Smart choice for power

xantrex

Owner's Manual

Inverter/Charger

UX Series

www.xantrex.com

About Xantrex

Xantrex Technology Inc. develops, manufactures and markets leading advanced power electronic and control products for the Distributed, Mobile, and Programmable Power markets. The company's enabling technology converts raw electrical power from any central, distributed, or backup power source into high-quality power required by electronic and electrical equipment.

Xantrex products are used for various applications: for renewable and distributed power solutions such as solar, wind, microturbines and fuel cells; to supply backup power for homes, small businesses and traffic lights during electric grid disruptions; to provide auxiliary electricity in boats, recreational vehicles, cars and heavy duty trucks; and to develop, test, and power precision equipment such as semi-conductor manufacturing and medical equipment. The company sells its products under the Xantrex, Trace, Heart and Statpower brands.

Trademarks

Xantrex is a registered trademark of Xantrex International.

Notice of Copyright

Disclaimer

Due to continual improvement through product updates, photographs and/or illustrations used in this manual may not *exactly* match your unit. Xantrex Technology Inc., reserves the right to update this product without notice or releasing an updated manual when *fit, form, or function* are not affected.

Please see Appendix C - Product Information and Warranty for specific warranty coverage.

Date and Revision

June 2002, Revision A

Part Number

975-0026-01-01

Contact Information

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IMPORTANT SAFETY INSTRUCTIONS

NOTE: This statement is important. Follow instructions closely.

NOTE: Cette déclaration est importante. Suivre les instructions de près.

CAUTION - This procedure is critical to the safe installation or operation of the unit. Follow these instructions closely.

ATTENTION - Cette procédure est essentielle à l'installation ou l'utilisation de l'unité en toute sécurité. Suivre ces instructions de près.

WARNING - A DANGEROUS VOLTAGE OR CONDITION EXISTS IN THIS AREA. USE EXTREME CAUTION WHEN PERFORMING THESE TASKS.

AVERTISSEMENT - UNE TENSION OU CONDITION DANGEREUSE EXISTE DANS CETTE ZONE. FAIRE PREUVE D'EXTRÊME PRUDENCE LORS DE LA RÉALISATION DE CES TÂCHES.

This manual contains important safety instructions that should be followed during the installation and maintenance of this product.

To reduce the risk of electrical shock, and to ensure the safe installation and operation of this product, the safety symbols shown on this page have been placed throughout this manual to indicate dangerous conditions and important safety instructions.

- All electrical work must be done in accordance with local, national, and/or international electrical codes.
- Before installing or using this device, read all instructions and cautionary markings located in the manual, and in (or on) the inverter, the batteries, and the PV array.
- Do not expose this unit to rain, snow, or liquids of any type. This product is designed for indoor mounting only.
- To reduce the chance of short circuits, use insulated tools when installing or working with the inverter, the batteries, or the PV array .
- Remove ALL jewelry while installing this system. This will greatly reduce the chance of accidental exposure to live circuits.
- The inverter contains more than one live circuit (AC line, batteries and/or PV array). Power may be present at more than one source.
- This product does not contain any user-serviceable parts. Do not attempt to repair this unit. All repairs should be done by an Authorized Service Center.
- DO NOT install 120 volt AC stand-alone inverters onto 120/240 volt AC *multi-branch circuit* wiring. This could pose a fire hazard due to an overloaded neutral return wire in this configuration.

See Section 5.0, Troubleshooting, pages 59 - 63, for additional information on multi-branch circuit wiring.

SAVE THESE INSTRUCTIONS

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BATTERY SAFETY INFORMATION

- Always wear eye protection, such as safety glasses, when working with batteries.
- Remove all jewelry before working with batteries.
- Never work alone. Have someone assist you with the installation or be close enough to come to your aid when working with batteries.
- Always use proper lifting techniques when handling batteries.
- Always use identical types of batteries.
- Never install old or untested batteries. Check each battery's date code or label to ensure age and type.
- Batteries are temperature sensitive. For optimum performance, they should be installed in a stable temperature environment.
- Batteries should be installed in a well-vented area to prevent the possible buildup of explosive gasses. If the batteries are installed inside an enclosure, vent its highest point to the outdoors.
- When installing batteries, allow at least 1 inch of air space between batteries to promote cooling and ventilation.
- NEVER smoke in the vicinity of a battery or generator.
- Always connect the batteries first, then connect the cables to the inverter. This will greatly reduce the chance of spark in the vicinity of the batteries.
- Use insulated tools when working with batteries.
- When connecting batteries, always verify proper voltage and polarity.
- Do not short-circuit battery cables. Fire or explosion can occur.
- In the event of exposure to battery electrolyte, wash the affected area with soap and water. If acid enters the eyes, flood them with running cold water for at least 15 minutes and get immediate medical attention.
- Always recycle old batteries. Contact your local recycling center for proper disposal information.

SAVE THESE INSTRUCTIONS

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1.0 Introduction

Thank you for purchasing the UX Series inverter/charger from Xantrex Technology Inc. The UX inverter takes DC energy stored in a battery-bank and converts it to usable AC power. The UX inverter/charger features an AC pass-through circuit, powering home appliances from utility or generator power while charging the batteries with its optional battery charger. When utility power fails, the battery backup system keeps your appliances powered until utility power is restored.

Internal protection circuits in the inverter prevent over-discharge of the batteries by shutting down the inverter when low-battery conditions occur. When utility or generator power is restored, the inverters with the battery charger option installed transfers to the AC source and recharges the batteries.

The front panel features LEDs for reading system status and controls to customize the inverter settings for your battery-bank.

Figure 1-1
UX Series Inverter/Charger

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1.0 Introduction

Features and Options

The UX Series inverter is an economical product designed to provide a reliable supply of electricity to all the essential circuits of a home or business. Critical loads can be powered for hours or days, depending on the size of the system battery-bank. When connected to the utility grid, the optional battery charger quickly recharges the batteries.

Standard Features

- *Modified Sine Wave Power*

  The UX Series inverters provide a modified sinewave output which operates most AC appliances and equipment.

- *Simplicity*

  The UX Series is simple to operate. All inverter and optional battery charger controls are located on the AC end panel.

- *High Efficiency*

  The inverter operates at over 90% efficiency through most of its power range.

- *Low Power Consumption*

  UX Series inverters use extremely low current while in the search mode, consuming little more than one watt of power. In the ON mode, the inverter uses less than 8 watts of power.

Options

The following options are available for the UX Series inverter:

- *SB Option (Battery Charger/AC Transfer Relay)*

  The inverter can be equipped with a three-stage battery charger designed to recharge typical, deep-cycle batteries.

  The built-in, AC transfer relay automatically transfers power from the utility to the inverter and handles 30 amps of current at 120 Vac (15 amps of current at 230 Vac).

- *RC8/50*

  The RC8 allows the inverter to be switched ON or OFF remotely and includes an LED status indicator.

RC8 Remote Control

- *Battery Temperature Sensor*

  The battery temperature sensor (BTS) ensures proper charging of the batteries based on temperature. Installing a BTS extends battery life by preventing overcharging in warm temperatures and undercharging in cold temperatures.

Battery Temperature Sensor

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1.0 Introduction

Unpacking and Inspection

NOTE: The unit weighs 25-40 lb/ 11.4–18.2 kg (depending on model). Have additional help available if necessary, to assist in lifting the unit during installation.

- Carefully unpack the inverter from its shipping carton.
- Verify all of the items listed on the packing material sheet are present. If any items are missing, please contact Xantrex Customer Service at 360.435.8826.
- Save your proof-of-purchase. This is required if the unit should require warranty service.
- Save the original shipping carton and packing materials! If the inverter ever needs to be returned for service, it should be shipped in the original carton. This is also a good way to protect the inverter if it ever needs to be moved.
- Record the unit's model, serial number and date of purchase in the appropriate fields on page C-6 in *Appendix C, Product Information and Warranty*.

Model Identification and Numbering Conventions

The UX Series inverter is identified by the model/serial number label located next to the AC access cover. All the necessary information is provided on the label such as AC output voltage, power, and frequency (punch holes).

The inverter also has a letter designator followed by 3 or 4 digits (depending on the version). The model number describes the type of inverter, the output specifications, the required battery voltage and the output voltage and frequency.

"**UX**" indicates the type of inverter - UX Series.

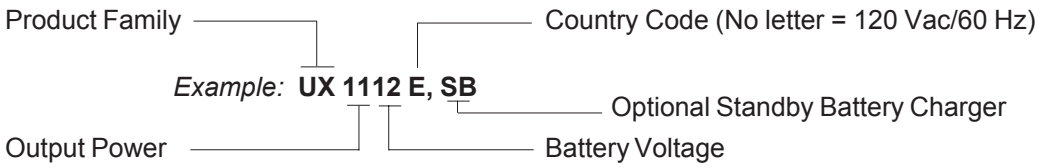
"**11**" the first two digits of the numerical designator indicate the inverter's output power (in hundreds of watts) - 1100 Watts.

"**12**" the second two digits indicate the required nominal battery bank voltage - 12 Vdc.

"**E**" the letter suffix code indicates the export output voltage and frequency of the inverter - 230 Vac/50 Hz. No letter indicates 120 Vac/60 Hz.

See Table 1-1, Output Parameters by Model Suffix Code on page 4.

"**SB**" indicates the inclusion of an optional, built-in, three-stage, standby battery charger.



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Model Identification and Numbering Conventions (continued)

Figure 1-2
Inverter/Charger Model Identification

Letter Suffix	Output Voltage	Output Frequency
(No letter)	120 VAC	60 Hz
E	230 VAC	50 Hz

Table 1-1
Output Parameters by Model Suffix Code

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2.0 System Configuration

Types of Applications

The UX Series inverter/charger can be configured for a wide variety of applications.

- It can be configured for OFF-GRID (stand-alone) applications where no utility power is available.
- It can be configured for ON-GRID applications where it can operate the AC loads when the utility grid fails, and/or keep the batteries charged.

Types of Configurations

NOTE: It is not possible to use an "E" model inverter to power 120/240 Vac/60 Hz loads.

The UX series inverter is designed for either 120 Vac/60 Hz or 230 Vac/50 Hz applications. In locations where there is a 230 Vac/50 Hz requirement, "E" models are available.

120 Vac/60 Hz Models

These models produce 120 volts between HOT and NEUTRAL which is standard for North America.

230 Vac/50 Hz Models

These models produce 230 volts between HOT (Line) and NEUTRAL which is standard for most locations except North America.

Battery-Bank Requirements

The inverter system can only support loads for the duration of their battery-bank capacity. Battery-bank pre-planning is essential.


See Appendix B, Batteries, for additional information on battery types and estimating battery-bank sizing.

Pre-Configuration Planning

Comprehensive pre-planning is recommended before installing the system to ensure all factors are accounted for.

Pre-planning should include (but is not limited to) the following.

1. What are the total watts required for all anticipated loads?
2. What are the voltage requirements for the anticipated loads? (120 Vac or 230 Vac)
3. Battery-bank type, size, and configuration?
4. Are there any local or national electrical codes that need to be met?
5. Are there any special permits required for this installation?

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Off-Grid Applications

The UX inverter can be used to support off-grid, stand-alone systems where no utility power is available. Using the UX inverter in an off-grid application include:

- renewable energy systems (without the SB Option on the inverter),
- renewable energy systems with generator backup (with the SB Option on the inverter), and
- generator-only systems (with and without the SB Option on the inverter).

Renewable Energy Systems

In this configuration, the main power is generated by renewable energy sources, such as solar, wind, or hydro-generators and is stored directly in a battery-bank. The UX inverter will invert the DC power stored in the battery-bank into AC power to operate the AC loads. The SB Option is not required for this application.

See Figure 2-1 for an illustration of a renewable energy application without the SB Option installed on the UX Inverter.

This illustration includes the optional accessories such as remote monitoring options and a variety of renewable energy sources. ***Disregard any part of this illustration that does not apply to the system configuration being installed.***

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Off-Grid Applications (continued)

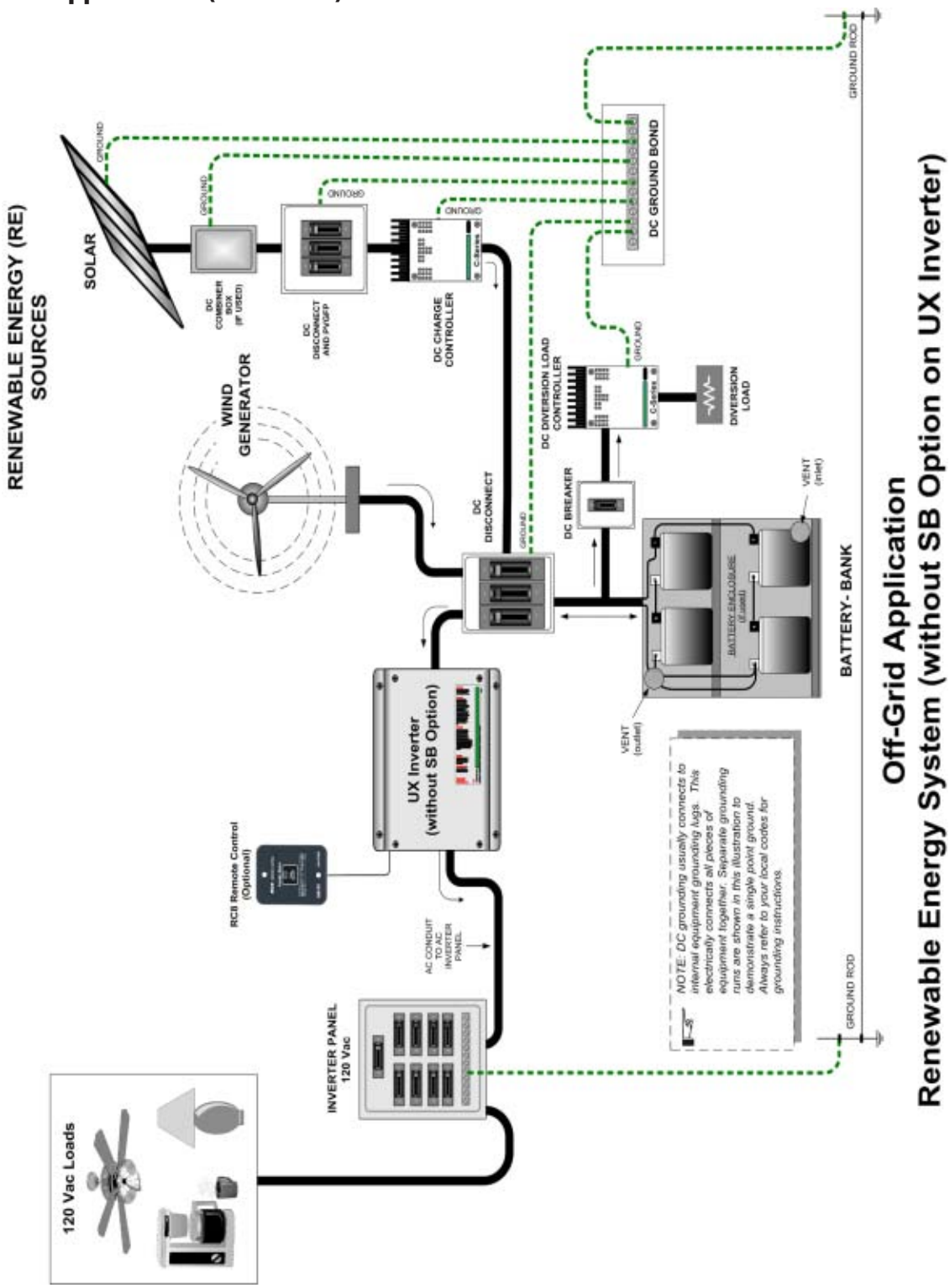

Figure 2-1
Off-Grid Application
Renewable Energy System (without SB Option on the UX inverter)

Off-Grid Applications (continued)

Renewable Energy Systems with Optional Generator Backup

In the event that renewable energy sources are insufficient to power the required loads or keep the batteries charged, a generator can be used to supplement the system. The SB Option is required on the inverter for this application. The SB Option provides a pass-through relay that allows power from the generator to pass through the inverter to either support the AC loads and/or charge the batteries.

See Figure 2-2 for an illustration of a renewable energy application with the SB Option installed on the UX Inverter.

This illustration includes the optional generator backup as well as illustrates the utilization of the optional accessories such as remote monitoring options and a variety of renewable energy sources. ***Disregard any part of this illustration that does not apply to the system configuration being installed.***

See page 20 for additional information regarding generator configurations.

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Off-Grid Applications (continued)

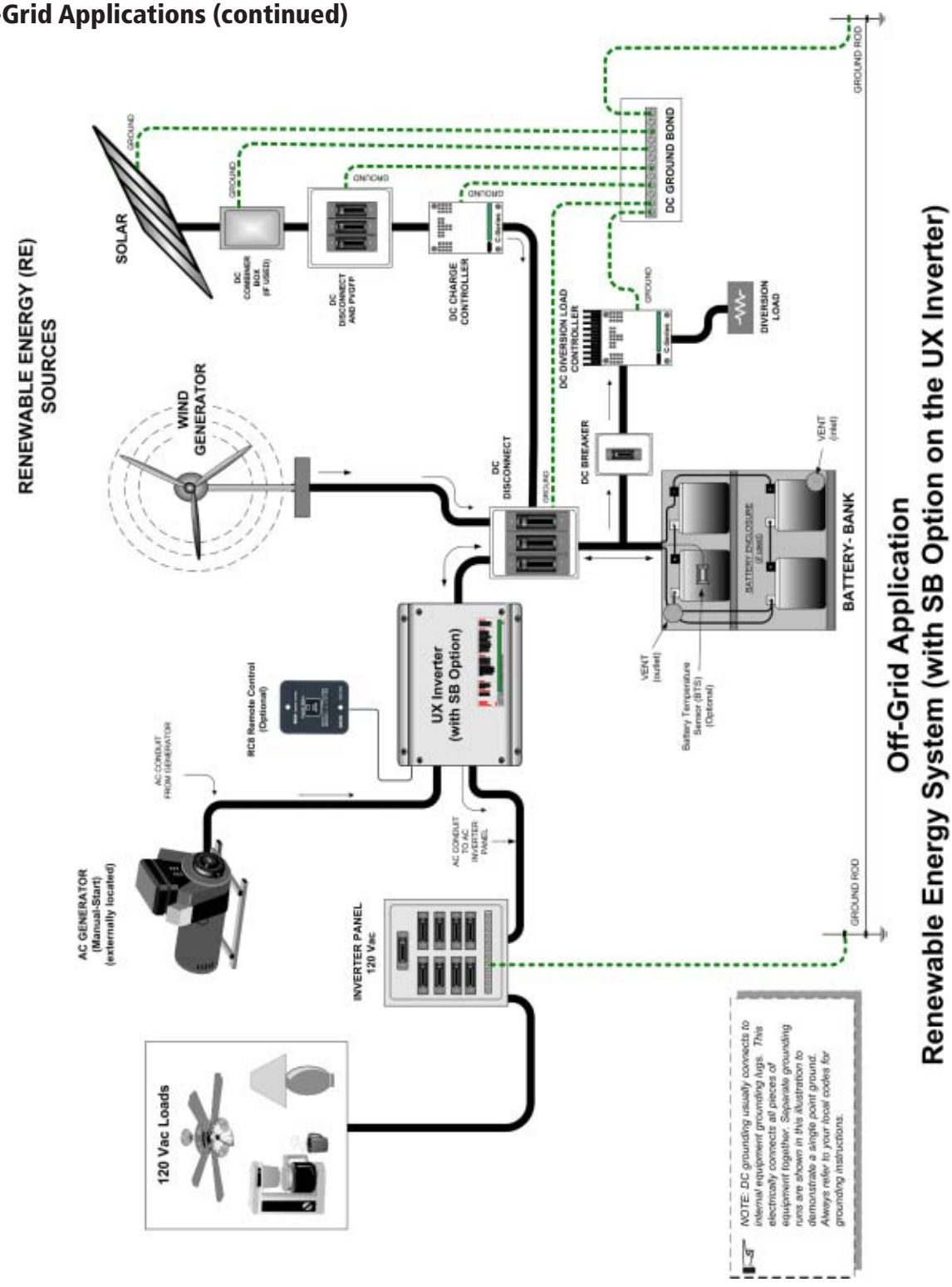

Figure 2-2
Off-Grid Application
Renewable Energy System (with SB Option on the UX inverter)

Off-Grid Applications (continued)

Generator-Only Systems

120 Vac Generators using the SB Option on the Inverter

In this configuration, the generator serves as the main AC source when batteries are insufficient to power the loads and provides a source of power for the optional UX battery charger.

See Figure 2-3 for an illustration of a 120 Vac Generator-Only System with the SB Option installed on the UX Inverter.

This illustration includes the optional accessories such as the RC8 Remote Control and the Battery Temperature Sensor. ***Disregard any part of this illustration that does not apply to the system configuration being installed.***

See page 20 for additional information regarding generator configurations.

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Off-Grid Applications (continued)

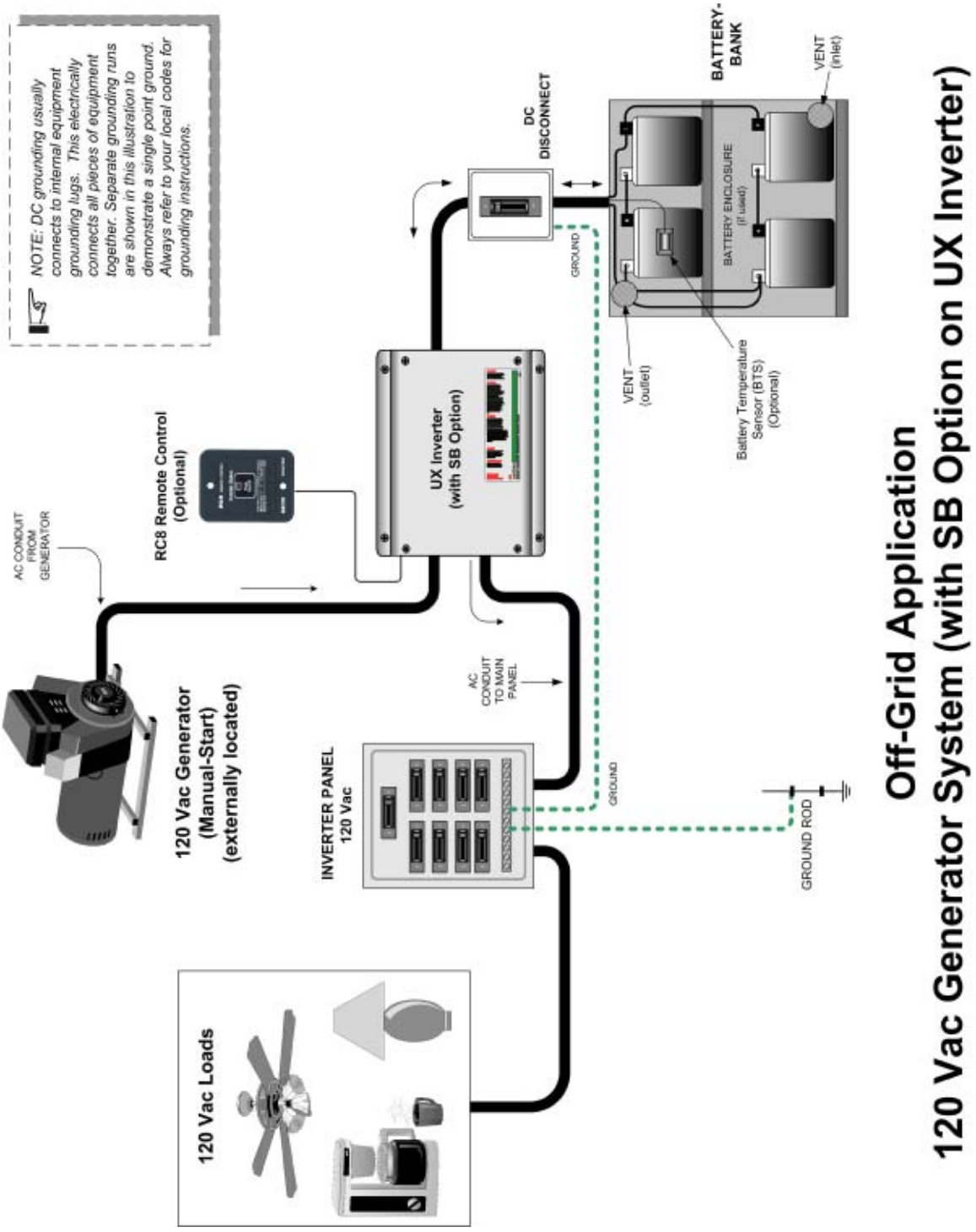

Figure 2-3
Off-Grid Application
120 Vac Generator-Only System (with SB Option on UX Inverter)

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Off-Grid Applications (continued)

Generator-Only Systems (continued)

120 Vac Generators using a Stand-alone Battery Charger

In this configuration, the generator serves as the main AC source when batteries are insufficient to power the loads. The batteries are charged by a stand-alone battery charger (e.g., TC20).

See Figure 2-4 for an illustration of a 120 Vac Generator-Only System without the SB Option installed on the UX Inverter.

This illustration includes the optional accessories such as the RC8 Remote Control and the Battery Temperature Sensor. ***Disregard any part of this illustration that does not apply to the system configuration being installed.***

See page 20 for additional information regarding generator configurations.

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Off-Grid Applications (continued)

Generator-Only Systems (continued)

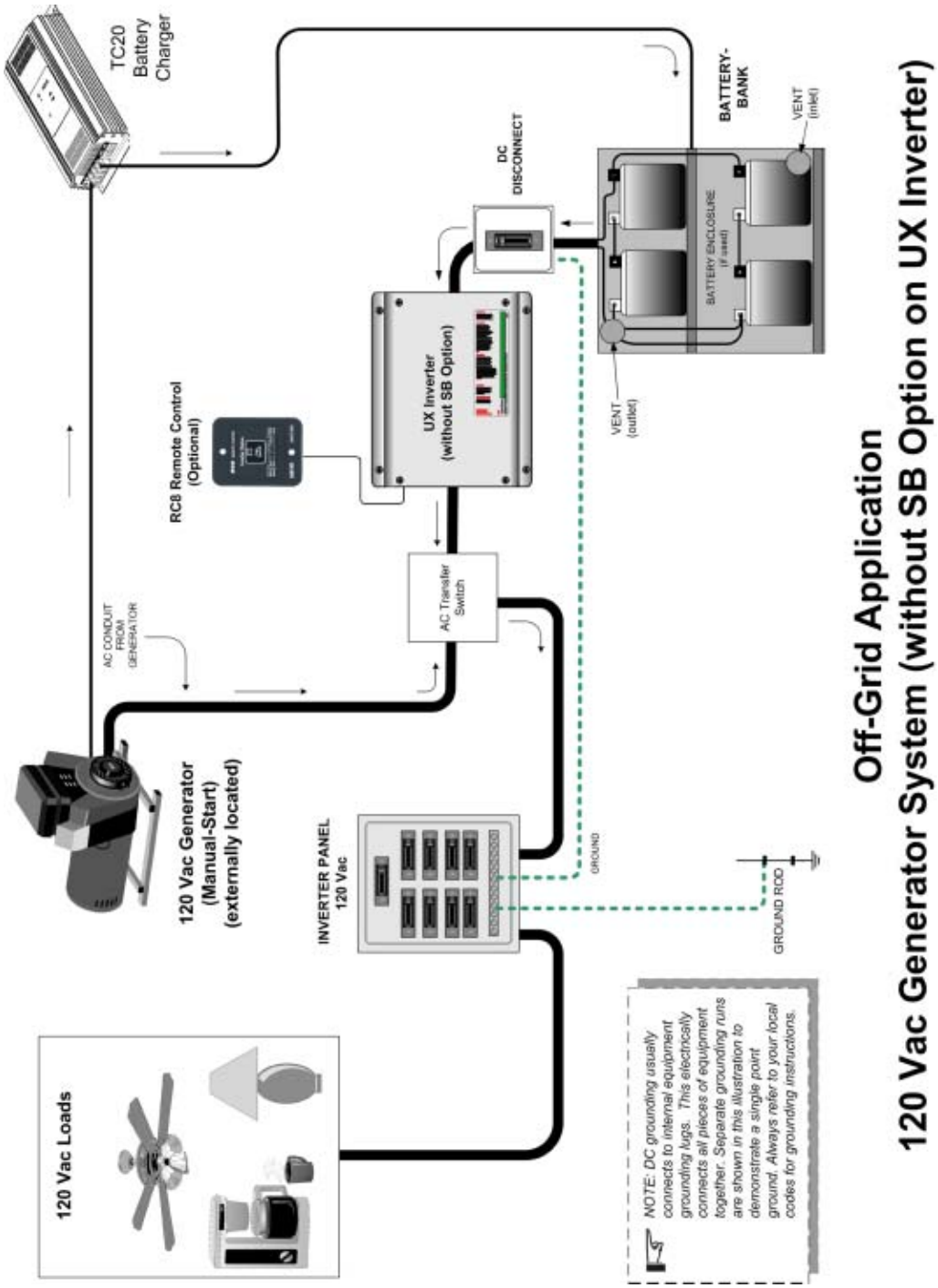

Figure 2-4
Off-Grid Application
120 Vac Generator-Only System (without SB Option on UX Inverter)

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Off-Grid Applications (continued)

240 Vac/60 Hz Generators

CAUTION: Do not use a 240 Vac input source in a 120 Vac/60 Hz inverter system without installing the T240 Autotransformer. Damage to the inverter can occur and is not covered under warranty.

If using a 120 Vac/60 Hz configuration with the optional battery charger, using a 240 Vac/60 Hz generator can optimize battery charging efficiency.

If using a 240 Vac input source (generator) with a 120 Vac/60 Hz inverter, a T240 Autotransformer must be installed preceeding the inverter's input to step down the voltage to 120 Vac.

See Figure 2-5 for an illustration of a 240 Vac generator system using a 120 Vac/60 Hz inverter.

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Off-Grid Applications (continued)

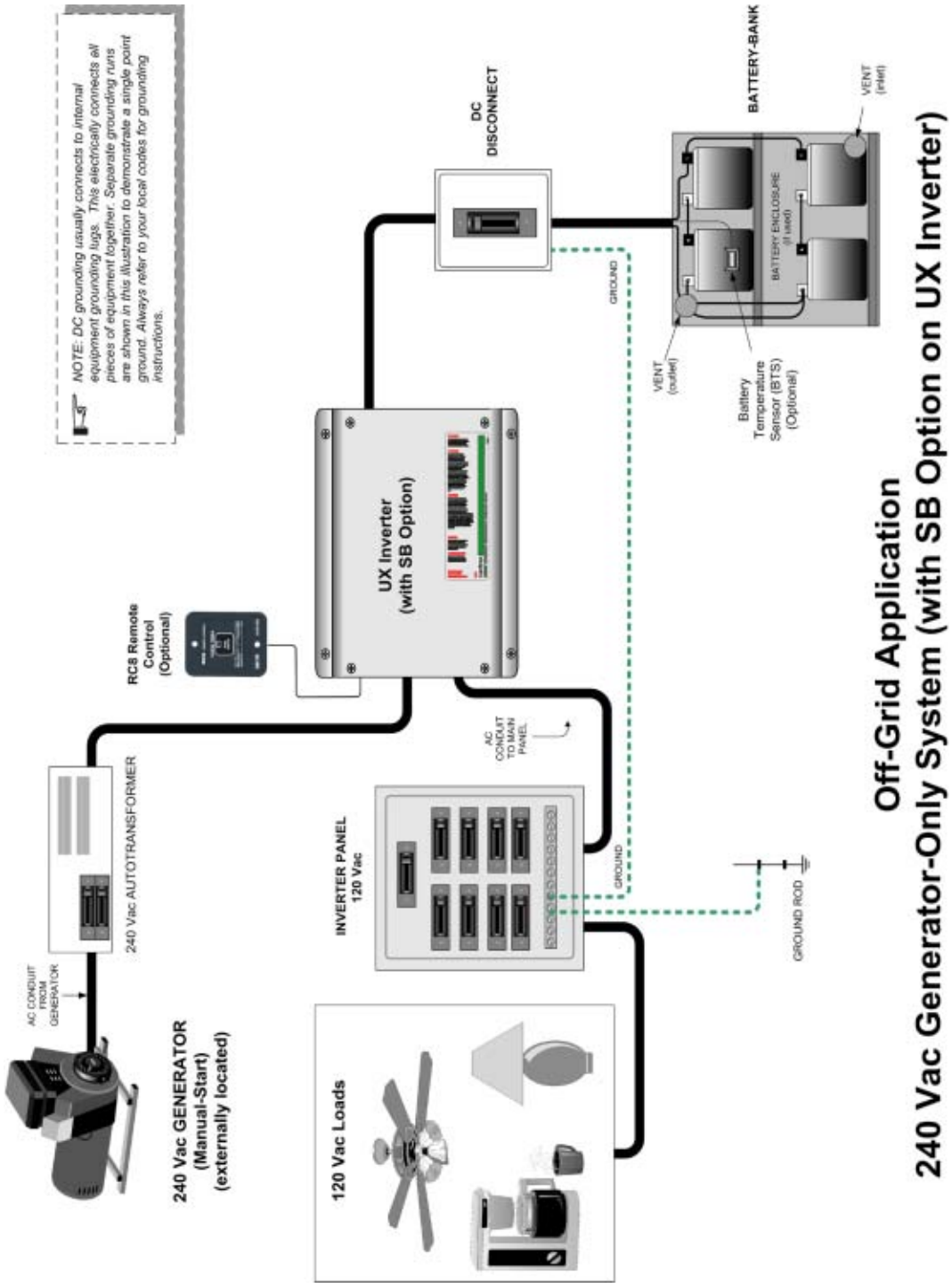

Figure 2-5
Off-Grid Application
240 Vac Generator-Only System

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On-Grid Applications

Utility Backup with a Generator

The UX inverter can be used with an AC Transfer switch to allow a generator to provide backup power in the event that the utility grid fails. When the utility grid fails, the inverter switches the loads over to the battery-bank. If the utility failure is prolonged and the batteries become discharged, the generator must be started to support the loads and recharge the batteries.

See Figure 2-6 for an illustration of a basic utility backup configuration.

This illustration includes the optional accessories such as the RC8 Remote Control and the Battery Temperature Sensor. ***Disregard any part of this illustration that does not apply to the system configuration being installed.***

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On-Grid Applications (continued)

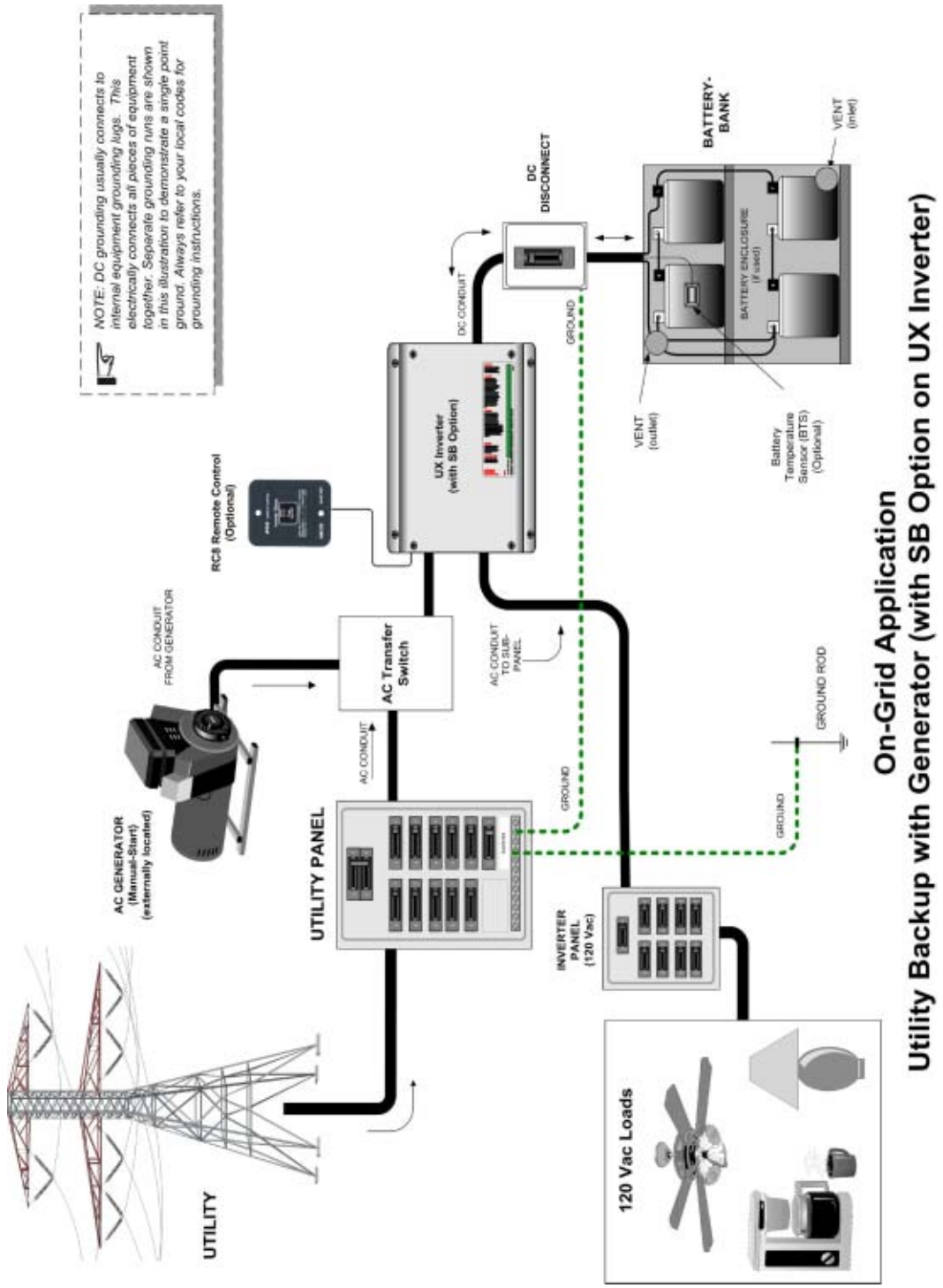

Figure 2-6
On-Grid Application
Utility Backup with a Generator (with the SB Option on the UX Inverter)

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Adding Accessories to the Inverter

Remote Monitoring

The UX inverter/charger can be configured with a remote monitor if desired. Remote monitoring can be accomplished by using the optional RC8 Remote Control accessory.

See page 48 for the location of the port for connecting the RC8 Remote Control to the inverter.

See the installation guide for the RC8 Remote Control for specific installation instructions.

Figure 2-7
RC8 Remote Control

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Adding Accessories to the Inverter (continued)

Battery Temperature Sensor

When the SP Option is installed on the UX inverter, a battery temperature sensor (BTS) can be used. The BTS ensures proper charging of the batteries based on temperature. Installing a BTS extends battery life by preventing overcharging in warm temperatures and undercharging in cold temperatures.

See page 38 for the location of the port for connecting the Battery Temperature Sensor to the inverter.

See the installation guide for the Battery Temperature Sensor for specific installation instructions.

Figure 2-8
Battery Temperature Sensor

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Generators

NOTE: Using an AC generator to power loads when utility power is not available requires additional hardware. Please consult the owner's guide for your generator for additional information.

Generator Requirements

An AC generator can be used with this inverter/charger: 1) as a replacement or substitute for utility power; 2) to power loads when utility power is not available (utility outage); and 3) to charge batteries.

The generator must be of the permanently installed type and not a portable unit used for emergency power. Small emergency generators may not have a stable enough voltage or frequency output for the inverter to synchronize to, or provide enough current to fully charge the batteries.

The maximum charge rate the battery charger can deliver is dependant upon the peak AC voltage available. Since the battery charger uses only the top portion of the input sine wave, small variations in peak voltage result in large variations in the amount of energy to the charger. The charger's rated output is based on a utility voltage of 120 Vac_{ms} which has a peak voltage of 169 Vac_{p} (230 Vac_{ms} has a peak voltage of 325 Vac_{p}).

Low power generators may not produce enough voltage under heavy load conditions to fully charge the batteries as the voltage peaks may be clipped, limiting the maximum charge rate. Size the generator appropriately for the system, including battery charge and load current.

Because generator hookups can vary widely, only basic hookup information is given. Complex hookups, involving both the utility and generator, require additional hardware such as a manual AC transfer switch and possibly an autotransformer for load balancing.

See pages 45-47 for basic generator wiring to the inverter.

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3.0 Installation

Pre-Installation

NOTE: Before installing the inverter, read all instructions and cautionary markings located in this manual.

NOTE: Installations should be performed by a qualified person or a licensed electrician following all local and NEC codes.

Finding people qualified to perform installations is sometimes difficult. Xantrex has made the process easier by developing a certification program for dealers who install Xantrex renewable energy products.

Xantrex Certified Dealers have completed an extensive technical certification examination and are committed to providing excellence in systems design, installation, and service to homeowners and businesses interested in purchasing a renewable energy system.

Contact a Xantrex Certified Dealer for site analysis, system design, and installation. For more information, see the Xantrex Web Site at **www.xantrexredealer.com**.

Tools Required

The following tools may be needed during this installation.

- #2 Phillips screwdriver
- Slotted screwdriver
- Assorted open-end wrenches
- Socket wrench and fittings
- Multimeter (True rms)
- Wire strippers
- Torque wrench
- Hole saw
- Level
- Pencil
- Utility knife
- Electrical tape

Hardware/Materials Required

The following materials may be needed during this installation.

- 4 ft x 4 ft sheet of ½" plywood or 2 x 4 studding (optional depending on mounting method selected)
- Conduit and appropriate fittings
- #12 wood screws (or ½" by 1¼" lag bolts)
- Wire nuts

Pre-Installation Planning

Pre-installation planning is recommended before installing the system to ensure all factors are accounted for.

Pre-planning should include (but is not limited to) the following.

1. Battery-bank location?
2. Location of all the components in relation to each other and wire routes?
3. Are renewable energy generators (if used) in a location best suited for it's respective energy source requirements (i.e., are PV arrays positioned in maximum sun light?)
4. Is the system design compliant with local or national electrical codes?

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Pre-Installation Planning (continued)

Location Considerations

CAUTION: The inverter/ charger can weigh up to 40 lb. (18.2 kg) depending upon configuration. Always use proper lifting techniques during installation to prevent personal injury.

- Inverters contain sophisticated electronic components and should be located in a well-protected, dry environment away from sources of fluctuating or extreme temperatures and moisture. Exposure to saltwater is particularly destructive and potentially hazardous.
- Locate the inverter as close to the batteries as possible in order to keep the battery cable length short. However, ***do not locate the inverter above the batteries or in the same compartment with vented batteries***. Batteries generate hydrogen sulfide gas which is corrosive to electronic equipment. They also generate hydrogen and oxygen. If accumulated, an arc caused by connecting the battery cables or switching a relay could ignite this mixture. **Mounting the inverter in a ventilated enclosure with *sealed* batteries is acceptable.**

Mounting Considerations

- The mounting surface must be capable of supporting twice the weight of the inverter.
- Mount the inverter either on a vertical surface (e.g., wall) or a horizontal surface (e.g., shelf).
- Use 0.25 inch (0.635 cm) lag bolts for mounting, if necessary.

Ventilation Requirements

- Install the inverter in a well-ventilated area/enclosure for proper operation. The inverter's thermal shutdown point will be reached sooner than normal in a poorly ventilated environment, resulting in reduced peak-power output and surge capability, as well as shorter inverter life.
- Some models have an internal fan. Ensure that the air vents and intakes are not obstructed in any way. Provide a minimum clearance of 1½ inches (3.81 cm) around the top and sides of the inverter for ventilation.

Wiring Considerations

- All wiring and installation methods should conform to applicable electrical and building codes.
- Pre-plan the wire and conduit runs. The AC circuits accept cable sizes up to #10 AWG. The DC circuits accept cable sizes up to #4/0 AWG.
- For maximum safety, run both AC and DC cables in conduits.

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Pre-Installation Planning (continued)

AC Connections

See Table 3-3 on page 41 for the minimum recommended wire sizes for AC connections.

- ***Inverter Bypass Switch***

  This simple item, if installed, could save hours of downtime. If it becomes necessary to disconnect the inverter or service the batteries, an inverter bypass switch allows another AC source, such as a generator or the utility power, to be used to directly power the AC loads without rewiring. This item is placed between the inverter, the generator (or utility power) and the load center and would be used with inverters that have the SB option installed.

- ***AC Transfer Switch***

  UX Units with the SB Option installed - If more than one AC source is available, this transfer switch would be used to switch from one source to the other. For example: If you have a utility power outage and the batteries require charging, you can switch over to your generator and use it to power the load center and charge the batteries.

See Figure 2-6 on page 17 for an illustration of using the AC transfer switch with two AC input sources.

UX Units without the SB Option installed - You can use an AC transfer switch to connect an inverter and an AC generator to the same house wiring. When the generator is not running, the inverter is connected to the house wiring. When you turn on the generator, you can use the AC transfer switch to power the house wiring from the generator.

See Figure 2-4 on page 13 for an illustration of using the AC transfer switch to connect the inverter and an AC generator to the same house wiring.

DC Connections

- Battery to inverter cabling should be only as long as required. For example, if #4/0 AWG cables are used, do not exceed 10 feet (one way). For optimal performance, use pre-assembled battery cables designed specifically for this application (available from Xantrex).

See Table 3-2 on page 34 for the minimum recommended cable sizes.

Grounding Considerations

AC Grounding

- The inverter should be connected to a grounded, permanent wiring system. Neutral and ground conductors should only be bonded at the main utility service panel.

DC Grounding

- The negative battery conductor should be bonded to the grounding system at only one point in the system. The size of the conductor is usually based on the size of the largest conductor (or battery disconnect) in the DC system.

See Table 3-1, Safety Ground Wire Size, on page 24 of this manual, for NEC 250-95 requirements for sizing the ground conductor.

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Pre-Installation Planning (continued)

System Grounding

NOTE: Be sure to consult your local and national electrical codes to confirm grounding and bonding requirements for your specific system.

NOTE: Through field experience, it is found that long distances or high impedance grounds were the cause of a majority of customer dissatisfaction issues or equipment damage during lightning storms.

It is recommended that the size and guage of grounding wire should be more than the NEC minimum requirements when installing power sources such as inverter/ chargers or generators.

The inverter/charger should be connected to a grounded, permanent wiring system. For most installations, the negative battery conductor should be bonded to the grounding system at one point in the system.

The grounding requirements vary by country and application. All installations must comply with national and local codes and ordinances. Consult local codes and the NEC for specific requirements.

Table 3-1 provides ***minimum*** required ground wire sizes per NEC Code.

Battery DC Disconnect Size	Minimim Size of Copper Ground Wire
30 amp or 60 amp	#10 AWG
100 amp	#8 AWG
200 amp	#6 AWG
300+ amp	#2 AWG or greater

Table 3-1
Safety Ground Wire Sizes

Equipment or Chassis Grounding

This grounding connects the metallic chassis of the various enclosures together to have them at the same voltage potential. This reduces the possibility for electric shock. It also provides a path for fault currents to flow through to blow fuses or trip circuit breakers. The size of the connecting conductors should be coordinated with the size of the over-current devices involved. Under some circumstances, the conduit and enclosures themselves will provide the current paths.

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Pre-Installation Planning (continued)

System Grounding (continued)

Grounding Electrodes/Ground Rods

NOTE: Be sure to consult your local and national electrical codes to confirm grounding and bonding requirements for your specific system.

WARNING: NEVER USE A GAS PIPE, GAS LINE, OR WATER PIPE FOR GROUNDING PURPOSES!

The purpose of the grounding electrode (often called a ground rod) is to "bleed" off any electrical charge that may accumulate in the electrical system and to provide a path for "induced electromagnetic energy" or lightning to be dissipated. The size for the conductor to the grounding electrode or grounding system is usually based on the size of the largest conductor in the system. Most systems use a copper-plated rod as the grounding electrode. The rod should be 5/8 inch (16 mm) round by 6 feet (2 meters) long and driven into the earth. It is also common to use copper wire placed in the concrete foundation of the building as a grounding system. Either method may be acceptable, but the local code will prevail. Connection to the ground electrode should be done with special clamps located above ground where they can be periodically inspected.

Many large systems use multiple ground rods. The most common example is providing a direct path from the solar array to earth near the location of the solar array. Most electrical codes want to see the multiple ground rods connected by a separate wire with its own set of clamps. If this is done, it is a good idea to make the connection with a bare wire located outside of the conduit (if used) in a trench. The run of buried wire may be a better grounding electrode than the ground rods. Well casings and water pipes can also be used as grounding electrodes. Under no circumstance should a gas pipe or line be used. Consult local codes and the NEC for more information.

Bonding the Grounding System

NOTE: The ground and neutral must be bonded at one place, and only one place, in the system.

If the generator is the main source of power, (i.e., no utility grid power) then the neutral and ground connections are bonded at the main AC distribution panel.

If the utility grid is the main source of power, then the bond should be at the utility AC distribution panel.

If there is no utility or generator in the system, then the ground/neutral bond should be in the inverter AC distribution panel.

Bonding means connecting one of the current-carrying conductors (usually the AC neutral and DC negative) to the grounding system. When the other ungrounded conductor (the hot or positive) touches the grounding system, current will flow through it to the point of connection to the grounded conductor and back to the source. This will cause the overcurrent protection to stop the flow of current, protecting the system. This point of connection between the *grounding system* (ground rod), the current carrying *grounded conductor* (AC neutral and DC negative), and the *equipment grounding conductor* (green ground wire, equipment ground) is called a "bond".

Bonding is usually located in the overcurrent protection device enclosures (both AC and DC). Although it can be done at the inverter, codes do not generally allow it since the inverter is considered a "serviceable" item that may be removed from the system. In residential systems, it is located at the utility panel, after the power has gone through the kilowatt-hour meter of the utility (if present).

Bonding must be done at only one point in an electrical system. Inherently, Xantrex systems have two separate electric systems – a DC system and an AC system. This means that two bonding points will occur in all inverter applications. The bonding point will also be connected to the equipment (chassis) grounding conductors. It is common to have two separate conductors connect the ground electrode and the two bonding points. Each conductor should use a separate clamp.

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Pre-Installation Planning (continued)

Battery Considerations

See Appendix B for more detailed information on battery types, battery-bank sizing, battery configurations, wiring requirements, and battery care and maintenance.

Battery Voltage

These inverters are for use with a 12 Vdc battery system only.

Battery Location

- Locate the batteries in an accessible location. Two feet of clearance above the batteries is recommended for access to the battery caps. They should be located as close to the inverter as possible without limiting access to the inverter's disconnects. Install the batteries to the right of a wall-mounted inverter for easy access to the DC side of the inverter and to ensure shorter cable runs.
- For safety and to limit access to the batteries, a secure/lockable, ventilated battery enclosure or dedicated room should be used. If an enclosure is used, it should be vented to the outside via a one-inch vent pipe located at the top of the enclosure. Install an intake vent at the bottom of the enclosure to promote air circulation. ***These vents exhaust explosive hydrogen gases and must not be overlooked when designing an enclosure.***
- The enclosure should be made of an acid-resistant material or have a finish that resists acid to prevent corrosion. It should be capable of holding the electrolyte from at least one cell of one battery should a leak occur.
- Enclosures located outside must be rainproof and screened to prevent access by rodents or insects.

Battery Temperature

NOTE: Cold temperatures drastically reduce battery capacity and performance.

Be sure to locate batteries in an environment with a stable temperature.

The battery enclosure should provide a fairly stable temperature for the batteries. For installation in a cold environment, insulation should be used to protect the batteries from the cold. Insulation also provides a more consistent temperature and better system performance.

The battery enclosure should not be installed in direct sunlight or in locations where the sun can overheat the batteries. Locate the enclosure where it will be protected from the afternoon sun and provide vents in the top and bottom of the enclosure to provide air flow. High battery temperatures greatly shorten the life of the batteries.

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Pre-Installation Planning (continued)

Battery Pre-Installation

CAUTION:
The inverter is not reverse polarity protected. Reversing the battery polarity on the DC input connections will cause permanent damage to the inverter which is not covered under warranty. Always check polarity before making connections to the inverter.

- Determine the *type* of batteries to be used for the installation.

See Appendix B, pages B-1 and B-2, for additional information on battery types and their applications.

- Determine the appropriate battery-bank size and battery configuration for the installation.

See Appendix B, pages B-3 through B-7, for additional information on calculating battery-bank size and how to wire the selected battery configuration.

- Determine the correct size battery cables to use for installation.

See Table 3-2, page 34, for recommended battery cable sizing.

- Determine the correct size disconnect/fuse to use for installation.

See Table 3-3, page 35, for recommended disconnect/fuse sizing.

- Color code the cables with tape or heat shrink tubing. The standard colors are red for positive (+) and black for negative (-).

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Removing the Top Cover of the Inverter

- Remove the four #12 X 1/2" Phillips SMS SST type A screws from the top of the unit (#1-4 in Figure 3-1).
- Remove the one 6-32 X 5/16" Phillips PMS S/S screw and #6 internal tooth, star washer from the side of the unit (#5 in Figure 3-1).

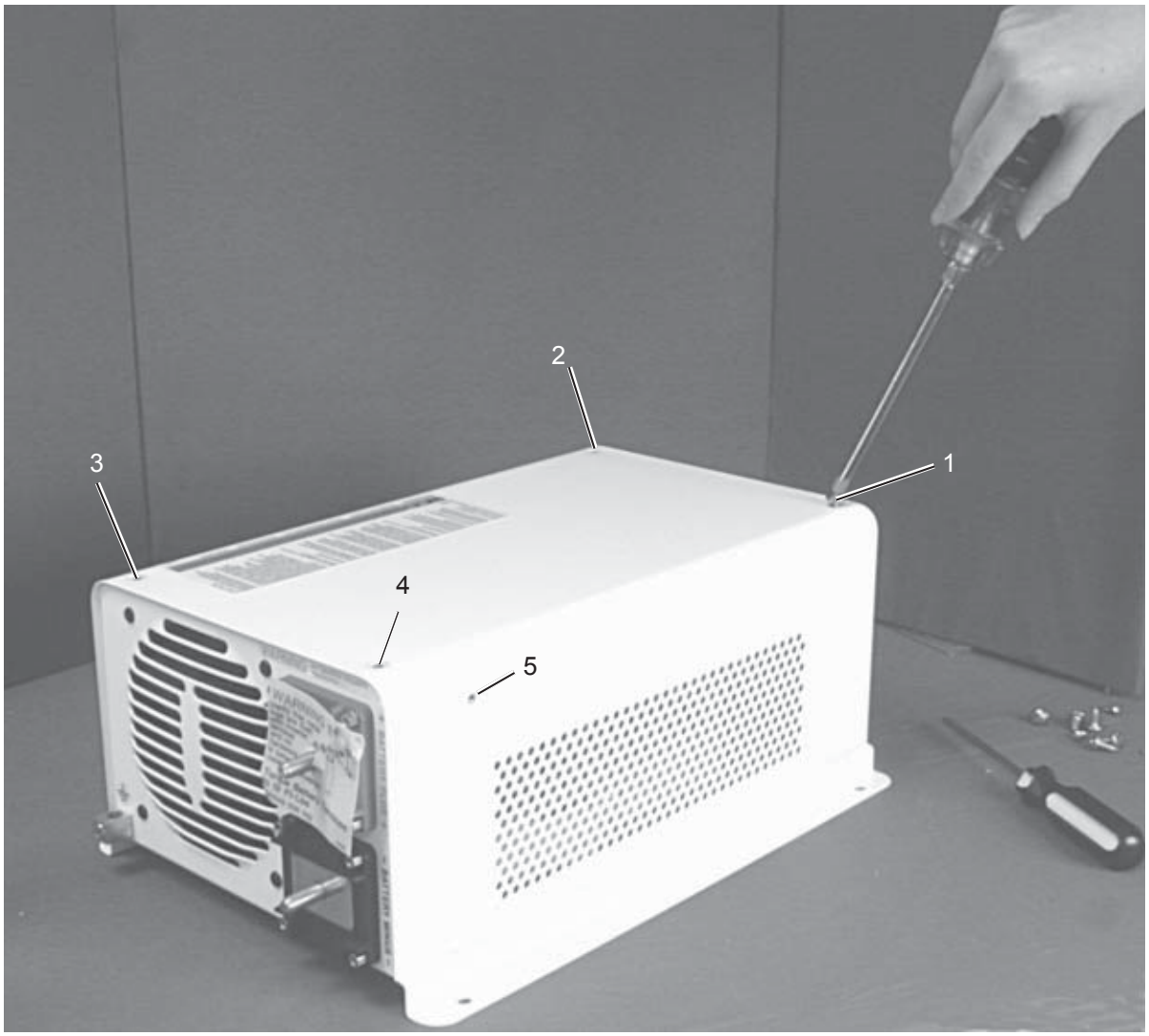

Figure 3-1
Removing the Cover from the Inverter

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Configuring the Inverter's Optional Battery Charger

When equipped with an optional battery charger, the UX inverter has three jumpers to control charger operation. A jumper is a small, rectangular piece of plastic with two square holes in it, as shown in Figure 3-2a, that fit over two pins as shown in Figure 3-2b. A jumper contains an internal conductor that joins the two pins completing a circuit. When the jumper is removed, the circuit is interrupted. Jumpers are often used for changing configuration parameters. When a jumper is not connecting two pins, it can be stored by slipping it over just one of the pins instead of both. This will have no effect upon the configuration but will keep the jumper handy for future use.

The jumpers in the UX inverter are located on the main circuit board and are labeled SEALED, DEEP, and UPS. To access the jumpers, remove the top cover from the inverter following the instructions on page 28.

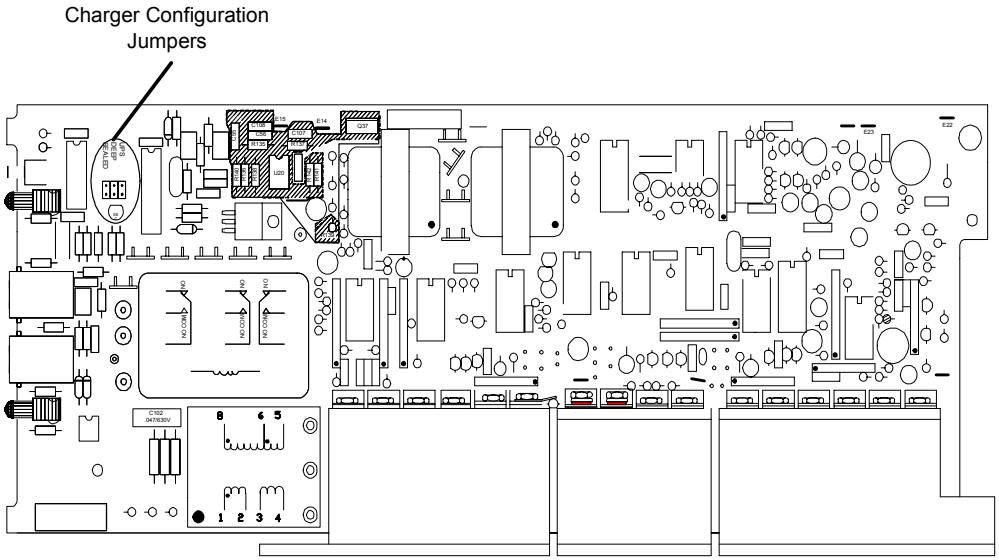

Figure 3-2
Location of the Optional Battery Charger Configuration Jumpers

Figure 3-2a
Jumper Enlargement

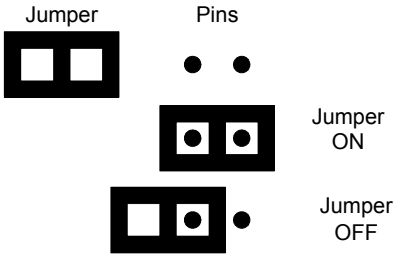

Figure 3-2b
Jumper Placement

Jumper Settings for the Optional Battery Charger

SEALED:

- *JUMPER ON* - If you are installing sealed batteries, the jumper remains across this pair of pins. This selection sets the charge rate to 14.3 Vdc in the Bulk stage and 13.6 Vdc in the float stage.
- *JUMPER OFF* - For vented batteries, remove the jumper across these pins to set the charge rate to 14.7 Vdc and 13.3 Vdc respectively.

DEEP:

- *JUMPER ON* - This pair of pins controls the amount of allowable battery discharge. When the jumper connects these two pins, the inverter will allow the batteries to discharge until completely drained.
- *JUMPER OFF* - When not installed, the inverter will not allow the batteries to be discharged below 11.8 Vdc for more than five minutes.

UPS:

- *JUMPER ON* - This pair of pins controls the sensitivity of the charger to variations in voltage from the AC source. When a jumper connects these two pins, the charger will stop charging and the inverter will provide AC power within 35 milliseconds or less of an AC voltage drop to below 85-90 volts.
- *JUMPER OFF* - With the jumper removed, the shift from charger to inverter will be delayed at least 200 milliseconds to allow AC voltage to return to normal. If AC voltage does return to normal within this period, the charger will disengage and the inverter (when turned on) will provide AC power from the batteries. This prevents the charger from disengaging unnecessarily due to poor quality voltage. For generator charging, do not connect these pins.

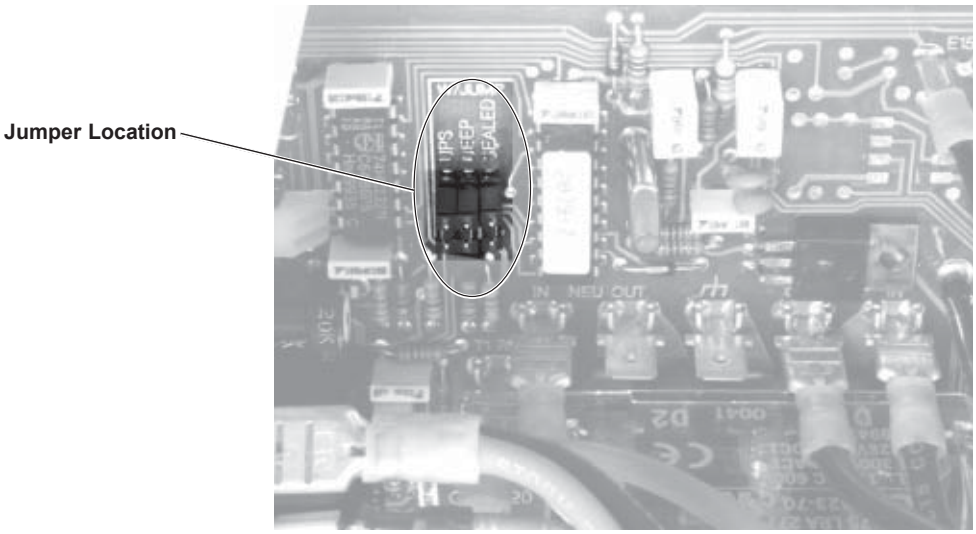

Figure 3-3
Battery Charger Jumper Settings

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Wiring Pre-Installation

Main Service Panel

If you have an inverter with the SB option, ensure you use the correct circuit breaker based on the total current rating of your inverter. This circuit breaker must be located in the utility service panel.

See Table 3-5 on page 41 for maximum recommended breaker sizes.

Sub-Panel

Loads backed up by the inverter will need to be rerouted from the main service panel to a sub-panel. This can be done several different ways, depending upon the installation. Always refer to electrical codes for safe wiring practices.

AC Circuit Breakers

Always use a properly rated circuit breaker. Depending upon the application, circuit breakers used to protect the load can be removed from the main service panel and put into the sub-panel ONLY if the two panels are from the ***same*** manufacturer.

DC Disconnect

Install a DC disconnect breaker or fuse in the positive battery line. This breaker protects the DC wiring in the event of an accidental short. Size the breaker in accordance with the battery cables. Switch this breaker OFF whenever servicing the batteries.

See DC Disconnect and Overcurrent Protection on page 35 for additional information and recommended fuse sizes.

Wire Routing

Determine all wire routes both to and from the inverter and which knockouts are best suited for connecting the AC conduits. Possible routing scenarios include:

- AC input wiring from the main utility service panel to the inverter
- AC input wiring from the generator to the inverter (if used)
- DC input wiring from the PV array (wind, hydro, etc.) to the inverter (if used)
- DC input wiring from the batteries to the inverter
- AC output wiring from the inverter to the sub-panel
- Battery temperature sensor cable from the batteries to the inverter (if used)
- Remote control cable to the inverter (if used)
- DC ground from the batteries to an external ground rod
- Load circuit wiring rerouted from the main service panel to the sub-panel

Check for existing electrical or plumbing prior to making cuts in the walls. Cut holes in the walls at appropriate locations for routing wiring/cables.

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Inverter Mounting

WARNING: USE APPROPRIATE LIFTING TECHNIQUES. HAVE EXTRA PEOPLE ON HAND TO ASSIST IN LIFTING THE INVERTER INTO POSITION WHILE IT IS BEING SECURED.

The UX inverter is designed for either shelf-mounting or wall-mounting.

The UX inverter can weigh as much as 40 pounds (18.2 kg). Wallboard is not strong enough to support this much weight so additional support must be added. The easiest method for securing the inverter to an existing wall is to place two 2 x 4's horizontally on the wall (spanning at least three studs) and securing the inverter to the 2 x 4's.

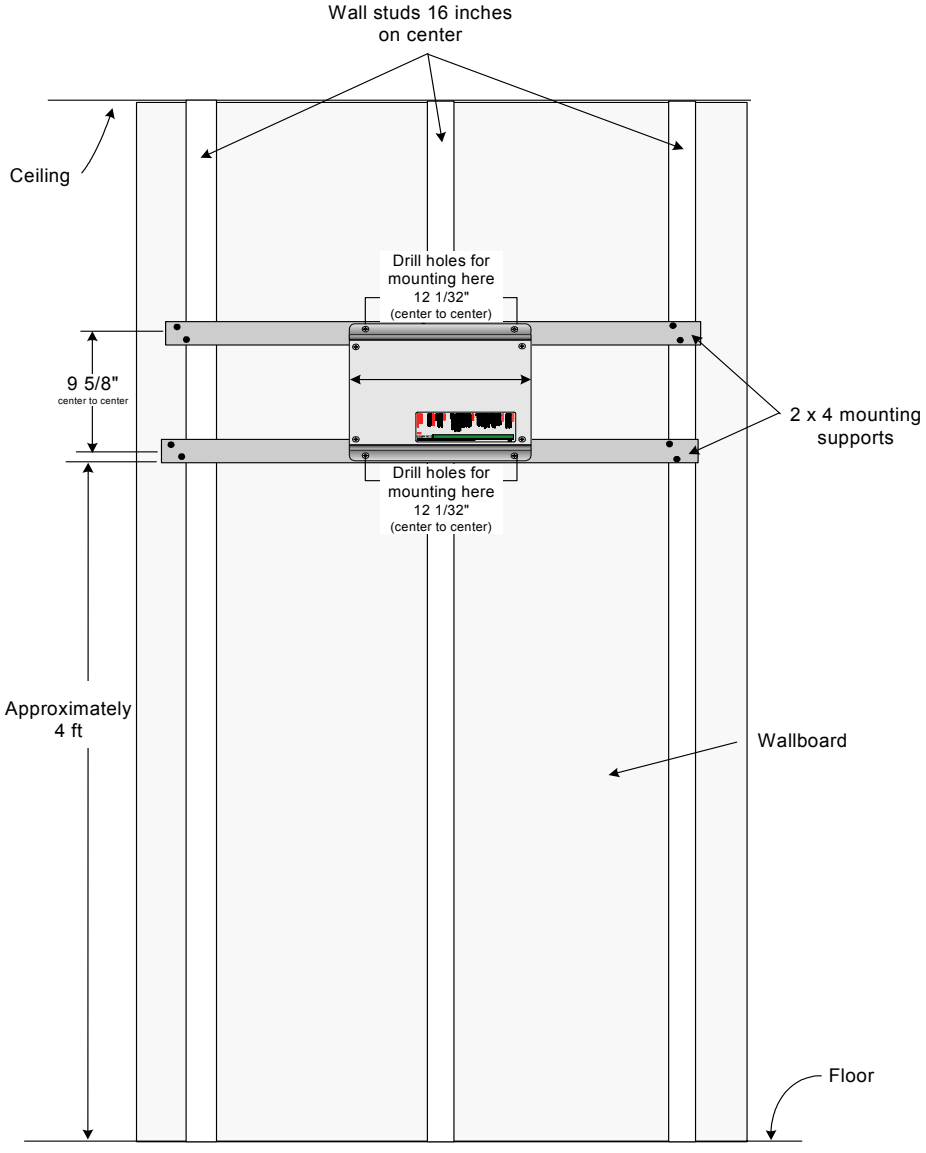

Figure 3-4
Wall-mounting Method (Not-to-Scale)

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Wall-Mounting Procedure

NOTE: To make a simple cardboard template, place the inverter on a piece of cardboard and trace around it. Mark the mounting holes on the cardboard.

1. Locate the studs and mark their location on the wall.
2. Measure the desired height from the floor for the inverter to be mounted.
3. Using a level, mark a horizontal line on the wall. The length of the line must span at least three studs.
4. Place a pre-cut 2 x 4 on the marked location and drill pilot holes through the 2 x 4's and studs.
5. Secure the 2 x 4 with #10 wood screws (length to penetrate 1½ inches into the studs).
6. Repeat the procedure for the remaining 2 x 4.
7. Referring to Figure 3-5 or by using a cardboard template, drill out the mounting hole locations for the inverter.
8. With assistance, lift the inverter into position and install it onto the 2 x 4's using ¼ x 1½-inch lag bolts and washers.

Alternatively, a half or quarter sheet of ½-inch plywood can also be used as a backing, with the inverter mounted directly to the plywood using ¼-inch diameter lag bolts and washers. The plywood must span three studs for adequate support.

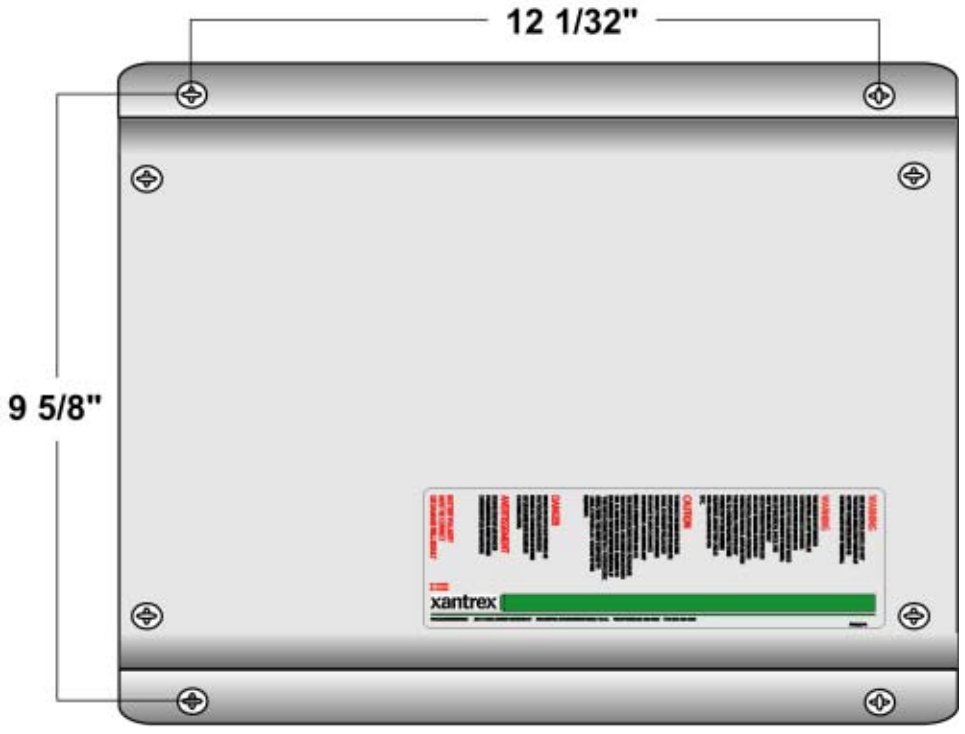

Figure 3-5
Dimensional Drawing for Screw Hole Placement
(Not to Scale)

DC Wiring

Battery Cables

WARNING: UNDERSIZED CABLES CAN OVERHEAT AND MELT, CREATING A FIRE HAZARD WHEN SUBJECTED TO HEAVY (PEAK) LOADS. ALWAYS USE A PROPERLY SIZED CABLE AND LENGTH RATED FOR THE AMPERAGE OF THE INVERTER AND BATTERIES.

NOTE: Use only copper cables.

NOTE: If the system includes a large battery bank or large DC source (such as a micro-hydroelectric plant or wind generator), increasing the size of the cables and disconnects will greatly reduce the number of nuisance outages associated with breaker tripping and open fuses.

NOTE: Run the positive and negative battery cables as close to each other as possible by taping them together. This reduces the effects of inductance and produces a better waveform increasing efficiency.

Proper cable sizing (diameter and length) is critical to the safe and efficient operation of an inverter system. Larger diameter cables (smaller AWG number) have less voltage drop and are, therefore, more efficient when transferring power to and from the batteries. If a cable is undersized (diameter too small), it could potentially overheat, creating a fire hazard.

Cable length is another important factor. Runs should be kept as short as practical. Longer cable runs increase resistance, thus lowering the overall efficiency of the system. This is especially true in lower voltage systems where, depending upon the length of the cable run, it may be necessary to oversize the diameter of the wire, or parallel (double) the cables.

Battery cables must have crimped or soldered and crimped copper compression lugs unless aluminum mechanical lugs are used. Soldered connections alone are not acceptable. High quality battery cables are available from Xantrex in an assortment of lengths: 1½ to 10 feet, and in #2/0 AWG or #4/0 AWG sizes. These cables are color-coded with pressure crimped, sealed ring terminals.

See Table 3-2 below for minimum recommended cable size for batteries.

Table 3-2 provides recommended minimum cable sizes for various cable lengths and inverter amperage. “Typical DC amps”, as shown in Table 3-2, is based on low-battery voltage with an efficiency of 85%. Be sure to check with any local regulatory agencies for additional requirements.

Inverter Model	Typical DC Amps	1 to 3 Feet (one-way)	3 to 5 Feet (one way)	5 to 10 Feet (one-way)
UX512E	55 A	#2 AWG (33.6 mm^2)	#2/0 AWG (67.4 mm^2)	#2/0 AWG (67.4 mm^2)
UX612	65 A	#2 AWG (33.6 mm^2)	#2/0 AWG (67.4 mm^2)	#2/0 AWG (67.4 mm^2)
UX1112	120 A	#2/0 AWG (67.4 mm^2)	#2/0 AWG (67.4 mm^2)	#4/0 AWG (107.4 mm^2)
UX1112E	120 A	#2/0 AWG (67.4 mm^2)	#2/0 AWG (67.4 mm^2)	#4/0 AWG (107.4 mm^2)
UX1512	150 A	#4/0 AWG (107.4 mm^2)	#4/0 AWG (107.4 mm^2)	#4/0 AWG (107.4 mm^2)

Table 3-2
Minimum Recommended Battery Cable Size Vs. Length

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DC Wiring (continued)

DC Disconnect and Over-current Protection

NOTE: for Table 3-3:

**The NEC allows rounding to the next standard fuse size from the cable rating (i.e.,150 amp cable size rounds u to a standard 175 amp size.)*

For safety and compliance with regulations, battery over-current protection is required. Fuses and disconnects must be sized to protect the wiring in the system and are required to open before the wire reaches its maximum current carrying capability.

The National Electrical Code (NEC) requires both over-current protection and a disconnect switch for residential and commercial electrical systems. These items are not supplied as part of the inverter. However, Xantrex offers a DC circuit breaker disconnect module specifically designed to meet NEC compliance. Two amperage ratings are available: a DC250 (250 amps) and a DC175 (175 amps).

When sizing the DC disconnect, the expected continuous load on the inverter should be used to determine the DC current. Efficiency loss through the inverter increase the DC current draw and must be accounted for. Divide the maximum continuous current draw by the inverter's efficiency. Add a 25% safety margin to comply with code requirements.

The term "free air" is defined by the NEC as cabling that is not enclosed in a conduit or a raceway. Cables enclosed in conduit or raceways have substantially lower continuous current carrying ability due to heating factors.

Some installations may not require conduit or a disconnect device, although over-current protection is still required. Xantrex offers a fuse block (TFB) providing the code required inverter over-current protection for these applications. These fuses are available in 110, 200, 300, 350 and 400 amp sizes.

See Table 3-3 below for battery cable to maximum breaker/fuse size.

Cable Size Required	Rating in Conduit	Maximum Breaker Size	Rating in "Free air"	Maximum Fuse Size
#2 AWG	115 amps max.	N/A	170 amps max.*	TFB200
#2/0 AWG	175 amps max.	DC175	265 amps max.*	TFB300
#4/0 AWG	250 amps max.	DC250	360 amps max.*	TFB400

Table 3-3
Battery Cable to Maximum Breaker/Fuse Size

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DC Wiring (continued)

DC Grounding

The inverter's chassis grounding lug is used to connect the chassis of the inverter to the DC grounding system. The terminal accepts wires from #14 AWG to #2 AWG.

Connect the negative (–) terminal of the battery bank to an appropriately sized conductor and connect it to a solid earth ground, such as a grounding rod, driven 6–8 feet into the earth. Xantrex DC disconnects include a grounding block for the DC negative to simplify grounding. This procedure will properly ground the DC circuits.

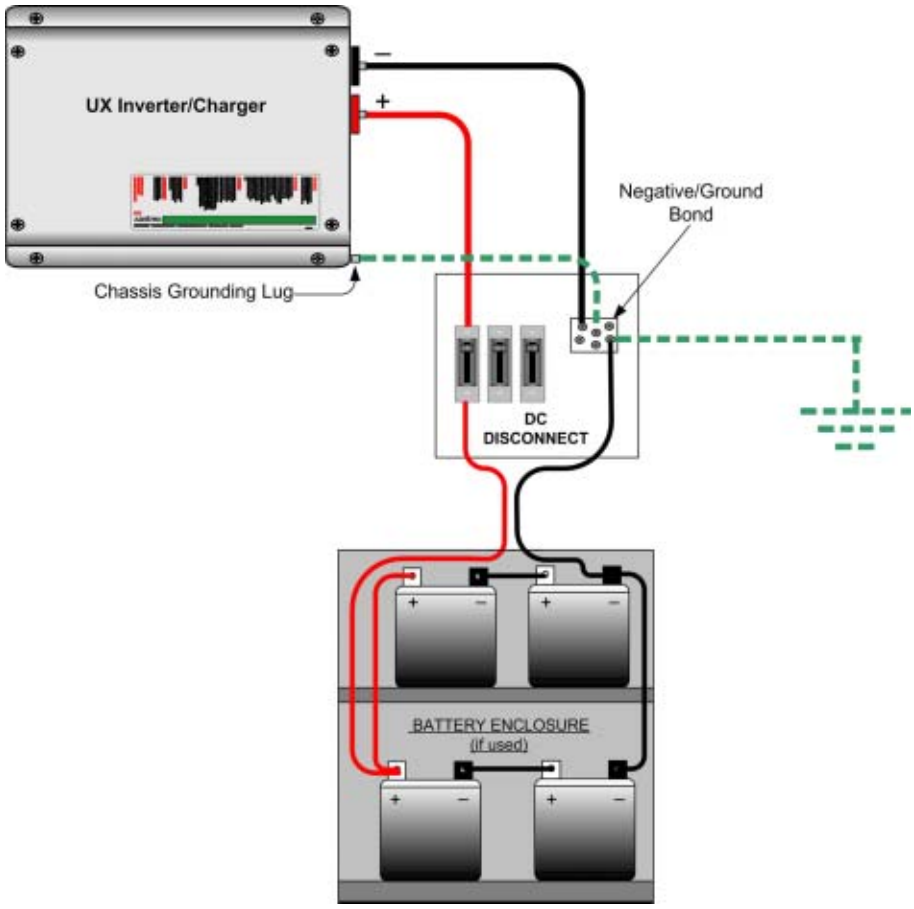

Figure 3-6
DC Grounding

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DC Wiring (continued)

Battery Installation

***WARNING**: ENSURE THAT THE INVERTER IS OFF BEFORE CONNECTING OR DISCONNECTING THE BATTERY CABLES AND THAT ALL AC POWER IS DISCONNECTED FROM THE INVERTER'S INPUTS.*

CAUTION: Verify the DC disconnect device is switched OFF.

NOTE: Xantrex DC disconnect boxes contain a NEGATIVE DC block which allows connection between the battery and inverter's negative terminals. The DC NEGATIVE block also provides the negative/ground bonding for the DC system.

NOTE: For residential installations, NEC requires that "DC disconnects" have both overcurrent protection and a disconnect switch.

CAUTION: Do not put anything between the cable ring terminal and the flat metal part of the terminal. See Figure 3-7. Overheating of the terminal may occur. Do not apply any type of antioxidant paste until after the battery cable wiring is tightened. The same applies for all DC connections.

1. Connect the positive cable between the battery's positive terminal and the DC disconnect/overcurrent protection device (torque to manufacture's recommendations). The DC disconnect device should be located as close to the batteries as possible.
2. Connect a cable between the DC disconnect device and the inverter's POSITIVE (+) terminal.
3. Connect the negative cable between the battery's negative terminal (torque to manufacture's recommendations) and the inverter's NEGATIVE (-) terminal.
4. Ensure the correct polarity of the cables with a DC voltmeter (DVM).
5. Use an insulated 1/2 inch wrench or socket to tighten the 5/16 SAE nuts to 10-15 foot/lb for each inverter input terminal.
6. Apply antioxidant paste to the battery, DC disconnect, and inverter's terminals.
7. Install the battery terminal connection covers (red for positive, black for negative) over the inverter's DC terminals and secure with the screws and washers provided.

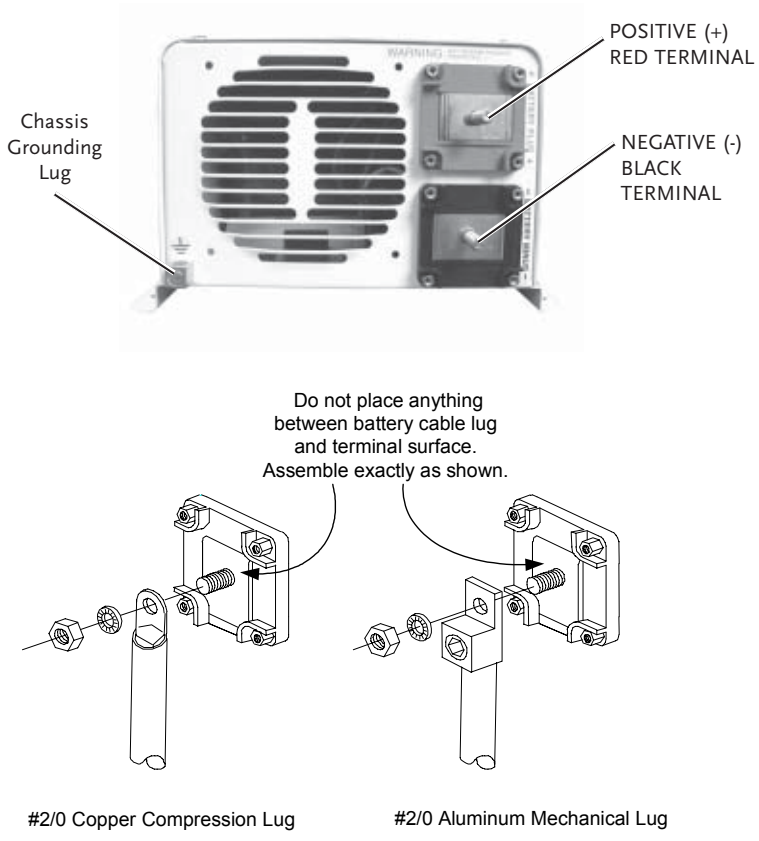

Figure 3-7
Battery Cable Connections

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DC Wiring (continued)

Installing the Battery Temperature Sensor (BTS)

NOTE: This accessory requires the installation of the SB Option on the inverter.

1. Insert the RJ11 connector on the battery temperature sensor wire into the BTS port located on the AC end of the inverter.
2. Secure the sensor to one of the batteries located in the center of the battery pack.

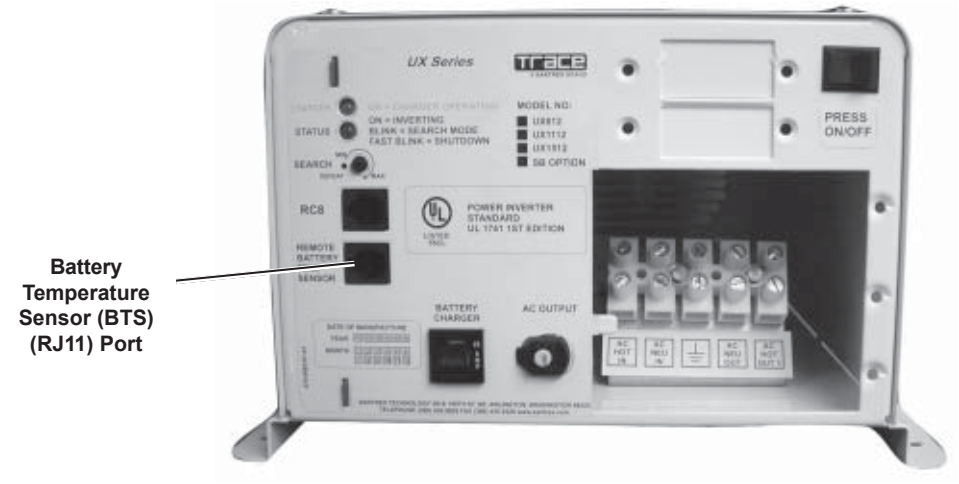

Figure 3-8
BTS (RJ11) Port Location

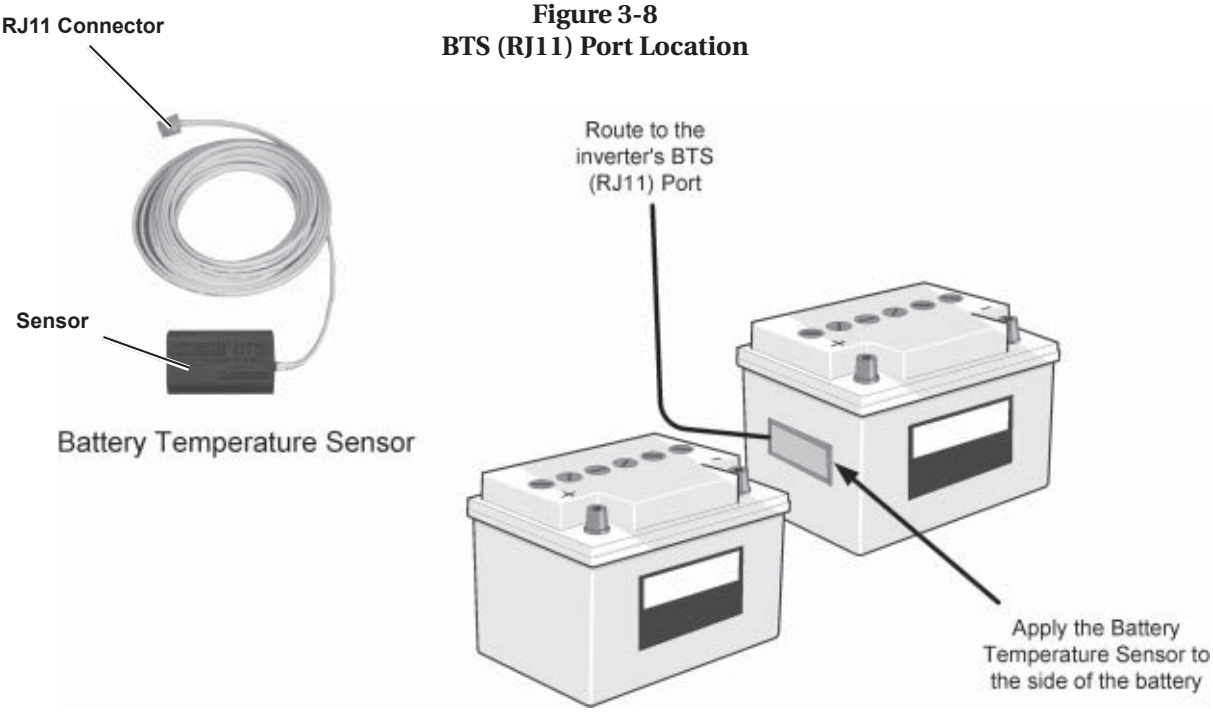

Figure 3-9
BTS Installed on Battery

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AC Wiring

WARNING: DISCONNECT THE POWER FROM THE UTILITY'S MAIN BREAKER BOX BEFORE PROCEEDING.

Sub-panel Mounting

NOTE: Installations should be performed by a qualified person or a licensed electrician following all local and NEC codes.

- Determine the location of the sub-panel and install it according to the manufacturer's directions.
- Install an appropriate-sized circuit breaker in the sub-panel based on the wire size being used from the inverter output. This will later be wired to the inverter's output.

Access to the Inverter's AC Terminal Block

CAUTION: The inverter's AC output must never be wired to the utility or generator output. This will cause severe damage to the inverter which is not covered under warranty.

All AC wiring connects to the terminal block located on the left-hand side of the inverter.

- To access the terminal block, remove the two AC cover panels (if installed) by removing the three Phillips screws. Units are shipped without the covers installed (packed in a small plastic bag with additional hardware).
- Locate the AC input and output terminals on the block.

See Figure 3-11 on page 42 for AC input wiring.

See Figure 3-12 on page 43 for AC output wiring.

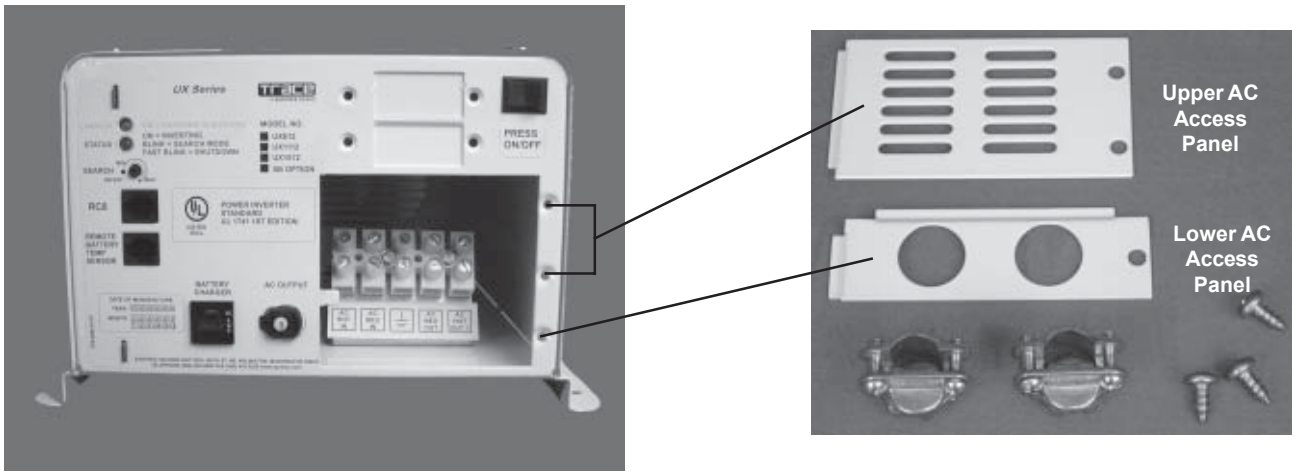

Figure 3-10
AC Access Covers and Hardware

AC Wiring (continued)

NOTE: Consult the NEC for actual wire sizes for specific installations.

Electrical code requires that disconnect switches be provided in the AC input and output wiring circuits. AC circuit breakers in the AC load center can be used to meet this requirement. The wiring, both in and out, of the inverter must also be protected from short circuits and overloads by a fuse or circuit breaker. There are many factors that determine the correct AC wire and breaker size based on your installation. Consult with your national and local codes to determine the correct wire and breaker size based on the current requirements for your particular model shown in the table below.

MODEL	INPUT Pass-thru (amps for charger)	OUTPUT Total
UX512E	Not available	2.2 amps
UX512ESB	15 amps (2.5 amps)	15 amps
UX612	Not available	5 amps
UX612SB	30 amps (5 amps)	30 amps
UX1112	Not available	9.2 amps
UX1112SB	30 amps (10 amps)	30 amps
UX1112E	Not available	4.8 amps
UX1112ESB	15 amps (5 amps)	15 amps
UX1512	Not available	12.5 amps
UX1512SB	30 amps (13 amps)	30 amps

Table 3-4
AC Current Requirements (Input and Output)

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AC Wiring (continued)

Table 3-5 is provided as a guide to help determine the minimum AC wire size needed and may be different based on your particular installation. AC wire sizes provided in Table 3-5 are from the NEC and assume the use of conduits, using copper wire, and with a temperature rating of 75 °C or higher. A minimum of #14 AWG is required for all AC wiring.

Consult your local code for more information and for other wire and breaker sizes.

MODEL	INPUT Wire Size/Maximum Breaker Size	OUTPUT Wire Size/Maximum Breaker Size
UX512E	Not Available	#14 AWG / 15 amps
UX512ESB	#14 AWG / 15 amps	#14 AWG / 15 amps
UX612	Not Available	#14 AWG / 15 amps
UX612SB	#10 AWG / 30 amps	#10 AWG / 30 amps
UX1112	Not Available	#14 AWG / 15 amps
UX1112SB	#10 AWG / 30 amps	#10 AWG / 30 amps
UX1112E	Not Available	#14 AWG / 15 amps
UX1112ESB	#14 AWG / 15 amps	#10 AWG / 30 amps
UX1512	Not Available	#14 AWG / 15 amps
UX1512SB	#10 AWG / 30 amps	#10 AWG / 30 amps

Table 3-5
Minimum Recommended AC Wire Size (Input and Output)

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AC Wiring (continued)

AC Input Wiring to Inverter (only for inverters with the SB Option installed)

WARNING: DISCONNECT THE MAIN BREAKER AT THE MAIN UTILITY BREAKER BOX. DISCONNECT THE BATTERY CONNECTIONS FROM THE INVERTER IF THEY ARE ALREADY CONNECTED.

1. Install an appropriate sized circuit breaker in the main utility breaker box. This will serve as both an AC disconnect and over-current protection.

   See Table 3-5 on page 41 for maximum breaker sizes.

2. Feed the HOT, NEUTRAL and GROUND wires (via conduit) from the inverter to the main utility breaker box. Leave several inches of extra wire at each end.

3. Make the connections to the inverter first. Wiring to the main utility breaker box is performed after all connections have been made in the inverter.

   a. Connect the GROUND (green) wire to the inverter's AC GROUND terminal.

   b. Connect the NEUTRAL (white) wire from the main utility breaker box to the inverter's NEUTRAL INPUT terminal.

   c. Connect the HOT (black) wire from the main utility breaker box to the inverter's AC HOT INPUT terminal.

4. Torque all connections to 16 inch-pounds.

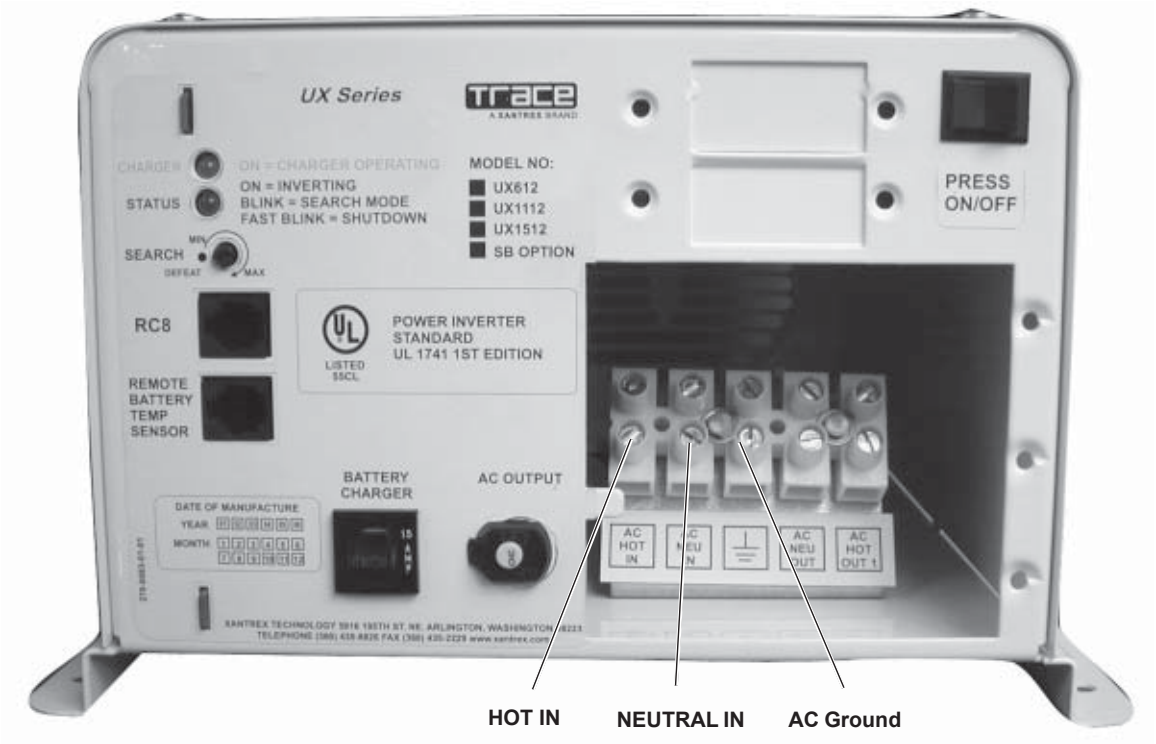

Figure 3-11
AC Input Wiring

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AC Wiring (continued)

AC Output Wiring to the Sub-panel

WARNING: ENSURE THE SUB-PANEL DOES NOT HAVE A NEUTRAL TO GROUND BOND. IF IT DOES, REMOVE IT. ALL AC NEUTRAL-GROUND BONDING IS DONE AT THE MAIN UTILITY BREAKER BOX (SERVICE ENTRANCE).

NOTE: The two neutral connections (input and output) are common to one another and may be used in any combination.

1. Connect the GROUND wire to the inverter's AC GROUND chassis terminal. Connect the other end of this wire to the GROUND bus in the sub-panel.
2. Connect the NEUTRAL (white) wire to the inverter's NEUTRAL OUTPUT terminal. Connect the other end of this wire to the NEUTRAL bus in the sub-panel.
3. Connect the HOT (black) wire to the inverter's terminal labeled AC HOT OUTPUT. Connect the other end of this wire to the sub-panel's input circuit breaker.
4. Torque all inverter terminal block connections to 16 inch-pounds. Refer to the sub-panel manufacturer's specifications for wire torques at the sub-panel.

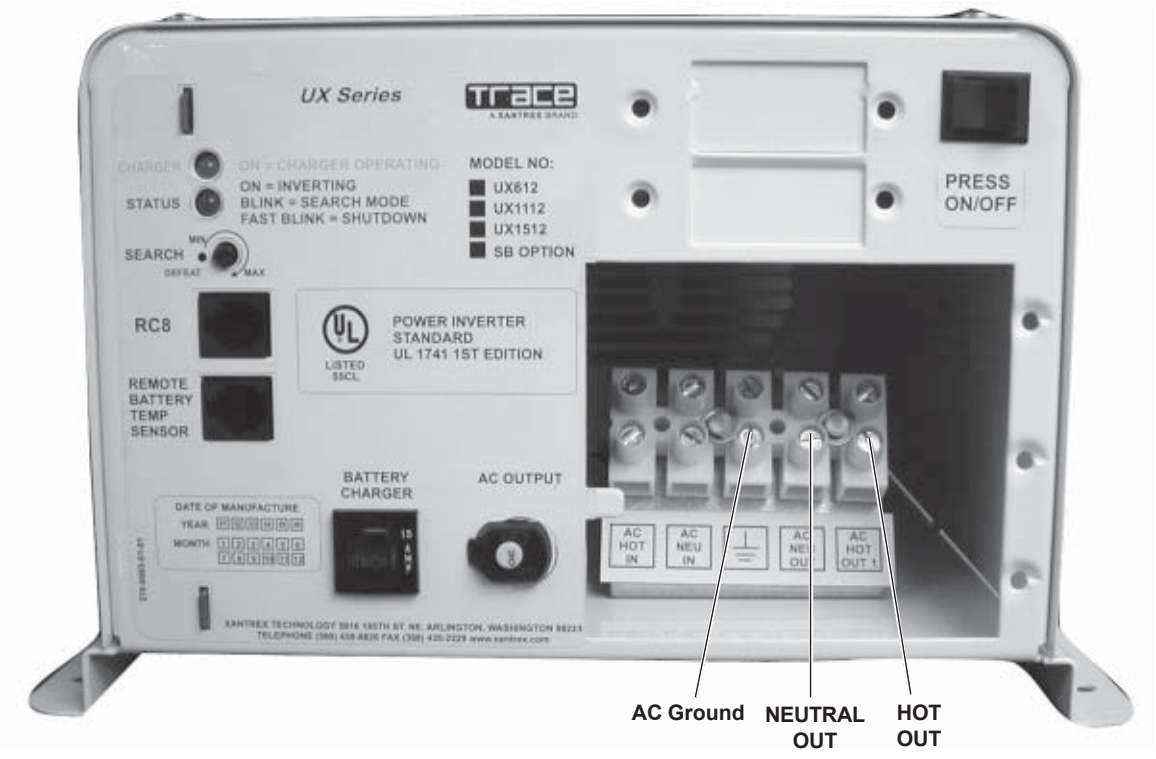


Figure 3-12
AC Output Wiring

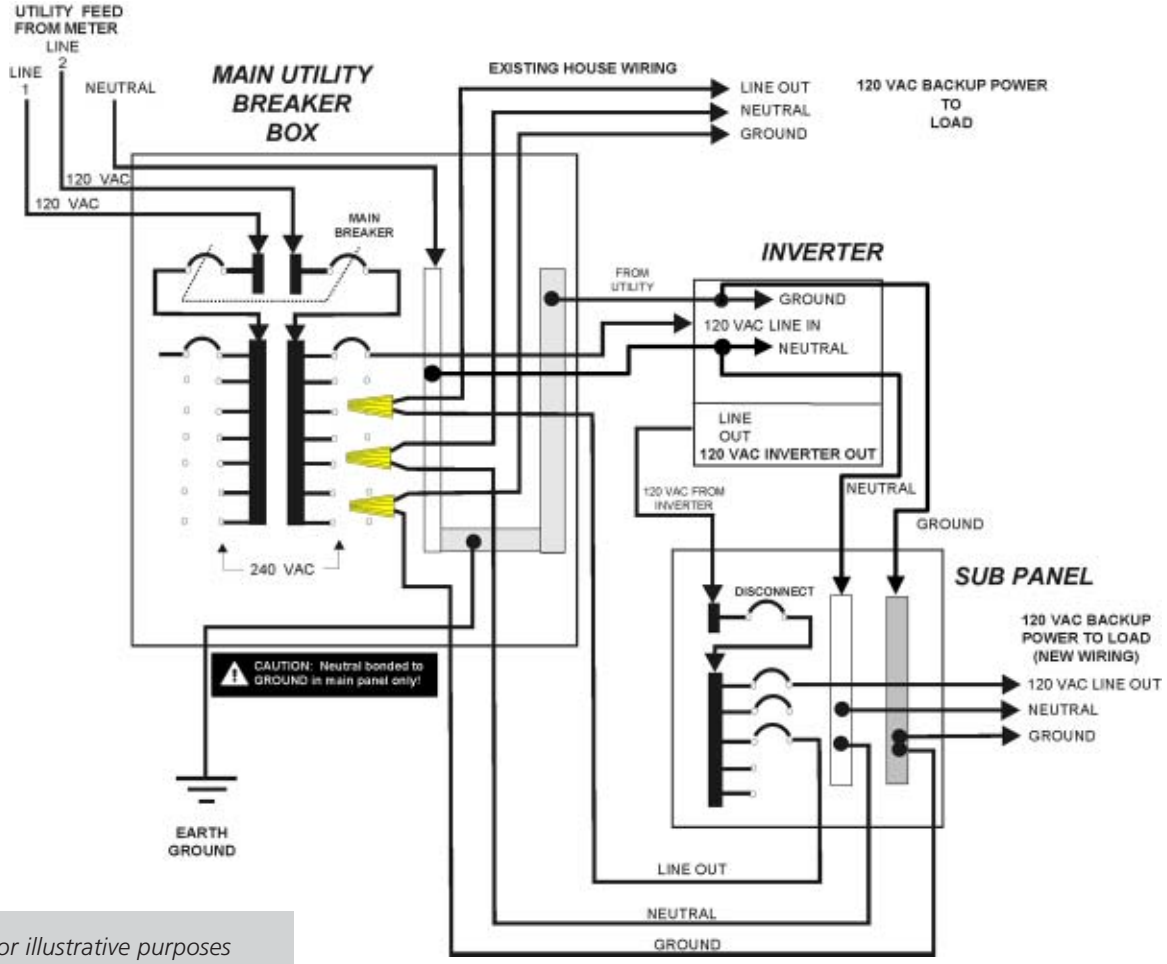
AC Wiring (continued)

AC Input Wiring to the Main Utility Breaker Box

WARNING: MAKE CERTAIN THE POWER TO THE MAIN UTILITY BREAKER BOX IS DISCONNECTED! NEVER WORK ON LIVE CIRCUITS.

CAUTION: Inspect all wiring for proper installation before reinstalling the cover plate.

1. Remove the cover plate from the main utility breaker box.
2. Connect the ground (green) wire to the GROUND bus in the main utility breaker box.
3. Connect the neutral (white) wire to the NEUTRAL bus.
4. Connect the hot (black) wire to the circuit breaker that was installed for the inverter.
5. Torque all wires to the manufacturer's specifications.



NOTE: For illustrative purposes only. Breaker boxes vary depending on the application. Main panel wiring to non-critical loads is not illustrated.

Figure 3-13
Utility Breaker Box Wiring Diagram

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Generators

Basic 120 Vac Generator Hookup (Off-Grid applications only)

NOTE: The ground and neutral must be bonded at one place, and only one place, in the system. If the generator is the main source of power, (i.e., no utility grid power) then the neutral and ground connections are bonded at the generator. If the generator is acting as a backup for the utility grid, then the bond should be at the main utility breaker box. In this case, ensure that no bond exists at the generator output.

1. Connect the ground wire on the generator to the GROUND terminal on the inverter.
2. Connect the generator neutral wire to the NEUTRAL terminal on the inverter.
3. Connect the generator HOT wire to the HOT input on the inverter.
4. Bond the neutral to the ground on the output of the generator (only if used in non-utility installations) *or* in the main utility breaker box (not both).
5. Drive a ground rod 6–8 feet (1.8 - 2.4 meters) into the ground and connect the generator's ground to the ground rod.
6. Start the generator and check for proper operation of the inverter (i.e., the inverter transfers from battery to generator power).

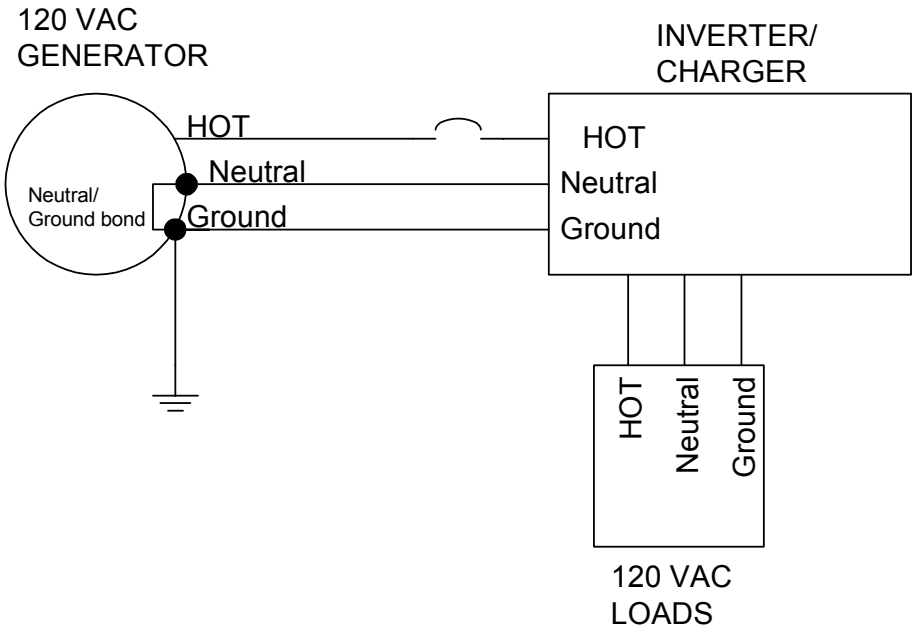

Figure 3-14
Basic 120 Vac Generator Block Diagram (for Off-Grid applications)

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Generators (continued)

Basic 120 Vac Utility/Generator Hookup

If a generator is used as a backup for the utility, then an AC transfer switch must be added to provide a means to switch the generator power to the inverter's inputs. The generator can be used during extended outages to recharge the batteries and provide pass-through power for the loads. Start and stop the generator manually using the generator's pull-cord, ON/OFF switch, etc.

See Figure 3-15 for a basic 120 Vac utility/generator block diagram.

Generator Connections (to AC transfer switch)

NOTE: Refer to the AC transfer switch installation manual for contact details, torque specifications, etc.

1. Connect a (green) ground wire between the generator's GROUND terminal and the GROUND terminal in the AC transfer switch.
2. Connect a (white) neutral wire between the generator's NEUTRAL terminal and the NEUTRAL bus in the AC transfer switch.
3. Connect a (black) HOT wire between the generator's HOT OUT terminal and the generator's HOT contact in the AC transfer switch.

Utility Connections (to AC transfer switch)

1. Connect a (green) wire between the GROUND terminal in the main utility breaker box and the GROUND terminal in the AC transfer switch.
2. Connect a (white) wire between the NEUTRAL bus in the main utility breaker box and the NEUTRAL bus in the AC transfer switch.
3. Connect a (black) wire between the inverter circuit breaker in the main utility breaker box and the utility HOT contact in the AC transfer switch.

Inverter Connections (to AC transfer switch)

1. Connect a (green) wire between the GROUND terminal in the AC transfer switch and the inverter's AC GROUND terminal.
2. Connect a (white) wire between the NEUTRAL terminal in the AC transfer switch and the inverter's NEUTRAL IN terminal.
3. Connect a (black) wire between the COMMON terminal in the AC transfer switch and the inverter's HOT IN terminal.
4. Torque all wires 16 in/lb.

Sub-panel Connections

1. Connect a (green) wire between the inverter's AC GROUND terminal and the GROUND terminal in the sub-panel.
2. Connect a (white) wire between the inverter's NEUTRAL OUTPUT terminal and the NEUTRAL bus in the sub-panel.
3. Connect a (black) wire between the inverter's terminal labeled AC HOT OUTPUT and the sub-panel's INPUT circuit breaker.
4. Torque all inverter terminal block connections to 16 in/lb. Refer to the sub-panel manufacturer's specifications for wire torques.
5. Recheck all connections.

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Generators (continued)

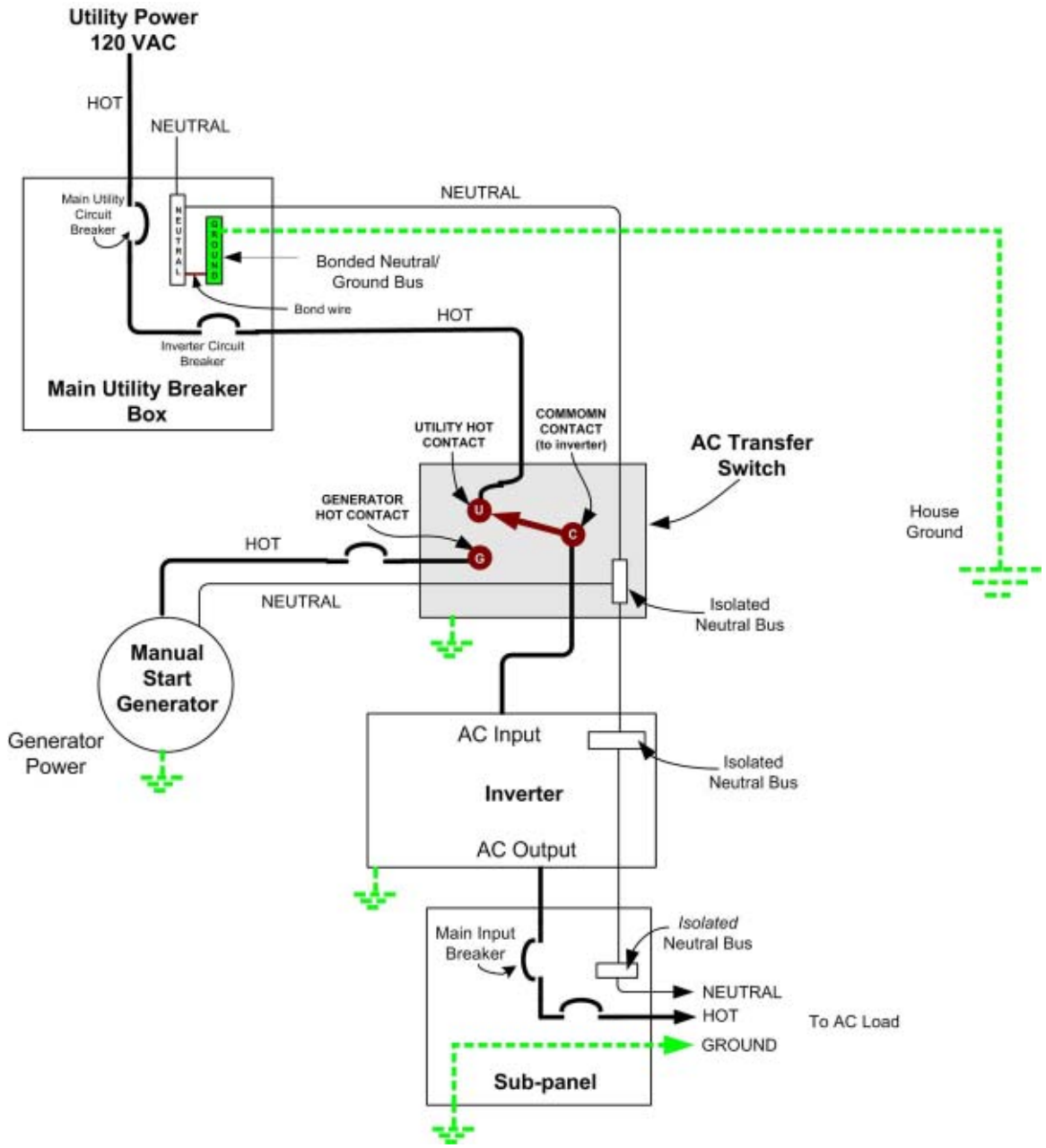

Figure 3-15
Basic 120 Vac Utility/Generator Block Diagram

Remote Monitoring

The UX inverter/charger can be controlled remotely by installing an RC8 Remote Control.

See Figure 3-16 below for the location of the RC8 Remote Control port on the UX inverter/charger.

See the RC8 Remote Control Installation Guide for specific installation instructions for installing the RC8 remote control.

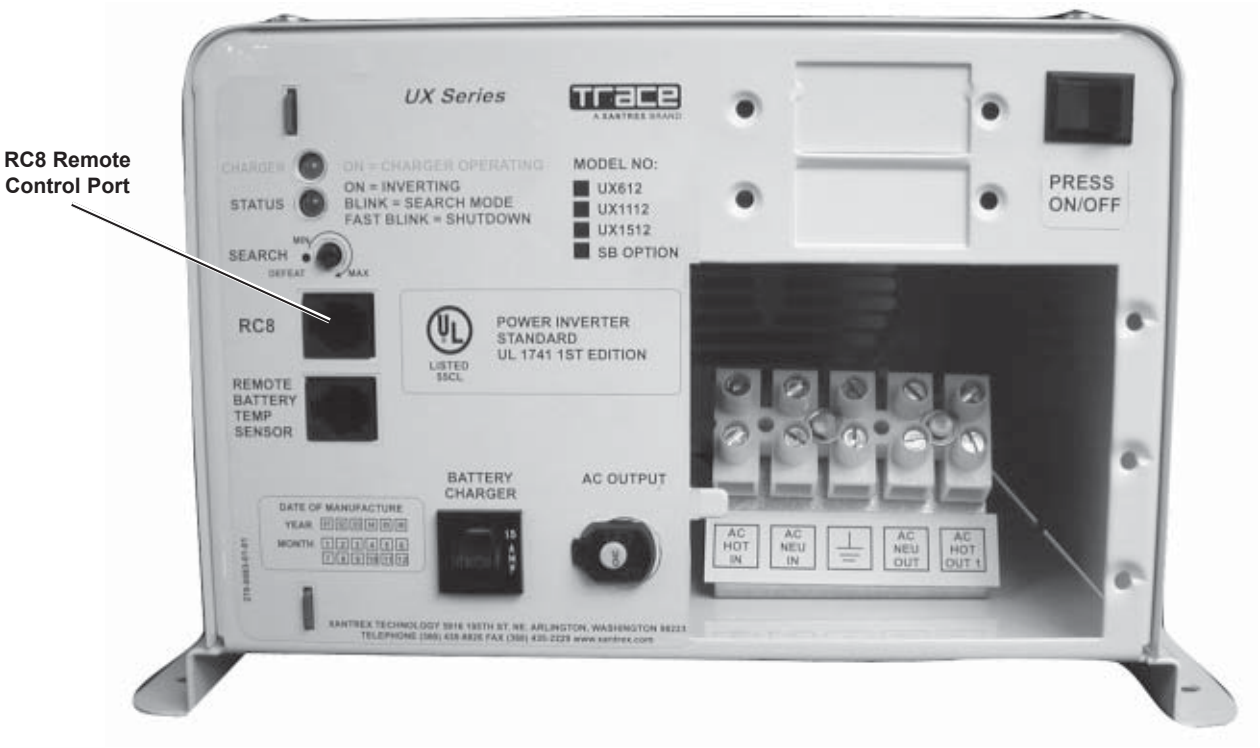

Figure 3-16
Remote Monitor Port Location

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Control Panel

This section describes the operation of the UX Series inverter/charger. The controls on the inverter are very straightforward.

The figure below shows the control panel, located on the left side (AC end) of the inverter.

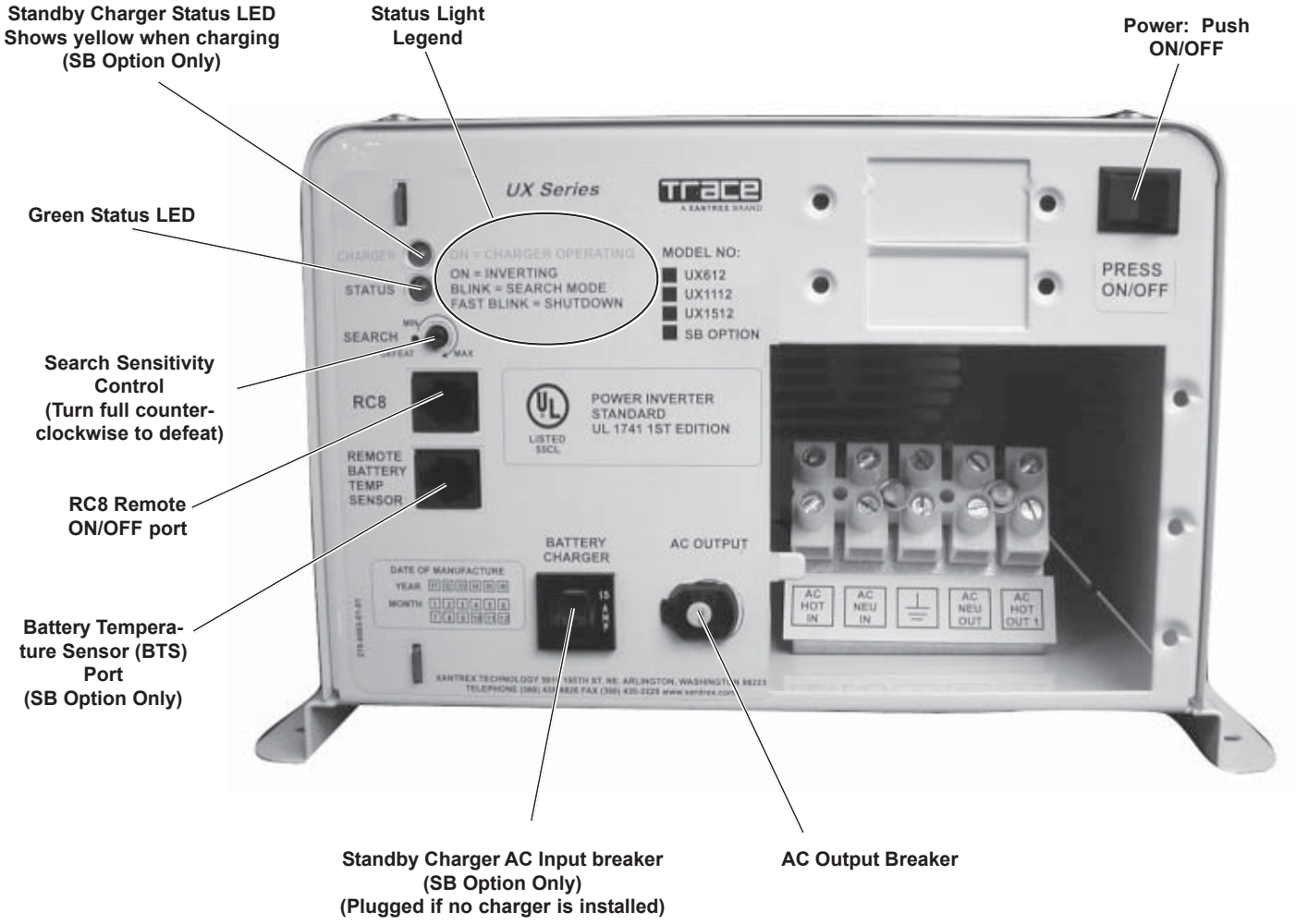

Figure 4-1
Control Panel

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Control Panel (continued)

Power ON/OFF Button

This button turns the inverter on and off: ***on initial power up, after connecting the batteries, press it twice.*** The ON/OFF button also resets the inverter in the event it shuts down completely due to a fault condition. To reset the unit after a fault condition, press the ON/OFF button only one time. The ON/OFF button turns off only the inverter portion of the unit. Anytime AC input power is present, the battery charger section (if installed) will be operable.

Green Status LED

- **Steady:** Unit is inverting.
- **Fast blinking:** Unit is in search mode.
- **Fast, erratic blinking:** Indicates an error condition, such as a low-battery voltage, high-battery voltage, overheating, or over-current condition. (Almost looks like a "flicker".)

Yellow Charger Status LED

If your unit is equipped with the optional standby charger, this yellow LED will be lit when the unit is charging. The greater the charging current, the brighter the LED will shine. When battery voltage is far below full charge, the LED will glow brightest. When the LED is not illuminated, battery voltage is higher than both the Absorb and the Float voltage charging threshold or another charger is connected in parallel with the unit.

Search Sense Mode

The inverter incorporates a power-saving "Search Sense Mode" that minimizes power drain when there is no load connected by reducing the inverter's output to brief test pulses. When a load exceeding the threshold specified on the control panel is detected, the inverter's output goes to full voltage. The sensitivity threshold is adjustable from about 5 watts to 100 watts. When the inverter is in search mode, the LED will slowly flash green.

Search Control Knob: The control panel knob labeled "Search" sets the sensitivity level in watts that will activate the inverter. Turn the knob full counterclockwise to "Defeat" or disable the search mode. The adjustment range is from 5 to 100 watts.

If problem loads can't be eliminated, disable the Search Sense Mode and the inverter will always remain at full output voltage.

See Section 5, Troubleshooting, page 58, for more information about potential problem loads when using Search Mode.

Search Sense Operation

While idling in Search Sense Mode, the inverter sends out a pulse about six times per second. This electrical pulse travels through the AC wiring "looking" for loads that are connected to the system.

When a load is detected, the inverter determines the wattage of the load and checks to see if it is greater than the threshold set by the operator. This threshold point is adjustable with the Search Control knob on the control panel. The lowest setting is about 5 watts and the highest setting is 100 watts.

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Control Panel (continued)

Search Sense Operation (continued)

For example: when the search sensitivity threshold is set at 40 watts and no loads are present that are 40 watts or greater, the inverter will "ignore" any loads less than 40 watts and remain in idle mode. When a load greater than 40 watts appears, the inverter comes out of idle mode and applies power to the load.

The Search Sense Mode may be disabled by turning the Search Control knob counterclockwise all the way to "Defeat." The inverter remains at full output voltage at all times.

Benefits of Using Search Sense

Search Sense allows you to selectively operate only loads that draw more than a specified amount of power, which means power savings. The inverter needs 5 watts to power itself, even when there are no loads to power.

For example: if a water pump is driven by an inverter for only one hour each day, the other twenty-three hours of the day the inverter is consuming five watts per hour while idle. This power comes from the batteries.

By setting the search sensitivity so that the inverter idles until the water pump tries to run, power savings are realized.

Instead of idling at 5 watts, the inverter consumes only ½ watt while in search mode. This is a savings of 4½ watts every hour or 108 watt hours per day. This converts directly to 8.6 amp hours at 12.6 Vdc (12 V nominal).

In systems with small batteries or limited charging capability, this can lead to substantial savings.

Setting Up Search Mode

The search sense feature significantly reduces battery drain when the inverter spends a fair amount of time "sleeping" each day. Therefore, if search sense is to be utilized it must be adjusted properly. The initial adjustment should be made so that the inverter comes on only when needed.

1. Determine the smallest load that will trigger the inverter out of search mode.
2. Turn the sensitivity control all the way to the lowest setting.
3. Turn on the desired load.
4. Turn the sensitivity up until the load just turns on (if loads change significantly, retuning of the search sensitivity will be necessary).

Some TVs have a menu or control to disable instant-on circuits. If clocks are a problem load, use battery powered units.

A solution might be to place all problem loads on one circuit with one master disconnect.

See Section 5, Troubleshooting, page 58, for more information about potential problem loads when using Search Mode.

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Standby (SB) Option

Units equipped with the standby (SB) option have an additional LED and circuit breaker on the front panel.

See Figure 4-2 on page 53 for the location of the Standby Charger Status LED and SB Charger AC Input Breaker.

SB Option Operation

The standby option adds an internal battery charger and automatic transfer relay. This allows the unit to operate as either a battery charger or inverter (but not both at the same time). An external source of AC power (e.g., utility or generator) must be supplied to the inverter's AC input in order to allow it to operate as a battery charger. When the unit is operating as a charger, it's AC output is powered by the external source (i.e., generator or utility).

The inverter automatically becomes a battery charger whenever AC power is delivered to its AC inputs. There is a 15 second time delay from the time the inverter senses that AC is present at its input and when the transfer is made. This delay is built in to provide time for a generator to spin-up to a stable voltage and avoid relay chattering. While in the battery charger mode, the inverter's AC input is internally connected to the inverter's AC output.

For 120 Vac units, 30 amps is the maximum power that can be handled by the inverter's internal wiring and transfer relay. For 230 Vac units, 15 amps is the maximum power that can be handled by the inverter's internal wiring and transfer relay. This amperage can be passed directly from the AC input to the AC output. During heavy charging, part of this input amperage will be consumed by the charger.

Transfer Switching Speed

While this inverter is not designed specifically as a uninterruptable power supply (UPS) system, its transfer time is normally fast enough to support computers. The transfer time is approximately 35 milliseconds when switching from charger to inverter mode.

When switching from inverter to charger, the inverter waits approximately 15 seconds to ensure the AC source is stable (generator up to speed) and then makes the transfer in approximately 30 milliseconds.

Success as a UPS will vary with computer models and cannot be guaranteed.

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Battery Charger LED Indicator

A yellow LED located on the lower control panel reports the status of the battery charger.

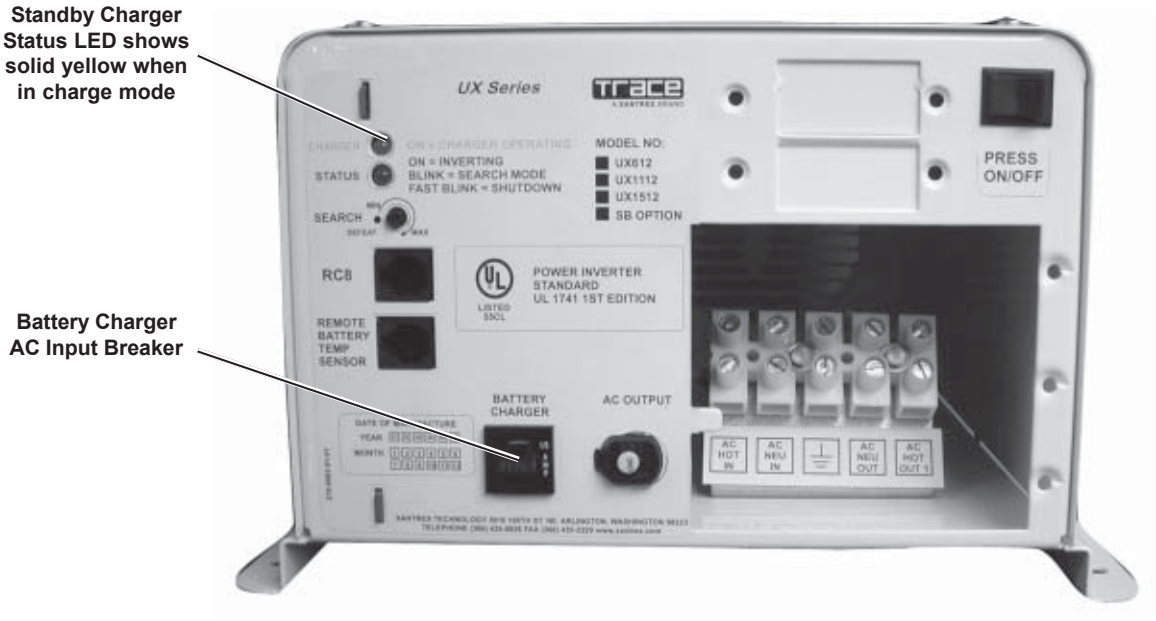

Figure 4-2
Battery Charger Status LED

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5.0 Troubleshooting

NOTE: The UX Series inverter/charger has no internal user serviceable parts. If service is required, refer to Appendix C.

The following information is provided to help identify the source of the problem if the system doesn't perform as expected.

SYMPTOM	POSSIBLE PROBLEM	REMEDY
No output power. LEDs are OFF.	Unit is switched OFF or the battery voltage is too low	Switch the unit on. Check the battery voltage, fuses, circuit breakers and cable connections.
No output power. Green STATUS LED is flashing (fast).	Low battery voltage	Check the battery voltage at the inverter's terminals. Charge, discharge, or replace batteries.
No output power. Green STATUS LED is flashing (slow).	Load too small for the search mode circuit to detect	Reduce the search threshold or defeat search mode.
Low output power. Inverter turns loads ON and OFF. Green STATUS LED is flashing (fast).	Low batteries	Check and recharge batteries.
	Loose or corroded battery connections	Check and clean all connections.
	Loose AC output connections	Check AC output connections.
AC output voltage appears low when using a meter.	Measuring with the wrong type voltmeter (displays 80-100Vac)	Voltmeter must be a true RMS reading meter.
Low surge power.	Weak batteries, battery cables too small or too long	Refer to cable and battery recommendations in manual.
Low charge rate.	Low peak AC input voltage (when connected to utility grid power)	Check AC input wiring. Adjust charge rate setting from remote or reduce load.
	Low peak AC input voltage (when using a generator)	Adjust the voltage regulator on the generator. (164 volts peak required for full charger output).
	Generator output is too small to power load and charger	Reduce load.
Charger is inoperative.	Loose battery cables or bad batteries	Check cables and batteries.
	Charger controls improperly set	Check cables and batteries.
	Wrong AC input voltage	Check AC input for proper voltage and frequency.

Table 5-1
Troubleshooting the UX Model Inverter/Charger

Potential Problem Loads for the Inverter

CAUTION: Some of these problem loads can cause irreparable damage to the load itself. Please contact a Customer Service Representative for more specific information before using any of these items with the UX inverter.

The inverter can operate most AC loads. However, there are special conditions that can cause a load to behave differently than expected. The following describes some of the common problems encountered when using an inverter.

Ceiling Fans

Most large-diameter, slow turning fans run correctly, but generate more noise than when connected to utility power. High speed fans tend to operate normally.

Cell Phones

Some cellular telephones experience interference in the form of a clicking sound.

Computers and Sensitive Electronics

Some computers and sophisticated electronics have power supplies that do not present a load until correct line voltage is available. When this occurs, each unit waits for the other to begin. This can usually be solved by plugging in an additional load (such as a lamp) to bring the inverter out of its search mode. Avoid starting large loads when using a computer .

Consumer Electronics

AM radios tend to pick up inverter noise, especially on the lower half of their band. Inexpensive tape recorders are likely to experience noise as well. Avoid starting large loads when using sensitive electronic devices.

Clocks

The inverter's crystal controlled oscillator keeps the frequency accurate to within a few seconds a day; however, external loads in the system may alter the inverter's output waveform causing clocks to run at different speeds. There may be periods where clocks keep time correctly and then mysteriously do not. This is because most clocks do not draw enough power to trigger the load sensing circuit. In order to operate, especially with no other loads present, the inverter's load sensing circuit will have to be defeated.

Decreasing Loads

If the amount of power a load draws decreases after it has been switched on (such as with a small motor) and its current draw becomes less than the load sensing threshold, it will be turned alternately ON and OFF by the inverter. This can usually be solved by plugging in an additional load (such as a lamp).

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Potential Problem Loads for the Inverter (continued)

Dimmer Switches

Most dimmer switches lose their ability to dim the lights when used with an inverter and operate only in the fully ON or OFF position. Newer dimmer switches controlled by microprocessors tend to work better in inverter applications.

Fluorescent Lights

Some devices cannot be detected by the inverter's load sensor and will not operate. Small fluorescent lights are the most common example. This can usually be solved by plugging in an additional load.

Heavy Loads

If the battery-bank cannot deliver the necessary amperage to operate a heavy load, the inverter will shut down. The battery voltage will then slowly rise back above the low-voltage threshold causing the inverter to resume operation. This cycling of the inverter will continue until the heavy load is reduced or an additional source of power is added.

Microwave Ovens

Microwave ovens are sensitive to peak output voltages. The higher the voltage, the faster they cook. Since the inverter's peak output voltage is dependent upon battery voltage and load size, the microwave's cook time may need to be increased.

Printers

⚠ ***CAUTION: Do not run a laser printer using the UX inverter for power.***

Most inkjet type printers work well in inverter applications. Laser printers, however, require a high current for their fusing circuit and are not recommended for use with an inverter.

Rechargeable Devices

When first using a rechargeable device, monitor its temperature for 10 minutes to ensure it does not become abnormally hot. Excessive heat will indicate that it is incompatible with the inverter.

Undersized Loads

If the power consumed by a device is less than the inverter's search mode circuitry threshold, it will not run. This can usually be solved by plugging in an additional load such as a 100-watt light bulb.

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Potential Problem Loads related to Search Sense Mode

Some loads can "fool" the Search Sense Mode, causing the unit to cycle on and off, or not to turn on at all.

Confirming Search Mode Operation

A neon-type nightlight can be used as a test indicator to show whether the inverter is searching for loads. Plug the night light into the wall–if the inverter is in search mode the light will blink, showing the search pulses sent out by the inverter. If the inverter is running a load, the light will be on continuously because continuous power is being delivered to a load. A typical incandescent nightlight may also work to show the pulses, but it will use more power.

Incandescent Lights

Incandescent lights have a higher starting wattage when the filament is cold than the continuous rating of the bulb. *For example:* if the inverter is set to sense a 40-watt load, and a 30-watt bulb is turned on, the inverter will initially sense a load because the bulb's cold-starting wattage will exceed the 40-watt threshold . When the bulb warms up, it will draw less than the threshold wattage, the inverter will revert to idle mode and the light will go off. When the light cools, its load will again exceed the threshold and the cycle will repeat.

Fluorescent Bulbs

These work the opposite of incandescent light bulbs. If the inverter is set to detect a 30-watt load and a 40-watt fluorescent light is switched on, the inverter will not detect it because fluorescent tubes draw less than 30 watts until the gas in the tube ionizes.

Other loads

Some appliances draw power even when turned off. Examples of this are television sets equipped with instant-on circuits, microwaves equipped with digital clocks, VCRs, and other clocks. If the search sensitivity threshold is set higher than the combined loads, an auxiliary load must be used to bring the inverter out of search mode before the appliances will turn on.

If the sensitivity threshold is set lower than the combination of the loads, the loads will remain on continually, and excess battery drain will occur. Three such 15-watt loads would consume an additional 90 amp hours per 24 hours in a 12 Vdc system. Some alternatives are:

- turn the item off at the wall,
- use an extension cord equipped with an on/off switch,
- place an on/off switch at the outlet, or
- install an appropriate circuit breaker.

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Multiwire Branch Circuits

A potential safety problem exists when installing stand-alone 120 Vac inverters into existing 120/240 Vac wired panels where multiwire branch circuit wiring methods were used.

Multiwire branch circuits are wired differently from "home run" type wiring in that only one neutral wire is used to provide the neutral-return path for each circuit connected to both phases of the AC grid. This method has been employed by electricians in recent years to keep construction costs down by saving copper and labor costs involved in running separate "romex" for each circuit.

See Figure 5-1 below for a diagram of conventional "Home-run" type wiring.

Under normal conditions, this technique is quite safe and meets code requirements. When used as originally installed, the current for each circuit is 180° out-of-phase with each other, so the neutral wire never receives more current than it was designed to handle as the current from each circuit subtracts (or cancels out–leaving only the difference current between the two circuits).

A safety problem occurs when a stand-alone 120 Vac inverter is installed to power these circuits, causing the one neutral wire to now carry the ***in-phase*** currents for both circuits. Since the current is in-phase, the two circuits ***add*** instead of subtract, potentially doubling the current flow in the neutral return wire! The branch circuit breakers do ***not*** protect the neutral wire from overload under this condition. This excess current will overheat the neutral wire, potentially creating a fire hazard.

See Figure 5-2 on page 60 for a diagram of multiwire branch circuit wiring and current flow.

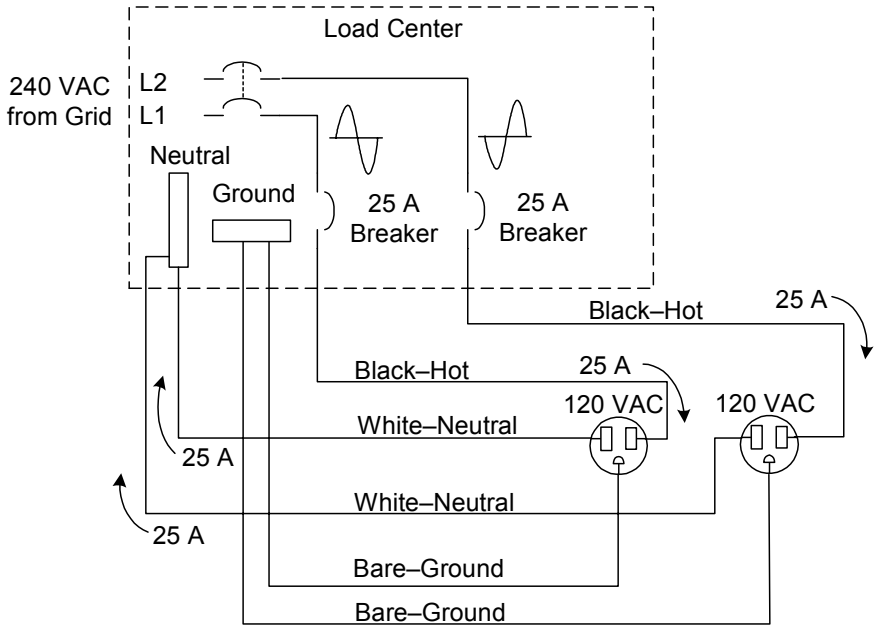

Figure 5-1
Conventional "Home-run" Type Wiring

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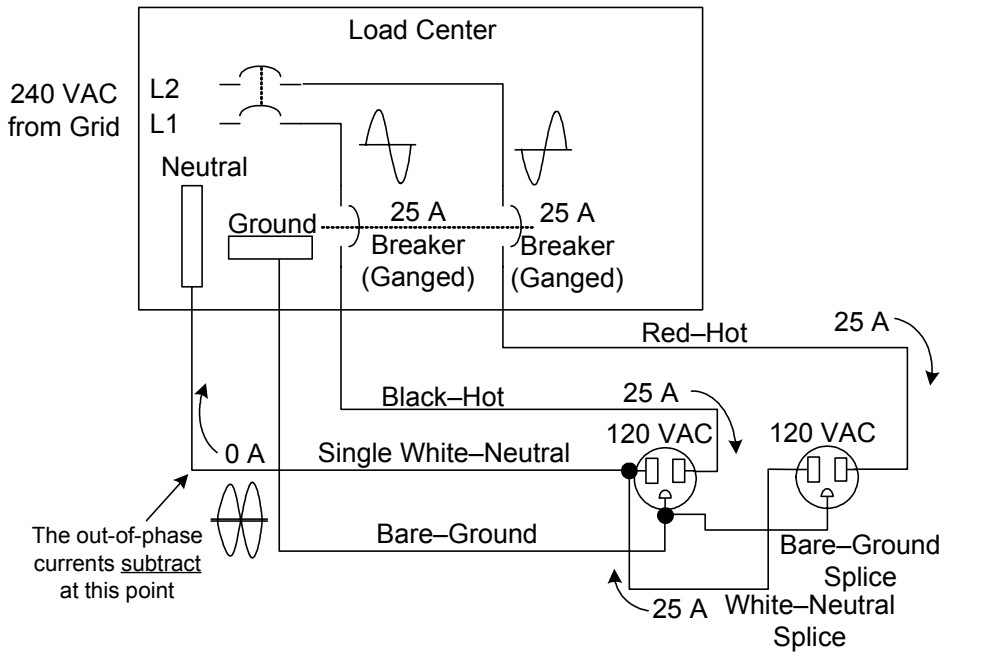
Multiwire Branch Circuits(continued)



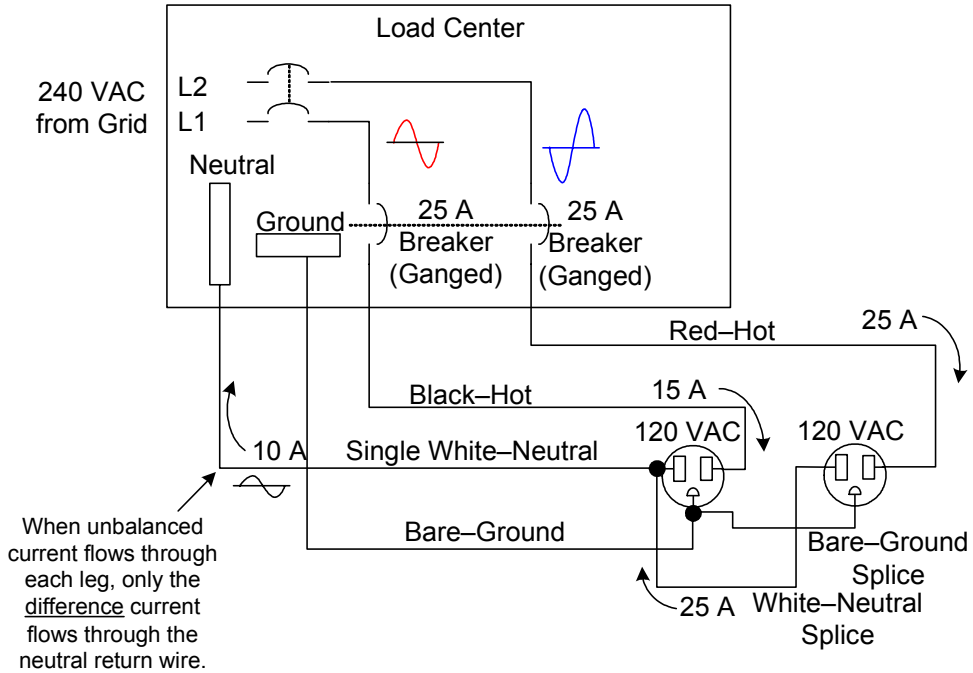


Figure 5-2
Multiwire Branch Circuit Wiring and Current Flow

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Multiwire Branch Circuits (continued)

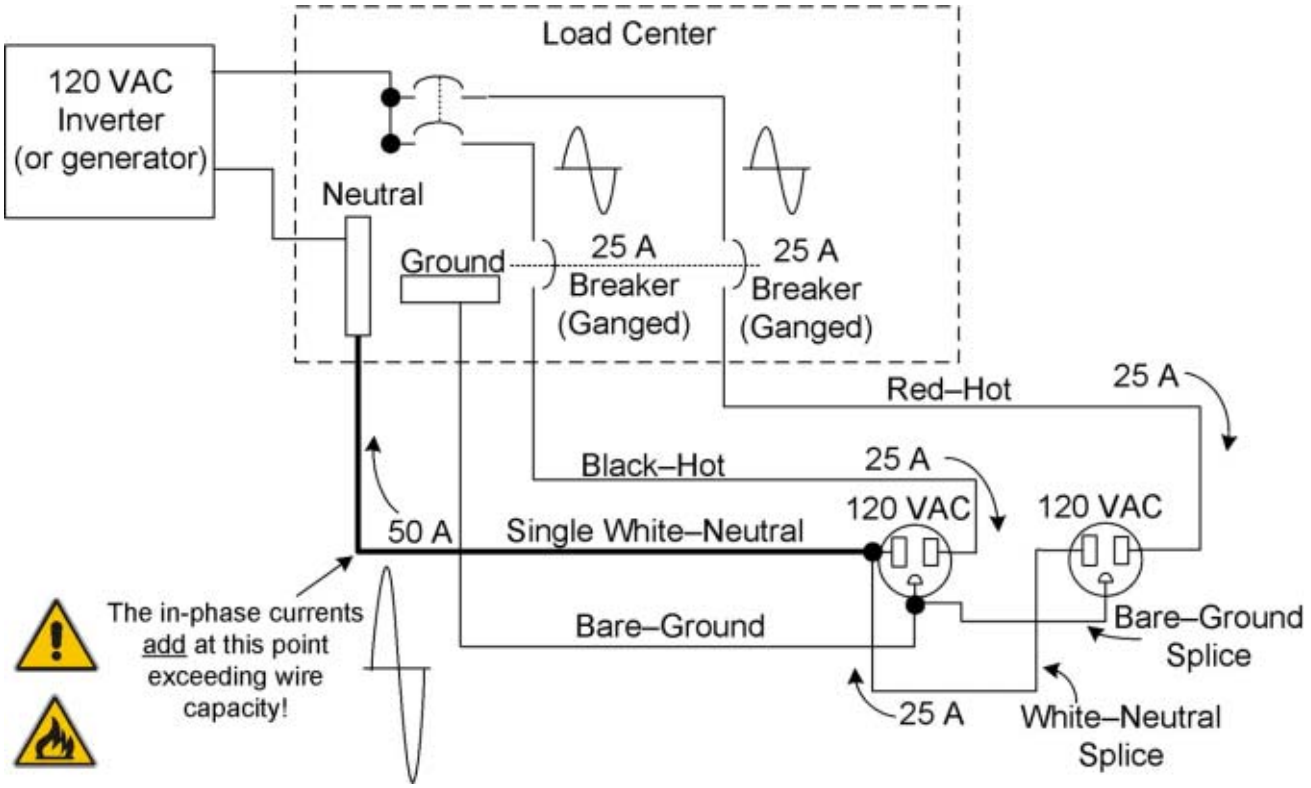

Figure 5-3
120 Vac Inverter Incorrectly Wired in a Multiwire Branch Circuit

Identifying Multiwire Branch Circuits

WARNING: THE NEXT STEP INVOLVES OPENING THE LOAD CENTER EXPOSING LIVE CIRCUITS. THIS PROCEDURE SHOULD ONLY BE PERFORMED BY QUALIFIED PERSONS OR ELECTRICIANS.

WARNING: IF THIS ARRANGEMENT EXISTS IN THE PANEL AND IT IS BEING POWERED BY A STAND-ALONE 120 VAC INVERTER, A POTENTIAL FIRE HAZARD EXISTS! FOR SAFETY, THESE CIRCUITS MUST BE REWIRED TO MEET CODE REQUIREMENTS.

Multiwire branch circuits can be identified by removing the cover on the load center and inspecting the wiring. Conventional 120 Vac circuits are identified by a 2-wire-plus-ground (black, white and copper) “romex” for each circuit. Multiwire branch circuits use a 3-wire-plus-ground arrangement (black, red, white and copper) for each circuit run.

See Figure 5-4 for an illustration showing the wire used in multibranch wiring.

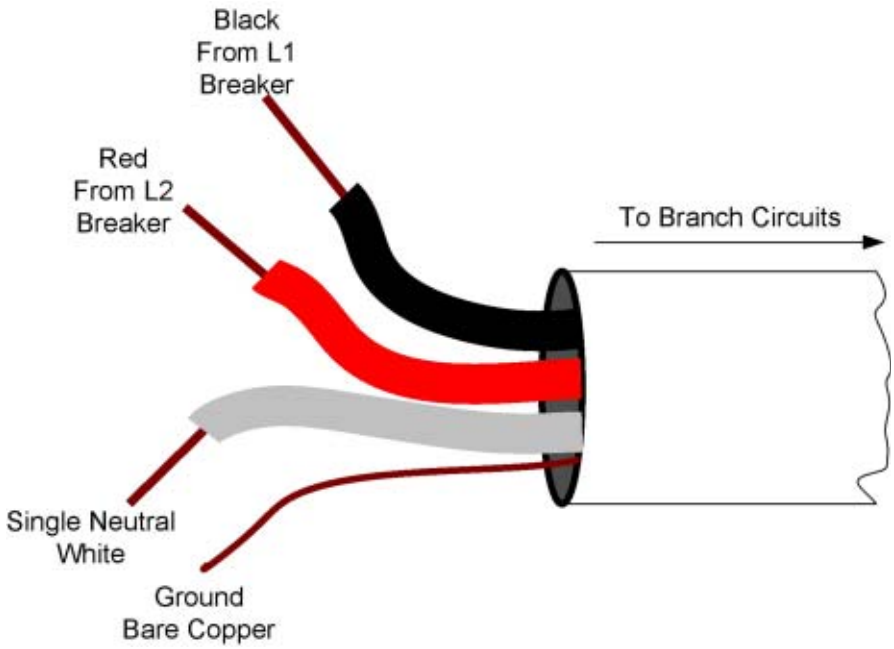

Figure 5-4
Multiwire Branch Circuit Wire

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Multiwire Branch Circuits (continued)

Correcting Multiwire Branch Circuit Wiring

WARNING: UNTIL ONE OF THE SOLUTIONS ABOVE IS IMPLEMENTED, A STAND-ALONE 120 VAC INVERTER (OR GENERATOR) MUST NOT BE INSTALLED WHERE MULTIWIRE BRANCH CIRCUITS EXIST.

Correcting multiwire branch circuit wiring is not an easy task. There are several approaches that can be taken, each with its advantages and disadvantages.

- Rewire existing multiwire branch circuits to conventional "home run" wiring. This requires a qualified electrician (knowledgeable of multiwire branch circuit wiring) and is expensive. There may be multiple multiwire branch circuits located throughout the structure, requiring complete rewiring.
- Add a T240 autotransformer to the output of the inverter to restore the split-phase configuration. This is the least expensive and easiest method to correct for multiwire branch circuit wiring. Using this method, half of the current is supplied to one leg of the circuit and half to the other in a split-phase arrangement (180° out-of-phase). This will restore the original functionality and safety to the multiwire branch circuit.

See Figure 5-5 for a diagram using a T240 Autotransformer in multiwire branch circuit wiring.

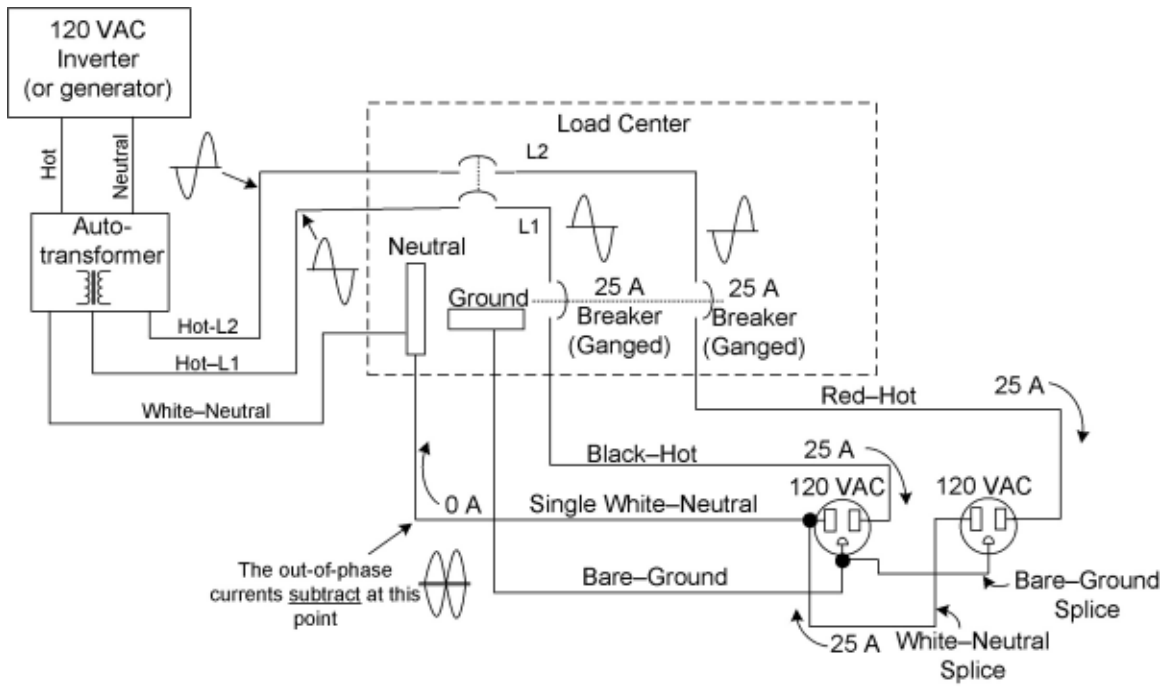

Figure 5-5
Using A T240 Autotransformer in Multiwire Branch Circuit Wiring

Notes:

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Appendix A - Specifications

	UX612	UX1112	UX1512	UX512E/SB	UX1112E/SB
Input (DC)					
Input Voltage (rated)	12 VDC	12 VDC	12 VDC	12 VDC	12 VDC
Input Voltage Range	10 to 16 VDC	10 to 16 VDC	10 to 16 VDC	10 to 16 VDC	10 to 16 VDC
Search Mode (typical)	<1 W	<1 W	<1 W	<1 W	<1 W
On Mode (no load - idle)	5 watts	5.5 watts	7 watts	5 watts	5.5 watts
Input (AC)					
Input Voltage	120 VAC	120 VAC	120 VAC	230 VAC	230 VAC
Input Frequency	60 Hz	60 Hz	60 Hz	50 Hz	50 Hz
Input / Pass-through Current (max)	30 A	30 A	30 A	15 A	15 A
Output					
Output Voltage (rms)	120 VAC	120 VAC	120 VAC	230 VAC	230 VAC
Output Frequency	60 Hz	60 Hz	60 Hz	50 Hz	50 Hz
Continuous Output Current	3.4 A	5 A	6.7 A	2.1 A	4.8 A
Continuous Power	400 VA	600 VA	800 VA	500 VA	1100 VA
Surge Capability					
1 mSec (1)	25 A (peak)	38 A (peak)	38 A (peak)	12 A (peak)	14 A (peak)
100 mSec (2)	22 A (rms)	22 A (rms)	25 A (rms)	11 A (rms)	11 A (rms)
Peak Efficiency	92%	92%	92%	92%	92%
Battery Charger					
Maximum Charging Rate	25 A	50 A	65 A	25 A	50 A
Selectable Charging Rate (default)	Sealed Batteries:	14.3 VDC (Bulk) / 13.6 VDC (Float)			
	Vented Batteries:	14.7 VDC (Bulk) / 13.4 VDC (Float)			
Charger Type	3-stage (Bulk, Absorption, Float)				
Temperature Compensation	with optional, plug-in sensor (BTS)				
Electrical					
AC Waveform	Modified sinewave				
Power Factor Allowed	0.5 to 1.0				
Voltage Regulation	± 5% (at rated voltage)				
Frequency Regulation	± 0.01% (crystal regulated)				
Load Sensing Range	5 to 100 W (adjustable)				
Low Battery Cutout	9.5 VDC				
High Battery Cutout	15.7 VDC				
Physical					
Enclosure Type	indoor, ventilated, steel chassis (with powdercoat finish)				
Temperature Range (specified)	0 °C to 25 °C				
Altitude Limit (operating)	15,000 feet (5,000 meters)				
Mounting	wall or shelf-mount				
Wiring Requirements (AC)	#14 AWG (minimum) - depends upon model and wire length				
Wiring Requirements (DC)	#2 AWG (minimum) - depends upon model and wire length				
Wiring Requirements (ground)	#10 AWG (minimum) - depends upon model and wire length				
Dimensions*	6" H x 10.25" W x 15.5" D (15.2 cm H x 26 cm W x 39.4 cm D)				
Weight	30 lb. (13.6 kg)	34 lb. (15.4 kg)	37 lb. (16.8 kg)	30 lb. (13.6 kg)	34 lb. (15.4 kg)
Standard Features					
Easy-to-Use Control Panel	ON/OFF switch, LED display, load sensing potentiometer				
Circuit Protection	front panel AC and charger circuit breakers				
High and Low Battery Protection	automatically shuts down batteries to prevent damage				
Overtemperature Protection	automatically shuts down inverter to prevent thermal damage				
Overcurrent Protection	automatically shuts down inverter to prevent damage				
Variable Speed, DC Cooling Fan	ensures maximum cooling under heavy loads (No fan provided on the UX512E or UX612 models)				
Options					
BTS	Battery Temperature Sensor				
RC8/50	on/off remote ON/OFF switch with status LED indicator and 50 foot (15 meter) cable				
BC5-4/0	battery / inverter cable (5 foot - #4/0 AWG)				
BC5-2/0	battery / inverter cable (5 foot - #2/0 AWG)				
Agency Approval	UL1741 1st Edition				

NOTES:

(1) Surge "1 mSec" - Maximum 1 ms peak output amps measured when starting AC loads

(2) Surge "100 mSec" - Maximum 100 ms peak output amps measured when starting AC loads

* Includes battery terminal covers, fan louvers, AC input breakers and ground lug

Specifications @ 25 °C Ambient

Specifications subject to change without notice.

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Appendix A - Specifications

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Appendix B - Batteries

Batteries are available in different sizes, amp-hour ratings, voltage, liquid or gel, vented or non-vented, chemistries, etc. They are also available for starting applications (such as an automobile starting battery) and deep discharge applications. Only the *deep discharge* types are recommended for inverter applications. Choose the batteries best suited for the inverter installation and cost. Use only the same battery type for all batteries in the bank. For best performance, all batteries should be from the same lot and date. This information is usually printed on a label located on the battery.

Selection of a Battery Type

There are two principal types of batteries: starting and deep-cycle (with several different types of chemistries). Batteries can be either sealed or non-sealed (vented).

The battery types recommended for use in an inverter system are: Flooded Lead Acid (FLA), Sealed Gel Cells (GEL), Sealed Absorbed Glass Mat (AGM); and alkaline types Nickel-iron (NiFe) and Nickel-Cadmium (NiCad). DO NOT use automotive (starting) batteries–they are designed to provide high starting current for short periods of time.

Flooded Lead Acid (FLA)

This type of battery is designed to be deep-cycled before being recharged, making it suitable for inverter applications. Flooded batteries require periodic maintenance consisting mainly of adding distilled water to the cells, checking battery cable connectors for tightness and keeping the terminals clean. Examples of flooded batteries include RV and marine, golf cart, and industrial.

RV and Marine

- Popular in small systems
- Often referred to as “Group 24” or “Group 27” batteries
- Designed for limited cycling
- Do not last as long as the other “true” deep-cycle batteries
- Typically rated at 12 volts (80 to 100 amp hours)

Golf Cart

- Popular for smaller off-grid home systems
- Many medium sized inverter systems use “L16” batteries
- Rugged, long lasting
- Typically rated at 6 volts (220 to 350 amp hours)

Industrial (electric forklift)

- Popular in large inverter systems
- Extremely rugged - lasts up to 10 years or more in an inverter system
- Typically 2 volt cells (1,000 amp hours or more)

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Selection of a Battery Type (continued)

Sealed Batteries (GEL and AGM)

CAUTION: If using sealed batteries, ensure the battery charger is set to the appropriate settings or battery damage will result.

Both gel cell and absorbed glass mat (AGM) batteries are virtually maintenance free, making them ideal for inverter applications. Since the batteries are completely sealed, they can be mounted in almost any position. The only disadvantages, compared to flooded batteries, are a higher initial cost and greater susceptibility to damage from changes in temperature during charging.

Gel Cell

- Gelled electrolyte instead of liquid
- Long life (up to 1500 cycles, typical)
- Low self-discharge

Absorbed Glass Mat

- Electrolyte is contained in glass-fiber mats between battery plates
- Similar to gel cells in characteristics
- Good low temperature performance

NiCad and NiFe Batteries

NOTE: The UX inverter/charger may not be able to adequately charge NiCad or NiFe batteries. A separate charger may be required if NiCad or NiFe batteries are going to be used.

Please consult with your Xantrex Customer Service Representative before using these types of batteries.

Xantrex inverters and battery chargers are optimized for use with lead acid batteries having a nominal 2.0 volts per cell (i.e., 6 cells for a 12-volt system, 12 cells for a 24-volt system and 24 cells for a 48-volt system). Alkaline batteries, such as NiCad and NiFe types, have a nominal cell voltage of 1.2 volts per cell. The number of cells required in a battery-bank for alkaline batteries must be adjusted for a 12-, 24- and 48-volt system (i.e., 10 cells for a 12-volt system, 20 cells for a 24-volt system and 40 cells for a 48-volt system).

Alkaline batteries require a higher charge voltage to fully recharge and drop to a lower voltage during discharge, compared to a similarly sized lead-acid type battery.

Another option for 24-volt (only) alkaline battery-banks is to use only 19 cells instead of 20. This allows the battery charger to operate closer to the settings used for lead acid batteries. However, the battery voltage will drop to as low as 18 volts when discharging the batteries.

Consult the battery manufacturer or supplier regarding system requirements and battery charger settings for alkaline type batteries.

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Battery-Bank Sizing

The battery-bank's size determines the length of time the inverter can continue to supply AC output power. The larger the bank, the longer the inverter can run. An undersized battery bank results in reduced battery life and short inverter run times.

In general, the battery-bank should be designed so the batteries do not discharge more than 50% of their capacity on a regular basis. Discharging up to 80% is acceptable on a limited basis, such as a prolonged utility outage. Totally discharging a battery results in permanent damage and reduced battery life.

For off-grid, stand-alone applications, design a battery-bank that can power the loads for 3–5 days without requiring recharging. To duplicate the conditions on sunless days or windless periods, the power supplied from other sources (i.e., solar, wind, hydro, etc.) is not included in this calculation. This is often referred to as the "number of days of autonomy." If the system is a hybrid, with daily generator run periods, the battery-bank size can be smaller.

Estimating Battery Requirements

To determine the proper battery-bank size, it is necessary to compute the number of amp hours that are required between charging cycles. When the required amp hours are known, size the batteries at twice this amount to ensure the batteries are not regularly over-discharged.

To compute the amp-hour requirements, the amp-hour ratings of each appliance powered by the inverter must be added together. Use the figures from the nameplate label on the appliances, then use the formula WATTS = VOLTS x AMPS. Then divide the calculated wattage of the load by the system battery voltage to determine the amperage the load will draw from the batteries.

(AC current) x (AC voltage) / (battery voltage) = DC amps

Watts

***Example*:**

To determine DC amps when AC amps are specified on the label:

Nameplate label specifies 6 amps at 120 Vac.
The system battery voltage is 24 volts DC.

- First determine the wattage by using the formula:

  WATTS = VOLTS x AMPS = 120 x 6 =720 watts.

- Then divide the wattage by the system battery voltage to determine the DC amperage.

  720/24 = 30 amps DC

To determine DC amps when watts are specified on the label:

Nameplate label specifies 720 watts.
The system battery voltage is 24 volts DC.

(watts) / (battery voltage) = DC amps

(720/24 = 30 DC amps)

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Estimating Battery Requirements (continued)

NOTE: Motors typically require 3–6 times their running current when starting. Check the manufacturer's data sheets for their starting current requirements. If large motors will be started from the inverter, increase the battery bank size to allow for the higher start-up current.

Multiply the amperage by the number of hours the load will operate to roughly calculate amp hours. Double this figure to reach the 50% battery capacity level.

Refer to the example and worksheet on the following pages as a guide to determine the battery bank's amp-hour requirements.

Complete the following steps to calculate the battery-bank capacity requirements. Use the blank table on page B-6 to enter the values for your system. A sample table is shown below.

*NOTE: Refrigerators and ice-makers typically run only about 1/3 of the time, therefore, the running wattage is 1/3 of the total wattage of the appliance. Divide the total wattage of the appliance by 3 and enter it in Step 2.

AC Appliance	Step 1	Step 2	Step 3	Step 4
	Appliance Running Watts	(x) Hours used each day	(x) Days used each week	(÷ 7 =) Average Daily Watt-Hour Requirement
Microwave	600	0.5	7	300
Lights (x4)	40	6	7	240
Hair Dryer	750	0.25	3	81
Television	100	4	7	400
Washer	375	1	2	107
Refrigerator*	480/3 = 160	24	7	3,840
Vacuum Cleaner	1,200	1	1	171
5,139	15,417	30,834	37,001	1,542
Step 6	Step 7	Step 8	Step 9	Step 10
Total Daily Watt Hours Required	Autonomy Battery Size	Rough Battery Size (Watt Hours)	Safe Battery Size (Watt Hours)	Safe Battery Size (Amp Hours)
5,139	15,417	30,834	37,001	1,542

Table B-1
Sample - Estimating Battery Requirements

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Estimating Battery Requirements (continued)

Step 1 Determine the loads the inverter will power and list them in the Step 1 column.

Step 2 Enter the running wattage of each appliance in the Step 2 column.

Step 3 Determine the number of hours (or fraction of hours) the appliance is used each day. Enter this figure in the Step 3 column.

Step 4 Determine the number of days the appliance will be used during the week. Enter this figure in the Step 4 column.

Step 5 Divide the number (entered into each row of the Step 4 column) by 7 to obtain the AVERAGE DAILY WATT HOURS REQUIRED figure. Enter these figures in the Step 5 column.

Step 6 Add all the figures entered into the AVERAGE DAILY WATT HOURS REQUIRED (Step 5) column and enter this number into the TOTAL DAILY WATT HOURS REQUIRED (Step 6) column in the second table.

Step 7 Multiply the TOTAL DAILY WATT HOURS REQUIRED (Step 6) figure by the number of days of autonomy (days between recharging expected, usually between 1 to 5. The examples use 3). Enter this figure into the AUTONOMY BATTERY SIZE (Step 7) column.

Step 8 Multiply the AUTONOMY BATTERY SIZE (Step 7) figure by 2 to provide a 50% maximum battery discharge level. Enter this figure in the ROUGH BATTERY SIZE (WATT HOURS) (Step 8) column.

Step 9 Multiply the ROUGH BATTERY SIZE (WATT HOURS) figure (Step 8) by 1.2 and enter this figure in the SAFE BATTERY SIZE (WATT HOURS) (Step 9) column. This figure allows for an efficiency of 80%.

Step 10 Divide the SAFE BATTERY SIZE (WATT HOURS) (Step 9) figure by the DC system voltage (i.e., 12, 24 or 48 volts). Enter this number in the SAFE BATTERY SIZE (AMP HOURS) (Step 10) column. Use this figure to determine the number of batteries required to reach the amp-hour rating.

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AC Appliance	Step 1	Step 2	Step 3	Step 4
	Appliance Running Watts	(x) Hours used each day	(x) Days used each week	(÷ 7 =) Average Daily Watt-Hour Requirement
Step 6	Step 7	Step 8	Step 9	Step 10
Total Daily Watt Hours Required	Autonomy Battery Size	Rough Battery Size (Watt Hours)	Safe Battery Size (Watt Hours)	Safe Battery Size (Amp Hours)

Table B-2
Estimating Battery Requirements - Worksheet

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Typical Appliance Wattages

The following chart lists some common appliances and their ***estimated*** wattage. These are only rough estimates and are not intended as a replacement for the actual label ratings found on the appliances. Be sure to check these labels for accurate wattage values.

Typical Appliance Wattage			
Appliance	**Watts**	**Appliance**	**Watts**
Fluorescent type light	10	Blender	400
Computer	200-300	Toaster	1000
Microwave (compact)	600-800	Hot Plate	1800
Microwave (full size)	1500	Washer/Dryer	375-1000
Stereo or VCR	50	3/8" Drill	500
Color TV (19")	150	Hair Dryer or Iron	1000
*Refrigerator (3 cu ft)	180	Vacuum Cleaner	1200
*Refrigerator (12 cu ft)	480	Coffee Maker	1200
**Refrigerators and icemakers typically run only 1/3 of the time; therefore, the running wattage is 1/3 of the total wattage of the appliance.*			

Table B-3
Typical Appliance Wattage

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Battery Cable Sizing

NOTE: Figure B-1 is for reference only. Sizes shown are for the conductor. Do not include any insulation when determining your wire size. ***Due to printing anomolies, these dimensions may not be to scale.***

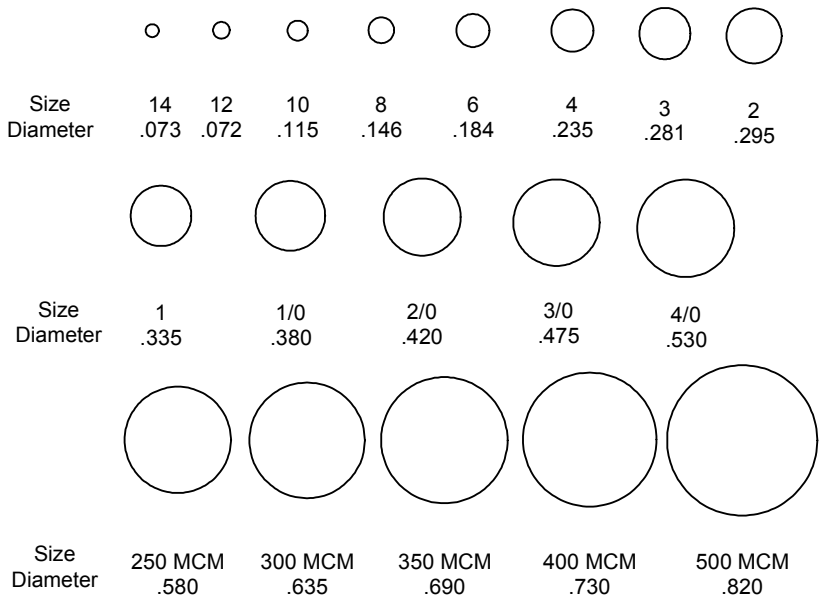

Figure B-1
AWG Wire Size Reference Chart

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Battery Configurations

The battery-bank must be wired to match the inverter's DC input voltage specifications (12 Vdc). In addition, the batteries can be wired to provide additional run time. The various wiring configurations are as follows.

Series

Wiring batteries in "series" increases the total bank output voltage. This voltage MUST match the DC requirements of the inverter or inverter and/or battery damage may occur.

Parallel

Wiring the batteries in "parallel" increases the total run time the batteries can operate the AC loads. The more batteries connected in parallel the longer the loads can be powered from the inverter.

Series-Parallel

"Series-parallel" configurations increase both the battery voltage (to match the inverter's DC requirements) and run-time for operating the AC loads.

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Battery Configurations (continued)

Wiring Batteries in Series

Wiring the batteries in a series configuration increases the *voltage* of the battery string. The total current capacity of the bank does not increase and it retains the same amp-hour rating as a single battery. In other words, six 2-volt batteries or two 6-volt batteries can be combined to create one 12-volt battery-bank.

See Figures B-2 below for an illustration of 6-volt/100 Ah battery wiring in a series configuration.

See Figures B-3 on page B-11 for an illustration of 2-volt/100 Ah battery wiring in a series configuration.

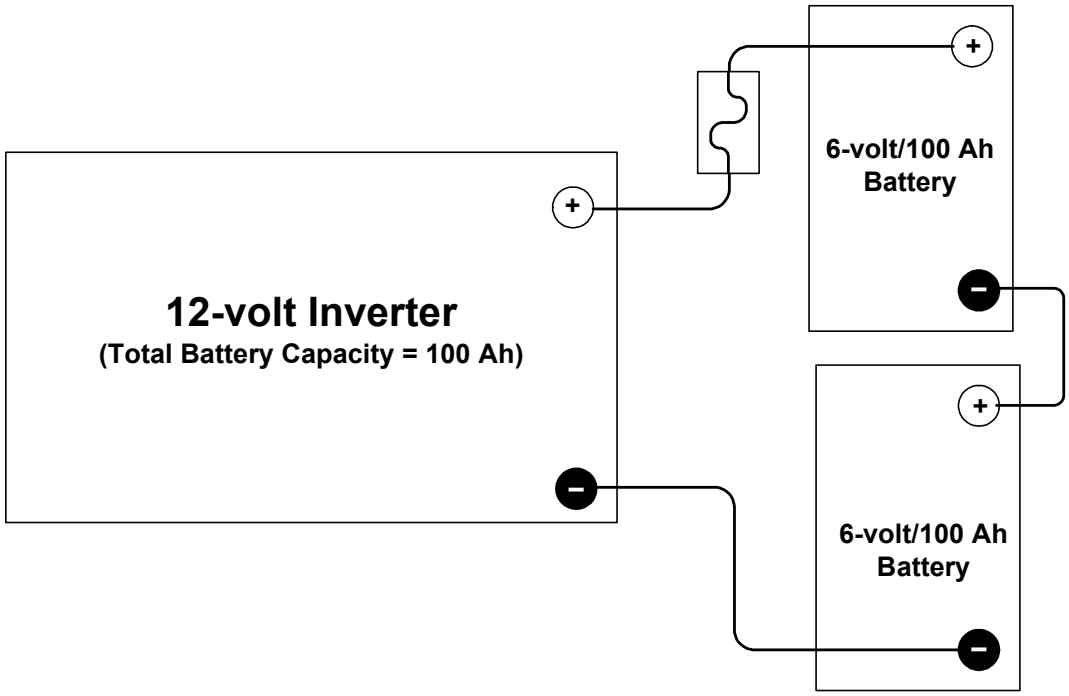

Figure B-2
6-volt/100 Ah Battery Wiring-Series Configuration

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Battery Configurations (continued)

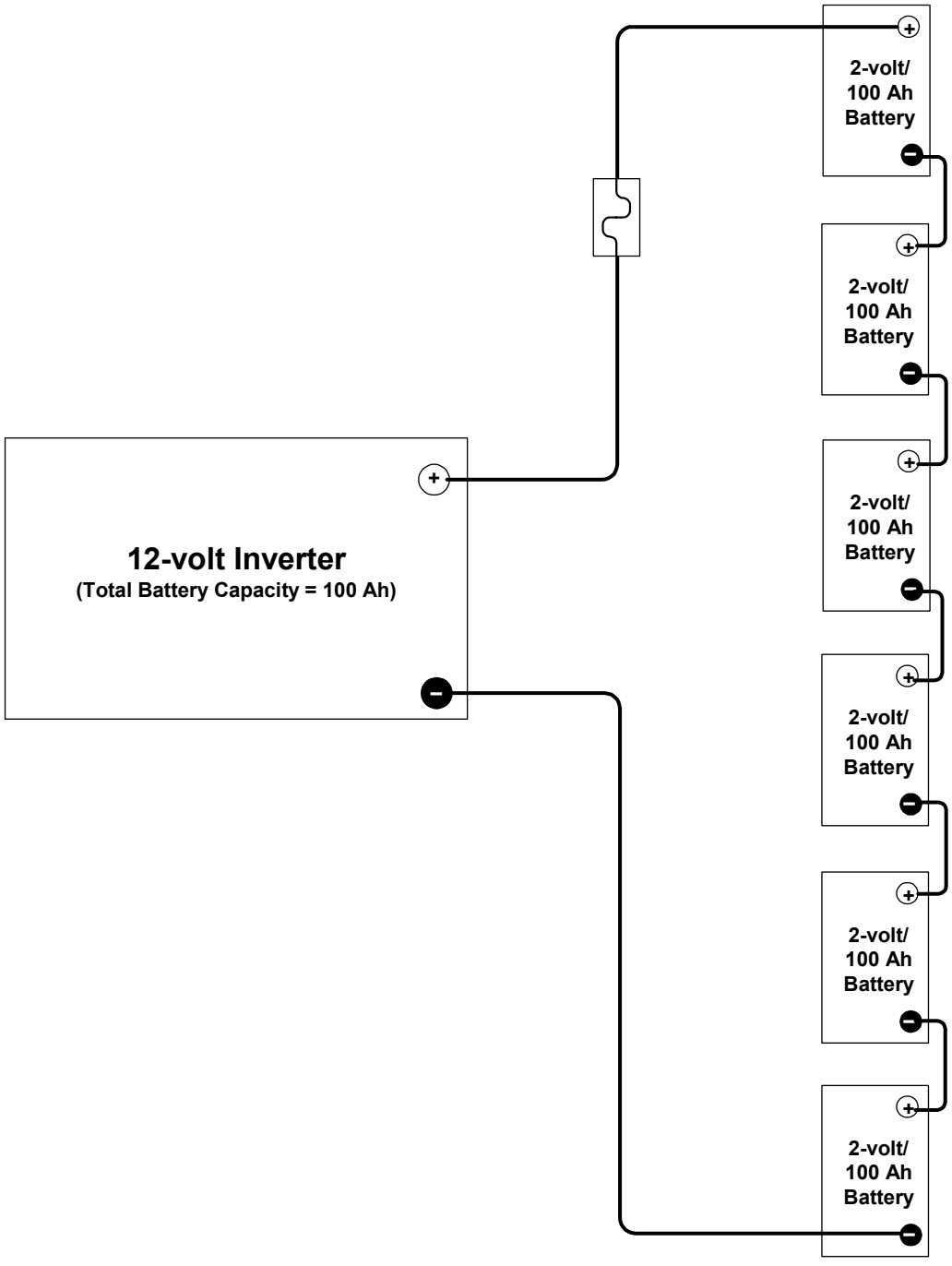

Figure B-3
2-volt/100 Ah Battery Wiring-Series Configuration

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Battery Configurations (continued)

Wiring Batteries in Parallel

Wiring the batteries in a parallel configuration increases the ***current*** of the battery string. This is commonly used in 12-volt configurations. The voltage of the battery bank remains the same as an individual battery. Parallel configurations extend the run times of the AC loads by providing increased current for the inverter to draw from. In a parallel configuration, all of the negative battery terminals are connected together and all of the positive battery terminals are connected together.

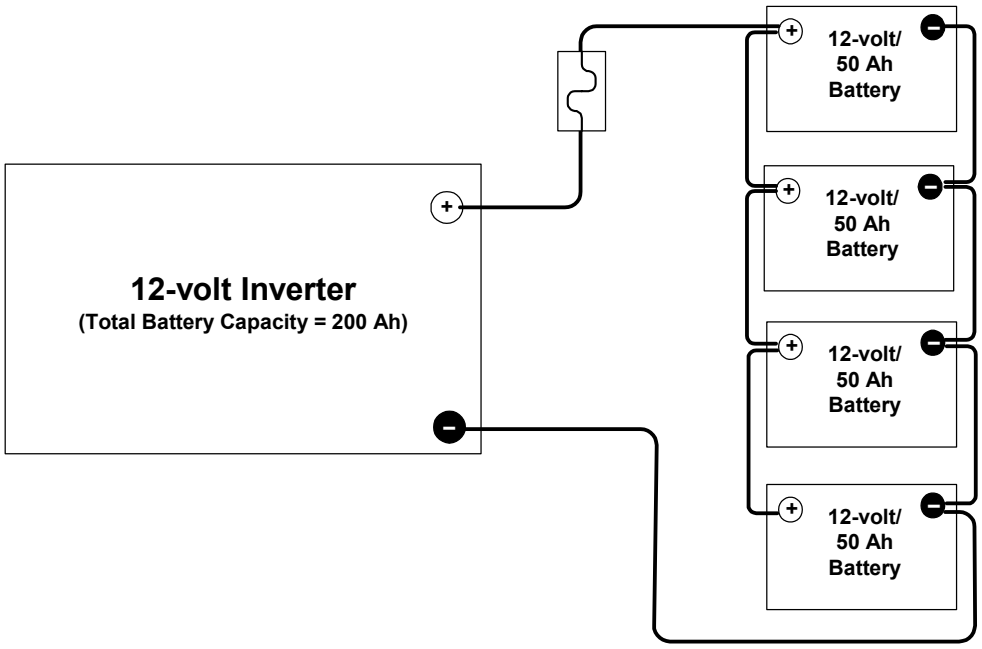

Figure B-4
12-volt/200 Ah Battery Wiring-Parallel Configuration

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Battery Configurations (continued)

Wiring Batteries in Series-Parallel

Wiring the batteries in a series-parallel configuration increases the ***current*** and ***voltage*** of the battery bank. Series-parallel wiring is more complicated and care should be taken when wiring these banks.

To construct a series-parallel battery-bank follow these instructions:

Step 1 - Wire Batteries in Series Strings

- First wire the batteries in series (voltage adds) with the positive terminal of one battery connected to the negative terminal of the next battery to meet the inverter's DC input requirements.

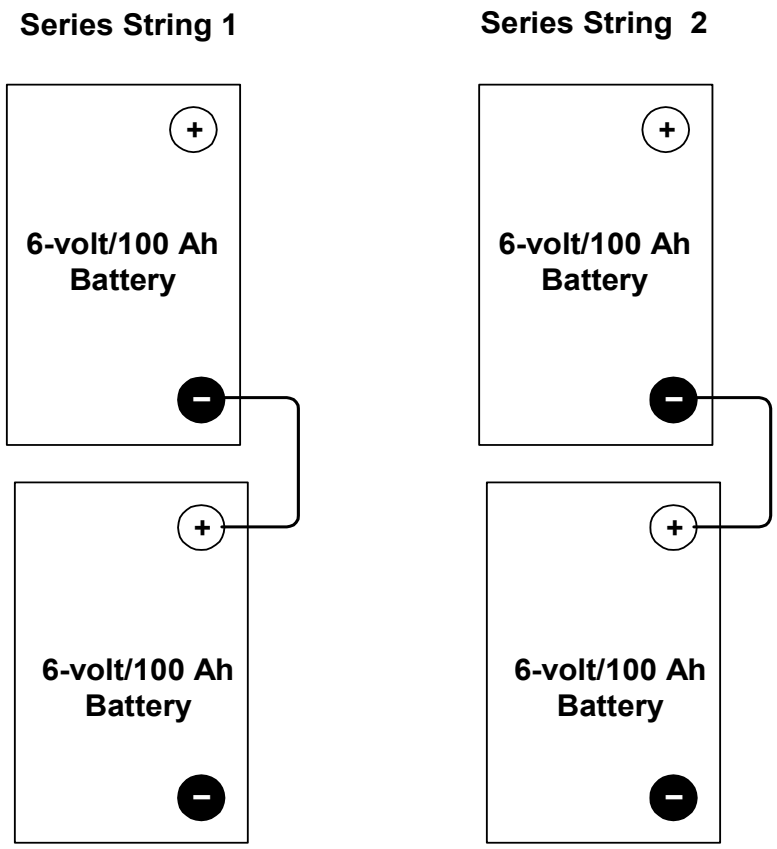

Figure B-5
Step 1 - Wiring Batteries in Series

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Battery Configurations (continued)

Wiring Batteries in Series-Parallel (continued)

Step 2 - Connecting Two Series Strings

- Connect the POSITIVE terminal of the first battery string to the POSITIVE terminal of the second battery string.
- Connect the NEGATIVE terminal of the first battery string to the NEGATIVE terminal of the second battery string.

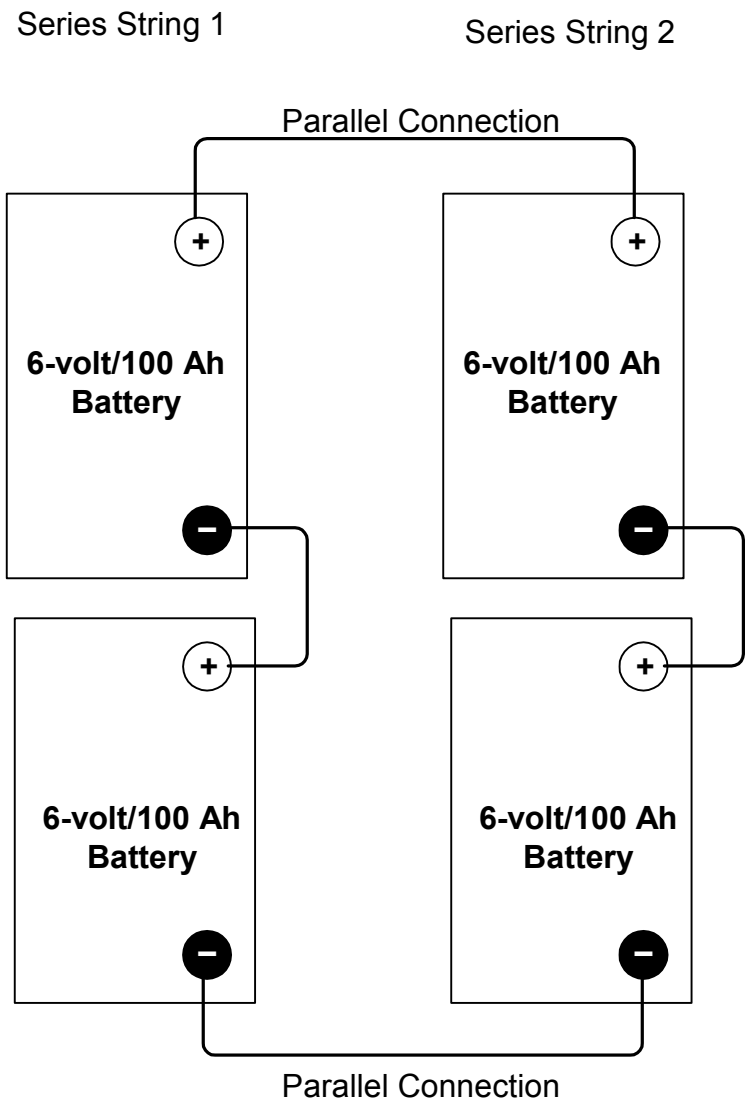

Figure B-6
Step 2 - Two Series Strings Wired in Parallel

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Battery Configurations (continued)

Wiring Batteries in Series-Parallel (continued)

NOTE: Connecting the positive and negative wires to the inverter from different strings ensures a balanced charge/discharge through the batteries, resulting in longer run times and improved battery life.

Step 3 - Connecting the Series-Parallel Configuration to the Inverter

- Connect a wire from the POSITIVE terminal of the first battery string to the inverter's POSITIVE DC terminal (via a fused device).
- Connect the NEGATIVE terminal of the second battery string to the inverter's NEGATIVE DC terminal.

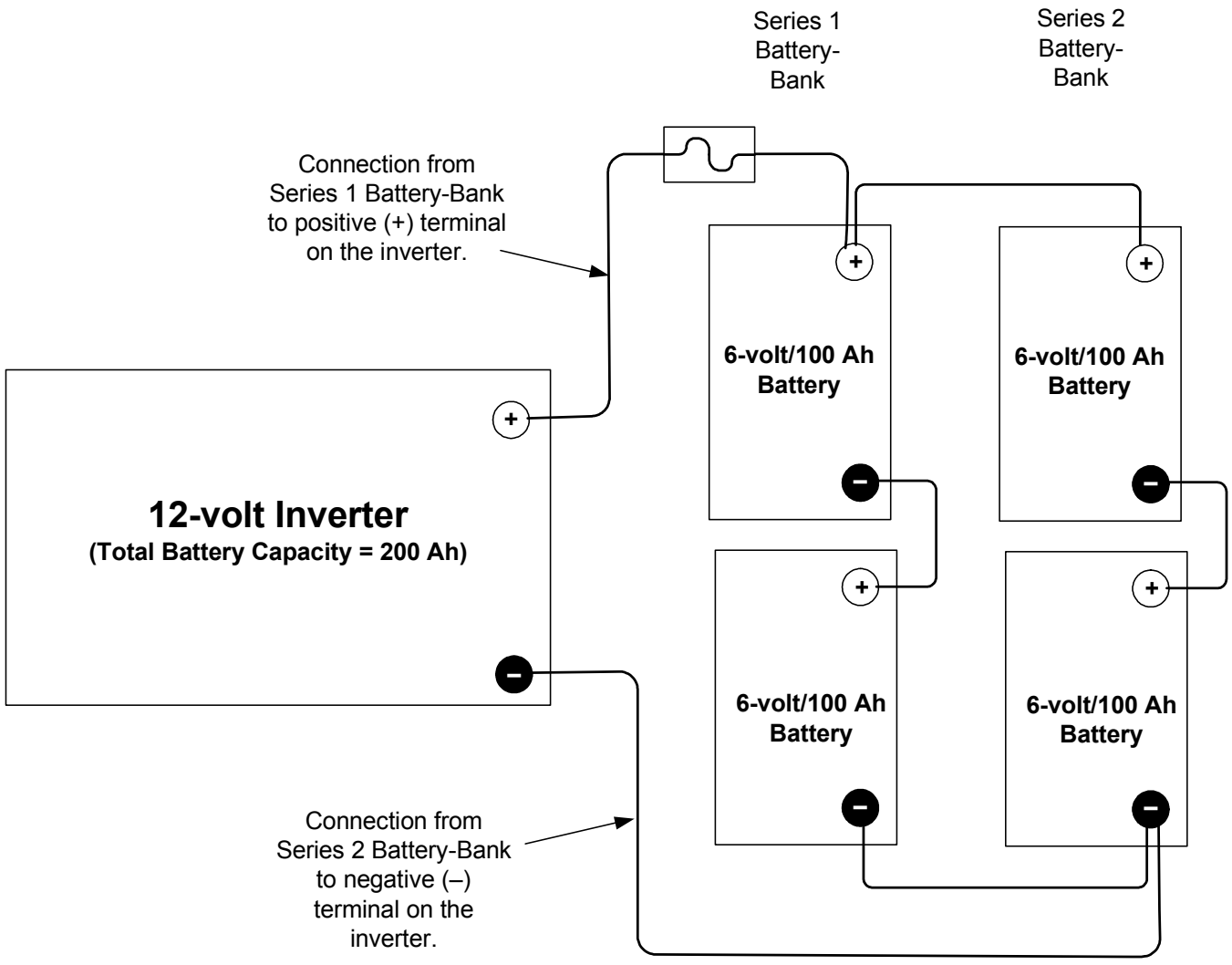

Figure B-7
Step 3 - Series-Parallel Configuration Wired to the Inverter

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Battery Care and Maintenance

NOTE: The UX inverter/charger does not have adequate voltage to equalize-charge batteries. If using batteries requiring occasional equalization, a separate charger will be required.

To get the best performance from an inverter system, the batteries must be properly setup and maintained. This includes setting the proper voltages for Bulk and Float charging. On a monthly basis, the batteries should be "Equalize-charged" (vented batteries only) and the water level checked and maintained (See the "CAUTIONS" in the section on equalization charging below). In addition, the battery terminals should be inspected, cleaned, and re-torqued, if necessary.

Neglecting any of these items may result in poor inverter performance and greatly reduce battery life.

Charge Rate

NOTE: The UX inverter/charger does not have flexible charge settings. Please refer to Appendix A - Specifications for actual charge rates.

The maximum, safe charge rate is related to the size and type of the batteries. Standard, vented, lead acid batteries (with removable caps) can be charged at a high rate, equal to their capacity. Small batteries may require a lower charge rate. Check with your battery manufacturer for the proper battery charging rate for the batteries used in the system.

Bulk Voltage

This is the maximum voltage the batteries will be charged to during a normal charge cycle. Gel cell batteries are set to a lower value and non-sealed batteries are set to a higher voltage setting.

Float Voltage

The float voltage is set lower than the bulk voltage and provides a maintenance charge on the batteries to keep them in a ready state.

Temperature Compensation

For optimal battery charging, the bulk and float charge rates should be adjusted according to the temperature of the battery. This can be accomplished automatically by using a Battery Temperature Sensor (BTS). The sensor attaches directly to the side of one of the batteries in the bank and provides precise battery temperature information.

See Section 1, page 2, for information on the Xantrex Battery Temperature Sensor (BTS).

Equalization Charging

CAUTION: Because a higher voltage is used to equalize-charge the batteries, any DC loads must be disconnected before an equalization-charge is started.

CAUTION: Equalization should be done for standard electrolyte vented batteries only. Sealed or gel cell batteries should not be equalize charged. Consult your battery supplier for details.

Every month or two the batteries should be equalize-charged. This helps to remove sulfate buildup on the battery plates and balances the charge of individual cells. Batteries that are not equalize-charged can be damaged by sulfate accumulation, thus sealing off a percentage of the plates and reducing battery capacity.

Equalize-charging also produces gassing which stirs up the electrolyte mixture and helps distribute the acid more evenly. Batteries that are not equalize-charged may have sulfuric acid accumulate at the bottom of the battery, potentially damaging the plates. At the same time, the electrolyte at the top of the battery gets watery. This is called stratification.

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Battery Care and Maintenance (continued)

Replenish Water Levels

Liquid lead acid batteries require periodic water refills in each battery cell. Only use distilled water in a battery, as tap or mineral water may contain contaminants which will upset the battery chemistry and may damage the battery.

When filling the battery, clean the surface first to prevent dirt from entering the cell. Fill the cell to just above the plates or to the bottom of the internal collar inside the battery. ***Never*** fill the cells to the top or acid will leak out during charging.

Check the water level in the batteries frequently when performing an equalize charge and add water if necessary. Always follow the safety steps covered in the front of the manual, page iv.

Clean Battery Cables and Posts

WARNING: BEFORE ATTEMPTING TO CLEAN THE BATTERY POSTS, TURN OFF THE DC CIRCUIT BREAKER. USE ONLY INSULATED TOOLS AND REMOVE ALL JEWELRY.

CAUTION: Never let a baking soda solution get into the battery as it will neutralize the acid resulting in permanent damage .

Battery posts must be clean to reduce the resistance between the battery post and cable connection. A buildup of dirt or oxidation may eventually lead to the cable terminal overheating during periods of high current draw.

Use a stiff wire brush and remove all dirt and corrosion from the battery terminals and cables. Use an alkaline solution of baking soda and water to clean the terminals and neutralize any battery acid on the terminals or cable lugs.

Torque Battery Connections

After the terminals are clean, reassemble the cable to the battery terminal and torque the connections to the battery manufacturer's recommendations.

Coat the battery terminals with an antioxidant compound.

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Check Battery's State-of-Charge

The battery's state-of-charge should be checked monthly and only when the battery is not powering heavy loads or being actively charged. If the batteries are readily accessible, measure the voltage across the individual battery terminals. There should be less than a 0.2 volt difference between each battery.

To determine the individual cell voltage, divide the voltage by the number of cells in the battery (i.e., 12.6 volts divided by 6 cells = 2.1 volts per cell). If a greater difference is measured, the batteries may need to be equalized (liquid lead acid types only) or replaced.

All batteries in the bank should measure the same voltage (this is not an accurate measurement for cross-tied batteries' as each battery is in parallel with another battery making individual battery measurements impossible).

The voltage should match the following table for the entire battery bank output. These values indicate the overall battery's state-of-charge for the entire bank. Individual cell voltages (if available) are also shown as a percentage of charge.

The values given are for a temperature of 77 °F (25 °C). Cooler temperatures produce lower voltage measurements.

Percent of Full Charge	System Voltage			Individual Cell Voltage
	12 V	24 V	48 V	
100%	12.7	25.4	50.8	2.12
90%	12.6	25.2	50.4	2.10
80%	12.5	25.0	50.0	2.08
70%	12.3	24.6	49.2	2.05
60%	12.2	24.4	48.8	2.03
50%	12.1	24.2	48.4	2.02
40%	12.0	24.0	48.0	2.00
30%	11.8	23.6	47.2	1.97
20%	11.7	23.4	46.8	1.95
10%	11.6	23.2	46.4	1.93
0%	≤ 11.6	≤ 23.2	≤ 46.4	≤ 1.93

Table B-4
Battery State-of-Charge

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Appendix C - Product Information and Warranty

Limited Warranty

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 UX Inverter/Charger. This warranty lasts for a warranty period of 2 years 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.

Xantrex covers both parts and labor necessary to repair the product, and return shipment to the customer via a Xantrex-selected non-expedited surface freight within the contiguous United States and Canada. Alaska and Hawaii are excluded. Contact Xantrex Customer Service for details on freight policy for return shipments outside of the contiguous United States and Canada.

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Limited Warranty (continued)

How do you get service?

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

Phone: 360.435.8826
Fax: 360.474.0616
Email: Tracewarranty@xantrex.com

Direct returns may be performed according to the Xantrex Return Material Authorization Policy described in your product manual. For some products, Xantrex maintains a network of regional Authorized Service Centers. Call Xantrex or check our website to see if your product can be repaired at one of these facilities.

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 dealer invoice or purchase receipt showing original equipment manufacturer (OEM) status, 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, generalized 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.

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DISCLAIMER

Product

THIS LIMITED WARRANTY IS THE SOLE AND EXCLUSIVE WARRANTY PROVIDED BY XANTREX IN CONNECTION WITH YOUR XANTREX PRODUCT AND IS, WHERE PERMITTED BY LAW, IN LIEU OF ALL OTHER WARRANTIES, CONDITIONS, GUARANTEES, REPRESENTATIONS, OBLIGATIONS AND LIABILITIES, EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE IN CONNECTION WITH THE PRODUCT, HOWEVER ARISING (WHETHER BY CONTRACT, TORT, NEGLIGENCE, PRINCIPLES OF MANUFACTURER'S LIABILITY, OPERATION OF LAW, CONDUCT, STATEMENT OR OTHERWISE), INCLUDING WITHOUT RESTRICTION ANY IMPLIED WARRANTY OR CONDITION OF QUALITY, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE TO THE EXTENT REQUIRED UNDER APPLICABLE LAW TO APPLY TO THE PRODUCT SHALL BE LIMITED IN DURATION TO THE PERIOD STIPULATED UNDER THIS LIMITED WARRANTY.

IN NO EVENT WILL XANTREX BE LIABLE FOR ANY SPECIAL, DIRECT, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, COSTS OR EXPENSES HOWEVER ARISING WHETHER IN CONTRACT OR TORT INCLUDING WITHOUT RESTRICTION ANY ECONOMIC LOSSES OF ANY KIND, ANY LOSS OR DAMAGE TO PROPERTY, ANY PERSONAL INJURY, ANY DAMAGE OR INJURY ARISING FROM OR AS A RESULT OF MISUSE OR ABUSE, OR THE INCORRECT INSTALLATION, INTEGRATION OR OPERATION OF THE PRODUCT.

Exclusions

If this product is a consumer product, federal law does not allow an exclusion of implied warranties. To the extent you are entitled to implied warranties under federal law, to the extent permitted by applicable law they are limited to the duration of this Limited Warranty. Some states and provinces do not allow limitations or exclusions on implied warranties or on the duration of an implied warranty or on the limitation or exclusion of incidental or consequential damages, so the above limitation(s) or exclusion(s) may not apply to you. This Limited Warranty gives you specific legal rights. You may have other rights which may vary from state to state or province to province.

Information

WITHOUT LIMITING THE GENERALITY OF THE FOREGOING, UNLESS SPECIFICALLY AGREED TO BY IT IN WRITING, XANTREX

(a) MAKES NO WARRANTY AS TO THE ACCURACY, SUFFICIENCY OR SUITABILITY OF ANY TECHNICAL OR OTHER INFORMATION PROVIDED IN MANUALS OR OTHER DOCUMENTATION PROVIDED BY IT IN CONNECTION WITH THE PRODUCT; AND

(b) ASSUMES NO RESPONSIBILITY OR LIABILITY FOR LOSSES, DAMAGES, COSTS OR EXPENSES, WHETHER SPECIAL, DIRECT, INDIRECT, CONSEQUENTIAL OR INCIDENTAL, WHICH MIGHT ARISE OUT OF THE USE OF SUCH INFORMATION.

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

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WARNING: LIMITATIONS ON USE

NOTE: DO NOT RETURN PRODUCTS TO THIS ADDRESS. Please call your Xantrex Customer Service Representative for return mailing instructions.

Please refer to your product user manual for limitations on uses of the product. Specifically, please note that the UX Series Inverter/Charger 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.

Xantrex Technology, Inc.
8999 Nelson Way
Burnaby, British Columbia
Canada
V5A 4B5

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Return Material Authorization Policy

Before returning a product directly to Xantrex you must obtain a Return Material Authorization (RMA) number and the correct factory "Ship To" address. Products must also be shipped prepaid. Product shipments will be refused and returned at your expense if they are unauthorized, returned without an RMA number clearly marked on the outside of the shipping box, if they are shipped collect, or if they are shipped to the wrong location.

When you contact Xantrex to obtain service, please have your instruction manual ready for reference and be prepared to supply:

- The serial number of your product
- Information about the installation and use of the unit
- Information about the failure and/or reason for the return
- A copy of your dated proof of purchase

Shipping Instructions

1. Package the unit safely, preferably using the original box and packing materials. Please ensure that your product is shipped fully insured in the original packaging or equivalent. This warranty will not apply where the product is damaged due to improper packaging.
2. Include the following:
   - The RMA number supplied by Xantrex Technology Inc clearly marked on the outside of the box.
   - A return address where the unit can be shipped. Post office boxes are not acceptable.
   - A contact telephone number where you can be reached during work hours
   - A brief description of the problem

Ship the unit prepaid to the address provided by your Xantrex customer service representative.

If you are returning a product from outside of the USA or Canada

In addition to the above, you MUST include return freight funds and are fully responsible for all documents, duties, tariffs, and deposits.

If you are returning a product to a Xantrex Authorized Service Center (ASC)

A Xantrex return material authorization (RMA) number is not required. However, you must contact the ASC prior to returning the product or presenting the unit to verify any return procedures that may apply to that particular facility.

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Service Information

Model Number: _____

Serial Number: _____

Purchase Date: _____

Problem: _____

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Include a telephone number where you can be reached during business hours and a complete return shipping address (P.O. Box numbers are not acceptable).

Name: _____

Address: _____

City: _____

State / Province: _____

Zip / Postal Code:_____

Country: _____

Phone: _____

FAX: _____

E-mail Address: _____

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