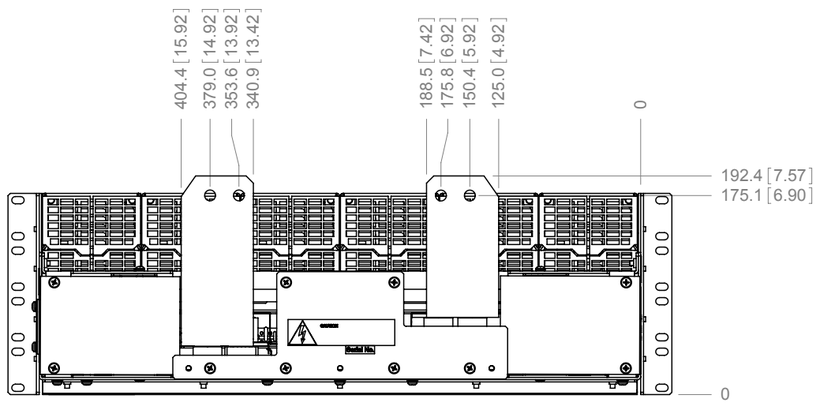
DO NOT SCALE DRAWING



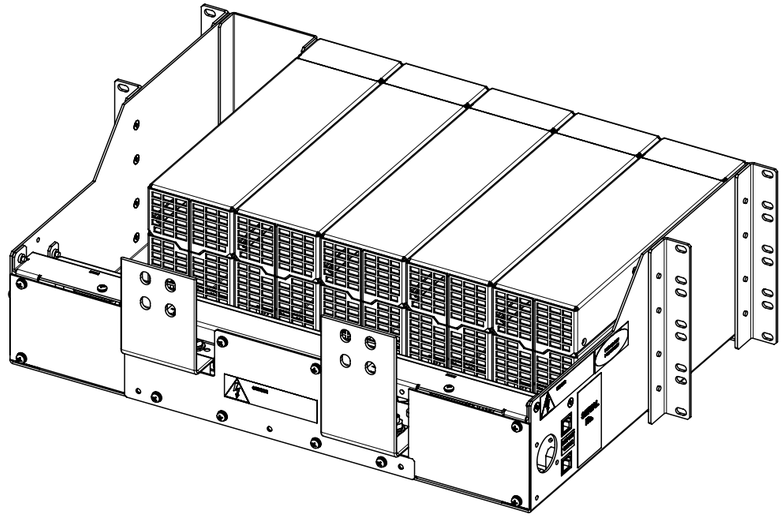
TOP VIEW
(LIST 81 - OUTPUT BARS)



REAR ISOMETRIC VIEW
(LIST 81 - OUTPUT BARS)



REAR VIEW
(LIST 81 - OUTPUT BARS)



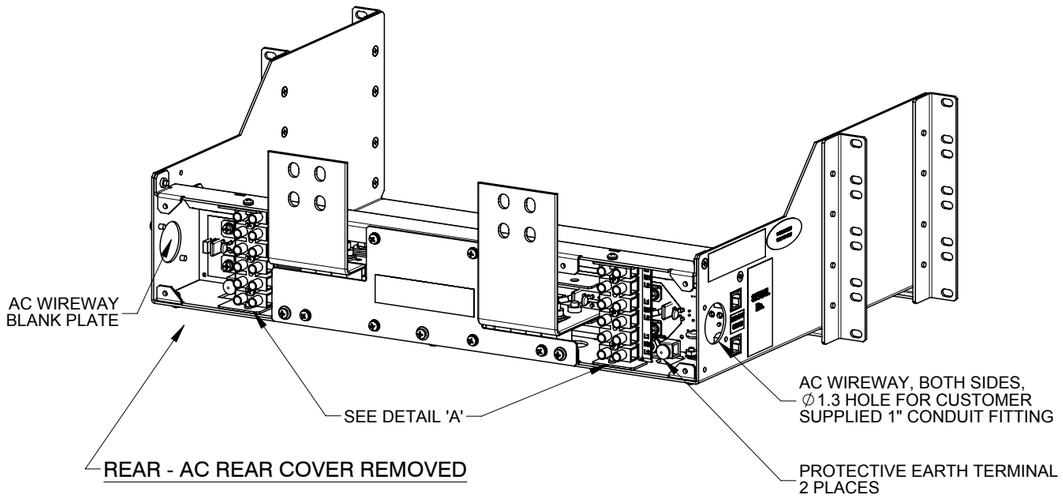
REAR ISOMETRIC VIEW
(LIST 82 - OUTPUT BARS)

TECHNOLOGIES™

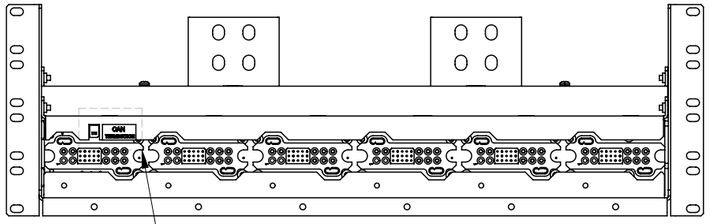
TITLE: OUTLINE, 23" SHELF, 3.6kW CORDEX		
SIZE B	DWG NO. 030-716-06	REV F
SCALE: NTS	SHEET 2 OF 2	

DO NOT SCALE DRAWING

REVISIONS				
LTR	DESCRIPTION	DWN	DATE	CHK
B	LIST 81 UPDATED	MP/JU	Oct/01/05	WES
C	CORRECTED VIEW DESCRIPTIONS	MP	Oct/15/05	GS
D	UPDATED LIST 85 LABELS	SDW	Mar/01/08	GIA
E	REVISED FOR SOLIDWORKS INTEGRATION	JL	Oct/01/10	SY
F	ADDED NOTE TO DETAIL A	JMAR	Aug/25/14	SP



REAR - AC REAR COVER REMOVED



SWITCH SETTING FOR CAN TERMINATION

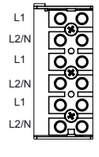
DETAIL 'A' - AC INPUT OPTIONS

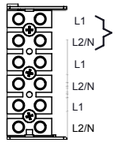
LIST 83: DUAL 3-PHASE INPUTS, 208-240VAC NO NEUTRAL

LIST 84: DUAL 3-PHASE INPUTS, 360-480VAC WYE SOURCE, NEUTRAL REQUIRED

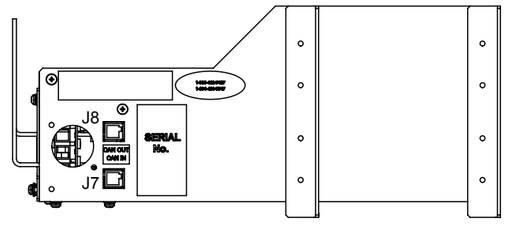
CONNECT NEUTRAL TO ANY ONE OF THE THREE TERMINAL BLOCK POSITIONS LABELED 'N'

LIST 85: SINGLE PHASE INPUTS, 208V-277VAC





DO NOT CONNECT AC TO THIS INPUT WHEN CXCM4 (F) IS USED IN THE SHELF



CAN OUT RJ12 OFFSET PIN OUT (J8)

1. GND
2. CAN H
3. NOT CONNECTED
4. CAN L
5. NOT CONNECTED
6. NOT CONNECTED

CAN IN RJ12 OFFSET PIN OUT (J7)

1. GND
2. CAN H
3. NOT CONNECTED
4. CAN L
5. NOT CONNECTED
6. NOT CONNECTED

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

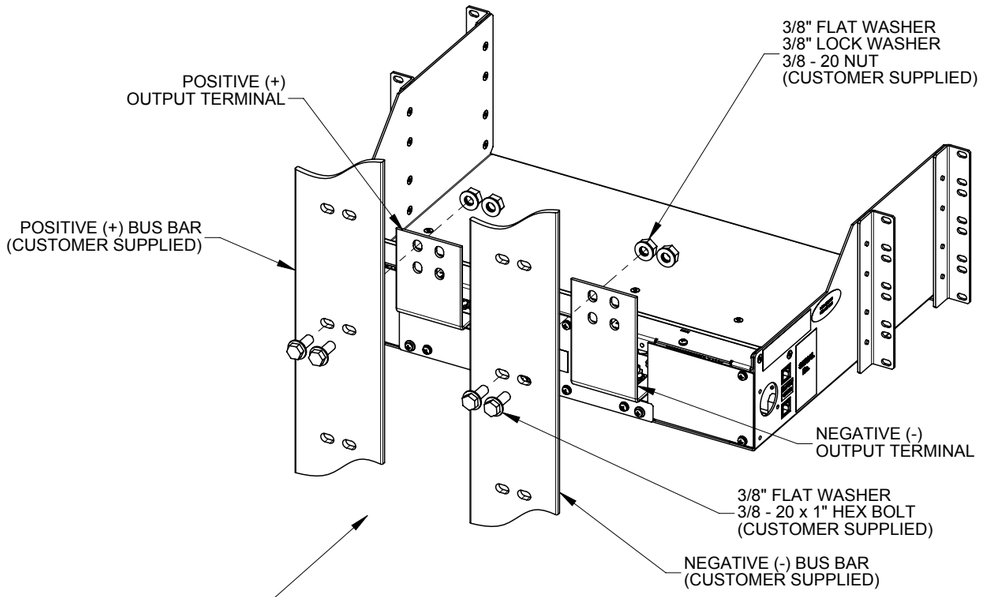
APPROVALS		DATE
DRAWN	JU	Feb/01/05
CHECKED	JK	Mar/01/05

TITLE: CUSTOMER CONNECTION, 23" SHELF, 3.6KW CORDEX

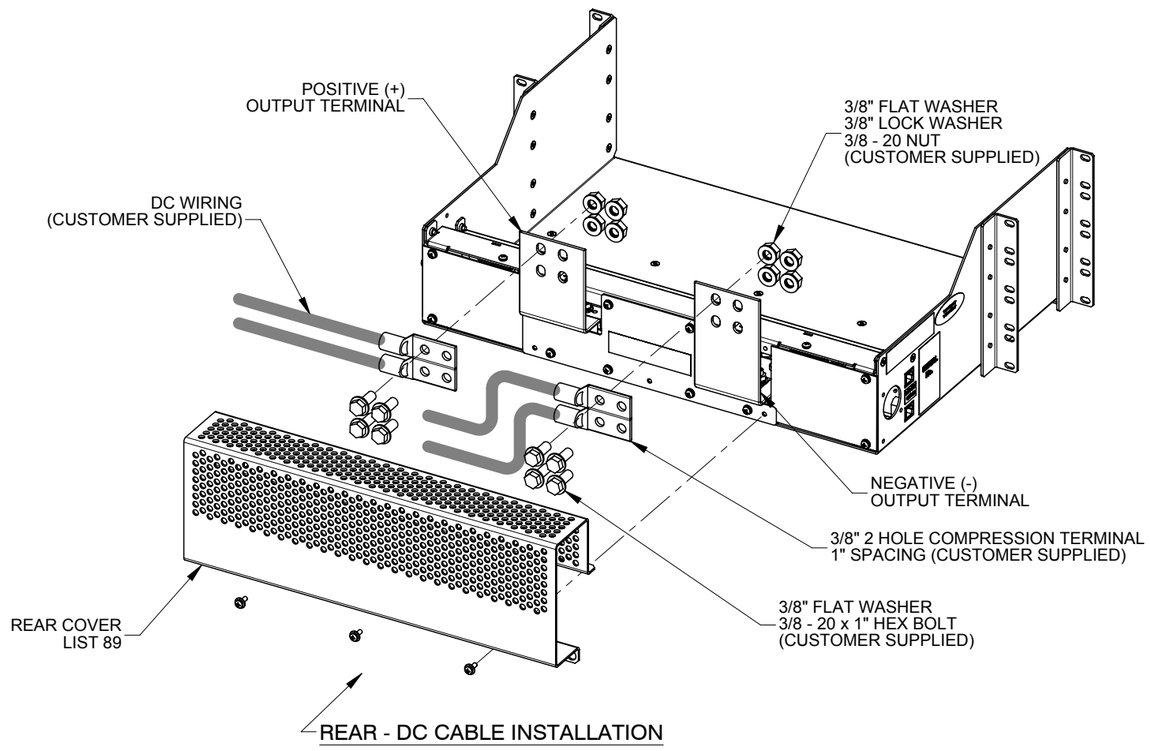
SIZE B | DWG NO. 030-716-08 | REV F

SCALE: N.T.S. | SHEET 1 OF 2

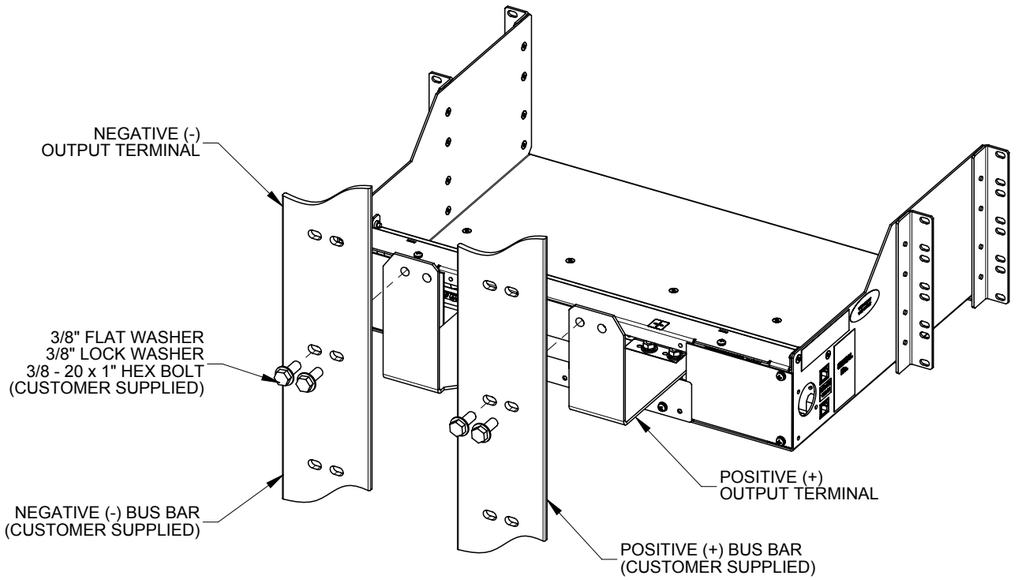
DO NOT SCALE DRAWING



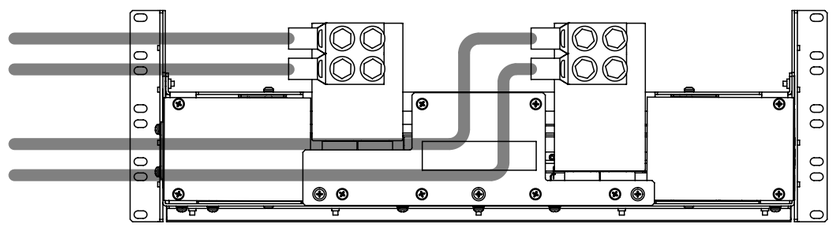
REAR - LIST 82 BUS BAR INSTALLATION



REAR - DC CABLE INSTALLATION



REAR ISOMETRIC VIEW - LIST 81 BUS BAR INSTALLATION

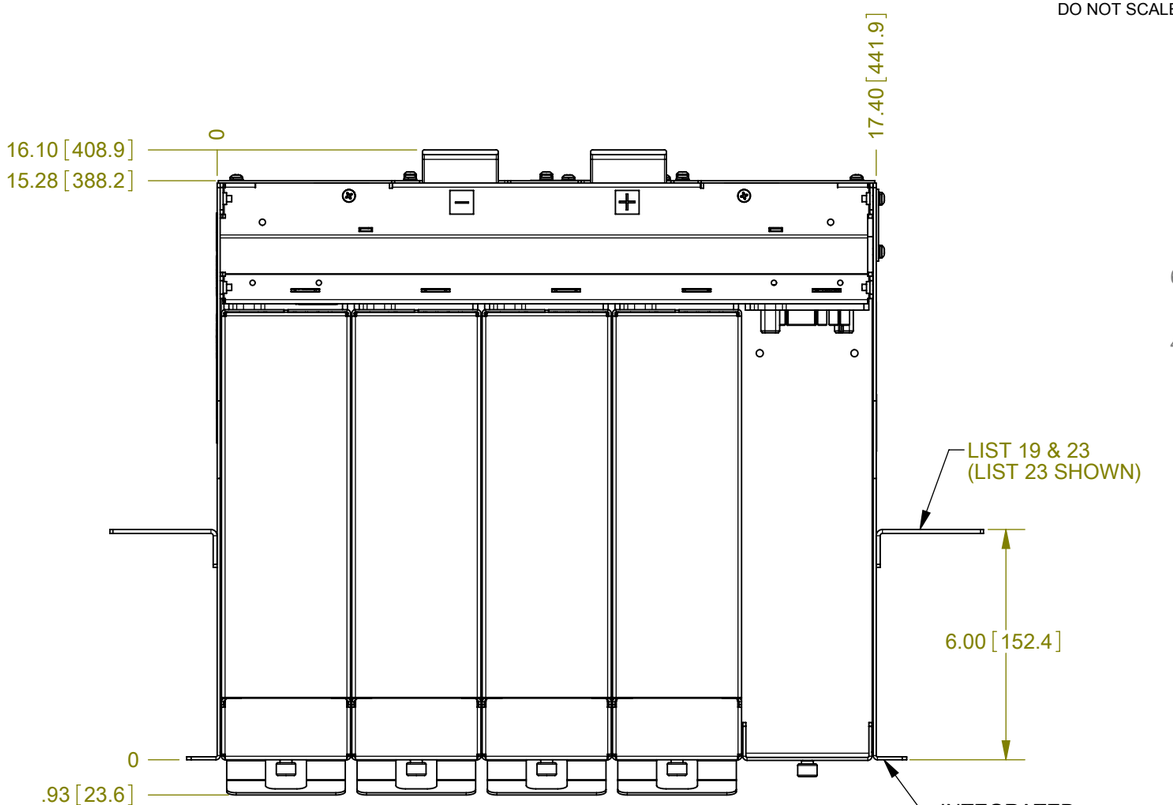


REAR VIEW - DC CABLE INSTALLATION
REAR COVER NOT SHOWN

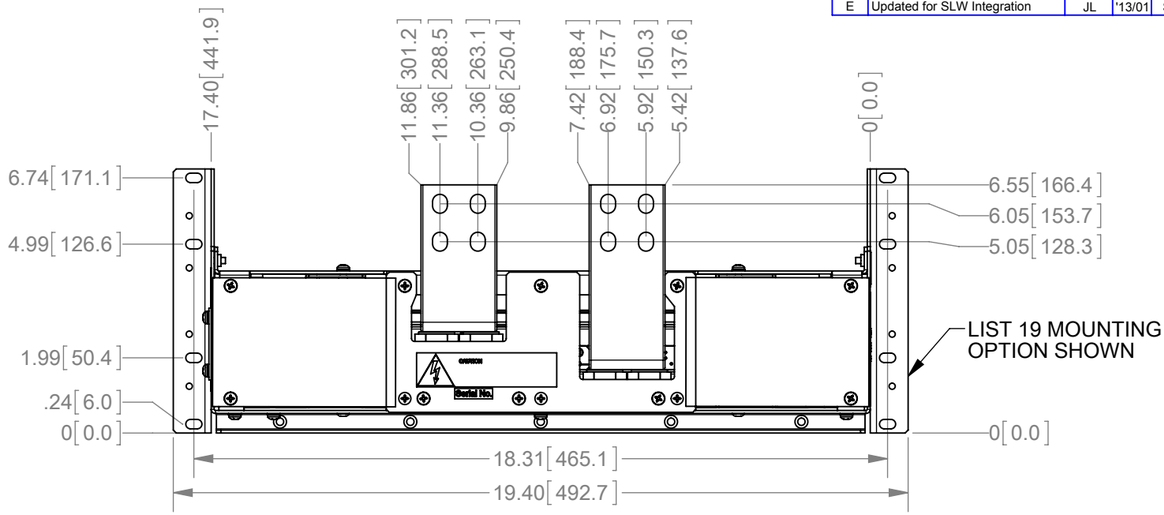
TITLE:	CUSTOMER CONNECTION, 23" SHELF, 3.6KW CORDEX		
SIZE B	DWG NO. 030-716-08		REV F
SCALE: N.T.S.		SHEET 2 OF 2	

DO NOT SCALE DRAWING

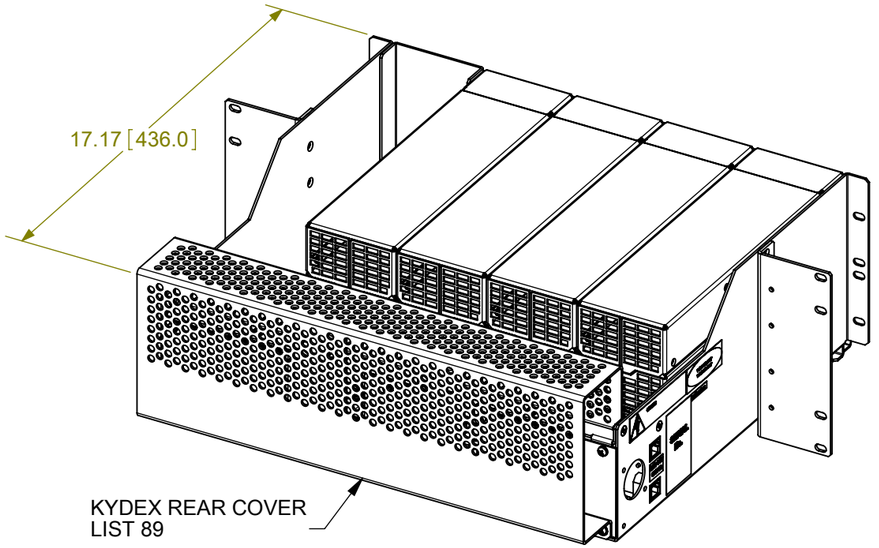
REVISIONS				
LTR	DESCRIPTION	DWN	DATE	CHKD
B	Corrected #of Mdls	EOF	'04/06	GS
C	Rear Cvr,Blanking Plate added	JU	'05/02	GS
D	Incorp. EO C1 (List 19 & 23 Add)	JLM	'06/09	GS
D1	Correct Spelling Error	JLM	'06/09	GS
E	Updated for SLW Integration	JL	'13/01	SY



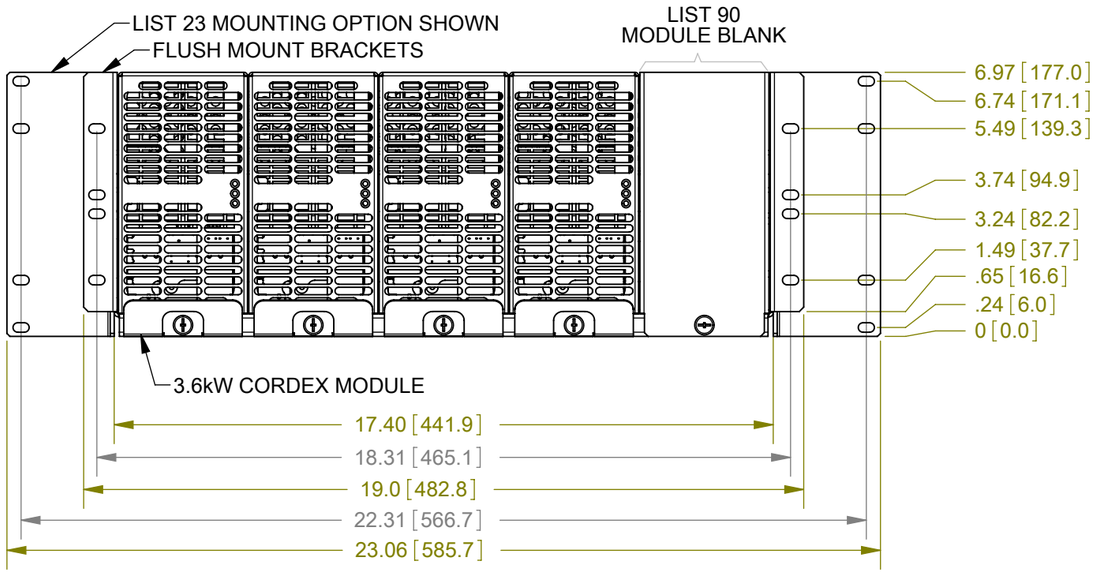
TOP VIEW
REAR COVER IS HIDDEN
(LIST 82 OUTPUT BARS)



REAR VIEW
REAR COVER AND MODULES ARE HIDDEN
(LIST 82 OUTPUT BARS



REAR ISOMETRIC VIEW



FRONT VIEW

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

APPROVALS		DATE
DRAWN	EOF	MAY-04
CHECKED	WS	MAY-04

ALPHA TECHNOLOGIES™

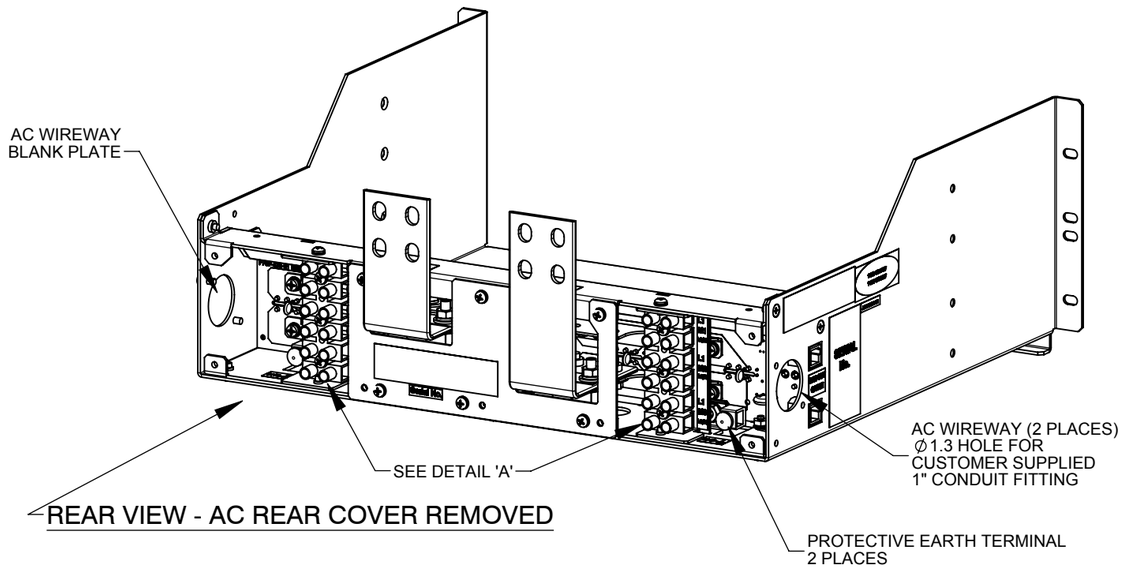
TITLE: OUTLINE, 19" SHELF, 3.6KW CORDEX

SIZE	DWG NO.	REV
B	030-717-06	E

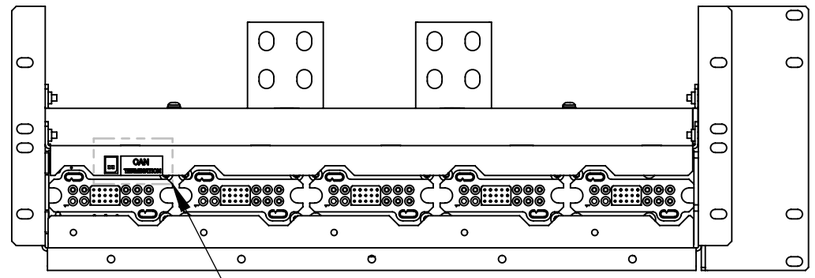
SCALE: 1:3 SHEET 1 OF 1

DO NOT SCALE DRAWING

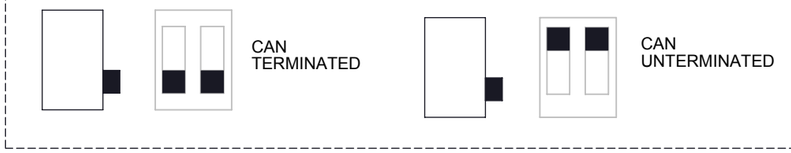
REVISIONS				
LTR	DESCRIPTION	DWN	DATE	CHK
B	UPDATED LABEL L2 TO L2/N	SDW	Feb/01/08	GIA
C	UPDATED FOR SLW INTEG.	JL	Jan/01/13	SY
D	ADDED NOTE TO DETAIL A	JMAR	Aug/25/14	SP



REAR VIEW - AC REAR COVER REMOVED

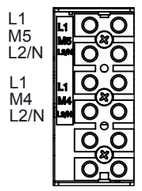


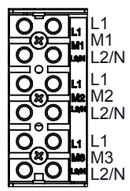
SWITCH SETTING FOR CAN TERMINATION



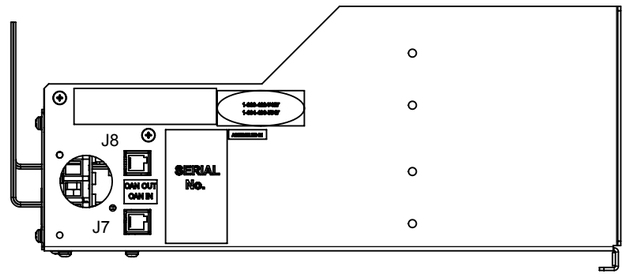
DETAIL 'A' - AC INPUT

SINGLE PHASE INPUTS, 208V 277VAC





DO NOT CONNECT AC TO THIS INPUT WHEN CXCM4 IS USED IN THE SHELF. △D



CAN OUT RJ12 OFFSET PIN OUT (J8)

1. GND
2. CAN H
3. NOT CONNECTED
4. CAN L
5. NOT CONNECTED
6. NOT CONNECTED

CAN IN RJ12 OFFSET PIN OUT (J7)

1. GND
2. CAN H
3. NOT CONNECTED
4. CAN L
5. NOT CONNECTED
6. NOT CONNECTED

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

APPROVALS		DATE
DRAWN	JU	Feb/01/02
CHECKED	XX	

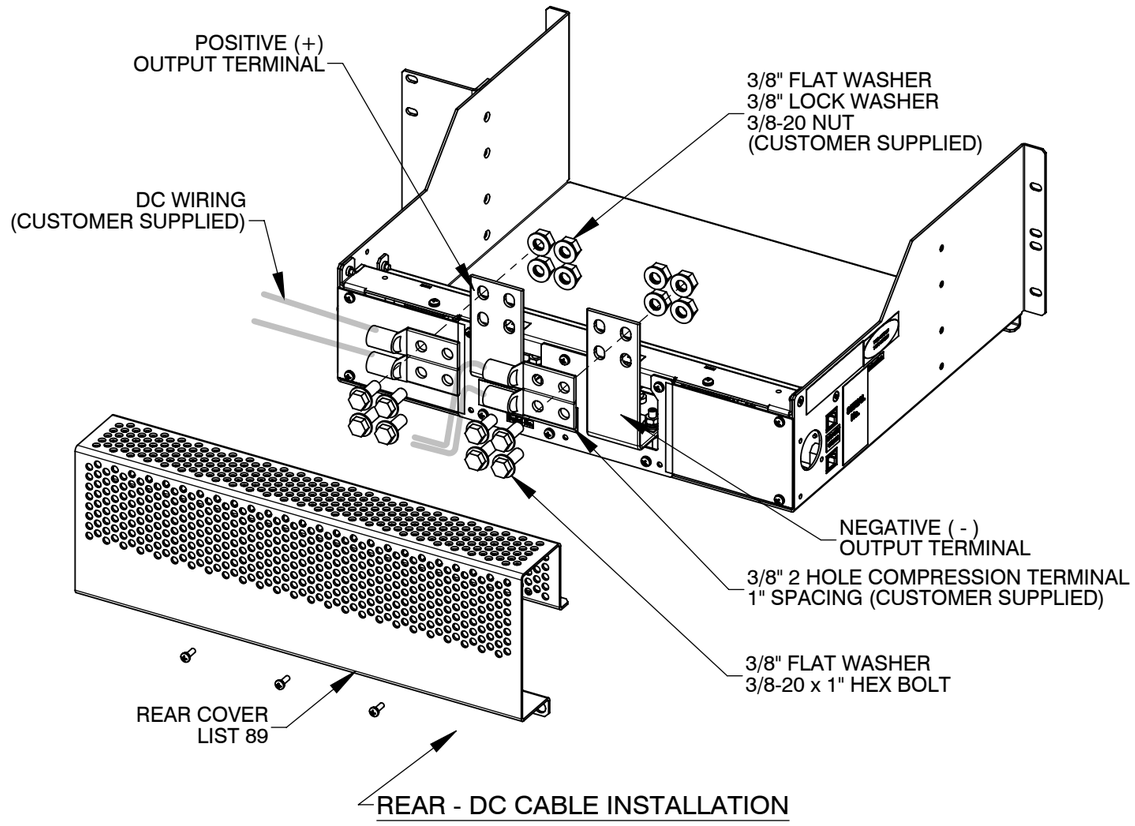
TECHNOLOGIES™

TITLE: CUSTOMER CONNECTION, 19" SHELF, 3.6kW CORDEX

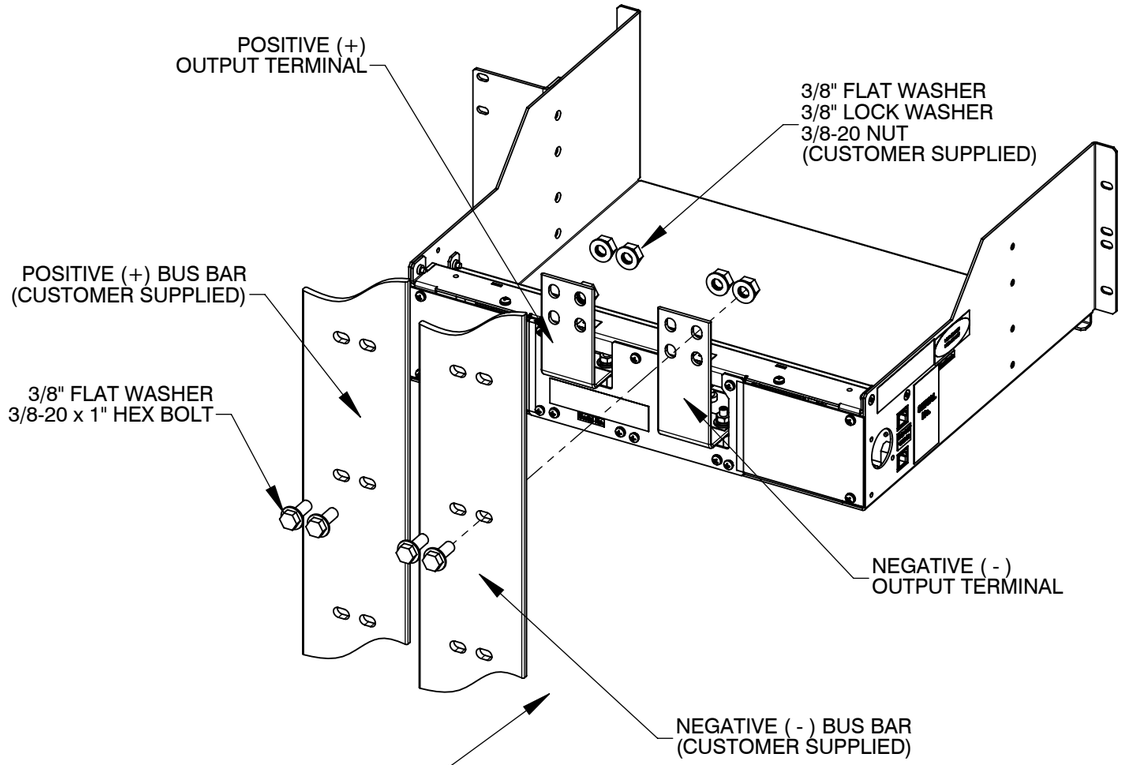
SIZE	DWG NO.	REV
B	030-717-08	D

SCALE: N.T.S. SHEET 1 OF 2

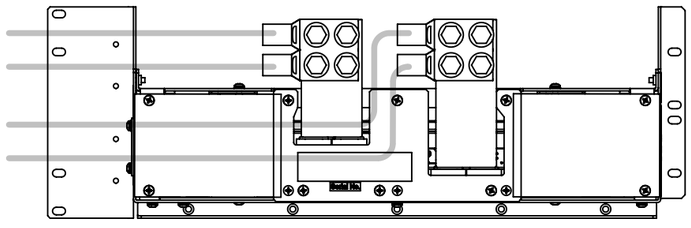
DO NOT SCALE DRAWING



REAR - DC CABLE INSTALLATION



REAR - BUS BAR INSTALLATION



REAR VIEW - DC CABLE INSTALLATION

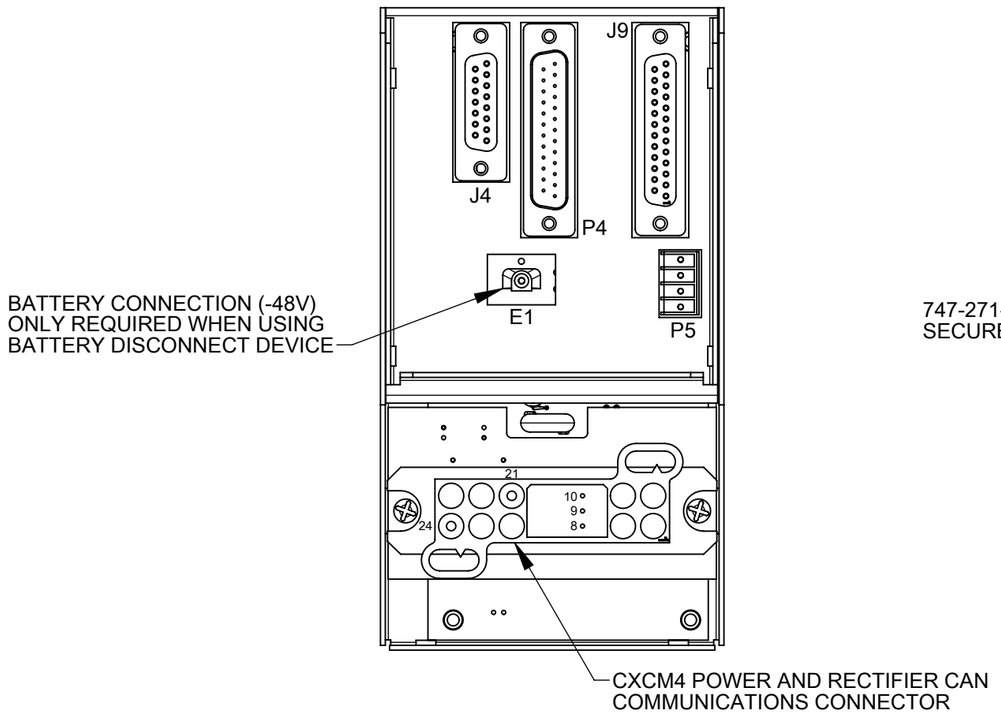
REAR COVER NOT SHAWN

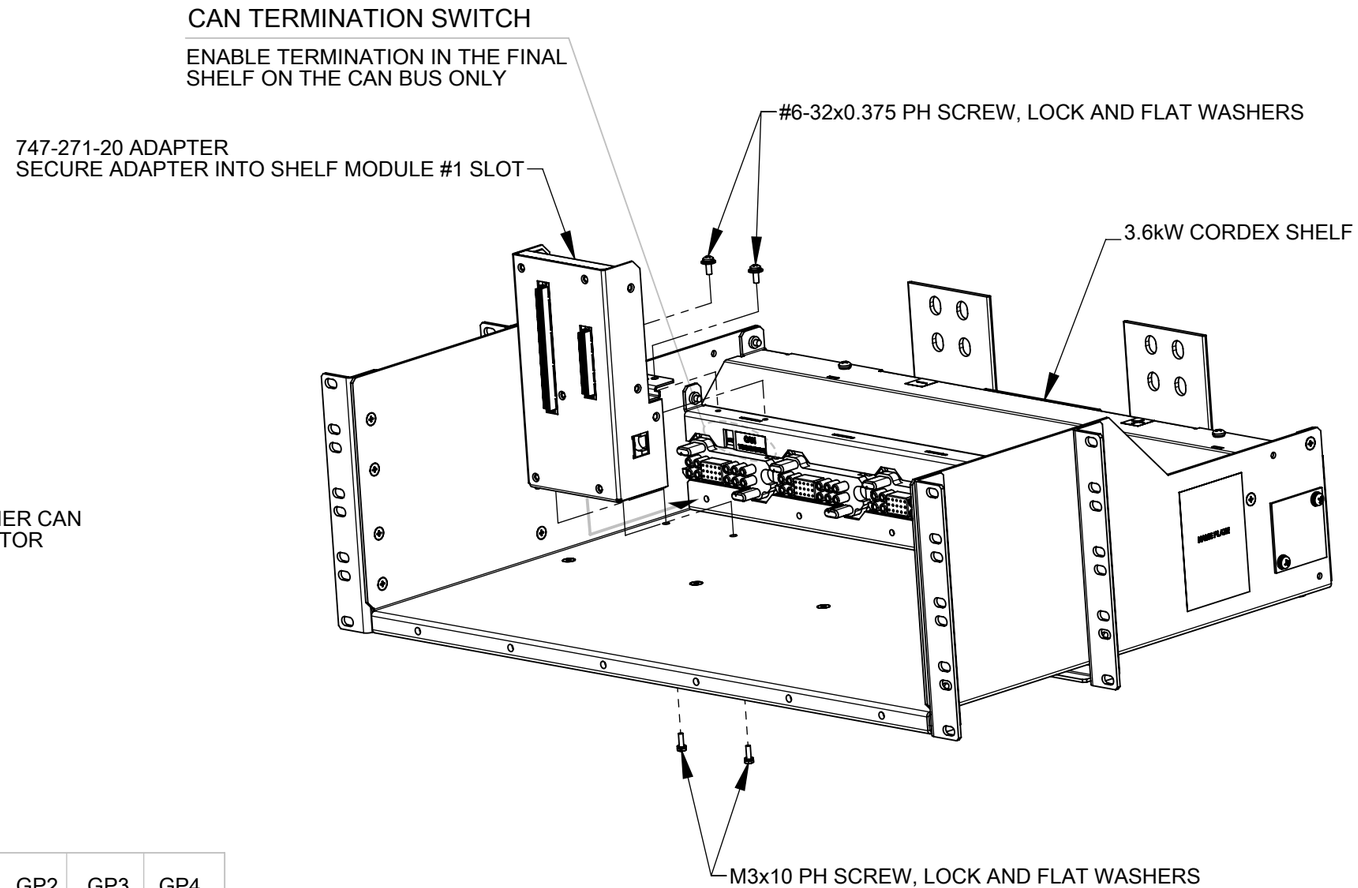
TECHNOLOGIES™

TITLE:	CUSTOMER CONNECTION, 19" SHELF, 3.6kW CORDEX		
SIZE B	DWG NO. 030-717-08		REV D
SCALE: N.T.S.		SHEET 2 OF 2	

DO NOT SCALE DRAWING

REVISIONS				
LTR	DESCRIPTION	DWN	DATE	CHKD
B	REVISED FOR INTEGRATION	JL	'13/03	FV





P4 PINOUT (DB25 MALE)

1. K2-NO
2. K2-NC
3. K3-COM
4. K4-NO
5. K4-NC
6. K5-COM
7. K6-NO
8. K6-NC
9. K7-COM
10. K8-NO
11. K8-NC
12. K0-COM
13. NOT CONNECTED
14. K2-COM
15. K3-NO
16. K3-NC
17. K4-COM
18. K5.NO
19. K5-NC
20. K6-COM
21. K7-NO
22. K7-NC
23. K8-COM
24. K0-NO
25. K0-NC

J9 PINOUT (DB25 FEMALE)

1. V1+
2. I2+
3. I1+
4. GP1+
5. GP2+
6. GP3+
7. GP4+
8. D1-1
9. D2-1
10. D3-1
11. D4-1
12. K1-NO
13. K1-NC
14. V1-
15. I2-
16. I1-
17. GP1-
18. GP2-
19. GP3-
20. GP4-
21. D1-2
22. D2-2
23. D3-2
24. D4-2
25. K1-COM

PINOUT

8. CAN-RET
9. CAN H
10. CAN L
21. +POWER
24. -POWER

CXCM4 LIST OPTION	GP1	GP2	GP3	GP4
121	T1	T2	T3	T4
125	T1	T2	BiV1	BiV2

P5 PINOUT CXCM4 LIST 125

1. I4+
2. I4-
3. I3+
4. I3-

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

APPROVALS		DATE
DRAWN	JU	JUN-06
CHECKED	XX	JUN-06

ALPHA TECHNOLOGIES™

TITLE: CXCM4 CONN. INTERFACE, CXRF 48V SHELF

SIZE	DWG NO.	REV
B	747-271-08	B

SCALE: N.T.S. SHEET 1 OF 1

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