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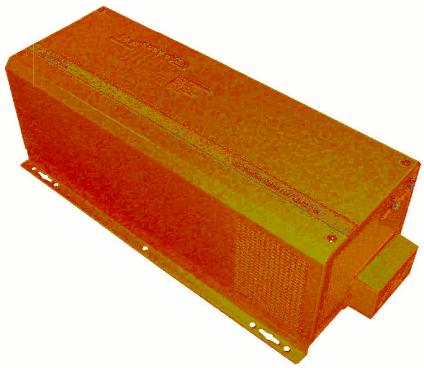

CR 1012E CR1012
CR 1024E CR1024
CR 1512E CR1512
CR 1524E CR1524
CR 2412E CR2412
CR 2424E CR2424

User Guide

Xantrex CR Series Professional 2-in-1 Backup System Inverter/Charger

www.xantrex.com

Contents

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

June 2005 Revision A

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Important Safety Instructions

WARNING

This chapter contains important safety and operating instructions. Read and keep this Operation/Installation/Owner's Guide or Manual for future reference.

READ AND SAVE THESE INSTRUCTIONS

Before using the Xantrex CR Series Professional 2-in-1 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 Installation

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 Xantrex CR Series Professional 2-in-1 Backup System Inverter/Charger (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

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 transfer time is a maximum of 20 milliseconds.

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.

CR Series Mounting

The Xantrex CR Series Professional 2-in-1 Backup System Inverter/Chargers can weigh as much as 45 lb. (20kg).

Mounting on Wallboard

Wallboard is not strong enough to support its weight so additional support must be added. The easiest method for securing it 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: Unit is heavy

To avoid personal injury, use appropriate lifting techniques. Have extra people on hand to assist in lifting the CR Series into position while it is being secured.

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 1-1/2 inches 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 1-1 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 Backup System 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.

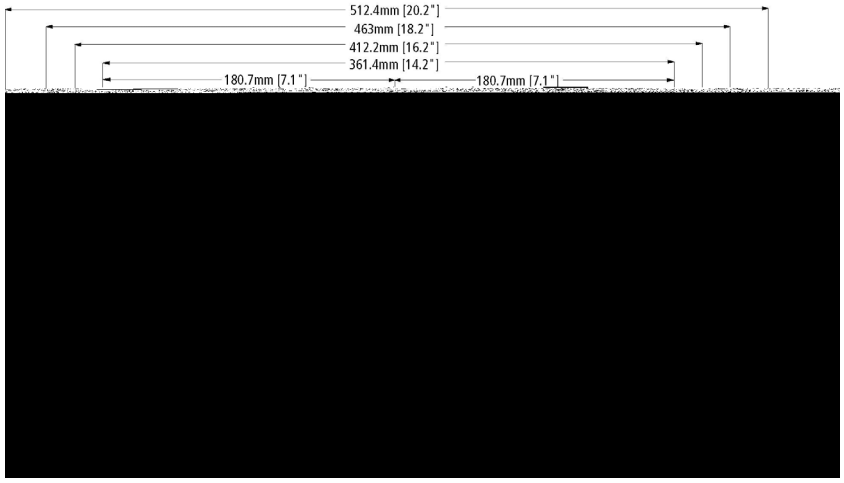

Figure 1-1 Dimensional Drawings for Screw Hole Placement

Mounting on Other Types of Walls

As the mounting walls may be made of materials other than wood, the above detailed mounting hole location drawing and method is valid, providing the 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 45 lb. (20kg) 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 1-2 illustrates the proper method to connect the battery cables to the CR Series terminals.

CAUTIOI I

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

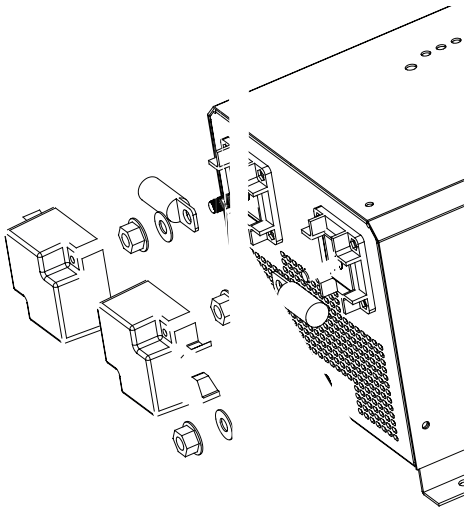

Figure 1-2 Battery Ca to CR Series

Table 1-1 p ded minimum cable sizes for various cab inverter amperages.

Table 1-1 Minimum Recommended Battery Cable Size Versus Length

Inverter Model	Typical Full Load DC Input Current	Minimum Recommended Cable Size[a] for any length run	Minimum Recommended Cable Size for Lengths up to 10 ft each way[b]	Minimum Recommended Cable Size for Lengths up to 20 ft each way[b]
CR1012 CR1012E	100 A	No. 4 AWG	No. 2 AWG	No. 0 AWG
CR1024 CR1024E	50 A	No. 8 AWG	No. 6 AWG	No. 2 AWG
CR1512 CR1512E	150 A	No. 1 AWG	No. 1 AWG	No. 3/0 AWG
CR1524 CR1524E	75 A	No. 6 AWG	No. 4 AWG	No. 1 AWG
CR2412 CR2412E	240 A	No.2/0 AWG	No. 3/0 AWG	No. 3/0 AWG
CR2424 CR2424E	120 A	No. 2 AWG	No. 2 AWG	No. 2/0 AWG

a. Based on the US National Electrical Code, NFPA 70, Table 310-17, for 75° C single-insulated cables
b. Based on max. total cable voltage drop of 0.5V at full load

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. Xantrex offers a fuse block (model TFB) providing the code- required inverter over-current protection for these applications. Refer to the table below for the proper size over-current protection (fuse or breaker) for specific cable sizes listed in Table 1-2.

Table 1-2 Battery Cable to Maximum Breaker/Fuse Size

Cable Size Required	Maximum Current Rating[a]	Maximum Breaker Size
No. 8 AWG	70 A	70
No. 6 AWG	95 A	100
No. 4 AWG	125 A	125
No. 2 AWG	170 A	175
No. 1 AWG	195 A	200
No. 0 AWG	230 A	250
No. 2/0 AWG	265 A	300
No. 3/0 AWG	310 A	350

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

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 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 1-3.
3. Following the wiring guide located in the AC wiring compartment (see Figure 1-3), 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.

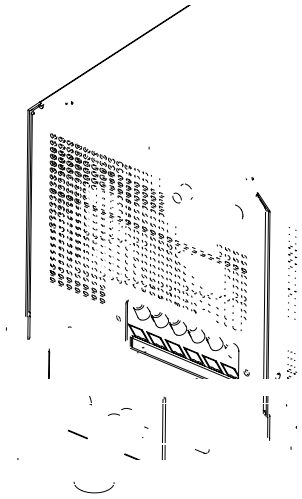

Figure 1-3 AC Connections

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.

2 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.

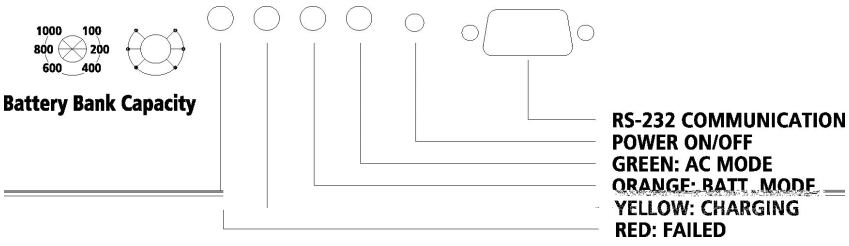

Figure 2-1 Control Panel

Power On/Off

Located on the left of the panel is the POWER ON/OFF button. Once the CR Series has been properly installed and the batteries are connected, press this button for 2 seconds and the CR Series will automatically turn on and off.

AC Mode LED

This green LED lights up when the AC output power is available.

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).

Red light This indicates one of the following possible failures: overload, overcharge, battery voltage too high, battery voltage too low, and fan failure. Inverter will shut down. To restart inverter, press power on/off switch once fault is corrected

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 100 to 1000 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 (Ahr) up to 40 A/50 A max (12 V) and 20 A/25 A max (24 V).

RS232 Communications

Used for factory upgrades and optional monitory software.

A Specifications

Table A-1 Invert Mode Specifications

MODEL	CR-1000	CR-1500	CR-2400
AC Output Power			

Table A-2 Charge and Bypass Mode Specifications

MODEL	CR-1000	CR-1500	CR-2400
Nominal AC Input Voltage	120VAC / 230VAC[a]		
AC Input Voltage Range	85VAC-132VAC / 184VAC-253VAC[a] ± 4%		
Acceptable Voltage Range	95-127VAC / 194-243VAC[a]		
Nominal AC Input Frequency	50Hz or 60Hz		
AC Input Frequency Range	47Hz~53Hz 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 battery: 13.5Vdc 24V battery: 27.0Vdc		
Charging Current (Depending on battery capacity)	12V battery: 0-40A and 0-50A 24V battery: 0-20A and 0-25A		
Transfer Time (AC to DC)	20 ms (typical)		
Transfer Time (DC to AC)	20 ms (typical)		
Overcharging Protection	12V battery: 15V 24V battery: 30V		

a. 230V, 50Hz models

Table A-3 Battery Specifications

MODEL	CR-1000	CR-1500	CR-2400
Battery Voltage	12V or 24V nominal[a]		
Battery Capacity	Up to 1000AH		
Low Battery Warning	12V battery: 11V ± 0.2V 24V battery: 22V ± 0.2V		
Low Battery Shutdown	12V battery: 10.5V ± 0.2V 24V battery: 21V ± 0.2V		

a. 24Vdc models

Table A-4 Environmental and Physical Specifications

MODEL	CR-1000	CR-1500	CR-2400
Temperature	0 to 40°C Maximum		
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-5 Interface Specifications

MODEL	CR-1000	CR-1500	CR-2400
Smart RS-232	Used for factory upgrade Supports Windows 95/98/NT/2000/XP, Novell, and Linux Visit www.xantrex.com for more information about the CR Series inverter chargers		

Warranty Information

Limited Warranty for:

Xantrex CR Series Professional 2-in-1 Backup System

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 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:

Phone:	+34 93 470 5330
Fax:	+34 93 473 6093
Email:	support.europe@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;
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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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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