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xantrex



CR 1012E	CR1012
CR 1024E	CR1024
CR 1512E	CR1512
CR 1524E	CR1524
CR 2412E	CR2412
CR 2424E	CR2424

User Guide

Xantrex CR Series Backup System Inverter / Charger

www.xantrex.com

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About Xantrex

Xantrex Technology Inc. is a world-leading supplier of advanced power electronics and controls with products from 50 watt mobile units to one MW utility-scale systems for wind, solar, batteries, fuel cells, microturbines, and backup power applications in both grid-connected and stand-alone systems. Xantrex products include inverters, battery chargers, programmable power supplies, and variable speed drives that convert, supply, control, clean, and distribute electrical power.

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Date and Revision

September 2005 Revision B

Part Number

975-0252-01-01

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Important Safety Instructions



WARNING

This chapter contains important safety and operating instructions. Read and keep this User Guide for future reference.

READ AND SAVE THESE INSTRUCTIONS

Before using the Xantrex CR Series Backup System Inverter/Charger (CR Series), read and obey all instructions and cautionary markings on the CR Series, the batteries, and in all sections of this instruction manual.



WARNING

The following warnings identify conditions or practices that could lead to injury or loss of life

1. To reduce risk of fire and electric shock, Xantrex recommends that all wiring be done by a qualified electrician to ensure adherence to the local and national electrical codes applicable in your application.
 2. To reduce risk of injury and damage, charge only deep-cycle lead acid type rechargeable batteries. Other types of batteries may burst, causing personal injury and damage.
 3. To reduce risk of shock or fire, do not disassemble the CR Series. It contains no user-serviceable parts and internal capacitors remain charged after all power is disconnected. Take it to a qualified service center when service or repair is required. Incorrect re-assembly may result in risk of shock or fire.
 4. To reduce risk of electric shock, disconnect all AC and DC sources before attempting any maintenance or cleaning. Turning off the CR Series will not reduce this risk.
-

5. To reduce risk of fire and electric shock, make sure that existing wiring is in good condition and that wire is not undersized. Do not operate the CR Series with damaged or substandard wiring.
6. **EXPLOSION HAZARD WORKING IN VICINITY OF A LEAD ACID BATTERY IS DANGEROUS. BATTERIES GENERATE EXPLOSIVE GASES DURING NORMAL OPERATION.** Provide ventilation to outdoors from the battery compartment. The battery enclosure should be designed to prevent accumulation and concentration of hydrogen gas in "pockets" at the top of the compartment. Vent the battery compartment from the highest point. A sloped lid can also be used to direct the flow to the vent opening location. Follow the instructions in this manual and those of the battery manufacturer regarding charging and ventilation.
7. **EXPLOSION HAZARD:** This equipment contains components which tend to produce arcs or can spark. To prevent fire or explosion, do not install the CR Series in compartments containing batteries or flammable materials or in locations that require ignition-protected equipment. This includes any space containing gasoline-powered machinery, fuel tanks, or joints, fittings, or other connections between components of the fuel system.
8. Do not operate the inverter/charger if it has received a sharp blow, been dropped, or otherwise damaged in any way. If the unit is damaged, see the Warranty information elsewhere in this manual.
9. To reduce risk of shock hazard and damage, do not expose the CR Series to rain, snow or liquids of any type. The CR Series is designed for indoor mounting only. Protect the CR Series from splashing if used in vehicle applications.
10. The inverter/charger must be properly grounded and provided with AC and DC disconnects and overcurrent protection as specified in this manual and in accordance with applicable electrical codes.

-
11. Be extra cautious when working with metal tools on, or around batteries. The potential exists to drop a tool and short-circuit the batteries or other electrical parts resulting in sparks that could cause an explosion.



WARNING

Obey the following personal precautions while working with and charging batteries. These warnings concern conditions or practices that could lead to injury or loss of life.

1. Someone should be within range of your voice to come to your aid when you work near batteries.
 2. Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.
 3. Wear complete eye protection and clothing protection. Avoid touching eyes while working near batteries. Wash your hands when done.
 4. If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters eyes, immediately flood eyes with running cool water for at least 15 minutes and get medical attention immediately. Baking soda neutralizes lead acid battery electrolyte. Keep a supply on hand in the area of the batteries
 5. NEVER smoke or allow a spark or flame in vicinity of a battery or generator.
 6. Be extra cautious when working with metal tools on, and around batteries. Potential exists to short-circuit the batteries or other electrical parts which may result in a spark which could cause an explosion.
 7. Remove personal metal items such as rings, bracelets, necklaces, and watches when working with a battery. A battery can produce a short-circuit current high enough to weld a ring, or the like, to metal causing severe burns.
-



CAUTION

The following cautions identify conditions or practices that could result in damage to the inverter/charger or other equipment

1. To reduce the risk of overheating, keep the ventilation openings clear and do not install the CR Series in a compartment with limited airflow. Maintain adequate clearance around the sides of the unit. Refer to the installation instructions in this manual.
2. Never charge a frozen battery.

1

Introduction

CR Series Function and Operation

The following sections describe important aspects of the Xantrex CR Series Backup System Inverter/Charger (CR Series) operation. Read this to understand how the CR Series functions.

Inverter to Charger Transition

The internal battery charger and automatic transfer relay allow the unit to operate as either a battery charger or inverter (but not both at the same time). The CR Series automatically becomes a battery charger whenever AC power is supplied to its AC input, while also passing the incoming AC power through to the loads on the CR Series' AC output (load) terminals.

Charger Terminology

Constant current stage During this stage of the charge cycle, the batteries are charged at a constant current, ensuring rapid replacement of most of the battery's charge.

Constant voltage stage During this stage of the charge cycle, the batteries are held at a constant voltage and accept whatever current is required to maintain this voltage. This stage ensures replacement of the remaining charge not replaced during the constant current stage, while preventing the batteries from being over-charged.

Transfer Switching Speed

While the CR Series is not designed specifically to operate as an uninterruptible power supply system (UPS), its transfer time is normally fast enough to maintain the power for computers. The relay transfer time is a maximum of 20 milliseconds.

2 Stage Operation

The CR Series is a simple 2 stage charger which holds the voltage steady (float) after charging. Both the charging and float voltage are 13.5 VDC (for 12 V models) and 27 VDC (for 24 V models).



CAUTION

To avoid damage to your batteries, ensure that your batteries are rated to withstand the constant float voltage.

Features

The following sections illustrate the features of the CR Series. Figure 1-1 shows the features of the front side of the CR Series and identifies the AC end from the DC end.

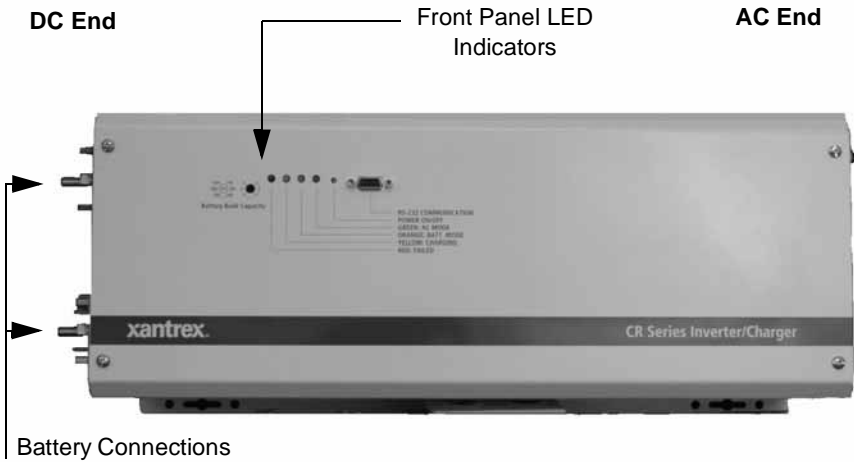


Figure 1-1 Front Panel Features

AC End

The AC end of the CR Series has one breaker for pass-thru AC Input, and one breaker for charger AC input.

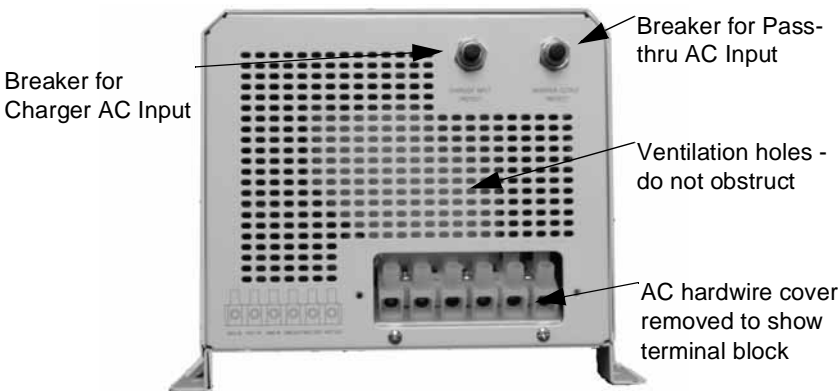


Figure 1-2 AC Side of the CR Series

DC End

The DC end of the CR Series has the equipment ground lug, the positive (+) battery terminal, and the negative (-) battery terminal.



Figure 1-3 DC Side of the CR Series

2

Installation

CR Series Mounting

Follow these instructions to mount the CR Series.



WARNING: Heavy equipment

The CR Series can weigh up to 27.5 kg (61 lbs) depending upon configuration (see Table A-3 on page 27). Always use proper lifting techniques during installation to prevent personal injury. Have extra people on hand to assist in lifting the CR Series into position while it is being secured.

Mounting on Wallboard

Wallboard is not strong enough to support the weight of the CR Series so additional support must be added. The easiest method for securing the CR Series to an existing wall is to place two 2 in. x 4 in. boards horizontally on the wall (spanning at least three studs) and securing the CR Series to those boards.



WARNING

Do not mount the CR Series using only the keyhole slots for mounting hardware. Use mounting bolts in at least two of the round holes in addition.

To mount the CR Series:

1. Locate the studs and mark their location on the wall.
2. Measure the desired height from the floor for the CR Series to be mounted.

3. Using a level, run a horizontal line. The length of the line must span at least 3 studs.
4. Place a pre-cut 2 in. x 4 in. board on the marked location and drill pilot holes through the board and studs.
5. Secure the 2 in. x 4 in. board to the 3 studs with #10 wood screws long enough to penetrate 1½ in. into the studs.
6. Repeat the above procedure for the second 2 in. x 4 in. board.
7. Drill pilot holes for the mounting bolts into the 2 in. x 4 in. boards, referring to Figure 2-1 for locations.
8. With assistance, lift the CR Series into position, and secure it to the 2 in. x 4 in. boards using ¼ x 1½ in. lag bolts and washers in at least 6 locations.

Alternatively, a half or quarter sheet of ¾ in. plywood can also be used as a backing, with the CR Series mounted directly to the plywood using ¼ in. diameter lag bolts and washers. The plywood must span and be secured to three studs for adequate support.

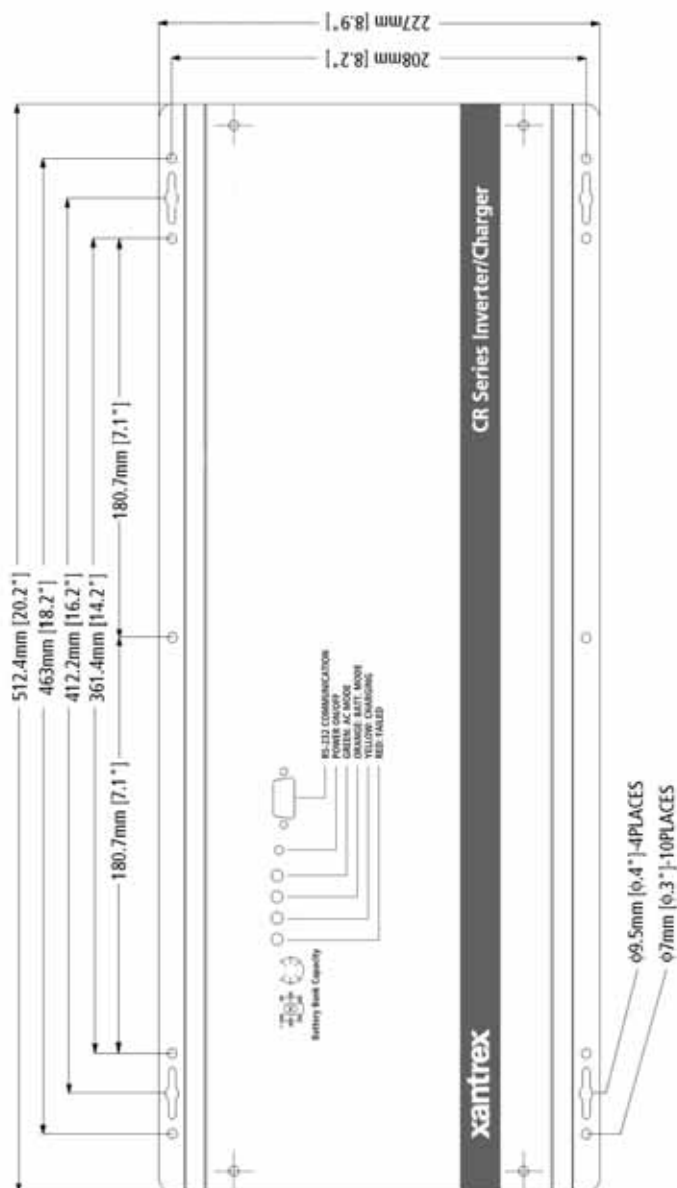


Figure 2-1 Dimensional Drawings for Screw Hole Placement

Mounting on Other Types of Walls

As the mounting walls may be made of materials other than wood, Figure 2-1 and the methods described in “Mounting on Wallboard” are valid, providing local mounting codes are met. You will need to refer to your local building codes in order to determine what type of mounting equipment is needed to securely mount the CR Series.

Battery Cable Connection



WARNING: Risk of overheating and fire

Risk of overheating and fire. Under-sized cables, loose connections, or improper connections will overheat. Use the recommended cable sizes below. Do not place anything between the flat part of the CR Series terminal and the battery cable ring terminal. Do not apply any type of anti-oxidant paste to terminals until after the battery cable wiring is torqued. Tighten the nuts on the DC terminals to 10 to 15 foot-pounds of torque.



CAUTION

Reverse polarity connection of the battery will damage the inverter/charger and is not covered by your warranty. Ensure correct polarity (positive to positive, negative to negative) before completing the connections from the battery to the CR Series.

Important: Run the positive and negative battery cables as close to each other as possible, using cable ties or clamps to hold them together. This reduces the effect of inductance, produces a better waveform, and increases efficiency.

Figure 2-2 illustrates the proper method to connect the battery cables to the CR Series terminals.



CAUTION

Do not place anything between the battery cable ring terminals and the terminal surfaces on the inverter. The terminal stud is not designed to carry current. Apply anti-oxidant paste to the terminals only after their terminals have been torqued.

Verify that cable lugs are flush against the battery terminal surfaces.

Tighten battery terminal to 10-15 foot-pounds torque.

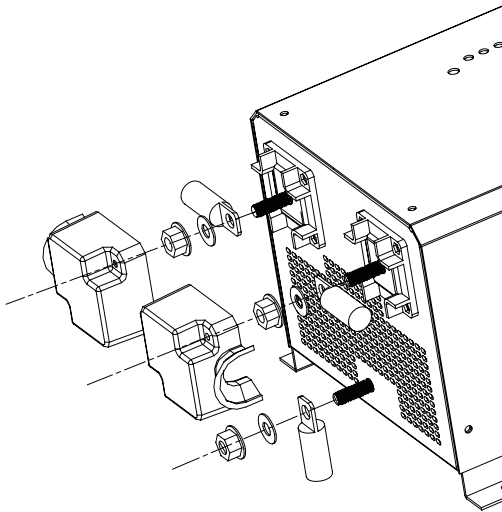


Figure 2-2 Battery Cable Connection to CR Series

Table 2-1 provides recommended minimum cable sizes for various cable lengths and inverter amperages.

Table 2-1 Minimum Recommended Battery Cable Size Versus Length

Inverter Model	Typical Full Load DC Input Current	Minimum Recommended Cable Size for Lengths up to 5 ft each way	Minimum Recommended Cable Size for Lengths up to 10 ft each way
CR1012 CR1012E	100 A	#2/0 AWG (67.4 mm ²)	#4/0 AWG (107 mm ²)
CR1024 CR1024E	50 A	#1/0 AWG (53.4 mm ²)	#2/0 AWG (67.4 mm ²)
CR1512 CR1512E	150 A	#4/0 AWG (107 mm ²)	#4/0 AWG (107 mm ²)
CR1524 CR1524E	75 A	#2/0 AWG (67.4 mm ²)	#2/0 AWG (67.4 mm ²)
CR2412 CR2412E	240 A	#4/0 AWG (107 mm ²)	Not recommended
CR2424 CR2424E	120 A	#4/0 AWG (107 mm ²)	#4/0 AWG (107 mm ²)

Important: Increasing the size of the cables and keeping them as short as possible will greatly improve inverter surge performance and will reduce the likelihood of nuisance outages (due to undervoltage shutdown, DC breaker tripping, or open fuses).

DC Disconnect and Over-Current Protection

For safety and to comply with regulations, battery over-current protection and disconnect devices are required. Fuses and disconnects must be sized to protect the DC cable size used, and must be rated for DC operation. Do not use devices rated only for AC service - they will not function properly.

Note that some installation requirements may not require a disconnect device, although over-current protection is still required. Refer to the table below for the proper size over-current protection (fuse or breaker) for specific cable sizes listed in Table 2-1.

Table 2-2 Battery Cable to Maximum Breaker/Fuse Size

Cable Size Required	Max. Continuous Current Rating ^a	Max. Fuse or Breaker Size
No. 1/0 AWG	230 A	250 Adc
No. 2/0 AWG	265 A	300 Adc
No. 3/0 AWG	310 A	350 Adc
No. 4/0 AWG	288 A	400 Adc

a. Based on the US National Electrical Code, NFPA 70, Table 310-17, for 75 C single-insulated cables at 80% loading

AC Connections



WARNING: Shock and fire hazard

Ensure all AC and DC sources are disconnected at the source before beginning wiring. Turning off the CR Series will not reduce this hazard. Xantrex recommends that all wiring be done by a qualified electrician to ensure adherence to the local and national electrical codes applicable in your application.

On the right (AC) end of the chassis is the AC hardwire cover or conduit box (dependent on the power level). A six-position terminal block is provided to make the AC input, AC output, and ground connections. Consult the applicable electrical codes to determine any AC input and output overcurrent protection and disconnect switches that may be required. The AC breakers in a sub-panel may meet this requirement.

To make AC connections:

1. Disconnect the CR Series from the battery either by turning off the battery switch or removing the battery cables from the battery. Disconnect the AC source by opening the appropriate circuit breaker in the AC panel supplying the circuit.
2. Feed the wires through appropriate conduit and the AC cover. In certain installations, conduit fittings may be replaced with strain reliefs, consult local and national codes. See Figure 2-3.
3. Following the wiring guide located in the AC wiring compartment (see Figure 2-3), connect the safety ground (bare, green or green and yellow), line (black or brown), and neutral (white or blue) wires from the AC input (utility, generator, etc.) to the terminal block and tighten to 10-15 inch pounds torque.

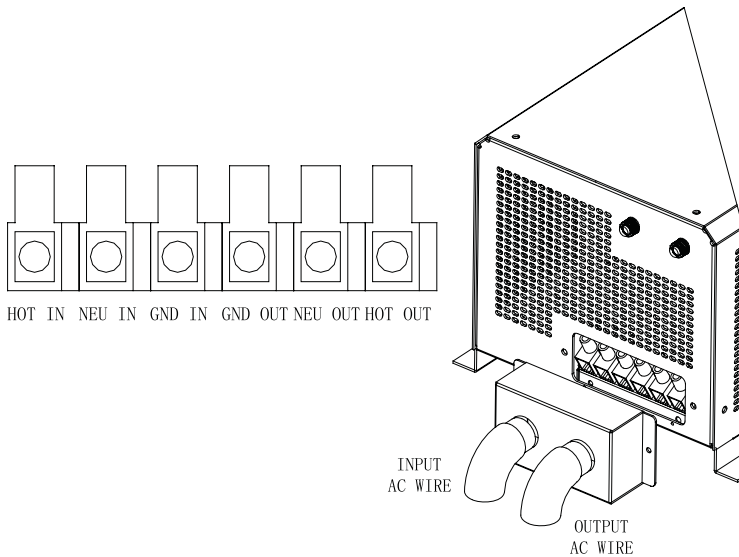


Figure 2-3 AC Connections

4. Following the wiring guide located in the AC wiring compartment (see Figure 4), connect the safety ground (bare, green or green and yellow), line (black or brown), and neutral (white or blue) wires from the AC output (loads) to the terminal block and tighten to 10-15 inch pounds torque.
5. Use the two M3 screws to secure the AC wiring compartment cover back in place over the terminals.
6. If using cable clamps, tighten the clamps on the AC cable jackets (not the individual wires) to provide strain relief for the connections.

3 Operation

Front Panel Controls and LED Indicators

Shown below are the controls and indicator lights on the front of the CR Series series. They control and provide information in either inverter or battery charging mode of operation. All models of the CR Series series operate identically.

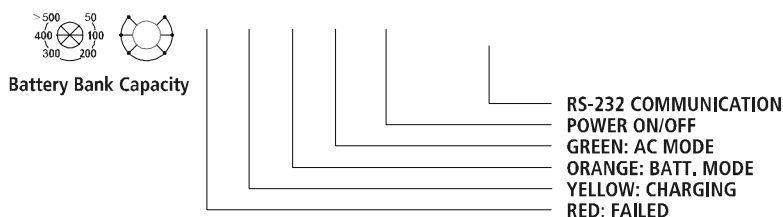


Figure 3-1 Control Panel

Power On/Off

Once the CR Series has been properly installed and the batteries are connected, press and hold the POWER ON/OFF button (approximately 2-5 seconds) to turn the unit on or off.

AC Mode LED

This green LED lights up when the AC Input power is qualified and passing through to the output (during charging).

Battery Mode LED

This orange LED lights up when the unit is in battery mode (using power from batteries).

Charger LED

Yellow This indicates that the charger is in the first stage (constant current stage).

Blinking Yellow This indicates that the charger is in the second stage (constant voltage stage). The LED blinks approximately every 8-10 seconds.

Failed (Fault) LED

Red light This indicates that the inverter has shut down from one of the following possible failures: overload, battery voltage too high and fan failure. To restart the inverter, first correct your fault and press and hold the ON/OFF POWER button (approximately 2 – 5 seconds) to turn the unit back on.

Battery Bank Capacity

The BATTERY BANK CAPACITY control is used to inform the microprocessor about the size of the battery bank being used. Battery bank size is adjustable from 50 to > 500 amp-hours. Set this adjustment to the setting closest to the size of your battery bank (in amp-hours). The charge current will be set at 0.1 times the battery bank setting up to the charging maximum (see Table A-1).

Audible Alarm (internal)

An alarm is located inside the unit as an audible alert for warning and fault conditions. The Low Battery warning causes the alarm to beep once every 4.5 seconds and the 110% Overload condition warning causes the alarm to beep continually. Faults, such as Battery Voltage Too High, Fan Locked, Short Circuit and 150% Overload condition cause the alarm to sound continuously. The Battery Undervoltage fault causes the alarm to sound continuously until the unit shuts down.

Circuit Breakers

The CR Series contains two circuit breakers located on the right-hand side of the chassis, directly above the AC input terminal block. The INVERTER OUTPUT PROTECT circuit breaker protects the internal AC pass-through wiring and transfer relay. The CHARGER INPUT PROTECT circuit breaker protects the charger circuit.

RS232 Communications

Used for factory testing. No customer interface is available.

A Specifications

Table A-1 Charge and Bypass Mode Specifications

MODEL	CR-1000	CR-1500	CR-2400
Nominal AC Input Voltage	120VAC / 230VAC ^a		
AC Input Disconnect Voltage	<85VAC or >132VAC, <184VAC or >253VAC ^a ± 4%		
Acceptable Voltage Connect Range	95VAC — 127VAC / 194VAC — 243VAC ^a		
Nominal AC Input Frequency	60Hz or 50Hz ^a		
AC Input Frequency Range	47Hz — 53Hz ^a or 57Hz — 63Hz ± 0.3Hz		
Max Total AC Input Current (Charge + Bypass)	14 Arms at 120Vac 7.4 Arms at 230Vac ^a	18.1 Arms at 120Vac 9.4 Arms at 230Vac ^a	27 Arms at 120Vac 14.1 Arms at 230Vac ^a
Rated AC Bypass Current	8.3 Arms at 120Vac 4.4 Arms at 230Vac ^a	12.5 Arms at 120Vac 6.5 Arms at 230Vac ^a	20 Arms at 120Vac 10.4 Arms at 230Vac ^a
Charging Voltage	12V model: 13.5Vdc 24V model: 27.0Vdc		
Charging Current (Depending on battery capacity)	12V model: 0 — 40A 24V model: 0 — 20A		12V model: 0 — 50A 24V model: 0 — 25A
Relay Transfer Time	20 ms (typical)		

a. 230V, 50Hz models

Table A-2 Invert Mode Specifications

MODEL	CR-1000	CR-1500	CR-2400
AC Output Power	1000VA / 1000W	1500VA / 1500W	2400VA / 2400W
Nominal AC Output Voltage	120VAC / 230VAC ^a		
AC Output Frequency	60Hz or 50Hz ^a \pm 0.3Hz		
AC Output Waveform	Modified Sinewave		
Peak Efficiency	(DC – AC) 86%		
Nominal DC Input Voltage	12V or 24V ^b		
DC Operating Range	12V models: 10.5V — 14.5V 24V models: 21V — 29V		
Maximum DC Input (to prevent damage)	12V models: 15V 24V models: 30V		
DC Input Current at Full Load	101 A at 12V 50 A at 24V ^b	152 A at 12V 74 A at 24V ^b	247 A at 12V 122 A at 24V ^b
Surge Capability	<1.5 times output power for 1 minute		
Overload Shutdown	>1.5 times output power immediate shutdown		
Low Battery Warning (Audible Alarm)	12V model: 11V \pm 0.5V 24V model: 22V \pm 0.5V		
Low Battery Shutdown	12V model: 10.5V \pm 0.5V 24V model: 21V \pm 0.5V		

a. 230V, 50Hz models

b. 24Vdc models

Table A-3 Environmental and Physical Specifications

MODEL	CR-1000	CR-1500	CR-2400
Temperature	0 — 40°C Maximum (32 — 104°F)		
Dimensions DxWxH	579 x 227 x 179mm (22.8in. x 8.9in. x 7in.)		
Net Weight	18kg (40 lbs.)	20kg (44 lbs.)	27.5kg (61 lbs.)

Table A-4 Interface Specifications

MODEL	CR-1000	CR-1500	CR-2400
RS-232 Port	Used for factory testing. No customer interface available.		

Warranty Information

Limited Warranty for:

Xantrex CR Series Backup System Inverter/Charger

What does this warranty cover and how long does it last? This Limited Warranty is provided by Xantrex Technology Inc. ("Xantrex") and covers defects in workmanship and materials in your Xantrex CR Series Series product. This warranty lasts for a Warranty Period of 1 year from the date of purchase at point of sale to you, the original end user customer.

What will Xantrex do? Xantrex will, at its option, repair or replace the defective product free of charge, provided that you notify Xantrex of the product defect within the Warranty Period, and provided that Xantrex through inspection establishes the existence of such a defect and that it is covered by this Limited Warranty.

Xantrex will, at its option, use new and/or reconditioned parts in performing warranty repair and building replacement products. Xantrex reserves the right to use parts or products of original or improved design in the repair or replacement. If Xantrex repairs or replaces a product, its warranty continues for the remaining portion of the original Warranty Period or 90 days from the date of the return shipment to the customer, whichever is greater. All replaced products and all parts removed from repaired products become the property of Xantrex.

How do you get service?

If your product requires troubleshooting or warranty service, contact your dealer. If you are unable to contact your dealer, or the dealer is unable to provide service, contact Xantrex directly at:

Telephone: +34 93 470 5330 (Europe)
1 360 925 5097 (Direct North America and rest of world)
Fax: +34 93 473 6093 (Europe)
1 360 925 5143 (Direct North America and rest of world)
Email: support.europe@xantrex.com (Europe)
customerservice@xantrex.com (North America and rest of world)
Web: www.xantrex.com

In any warranty claim, dated proof of purchase must accompany the product and the product must not have been disassembled or modified without prior written authorization by Xantrex.

Proof of purchase may be in any one of the following forms:

- The dated purchase receipt from the original purchase of the product at point of sale to the end user, or
- The dated invoice or purchase receipt showing the product exchanged under warranty

What does this warranty not cover? This Limited Warranty does not cover normal wear and tear of the product or costs related to the removal, installation, or troubleshooting of the customer's electrical systems. This warranty does not apply to and Xantrex will not be responsible for any defect in or damage to:

- a) the product if it has been misused, neglected, improperly installed, physically damaged or altered, either internally or externally, or damaged from improper use or use in an unsuitable environment;
- b) the product if it has been subjected to fire, water, excessive corrosion, biological infestations, or input voltage that creates operating conditions beyond the maximum or minimum limits listed in the Xantrex product specifications including high input voltage from generators and lightning strikes;
- c) the product if repairs have been done to it other than by Xantrex or its authorized service centers (hereafter "ASCs");
- d) the product if it is used as a component part of a product expressly warranted by another manufacturer;

Warranty Information

- e) the product if its original identification (trade-mark, serial number) markings have been defaced, altered, or removed.

DISCLAIMER OF WARRANTY

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Exclusions This Limited Warranty gives you specific legal rights. You may have other rights which may vary depending on the applicable law. Consumers have statutory rights under applicable national laws relating to the sale of consumer products. This warranty does not affect statutory rights that you may have or your rights against the entity from which you purchased the product, and it does not curtail or limit those rights that cannot be excluded or limited. Xantrex grants all warranties prescribed by your national statutory law, provided that if the Buyer is entitled to claim damages pursuant to the national law, Xantrex's liability is limited to the fullest extent as set out in this warranty and allowed by law.

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THE USE OF ANY SUCH INFORMATION WILL BE ENTIRELY AT THE USER'S RISK.

WARNING: LIMITATIONS ON USE

Please refer to your product user manual for limitations on uses of the product. Specifically, please note that the CR Series is not intended for use in connection with life support systems and Xantrex makes no warranty or representation in connection with any use of the product for such purposes.

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