

Smart choice for power

xantrex



PS2.5
PS3.0

Installation and Operation Guide

Xantrex
Prosine™ 2.5 and 3.0
Inverter/Chargers

www.xantrex.com

Prosine™ PS2.5 Inverter/Charger PS3.0 Inverter/Charger

Installation and Operation Guide

About Xantrex

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

Trademarks

Xantrex is a registered trademark of Xantrex International. © 2002 Xantrex International. All rights reserved. Prosine is a registered trademark of Xantrex International.

Other trademarks, registered trademarks, and product names are the property of their respective owners and are used herein for identification purposes only.

Notice of Copyright

Installation and Operation Guide © November 2002 Xantrex International.

Disclaimer

Xantrex manufactures its products from parts and components that are new or equivalent to new, in accordance with industry-standard practices.

UNLESS SPECIFICALLY AGREED TO IN WRITING, XANTREX TECHNOLOGY INC. ("XANTREX"):

- (a) MAKES NO WARRANTY AS TO THE ACCURACY, SUFFICIENCY OR SUITABILITY OF ANY TECHNICAL OR OTHER INFORMATION PROVIDED IN ITS MANUALS OR OTHER DOCUMENTATION.
- (b) ASSUMES NO RESPONSIBILITY OR LIABILITY FOR LOSS OR DAMAGE, WHETHER 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.

Date and Revision

November 2002, Revision 3

Part number

445-0096-01-01 Rev 3

Contact information

Telephone: 1-800-670-0707 (toll free in North America)

1-604-422-2777 (outside North America)

Fax: 1-604-420-2145 (outside North America)

Email: CustomerService@xantrex.com

Web: www.xantrex.com

IMPORTANT SAFETY INSTRUCTIONS

This manual contains important safety and operating instructions as prescribed by UL and CSA specifications for inverter/chargers. This manual covers PS 2.5 and PS 3.0, 12- and 24-volt model inverter/chargers.



General Safety Precautions

1. **READ AND SAVE THESE INSTRUCTIONS.** They contain important safety and operating information for the Prosine inverter/charger.
2. Before using the inverter/charger, read all instructions and cautionary markings on (1) the inverter/charger, (2) the batteries, and (3) all appropriate sections of this instruction manual.
3. Do not expose the Prosine inverter/charger to rain, snow, spray or bilge water. To reduce risk of fire hazard, do not cover or obstruct the ventilation openings. Do not install the Prosine inverter/charger in a zero-clearance compartment. Overheating may result.
4. Do not use attachments not recommended or sold by the manufacturer. Doing so may result in a risk of fire, electric shock, or injury to persons.
5. The Prosine inverter/charger is designed to be permanently connected to your AC and DC electrical systems. Xantrex recommends that all wiring be done by a certified technician or electrician to ensure adherence to proper electrical wiring regulations.
6. To avoid a risk of fire and electric shock, make sure that existing wiring is in good electrical condition; and that wire size is not undersized. Do not operate the Prosine inverter/charger with damaged or substandard wiring.
7. Do not operate the Prosine inverter/charger if it has received a sharp blow, been dropped, or otherwise damaged in any way. If the Prosine inverter/charger is damaged, see the Warranty section of this manual.
8. Do not disassemble the Prosine inverter/charger. See the Service section of the Owner's Manual for instructions on obtaining service for the Prosine inverter/charger. Attempting to service the unit yourself may result in a risk of electrical shock or fire. Internal capacitors remain charged long after all power is disconnected.
9. To reduce risk of electrical shock, disconnect both AC and DC power from the Prosine inverter/charger before attempting any maintenance or cleaning or working on any circuits connected to the Prosine inverter/charger. Turning off controls will not reduce this risk.
10. Grounding: the Prosine inverter/charger must be provided with an equipment-grounding conductor connected to the AC input ground terminal. Grounding and all other wiring must comply with local codes and ordinances
11. For marine applications in the United States, external connections to the Prosine inverter/charger shall comply with the United States Coast Guard Electrical Regulations (33CFR183, Sub part 1).



12. WARNING—RISK OF EXPLOSIVE GASES

- a) WORKING IN THE VICINITY OF A LEAD-ACID BATTERY IS DANGEROUS. BATTERIES GENERATE EXPLOSIVE GASES DURING NORMAL BATTERY OPERATION. BEFORE INSTALLING OR USING YOUR INVERTER/CHARGER, READ THIS MANUAL AND FOLLOW THE INSTRUCTIONS EXACTLY.
- b) This equipment contains components which tend to produce arcs or sparks. To prevent fire or explosion do not install in compartments containing batteries or flammable materials or in locations which require ignition protected equipment. This includes any space containing gasoline-powered machinery, fuel tanks, or joints, fittings, or other connection between components of the fuel system.
- c) To reduce the risk of battery explosion, follow these instructions and those published by the battery manufacturer and the manufacturer of the equipment in which the battery is installed.



13. PRECAUTIONS WHEN WORKING WITH BATTERIES

- a) Someone should be within range of your voice or close enough to come to your aid when you work near a lead-acid battery.
- b) Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.
- c) Wear complete eye protection and clothing protection. Avoid touching eyes while working near battery.
- d) If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters eye, immediately flood eye with running cold water for at least 20 minutes and get medical attention immediately.
- e) Baking soda neutralizes lead-acid battery electrolyte. Keep a supply on hand in the area of the batteries.
- f) NEVER smoke or allow a spark or flame in vicinity of a battery or engine.
- g) Be extra cautious to reduce risk of dropping a metal tool on the battery. It might spark or short-circuit the battery or other electrical part that may cause an explosion.
- h) Remove personal metal items such as rings, bracelets, necklaces, and watches when working with a lead-acid battery. A lead-acid battery produces a short-circuit current high enough to weld a ring or the like to metal, causing a severe burn.
- i) Use the Prosine inverter/charger for charging a LEAD-ACID battery only. Do not use the Prosine inverter/charger to charge nickel-cadmium or dry-cell batteries commonly used with home appliances and electronic equipment. These batteries may burst and cause injury to persons and damage to property.
- j) NEVER attempt to charge a frozen battery. Charging a battery when its temperature is below 32° F (0° C) is inefficient and ineffective. If possible, gradually warm the battery above 32° F (0° C) before charging.

FCC INFORMATION TO THE USER

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Materials List

Your Prosine Inverter/Charger package includes the following items. (See the illustration on [page vi.](#))

1. Prosine inverter/charger
2. Control panel with fasteners
3. Control panel communications cable
4. Red & black DC terminal covers
5. Installation and Operation Guide
6. Quick Installation Guide
7. Mounting brackets with fasteners (PS3.0 only).
8. Drip cover/vent shield
9. Battery temperature sensor

If any of these materials are missing from your package, or if it is unsatisfactory in any manner, please call Customer Service:

Phone: 1-800-670-0707 (toll free) 1-604-422-2777 (direct)

Fax: 1-604-420-2145

Web site: <http://www.xantrex.com>

Email: CustomerService@xantrex.com

Please record the following information:

Model Number: _____

Serial Number: _____

Purchased From: _____

Purchase Date: _____

Comments:

Thank you for choosing Xantrex to meet your independent power needs.

System / Installation Information

Before you call Customer Service, please record the following information about your system. It will help our staff to give you better service.

<input type="checkbox"/>	Serial Number (This is on the side of the Prosine).
<input type="checkbox"/>	Type of installation (e.g., RV, Boat, Home).
<input type="checkbox"/>	Date of installation.
<input type="checkbox"/>	Battery bank size.
<input type="checkbox"/>	Battery type (e.g., flooded, sealed gel cell, AGM).
<input type="checkbox"/>	AC service setting.
<input type="checkbox"/>	AC wiring size and length.
<input type="checkbox"/>	DC wiring size and length.
<input type="checkbox"/>	Options installed on inverter/charger.
<input type="checkbox"/>	Charger or Invert mode when failure occurred.
<input type="checkbox"/>	Warning, Error, or Panel Fault message if any.
<input type="checkbox"/>	Appliance(s) operating when failure occurred.

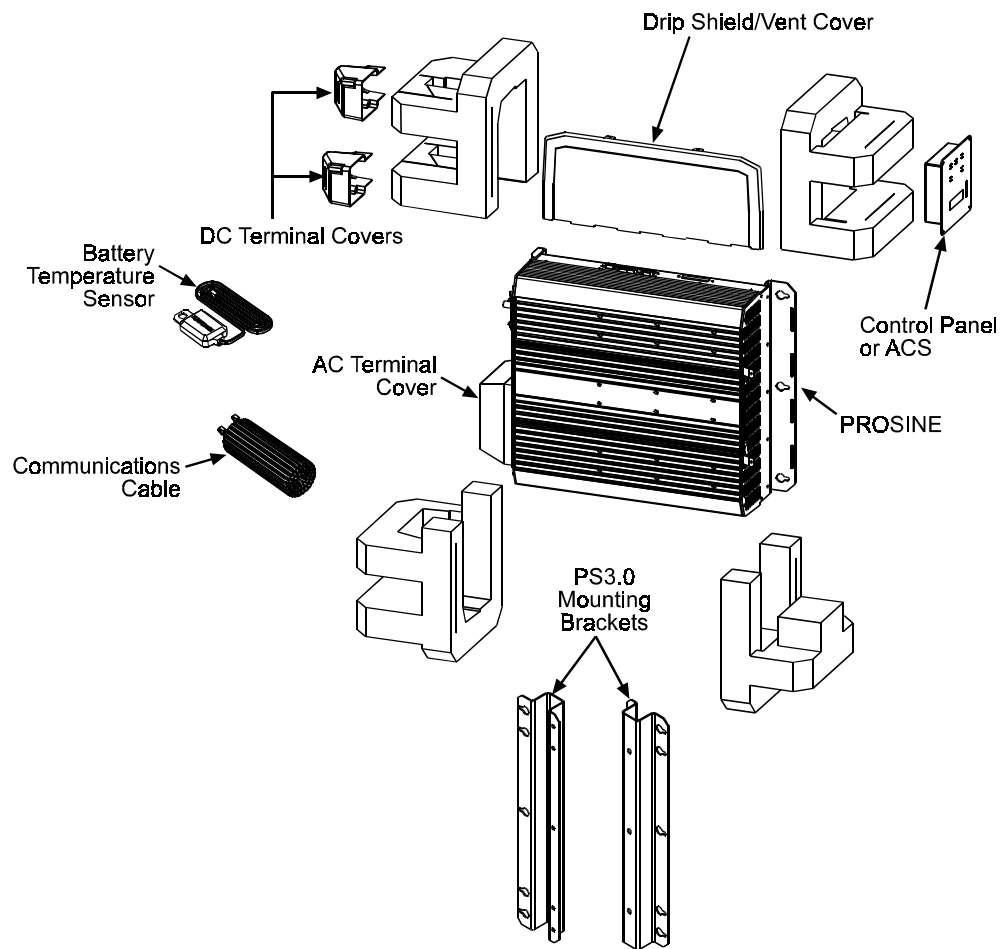


Figure 1. Inverter/Charger Components

Warranty

What does this warranty cover? This Limited Warranty is provided by Xantrex Technology, Inc. ("Xantrex") and covers defects in workmanship and materials in your Xantrex Prosine 2.5/3.0 Inverter/Charger. This warranty lasts for a Warranty Period of 24 months from the date of purchase at point of sale to you, the original end user customer.

This Limited Warranty is transferable to subsequent owners but only for the unexpired portion of the Warranty Period.

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.

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: 1-800-670-0707 (toll free) 1-604-422-2777 (direct)

Fax: 1-604-420-2145

Email: CustomerService@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.

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.

Warning: Limitations On Use

Please refer to your product user manual for limitations on uses of the product. Specifically, please note that the Xantrex Prosine 2.5/3.0 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.

Please note that the Xantrex Prosine 2.5/3.0 Inverter/Charger is not intended for use as an uninterruptible power supply and Xantrex makes no warranty or representation in connection with any use of the product for such purposes.

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

Return Procedure

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
3. 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.

Contents

Important Safety Instructions	i
Materials List	iv
Warranty	vii
<i>Disclaimer</i>	viii
Product	viii
<i>Exclusions</i>	viii
<i>Warning: Limitations On Use</i>	ix
<i>Return Material Authorization Policy</i>	ix
<i>Return Procedure</i>	ix
Contents	xi
Section 1: Features	1
<i>Battery Charger Features</i>	1
<i>Inverter Features</i>	2
Section 2: Controls and Indicators	5
<i>DIP Switch Panel</i>	5
<i>Accessory Jacks</i>	5
<i>AC Bypass Selector</i>	6
<i>DC Terminals & Covers</i>	6
<i>AC Terminals & Covers</i>	6
<i>Standard LED Control Panel</i>	7
Battery Status Indicator	8
Faults Indicators & Reset Button	8
Inverter Status Indicators and On/Off Button	9
Power Indicator	10
Charger Status Indicator and On/Off Button	10
<i>Mounting and Installing the LED Control Panel</i>	11
<i>ACS Control Panel</i>	12
Liquid Crystal Display	13
Control Buttons	13
Menu Navigation Procedure	14
ACS Menu Tree	14
AC Information Menu	15
Battery Information Menu	16
Inverter Information Menu	16
Charger Information Menu	17

System Information Menu	18
Version Information Menu	19
<i>Faults Display & Reset Button</i>	20
<i>Inverter Status Indicators and On/Off Button</i>	20
<i>Power Indicator</i>	21
<i>Charger Status Indicator and On/Off Button</i>	21
<i>Mounting and Installing the ACS Control Panel</i>	22
<i>Battery Temperature Sensor</i>	23
Section 3: Configuration	25
<i>DIP Switch Settings</i>	25
<i>ACS Configuration</i>	28
User Configuration Items	28
Installer Configuration Items	28
<i>ACS Configuration Considerations</i>	29
AC (Shorepower) Configuration	30
Battery Configuration	31
Inverter Configuration	33
Charger Configuration	34
System Configuration	36
Section 4: Inverter/Charger Installation	37
<i>Safety Instructions</i>	37
<i>Installation Overview</i>	37
<i>Designing the Installation</i>	40
<i>Tools and Materials Required</i>	42
<i>Where to Install the Prosine Inverter/Charger</i>	42
<i>Mounting the Prosine Inverter/Charger</i>	44
<i>AC Cabling</i>	45
Recommended Wire Size vs Breaker Rating	45
AC and DC Wiring Separation	45
AC Output Neutral-to-Ground Bonding	45
<i>AC Disconnect and Overload Protection</i>	45
<i>DC Cabling</i>	46
DC Over-Current Protection	46
<i>Recommended DC Cable Sizes For Proper Operation</i>	47
DC Disconnect	47
Battery Cable Routing	47
DC Cabling Connections	47
DC Cabling Procedure	48
DC Grounding	49
<i>Connecting the Battery Temperature Sensor</i>	49
Mounting Options	49

Mounting to the Negative Battery Terminal	50
Mounting to the Side of the Battery Case	51
<i>Typical System Diagrams</i>	52
Residential Backup System	52
Recreational Vehicle System	53
Residential Solar and Wind System	54
Section 5: Operation	55
<i>Prosine Inverter Load Sense Mode</i>	56
<i>Operating Limits for Inverter Operation</i>	56
Section 6: Multistage Charging	59
<i>Charging Profile</i>	59
Bulk Charge	59
Absorption Charge	59
Float Charge	60
Equalization Charge	60
<i>Operation in Charger Mode</i>	61
<i>Operation in Equalization Mode</i>	61
Equalization Procedure	61
Adjustable Charger Mode Settings	62
Battery Charging Times	63
<i>Operating Limits for Charger Operation</i>	63
Battery Charging and Equalization Guide	64
Section 7: Batteries	67
<i>Terminology</i>	67
<i>Types</i>	67
Starting Batteries	68
Deep-Cycle Batteries	68
Sealed Gel Cell	69
Environment	69
Location	69
Enclosures	69
Temperature	69
<i>Battery Bank Sizing</i>	70
<i>Estimating Battery Requirements</i>	70
Battery Bank Sizing Example & Worksheet	71
<i>Monthly Battery Maintenance</i>	73
Cleaning Batteries	73
Preparation	73
Attire	73
Tools	73

Equipment	74
Supplies	74
Procedure	74
Cables	75
<i>Cabling & Hook-up Configurations</i>	75
Parallel Connection	75
Series Connection	76
Series – Parallel Connection	77
Appendix A: Specifications	79
Charger Output Voltages	80
Prosine 2.5/3.0 Chassis Dimensions	81
Prosine 2.5/3.0 Chassis Dimensions with Brackets	82
Appendix B: Inverter Applications	85
<i>Resistive Loads</i>	85
<i>Inductive Loads</i>	85
<i>Problem Loads in Load Sense</i>	85
Appendix C: Troubleshooting	87
<i>What to do if a problem occurs.</i>	87
<i>Error Code Displays and What They Mean</i>	88
Control Panel	88
Advanced Control System (ACS)	88
<i>Error Code Table</i>	89

Section 1: Features

Congratulations on your purchase of the Prosine inverter/charger. The Prosine inverter/charger uses advanced high-frequency switching technology in the power conversion process. The circuits are similar to those used in power supplies for computers and other modern electronic equipment. This technology offers several benefits:

- Light weight: for easy installation
- Quiet operation: no transformer buzz
- Clean DC output: filtered output for ideal battery charging
- High surge capability: for hard-to-start AC loads

All Prosine inverter/chargers are approved for general use including residential, recreational vehicle, marine, and photovoltaic applications based upon Canadian Standards Association (CSA), Underwriter Laboratories (UL), and other regulatory agency standards. Prosine inverter/chargers meet the stringent requirements of CSA 107.1 *“General Use Power Supplies,”* UL 458 *“Power Converters/Inverters and Power Converter/Inverter Systems for Land Vehicles and Marine Crafts,”* UL1741 *“Power Conditioning Units for Use in Residential Photovoltaic Systems,”* and other standards.

Battery Charger Features

Dead Battery Charging Starts recharging batteries even if the battery voltage is near zero.

Power Factor Correction High power factor charging results in faster battery charging because lower AC current is required from your generator or shorepower. When the AC source has limited capacity, the charger leaves more current available for other AC loads on the circuit. On a 15-ampere shorepower circuit, a Prosine charger delivers as much as 100 amps of DC current to the battery, while non power-factor-corrected chargers typically can deliver only about 70 amps.

Automatic Three-Stage Charging Whenever AC power is supplied to the Prosine inverter/charger, the “smart” charging capability of the Prosine provides a three-stage charge to quickly bring back deep-cycle batteries to their full charge. Using microprocessor control, the Prosine precisely regulates the voltage and current delivered to the battery, accurately charging the battery without risk of overcharging and battery damage. Depleted batteries are taken through the recommended “Bulk”, “Absorption”, and “Float” stages. The charging algorithm used in the Prosine inverter/charger is based on the same charge cycle algorithm used in Xantrex’s proven Truecharge battery charger line.

Manual Equalization Charging The Prosine inverter/charger enables you to initiate an equalization charge to optimize your battery capacity and rejuvenate your batteries. Equalization (for flooded batteries only) helps reduce sulfation and extends battery life.

Battery Temperature Sensor Since battery temperature is a key factor in correct charging, the charging formula must be adjusted (automatically and in real time) according to the actual battery temperature to ensure that batteries are fully, but not over charged. For this reason, Xantrex has included a battery temperature sensor with your Prosine inverter/charger and has temperature-compensated the charge algorithm.

Battery Temperature Shut Down When using the battery-temperature sensor, the charger will shut down if it detects excessively high or low battery temperatures. If battery temperature exceeds 50°C (122°F), or falls below -15°C (5°F), the charger will shut down.

Adjustable Maximum AC Input Current This feature protects against nuisance tripping of AC circuit breakers on the utility or generator AC supply. You can set the maximum AC input current to 8, 12, 16, or 24 amps to prevent 10, 15, 20, and 30-amp (respectively) circuit breakers from unnecessarily tripping as AC load demands approach their current rating. You can set the maximum AC input current in one (1) amp increments using the ACS control panel. The Prosine automatically reduces its charging current to attempt to keep the sum of all loads from exceeding this setting. The Prosine has no control over the loads you apply, so if nuisance-tripping still occurs, try removing one or more of your AC loads.

Inverter Features

Automatic Transfer Switch When utility AC power fails or is disconnected from the unit, or falls below 90 volts, the Prosine will automatically begin inverting and provide AC power from your batteries within 20 milliseconds; fast enough to keep a computer running. When utility AC is restored, the inverter will sample the AC power for about 8 seconds, synchronize to the AC waveform, and automatically switch your loads to utility power. It also returns to charging the batteries.

Automatic Waveform Regulation The Prosine inverter/charger monitors and regulates the AC waveform when inverting, delivering a true sinewave with typically only 1% total harmonic distortion (THD). This is usually cleaner than generator and utility waveforms.

High Surge Capacity The Prosine inverter will deliver up to 4000 watts of power for up to five seconds to start large motors and other inductive loads that require high power levels to start. The Prosine 2.5 will deliver 2500 watts (21-amps RMS) continuously, while the Prosine 3.0 delivers up to 3000 watts (25-amps RMS) continuously.

Load Sense Prosine inverters reduce power consumption during idle periods to conserve battery capacity by “searching” for loads that exceed a specified threshold. When a load is detected, the inverter ‘turns-on’ and delivers full voltage. When no load is detected, the inverter ‘stands-by,’ consuming less than three watts of power. The threshold can be set at 10, 25, or 50 watts (10 to 1401 watts using the ACS Control Panel), or disabled by setting it to zero (0).

Integral Protective Circuitry All Prosine inverter/chargers feature built-in protective circuitry that guards against damage to the inverter and your AC equipment due to high battery voltage, low battery voltage, AC overload, and high temperature conditions. This protective circuitry includes:

Automatic Low Battery Shut Down The Prosine inverter protects your batteries from damage by over-discharge by shutting down when battery voltage drops to 10.00 volts for 12-volt units, and 20 volts for 24-volt units. The unit will resume inverting when battery voltage exceeds 12.3 volts for 12-volt models, and 24.6-volts for 24-volt models.

Automatic High Battery Shut Down The Prosine inverter/charger protects itself from damage from excessive battery voltages by shutting down when battery voltage reaches 16-volts for 12-volt units, and 32-volts for 24-volt units. When battery voltage falls to 15.5-volts for 12-volt units, and 31-volts for 24-volt units, the unit will automatically restart.

Over-Current Protection When the AC loads connected to the Prosine inverter/charger exceed 50 amps, the inverter will instantaneously reduce the output voltage until the loads on the inverter are reduced. If the overload continues, the inverter will shut down. The unit will automatically restart after a calculated recovery time.

High-Temperature Shut Down When the inverter detects a high-temperature condition internally, the inverter will shut down. When the internal temperature cools by at least 6°C (11°F) the unit will automatically restart.

Audible Fault Alarm The Prosine inverter/charger features a user-enable audible alarm to alert you in the event of a fault condition. The audible alarm is accompanied by blinking LEDs (on the control panel) or by a fault code display (on the ACS control panel). There are four fault conditions at which the audible alarm will sound:

- Battery high-voltage
- Battery low-voltage
- System over-temperature
- Communication error or temporary fault

Visual Fault Code Display If an error occurs, the Prosine inverter/charger control panel will display an error code that you can use to determine the cause of the error. Three LEDs will flash on the standard control panel to describe the error. On the ACS control panel, the error code will be displayed on the LCD display. A table of fault codes and likely causes, along with corrective measures to take, is provided in [“Appendix C: Troubleshooting”](#).

Section 2: Controls and Indicators

Prosine 2.5 inverterchargers feature DC input and output connectors, an AC terminal block, a DIP switch panel for custom configuration, three accessory jacks, an LED control panel for the PS2.5 and an ACS panel for PS3.0, an LCD control panel, a cover for the AC connector block. DC terminal covers come standard with both units. A replacement AC cover with a GFCI outlet is available as an accessory option for both the PS2.5 and PS3.0.

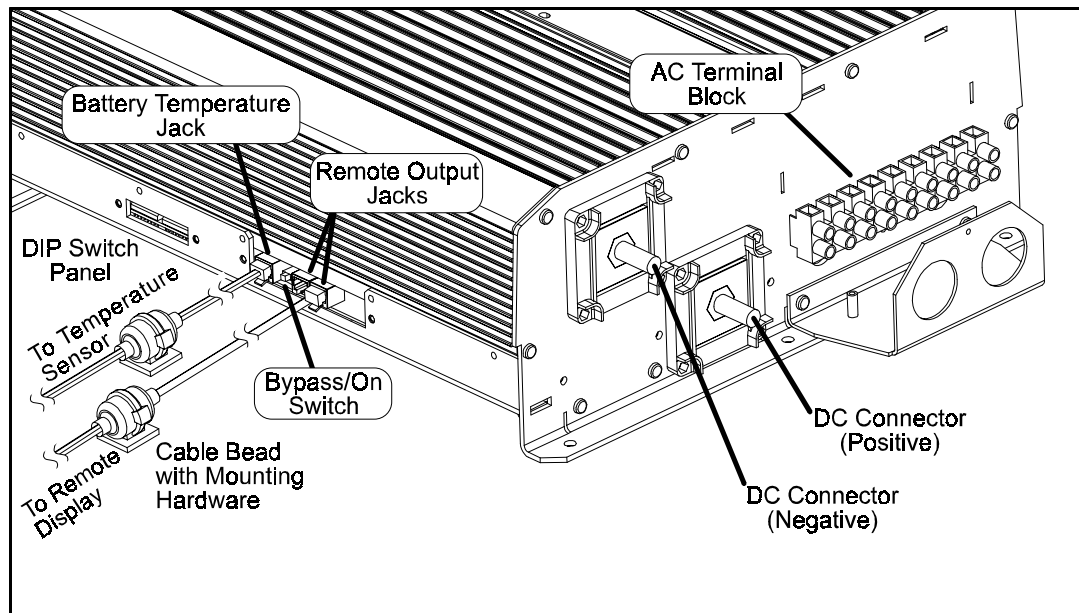


Figure 2. Prosine Chassis Side and Bottom Views

DIP Switch Panel

The DIP switch panel consists of two small, eight-position up-down switches located under a cover on the side of the Prosine inverter/charger: SW1 and SW2.

These switches are used to configure the Battery Type, Battery Temperature, Load Sensing, Audible Signal, AC Service Rating, and Battery Size user-selectable options. See [“Section 3: Configuration”](#) on [page 25](#) for configuration instructions.



Accessory Jacks



Three accessory jacks are provided on the side of Prosine inverter/charger: a battery temperature sensor jack (labeled BATT TEMP) and two Remote Output jacks. The battery temperature sensor reports battery temperature to the charger to

optimize the charging profile. The remote output jacks enable you to remotely mount the standard and/or the ACS control panels, described later in this section of this manual.

AC Bypass Selector

The small slide switch located between the Batt Temp jack and the Remote Output jacks is the AC Bypass selector switch. The default position of this switch is On. In the On position, the inverter/charger operates as programmed. When the switch is in the Bypass position, the inverter/charger is Off, and AC current bypasses the inverter/charger to supply the AC loads directly.

DC Terminals & Covers



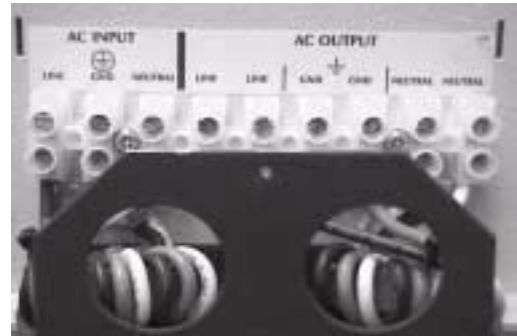
The DC cabling connectors are located on the bottom of the Prosine inverter/charger. Each connector is an M10 x 1.5 stainless steel stud and nut. The studs are about 1-inch long and approximately 3/8-inch in diameter. Use a 17mm (~11/16-inch) wrench. Two color-coded covers, a red one for the positive terminal and a black one for the negative terminal, are provided for preventing accidental contact with these connectors after installation.



Adjacent to the DC terminals is the chassis ground lug. The chassis ground lug provides a ground path for DC fault current from the inverter/charger chassis to ensure your battery fuse opens in the event of a fault.

AC Terminals & Covers

On the bottom of the Prosine inverter/charger, alongside the DC connectors, a nine-position terminal block is provided for attaching AC cabling to the unit. The terminal block is divided into AC-Input and AC-Output sections. One terminal each is provided for the AC Line-In (Hot) cable, the AC Neutral-In cable, and the AC Ground-In (GND) cable. Two terminals each are provided for the AC Line-Out cable, the AC Neutral-Out cable, and the AC Ground-Out cable. All are clearly labeled. The AC Line cable usually has a black insulator, the AC Neutral generally has a white insulator, and the AC Ground cable generally has either a green insulator, or no insulator at all.



Adjacent to the AC terminal block is a black bracket with two 1-inch diameter holes in it. This bracket is provided for attaching cable clamps (strain reliefs) or conduit. A cover is provided that slides into the end plate of the inverter and attaches to the strain-relief bracket. This cover is also available with an optional AC duplex GFCI outlet and 15-amp circuit protector.

Standard LED Control Panel

The Prosine inverter/charger is supplied with a control panel that can be mounted into an instrument panel, bulkhead or wall. The standard control panel is used to report information about Prosine operating parameters and the external AC and DC power sources connected to it. The standard control panel has five separate functional divisions: the Battery Status LED display, the Faults Display and Reset Button, the Inverter Status Indicator and On/Off Control Button, the Shorepower Indicator, and the Charger Status Display and On/Off Control. These functional divisions are shown in the following illustration.

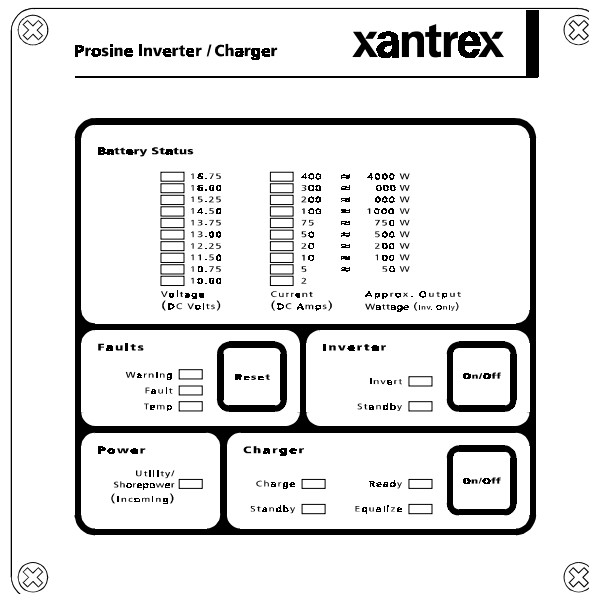


Figure 3. Standard LED Control Panel Display

Battery Status Indicator

The Battery Status LED Display includes two vertical series of LEDs that indicate the battery voltage and current. A conversion table enables you to estimate the AC output from the inverter by the DC current.

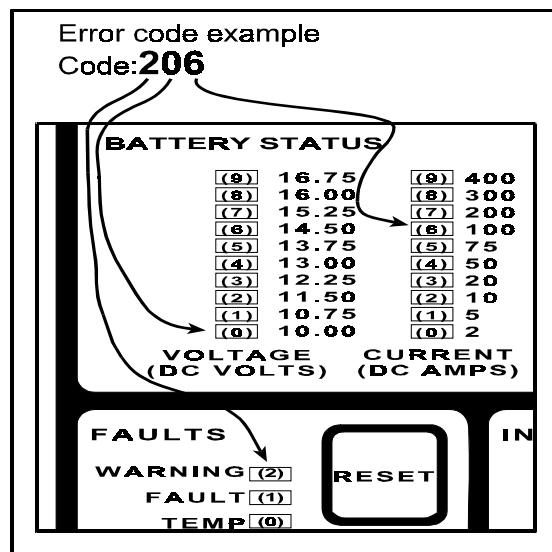
Battery Status

<input type="checkbox"/>	16.75	<input type="checkbox"/>	400	≈	4000 W
<input type="checkbox"/>	16.00	<input type="checkbox"/>	300	≈	000 W
<input type="checkbox"/>	15.25	<input type="checkbox"/>	200	≈	000 W
<input type="checkbox"/>	14.50	<input type="checkbox"/>	100	≈	1000 W
<input type="checkbox"/>	13.75	<input type="checkbox"/>	75	≈	750 W
<input type="checkbox"/>	13.00	<input type="checkbox"/>	50	≈	500 W
<input type="checkbox"/>	12.25	<input type="checkbox"/>	20	≈	200 W
<input type="checkbox"/>	11.50	<input type="checkbox"/>	10	≈	100 W
<input type="checkbox"/>	10.75	<input type="checkbox"/>	5	≈	50 W
<input type="checkbox"/>	10.00	<input type="checkbox"/>	2		
Voltage (DC Volts)		Current (DC Amps)		Approx. Output Wattage (Inv. only)	

Battery Voltage Indicator This indicator reports the battery voltage at the input terminals of the Prosine inverter/charger. At low currents, the indicator is very accurate. At high currents, the indicated voltage will be somewhat lower than the actual battery voltage due to voltage drop across the cables between battery and inverter. The range of the battery voltage indicator is from 10.0 to 16.75 volts DC. The LEDs do not light until the voltage level exceeds the value printed alongside the LED.

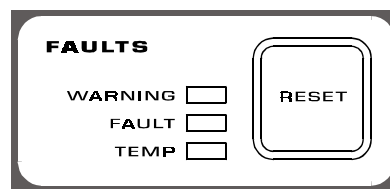
Battery Current Indicator This indicator reports the current drawn by the Prosine inverter/charger from the batteries. It does not indicate current drawn by other loads connected to the batteries. High current loads (over 200A) are displayed by yellow LEDs. The LEDs do not light until the current level exceeds the value printed alongside the LED.

Error Code Display When an error occurs, either the Warning, the Fault, or the Temp LED will be lighted, as well as one of the Battery Voltage LEDs, and one of the Battery Current LEDs. These three LEDs indicate an error code that you can look up on the Error Code table in [“Appendix C: Troubleshooting”](#) to assist in determining the nature of the error. In the example at right, the Warning, 10V, and 100A LEDs are flashing, and the error code indicated is derived from the value shown in parenthesis, in this case: 206. Look in the tables in [“Appendix C: Troubleshooting”](#) to determine the meaning of the code.



Faults Indicators & Reset Button

Warning LED This LED flashes on-and-off for the duration of any error condition, accompanied by an audible alarm if the alarm is enabled.



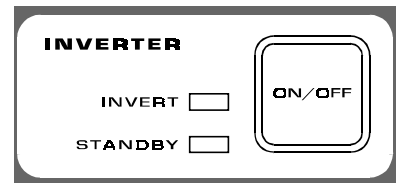
Fault LED This LED flashes on-and-off during an error condition from which the unit will automatically recover and restart when the condition is remedied. The FAULT LED will be lighted steadily when any error occurs from which the inverter/charger cannot automatically recover. It is usually necessary to disconnect the AC or DC supply to recover from this type of error. An error condition is accompanied by an audible alarm if the alarm is enabled.

Temp LED This LED flashes on-and-off to indicate that the internal temperature of the Prosine inverter/charger is too high and the unit has shutdown. When the internal temperature of the unit cools sufficiently, the inverter/charger will automatically restart. The audible alarm that accompanies this condition (if enabled) will also be silenced upon auto-restart.

Reset Button The RESET button on the Faults panel has two functions: pressed and released, it will silence the audible alarm which, if enabled, will sound an insistent intermittent tone anytime an error condition occurs, which can be looked up in a table to determine the nature of the error. Press and hold the RESET button to display error codes. Error codes are listed in an Appendix to this manual.

Inverter Status Indicators and On/Off Button

Invert LED When the green LED labeled INVERT is flashing, shorepower is not present, Load Sense is enabled, and no AC loads exceed the Load Sense threshold. The inverter is not producing AC power from the batteries. When the INVERT LED is lighted steadily, shorepower is not present and the inverter is producing AC power from the batteries. The INVERT LED is not lighted when shorepower is present.



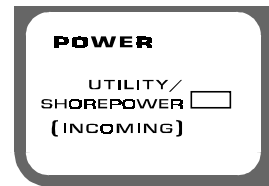
Standby LED When the amber LED labeled STANDBY is lighted steadily, shorepower is present and the inverter will pass AC power through to any AC loads that may be present.

If shorepower should fail or be removed while the inverter is in Standby mode, the inverter will automatically begin to produce AC power from the batteries, and the INVERT LED will be lighted.

On/Off Button. A button labeled ON/OFF is provided adjacent to the INVERT and STANDBY LEDs. When pressed, this button switches the inverter from On to Standby mode. Use in conjunction with the charger's ON/OFF button to set the startup inverter/charger mode. See [“Section 3: Configuration,” on page 25](#) for instructions on how to set the startup inverter/charger mode.

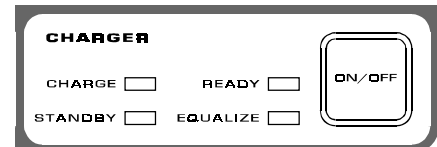
Power Indicator

A green LED labeled UTILITY/SHOREPOWER (INCOMING) lights whenever AC power is supplied to the AC INPUT connectors on the inverter/charger. Throughout this manual, the term “shorepower” refers to the presence of AC power at the AC INPUT connectors, regardless of the source of the power: from the utility grid (power company), a generator, or any other source.



Charger Status Indicator and On/Off Button

The Charger Status Indicator includes four LEDs: a green LED labeled CHARGE; a green LED labeled READY; an amber LED labeled STANDBY; and an amber LED labeled EQUALIZE. A charger ON/OFF button is also provided.



Charge LED The green CHARGE LED lights when the Prosine charger is in Bulk or Absorption charging mode. A discussion of the Prosine three-stage charging profile is found in the [“Charging Profile”](#) section of this manual (see [page 59](#)).

Ready LED The green READY LED lights when the charging cycle has been completed, and the charger is in Float charging mode.

Standby LED The amber STANDBY LED lights when the charger is enabled awaiting AC power. When shorepower becomes available, the charger will begin charging, the STANDBY LED will be extinguished, and the CHARGE LED will be lighted.

Equalize LED The amber EQUALIZE LED lights when the battery equalization has been requested, and the Prosine is in Charge mode. An equalization charge cycle will commence after fully charging the batteries, and both the EQUALIZE LED and the CHARGE LED will flash on-and-off. See [“Section 6: Multistage Charging”](#) on [page 59](#) for more information about equalization.

On/Off Button The charger ON/OFF button switches the charger between charger standby mode, On, and Off. In standby mode, the charger begins charging automatically when AC shorepower is available. In charge mode, press and hold this button for 5 seconds to request an equalize charge. Equalize mode will not begin until the batteries are fully charged.



CAUTION Disconnect DC loads on the batteries during equalization to prevent damage to them by the high voltages encountered during equalization. Equalization must be monitored to prevent battery damage. Refer to [“Section 6: Multistage Charging”](#) for more details.

Mounting and Installing the LED Control Panel

You can install the LED Control Panel in a convenient location up to 50-feet from the Prosine inverter/charger unit. This can be extended up to 100-feet with an appropriate extension cable of the same type.

For flush mount installation onto a wall, bulkhead, or panel, the remote panel requires an opening with the measurements of 4 1/8 inches by 4 1/8 inches (10.5cm by 10.5cm). Be sure that there is no wiring or other obstruction within the wall before making an opening. The LED Control Panel requires approximately 2 inches (5cm) of free space within the wall to accommodate its depth. Follow the steps shown below:

1. Select an appropriate location that is dry, not subject to corrosive or explosive fumes, and otherwise appropriate for mounting an electronic device.
2. Hold the control panel faceplate flush against the wall, bulkhead or panel and mark around the outside edge of the faceplate with a pencil.
3. Mark the location of the four mounting holes at each corner.
4. Remove the faceplate and mark a line 7/16-inch *inside* each of the four perimeter lines that you marked previously.
5. Drill an access hole at each corner of the resulting small square, large enough to allow you to insert a jigsaw blade. Place your drill bit so that the finished hole will not extend beyond the 4 1/8-inch by 4 1/8-inch square you marked on the bulkhead.
6. Use your jigsaw to cut between the holes you just drilled, and remove the material you just cut out. Blow out any waste residue from the cutting and drilling.
7. Route the telephone-type connector cable from your inverter/charger and the control panel and plug it into the control panel only.
8. Insert the control panel into the bulkhead and secure with appropriate fasteners.
9. Insert the other end of the connector cable it one of the RJ-11 connectors marked "Remote Output."
10. Secure the EMI bead attached to the communications cable to a location close to the inverter/charger. The EMI bead reduces interference from the inverter on the control panel. Securing it prevents accidental disconnect of the remote panel.

If you purchased the ACS Panel as an accessory to be used with your Prosine 2.5, the ACS Panel and standard supplied panel can both be used at the same time. Either connect the standard panel to the OUTPUT jack on the back of the ACS Panel, or connect the standard panel to the REMOTE output connector jack on the side of the Prosine inverter/charger. The standard panel can then be mounted close by the Prosine unit for system monitoring in that location and the ACS Panel can be mounted remotely in some other area where you want more detailed operating information and control capability.

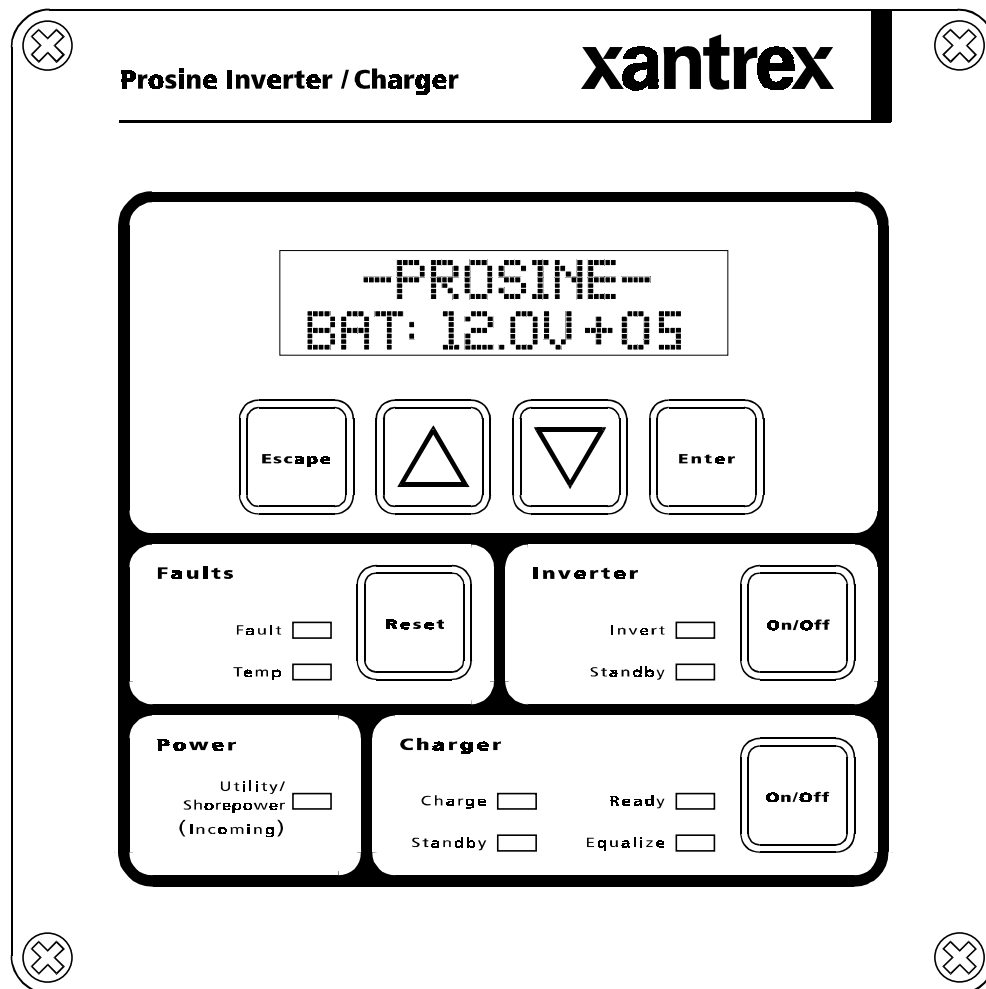
ACS Control Panel

The Advanced Control System (ACS) panel features a two-line 16-character liquid crystal display (LCD) that enables you to monitor and control your Prosine inverter/charger from a remote location. It comes standard with a 50-foot (15-metre) four-conductor telephone cord. The ACS control panel provides you with a finer degree of both monitoring and operating control over the standard control panel. If you purchased a Prosine 3.0, it comes with the ACS panel in place of the standard panel. The digital readout of the ACS gives you a detailed display of many parameters for the system, while the menu structure allows advanced configuration as well as the convenience to change system settings when you need to.



CAUTION Configuration settings made with the ACS panel will override settings made by configuring the DIP switches on the side of the chassis.

The ACS Panel has a backlight to facilitate reading. The backlight for the LCD panel illuminates when any key on the ACS is pressed. The backlight will remain on for one minute after the last key press, or after a warning has been displayed.



Liquid Crystal Display




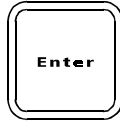
You can cycle the LCD panel through a menu tree of items that provide both system display information and adjustable parameters. Some display screens allow you to set configuration parameters. The following diagram and tables will help you get familiar with the buttons and LEDs on the ACS Panel and their functionality.

The top level screen for the ACS panel displays battery voltage and current flow, either *from* the batteries to the inverter (a “–” in front of the current reading) or *to* the batteries from the charger (a “+” in front of the current reading). The “–” indicates that the inverter/charger is in inverter mode while the “+” indicates charger mode. In the example shown, the battery voltage is at 12.9 volts and the battery is being charged at the rate of 0.5 amps.

–PROSINE–
BAT: 12.9V +0.5A

Control Buttons

The ACS LCD display panel includes four menu control keys, an **ESCAPE** key, an Up arrow key, a Down arrow key, and an **ENTER** key. The function of each key is described below.

Button	Purpose	Comments
	Moves up one level in the menu tree.	Does not change values.
	Moves up one option in the selected menu, or Selects the next higher value (or previous choice) in a screen that allows the user or installer to scroll through selectable values.	This button is shown as S in the following instructions. For some menus, if you hold the button down, it will scroll rapidly through the numerical values.
	Moves down one option in the selected menu, or Selects the next lower value (or next choice) in a screen that allows the user or installer to scroll through selectable values.	This button is shown as T in the following instructions. For some menus, if you hold the button down, it will scroll rapidly through the numerical values.
	Selects the menu level, or is used to enter your choice. If editing of the displayed value is permitted, this key places the value in edit mode, allowing you to scroll through the allowed values, then when pressed again, the current value displayed will be the new value for that menu item.	You can then use the S or T buttons to move through the screens at that level. If the screen has editable options, you can then use the S or T buttons to move through the options.

Menu Navigation Procedure

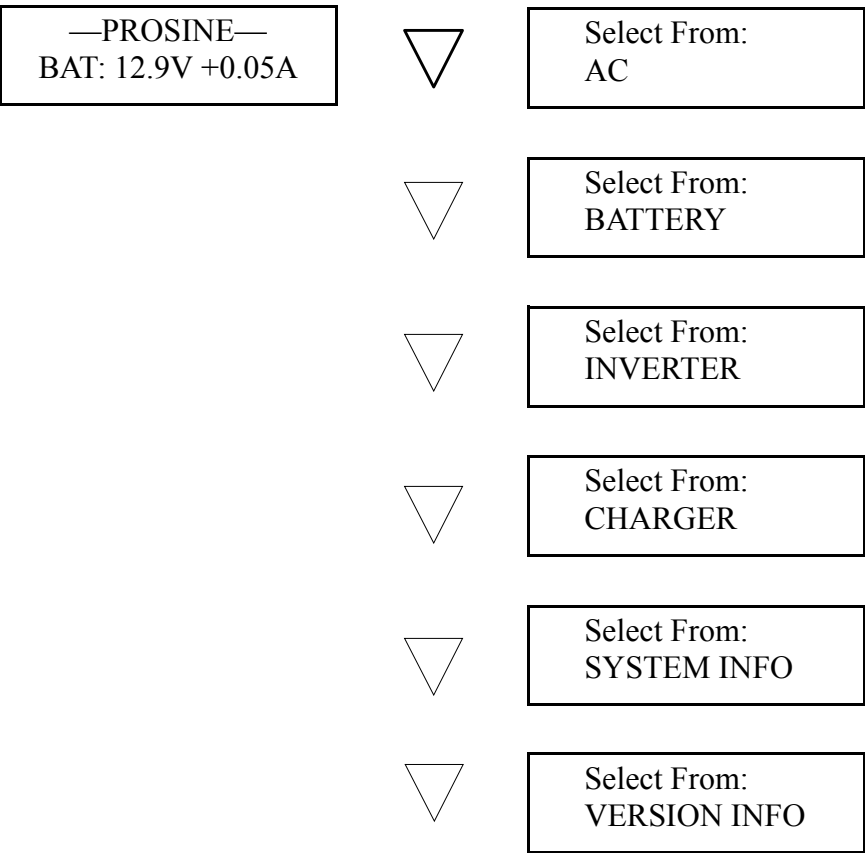
To navigate through the menu and select parameters:

1. Press the S or T keys to scroll up or down through the menu;
2. Press the **ENTER** key to enter a menu;
3. Press the S or T key to scroll to the desired menu item;
4. If the menu item you select includes a value that you can change, you can press **ENTER** again, then the S or T button to scroll (up or down) through the available choices. To select a displayed value, press **ENTER** again. Then press **ESCAPE** repeatedly to return to the battery status display.

ACS Menu Tree

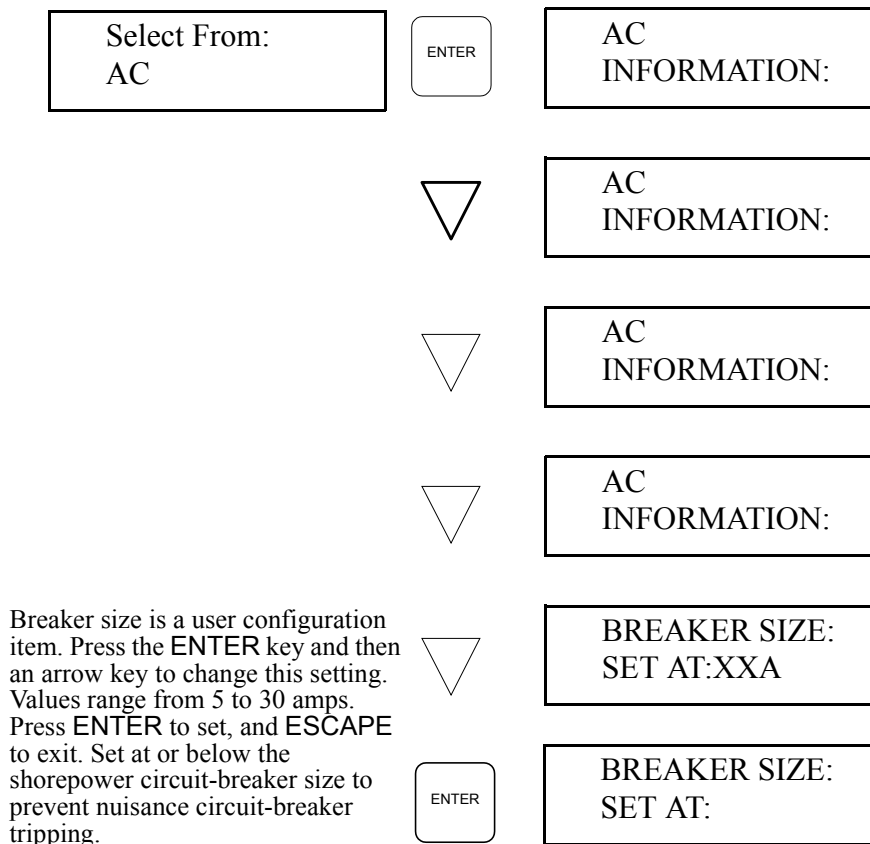
The ACS menus include system status and configuration parameters. All menus fall into one of six categories: AC Information, Battery, Inverter, Charger, System Information, and Version Information. This section describes each menu display and configuration parameter.

The battery status display is the top of the ACS menu tree. When it is displayed, press any key to display the AC Information menu. Press the T to scroll through the remaining menus, or press **ENTER** to display the menu items.



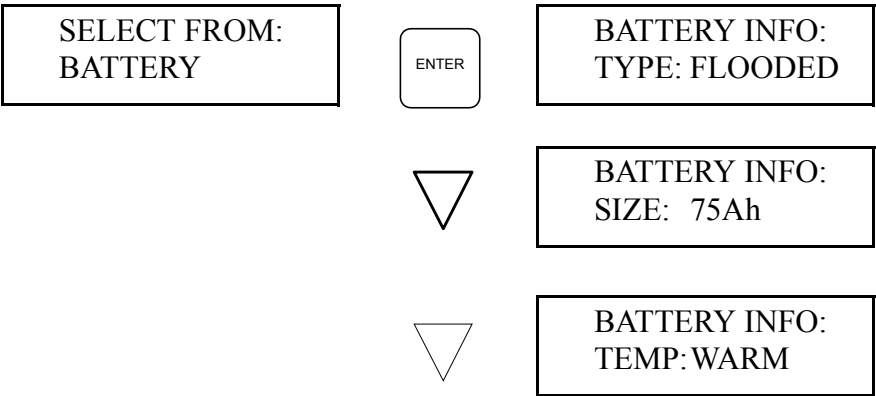
AC Information Menu

AC Information menus include AC input and output voltage, AC input and output current (amperage), and one configuration parameter: breaker size. The menu flow is shown below:



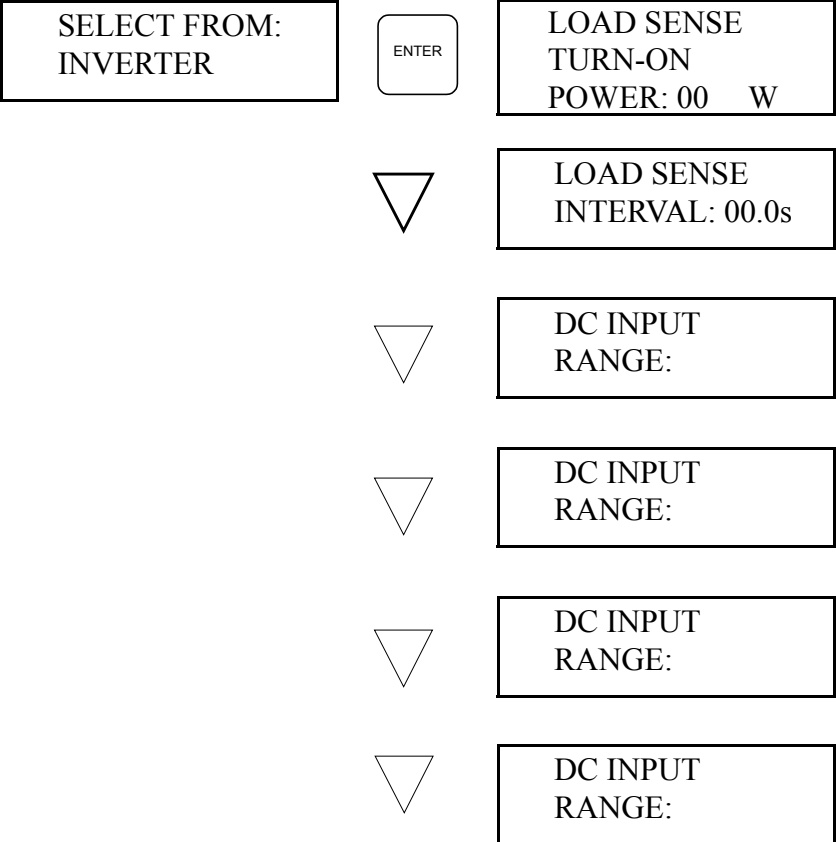
Battery Information Menu

This menu displays the current configuration settings associated with the battery system. These parameters include battery type, size, and temperature. See “[Section 3: Configuration](#)” for detailed information about these configuration parameters.



Inverter Information Menu

The Inverter menu displays configuration information about the inverter section of the Prosine inverter/charger. All of these parameters are user-configured. See “[Section 3: Configuration](#)” ([page 25](#)) for information about setting these parameters.



Charger Information Menu

The Charger menu displays the charging status and enables you to determine if an equalization request is enabled. A charger override request is also available at this menu.

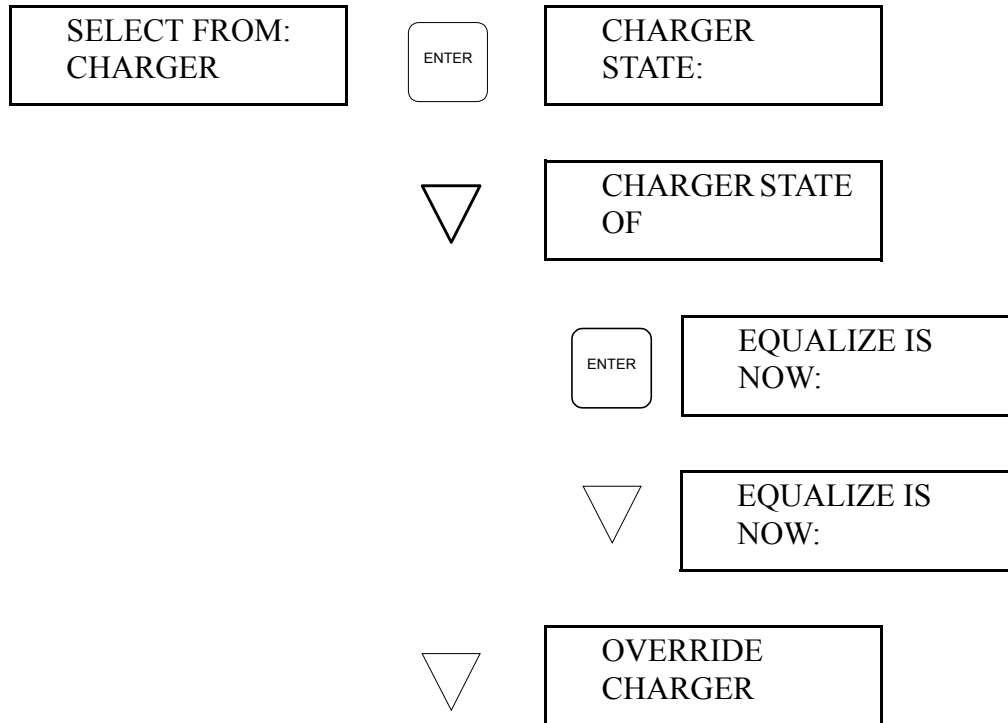


Table 1: Charger Status

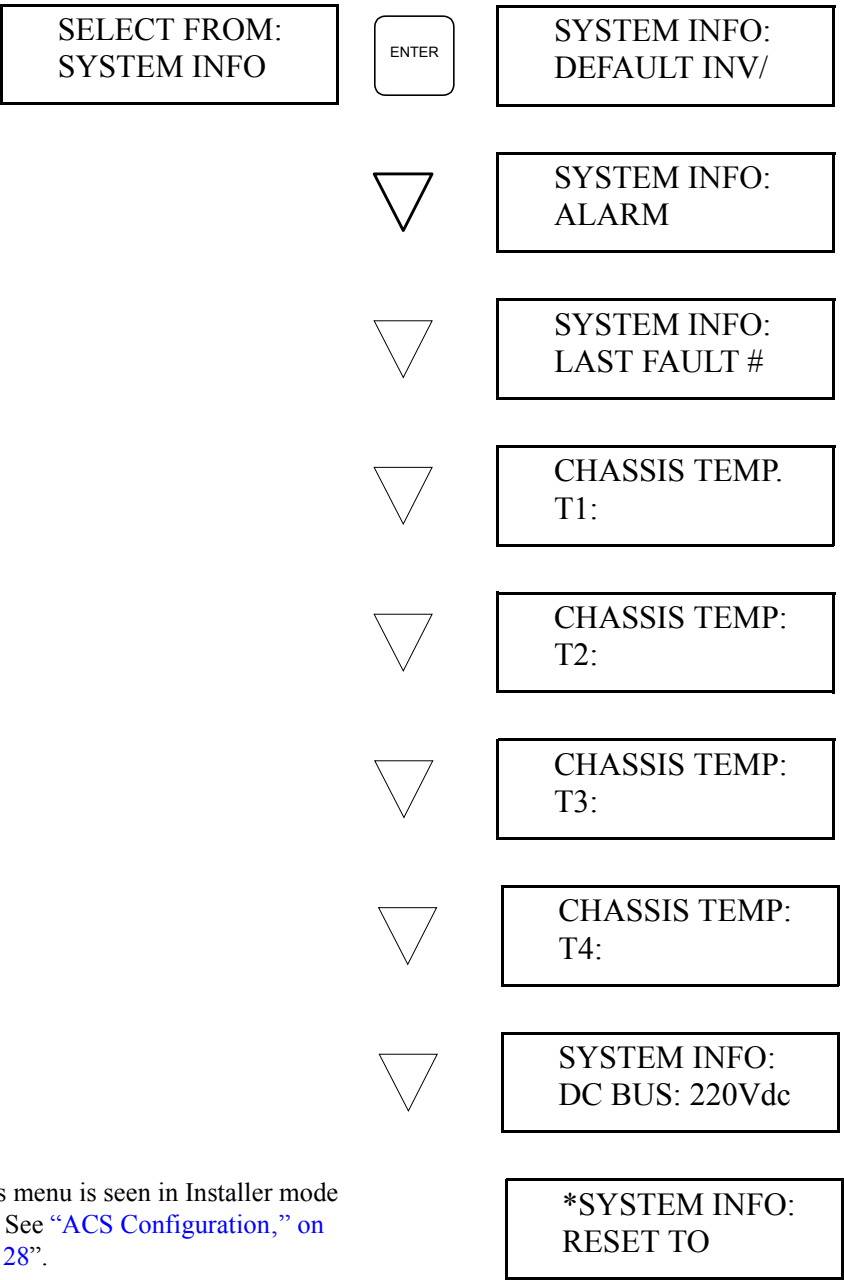
STAGE	DESCRIPTION
Not Charging	Charger has been disabled or is on standby.
Bulk Charging	The first phase of the three-phase charging cycle has started.
Absorption Charging	Bulk charging has completed and the second phase of the charging cycle has begun.
Float Charging	Absorption charging has completed and the charger is ‘topping-off’ and maintaining the batteries.
Equalization	The charger has started the special “equalization” stage.

See [“Section 6: Multistage Charging” \(page 59\)](#) for a detailed description of the charging regime, and a discussion of equalization in general. See [“ACS Configuration,” on page 28](#) for detailed instructions on setting configuration parameters using the ACS panel.

See [“ACS Configuration,” on page 28](#) for details on the Equalization Request and Override Charger Operating Mode procedure.

System Information Menu

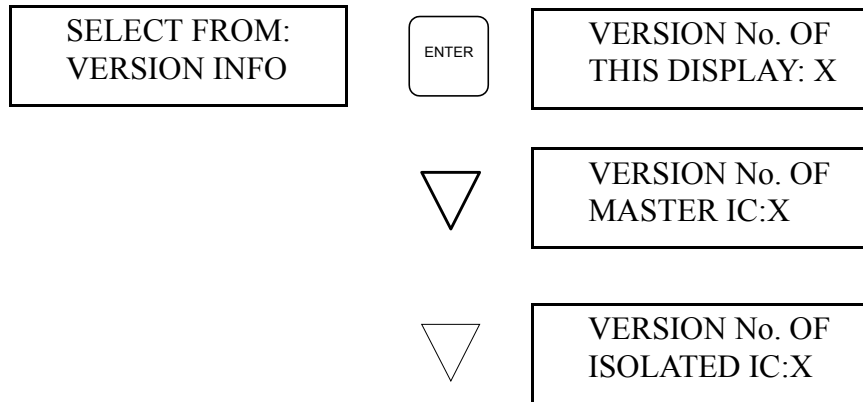
The System Information menu displays the current system startup mode, audible alarm mode, last system fault number, chassis temperature at four areas in the inverter/charger, and the system buss voltage. All except the system startup mode and audible alarm mode settings are troubleshooting aids. All the system information configuration parameters can be reset to the factory configuration by entering a special key sequence in this menu. See “[ACS Configuration](#),” on page 28 for configuration instructions.



*This menu is seen in Installer mode only. See “[ACS Configuration](#),” on page 28”.

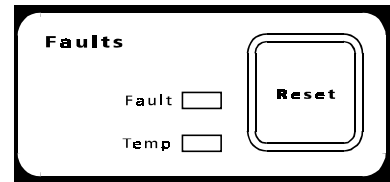
Version Information Menu

The Version Information menu displays the version number of the software used in the ACS, and the version number of the two main internal microprocessors used in the Prosine inverter/charger.



Faults Display & Reset Button

Fault LED This LED flashes on-and-off during an error condition from which the unit will automatically recover and restart when the condition is remedied. The FAULT LED will be lighted steadily when any error occurs from which the inverter/charger cannot automatically recover. It is usually necessary to disconnect the AC or DC supply to recover from this type of error. An error condition is accompanied by an audible alarm if the alarm is enabled. All error messages, their meanings, and the appropriate action to take are listed in a table in [“Appendix C: Troubleshooting”](#).

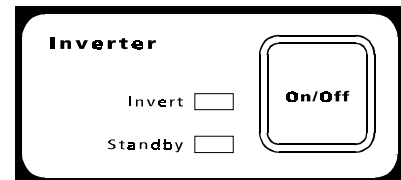


Temp LED This LED flashes on-and-off to indicate excessive internal temperature of the Prosine inverter/charger and the unit has shutdown. When the internal temperature of the unit cools sufficiently, the inverter/charger will automatically restart. The audible alarm that accompanies this condition (if enabled) will also be silenced upon auto-restart.

Reset Button The RESET button on the Faults panel has two functions: silencing the audible alarm; and displaying error codes. Pressed and released, it will silence the audible alarm which, if enabled, will sound an irritating intermittent tone anytime an error condition occurs. Pressed and held, the RESET button causes the LCD screen to display error codes.

Inverter Status Indicators and On/Off Button

Invert LED When the green INVERT LED is flashing, shorepower is not present, Load Sense is enabled, and no AC loads exceed the Load Sense threshold. The inverter is not producing AC power from the batteries. When the **Invert LED** is lighted steadily, shorepower is not present and the inverter is producing AC power from the batteries. The INVERT LED is not lighted when shorepower is present.



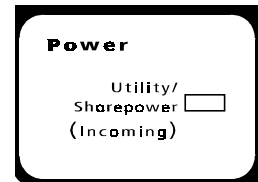
Standby LED When the amber LED labeled STANDBY is lighted steadily, shorepower is present and the inverter will pass AC power through to any AC loads that may be present.

If shorepower should fail or be removed while the inverter is in Standby mode, the inverter will automatically begin to produce AC power from the batteries, and the INVERT LED will be lighted.

ON/OFF Button When pressed, this button switches the inverter from On to Standby mode.

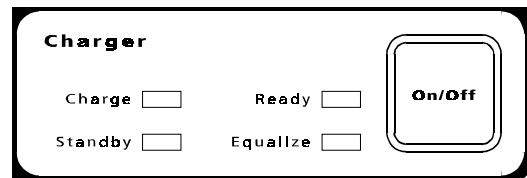
Power Indicator

A green LED labeled “UTILITY/SHOREPOWER (INCOMING)” lights whenever AC power is supplied to the AC INPUT connectors on the inverter/charger. Throughout this manual, the term “shorepower” refers to the presence of AC power at the AC INPUT connectors, regardless of the source of the power: from the utility grid (power company), a generator, or any other source.



Charger Status Indicator and On/Off Button

The Charger Status Display includes four LEDs: a green LED labeled CHARGE; a green LED labeled READY; an amber LED labeled STANDBY; and an amber LED labeled EQUALIZE. A charger On/Off button is also provided.



Charge LED The green CHARGE LED lights when the Prosine charger is in Bulk or Absorption charging mode. A discussion of the Prosine multi-stage charging profile is found in [“Section 6: Multistage Charging”](#) (page 59).

Ready LED. The green READY LED lights when the charging regime has been completed, and the charger is in Float charging mode.

Standby LED. The amber “STANDBY” LED lights when the charger is enabled awaiting AC power. When shorepower becomes available, the charger will begin charging, the Standby LED will be extinguished, and the Charge LED will be lighted.

Equalize LED The amber “EQUALIZE” LED lights when the battery equalization has been requested, and the Prosine is in Charge mode. An equalization charge cycle will commence after fully charging the batteries, and both the EQUALIZE LED and the CHARGE LED will flash on-and-off. See [“Section 6: Multistage Charging”](#) on page 59 for more information about equalization.

On/Off Button The charger ON/OFF button switches the charger between charger standby mode, On, and Off. In standby mode, the charger begins charging automatically when AC shorepower is available. In charge mode, press and hold this button for 5 seconds to request an equalize charge. Equalize mode will not begin until the batteries are fully charged.



CAUTION Disconnect DC loads on the batteries during equalization to prevent damage to them by the high voltages encountered during equalization. Equalization must be monitored to prevent battery damage. Refer to [“Section 6: Multistage Charging”](#) for more details.

Mounting and Installing the ACS Control Panel

You can install the ACS Control Panel in a convenient location up to 50 feet from the Prosine inverter/charger unit.

For flush mount installation onto a wall, bulkhead, or panel, the remote panel requires an opening with the measurements of 4-1/8 inches by 4-1/8 inches (10.5cm by 10.5cm). Be sure that there is no wiring or other obstruction within the wall before making an opening. The LCD Control Panel requires approximately 2 inches (5cm) of free space within the wall to accommodate its depth. Follow the steps shown below:

1. Select an appropriate location that is dry, not subject to corrosive or explosive fumes, and otherwise appropriate for mounting an electronic device.
2. Hold the control panel faceplate flush against the wall, bulkhead or panel and mark around the outside edge of the faceplate with a pencil.
3. Mark the location of the four mounting holes at each corner.
4. Remove the faceplate and mark a line 7/16-inch *inside* each of the four perimeter lines that you marked previously.
5. Drill an access hole at each corner of the resulting small square large enough to allow you to insert a jigsaw blade. Place your drill bit so that the finished hole will not extend beyond the 4 1/8-inch by 4 1/8-inch square you marked on the bulkhead.
6. Use your jigsaw to cut between the holes you just drilled, and remove the material you just cut out. Blow out any waste residue from the cutting and drilling.
7. Route the telephone-type connector cable from your inverter/charger and the control panel and plug it into the receptacle labeled "INPUT" on the back of the control panel. You can add another ACS panel in series to the first ACS panel by plugging the second ACS panel into the receptacle labeled "OUTPUT" on the back of the first ACS panel.
8. Insert the control panel into the bulkhead and secure with appropriate fasteners.
9. Insert the other end of the connector cable into the one of the RJ-11 connectors marked "Remote Output" on the Prosine inverter/charger. You can connect another control panel to the other output connector on the inverter/charger if you desire.
10. Secure the EMI bead attached to the communications cable to a location close to the inverter/charger. The EMI bead reduces interference from the inverter on the control panel. Securing it prevents accidental disconnect of the remote panel.

If you purchased the ACS Panel as an accessory to be used with your Prosine 2.5, the ACS Panel and standard supplied panel can both be used at the same time. Either connect the standard panel to the OUTPUT jack on the back of the ACS Panel, or connect the standard panel to the REMOTE output connector jack on the side of the Prosine inverter/charger. The standard panel can then be mounted close by the Prosine unit for system monitoring in that location and the ACS Panel can be mounted remotely in some other area where you want more detailed operating information and control capability.

Battery Temperature Sensor

The temperature sensor continuously measures the temperature of the battery and adjusts charger output for a more accurate, temperature-compensated charge.

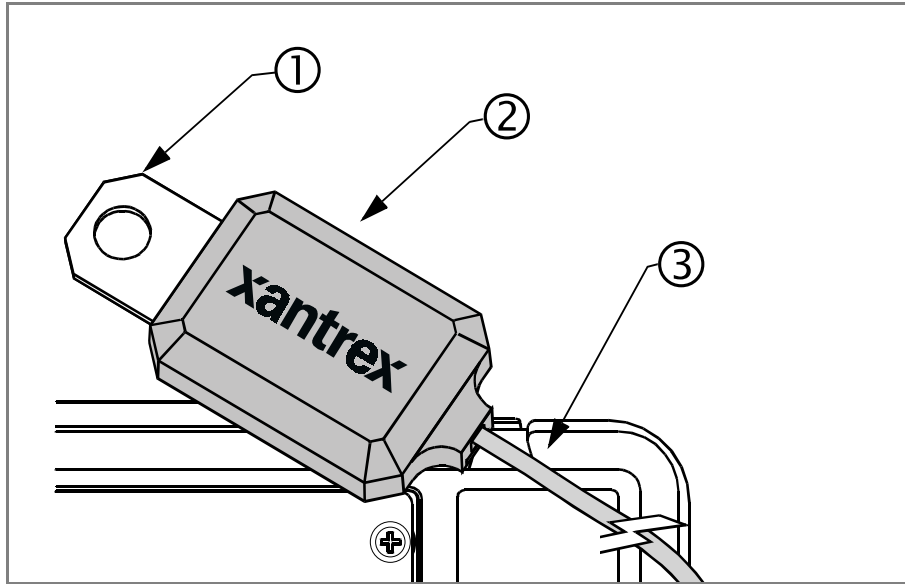


Figure 4. Battery Temperature Sensor

Feature	Description
①	Mounting plate. Connects to the negative battery terminal.
②	Sensor. Reverse side has peel-off backing and self-adhesive strip so you can attach the sensor to the side of the battery case.
③	Sensor cable (25ft; 8m).
NOTE: The battery temperature sensor is electrically isolated from the mounting plate.	

Section 3: Configuration

This section explains how to configure the Prosine inverter/charger to best meet your electrical system requirements and get maximum performance using the DIP switches located on the side of the unit. You will need a pen or other fine-pointed instrument to adjust the switches. Each switch has two positions: Up and Down.

DIP Switch Settings

Each configuration parameter is defined in the list below. DIP switch settings are described in the tables on the next two pages. An asterisk (*) indicates the factory default settings.



WARNING Risk of battery damage and fire or explosion: “Installer settable” configuration items are meant to be configured by a professional installer who is not only familiar with the system settings of the inverter, but also the ramifications of changing those system settings. Setting these parameters incorrectly can cause damage to your equipment or severely affect the performance of your system.

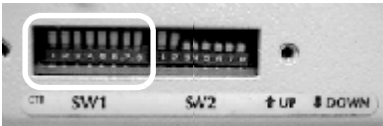
NOTE After configuring the inverter/charger using the DIP switches, make sure you replace the DIP switch cover.

Battery Type	This is an “Installer-only” configuration item. Note the preceding Warning . Settings are available for either flooded or gel electrolyte. Sealed batteries should be charged as gel batteries even though they may have a liquid electrolyte. For further details, see “ Section 7: Batteries ”.
Battery Temperature	With the battery temperature sensor installed, leave the switches in the WARM position; they are ignored unless battery temperature falls below 5°C. Between 5°C and -10°C, the charger stops. If the temperature is below -10°C, the temperature sensor is not detected, and the inverter/charger responds to the manual defaults. With the battery temperature set to the average ambient temperature the manual defaults are: COLD: < 50°F (10°C), WARM: between 50° F to 80° F (10°C to 27°C), and HOT: > 80°F (27°C).
Load Sense	This setting determines what power level the inverter has to detect before it will auto start. Setting this value to 0 will cause the inverter to remain on all the time. Note that extremely low power loads (e.g. digital clocks on microwaves) may require the 0 setting in order for the inverter to stay on.
Audible Alarm	This switch turns the audible alarm On or Off.
AC Service Rating	The maximum AC current that the Prosine inverter/charger will draw from shore-power is determined by this value. If you find that the Prosine inverter/charger keeps tripping the utility power breaker, set this value to a lower level. This value may limit the maximum charging current to your batteries, depending also upon battery capacity.
Battery Size	This is an “Installer-only” configuration item. The capacity of the battery or battery bank in amp-hours. Note the preceding Warning : charging at a rate too high for your batteries can damage and/or destroy them.

SWITCH BANK 1 (SW1)

Battery Type

Switch 1	*UP	Flooded
	DOWN	Gel



Not used

Switch 2
Switch 3
Switch 4

Battery Temperature

Switch 5 and	Switch 6	
*UP	*UP	Warm, usually 50–80 °F / 10–27 °C
DOWN	UP	Cold, usually below 50 °F / 10 °C
UP	DOWN	Hot, usually above 80 °F / 27 °C
DOWN	DOWN	Warm, usually 50–80 °F / 10–27 °C

Load Sense

Switch 7 and	Switch 8	
*UP	*UP	0 Watts. Load sense is disabled
DOWN	UP	10 Watts
UP	DOWN	25 Watts
DOWN	DOWN	50 Watts

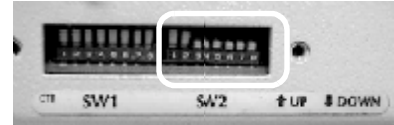
SWITCH BANK 2 (SW2)

Audible Alarm

Switch 1

- *UP Audible signals enabled
- DOWN Audible signals disabled

Switch 2 Not Used



AC service rating

Switch 3	Switch 4	Breaker Rating (Amps)	Max AC Current Draw	Maximum DC Charging Amps			
				PS 2.5		PS 3.0	
				12V	24V	12V	24V
*UP	*UP	10 A	8 A	55	30	55	30
DOWN	UP	15 A	12A	90	45	90	45
UP	DOWN	20 A	16A	100	55	100	60
DOWN	DOWN	30 A	24A	100	55	120	60

Battery Size

Switch 5, 6, 7, 8

				Battery Capacity	Max DC charging current (amps)			
#5	#6	#7	#8		Prosine 2.5		Prosine 3.0	
					12V	24V	12V	24V
*UP	*UP	*UP	*UP	50 Ah	11A	11A	11A	11A
DOWN	UP	UP	UP	75 Ah	25A	25A	25A	25A
UP	DOWN	UP	UP	100 Ah	33A	33A	33A	33A
DOWN	DOWN	UP	UP	150 Ah	50A	50A	50A	50A
UP	UP	DOWN	UP	200Ah	67A	50A	67A	60A
DOWN	UP	DOWN	UP	300 Ah	100A	50A	100A	60A
UP	DOWN	DOWN	UP	400 Ah	100A	50A	120A	60A
DOWN	DOWN	DOWN	UP	500 Ah	100A	50A	120A	60A
UP	UP	UP	DOWN	600 Ah	100A	50A	120A	60A
DOWN	UP	UP	DOWN	700 Ah	100A	50A	120A	60A
UP	DOWN	UP	DOWN	800 Ah	100A	50A	120A	60A
DOWN	DOWN	UP	DOWN	1000 Ah	100A	50A	120A	60A
UP	UP	DOWN	DOWN	1200 Ah	100A	50A	120A	60A
DOWN	UP	DOWN	DOWN	1400 Ah	100A	50A	120A	60A
UP	DOWN	DOWN	DOWN	1700 Ah	100A	50A	120A	60A
DOWN	DOWN	DOWN	DOWN	2000 Ah or greater	100A	50A	120A	60A

ACS Configuration

The ACS Control Panel enables you to configure the Prosine inverter/charger to your particular installation. All of the ACS Control Panel menus (except Version Information) contain one or more configurable parameters. Each configuration parameter is discussed in the appropriate menu section that follows.

User Configuration Items



CAUTION Do not change the configuration of your Prosine if you are uncertain of your changes. If you are uncertain of the effects of your changes, read the entire manual, then consult a qualified installer or call Xantrex Customer Assistance.

For User Configuration items, press ENTER to select the parameter you want to change, and then an arrow key to change the value. Set the value by pressing ENTER.

Installer Configuration Items



WARNING Risk of battery damage and fire or explosion: An “installer settable” configuration item is meant to be configured by a professional installer who is familiar not only with the system settings of the inverter, but also the ramifications of changing those system settings. Setting these parameters incorrectly can cause damage to your equipment or severely affect the performance of your system.

To enter Installer Mode:

1. Scroll the display until the parameter to be changed is visible.
2. Press and hold down the ESCAPE and DOWN ARROW keys until the panel beeps.
3. Press ENTER.
4. Use the UP and DOWN ARROW keys to change the parameter as appropriate.
5. To store the change, press ENTER.

After a change is stored, the inverter/charger will remain in Installer Mode. To change additional parameters, select the parameter and repeat steps 3, 4 and 5.

To exit Installer Mode:

- Press the ESCAPE key repeatedly until you reach the main menu.

If you want to change another installer-settable parameter after reaching the main menu, follow the keypress sequence (steps 1, 2 and 3) to enter Installer Mode again.

ACS Configuration Considerations

ACS Configuration settings override the DIP switch settings discussed above. If your unit has been configured using the ACS control panel, it will retain these configuration settings even after the ACS has been disconnected. The physical position of the DIP switches does not necessarily indicate the setting. To reset the configuration settings to the DIP switch settings, perform these actions:

- Change all the DIP switches to the alternate setting.
- Wait at least 20 seconds for the Prosine to recognize the new setting.
- Change the DIP switches to the desired setting.
- Wait at least another 20 seconds for the desired setting to be recognized.

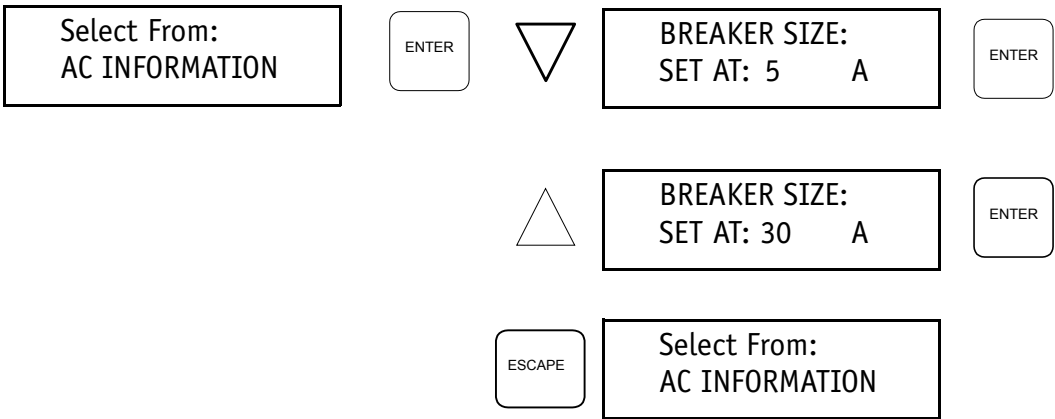
AC (Shorepower) Configuration

Only one configurable parameter is found in the AC Information menu: breaker size. An AC circuit breaker must be installed in the AC supply circuit (shorepower) leading to the Prosine inverter/charger. Specifying the size of the breaker in the AC Information menu reduces ‘nuisance’ tripping of the supply breaker by preventing the charger from attempting to draw more current than is available through the supply circuit breaker.

Example: when the breaker size parameter is set to 10 amps and AC loads are operating while the charger is also charging the batteries, the Prosine automatically reduces charging current to help keep the sum of all AC loads (including the charger) at or below 8 amps. As AC loads fluctuate, the Prosine automatically adjusts charging current up to the maximum allowed by this setting.

For RV, marine, and mobile installations, the available shorepower circuit breaker size may vary frequently. Marinas and RV parks often supply shorepower with from 15- to 50-amp service. By adjusting the breaker size parameter in the AC Information menu, you can increase the maximum current available for more rapid charging, or prevent nuisance circuit-breaker tripping when shorepower current is limited.

To adjust the breaker size parameter, enter the AC Information menu by pressing the Enter key, as shown below. Use the ▼ arrow key to scroll through the menu to the Breaker Size screen. Press ENTER to enter the menu, followed by an arrow key to scroll to the desired value. Press ENTER again to accept the value, then press ESCAPE to exit the menu.



Battery Configuration

The Battery Information menu has three configuration parameters: Battery Type, Battery Size, and Battery Temperature. All of these parameters have an effect upon the optimal charging regime. For a comprehensive discussion about batteries, see “[Section 7: Batteries](#)”.



WARNING Risk of battery damage and fire or explosion if using the wrong battery type or size setting.

Battery Type

NOTE: This is an “Installer-only” configuration item. There are two types of batteries appropriate for use with the Prosine inverter/charger: flooded lead-acid batteries, and gel-cell lead-acid batteries. The factory default setting for this parameter is flooded. When using sealed or gel lead-acid batteries, change the setting of this parameter to Gel.

Battery Size

NOTE: This is an “Installer-only” configuration item. You can use one battery with a capacity of only 50 amp hours (Ah) or a group of batteries with a combined capacity of over 2000Ah to provide DC power to the inverter/charger. The amount of current used to recharge the batteries will vary with the combined capacity of the batteries. Setting this parameter too high (larger than your batteries’ actual capacity) can result in damage to your batteries or cause them to produce excessive amounts of corrosive and explosive gasses. Setting this parameter too low can result in under-charged batteries, or excessively long charging periods. Consult with your battery supplier to determine the type and capacity of your batteries.

Battery Temperature

The amount of current your batteries can absorb while charging is directly related to their temperature. The ambient temperature affects the amount of current that will pass into and out of the batteries. You can set the battery temperature to optimize the Prosine charging regime for cold, warm, or hot ambient temperatures. Xantrex strongly recommends use of the included Battery Temperature Sensor that enables the Prosine inverter/charger to automatically adjust the charging regime for temperature. When the temperature sensor is installed, the Battery Temperature setting is ignored. You can switch between the Celsius (C) and Fahrenheit scales by pressing ENTER and then ▼ or ▲ but use of the battery temperature sensor is preferred.

Cold = <10°C (50°F), Warm = 10°C to 27°C (50°F to 80°F), Hot = >27°C (80°F)

Battery temperature can be set in the usual way: by entering the menu, scrolling to the desired value, and accepting the value by pressing ENTER.



Battery type and **size** parameters are installer configuration items. Enter Installer Mode, then enter the menu, and set the value as above. Press ENTER to accept the value and ESCAPE to exit the menu.

BATTERY INFO:
TYPE: FLOODED



BATTERY INFO:
TYPE: GEL

ENTER

BATTERY INFO:
SIZE: 75Ah



BATTERY INFO:
SIZE: 2000Ah

ENTER

Inverter Configuration

All the items on the Inverter menu are configuration parameters. The first two items are Load Sense parameters. The remaining items are high- and low-voltage alarms and cut-off settings. See “[Prosine Inverter Load Sense Mode,](#)” on page 56 for a complete discussion of the Load Sense feature.

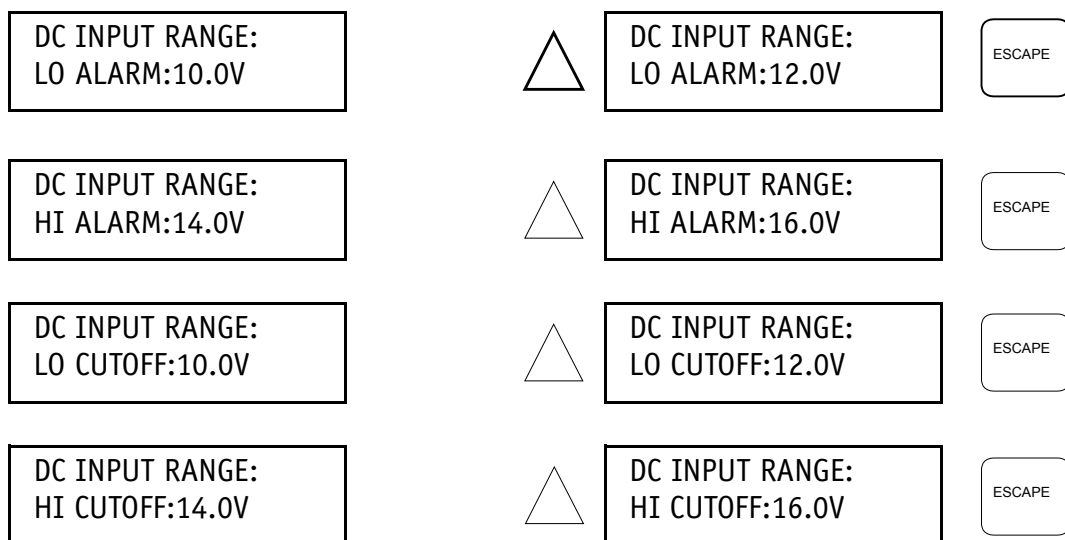
Load Sense Parameters. You can define a minimum load at which the inverter will provide AC power. Any load that draws less than the minimum current, adjustable from 1 to 1401 watts, will not activate the inverter. Loads that draw more than the minimum current will activate the inverter from Standby mode to Invert mode. A minimum setting of zero will disable Load Sense altogether. Power consumption by the inverter when it is not on Standby is about 60 watts. When Load Sense is enabled and the inverter is in Standby mode, power consumption is about three watts, conserving your batteries.



When Load Sense mode is active (turn-on power >0), the inverter tests for loads connected to it by sending a pulse signal. You can define the interval between these pulse signals. A longer interval between pulse signals consumes less energy than a shorter interval, thus reducing idle current requirements. You can set the interval between signals from two to 26.5 seconds.



High and Low Voltage Alarms & Cutoffs. The Prosine inverter/charger features integrated circuitry to protect excessive charging and discharging of your batteries, and an audible warning alarm to alert you to when high- and low-voltage conditions occur. You can use the ACS Control Panel to specify the levels at which the alarms will sound, and at which the inverter/charger unit will cut off and shut down. Alarm values cannot be outside the cutoff range. Ex: Low Cutoff Range = 11.0V; Low Alarm must be 11.0V or higher.



The voltage range for these alarms and cutoffs is generally set at the factory at the absolute minimum and maximum, as shown in the illustration above for 12-volt systems. Example: Lo Cutoff = 10.0V, Hi Cutoff = 16.0V, Range = 10.0 to 16.0 volts DC. The table below illustrates the factory settings and the min-max range for both 12-volt and 24-volt systems.

High and Low Voltage Alarms and Cutoffs

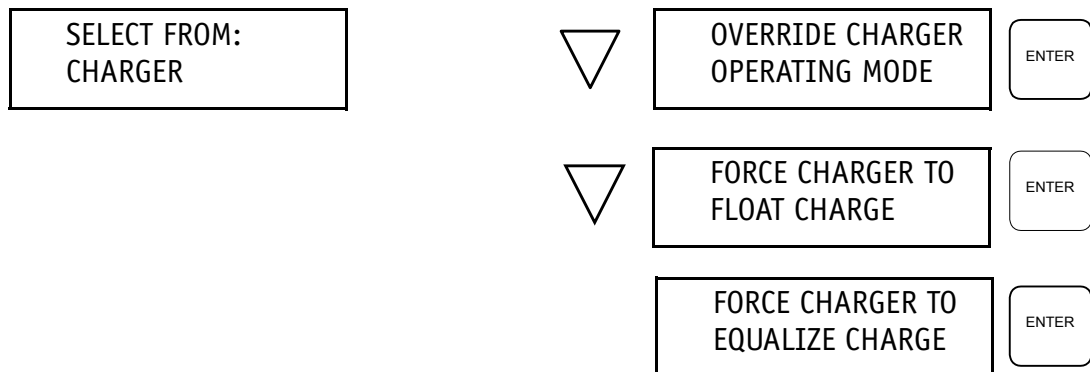
ALARM OR CUTOFF	12-VOLT MIN-MAX RANGE	Factory Default	24-VOLT MIN-MAX RANGE	Factory Default
LO ALARM	10.0V - 12.0V	10.5V	20.0V - 24.0V	21.0V
HI ALARM	14.0V - 16.0V	15.5V	28.0V - 32.0V	31.0V
LO CUTOFF	10.0V - 12.0V	10.0V	20.0V - 24.0V	10.0V
HI CUTOFF	14.0V - 16.0V	16.0V	28.0V - 32.0V	16.0V

Charger Configuration

The ACS Charger menu displays the current status of the charger and enables you to begin an equalization charge, or to override the current charger status and force the charger into Float or Equalization mode.

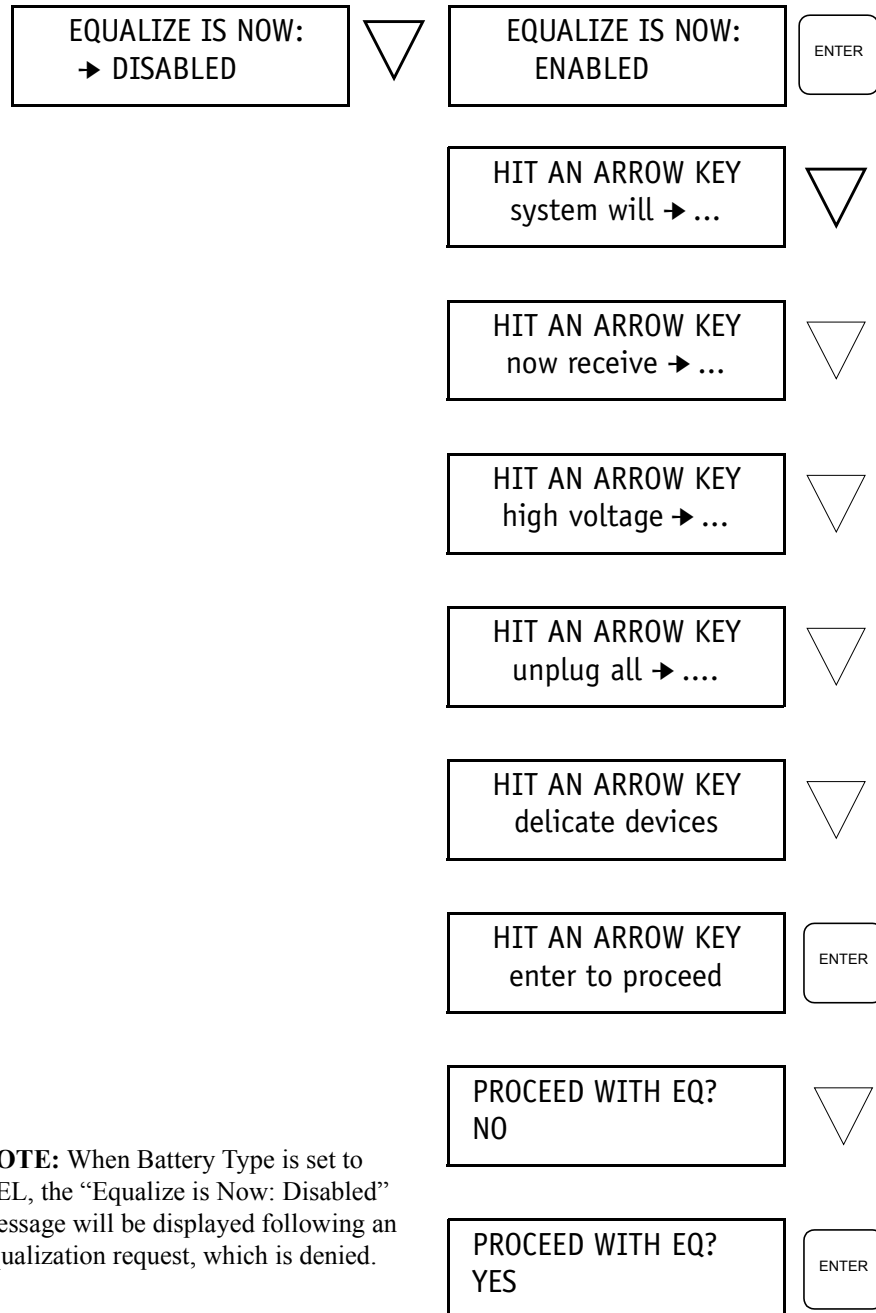
Override Charger Operating Mode The charger will not begin an equalization charge until it has completed a Bulk or Absorption charge. It may be desirable to force an equalization charge in some instances. Forcing the charger into Float or Equalization mode is usually performed only during an installation, and should not be lightly considered. Consult your installer or call Xantrex Customer Service before attempting to override the charger mode. Overriding the charger operating mode is an installer-configuration item. The menu procedure is illustrated below.

Enter “Installer Mode, and then:



Equalization Request For some batteries, equalization is a regular maintenance activity; for others, equalization is damaging. Read “[Section 6: Multistage Charging](#)” (page 59) before attempting to initiate an equalization charge. Inappropriate equalization charging can ruin your batteries. An equalization request is a user-configuration item: press **ENTER** at the menu and follow the prompts shown below to initiate an equalization request. When you press **ENTER** at the YES prompt, equalization will begin immediately if the batteries are fully charged, and AC power is available. Since equalization voltage is usually above the range of the High Voltage Alarm, an audible alarm will sound briefly when it is enabled. The Faults and Charger LEDs will also flash as a visual alarm. This

is normal. The audible alarm will be silenced after a few moments, the LEDs will stop flashing, and the EQUALIZE LED will be lighted.

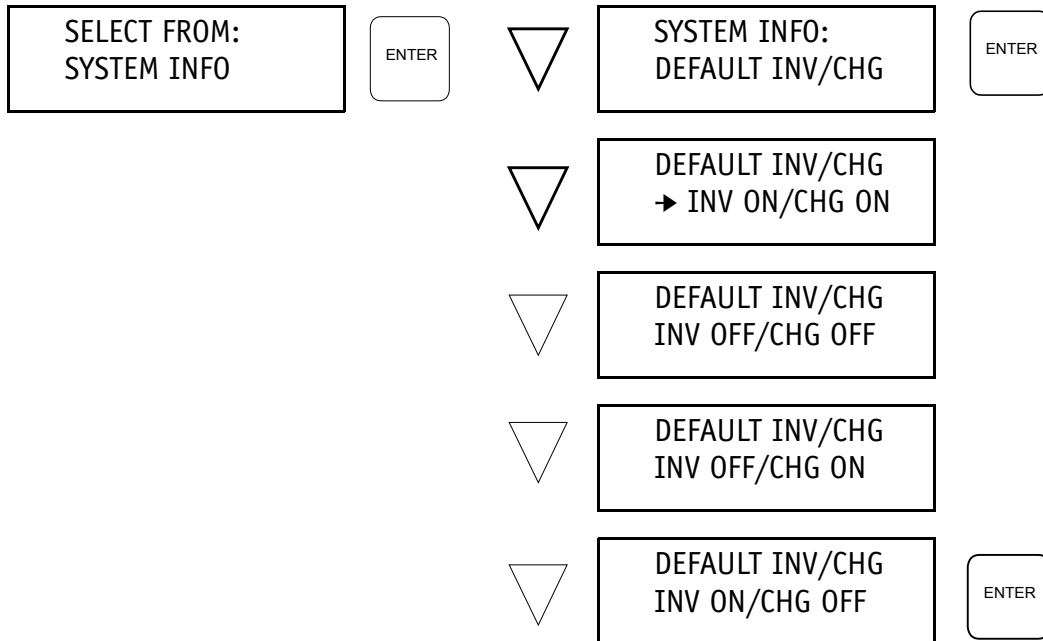


NOTE: When Battery Type is set to GEL, the “Equalize is Now: Disabled” message will be displayed following an equalization request, which is denied.

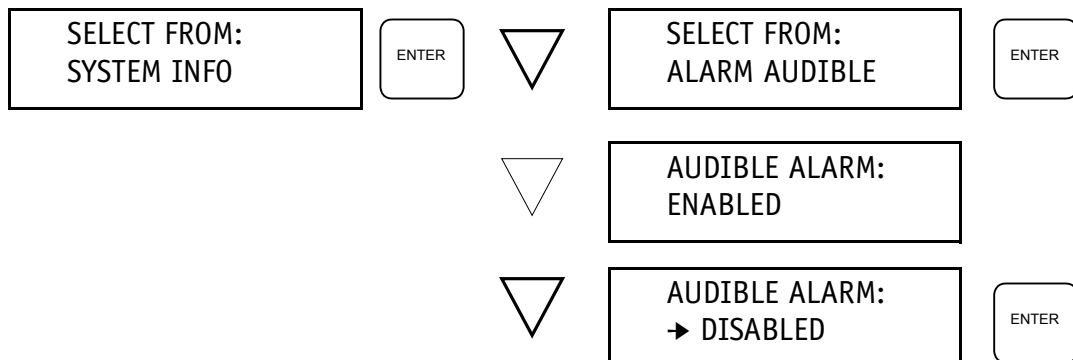
System Configuration

The System Information menu contains two configuration items: System Startup Default and Audible Alarm. Both are user configuration items and are selected by pressing ENTER.

System Startup Default You can set the initial power-up configuration when AC shorepower is provided to the Prosine inverter/charger so that the inverter and charger are either both On, both Off, or one is On and the other is Off. This is a User configuration item set by pressing ENTER, scrolling to the desired value by pressing an arrow key, pressing ENTER to select the value, and pressing ESCAPE to exit the menu. The ➔ indicates the current selection.



Audible Alarm The System Info menu also allows you to turn the audible alarm Off or On. The audible alarm sounds any time there is an inverter/charger fault, or when the DC high- or low-voltage range is exceeded. If equipped with a battery temperature sensor, the audible alarm will also sound when battery temperature is less than -15°C (5°F) or more than 50°C (122°F). The audible alarm is always accompanied by flashing LEDs and an error code display. The alarm is **ENABLED** at the factory.



Section 4: Inverter/Charger Installation

This section describes the tools and materials required, the appropriate location and environment for mounting the inverter/charger, AC and DC cabling, and step-by-step instructions to install the unit. A number of diagrams for various types of installations are provided. These instructions are intended to be used as a guide only. It is the installer's responsibility to observe all safety and appropriate installation regulations and to proceed accordingly.

Read the entire chapter first before commencing the installation to ensure you have all the materials necessary to install the PS2.5/3.0 and that it is being installed in an appropriate environment.



WARNING: FIRE, SHOCK, AND ENERGY HAZARD Installation should be performed by certified and experienced technicians familiar with inverter/charger installations and the applicable installation codes.

Governing installation codes will vary depending upon the specific location and application of the inverter/charger installation. Installations may be governed by the Code of Federal Regulations (CFRs), the American Boat and Yacht Council, (ABYC), National Electrical Code (NEC), Canadian Standards Association (CSA), Canadian Electrical Code (CEC), RV Industry Association (RVIA) or others. For complete and authoritative installation regulations contact the appropriate regulatory agency.

Safety Instructions

Before beginning the installation of the Prosine inverter/charger, review the safety instructions at the beginning of this manual, and read this entire section. Disconnect all sources of AC and DC power to prevent accidental shock. Disable and secure all AC and DC disconnect devices and automatic generator starting devices. Use the DIP switches to configure the inverter/charger after reading ["Section 3: Configuration" page 25](#). If you have the ACS Control panel, you can configure the unit after installation, but before operating.

Installation Overview

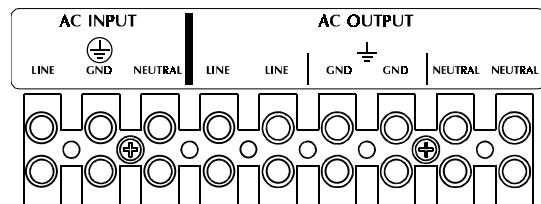
Experienced and licensed installers familiar with inverter/charger installations may follow the steps listed below to install the Prosine 2.5/3.0 inverter/charger. For system component recommendations and requirements, refer to each specific section in this manual. For instance, the ["AC Cabling"](#) section describes AC wiring guidelines, while the ["DC Cabling"](#) section describes DC wiring guidelines.

This is an overview only. If you are unsure of any aspect of inverter/charger installation, read the entire manual, cover to cover, before attempting to perform an installation.

1. Before beginning any installation, disconnect all sources of power, both AC and DC.
2. Remove the Prosine inverter/charger from the shipping container and verify that all components are present. Record the model and serial number on the packaging page of this manual.
3. Slide the BYPASS/ON switch on the side of the Prosine inverter/charger to BYPASS.

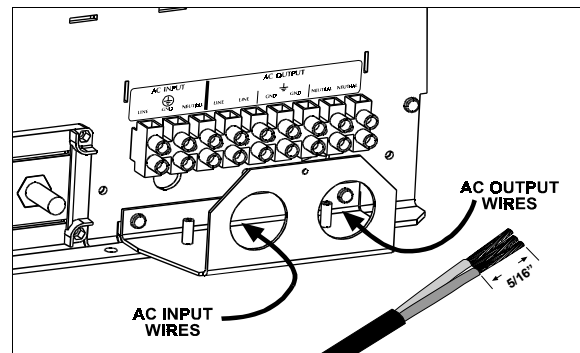
4. Select an appropriate mounting location. The Prosine must be mounted vertically on a bulkhead or wall with the AC and DC connectors on the bottom. The Prosine is a solid-state electronic device and must be located in an appropriate environment. (Refer to [“Where to Install the Prosine Inverter/Charger,”](#) on page 42.
5. Configure the Prosine inverter/charger using the DIP switches on the side of the unit. See [“Section 3: Configuration,”](#) on page 25 and following for details.
6. Remove the cover over the AC connector block. Install two, one-inch cable clamps (strain reliefs) in the holes in the cover mounting bracket.
7. Locate the mounting screw locations and pre-drill a pilot hole for each location. For the Prosine 3.0, locate the mounting holes using the mounting brackets provided with the unit, then install the mounting brackets on the Prosine using the fasteners provided.
8. Attach the Prosine inverter/charger to the bulkhead or wall. Use #12 or #14 pan-head wood or sheet metal screws to secure the inverter/charger to the framing behind the wall or bulkhead. Alternatively, use nut inserts and 1/4-20 machine screws.
9. Route the AC input cable through the left cable clamp on the bottom of the inverter/charger. Strip about two inches of the exterior insulation from the AC cable and separate the three wires. Strip 5/16-inch of insulation from each of the three AC conductors within the AC cable.

10. Insert the AC Line (HOT) conductor (black insulation) into the opening at the top of the AC input connector labeled LINE; insert the Ground conductor (green insulation or bare) into the AC Input connector labeled GND; and insert the Neutral conductor (white insulation) into the AC Input connector labeled NEUTRAL. Tighten the screw in the connectors to min. 21 inch-pounds.



11. Route the AC Output cable through the right cable clamp on the bottom of the inverter. Strip about three-inches of the outside insulator from the AC cable and separate the three wires inside. Strip 5/16-inch of insulation from each wire in the AC output cable.

12. Insert the AC Output line, ground, and neutral conductors into the top openings of the AC output connector block labeled LINE, GND, and NEUTRAL respectively. There are two each connectors on the AC OUTPUT connector block labeled LINE, GND, and NEUTRAL. The two LINE output connectors are bonded together; as are the two GND output connectors, and the two NEUTRAL output connectors. The second set is for the GFCI receptacle option. Tighten the screw in each connector to min. 21 inch-pounds.



- 13.** Tighten the cable clamps and secure the cables to the wall or bulkhead to prevent unnecessary strain on the connections. Replace the cover over the AC connection block.
- 14.** Connect a cable from the Chassis GND terminal on the inverter to earth ground for on-shore installations, to the vehicle chassis for RV installations, or to the engine negative terminal for marine installations. DO NOT connect this conductor to the AC input ground wire or directly to the negative pole of the battery. Refer to “DC Grounding,” below.
- 15.** For residential installations, a DC wiring enclosure is required to cover DC connections and cables. Contact Xantrex or your distributor for this part.
- 16.** Route your DC supply cables from the battery bank to your inverter/charger. Provide an anti-chaffing device around the cables where they pass through a bulkhead or partition. Seal around the cables where they pass through the bulkhead or partition to prevent gasses from passing through them.
- 17.** An inline fuse is recommended between the inverter/charger and the battery and is required by regulations for some installations. This protects your wiring in case of accidental shorting. The fuse and fuse holder need to be installed in the positive side of the DC circuit, as close as possible to the batteries. Attach the cable from the positive (+) terminal on the fuse to the positive DC connector post on the inverter/charger. Tighten the hex nut on the inverter/charger connector to 216–240 inch-pounds (24–27Nm). Secure the cable to the bulkhead or partition to prevent unnecessary strain on the connector.
- 18.** Attach the cable to the negative (–) terminal on the battery first, and then connect it to the negative DC connector post on the inverter/charger. There will be a “snap” or spark as electrical current jumps from the cable to the connector post. This is normal. Tighten the hex nut on the DC terminal to 216–240 inch pounds.
- 19.** Attach the DC terminal covers and the vent cover/drip shield.
- 20.** Connect the standard or ACS control panel by inserting the RJ-11 telephone-type connector plug into one of the jacks labeled “Remote Output” on the inverter/charger. Secure the EMI bulb on the control panel cable to the wall or bulkhead adjacent to the inverter/charger to prevent unnecessary strain on the cable connector.
- 21.** Reconnect your AC shorepower supply.
- 22.** Slide the BYPASS/ON switch on the side of the inverter/charger to the ON position.
- 23.** Verify that you have configured the unit correctly, and that it is operating correctly.

Designing the Installation

All installations of the Prosine inverter/charger system share many common components, described briefly in this section. AC & DC cabling, circuit breakers, fuses, and distribution panels are more fully described in following sections. The figure below diagrams a typical residential installation showing these components and their relationship to each other in a typical installation.

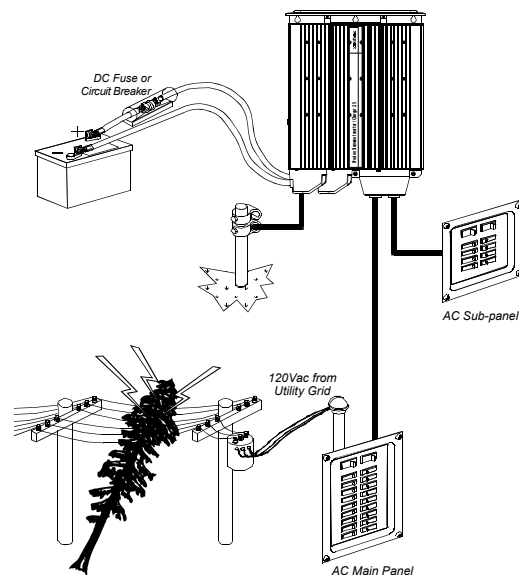
AC Shorepower A source of 120-volt, 60-Hz alternating current is necessary to provide a source of energy for charging batteries, and to pass-through to AC loads. This source could be the utility grid or power company, or a gasoline-, diesel-, or natural gas-powered AC generator. Multiple sources of shorepower may also be available.

AC Disconnect and Overload Device Every system requires a method of disconnecting the AC power source, and an overload protection device (circuit breaker or fuse). These two components are often integrated into an AC circuit breaker, which provides a disconnect and protects against overload at the same time. These devices are usually installed within a protective box. Some provide a method of selecting between multiple AC sources as well as circuit protection and disconnect. You can use up to a 30-amp circuit breaker in the AC supply line feeding the inverter/charger. The current rating of the breaker or fuse must be matched to the wire size(s) involved, in accordance with the applicable installation codes.

AC Distribution Center The AC distribution center is often called a ‘main panel,’ or a ‘sub panel.’ A main panel includes a main circuit breaker, which serves as a disconnect for the AC power supply line. Additional circuit breakers serve individual circuits, one of which may serve the inverter/charger. Some systems route all AC service through the inverter/charger, in which the main AC distribution panel is fed by the inverter/charger AC output. In all systems, both the inverter/charger and the AC loads on the inverter/charger must be protected with circuit breakers.

AC Cabling AC cabling includes all of the wires and connectors between the AC source and the inverter/charger; and between the inverter/charger and the AC distribution panels, circuit breakers, and loads. The type and size of the wiring varies with the installation and the load. For marine and some RV applications, flexible multiple-strand wire known as ‘boat cable’ is required. For residential installations, solid ‘ROMEX’ cable is often used. Your installation code may specify the number of strands, the overall size of the conductors, and the type and temperature rating of the insulation around the wire.

DC Cabling DC cabling includes all of the wires and connectors between the batteries, the DC disconnect and over-current protection device, and the inverter/charger. All installations require multi-strand insulated cables as well as disconnect and over-current devices. DC cables come in a large assortment of sizes, indicated by the AWG notation or the kcmil (MCM) notation. AWG refers to the American Wire Gauge standard, while kcmil refers to thousands of circular mils. Under the AWG standard, a larger



gauge number indicates a smaller wire diameter (for example: a 2 AWG cable is smaller than a 00 AWG cable). Under the MCM standard, a larger number indicates a larger cable (example: a 350 MCM cable is larger than a 250 MCM cable). Wire size is usually marked on the cables for sizes this large.

DC Disconnect and Over-Current Device The DC power supply leading to the inverter/charger must also be equipped with a disconnect and over-current device. These usually consist of a circuit breaker or a fuse and disconnect. Do not confuse AC circuit breakers with DC circuit breakers. They are not interchangeable. The Prosine inverter/charger requires a DC over-current device rated at least 300-amps. This can be a fuse in the positive DC cable, or a DC breaker in the same line.

Batteries Every Prosine inverter/charger system requires a deep-cycle battery or group of batteries that provide the DC current that the inverter/charger converts to AC current. There are different types and sizes of batteries, many of which are discussed in "[Section 7: Batteries](#)". Automotive-type batteries are not recommended for use with the Prosine inverter/charger, except for temporary emergency use only. The Prosine inverter/charger utilizes 12-volt or 24-volt battery banks, depending upon the model purchased. Read the label on the side of the inverter/charger to determine the correct battery voltage to use.

Generator When a generator is included as a secondary AC power source, a manual or automatic AC source selector switch must be installed ahead of the circuit breaker in the line leading to the inverter/charger. In marine and RV applications, the AC cabling from the generator to the circuit breaker must be composed of stranded cable. Both the Line (Hot) conductor and the Neutral conductor must be protected by circuit breakers. If the generator is the only AC shorepower source, no source selector switch is needed.

Ground Fault Circuit Interrupters (GFCIs) A GFCI is a device that de-energizes a circuit when a current to ground exceeds a specified value that is less than that required to blow the circuit breaker. GFCIs are intended to protect people from electric shocks.

Installations in marine and recreational vehicles may require GFCI protection of branch circuits connected to the AC output of the inverter/charger. In addition, electrical codes require GFCI protection of certain receptacles in residential installations.

While the true sine wave output of the Prosine inverter/charger is equivalent to the waveform provided by utilities, compliance with UL standards requires that Xantrex test and recommend specific GFCIs. Xantrex has tested the GFCI-protected 15A receptacles listed in [Table 2](#) and found that they function properly when connected to the AC output of the Prosine 2.0.

Table 2: GFCI Models

Manufacturer	Model Number
Leviton	6599/701
Leviton	6598/722 (with polarity check and indicator light)
Eagle	Shock Sentry
Pass & Seymore	1591-WCN
Hubbell	GF252GYA
Bryant	GFR52FTI
Bryant	GFR82FTI

Tools and Materials Required

You will need the following tools and materials to properly install the Prosine inverter/charger:

- ☐ Wire insulation stripper
- ☐ Mounting screws or bolts (#12 or #14)
- ☐ #2 (1/4-inch) flat blade screwdriver
- ☐ Small Phillips screwdriver
- ☐ 17mm or adjustable wrench for DC terminals
- ☐ AC cable sized appropriate for load and application
- ☐ Two one-inch AC cable strain-relief clamps
- ☐ DC cable, sized appropriate for load and application
- ☐ Lugs or terminals for your DC cables and appropriate tools
- ☐ AC and DC disconnects and overcurrent protective devices

Where to Install the Prosine Inverter/Charger

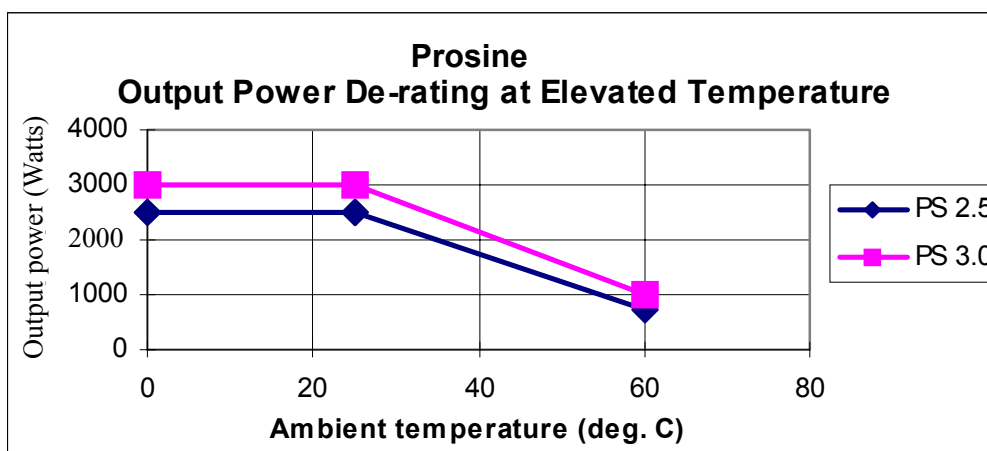
Install the Prosine inverter/charger only in locations that are dry, cool, well ventilated, close to batteries and loads, and protected from the weather. These terms are described below:

Dry—Do not allow water or other fluids to drip or splash on the Prosine inverter/charger. **Do not mount the Prosine inverter/charger in an area subject to splashing water or bilge water.**

Cool—Normal ambient air temperature should be between 32°F (0°C) and 77°F (25°C)—the cooler the better.

Ventilated—For the Prosine 2.5, allow at least 5 inches (13cm) clearance at the bottom of the unit for air flow, 3 inches (8cm) on each side, and 1.5 inches (4cm) at the top. For cooling purposes, the volume of the enclosure is not as important as the overall supply of air. Do not allow the ventilation openings on the back and top of the unit to become obstructed. When mounting in a closed compartment, provide a fresh-air intake opening directly to the fans (located behind the unit) to assure a good supply of cooling air. The Prosine 3.0 must be mounted on top of the brackets that are provided with it to allow adequate airflow to the cooling fans.

The figure below illustrates the effect of inadequate ventilation on the output power of the Prosine 2.5 and 3.0 inverter/chargers. As with all inverters, the amount of continuous power that the Prosine inverter/chargers can deliver without overheating is limited by the ambient temperature. They will operate and deliver their continuous power ratings at higher temperatures, but the ambient temperature as well as the input voltage from the battery limits the extent to which they can do this. The following curve illustrates the relationship between rated power output and ambient temperature. Operating the unit in conditions outside the power and temperature limits will result in thermal shutdown and/or significantly decreased performance. In addition, operation in this range is outside the ratings covered by the regulatory approvals of the products.



WARNING Explosion hazard: This equipment contains components which tend to produce arcs or sparks. To prevent fire or explosion do not install the Prosine inverter/charger in compartments containing batteries or flammable materials or in locations which require ignition protected equipment. This includes any space containing gasoline-powered machinery, fuel tanks, or joints, fittings, or other connection between components of the fuel system.

Safe—Do not install the inverter/charger in the same compartment as vented (non-sealed) batteries or in any compartment capable of storing flammable liquids such as gasoline. The Prosine inverter/charger is not ignition protected. Do not install it in an engine or gas tank compartment or any other location where ignition protected equipment is required. These gases are very corrosive and prolonged exposure will damage the Prosine inverter/charger.

Close to batteries and the AC distribution box—Avoid excessive cable lengths, which reduce input and output power due to wire resistance. Use the recommended wire lengths and sizes.

Protected from battery acid—Never allow battery acid to drip on the Prosine inverter/charger or its wiring when reading specific gravity or filling the battery.

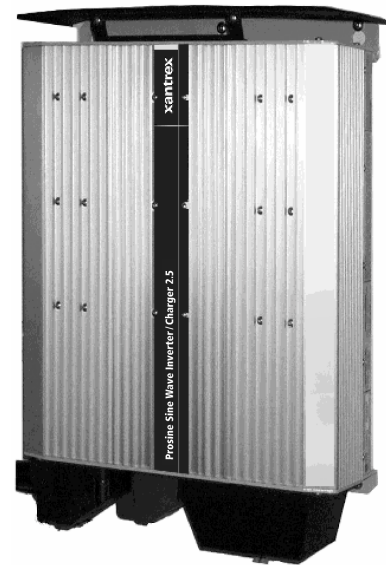
Mounting the Prosine Inverter/Charger

The inverter must be mounted on a vertical surface as shown. Before mounting the Prosine inverter/charger, test the chosen location for adequate space around the unit to allow for connections, ventilation and access to configuration DIP switches. Mounting hardware should be corrosion resistant and #12 or #14. Your mounting system should be able to support three times the weight of the Prosine inverter/charger, which weighs 32 pounds (14.5kg).

The more clearance for ventilation around the unit, the better the performance. Allow at least 5 inches at the bottom, 3 inches on each side, and 1.5 inches at the top for ventilation. For better ventilation, route a fresh-air supply through the bulkhead near the fans. This fresh-air supply must be baffled or otherwise constructed to prevent rain or spray from entering the unit.

Mount the Prosine inverter/charger on a vertical surface (such as a wall or bulkhead) using the mounting holes provided, with the DC and AC wiring connections at the bottom. Mark the location of the holes on the mounting surface. Use all six mounting holes. If you are installing a Prosine 3.0, you must use the mounting brackets provided with the unit to allow for sufficient air circulation. The mounting holes on these brackets are spaced 16 inches apart to align with wall-stud spacing.

Attach the vent cover/drip shield to the top of the Prosine inverter/charger after securing the unit. The screws for attaching this cover can be found already in the bracket holes. Remove the screws, place cover in the slots and align holes, then replace the screws.



AC Cabling

AC wiring must be sized to match the current rating of the AC breakers you provide on the input and output AC circuits in accordance with the electrical codes or regulations applicable to your installation. The input and output circuits to and from the inverter/charger must be protected with a maximum 30-amp circuit breaker. The output branch circuit breaker size is determined by the load that will be placed on the circuit. Determine the output load, then select the appropriate circuit breaker size, the appropriate wire size and type. The following table is based on the U.S. National Electrical Code and the Canadian Electrical Code. There may be other codes and regulations applicable to your installation.

Recommended Wire Size vs Breaker Rating

Breaker Size	10A	15A	20A	30A
Min Wire Size	14AWG	14AWG	12AWG	10AWG

AC and DC Wiring Separation

Do not mix AC and DC wiring in the same conduit or panel. Where DC wiring must cross AC or vice-versa, make the wires at the crossing point 90° to one another. Consult code for details of DC and AC wiring in vicinity to one another.

AC Output Neutral-to-Ground Bonding

The neutral (common) conductor of the AC output circuit of the Prosine inverter/charger is automatically connected (bonded) to the input safety ground during inverter operation. This conforms to National Electrical Code requirements that separately derived AC sources (such as inverter and generators) have their neutral conductors tied to ground in the same way that the neutral conductor from the utility is tied to ground at the AC breaker panel. When AC utility power is present and the Prosine inverter/charger is in charger mode, this connection (neutral of the Prosine inverter/charger's AC output to input safety ground) is not present so that the utility neutral is only connected to ground in one place, at your AC input breaker panel, as required. Your AC load distribution panel must not bond the neutral to ground. Many sub-panels have a bonding screw designed to allow the installer to bond or un-bond the panel's neutral.

AC Disconnect and Overload Protection

AC Input: The circuit breaker or fuse used to protect the inverter/charger must be rated max. 30A, and must be approved for use on 120VAC branch circuits. The wire size used between the breaker and the Prosine inverter/charger input must be sized to match the circuit breaker, in accordance with the electrical codes or regulations applicable to your installation. The "AC Service Rating" setting of the Prosine inverter/charger must also be set to match the size of the breaker provided.

AC Output: The circuit breaker or fuse used must be rated max. 30-amp, and must be approved for use on 120V AC branch circuits. The wire size used between the Prosine inverter/charger output and the breaker, and between the breaker and your loads, must be sized to match the circuit breaker's rating, in accordance with the electrical codes or regulations applicable to your installation.

Disconnect Devices: Since circuit breakers can be turned off, they will also meet the requirement for a disconnect device. As an alternate, use separate fuses and disconnect switches. Note that the required disconnect device is not intended for disconnection under load, it is only meant to be a way to isolate the Prosine inverter/charger from the input and output circuits.

DC Cabling

DC wiring includes the positive and negative conductors from the battery(s) as well as a disconnect device and over-current protection. Locate your battery(s) as close as possible to your inverter (or vice-versa) to reduce energy losses caused by cable resistance. Cables should be as short as possible (5-10 feet) and large enough to handle the required current, in accordance with the electrical codes or regulations applicable to your installation. The connectors on the inverter/charger are designed to fit up to 500 MCM crimp-on ring terminals (either AMP or ILSCO) or box connectors.

Do not route your DC wiring through an electrical distribution panel, battery isolator, or other device that will add additional voltage drops.

DC Over-Current Protection

Installation codes require over-current protection for battery cables, installed as close as possible to the battery, in the positive side of the circuit. The current rating of this DC fuse or circuit breaker must be large enough to allow the Prosine inverter/charger to operate your loads, but if the rating is too high, electrical codes will require you to use larger DC cables than you would otherwise have to. The fuse or circuit breaker must be rated for use on DC circuits. Fuses or circuit breakers rated only for AC service are not suitable for use on DC circuits and may pose a hazard. The wire size used between the inverter/charger and the fuse or circuit breaker must be sized to match the fuse or circuit breaker's current rating, in accordance with the electrical codes or regulations applicable to your installation.

The following table outlines the **minimum** DC cable size and **maximum** fuse size required for some common installation codes. There may be other codes and regulations applicable to your installation.

	Marine Installation See footnote a.		RV Installation See footnote b.		Residential Installation See footnote c.	
Model	Wire Size	Fuse Size	Wire Size	Fuse Size	Wire Size	Fuse Size
Prosine 2.5/12	# 2/0 AWG	350A	# 3/0 AWG	350A	350 MCM	350A
Prosine 2.5/24	# 4AWG	175A	# 3 AWG	175A	# 2/0 AWG	175A
Prosine 3.0/12	# 3/0AWG	450A	# 4/0 AWG	450A	500 MCM	400A
Prosine 3.0/24	# 2AWG	250A	# 2 AWG	200A	# 3/0 AWG	200A

a. Based on ABYC Recommended Practice E-9, 75C wire, no conduit.

b. Based on the NEC, NFPA 70, Article 551, 90C wire.

c. Based on NFPA 70, Article 240 and 310, 75C wire, wire in conduit. If your installation code allows you to wire in free air, then the following table applies. NOTE: This table applies to residential installations only.

Model	Wire Size	Fuse Size (Amps DC)
Prosine 2.5/12	# 3/0 AWG	350A
Prosine 2.5/24	# 2 AWG	175A
Prosine 3.0/12	250 MCM	450A
Prosine 3.0/24	# 1 AWG	200A

What the above tables do not take into account, however, is voltage drop associated with greater cable lengths. It is always best to use oversize cables to reduce voltage drop and improve inverter performance.

For best performance, the wire sizes shown in the table below will allow the Prosine to operate properly. Please note that regulatory requirements may not allow you to use the wire size given for 5 foot and 10 foot distances. Also, increasing the wire size will provide longer inverter performance.

Recommended DC Cable Sizes For Proper Operation

Cable Length in Feet (from invert/charger to battery)	5 ft	10 ft	15 ft	20 ft	30 ft
PS 2.5 12-volt	2/0 AWG	250MCM	350MCM	500MCM	750MCM
24-volt	2 AWG	2/0 AWG	4/0 AWG	250MCM	350MCM
PS 3.0 12-volt	3/0 AWG	350MCM	500MCM	750MCM	1000MCM
24-volt	1 AWG	3/0 AWG	250MCM	350MCM	500MCM

DC Disconnect

If a DC circuit breaker is used to provide over-current protection for the battery circuit, it will also meet the requirement to provide a disconnect. If a DC fuse is used to provide over-current, however, a separate DC disconnect switch or a combined “fusible disconnect” will be required. As with the AC disconnects, the DC disconnect is not intended for disconnection under load.

Battery Cable Routing

When a distance separates positive and negative battery cables, they have much more inductance than if they are close together, and when the high current drawn by the inverter is flowing, strong magnetic fields are generated. These fields may interfere with sensitive equipment, so it is very important to route the positive and negative cables in parallel, as close together as possible.

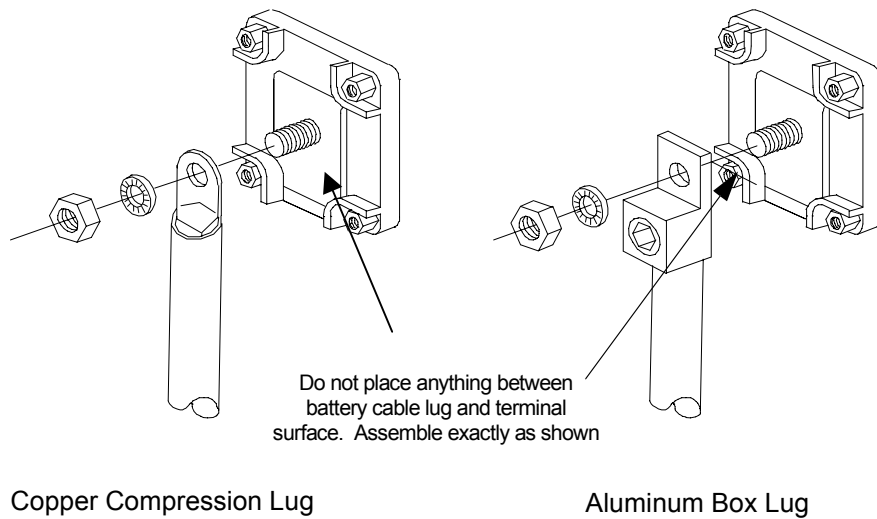
DC Cabling Connections

Color-code your battery cables with colored tape or heat shrink tubing. The standard is **red** for positive (+) and **black** for negative (–).

Use crimp-on ring terminals or set-screw type pressure connectors (i.e., “box lugs”).

For marine installations, you must use a wire protector between the set-screw and stranded wire.

If you are using crimp-on terminals, use the manufacturer’s recommended crimping tool to install them.



DC Cabling Procedure



CAUTION Reversing the positive and negative battery cables will damage the Prosine inverter/charger and void your warranty. This type of damage is easily detected. Before making the final DC connection, check cable polarity at both the battery and the inverter/charger. Follow the procedure outlined below to make your DC cable connections. Observe the polarities carefully while performing the installation, and route both cables before making any connections.

1. Cut the cables to the correct length with enough insulation stripped off to properly install the lugs.
2. If using compression lugs, attach the terminals to both cables using the crimp tool recommended by the manufacturer of the ring terminals. There must be no stray wire strands protruding from the terminal. If using box lugs, attach the lug to the Prosine first, then insert the wire and tighten the set screw to the torque recommended by the lug manufacturer.
3. Connect the positive cable to the positive battery connector (stud) on the Prosine inverter/charger and tighten to a torque of 216–240 inch-pounds (24–27Nm) with a wrench. Test that the cable is secure.
4. Install an inline fuse between the Prosine inverter/charger and the battery. Refer to the tables to determine the fuse sizes required. This protects your battery and wiring in case of accidental shorting. The fuse and fuse holder must be installed in the positive side of the DC circuit, as close as possible to the batteries.
5. Connect the cable from the POSITIVE connector on the Prosine inverter/charger to the POSITIVE (POS +) terminal on the battery fuse.
6. Connect the DC NEGATIVE cable to the NEGATIVE (NEG -) terminal on the battery.
7. Connect the DC NEGATIVE cable to the negative terminal on the inverter/charger. This connection should be the last connection made. A spark when making this final connection is normal.

8. If you are using the remote temperature sensor, plug it into the temperature sensor jack (BATT TEMP) on the side of the Prosine inverter/charger chassis. Route the sensor wire safely to the battery location and mount the sensor's ring tongue connector directly on the NEGATIVE battery post. Do not mount the sensor between the DC negative power cable and the negative battery terminal.
9. For residential installations, a DC wiring enclosure is required to cover DC connections and cables. Contact Xantrex or your distributor for this part. For other installation, install the red and black DC terminal covers over the positive and negative terminals, respectively.

DC Grounding

The Prosine inverter/charger has a lug on the rear panel labeled Chassis Ground. This lug is used to connect the chassis of the inverter/charger to your DC ground as is required by regulations for some installations. Depending on where the inverter/charger is being installed, follow the instructions below that correspond to your installation location.

Recreational Vehicle Installations

Use #8 AWG or larger copper wire (green if insulated) and secure it to the Chassis Ground Lug as well as the grounding point in your vehicle (usually the vehicle chassis).

Residential Installations

The chassis of the Prosine inverter/charger must be connected to the system's DC grounding point. Typically wire is #2 AWG (12-volt models) or #6 AWG (24-volt models) copper wire. Consult your codes.

Marine Installations

The Chassis Ground Lug should be connected to the boat's Engine Negative bus or DC Grounding bus. The ABYC recommends the following, based on 75 C wire:

- PS2.5/12: # 1/0 AWG
- PS3.0/12: # 2/0 AWG
- PS2.5/24: # 3 AWG
- PS3.0/24: # 1 AWG

Connecting the Battery Temperature Sensor

Mounting Options

You can mount the battery temperature sensor (BTS) in one of two ways:

- Mounting the sensor to the negative battery post allows the internal battery temperature to be sensed and provides the most accurate results.

- Attaching the sensor to the side of the battery using the self-adhesive backing also provides good results in most situations.

WARNING: Energy and Explosion Hazard

Review the “[Important Safety Instructions,](#)” on page i.

Mounting to the Negative Battery Terminal

To mount the sensor on the negative battery terminal:

See [Figure 5](#).

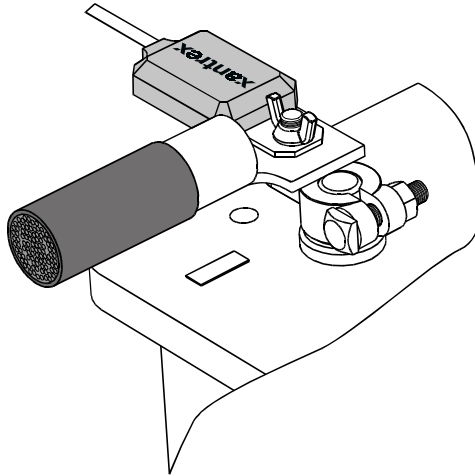


Figure 5. BTS Attached to Negative Battery Terminal

1. Decide which battery is to be monitored.
When all battery banks are located in the same compartment, select the battery that requires the most frequent charging (in a boat or an RV, this is usually the “house” battery). Where a battery is located in a separate compartment from other batteries, and where temperatures are constantly high (as in an engine room), it is a good idea to monitor this battery to keep it from being overcharged as a result of its constant high temperature. In this situation, the cooler battery bank will be slightly undercharged since it will be at a lower temperature than the battery being monitored, but this procedure will prolong the warmer battery’s life.
2. Switch off all devices operating from the battery, or open the battery switch, if present, to disconnect the battery.
3. If the charger has been operating, wait ten minutes for any explosive battery gasses to dissipate.
4. Remove the nut that secures the existing negative DC wire to the battery.
5. Move or reorient the existing negative DC wire so there is a flat surface on which to seat the battery temperature sensor mounting plate. You may need to bend the ring terminal and/or wires downward to allow the sensor to seat on the top surface of the upper ring terminal.
6. Mount the sensor directly on top of the negative DC wire terminal, as shown in [Figure 5](#), and tighten the terminal nut firmly.

7. Check that the sensor and all wires are fastened securely.
8. Turn the battery switch on again (if you opened it in step 2).
9. Route the sensor cable to the inverter/charger and plug it into the BATTERY TEMP jack. Secure the cable along its length.

NOTE

In this procedure, you must install the DC cable on the battery terminal first. Then the sensor is installed on top of the DC cable. This sequence is required to provide the best connection to the battery and to thereby ensure correct performance of the sensor.

Mounting to the Side of the Battery Case

To mount the sensor on the battery case

See [Figure 6](#).

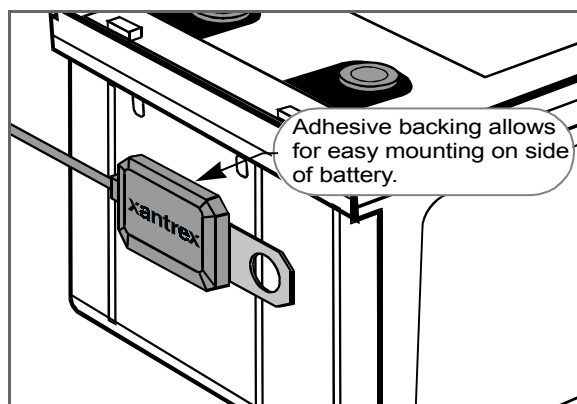


Figure 6. BTS Attached to Battery Case

1. Select the battery to be monitored (see step 1 in the preceding procedure).
2. Select a side suitable for attaching the sensor.
The surface where the sensor is to be mounted must be flat and free from reinforcing ribs or other raised features. As well, this surface must be in direct internal contact with battery electrolyte, so do not install the sensor on a side near the top of the battery or on the battery's top surface.
3. Clean the selected area thoroughly to remove any oil or grease that could prevent the sensor from adhering to the battery case, and allow the battery case to dry thoroughly.
4. Peel the protective backing from the self-adhesive strip on the rear of the sensor.
5. Press the sensor firmly against the clean side of the battery to fix it in place.
6. Route the sensor cable to the inverter/charger and plug it into the BATTERY TEMP jack. Secure the cable along its length.

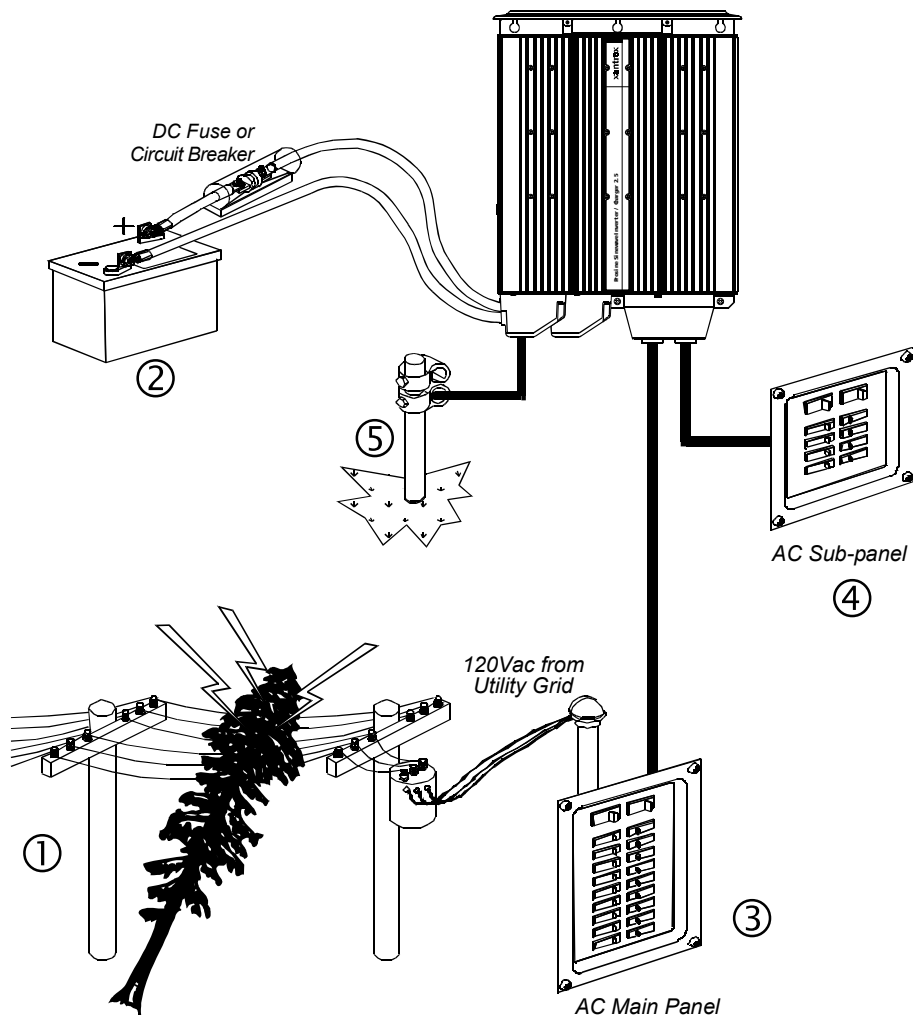
Typical System Diagrams

Every installation is a custom-designed system. It could be a residential, solar, marine, or RV installation with an almost unlimited number of variations. The following diagrams illustrate a few typical system designs for residential, solar, and marine installations.

Residential Backup System

This diagram illustrates a typical residential backup system. This system features:

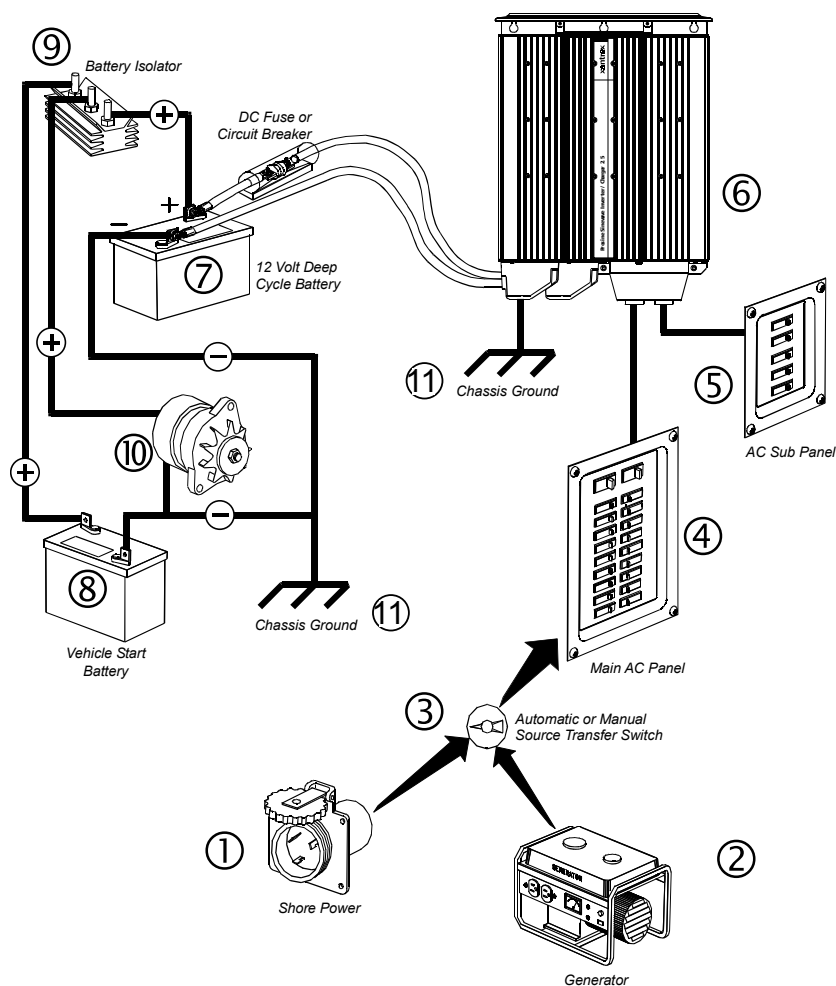
1. AC power supplied by a utility system
2. DC power supplied by a battery bank and protected by a DC fuse in the positive cable
3. A main AC distribution center that includes a maximum 30-amp circuit breaker that supplies the inverter/charger
4. A sub-panel AC distribution center with branch circuit breakers that supply only loads that run off of the inverter/charger
5. The earth ground



Recreational Vehicle System

The diagram below illustrates a typical RV system with the following components:

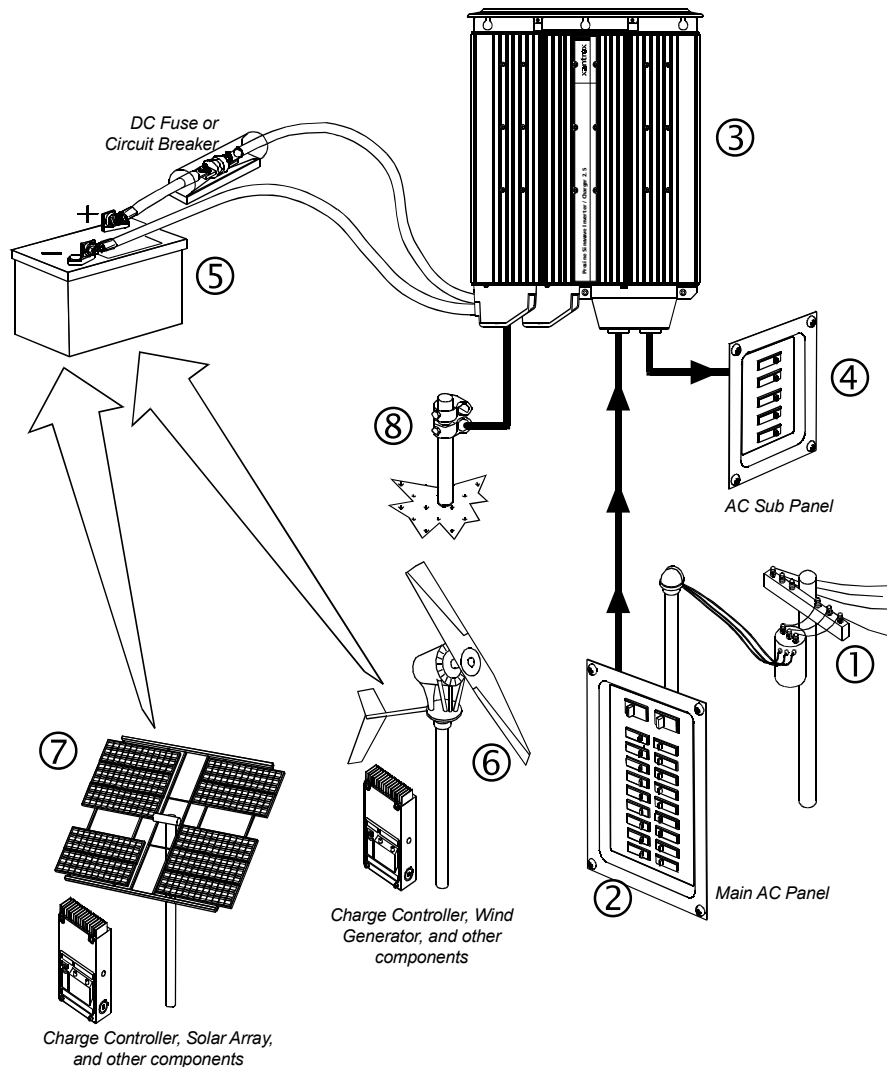
1. AC power supplied from a shorepower connector
2. AC power supplied from a generator
3. AC Source Selector switch that isolates the two AC supply sources
4. AC distribution panel that provides a 30-amp circuit breaker that feeds the inverter
5. AC sub-panel with branch circuit breakers that supply only inverter loads
6. Inverter/charger
7. DC power supplied by a house battery bank that is isolated from the vehicle starting batteries
8. Vehicle starting battery
9. Battery isolator
10. DC alternator
11. Chassis grounds for both the inverter and the DC components



Residential Solar and Wind System

This diagram illustrates a residential system that features the following components:

1. AC power from utility lines
2. Main AC distribution center with 30-amp circuit breaker feeding the inverter/charger
3. Inverter/charger
4. AC sub-panel distribution center with circuit breakers for all branch circuits
5. DC supply from dedicated battery bank
6. A wind generator providing DC charging current to the battery bank through a charge controller
7. A solar panel providing DC charging current to the battery bank through a charge controller
8. Inverter chassis ground to earth ground



Section 5: Operation

After all the AC and DC wiring has been installed, you can follow the instructions below to perform the initial startup. First, take a moment to go back over all connections and make sure they are secure and in the proper terminal. If the system utilizes flooded lead-acid type batteries instead of sealed gel-cell type, use the ACS or the DIP switch settings to change the set-up for battery type from gel-cell to flooded lead-acid. If you don't know which battery type you have, use the gel-cell setting just to be safe, and then contact the battery manufacturer.

1. Verify that the DIP switch settings are correct for your system. See [“Section 3: Configuration”](#) if you have the standard control panel, or the ACS Control Panel section if you have that.
2. Check to see that the inverter BYPASS/ON slide switch is in the BYPASS position.
3. Connect the battery cable (or close the battery disconnect switch) to complete the battery circuit. Turn the inverter BYPASS/ON slide switch to the ON position. The System Startup Default is set at the factory at INV OFF/ CHG ON. Press the Inverter ON/OFF switch on the control panel to enable the inverter. When the DC connection is completed, the inverter will begin inverting if there is an AC load and the AC shorepower has not been connected.
4. Place a load on the inverter (plug in a light or other load to an outlet the inverter is powering), and make sure it works. The inverter should run a load without AC shorepower connected (battery only).
5. If the inverter does not come on or go through the start-up, check all connections. Check the inverter's DC voltage on the positive (+) and negative (–) terminals. If the DC voltage is low or if the battery bank needs to be charged, go directly to Step 6.
6. To charge your batteries, connect shorepower to the inverter by plugging in the shorepower cord and turning on the shorepower breaker. After a few seconds delay, the utility/shorepower LED should light and the Charge LED on the front of the inverter should indicate it is charging. This indicates the charger is working properly. Any AC loads connected to the AC output should also work at this point.
The delay before connecting to the utility AC supply is the inverter sampling the shorepower to see that it is within acceptable frequency and voltage limits. This delay also allows time for a generator to spin up to a stable operating condition before the inverter/charger places a load on it.
7. Disconnect shorepower by turning the shorepower breaker off, or unplugging the shorepower. The inverter should transfer to inverter mode immediately. This will be indicated by a clicking sound as the internal transfer relays change position. The loads should continue to operate uninterrupted.



The preceding steps will complete a functional test of the inverter. If all areas pass, the inverter is ready for use. If any area fails, determine why before proceeding. [“Appendix C: Troubleshooting”](#) will help you solve problems you encounter.

Prosine Inverter Load Sense Mode

When the inverter is ON, it can be set up so that it periodically searches for the presence of a load. The unit will “sleep” if the load it detects is less than the search mode setting. This “sleep” mode shuts off much of the power control circuitry of the Prosine inverter/charger, reducing the standby current draw considerably. The Prosine inverter/charger detects the presence of a load by sending out pulses depending on user settings. Full output power is available with the detection of a load. You can set the minimum load required to start the inverter, by either changing the configuration DIP switches on the side of the chassis, or using the ACS Panel (Advanced Control System Panel). The INVERT LED will blink approximately once per second when the Prosine inverter/charger is in this search mode. There are four choices for the setting of the minimum load start power when using the chassis DIP switches (the ACS Panel offers a much wider range of load start-power settings):

<u>Setting</u>	<u>Description</u>
0 watts	Inverter always on, search mode disabled
10 watts	Set to the load rating that you want the inverter
25 watts	to power. Example Set at 50-watts, a 75-watt
50 watts	light bulb will activate the inverter; a 25-watt
	bulb will not activate inverter.

Operating Limits for Inverter Operation

Power Output: The invert mode output rating for your Prosine inverter/charger is:

Prosine 2.5 = 2500 watts or 21 amps @ 120VAC; surge to 4kw

Prosine 3.0 = 3000 watts or 25 amps @ 120VAC; surge to 4kw

The units should be able to operate all AC loads rated at or below their respective power ratings. Some high horsepower induction motors used in pumps and other motor operated equipment require very high surge currents to start and the Prosine inverter/charger may have difficulty starting these loads. If you have problems with the Prosine inverter/charger starting certain loads, ensure that battery connections are solid, DC and AC wiring is of sufficient size, and that the battery is of sufficient capacity and fully charged.

Input Voltage: The Prosine inverter/charger operates from an input voltage ranging from 10 volts to 16 volts, (20 to 32 volts on 24V models) and peak performance occurs when voltage is in the range of 12 volts to 13 volts (24 to 26 volts on 24V models) as shown in the following table.

Prosine Operating Voltage Limits

Operating Condition	Voltage Range 12-Volt System	Voltage Range 24-Volt System
Normal	10V - 16V	20V - 32V
Peak Performance	12V - 13V	24V - 26V
High Voltage Alarm		
LED On	>15.5V	>31V
Unit Shuts Down	>16V	>32V
Low Voltage Alarm		
LED Flashes	$\leq 10.5V$	$\leq 21V$
Unit Shuts Down	$\leq 10.0V$	$\leq 20V$
Unit Restarts	$\geq 12.3V$	$\geq 24.6V$

Section 6: Multistage Charging

The Prosine inverter/charger has a fully functional multistage battery charger. Any time an acceptable (within frequency and voltage parameters) AC source is presented to the unit, it will charge the batteries connected to it. When AC is present and the charger is enabled, the charger will charge the battery bank regardless of the position of the inverter's On/Off switch.

Charging Profile

The battery charger in the Prosine charges in three stages—**BULK**, **ABSORPTION**, and **FLOAT**—to provide rapid and complete charge cycles without undue battery gassing. The figure below shows how DC voltage and current change with time through the different charge stages.

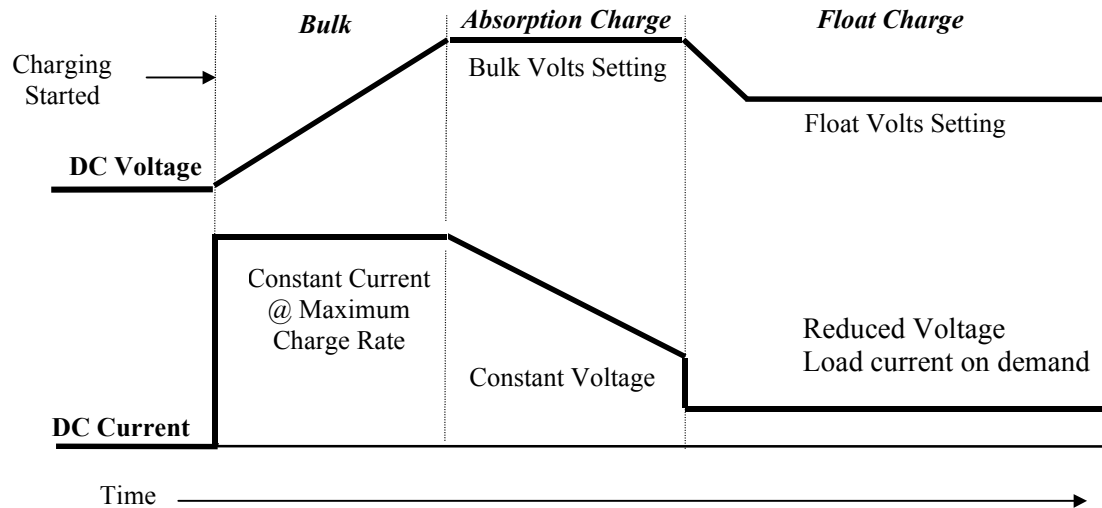


Figure 7. Three-Stage Charging Profile

Bulk Charge

In the first step, known as the *bulk charge*, the Prosine inverter/charger delivers the maximum charge current allowable given the configuration settings, that is, battery type and temperature, maximum AC input setting and battery bank size. This current is delivered to the batteries until the battery voltage approaches its *gassing voltage*—typically around 14.4 volts for 12 volt batteries and 28.8 volts for 24 volt batteries (again this voltage can vary depending on battery type and other settings). The bulk charge step restores about 75% of the battery's charge. The gassing voltage is the voltage at which the electrolyte in the battery begins to break down into hydrogen and oxygen gases. Under normal circumstances, a battery should not be charged at a voltage above its gassing voltage since this will cause the battery to lose electrolyte and dry out over time. Therefore the Prosine inverter/charger transfers to the next stage, known as the *absorption charge*.

Absorption Charge

During the absorption charge, the charging voltage is held constant near the gassing voltage and the charging current is steadily decreased. When the charging current has decreased to a predetermined

limit, based on battery size settings, charging moves on to the next stage. For flooded batteries, the absorption charge is maintained for approximately one more hour. The absorption charge stage restores the remaining 25% of the battery's charge.

Float Charge

The float charge is a maintenance mode in which the output voltage of the Prosine inverter/charger is reduced to a lower level, typically about 13.5 volts, (27 volts for 24V models) to maintain the battery's charge without losing electrolyte through gassing. Unlike many stand-alone chargers, the Prosine inverter/charger can be left connected to your battery indefinitely without risk of overcharging. When DC loads are placed on the battery, the charger will deliver currents up to the Maximum Charge Rate setting while maintaining the float voltage.

Equalization Charge

The fourth charging step, known as the *equalization charge*, is manually initiated because it is not required every time the battery is recharged. Equalization is a deliberate overcharge of the battery. Equalizing your batteries will reduce sulfation and help reach and maintain the peak capacity of the battery.

During normal charging, temperature and chemical imbalances prevent some cells from reaching full charge. These reduced capacity cells accelerate sulfation (the build up of lead sulfate on the battery plates) and decrease the ampere-hour capacity of the battery. During equalization, the battery is intentionally held above the gassing voltage. Fully charged cells dissipate the charging energy by gassing while incompletely charged cells continue to charge. The rapid gassing that occurs during equalization also helps to recondition the battery. The gassing creates a stirring action which reverses electrolyte stratification (the separation of the liquid electrolyte into layers of different acid concentrations). The stirring action also helps to break up any lead sulfate which may remain after normal charging.

An equalization charge should only be performed on vented, flooded (non-sealed or "wet") batteries and only as often as recommended by the battery manufacturer. The battery section of this manual provides further information on battery types and their charging characteristics. Refer to [“Operation in Equalization Mode,” on page 61](#) for further details.

Operation in Charger Mode



WARNING Explosion hazard: During charging, the battery may generate potentially explosive gases. Follow all the Important Safety Instructions that start on [page i](#). Ventilate the area around the battery thoroughly and ensure that there are no sources of flame or sparks in the vicinity.

Study all battery manufacturer's specific precautions such as removing or not removing cell caps while charging and recommended rates of charge. When using a non-sealed battery, before charging add distilled water in each cell until electrolyte level reaches the level specified by battery manufacturer. This helps purge excessive gases from cells. Do not overfill. For a battery without cell caps, carefully follow manufacturer's recharging instructions.

If AC power is available, upon system power-up, the unit will begin charging. If AC power is not available the charger will automatically enter into STANDBY mode. If the inverter mode is not enabled then the charger STANDBY LED will turn off after a few seconds as the unit enters low power-draw sleep mode. If the inverter mode is enabled and the unit is inverting, when AC power becomes available the unit automatically switches from inverter mode to charger mode after an 8 second delay. This delay gives the AC source time to stabilize. The Prosine inverter/charger senses the battery state and the appropriate charge is delivered to the batteries. During charging, the charging current will be indicated by the current bar graph on the Prosine inverter/charger control panel. As the battery charges and the end of the charge cycle nears, the charging current will decrease and eventually the READY LED will come on. This indicates that Prosine inverter/charger is now in Float mode and will maintain the battery's charge as long as AC is supplied to the Prosine inverter/charger.

Operation in Equalization Mode

Follow your battery manufacturer's recommendations for equalizing your batteries. "[Section 7: Batteries](#)" provides some background on different batteries. As a guide, a heavily used flooded battery may need to be equalized once per month and a battery in light duty service, every two to four months.



CAUTION Sealed lead-acid and gel batteries must NEVER be equalized. Premature battery failure will result if these types of battery are equalized. Equalization should only be performed on flooded lead-acid batteries. As a general rule, do not equalize a battery unless there are provisions to add water to the battery. Equalize mode is disabled if the Battery Type is set to GEL.

If performed too frequently, or done improperly, equalization can be hazardous to the health of your batteries. Never equalize a battery more than necessary. Always check battery fluid level before AND after equalization. Fill only with DISTILLED water. Monitor the electrolyte specific gravity (S.G.) with a hydrometer throughout the equalization.



WARNING Explosion hazard Equalization generates explosive gas. Maintain adequate ventilation to the battery enclosure during equalization.

The Prosine inverter/charger delivers a high quality charge so batteries will not need to be equalized as often as may be necessary when using a lower quality charger.

Equalization Procedure

1. Turn off or disconnect all DC loads on the battery during equalization. The voltage applied to the battery during equalization may be above safe levels for some loads and this high voltage can damage some electronic equipment. Equalization also won't be as successful if additional loads are drawing current from the batteries. Be sure to check

battery electrolyte level. Fill only with distilled water if the electrolyte level is low. Use a battery hydrometer to measure specific gravity of each cell. For lead-acid batteries that are fully charged, the reading should be approximately 1.265 (consult your battery manufacturer). Equalization is needed if one or more cells have substantially lower S.G. than the others.

2. To start the equalization charging cycle, the charger must already be in operation. With the Standard Control Panel, press and hold the CHARGER ON/OFF push-button switch on the control panel for five seconds until the EQUALIZE LED comes on. With the ACS control panel, the equalize mode must be initiated through the menu system. When the charger is waiting to enter equalization mode, the EQUALIZE LED stays lit constantly. Equalization will start when the bulk and absorption charge have finished, that is, when the battery current is less than 1% of the amp-hour setting. When the system is in equalization, the CHARGE and EQUALIZE LEDs will blink.

Even if the batteries are fully charged, it will take several minutes after the charger is first turned on for it to enter equalization mode. It takes a minimum of three minutes for the charger to move through bulk and another three minutes to go through absorption before equalization begins.

3. Monitor the battery specific gravity during equalization with a battery hydrometer. When all cells have a specific gravity of approximately 1.265, manually terminate equalization. Terminate the equalization charge by momentarily depressing the CHARGE ON/OFF push-button. As a safety feature, the Prosine will time-out and exit Equalize Mode after eight hours. If the battery specific gravity is still rising and has not yet reached the target value when the charger exits equalization, restart equalization by holding the push-button for five seconds. To cancel equalization at any time, turn charger off.
4. When equalization is finished, be sure to check battery electrolyte level. Refill with distilled water only.

Adjustable Charger Mode Settings

These settings can be changed by adjusting the DIP switches on the chassis, or by using the optional Advanced Control System which gives a finer degree of control over the setpoint adjustability. For further details on these settings and instructions for changing them, refer to “[Section 3: Configuration](#)” starting on [page 25](#).



CAUTION Incorrect settings can damage your batteries. Refer to “[Section 3: Configuration](#)”.

Temperature Compensation: Configuration DIP switches found on the side of the chassis can be set up on the Prosine inverter/charger to modify the charging characteristics depending on battery temperature. By setting the switches correctly before charging your battery, you can ensure that your batteries receive the best possible charge. The Prosine inverter/charger also has a jack for a remote battery temperature sensor which automatically adjusts the charge according to the temperature of the battery. This allows the Prosine inverter/charger to provide a more accurate temperature compensated charge.

Battery Type Selection: The DIP switch for “Battery Type” allows you to set the charge output of the Prosine inverter/charger for the charging characteristics of sealed lead acid “gel” batteries, or for the charging characteristics of conventional flooded “wet” batteries. If you can add water to your batteries, this switch should be set to the FLOODED position. If your batteries are sealed, then set this

switch to the GEL position even if they use starved-electrolyte technology rather than gelled electrolyte technology.

Battery Size Selection: Given the wide variety of potential installations, the size of the battery bank used with the Prosine inverter/charger will vary greatly. Four DIP switches on the Prosine inverter/charger chassis can be set to indicate your battery capacity and allow the Prosine inverter/charger to deliver the charging requirements to match your battery capacity.

Maximum AC Current (AC service setting): The Prosine inverter/charger has been designed so it does not overload the AC breaker to which it is connected. The Prosine inverter/charger measures the current it draws from the breaker and reduces charge current to prevent breaker overloading. Two DIP switches need to be configured on the Prosine inverter/charger to match your AC breaker.

Battery Charging Times

Charging time will depend on the capacity of your battery bank and on how deeply it is discharged. The following equation gives an approximate charging time:

$$\text{Charging time} = \frac{CAP \times DOD}{CC \times 80}$$

where:

Charging Time = Battery recharge time in hours

CAP = Battery capacity in ampere-hours

DOD = Battery depth of discharge in % (A fully discharged battery has 100% DOD)

CC = Charge current, the current output of the charger in amps. (charge current depends on battery size and breaker size settings)

Example for 12V model:

The battery bank is made up of two 8D Group size batteries with a rated capacity of 200 amp/hours each. The bank is 80% discharged (i.e. DOD = 80). The approximate charging time with the Prosine inverter/charger will be:

$$\frac{400 \times 80}{100 \times 80} = 4 \text{ hours}$$

Operating Limits for Charger Operation

Output Current: The maximum output current for the Prosine 2.5/12 is 100 amps and the Prosine 3.0/12 can deliver 120 amps. The maximum output current for the 24V Prosine 2.5/24 is 50 amps and the Prosine 3.0/24 can deliver 60 amps. The total output can be reduced by changing the battery size or maximum AC input current (breaker) selection switches.

Input Voltage: The wide input voltage range specification allows the Prosine inverter/charger to deliver a precise charge to your batteries even when incoming AC voltage is less than ideal. The Prosine inverter/charger maintains the correct charging voltage for your battery when the AC line voltage drops as low as 90VAC, or rises as high as 135VAC. A built in surge protector in the Prosine inverter/charger protects it, and your DC circuits, from surges and spikes on the AC power line.

Battery Charging and Equalization Guide

The following table lists several popular batteries by brand and type, and provides charging and equalization guidelines:

Manufacturer	Model	Flooded/ Gel	Comments
Trojan	All deep cycle flooded	Set to FLOODED	Equalize on each charge cycle to reach and maintain maximum capacity. If 100% of capacity is not required, equalize less often to reduce maintenance and increase battery life.
West Marine	All deep cycle flooded	Set to FLOODED	Equalize on each charge cycle to reach and maintain maximum capacity. If 100% of capacity is not required, equalize less often to reduce maintenance and increase battery life.
Delco	Voyager	Set to FLOODED	This is a calcium/lead type battery and requires a higher charging voltage than normal. Though performance should be good, this battery will not reach full charge without equalization. Set temperature to “Cold” and/or equalize on every charge cycle to improve performance. Stop equalization/charging when green dot appears in battery hydrometer. Shake occasionally during equalizing (if possible to do so safely) to ensure adequate mixing of electrolyte at hydrometer.
GNB Industrial	EVolyte	For Charge: GEL For Float: FLOODED	Set battery type to “Flooded” after battery reaches “Ready”. Since charging cycle of the Prosine inverter/charger does not match GNB’s recommended charge cycle the following routine can be followed every few charge cycles to maximize performance. Charge to “Ready” with battery type set to “Gel”. Set battery type to “Flooded” and equalize the battery for 45 minutes to 1 hour. Reset battery type to Gel and turn charger OFF and ON again to reset to Bulk charge mode. Battery will be ready in approximately 10 minutes.
GNB	SUNlyte	For Charge: GEL For Float: FLOODED	Can be equalized on every charge cycle to reach and maintain maximum capacity. With battery type at Flooded, equalize for a maximum of 4 hours. Manually turn off equalize if charger does not terminate equalize after 4 hours. This is the recommended charge routine for this battery as specified by GNB, but for convenience sake, this battery can be left on FLOODED for both charging and float operation with no apparent consequence.
GNB	Action Pac	Set to FLOODED	Equalize every 1 to 2 months for heavy use, 4 to 6 months for light use. Battery is fully charged at a specific gravity of 1.265. If battery is not reaching full charge, equalize more often or set to “Cold” temperature setting when charging. “Warm” temperature setting (or optional remote sensor) must be selected when battery is at float.

GNB	Stow-away	Set to FLOODED. Set to Cold for all ambient temps	Battery is fully charged at a specific gravity of 1.285. This is a calcium/lead type battery and requires a higher charging voltage than normal. If performance is poor, this battery will likely need to be equalized on every charge cycle. It is very important to check electrolyte level regularly when equalizing on every charge cycle. Set battery size 20% lower than actual battery capacity.
Motomaster	Nautilus	Set to FLOODED. Temperature switch should be set one setting higher.	Fully charged at a specific gravity of 1.265 - 1.280. Equalize on every charge cycle to maximize capacity and performance.
Hawker Energy/Gates	Genesis	Set to FLOODED	Do not Equalize.
Optima	Yellow Top	Set to GEL	Do not Equalize.
Johnson Controls	Dynasty: Gel, GC Series, AGM, U131	Set to GEL	Do not Equalize. The “Gel” setting should give you the best performance with your batteries. However, if you suspect your batteries need equalizing, charge them once using the “Flooded” setting. Set back to Gel when batteries return to “Ready”.
Sonnenschein	Prevailer	Set to GEL	Do not Equalize.
West Marine	SeaGel	Set to GEL	Do not equalize.
Exide	Marine/ Deep Cycle/ Golf Cart	Set to FLOODED. Temperature switch should be set one setting higher.	Fully charged at a specific gravity of 1.265 - 1.280. Equalize on every charge cycle to maximize capacity and performance.
Exide	Gel	Set to GEL	Do not equalize.
Ramcar	Flooded Type	Set to FLOODED	This battery performs poorly with Xantrex charging products. Try setting to “Cold” for all ambient temperatures if battery does not charge. Try equalizing on every charge cycle. Full charge may take 2 or more equalization charge cycles.

Section 7: Batteries

This section of the manual is included to help you better understand the factors involved with battery charging, care, and maintenance, by discussing the physical make-up and characteristics of chemical storage batteries. This is not intended to be an exhaustive discussion of battery types, but simply a guideline. The manufacturer of each specific battery is the best authority as to its use and care.

Batteries come in different sizes, types, amp-hours, voltages and chemistries. It is not possible here to discuss all aspects in detail. However, there are basic guidelines you can follow that will help in battery selection and ensure that your batteries are better maintained than the majority.

Terminology

A description of battery charger operation requires the use of terms with which you may not be familiar. The following terms appear in the description of batteries and battery charger operation.

Electrolyte Typically a mixture of water and sulfuric acid, it is commonly referred to as battery acid.

Plates Originally made of lead, now fabricated from lead oxide. Plates connect to the battery terminals and provide a structure for the chemicals that create current. There are several plates in each cell, each insulated from the other by separators.

Sulfating As a battery discharges, its plates become covered with lead sulfate. During recharging, the lead sulfate leaves the plates and recombines with the electrolyte. If the lead sulfate remains on the plates for an extended period of time (over two months), it hardens, and recharging will not remove it. This reduces the effective plate area and the battery's capacity. Equalization helps reduce sulfation on flooded batteries.

Stratification Over time, a battery's electrolyte (liquid) tends to separate. The electrolyte at the top of the battery becomes watery while at the bottom it becomes more acidic. This effect is corrosive to the plates. Equalization helps reduce stratification.

Deep Cycle A deep cycle occurs when a battery is discharged to less than 50% of its capacity (50% depth-of-discharge). A deep cycle battery is one that is intended to be repeatedly, deeply discharged and charged.

Temperature Compensation Optimal battery charging voltage is temperature dependent. As ambient temperatures fall, the proper voltage for each charge stage needs to be increased. A battery temperature sensor automatically re-scales charge-voltage settings to compensate for ambient temperatures. The compensation slope based on cell voltage is -2.17mv per degree Fahrenheit per cell (30mv per degree Celsius) for lead-acid batteries.

Types

There are two principal types of batteries: starting and deep-cycle. There are several different types of battery chemistries including flooded lead-acid, nickel-iron (NiFe), nickel-cadmium (NiCad), alkaline, and gel-cell just to name a few. Batteries are either sealed or vented. However, there are even different kinds of these batteries. This section explains some of the differences between the different lead acid batteries to help you choose a battery which best suits your needs.

Your Prosine inverter/charger is designed to be used with deep-cycle, lead-acid batteries. These batteries are designed for deep discharge service where they will be repeatedly charged and discharged. This type of battery is often labeled as a marine, recreational vehicle, or golf cart battery. Xantrex recommends you use one or more of these batteries separated from the starting battery of your vehicle or boat with a battery isolator.

Starting Batteries

Starting batteries are designed for high cranking power, not deep discharge cycling. Do not use them with your inverter. They do not hurt the inverter but they simply will not last long in a deep-cycle application. The way they are rated should give a good indication of their intended use: “Cold Cranking Amps” is a measure of the amperage output of a starting battery.

Starting batteries use lots of thin plates to maximize the surface area of the battery. This allows very high starting current but allows the plates to warp when the battery is cycled. The most familiar lead-acid battery is probably the starting battery in your automobile. An automotive starting battery is designed to deliver a large amount of current for a short period of time (so it can start your engine). Only a small portion of the battery’s capacity is used when starting the engine and it is quickly recharged by the running engine. It is not designed for repeated charge-discharge cycles where the battery is almost completely discharged and then recharged. Starting batteries used in this kind of deep discharge service will wear out rapidly.

Deep-Cycle Batteries

Deep-cycle batteries are best suited for use with inverters. They are designed to have the majority of their capacity used before being recharged. Available in many sizes and types, the most common type is the non-sealed, liquid electrolyte “flooded” battery used in boats and motor homes. Non-sealed types have removable battery caps. The caps should be removed at least monthly to check the level of electrolyte. When a cell is low, only distilled water should be added. The electrolyte level should be checked monthly and topped up if needed after recharging.

The many different types of deep cycle lead acid batteries can be grouped into four categories: flooded (or wet), sealed flooded (“maintenance free”), recombinant flooded (often “starved electrolyte”), and gel batteries.

Another popular and inexpensive battery of this type is the “golf car” (T-105 or CG220) battery. Rated at about 220 amp-hours, these six-volt batteries can be connected in series to produce 12- or 24-volt battery banks, and discharged repeatedly to 80% of their capacity without being damaged. This is the minimum quality of battery that should be used with the Prosine inverter in normal applications.

Some systems use the L16 type of battery. These are 6-volt batteries rated at 350 amp-hours and are available from a number of manufacturers. They are 17 inches (430mm) in height and weigh up to 130 pounds (60kg) each—which may be troublesome in some installations.

Type 8D batteries are available in either cranking or deep-cycle construction. The deep-cycle versions are 12-volt batteries rated at 200 amp-hours or so. Since they are most commonly used to start truck engines, you should make sure you purchase the deep cycle version, not the cranking version. Type 4D batteries are very similar in construction, but somewhat smaller (about 170Ah).

Sealed Gel Cell

Another type of deep-cycle battery construction is the sealed gel-cell. They don't use removable battery caps. The electrolyte is in the form of a gel rather than a liquid. The sealed construction allows the batteries to be mounted in any position without spilling. The advantages are no maintenance (to the battery itself—the system will still require routine maintenance), long life (800 cycles claimed) and low self-discharge. The disadvantages are high initial cost and the possibility of damage from overcharging.

While there are many manufacturers of quality flooded batteries, there are only a few manufacturers of suitable gel-cells. Don't confuse gel batteries with maintenance free batteries. The latter is typically a standard liquid electrolyte type battery without caps for adding water, and if the electrolyte gets low, you replace the battery.

AGM (absorbed glass mat) batteries are similar to gel-cells and deep-cycle types may be used in inverter applications.

Environment

For long life and good performance, batteries need to be located in protected, ventilated enclosure insulated from extremes in temperature.

Location

Batteries should be located in an accessible location with access to the battery caps and terminals. At least six inches of clearance above is recommended. They must be located as close as possible to the inverter, but can not limit the access to the inverter and the inverter's over-current protection device. Do not locate the inverter in the same space as the batteries, unless the batteries are of the sealed gel-cell type.

Enclosures

Batteries must be protected inside a ventilated enclosure. The enclosure should be ventilated to the outdoors from the highest point to prevent accumulation of hydrogen gasses released in the charging process. An air intake should also be provided at a low point in the enclosure to allow air to enter the enclosure to promote good ventilation.

Temperature

The effective capacity of a battery is reduced when cold. This phenomenon is more significant with lead-acid type batteries compared to alkaline types. When the internal temperature of a lead-acid battery is 32°F (0°C) the capacity can be reduced by as much as 50%. This effectively reduces the size of the system's "gas tank", requiring more frequent "refueling" by the charger. This should be considered when designing the system. If extremely cold temperatures are expected at the location of a system, a heated equipment room should be considered.

If the system is located in an unheated space, an insulated enclosure is highly recommended for the batteries. During the charging process, the batteries release heat due to the internal resistance of the battery. If the batteries are insulated, the heat can be kept in the batteries to keep them warmer. This will substantially increase the performance of the system.

Insulated battery enclosures also ensure that the temperatures of the individual battery cells are more consistent, preventing unequal charging which can cause battery failure (some cells will be overcharged while others are undercharged).

The batteries should also be protected from high temperatures $>20^{\circ}\text{C}$ (70°F). High temperatures can be caused by high ambient temperatures, solar heating of the battery enclosure, or heat released by a closely located engine or generator. High battery temperatures result in short battery life and should be avoided by ventilating the enclosure and reducing the external heat sources by shading and insulation.

Battery Bank Sizing

Just as important as the type of battery selected for use with your Prosine inverter/charger is the battery size or capacity. The batteries are the most important part of your system, so we recommend you purchase as much battery capacity as possible. A large battery will extend running time and ensure your inverter/charger delivers full rated surge. Your inverter/charger can be configured to work with batteries from 50Ah (120 reserve minutes) to 2000Ah (4800 reserve minutes).

There are a number of different standards for rating battery energy storage capacity. Automotive and marine starting batteries are normally rated in cranking amps. This is not a relevant rating for continuous loads like an inverter. Deep cycle batteries use a more suitable rating system, either “amp-hours” (“Ah”) or “reserve capacity” in minutes. Battery reserve capacity is a measure of how long a battery can deliver a certain amount of current—usually 25 amps. For example, a battery with a reserve capacity of 180 minutes can deliver 25 amps for 180 minutes before it is completely discharged. Amp-hour capacity is a measure of how many amps a battery can deliver for a specified length of time—usually 20 hours. For example, a typical marine or RV battery rated for 100 amp-hours can deliver 5 amps for 20 hours (5 amps \times 20 hours = 100 amp-hours). This same battery can deliver a higher or lower current for less or more time, limited approximately by the 100Ah figure (e.g., 50A for 2 hours, or 200A for 1/2 hour), but usually the capacity figure given is only accurate at the specified rate (20 hrs.)

The minimum battery size you can use with the Prosine inverter/charger is 50Ah. However, you can expect performance to suffer with such a small battery. Even if your battery is in excellent shape and is fully charged, you will likely experience poor surge power performance and unsatisfactory operating time with anything but a small AC load. Xantrex recommends a minimum battery size of 200Ah for moderate loads ($<1000\text{W}$) and greater than 400 Ah for heavy loads.

Estimating Battery Requirements

To determine the proper battery bank size, it is necessary to compute the number of amp-hours that will be used between charging cycles. When the required amp-hours are known, size the batteries at approximately twice this amount. Doubling the expected amp-hour usage ensures that the batteries will not be overly discharged and extends battery life. To compute total amp-hours usage, the amp-hour requirements of each appliance that is to be used can be determined and then added together, or the watt-hours can be totaled and converted to amp-hours.

Start with the nameplate ratings of your appliances. If the wattage is marked on the appliance, you can use that number directly; otherwise, multiply the marked voltage and amperage: $\text{WATTS} = \text{VOLTS} \times \text{AMPS}$. Once the AC wattage drawn from the inverter is known, multiply that by the length of time the appliance will be used to determine the energy the load will require: $\text{WATT-HOURS} = \text{WATTS} \times$

HOURS. This can then be easily converted to an estimate of the battery amp-hours that the appliance requires:

BATTERY AMP-HOURS USED = AC WATT-HOURS / 10 (for a 12-volt battery), or

BATTERY AMP-HOURS USED = AC WATT-HOURS / 20 (for a 24-volt battery)

For example, a 100W light bulb that is used for 4 hours will use 400 watt-hours (Wh) and the inverter will consume approximately 40Ah from a 12V battery, or 20Ah from a 24V battery.

Another useful rule of thumb is that the current drawn from the battery can be estimated from the AC output watts by using these same factors (10 for 12V systems, 20 for 24V systems). For example, when running an 800W microwave oven, the inverter will draw approximately 800 divided by 10 = 80A from a 12V battery.

Motors are normally marked with their running current rather than their starting current. Starting current may be three to six times running current. The manufacturer's literature may provide more accurate information than the motor nameplate. If large motors will be started, you may need increase the battery size to allow for the high start-up demand.

Battery Bank Sizing Example & Worksheet

The following battery sizing example illustrates a typical calculation, assuming an opportunity to charge the batteries every three days:

Table 3: Battery Sizing Example

Appliance	(A) Power Consumption	(B) Operating Time per day	Daily watt- hours needed for this appliance (= A x B)
<i>TV & VCR</i>	<i>200 W</i>	<i>2 hours</i>	<i>400 Wh</i>
<i>Small microwave oven</i>	<i>800 W</i>	<i>15 mins = 1/4 hour</i>	<i>200 Wh</i>
<i>3 lamps, 60W each</i>	<i>180 W</i>	<i>4 hours</i>	<i>720 Wh</i>
<i>Coffee maker</i>	<i>600 W</i>	<i>15 mins = 1/4 hour</i>	<i>150 Wh</i>
<i>Hair dryer</i>	<i>1500W</i>	<i>6 mins = 1/10 hour</i>	<i>150 Wh</i>
Total Daily Watt hours of AC load:			<i>1620 Wh</i>
x Number of Days between charges:			<i>3</i>
= Total Watt hours of AC load between charges:			<i>4860 Wh</i>
Battery Ah used between charges (divide by 10 for 12V system, divide by 20 for 24V system)			<i>486 Ah</i>
Recommended Battery Bank Size in Ah (multiply by 2)			<i>972 Ah</i>

This example illustrates how quickly your battery needs can escalate. To reduce the required battery bank size, you can either conserve energy by eliminating or reducing the use of some loads, or re-charge more frequently.

When sizing your battery, be conservative, and resist the temptation to skip the last (multiply by 2) step of this calculation. More capacity is better since you will have more reserve capacity, be better able to handle large loads and surge loads, and your battery won't be discharged as deeply. Battery life is directly dependent on how deeply the battery is discharged. The deeper the discharge, the shorter the battery life.

As your power requirements increase, you may need to use more than one battery to obtain sufficient capacity. Batteries can be connected in parallel or series to create higher capacity systems. It is not recommended to connect batteries from different manufacturers, different types, or that have different amp-hour ratings in parallel. Improper charging and decreased battery life will result. See “[Cabling & Hook-up Configurations](#),” on page 75 for more information on battery inter-connection schemes.

The following worksheet is provided as a guide for determining your battery needs. Be generous in estimating the time for which you will run each of the loads to ensure sufficient battery capacity.

Table 4: Battery Sizing Worksheet

Appliance	(A) Power Consumption	(B) Operating Time per day	Daily watt- hours needed for this appliance (= A x B)
	W	hours	Wh
	W	hours	Wh
	W	hours	Wh
	W	hours	Wh
	W	hours	Wh
	W	hours	Wh
	W	hours	Wh
	W	hours	Wh
	W	hours	Wh
	W	hours	Wh
	W	hours	Wh
	W	hours	Wh
	W	hours	Wh
Total Daily Watt hours of AC load:			Wh
x Number of Days between charges:			
= Total Watt hours of AC load between charges:			Wh
Battery Ah used between charges (divide by 10 for 12V system, divide by 20 for 24V system)			Ah
Recommended Battery Bank Size in Ah (multiply by 2)			Ah

Monthly Battery Maintenance



WARNING Wear appropriate attire and eye protection. Use caution when working with metal tools around batteries. Do not allow any metal object to come into contact with both battery terminals at the same time. Battery explosion or failure can occur.

At a minimum, check the level of the electrolyte in each battery cell once a month (for non-sealed batteries). It should be above the top of the plates, but not completely full. Most batteries have a plastic cup that, when full, just touches the electrolyte. Don't overfill the batteries or the electrolyte will spill out of the batteries when they are being charged. Refill the batteries with distilled water only—“spring” water and regular tap water may have high levels of minerals that can poison the battery chemistry and reduce battery life.

It is also good to periodically check the battery connections for tightness and corrosion. If any corrosion is found, disconnect power from the Prosine, disconnect the cables, and carefully clean with a mild solution of baking soda and water. *Do not allow the solution to enter the battery.* Rinse the top of the battery with clean water when finished.

To reduce the amount of corrosion on the battery terminals, after reassembly, coat them with anti-corrosion grease or liquid neoprene (liquid electrical tape) available from automotive parts stores or battery suppliers. Do not apply anything between the terminal and the cable lugs. The connection should be metal to metal. Apply the protective material only after the bolts have been tightened.

Cleaning Batteries

Dirty batteries may leak current, and tend to run warmer. Cleaning the batteries, when necessary, is easy and safe when the instructions presented here are followed.

Preparation

You will need appropriate attire, a few tools, and some equipment and supplies on hand. Read over the list and gather what you need before you begin.



WARNING Wear appropriate attire and eye protection.

Attire

Appropriate attire might include old clothes, rubber boots or old shoes. Battery acid is very corrosive and will dissolve most textiles within a few days after exposure, so wear something you can live without just in case you splash some on yourself. Be sure to wear rubber gloves and eye protection.

Tools

- ☐ ½-inch and/or 9/16 wrench as required, or an equivalent socket and ratchet
- ☐ adjustable and/or locking pliers
- ☐ torque wrench (suggested, not required)
- ☐ soft-bristled brush (discarded toothbrushes work just fine)
- ☐ 6-inch scrub brush
- ☐ inexpensive ½ inch chip brush or soldering brush

Equipment

- ☐ Water hose with spray nozzle or 5-gallon watering bucket
- ☐ Empty spray bottle
- ☐ Old clothing
- ☐ Eye protection
- ☐ Rubber gloves

Supplies

- ☐ Baking soda (always keep a supply on hand in the event of a spill)
- ☐ Water
- ☐ Hand cleaner or soap
- ☐ Towel
- ☐ After re-attaching cables only: liquid neoprene or white lithium grease (available at auto, RV, and marine stores)

Procedure

Battery Enclosure and Batteries Mix four ounces of baking soda with a gallon of fresh water and fill a spray bottle. Spray solution on all exposed surfaces of the battery compartment and wash down the exposed surfaces of the batteries and their enclosure. Scrub stubborn areas. Baking soda will neutralize any acid that may have collected on these surfaces. Finish by rinsing with water.

Terminals & Lugs Loose battery terminals and lugs exposed to open air corrode rapidly. The corrosion appears as a white powder or granular foam on the terminals and any nearby exposed metal parts. This is actually crystallized sulfuric acid, which is extremely corrosive. If it contacts your skin, it will burn unless you rinse it off immediately. Most textiles that are exposed to this corrosive eventually dissolve.

The most common cause of battery system failure is loose or corroded battery terminals and cable lugs. If any white residue forms between the battery cable lug and the battery terminal, remove the cable for cleaning. When you need to detach a battery cable, disconnect all loads and charging sources. Using the appropriate tool, remove the Negative battery cable first and install it last.

Use a toothbrush (or other soft bristle brush) and baking soda to remove any stubborn residue. Sprinkle the baking soda directly on the area and scrub with a wet toothbrush, adding water as required, then rinse.

Reconnect the battery cable terminals to the battery lugs and tighten to the torque specified by the battery or terminal lug manufacturer. If you do not have a torque wrench, use the appropriate tool to tighten the bolts reasonably snug. Do not over-tighten.

After tightening the cables, evenly coat all the exposed metal surfaces of the battery terminals and lugs with liquid neoprene, which will cure to form an airtight protective layer. If liquid neoprene is not available, use a light coating of white lithium grease or other sealant. Don't let anything come between the mating surfaces of the lugs and terminals.

Cables

Inspect all battery cables for missing or damaged insulation or loose connections. Inspect any openings through which the cables pass. Ensure that all such openings are equipped with a rubber grommet or conduit to prevent chafing the cable. If necessary, replace worn grommets. If the cable insulation is worn, replace the cable.

Cabling & Hook-up Configurations

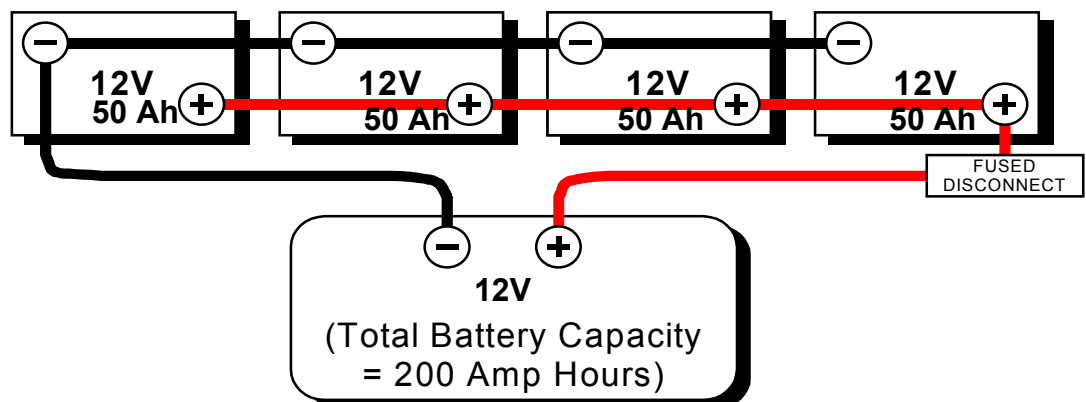
It is possible to connect individual batteries together to make a larger battery “bank” with heavy cables. The actual size of the cable depends upon whether the batteries are connected in parallel or series. Generally, the cables should not be smaller than the inverter cables—if the main cables are 4/0 AWG, the battery interconnects should be 4/0 AWG.

The best configuration is to connect the batteries both in series and parallel—a configuration often called “cross-tying”. This requires additional cables but reduces imbalances in the battery and can improve the overall performance. Consult your battery supplier for more information regarding the hook-up configuration required for your system.

Connect several smaller batteries together when creating a battery bank of substantial size. There are three ways to do this. Batteries can be connected in parallel series or series—parallel and cross-tied.

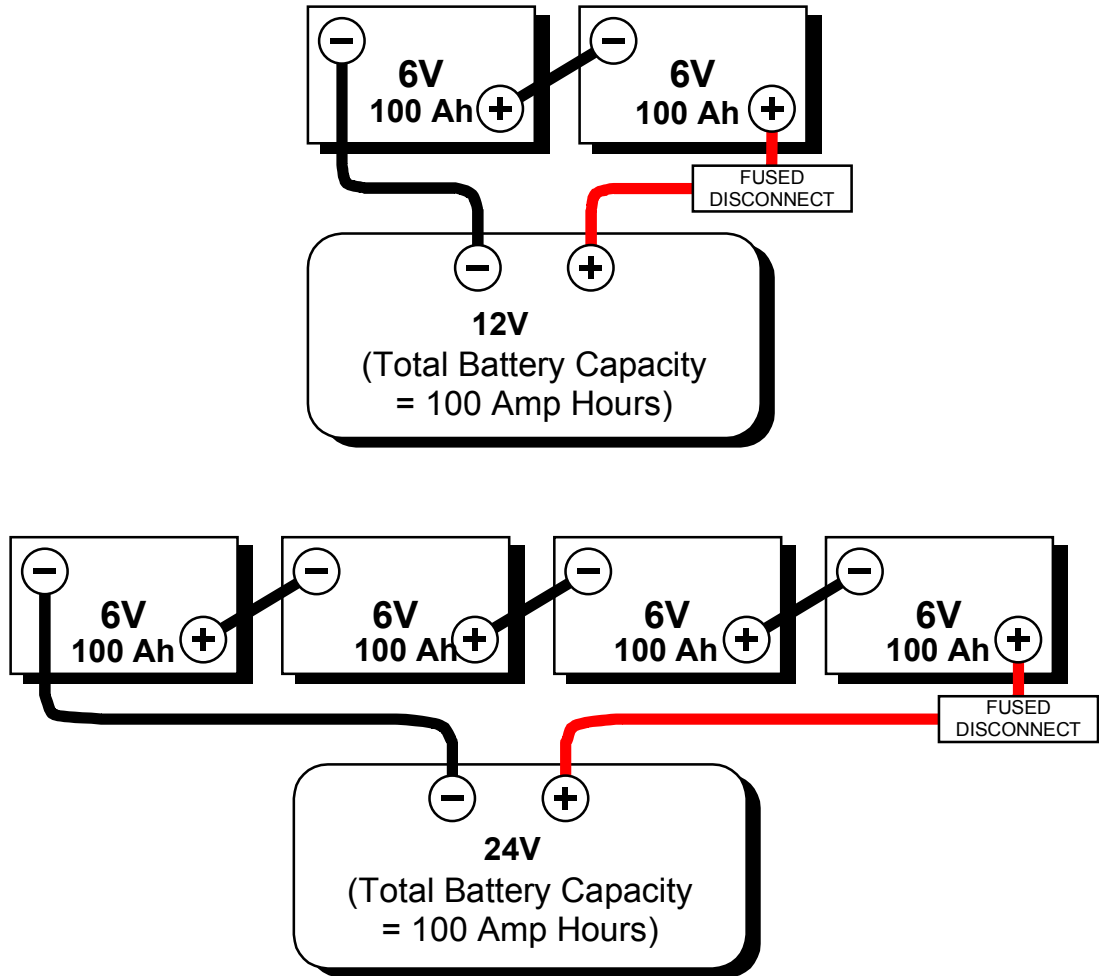
Parallel Connection

Batteries are connected in parallel when all the positive terminals of a group of batteries are connected and then, separately, all the negative terminals are connected. In a parallel configuration, the battery bank has the same voltage as a single battery, but an amp/hour rating equal to the sum of the individual batteries.



Series Connection

When batteries are connected with the positive terminal of one to the negative terminal of the next, they are connected in series. In a series configuration, the battery bank has the same amp/hour rating of a single battery, but an overall voltage equal to the sum of the individual batteries.

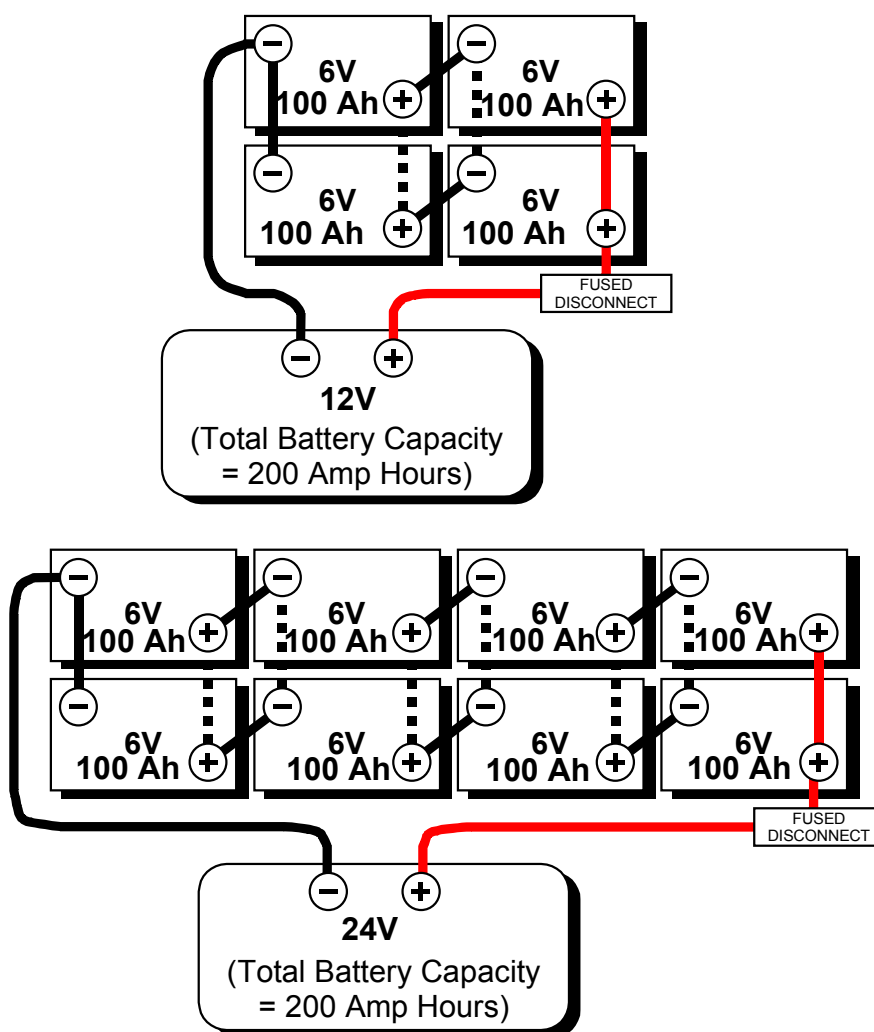


Series – Parallel Connection

As the name implies, both the series and parallel techniques are used in combination. The result is an increase in both the voltage and the capacity of the total battery bank. This is done very often to make a larger, higher voltage battery bank out of several smaller, lower voltage batteries. This is common with all battery-inverter system voltages. The smaller, lower voltage batteries are first connected in series to obtain the needed voltage, and then these “batteries, connected in series” sets are connected in parallel to increase the battery bank capacity.

The best arrangement when using a series-parallel configuration is to connect all the smaller, lower voltage batteries in parallel, then connect all these “batteries in parallel” into series sets to obtain the needed voltage. This configuration is often called “cross-tying.” This is less convenient and requires additional cables but reduces imbalances in the battery, can improve the overall performance.

Cross-tying (shown as dashed ----- lines in the illustration below) helps equalize the voltage in the batteries. If cross-tying is not desired, the dash lines can be ignored.



Appendix A: Specifications

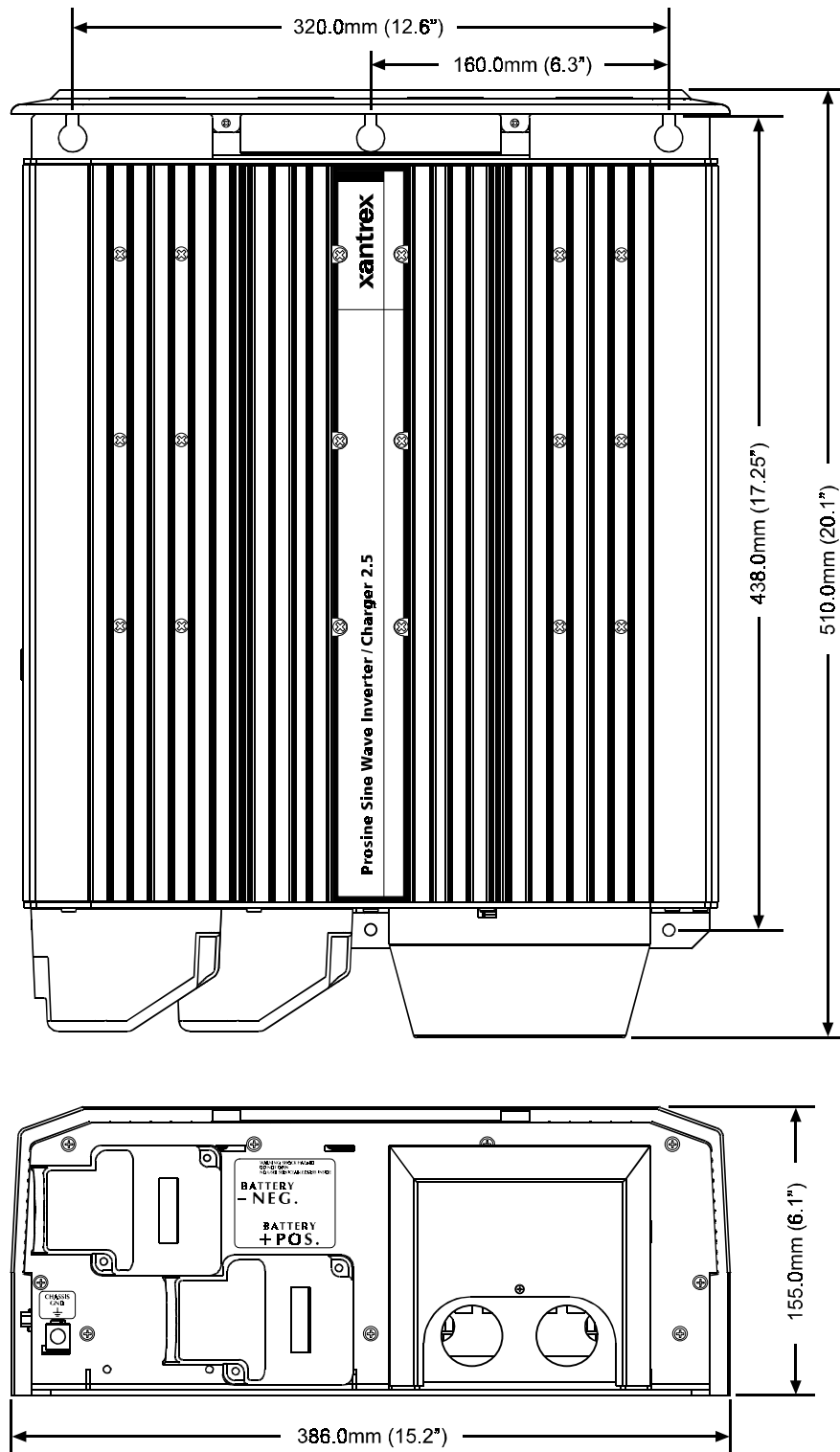
INVERTER	Prosine 2.5 12-volt; (24-volt in parenthesis)	Prosine 3.0 12-volt; (24-volt in parenthesis)
Continuous output power / current	2500W / 21A RMS	3000W / 25A RMS
Surge rating (5 seconds)	4000W	4000W
Peak output current	50A	50A
Peak inverter efficiency	88%	88%
No load current draw, in load sense mode	<3W	<3W
Idle circuit adj. load sensing	OFF, 10W, 25W, 50W [dip switches]	OFF, 10W, 25W, 50W [dip switches]
No load current draw, inverter idle	60W	60W
Output frequency	60Hz \pm 0.05% (crystal controlled)	60Hz \pm 0.05% (crystal controlled)
Output waveform	Sine wave <5%THD	Sine wave <5%THD
Input voltage range	10-16Vdc (20-32Vdc)	10-16Vdc (20-32Vdc)
Output voltage (at no load)	120Vac RMS \pm 3%	120Vac RMS \pm 3%
Output voltage (over full load & battery voltage range)	120Vac RMS -10% / +4%	120Vac RMS -10% / +4%
Low Battery Cut-out	10Vdc, 10.5Vdc warning (20Vdc, 21Vdc warning)	10Vdc, 10.5Vdc warning (20Vdc, 21Vdc warning)
High Battery Cut out	16Vdc (32Vdc)	16Vdc (32Vdc)
Protection	Automatic overload, short circuit, overtemperature Reverse polarity (fuse)	Automatic overload, short circuit, overtemperature Reverse polarity (fuse)
CHARGER		
Battery capacity selections	50, 75, 100, 150, 200, 300, 400, 500, 600, 700, 800, 1000, 1200, 1400, 1700, >2000	50, 75, 100, 150, 200, 300, 400, 500, 600, 700, 800, 1000, 1200, 1400, 1700, >2000
Charge Rate 12V (24V)	100A (50A)	120A (60A)
Charger Power Factor Rating	.99	.99
Charger Efficiency	> 80%	> 80%
Charge banks	1 high current	1 high current
Charge control	3-stage with manual equalize	3-stage with manual equalize
Temperature compensation	3 settings or optional sensor	3 settings or optional sensor
Electrolyte compensation	flooded/gel	flooded/gel
Input voltage range	90-135 Vac	90-135 Vac
AC service setting [max. current draw]	10 [8], 15 [12], 20 [16], 30 [24] amps	10 [8], 15 [12], 20 [16], 30 [24] amps
Transfer Relay rating	30A	30A

GENERAL	Prosine 2.5 12-volt; (24-volt in parenthesis)	Prosine 3.0 12-volt; (24-volt in parenthesis)
Transfer Time Inverter to AC	zero seconds, [8 second delay]	zero seconds, [8 second delay]
Transfer Time AC to Inverter (including detect time)	20 milliseconds	20 milliseconds
Regulatory Approvals	CSA/NRTL approved to CSA 107.1, UL 458 and UL 1741, FCC Class A	CSA/NRTL approved to CSA 107.1, UL 458 and UL 1741, FCC Class A
Dimensions (L x W x H)	20" x 15" x 5.5", 508mm x 381mm x 140mm	20" x 15" x 7.0", 508mm x 381mm x 178mm
Weight	32 lbs, 14.5 kg	32 lbs, 14.5 kg
Operating Temperature Range (power derating above 25°C)	0-60°C Inverter mode, 0-50°C Charger mode	0-60°C Inverter mode, 0-50°C Charger mode
Storage Temperature Range	-30°C to 70°C	-30°C to 70°C

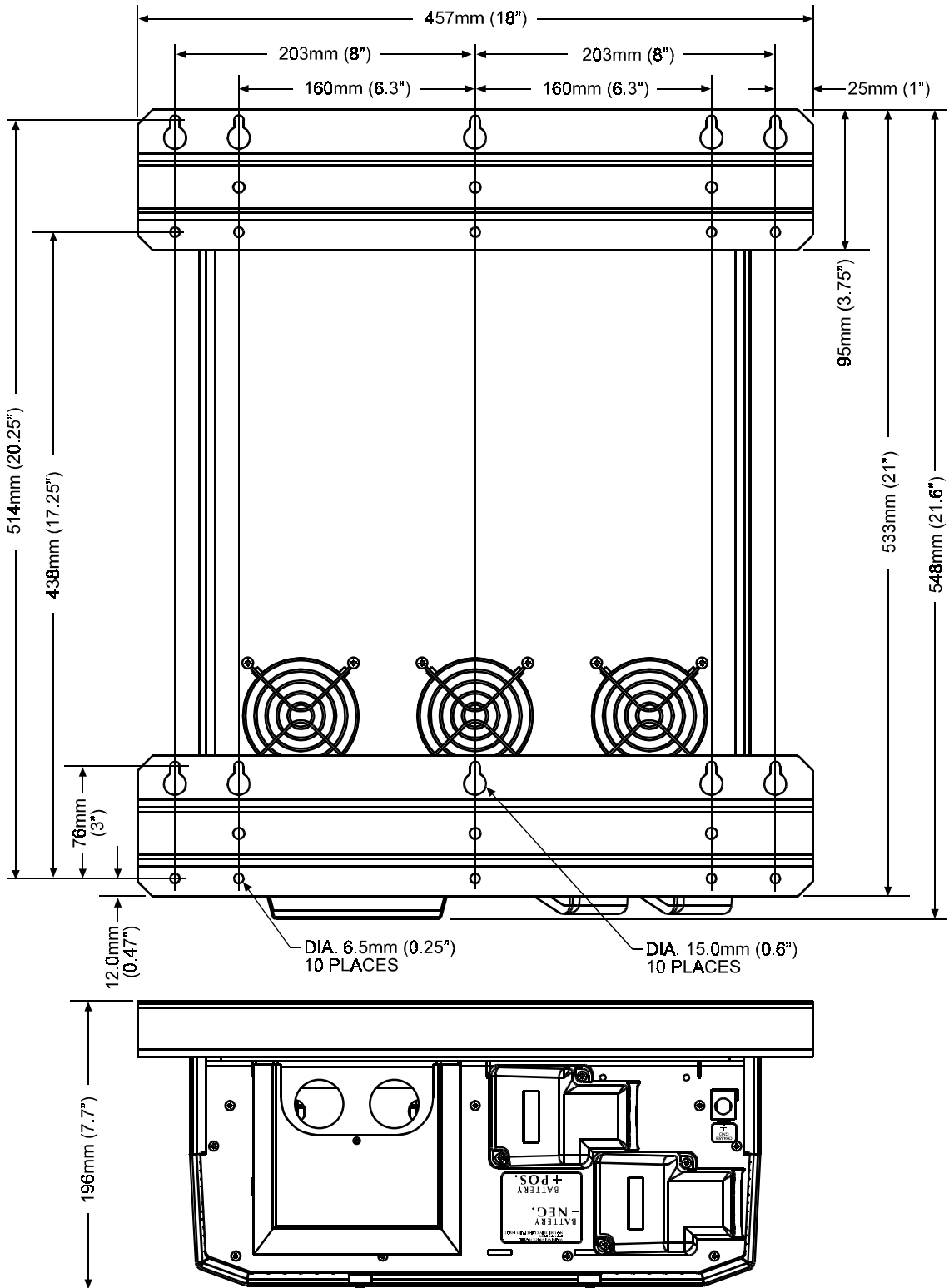
Charger Output Voltages

Absorption / Float Voltage (Volts)	Cold	Warm	Hot
Flooded	14.8 / 13.9	14.4 / 13.5	14.0 / 13.1
Gel	14.6 / 14.2	14.4 / 13.8	13.8 / 13.4

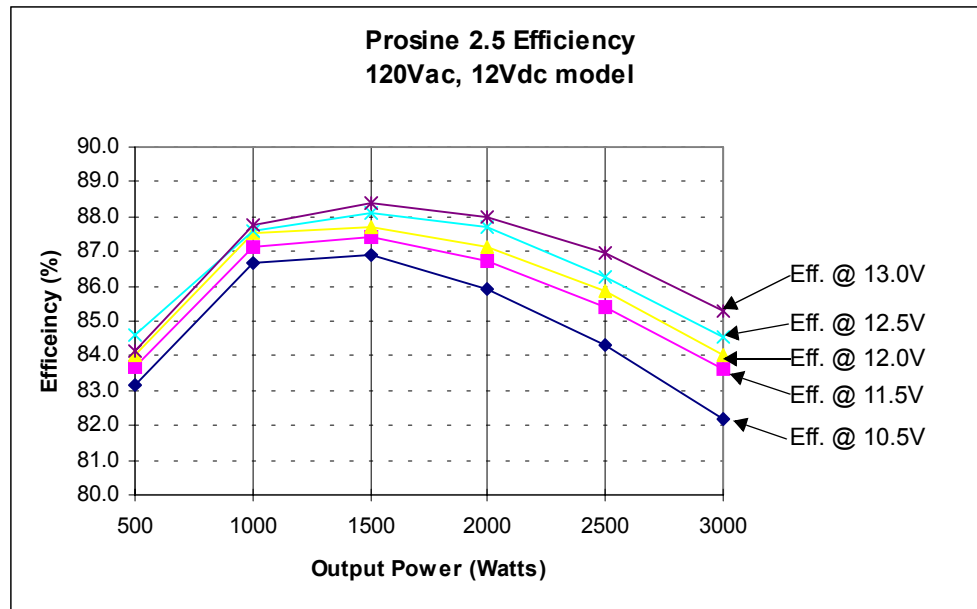
Prosine 2.5/3.0 Chassis Dimensions



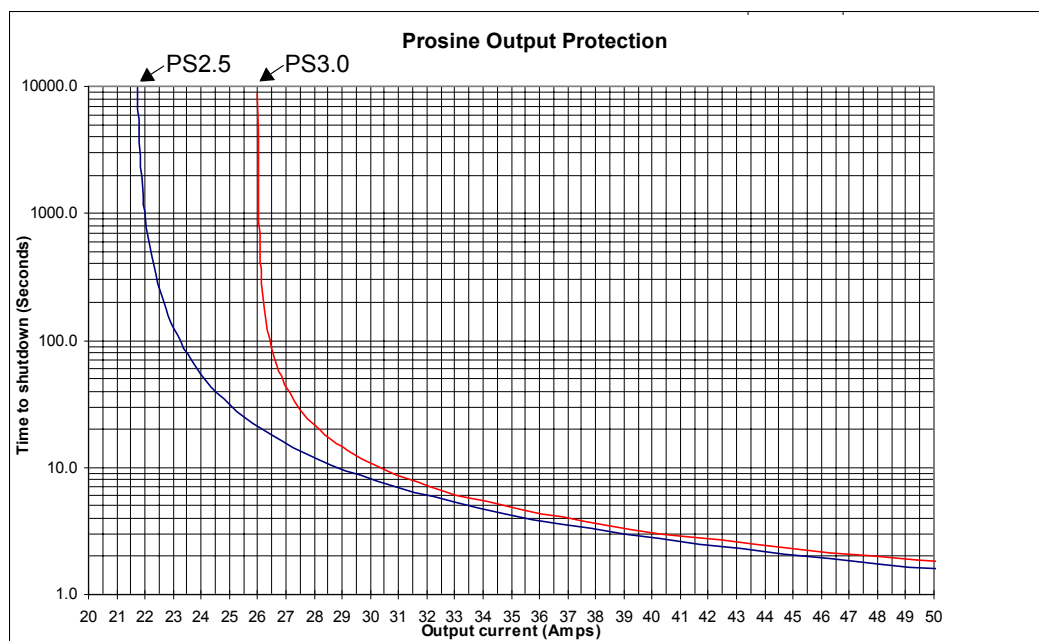
Prosine 2.5/3.0 Chassis Dimensions with Brackets



Prosine 2.5 Efficiency Curve



Prosine Over-Current Shutdown Response



Appendix B: Inverter Applications

AC loads on the inverter differ in the way they perform. There are different types of loads: resistive loads, inductive loads, and problem loads.

Resistive Loads

These are the loads that the inverter finds the simplest and most efficient to drive. Voltage and current are in phase, or, in this case, in step with one another. Resistive loads usually generate heat in order to accomplish their tasks. Toasters, coffee pots and incandescent lights are typical resistive loads. Larger resistive loads—such as electric stoves and water heaters—are usually impractical to run off an inverter due to their high current requirements. Even though the inverter can most likely accommodate the load, the size of battery bank required would be impractical.

Inductive Loads

Any device that has a coil of wire in it probably has an inductive load characteristic. Most electronics have transformers (TVs, stereos, etc.) and are therefore inductive. Typically, the most inductive loads are motors. The most difficult load for the inverter to drive will be the largest motor it manages to start. With inductive loads, the rise in voltage applied to the load is not accompanied by a simultaneous rise in current. The current is delayed. The length of the delay is a measure of inductance. The current makes up for its slow start by continuing to flow after the inverter stops delivering a voltage signal. How the inverter handles current that is delivered to it while it is essentially “turned off”, affects its efficiency and “friendliness” with inductive loads. The best place for this out-of-phase current is in the load. Inductive loads, by their nature, require more current to operate than a resistive load of the same wattage rating, regardless of whether power is being supplied by an inverter, a generator, or utility power (the grid).

Induction motors (motors without brushes) require two to six times their running current on start-up. The most demanding are those that start under load, e.g., compressors and pumps. Of the capacitor start motors (typical in drill presses, band saws, etc.), the largest you may expect to run is ½ to 1 hp (depending on inverter size and surge power capability). Universal motors are generally easier to start. Since motor characteristics vary, only testing will determine if a specific load can be started and how long it can be run.

If a motor fails to start within a few seconds, or it begins to lose power after running for a time, it should be turned off. When the inverter attempts to start a load that is greater than it can handle, it will turn itself off after about 10 seconds.

Problem Loads in Load Sense

Very small loads - If the power consumed by a device is less than the threshold of the load sense circuitry, it will not run. See “Load Sense” information in [“Section 3: Configuration” \(page 25 and following\)](#) for ways to solve this problem. Most likely the solution will be to defeat the load sense feature.

Fluorescent lights & power supplies - Some devices when scanned by load sense circuitry cannot be detected. Small fluorescent lights are the most common example. (Try altering the plug polarity by turning the plug over). Some computers and sophisticated electronics have power supplies that do not

present a load until line voltage is available. When this occurs, each unit waits for the other to begin. To drive these loads either a small companion load must be used to bring the inverter out of its search mode, or the inverter may be programmed to remain at full output voltage by defeating the search mode feature. See “[Section 3: Configuration](#)” (page 25 and following).

Clocks- The inverter’s crystal controlled oscillator keeps the frequency accurate to within a few seconds a day. Most clocks do not draw enough power to trigger the load sensing circuit. In order to operate without other loads present, the load sensing will have to be defeated. See “Load Sense” information in “[Section 3: Configuration](#)” (page 25 and following). Clock accuracy is also affected by the accuracy of the generator. The best solution is to buy a battery-operated clock, or a clock that is not dependent on line frequency or voltage. Any clock with a crystal controlled oscillator will probably work just fine.

Searching- If the amount of power a load draws decreases after it turns on, and if this “on” load is less than the load sensing threshold, it will be turned alternately on and off by the inverter. Incandescent light bulbs may present this problem when the search threshold is set near the wattage rating of the bulb.

Other Problem Loads

Electronics- AM radios may pick up noise, especially on the lower portion of their band. Inexpensive tape recorders are likely to pick up a buzz.

Computers - Computers may crash if large loads are started while the inverter is operating. The inverter output voltage may fall briefly, allowing computers to fall. Large motors may generate voltage spikes that are not completely suppressed by the inverter's internal voltage transient suppression circuit.

Appendix C: Troubleshooting

What to do if a problem occurs

This section may help you narrow down the source of any problem you may encounter. Before contacting Xantrex, please work through the steps listed below.



WARNING: Shock and energy hazards. Some of the troubleshooting solutions below require knowledge of electrical principles, servicing, and the hazards involved. Refer service to a qualified electrician or technician.

1. Check for an Error Code display (see [“Error Code Displays and What They Mean,” on page 88](#)). If a code is displayed, record its number before doing anything further.
 2. As soon as possible, record the conditions at the time the problem occurred, in the event you need to contact Xantrex. These details should include:
 - Serial number of the unit
 - Make or model of batteries
 - Wiring diagram with all devices
 - Grounding information
 - Equipment or loads the Prosine was running or attempting to run
 - Battery condition at the time (voltage, state of charge), if known
 - Recent sequence of events (for example, charging had just finished, we disconnected shore-power as we were preparing to leave the dock, but the inverter didn’t come on, and so on.)
 - Any known unusual AC shorepower factors—low voltage, unstable generator output, etc.
 - Any extreme ambient conditions existing at the time (temperature, vibrations, moisture, etc.)
 3. Attempt the solution indicated in the [“Error Code Table,” on page 89](#) for the indicated error code (if any).
 4. If you see an error code of 000 it means that no errors were detected. Check the following conditions to make sure the present state of the installation allows proper operation of the unit (refer to details elsewhere in this manual):
 - Is the inverter located in a clean, dry, adequately ventilated location?
 - Are the battery cables the right size and length for your installation? (See [“Recommended DC Cable Sizes For Proper Operation” on page 47](#).)
 - Is the battery in good condition?
 - Are the AC input and output connections and wiring in good shape?
 - Are the DIP switch and/or ACS settings correctly configured for your particular installation?
 - Is the Display Panel and/or ACS cable properly connected and undamaged?
 - Is the Bypass/On switch on?
- If any of these conditions are not met, look through the “Possible Cause” column of the Error Code table below for similar conditions, and consider attempting the indicated solution.
5. Contact Xantrex for further assistance. Please be prepared to describe details of your system installation and to provide the model and serial number of the unit.

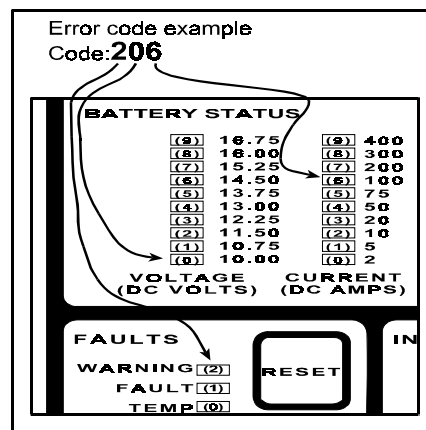
Error Code Displays and What They Mean

Many types of faults are recognized by the Prosine inverter/charger. Should a recognized fault occur, the fault LED will illuminate and an error code will be displayed. These error codes will override any other menu items being displayed. The way in which this is done is different for the Standard Control Panel and the Advanced Control System (ACS).

Control Panel

When the WARNING, FAULT, or TEMP LED is on, try to find what is causing the fault condition by following these steps:

1. Press and hold the RESET button to display the error. It takes about five seconds before the code displays.
2. Note the LEDs that illuminate to determine the 3-digit fault code, as in the example below.
3. Look up the error code in the Error Code Table to assist in troubleshooting the fault condition.



While the RESET button is pressed, the 3-digit number is displayed as follows:

1. The first digit is shown in the FAULT section, TEMP = 0, FAULT = 1, WARNING = 2.
2. The second digit is shown on the DC VOLTS bar graph, the bottom LED = 0, the second lowest LED = 1, and so on to the top LED = 9.
3. The third digit is shown on the DC AMPS bar graph, the bottom LED = 0, the second lowest LED = 1, and so on to the top LED = 9.

When none of the FAULTS lights are on, pressing and holding the RESET switch will display the last recorded fault.

Advanced Control System (ACS)

Should a fault occur, the Fault LED will illuminate and an error code will be displayed in the LCD. The error code display will override any other menu items being displayed.

Error Code Table

The following table lists the error codes, likely causes, and suggested solutions.

Error Code	Description of Fault	Possible Cause	Solution
000, 255	No Fault recorded	No faults detected since the Prosine was turned on.	
001	<p>A. Battery Temperature is too high or too low. (This code only applies if the external battery temperature sensor is connected)</p> <p>B. If there is no external battery temperature sensor, there may be a wiring fault inside the unit.</p>	<p>1. Room temperature around the batteries is too high or too low.</p> <p>2. Battery heating (battery or battery terminals are warmer than room temperature)</p> <p>3. Faulty connection of battery temperature probe.</p> <p>B. Damage has likely occurred during shipping or there has been extreme shock or vibration.</p>	<p>1. Keep the temperature around batteries moderate. In cold weather, try a battery heating blanket. In warm weather, try improving the ventilation.</p> <p>2. For flooded batteries, check the electrolyte level and top up with distilled water if necessary. Check the tightness of all connections. If the condition persists, the battery may be faulty and need replacement.</p> <p>3. Check connections and make sure probe is in good thermal contact with battery. Probe may require replacement.</p> <p>B. Record the error code and contact Xantrex.</p>

Error Code Table

Error Code	Description of Fault	Possible Cause	Solution
002	Battery Voltage is too low	<ol style="list-style-type: none">1. Discharged battery.2. Old or faulty battery.3. Battery cables to the Prosine inverter/charger are too small, too long, or there is a loose connection.	<ol style="list-style-type: none">1. Charge battery.2. Battery may not be holding charge properly. If flooded, check electrolyte level and fill with distilled water if necessary. Equalization may help if recommended by the battery manufacturer. Battery may be faulty and require replacement.3. Check cable size and length against recommendations in this manual. Check and tighten all connections. Large loads may draw the voltage down very quickly on a small battery or in an installation with cables that are too small or too long.
003	Battery Voltage is too high.	<ol style="list-style-type: none">1. External charger or alternator has output voltage greater than 16 V.2. A 12V Prosine inverter/charger could be connected to a 24V battery (two batteries in series).	<ol style="list-style-type: none">1. Correct or disconnect the external charging source.2. Make sure the battery bank is nominal 12V for a 12v Prosine.
006,065	Microprocessor communication error.	Remote display cable is pinched or has loose connection.	Check display cable connections and attempt restart. If the problem persists, try a replacement cable. If the problem persists, call Xantrex.

Error Code	Description of Fault	Possible Cause	Solution
008-015	Ambient temperatures or internal component temperatures are too high or too low.	<ol style="list-style-type: none"> 1. Power required by AC load is too high. 2. Blocked ventilation. 3. Room temperature too high 4. Room temperature too low. 	<ol style="list-style-type: none"> 1. Reduce AC load to specified limits. Reduce AC load below rated maximum if room temperature is above 25°C / 77°F. See temperature de-rating curve in Owner's Manual. 2. Allow more room for air circulation around unit. 3. Allow more ventilation in compartment. 4. In extremely cold climates (below freezing), a heated room may be required
064	AC Output Overcurrent	Temporary AC output overload. The higher the output current, the faster the unit will shut down (minimum 2 seconds).	Reduce AC load so that even for short times, the AC output current does not exceed 26 A. See Overcurrent Protection curve in this manual.
066	Communication Fault	<ol style="list-style-type: none"> 1. Faulty cable between Prosine and remote panel. 2. Internal Fault 	<ol style="list-style-type: none"> 1. Check display cable connections and attempt restart. If problem persists, try a replacement cable. If problem still persists, call Xantrex. 2. Record the error code and contact Xantrex.
129-134	Internal fault	Various. There could be a fault inside the unit or the microprocessor is fooled by some external condition.	Record the error code and contact Xantrex.
135	Battery voltage stays low in charge mode	24 VDC model connected to a 12 V battery or a 12 VDC model is connected to a 6 V battery	Correct the battery wiring or replace Prosine with different battery nominal Dc voltage.
136,192-194	Internal fault	Various. There could be a fault inside the unit or the microprocessor is fooled by some external condition.	Record the error code and contact Xantrex.

Error Code Table

Error Code	Description of Fault	Possible Cause	Solution
195	Internal DC bus voltage is low in Charge mode	1 There may be a hot to ground wiring error. A mistake made in AC wiring caused internal traces to open. Shoring the AC line to the chassis ground occasionally causes damage especially if supplied from a 50 A service with a short cord. 2 Internal fault	1. Contact Xantrex and return unit for repair. 2. Record the error code and contact Xantrex.
196	Internal fault	Various. There could be a fault inside the unit or the microprocessor is fooled by some external condition.	Record the error code and contact Xantrex.
197	Unexpected AC output voltage	AC Input Line and Neutral are reversed.	Check AC Input wiring. There should be less than 5V RMS between AC Input Neutral and Earth Ground. If you measure higher voltage from neutral to ground, then the AC shorepower source likely has reversed polarity and requires correction. Long and/or loose connections to the utility/shorepower can result in a high neutral voltage as well. Check connections and repair as necessary.
198-201	Internal fault	Various. There could be a fault inside the unit or the microprocessor is fooled by some external condition.	Record the error code and contact Xantrex.
202,203	Relay Contact Fault	One of the relay contacts is stuck in the closed position.	Record the error code and contact Xantrex.
204	AC Input Neutral Warning	AC Input Neutral voltage is greater than 10 V with respect to Earth Ground.	See Fault Code 197.
205	Internal fault	Various. There could be a fault inside the unit or the microprocessor is fooled by some external condition.	Record the error code and contact Xantrex.

Error Code	Description of Fault	Possible Cause	Solution
206	AC Output voltage too high	<ol style="list-style-type: none"> 1. Some loads, like motors, can feed power back into the output of the Prosine. This may result in a temporary over-voltage which may trigger a fault condition. 2. There is an internal hardware or software fault. 	<ol style="list-style-type: none"> 1. Try resetting the unit and running the load again. Contact Xantrex if you find consistent incompatibility with a certain type of load. 2. Record the error code and contact Xantrex.
207	Internal DC Bus voltage is low in invert mode.	<ol style="list-style-type: none"> 1. Temporary condition caused by low battery voltage in conjunction with an overload condition. 2. Internal Fault. 	<ol style="list-style-type: none"> 1. Check if battery is OK (see error code 002). Disconnect AC and DC power to the Prosine. Reconnect DC and AC power after 15 minutes. If the problem persists, contact Xantrex. 2. Record the error code and contact Xantrex.

Index

A

- absorption charge
 - defined, 59
- AC (shorepower) configuration, 29
- AC bonding, 45
- AC cabling, 40, 45
- AC circuit breakers, 45
- AC disconnect and overload device, 40
- AC disconnect and overload protection, 45
- AC distribution center, 40
- AC fuse, 40
- AC grounding, 45
- AC information, 15
- AC Information menu, 15, 29
 - Breaker Size, 15
- AC Input
 - circuit breaker, 45
- AC input current
 - maximum, 2
- AC Output
 - circuit breaker, 45
- AC service rating, 25
 - setting, 27
- AC service setting, 63
- AC terminal block, 6
 - illustrated, 5, 38
- AC terminals
 - location, 6
- AC wire size, 45
- accessory jacks, 5
- ACS control panel, 12
 - battery status display, 14
 - Charger status indicator, 21
 - dimensions, 22
 - illustrated, 12
 - installation procedure, 22
 - liquid crystal display, 13
 - menu navigation procedure, 14
 - menu structure, 14
 - Power indicator, 21
 - used to configure inverter/charger, 28

ACS menus, 14

- AC Information menu, 15, 29
- Battery Information menu, 16, 30
- Charger Information menu, 17, 33
- Inverter Information menu, 16, 32
- Version Information menu, 19
- System Information menu, 18, 35

adjustable charger mode settings, 62

AGM batteries, 69

alkaline batteries, 69

Amp-hour capacity, 70

amp-hour capacity, 30

audible alarm, 3

- configuring, 18, 25, 27
- disabling, 35
- enabling, 35

automatic transfer switch, 2

automatic waveform regulation, 2

AWG, 75

B

backlight for LCD display, 12

band saw, 85

BATT TEMP jack, 5

batteries

- AGM (absorbed glass mat), 69
- alkaline, 69
- cleaning, 73
- deep-cycle, 68
- depth of discharge, 63
- gel-cell, 30, 69
- lead-acid, 30, 69
- parallel connection, 75
- precautions when working with, ii
- sealed, 61
- series connection, 76
- series—parallel connection, 77

battery

- enclosures, 69
- selecting type, 26, 30, 55
- suitable location, 69

- battery Amp-hour capacity, 70
- battery bank sizing, 70
- battery capacity, 30, 70
- battery configuration, 30
- battery current indicator, 8
- Battery Information menu, 16, 30
- battery requirements, estimating, 70
- battery reserve capacity, 70
- battery size
 - minimum, 70
 - setting, 25, 27, 30, 63
- Battery status display (ACS control panel), 14
- Battery Temp jack, 51
- battery temperature, 69
 - setting, 25, 26, 30
- battery temperature sensor, 49
 - attaching to battery terminal, 50
 - attaching to side of battery, 51
 - cable, 51
- battery temperature sensor jack, 5
- battery temperature shut down, 2
- battery type
 - selecting, 25, 26, 55, 62
- battery voltage indicator, 8
- breaker size
 - setting, 15, 29
- BTS. See battery temperature sensor.
- bulk charge
 - defined, 59
- bypass/on switch, 6
 - described, 6
 - illustrated, 5

C

- cable, battery temperature sensor, 23, 51
- capacitor start motors, 85
- Charge LED, 10, 21
- charger configuration, 33
- Charger Configuration menu, 33
- Charger Information menu, 17
- charger mode settings
 - AC service setting, 63
 - adjusting, 62
 - battery size selection, 63
 - battery type selection, 62
 - maximum AC current, 63
 - temperature compensation, 62
- charger output voltage, 80
- Charger override, 33
- Charger status indicator (ACS control panel), 10, 21
- charging
 - dead batteries, 1
 - multi-stage, 59

- charging profile, 59
- charging times
 - calculating, 63
- chassis ground, 49
- chassis ground lug
 - described, 6
 - illustrated, 6
- circuit breakers
 - AC, 40, 45
 - DC, 41
- cleaning batteries, 73
- clocks
 - accuracy, 86
 - battery-operated, 86
- compressors, 85
- conduit, 45
- configuration menus. See ACS menus.
- configuration. See DIP switch settings or ACS menus.
- control buttons (ACS control panel), 13
- control panel. See LED control panel or ACS control panel.
- control panels, using LED and ACS in series, 11, 22
- Customer Service, contacting, iv

D

- DC cables, recommended sizes, 47
- DC cabling, 40, 46
- DC connectors, illustrated, 5
- DC disconnect devices, 45
- DC fuses, 39
- DC grounding, 49
 - marine, 49
 - recreational vehicles, 49
 - residential, 49
- DC over-current protection, 46
- DC terminal covers, 39
- DC terminal covers, illustrated, 6
- dead batteries, charging, 1
- deep cycle, 67
- deep-cycle battery, 68
- default settings, described, 25
- depth of discharge, 63
- dimensions
 - ACS control panel, 22
 - inverter/charger chassis, 81, 82
 - inverter/charger with brackets, 82
 - LED control panel, 11
- DIP switch panel, 5
- DIP switch settings, 25
 - AC service rating, 25, 27
 - audible alarm, 25, 27
 - battery size, 25, 27

- battery temperature, 25, 26
- battery type, 25, 26
- load sense, 25, 26
- distilled water, 61, 62, 73
- down arrow key, 13
- drill press, 85

E

- efficiency, 85
- electrolyte, 67, 69, 73
- electrolyte level, 61, 62
- electronics, 86
- EMI bulb, 11, 39
- Enter key, 13
- equalization charge
 - defined, 60
 - described, 1
- equalization procedure, 61
- equalization request, 33
 - status, 17
- Equalize LED, 10, 21
- error code display
 - described, 8
- Escape key, 13
- estimating battery requirements, 70

F

- fault code display, 3
- Fault LED, 9, 20
- Faults display, 20
- Faults Indicator, 9
- FCC regulations, iii
- float charge
 - defined, 60
- fluorescent lights, 85
- functional test, 55
- fuses
 - AC, 40
 - DC, 39, 41
 - required sizes for DC circuits, 46

G

- gases, battery
 - venting, 50
- gel-cell, 30
- generator, 41, 69, 70, 85
 - spin up, 55
- GFCI outlet, 6
- GND, 38
- ground
 - AC line, 38

H

- high battery shut down, 2
- high temperature shut down, 3
- high voltage
 - alarm, 32
 - cutoff, 32
- hydrogen, 69

I

- IC version, 19
- induction motors, 56, 85
- inductive loads, 85
- input voltage range, 57
- installation
 - battery temperature sensor, 49
- installer configuration, 28
- Invert LED, 9, 20
- inverter configuration, 32
- Inverter Information menu, 16, 32
- Inverter status indicators, 9, 20
- inverter/charger chassis dimensions, 81, 82
- inverter/charger dimensions with brackets, 82
- inverter/charger installation
 - AC cabling, 45
 - DC cabling, 46
 - designing an installation, 40
 - environment, 42
 - mounting the inverter/charger, 44
 - overview, 37
 - tools and materials, 42
- inverter/charger operating limits, 56

J

- jacks
 - Battery Temp/Remote, 51

L

- lead-acid batteries, 69
- LED control panel, 7
 - battery status indicator, 8
 - dimensions, 11
 - illustrated, 7
 - mounting procedure, 11
- LEDs
 - Battery Status, 8
 - Charge, 10, 21
 - Current, 8
 - Equalize, 10, 21
 - Fault, 9, 20
 - Invert, 9, 20
 - Ready, 10, 21
 - Standby, 9, 10, 20, 21
 - Temp, 9, 20

- Voltage, 8
- Warning, 9
- lights
 - fluorescent, 85
 - incandescent, 86
- line (hot), 38
- liquid crystal display, 13
- load sense
 - described, 2
 - parameters, 32
 - setting parameters, 25, 26, 32, 56
 - threshold, 85
- loads
 - inductive, 85
 - problem, 85
 - resistive, 85
- low battery shut down, 2
- M**
- maintenance
 - batteries, 73
- maintenance free batteries, 69
- materials list, iv
- maximum AC input current, 2, 63
- motor operated equipment, 56
- motors
 - capacitor start, 85
 - induction, 56, 85
 - starting current, 71
 - universal, 85
- multi-stage charging, 59
- N**
- neoprene, liquid, 73
- neutral, 38
- O**
- On/Off button (Charger), 10, 21
- On/Off button (Inverter), 9, 20
- operating limits for charger, 63
- operating limits for inverter/charger, 56
- operation
 - in charger mode, 61
 - in equalization mode, 61
- output power derating, 43
- over-current protection, 3
- Override charger operating mode, 33
- P**
- power factor correction, 1
- Power indicator (ACS control panel), 21
- Power indicator (LED control panel), 10
- power output, 56
- power supplies, 85

- problem loads, 85
 - clocks, 86
 - electronics, 86
 - fluorescent lights, 85
 - power supplies, 85
 - radios, 86
 - small loads, 85
- pumps, 56, 85
- R**
- radios, 86
- Ready LED, 10, 21
- recreational vehicle system
 - diagram, 53
- remote output jacks, 5
- reserve capacity, 70
- Reset button (ACS control panel), 20
- Reset button (LED control panel), 9
- residential backup system
 - diagram, 52
- resistive loads, 85
- returning products
 - policy, vii
 - procedure, viii
- running current, 71, 85

- S**
- safety instructions, i
- sealed batteries, 61
- sealed gel-cell batteries, 69
- self test procedure, 55
- serial number, recording, iv, v
- shorepower
 - configuring, 29
 - defined, 40
- shut down
 - battery temperature, 2
 - high battery, 2
 - high temperature, 3
 - low battery, 2
- software version, 19
- solar and wind system
 - diagram, 54
- specific gravity, measuring, 61, 62
- specifications, 79
- Standby LED, 9, 10, 20, 21
- starting batteries, 68
- starting current, 71
- stereo, 85
- surge capacity, 2
- surge power, 85
- switches
 - bypass/on, 6
 - bypass/on, illustrated, 5

- system configuration, 35
- system diagrams
 - recreational vehicle, 53
 - residential backup system, 40, 52
 - residential solar and wind, 54
- System Information menu, 18, 35
- system startup default, 35

T

- tape recorders, 86
- Temp LED, 9, 20
- temperature
 - effect on batteries, 69
- temperature compensation, 1, 62, 67
- temperature sensor, 49
- three-stage charge
 - described, 1
- TV, 85

U

- universal motors, 85
- up arrow key, 13

V

- Version Information Menu, 19

W

- Warning LED, 9
- warranty
 - explained, vii
 - obtaining service, vii
- wire size
 - AC, 45
 - DC, 46
- wiring separation, 45

X

- Xantrex web site, iv

<p>Xantrex Technology Inc. Toll free 1 800 670 0707 Direct 1 604 422 2777 Fax 1 800 420 2145 CustomerService@xantrex.com www.xantrex.com</p>	
445-0096-01-01 Rev. 3	Printed in China