# Cordex Switched Mode Rectifiers

2014

Ozcan Akbaba
Managing Director/Alpha Technologies Turkey Enerji Ltd Sti
Ozcan.akbaba@alpha.ca +90 542 432 67 95

# Cordex Features

# Alarms and Visual Indicators

- LED indicators
  - Visual indication of module operational status

- True module fail alarm
  - Output current < 2.5-5% of the rated output
  - Module ramps output voltage up
  - If no increase in current = module fail alarm.

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# Thermal Protection

- Thermal fold-back and shutdown
  - Typical performance
    - Heat-sink temperature >120 deg C
      - Output current is reduced
    - Heat-sink temperature >135 deg C
      - Module goes into standby mode.
    - Ambient temperature >75 deg C
      - Module goes into standby mode.
    - Heat-sink temperature <120 deg C
      - Normal capacity is restored.

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# Major Alarms

- Major module fail alarms
  - These alarms signify a complete failure or shutdown of the module.
    - Remote shutdown
    - Output fuse open
    - Input fuse open
    - AC mains fail
    - High voltage shutdown
    - Thermal shutdown
    - UPF fail/primary power circuit shutdown
    - No output power
    - Local shutdown
    - Start delay

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# Minor Alarms

- Minor module fail alarms
  - Service required – module output ok
    - VAC meter fail
    - AC mains low or high
    - Fan fail
    - Over temperature conditions
    - Low output voltage
    - Current limiting/short circuit protection
    - Power limiting
    - Temperature sense fail
    - Fan Speed Error
    - High Output Voltage
    - Local Access Alarm (with LCD option)
    - Soft Start

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# Input Features

- Power quality management
  - UPF - power factor >.99
  - AC voltage and current THD <5%
  - Improved generator compatibility
  - Elimination of neutral current problems
  - No electrical billing surcharge for low PF
  - No expensive isolation transformers needed
  - Reduced cable size/breaker requirements
- Wide range AC input
  - Continuous operation during brown out conditions
- AC inrush/MOV transient suppression
  - Inrush current is limited to less than three times the nominal line current to prevent surges on the AC line
  - Surge protection meets IEEE C62.41 B3
- Start delay
  - The startup of modules can be controlled via a user programmable delay timer
  - Stagger start a multiple module system to prevent excessive loading of generators

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# Output Features

- Constant power feature
  - Available with some models
  - Extra current is available when the output voltage is low
    - Up to 140% of nominal (module dependent)
  - Reduced battery recharge time for flooded cells
  - Enhanced system capacity for peak loads

- Over voltage protection (OVP)
  - High voltage shutdown (HVSD)
  - Protects the load from rectifier output over voltage conditions
  - Shuts down rectifier with OVP condition

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# Battery Charging

- Float/equalize/test modes
  - Float mode
    - Default operating mode where the rectifiers supply power to the load and/or batteries
    - Normal charging voltage for battery
  - Equalize mode is used to “boost” charge batteries while supplying power to the load
  - Test mode allows an extended voltage range for testing special functions, i.e. LVD etc.

- Battery eliminator operation
  - Modules maintain normal operation without batteries attached to the output

- Paralleling diode
  - Optional on small rectifiers
  - Helps isolate a rectifier fault from the system in battery less systems

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# Additional Features

- Temperature hardened
  - Universal application
  - Rugged design for use in outdoor applications
- Easy field service
  - Typical consumable parts are field replaceable
  - Module dependent
- Microprocessor controlled rectifier
  - Full remote access & control of module
  - Allows for single point adjustment
  - Increased calibration accuracy
  - Reduces system supervisory costs
  - Self diagnostic with increased functionality

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# Remote Monitoring

- Advanced remote monitoring and control
  - Pathfinders via RS-485 communications
  - Cordex via Controller Area Network (CAN) bus
  - Two RJ type ports per cabinet allow daisy chaining of cabinets

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# Cordex Switched Mode Rectifiers and Power Systems

# Cordex Telecom Rectifiers

12Vdc Cordex 250W

24Vdc Cordex 400W

48Vdc Cordex 650W

48Vdc Cordex 1kW

48Vdc Cordex 1.8kW

24Vdc Cordex 3.1kW

48Vdc Cordex 3.6kW

48Vdc Cordex HP 300W

48Vdc Cordex HP 1.2kW

48Vdc Cordex HP 2.0kW

48Vdc Cordex HP 4.0kW

Cordex HP 12kW

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# Cordex High Performance HP : Key Success Factors

- Low cost
- High Reliability
- High Efficiency
- High Power Density

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# Cordex PSU (Power Supply Unit)

- Internet ready and remotely accessible for complete and cost effective system and site monitoring
- Configurable platform with I/O's for site monitoring, user-definable alarms, data logging and control
- Extended temperature range for installation in harsh outdoor environments
- Two options 24V/400W and 48V/650W
- Wide AC input operating range for world wide installation requirements : 90 to 320 Vac
- 91% Efficiency
- High Reliability: MTBF >400,000 hours
- 24V-400W model P/N: 0100011-002
  48V-650W model P/N: 0100012-002

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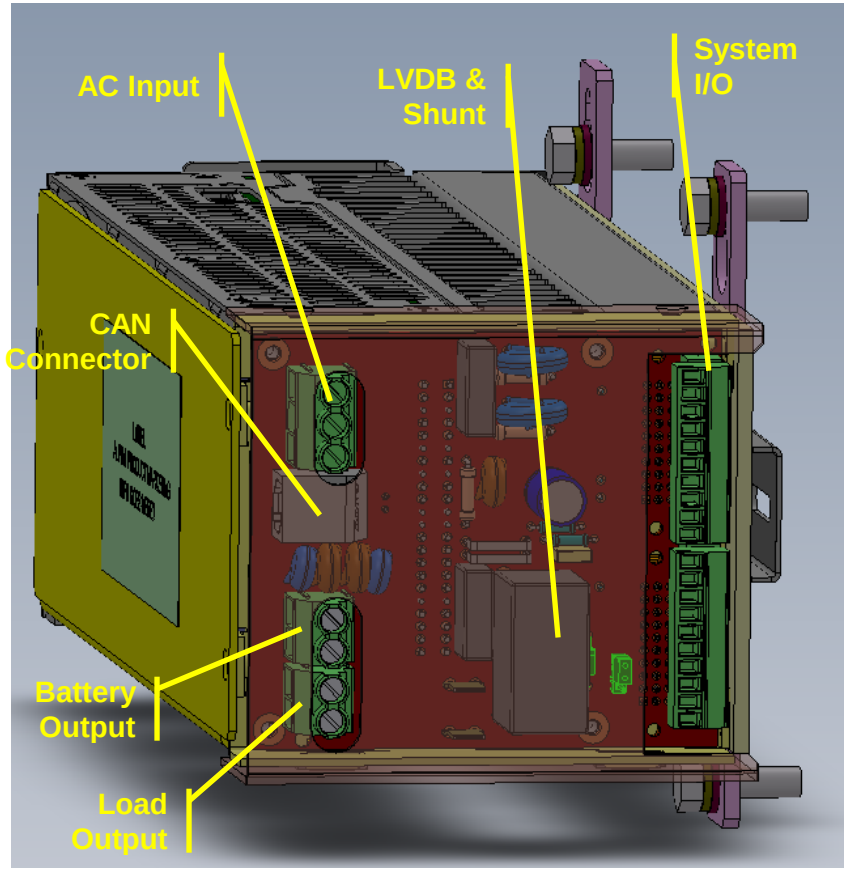
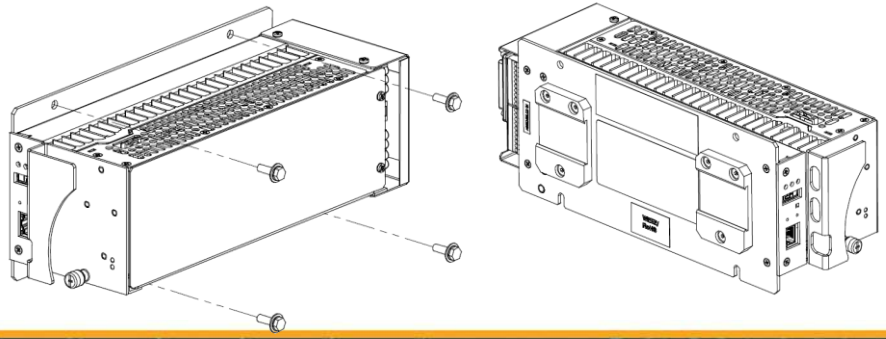
# Cordex PSU

- Electrical
  AC Input: 90 to 320VA (power de-rated from 90 to 176 Vac for the 48V version)
  Output voltage: 43-58Vdc
- Mechanical
  mm: 117H x 281Wx 101D
  in: 4.6H x 11.1W x 3.98D
  Weight: 3kg (6.6lb)
  Include both Panel and DIN rail mounting features
- **Distribution**
  - 10A Battery Shunt
  - 20A Low Voltage Disconnect LVBD (may be disabled with jumpers)
- Connections:
  - AC, Load & Battery: screw terminal 4mm2 (#12AWG)
  - Alarms & I/O's: screw terminals 2.5mm2 to (#14AWG)
- Communication Ports:
  - CAN: Smart Peripherals
  - Ethernet: 10/100 Base-T for TCIP/SNMP/Email features
  - System I/O:
    - Alarm relays: 3
    - Temperature inputs: 2
    - Digital inputs: 2
    - Voltage input: 1
- **Controller: CXCi+**



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# Cordex HP 48-300W

- Dual front and back DC outputs allow maximum flexibility
- 94% Efficiency for increased Op-Ex savings and reduced carbon footprint
- Compact size yields more space for revenue generating equipment
- Wide range AC input for worldwide installation requirements
- N+1 Redundancy
- Wide Temperature Range: -40 to 70C (-40 to 158F)
- Site energy and management solution
- Size: 1Ux2U x 6.3” (1.6”H x 3.4”W x 6.5”D)

**Alpha p/n #0100010**

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# Cordex CXPS 48-300W – Standard 1 RU, 19” Shelf

- Shelf p/n 0300072
  - 1RU 19” - 3 module shelf
  - Mechanicals
    - mm: 43H (1U) x 440W x 250D
    - In: 1.75H x 17.3W x 9.45D
    - Weight: 2kg (6.6lb)
- Electrical
  - AC Input: 90 to 265 Vac, single phase
  - Input current (per module)
    - 1.4A @ 230Vac
    - 3A @ 110Vac
    - 3.7A @ 90Vac

Output voltage: 43-58Vdc

Power output: 300W per module

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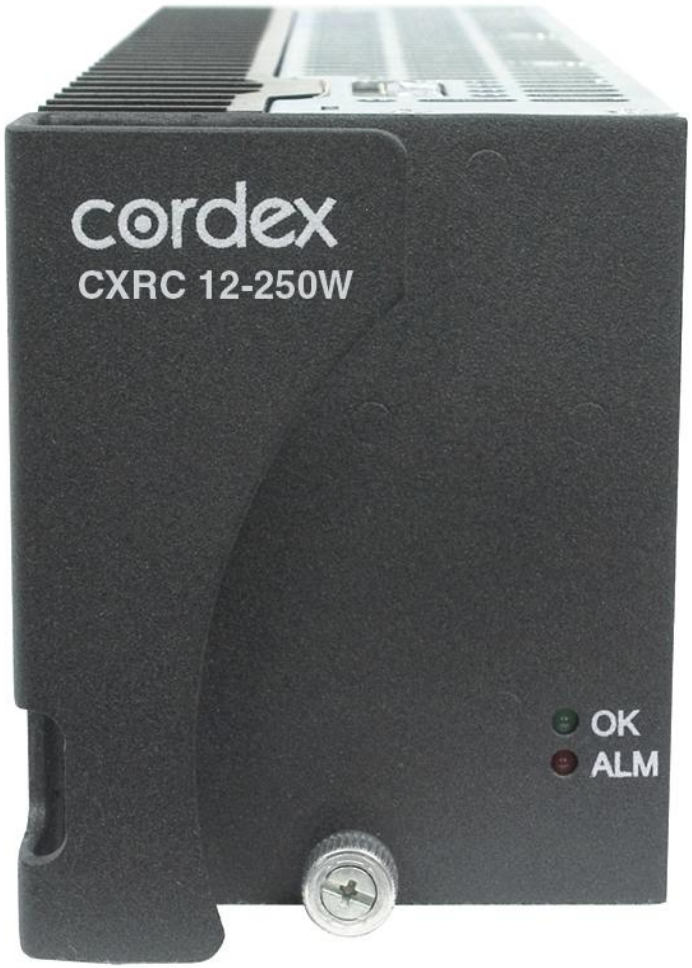
# Cordex CXRC 12-250W

- 20.8A @ 12V
- Hot swappable
- Dimensions
  - 3.5”H x 2.8”W x 9.5”D
- AC Input Voltage
  - 120/240V Universal
- Convection cooled
- Replaceable MOV’s

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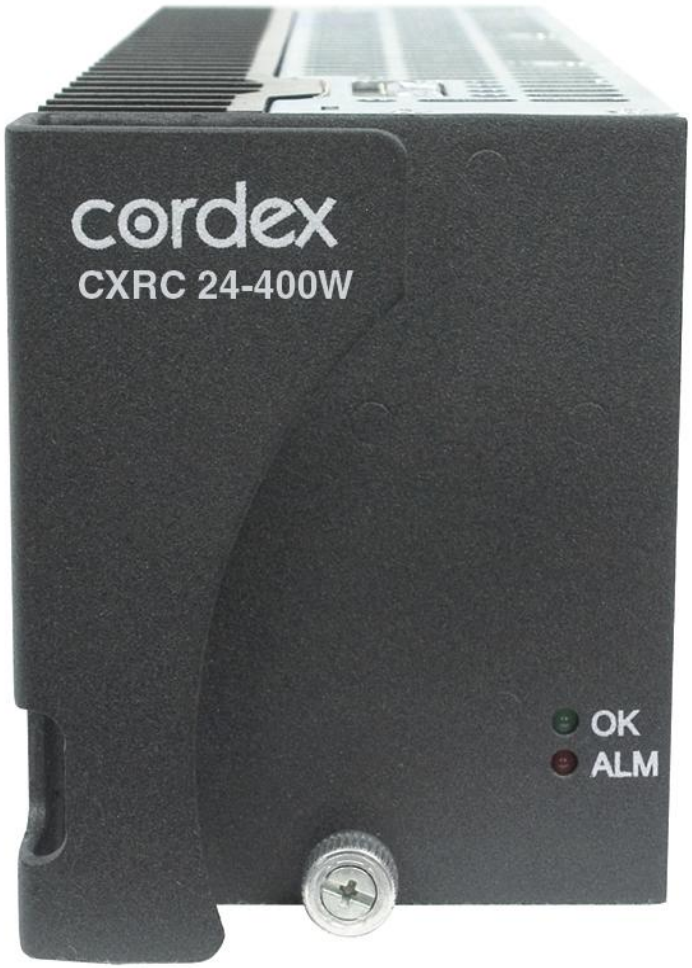
# Cordex CXRC 24-400W

- 14A @ 24V (Constant Current)
- Hot swappable
- Dimensions
  - 3.5”H x 2.8”W x 9.5”D
- AC Input Voltage
  - 120/240V Universal
- Convection cooled
- Replaceable MOV’s

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# Cordex CXRC 48-650W

- 13.5A @ 48V
- Hot swappable
- Dimensions
  - 3.5”H x 2.8”W x 9.5”D
- AC Input Voltage
  - 120V unit
  - 120/240V Universal
    - De-rated at 120V
- Convection cooled
- Replaceable MOV’s

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# 2RU Cordex System

- 2 RU high
- 19/23” mounting
- 4 CXRC 250/400/650W
- CXCi
- Distribution
  - 4 AM bullet C.B.

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# Front Access Cordex System

- 23” Shelf Power System 2RU (48VDC)
  - 4x 650W CXRC
  - CXCI
  - Distribution
    - 4 AM breakers
    - 10 GMT fuses
  - Complete front access in front of rail (AC, DC, CXCI I/O)

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# Cordex CXRC 48-1kW

- 20A @ 48V
- Hot swappable
- Dimensions / weight
  - 7”H x 2.7”W x 9.7”D
  - 2.9kg (6.4lb)
- Convection cooled

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# 48-1 kW Power Module Specs

- **Input voltage:**
  **176 to 265VAC (45 to 66Hz)**
  **150 to 176VAC Extended Range (derated)**

- **Output voltage:**
  **40.5 to 58V**

- **Output current:**
  **18.5A at 54VDC (nominal)**
  **20.8A max at 48VDC (maximum)**

- **Output power:**
  **1000W continuous per module**

- **Power factor: >.99 true at 50 to 100% load under nominal conditions**

- **Efficiency: >.91 at 50-100% load under nominal conditions**

- **Response time: <2mSec to .1% output**

- **Acoustic noise: <55dBA at 1m (3ft)**

- **Noise:**
  **< 26dBrnc w/out batteries (voice band)**
  **< 22dBrnc w/ batteries (voice band)**
  **< 5mV RMS to 100MHz wide band**
  **< 100mV pk to pk to 100MHz**

- **Temperature:**
  **-40 to 50° C (standard)**
  **400W at 65 ° C (extended)**

- **Humidity: 0 to 95% non-condensing**

- **Elevation: -500 to 4000m**

- **Protection: input transient/inrush protection; over temperature; current limit/short circuit**

- **Reliability: MTBF: > 400,000 hours**

- **Regulation:**
  **Dynamic Load:< +/-2%, for 10-90% step**
  **Dynamic Line: < +/-1% for any change in input voltage**

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# 48-1kW System 030-704-20

- Integrated 48VDC Power System
  - 4 CXRC 1kW
  - 1 CXCM
  - Distribution

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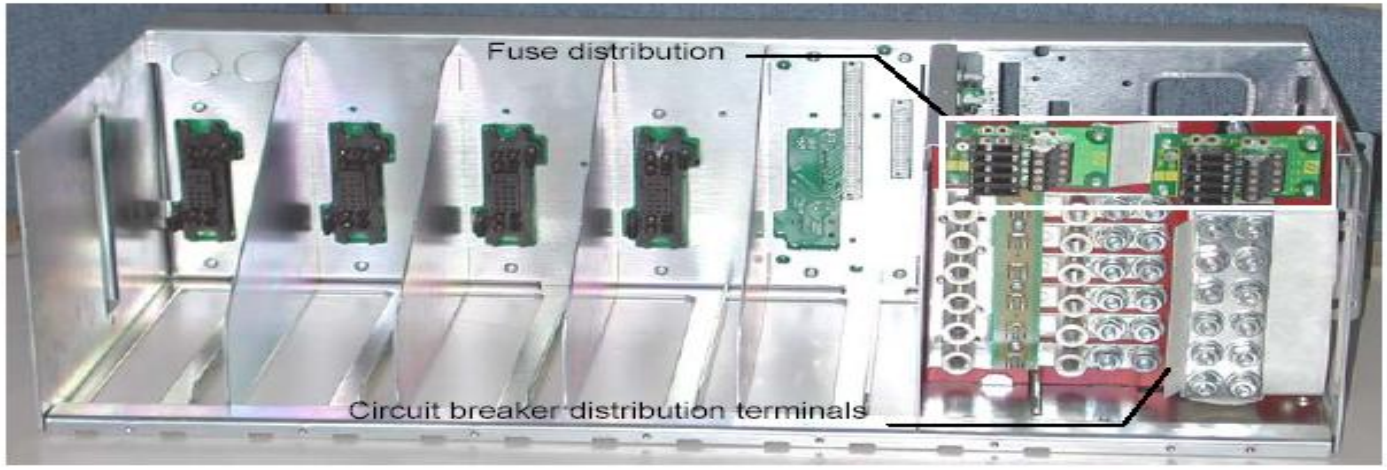
# 48-1kW System 030-704-20

- Distribution
  - 6 x AM Bullet CB's
    - 2 load positions & 4 battery positions
    - 4 load positions & 2 battery positions
  - 10 x GMT Fuses
  - Low voltage disconnect option (LVD)

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# Bulk Output 48-1kW System

- 030-707-20 19/23” universal mount or 19” flush mount
  - 6 x CXRC or
  - 5 x CXRC & 1 x CXCM

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# 48V-1.2kW Rectifier

- Compact Footprint: 1RU x 2RU for Multiple Mounting Orientations
- Wide AC Input Range: De-rated to 600W below 176Vac.  Allows for (2) Modules to run on 15A, 120V circuit
- Efficiency: >93% (40 to 100% load) @ 240Vac
- High Temperature Operation: 65deg C w/ No Power De-Rating
- Black Plastic Front Panel
- 1.63”H x 3.3”W x 10.1”D

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# 2RU Front Access Shelf

- Up to (4) 1.2kW Rectifiers; 100A Max @ 48Vdc
- 2RU High, 19/23” Universal Rack Mount
- Complete Front Access Connections
- CXCM1 Controller (Modular CXCi)
- Battery LVD and Battery Shunt
- (2) IEC AC Line Cord Connections
- (2) Battery Connections
- Distribution Module
  - (4) Plug-In Breakers
  - (10) GMT Fuses

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# 1RU Bulk Power Shelves

- 030-835: Up to (4) 1.2kW Rectifiers; 100A Max @ 48Vdc
- 030-845: Up to (5) 1.2kW Rectifiers; 125A Max @ 48Vdc
- 1RU High, 19/23” Universal Rack Mount
- Rear Access Connections
- CXCM1 Controller (Modular CXCi)
- IEC AC Line Cord Connections
- Bus Bar Output w/ 3/8”-1”C Connex
- Shelf: 1.75”H x 17.3”W x 12”D
- System: 5.3”H x 17.3” W x 15”D

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# Cordex CXRF HP 48-2kW

- **41.6A** @ 48V (1.8kW: 37.5A)
- Efficiency: **94.2%**
- Backwards compatible with 48V-1.8kW
- Improved locking mechanism
- Hot swappable
- Field replaceable Fan
- Size: 3.4”H x 4”W x 10.6”D

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# Cordex CXRF 48-2kW

- Shelves
  - 2RU 23” 5 module shelf
    - Dual AC Input
      - 1 30A 1 Phase 208/240V
      - 1 50A 1 Phase 208/240V
      - Hardwire
  - 2RU 19” 4 module shelf
    - Dual AC Input
      - 2 30A 1 Phase 208/240V
      - Modular or hardwire
  - Controller
    - CXCi or
    - CXCM2
      - -1 rectifier slot

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# Cordex CXRF 48-1.8kW/2kW

- Shelves
  - 2RU 23” 5 module shelf
    - Dual AC Input
      - 1 x30A 1 Phase 208/240V
      - 1 x 50A 1 Phase 208/240V
      - Hardwire
  - 2RU 19” 4 module shelf
    - Dual AC Input
      - 2 x 30A 1 Phase 208/240V
      - Modular or hardwire
  - Controller
    - CXCi or
    - CXCM2
  - Size 23” : 3.5”H x 21.3”W x 12.2”D
  - Size 19” : 3.5”H x 17.2”W x 12.2”D

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# Cordex HP CXRF 48-2.4kW Rectifier

- **1RU high** for flexible and multiple mounting options
- **Multiple 48V configurations up to 250A** in 1RU shelf system
- **96% efficiency** for decreased Op-Ex and reduced carbon footprint
- **High power density (28 W/in$^3$)** yields more space for revenue generating equipment
- **High temperature operation** for installation i harsh outdoor environments
- **Wide AC input operating range** that satisfy a variety of global installation requirements
- Size: 1.6”H x 4.1”W x 13”D

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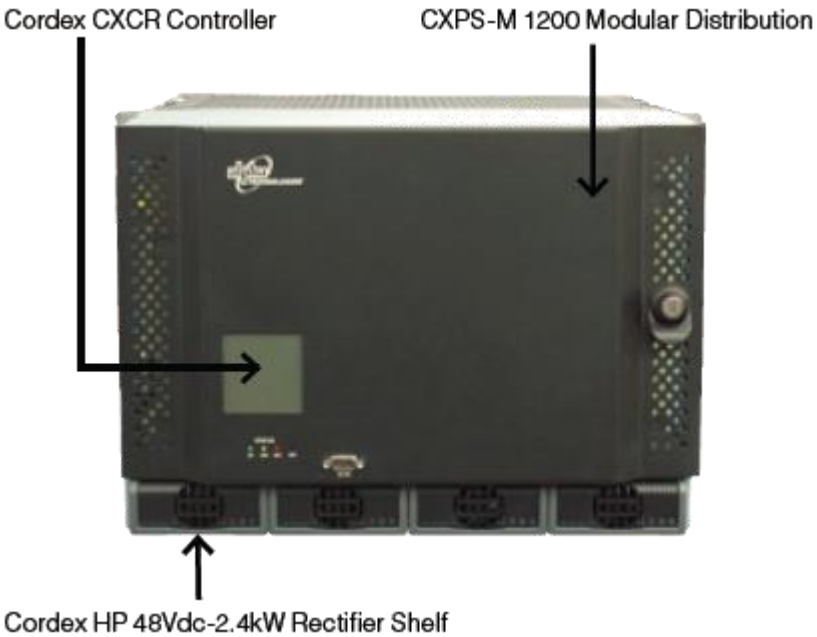
# Cordex HP CXRF 48-2.4kW

Input voltage

| | |
|---|---|
| Nominal: | 187 to 277VAC |
| Operating: | 187 to 310VAC |
| Extended: | 90 to 187 VAC (de-rated power) |
| Input frequency: | 45 to 66Hz |
| Power: | 2400W continuous |
| | (~1200W Output at 120Vac Input) |
| Efficiency: | >96% (40-80%load) |
| Output voltage: | 44 to 58Vdc |
| Output current: | 44.5A @ 54VDC (50A max.@ 48VDC) |
| | (~25A @ 48VDC at 120 Vac Input) |

Size (23”): 1.75”H x 21.4W x 16.6”D

Size (19”): 1.75”H x 17.3W x 16.6”D

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# CXRF HP 48-4kW

- 83.3A @ 48V
- Efficiency: 95%
- Hot swappable
- 15.5W/cu inch
- Weight/dimensions
  - 177H x 86.5W x 300D
  - 7”H x 3.4”W x 11.8”D
  - 4.6 kg (10.1 lb)
- Field replaceable
  - Fans (2)
  - MOV surge arrestors

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# CXRF 48V-3.6/4kW, 24V-3.1kW

- 4RU 23” 6 module shelf
  - AC Input options
    - 6 x 25 or 30A 1 Phase 208,240 or 277 VAC
    - 2 x 50A 3 Phase 208 VAC
    - 2 x 30A 3 Phase 277/480 VAC4RU 23” shelf
- 4RU 19” 5 module shelf
  - AC Input 5 x 25 or 30A 1 Phase 208, 240 or 277 VAC
- CXCM4 optional modular controller
- Size: 7”H x 20.9”W x 15.3”D

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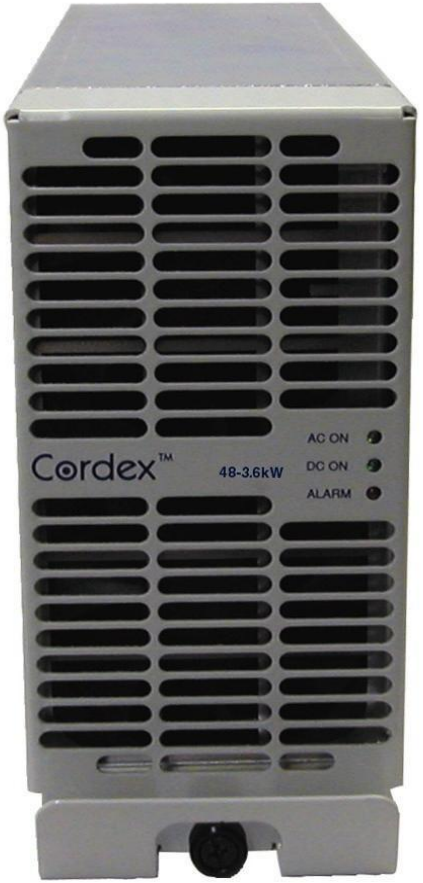
# CXRF 24-3.1 kW

- 130A @ 24V
- Hot swappable
- 12w/cu
- Weight/dimensions
  - 177H x 86.5W x 300D
  - 7”H x 3.4”W x 11.8”D
  - 4.6 kg (10.1 lb)
- Field replaceable
  - Fans (2)
  - MOV surge arrestors

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# CXRF 48-4kW, 24-3.1kW

- 4RU 23” 6 module shelf
  - AC Input options
    - 6 x 25 or 30A 1 Phase 208,240 or 277 VAC
    - 2 x 50A 3 Phase 208 VAC
    - 2 x 30A 3 Phase 277/480 VAC4RU 23” shelf
- 4RU 19” 5 module shelf
  - AC Input 5 x 25 or 30A 1 Phase 208, 240 or 277 VAC
- CXCM4 optional modular controller

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# CXRF 48-4kW, 24-3.1kW Power Module Specs

- **Input voltage:**
  **176 to 312VAC (45 to 66Hz)**
  **90 to 176VAC Extended Range (derated)**

- **Output voltage:**
  **48 to 58V**
  **24 to 30V**

- **Output current:**
  **74A at 54VDC (nominal)**
  **83A max at 48VDC (maximum)**
  **115A at 27VDC (nominal)**
  **130A at 24VDC (maximum)**

- **Output power:**
  **400W continuous per module (48V)**
  **3100W continuous per module (24V)**

- **Power factor: >.99 true at 50 to 100% load under nominal conditions**

- **Efficiency: >95% (48V), 89% (24V)**

- **Acoustic noise: <60dBA at 1m (3ft)**

- **Noise:**
  **24V < 32dBrnc w/out batteries (voice band)**
  **< 10mV RMS to 100MHz wide band**
  **< 100mV pk to pk to 100MHz**
  **48V < 38dBrnc w/out batteries (voice band)**
  **< 20mV RMS to 100MHz wide band**
  **< 150mV pk to pk to 100MHz**

- **Temperature:**
  **-40 to 65° C (standard)**

- **Humidity: 0 to 95% non-condensing**

- **Elevation: -500 to 2800m**

- **Protection: input transient/inrush protection; over temperature; current limit/short circuit**

- **Regulation:**
  **Transient response:< +/-1%, for 10-90% step**

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# Industrial Switched Mode Rectifiers and Power Systems

# Cordex Industrial Switched Mode Rectifiers

Cordex 4.4kW

Cordex 3.3kW 220V

Cordex 3.3kW 125V

Cordex 1.1kW 220Vdc

Cordex 1.1kW 125Vdc

Alpha Technologies
Industrial Power products

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# CXRC 125-1.1kW

- 8.8A @ 125V
- Hot swappable
- Dimensions / weight
  - 7”H x 2.7”W x 9.7”D
  - 2.9kg (6.4lb)
- Convection cooled
- 6 module bulk power shelf
  - 2 feed 30A or
  - 3 feed 20A
- For Substation applications

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# CXRC 220-1.1kW

- 5A @ 220V
- Hot swappable
- Dimensions / weight
  - 7”H x 2.7”W x 9.7”D
  - 2.9kg (6.4lb)
- Convection cooled
- 6 module bulk power shelf
  - 2 feed 30A or
  - 3 feed 20A
- For Power Plant Applications

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# CXRC 125/220-1.1 kW Specs

- **Input voltage:**
  **176 to 320VAC (45 to 66Hz)**
- **150 to 176VAC Extended Range de-rate Pwr**
- **176 to 320VAC Extended Range de-rate PF**
- **Output voltage:**
  **90 to 160VDC**
- **Output current:**
  **8.8A @ 125VDC (11A max) or**
- **5A @ 220VDC**
- **Output power:**
  **1100W continuous per module**
- **Power factor:**
  **>.99 true at 50 to 100% load under nominal conditions**
- **Efficiency:**
  **>.93 at 50-100% load under nominal conditions**
- **Acoustic noise: <55dBA at 1m (3ft)**
- **Noise:**
  **< 10mV RMS to 100MHz wide band**
  **< 80mV pk to pk to 100MHz**
- **Temperature:**
  **-40 to 50° C (standard)**
  **600W at 65 ° C (extended)**
- **Humidity: 0 to 95% non-condensing**
- **Elevation: -500 to 4000m**
- **Protection: input transient/inrush protection; over temperature; current limit/short circuit**
- **Reliability: MTBF: > 400,000 hours**
- **Regulation:**
- **Dynamic Load:< +/-2%, for 10-90% step**
  **Dynamic Line: < +/-1% for any change in input voltage**

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# CXC for 3.3 kW HV Shelf

- 125/220 VDC
- Ground Fault Detection (GFD)
- 1 analog inputs
  - Voltage V2
- 4 digital inputs
  - 1 Breaker alarm
- 6 form C relay
  - 1-3 unused
  - 4 Power minor alarm
  - 5 Power major alarm
  - 6 AC fail alarm

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# CXRF 125/220-4.4 kW

- 35A @ 125V
- 20A @ 220V
- Hot swappable
- Weight/dimensions
  - 177H x 86.5W x 300D
  - 7”H x 3.4”W x 11.8”D
  - 4.6 kg (10.1 lb)
- Field replaceable
  - Fans (2)
  - MOV surge arrestors
- For Power Plant and Substation applications

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# CXRF 125/220-4.4 kW

- 4RU 19” 5 module shelf
  - AC Input options
    - 5 x 30A 1 Phase 208,240 or 277 VAC
- 4RU 23” 6 module shelf
  - AC Input options
    - 6 x 30A 1 Phase 208,240 or 277 VAC
    - 2 x 50A 3 Phase 208 VAC
    - 2 x 30A 3 Phase 277/480 VAC

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# CXRF 125/220-4.4kW Specs

- **Input voltage:**
  **176 to 312VAC (45 to 66Hz)**
- **90 to 176VAC Extended Range (derated)**
- **Output voltage:**
  **90 to 160 VDC or**
- **180 to 320 VDC**
- **Output current:**
  **35A at 125 VDC (40A max) or**
- **20A at 220 VDC**
- **Output power:**
  **4400W continuous per module**
- **Power factor:**
- **>.99 true at 50 to 100% load under nominal conditions**
- **Efficiency: >93%**
- **Acoustic noise: <60dBA at 1m (3ft)**
- **Noise:**
  **<30mV RMS to 100MHz wide band**
  **< 150mV pk to pk to 100MHz**
- **Temperature:**
  **-40 to 50° C (standard)**
  **-40 to 75° C (extended)**
- **Humidity: 0 to 95% non-condensing**
- **Elevation: -500 to 2800m**
- **Protection: input transient/inrush protection; over temperature; current limit/short circuit**
- **Transient response:**
  **< +/-2%, for 50-90% step**

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