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User's Manual

PROsine 2.0 Inverter/Charger

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PROsine 2.0 Inverter/Charger

User's Manual

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About This Manual

Purpose

The purpose of this User's Manual is to provide explanations and procedures for installing, operating, maintaining, and troubleshooting the PROsine 2.0 Inverter/Charger.

Scope

The Manual provides safety guidelines, detailed planning and setup information, procedures for installing the inverter, as well as information about operating and troubleshooting the unit. It does not provide details about particular brands of batteries. You need to consult individual battery manufacturers for this information.

Audience

The Manual is intended for anyone who needs to install and operate the PROsine 2.0 Inverter/Charger. Installers should be certified technicians or electricians.

Organization

This Manual is organized into seven chapters and three appendixes:

Introduction: Chapter 1 introduces you to the PROsine, explains the inverting, changing and power system management functions

Product Orientation: Chapter 2 will familiarize you with the following components of a PROsine system:

Installation: Chapter 3 This section gives complete information for installing a PROsine system.

Configuration: Chapter 4 explains how to configure the PROsine to best meet your electrical system requirements. It is divided into three parts:

Operation: Chapter 5 begins with a system startup check that you carry out after installation and configuration to verify that the PROsine is operating correctly. The chapter also provides information that will guide you during routine, ongoing operations.

Troubleshooting: Chapter 6 describes how to troubleshoot the PROsine

Series Operation: Chapter 7 provides information about installing and operating two PROsines in series:

Specifications: Appendix A contains specifications and performance graphs for the PROsine and the display panel.

System Diagrams: Appendix B illustrates typical designs for PROsine custom-designed systems.

Charging Algorithms: Appendix C provides information about the charging algorithms for PROsine 2.0.

Conventions Used

The following conventions are used in this guide.



WARNING

Warnings identify conditions or practices that could result in personal injury or loss of life



CAUTION

Cautions identify conditions or practices that could result in damage to the unit or other equipment.

Important: These notes describe things which are important for you to know, but not as serious as a caution or warning.

Abbreviations and Acronyms

<just the common ones--don't make the list too long. If there are lots, then create an appendix to contain them>

Related Documents

PROsine 2.0 Inverter/Charger Quick Installation Guide

Part Number: 445-0099-01-01: This document is included with your PROsine. It is a job aid that provides instructions for installing the PROsine and its display panel. It also provides a mounting template for the PROsine.

PROsine 2.0 Inverter/Charger Display Panel Mounting Template

Part Number: 445-0101-01-01: This is provided with your PROsine.

PROsine 2.0 Inverter/Charger Quick Reference Guide

Part Number: 445-0100-01-01: This document is included with your PROsine. It provides frequently used information about configuring and operating the unit as well as system default values.

Related Information

You can find more information about Xantrex Technology Inc. as well as its products and services at www.xantrex.com

Important Safety Instructions



WARNING

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



WARNING: Limitations on use

The PROsine 2.0 Inverter/Charger is not intended for use in connection with life support systems or other medical equipment or devices.

1. Before installing and using the PROsine 2.0 Inverter/Charger (PROsine), read all instructions and cautionary markings on the PROsine, the batteries, and all appropriate sections of this Manual.
2. Do not expose the PROsine 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 in a zero-clearance compartment. Overheating may result.
3. Use only attachments recommended or sold by the manufacturer. Doing otherwise may result in a risk of fire, electric shock, or injury to persons.
4. The PROsine is designed to be permanently connected to you 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.
5. To avoid a risk of fire and electric shock, make sure that existing wiring is in good condition and that wire is not undersized. Do not operate the PROsine with damaged or substandard wiring.
6. Do not operate the PROsine if it has received a sharp blow, been dropped, or otherwise damaged in any way. If the PROsine is damaged, see the Warranty section.
7. Do not disassemble the PROsine. It contains no user-serviceable parts. See the Warranty section for instructions on obtaining service. Attempting to service the PROsine yourself may result in a risk of electrical shock or fire. Internal capacitors remain charged after all power is disconnected.
8. To reduce the risk of electrical shock, disconnect both AC and DC power from the PROsine before attempting any maintenance or cleaning or working on any circuits connected to the PROsine. Turning off controls will not reduce this risk.
9. The PROsine 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.

Explosive gas precautions



WARNING: Explosion hazard

1. Working in the vicinity of lead-acid batteries is dangerous. Batteries generate explosive gases during normal operation. Therefore, you must read this guide and follow the instructions exactly before installing or using your PROsine.
2. This equipment contains components which tend to produce arcs or sparks. To prevent fire or explosion, do not install the PROsine in compartments containing batteries or flammable materials, or in locations that require ignition-protected equipment. This includes any space containing gasoline-powered machinery, fuel tanks, as well as joints, fittings, or other connections between components of the fuel system.
3. 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.

Precautions When Working With Batteries



WARNING: Explosion or fire hazard

1. Follow all instructions published by the battery manufacturer and the manufacturer of the equipment in which the battery is installed.
2. Make sure the area around the battery is well ventilated.
3. Never smoke or allow a spark or flame near the engine or batteries.
4. Use caution to reduce the risk of dropping a metal tool on the battery. It could spark or short circuit the battery or other electrical parts and could cause an explosion.
5. Remove all metal items, like rings, bracelets, and watches when working with lead-acid batteries. Lead-acid batteries produce a short circuit current high enough to weld metal to skin, causing a severe burn.
6. Have someone within range of your voice or close enough to come to your aid when you work near a lead-acid battery.
7. Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.
8. Wear complete eye protection and clothing protection. Avoid touching your eyes while working near batteries.

9. If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters your eye, immediately flood it with running cold water for at least twenty minutes and get medical attention immediately.
10. If you need to remove a battery, always remove the ground terminal from the battery first. Make sure all accessories are off so you don't cause a spark.

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1

Introduction

Chapter 1 introduces you to the PROsine, explains the inverting, changing and power system management functions

Your PROsine

Congratulations on your purchase of the PROsine 2.0 Inverter/Charger (PROsine). As part of the PROsine Inverter/Charger family, the PROsine 2.0 gives you quality power, worry-free operation, and outstanding reliability. Its integrated inverting–charging functions and numerous power management features make it ideal for marine installations, recreational and commercial vehicles, and residential back-up systems.

Quality Power

The PROsine’s true sine wave output is identical to (or better than) the power supplied by your utility. A few of the benefits of true sine wave power are less interference on your TV set, more consistent cooking in your microwave, better handling of sensitive loads, and the ability to use dimmer switches and appliances with speed controls. In effect, the PROsine gives you a high quality, mobile wall socket!

Comprehensive Protection

The PROsine’s built-in protection features safeguard your batteries and equipment to give you worry-free operation:

- The adjustable **low battery cutout** prevents your batteries from becoming completely discharged.
- The **battery temperature sensor** ensures that the charge delivered to the batteries is adjusted according to their actual temperature.
- The **multi-stage charging capability** ensures that batteries receive the “best” charge with minimal wear and tear.
- If the PROsine detects “bad” AC voltage, it **switches seamlessly** to Invert mode and supplies your equipment with pure sine wave power derived from the batteries. When “good” AC becomes available again, the PROsine allows the AC to pass through to your loads and automatically begins to recharge the batteries.

Reliable Back-up

If utility-supplied power fails, the PROsine automatically detects the failure and instantly becomes an independent power source that supplies quality AC to your loads. There’s no interruption in service and no degradation in performance.

The Heart of a Sophisticated, Independent Power System

Your PROsine has been designed to be the heart of a sophisticated, independent power system. While the PROsine is an extremely “friendly” product to operate, Xantrex wants to ensure that you get the best performance from your system. So please take a few minutes to read the next few pages: they’ll give you an excellent understanding of the PROsine’s features and capabilities.

In basic terms, the PROsine is designed to:

- ρ Invert
- ρ Charge
- ρ Manage your power system

Inverting

The PROsine’s inverting function:

- ρ Produces 120Vac from your 12V batteries
- ρ Delivers 2kW of power on a continuous basis and 4.5kW of surge power to start heavy loads like air conditioners, fridges, and pumps

Much of the time the inverter may not be powering loads. During these times, you don’t want power to be drawn needlessly from the batteries. To reduce idle current to an absolute minimum, Xantrex has included three features:

- ρ Low standby battery demand
- ρ Load sense (search) mode
- ρ Remote Shutdown

Low Standby Battery Demand

When the PROsine is inverting (producing 120Vac output without a load), it draws less than 2A of current from the batteries.

Load Sense (Search) Mode

To reduce battery draw even further, you can turn on **Load Sense mode**. In Load Sense mode, the PROsine periodically sends out a search pulse to see whether a load is present. If it finds a load, it will turn on. You can adjust the interval between search pulses, and you can also adjust the load power at which the PROsine will turn on.

Note that in Load Sense mode, there’s a short time delay (up to the interval you’ve set) between the time you turn on a load and the time the PROsine delivers power. Of course, you can disable Load Sense mode at any time if you find the delay inconvenient.

Remote Shutdown Naturally, when you are not using the PROsine, you will disable the inverter to conserve your battery. The PROsine still draws up to 50mA of battery current, however—and this will eventually discharge the battery. So when you don't need the PROsine for an extended period of time, you can reduce battery draw to less than 1mA by setting the PROsine's ON/OFF/REM switch to OFF.

This disables all circuitry in the PROsine and removes all power from the display panel. Setting the PROsine's ON/OFF/REM to REMOTE lets you achieve the same result using a conveniently located system "kill" switch. This feature is particularly valuable for vehicles like ambulances where it is imperative that the system not draw power when the vehicle motor is not running.

Charging

Built-in Charge Formulas For the inverter to perform at the highest level, the batteries must be charged correctly. Every battery has a unique charge formula (or "algorithm") dictated by the manufacturer for optimal performance. The PROsine has **twenty-one built-in formulas** to charge your batteries correctly—and you have the ability to fine tune these formulas to meet the needs of new models or specialized batteries.

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 and has temperature compensated the charge algorithm.

Manual Equalization Mode Over a period of time, the cells in a flooded battery can develop uneven chemical states. This can result in a weak (undercharged) cell which, in turn, can reduce the overall capacity of the battery. To improve the life and performance of a non-sealed flooded battery, the PROsine's multi-stage charging cycle includes a manual Equalize mode that should be used occasionally to restore an equal chemical state to all cells.

Dead Battery Charging In addition to the numerous features which let you maximize your battery's life and performance, the PROsine—unlike many chargers—also has the ability to recharge batteries even if the voltage is near zero.

Power System Management

As we pointed out at the beginning of this introduction, the PROsine is designed to be the heart of your power system. In addition to refined charging and inverting functions, the PROsine is the control center for managing your power system. As the interface between your batteries, loads, and AC source, the PROsine:

- ρ Takes 12Vdc and produces 120Vac to power your loads
- ρ Takes 120Vac, when available and, via its intelligent, automatic, and fast Transfer Relay, passes the 120Vac to your loads
- ρ Uses its Power Share capability to tap off power to charge the batteries while 120Vac is being passed to the loads

And finally, the PROsine allows for the expansion of your system to meet changing power requirements.

Load Management

The PROsine has a built-in **Transfer Relay** that connects AC shorepower or inverter output to your loads. Because the usual AC power sources (marina and campground outlets or small generators, for example) often have limited current availability, having the ability to manage your AC loads is extremely valuable, and therefore the PROsine provides a number of features to facilitate this:

- ρ The charger is power factor corrected to use AC current as efficiently as possible and only requires 15 amps to provide rated charger output—some other chargers require as much as 22 amps to provide the same output. Minimizing the AC current used by the charger means more current for your loads.
- ρ The PROsine uses a Power Share feature which senses the AC load on the system and gives priority to your AC loads, thereby reducing the charger current to avoid nuisance tripping of the breaker.
- ρ Sometimes the usual AC shorepower sources have low voltage. To avoid loading these weak sources any further, the charger automatically reduces its AC current draw as the AC voltage approaches the minimum acceptable level (as set by the user).

Expandability

As your power needs grow, you can connect two PROsines in **series mode** to create a 120/240Vac split phase system which is capable of supplying 4kW (continuously).

Both of these PROsines can be connected to operate from a single (but larger) battery bank, and will work in tandem to provide the fastest possible, accurate charge.

Auto Restart After Errors The PROsine protects itself against numerous conditions (e.g. AC overload or over temperature) by shutting down. You can program the PROsine to restart automatically when the cause of the shutdown has corrected itself.

Important: **Auto Restart After Errors** is factory-set to **OFF** since this feature can cause the PROsine to start unexpectedly and supply AC.

Run Without Panel The **Run Without Panel** configuration setting is an excellent recovery feature that enables your PROsine to continue running if the display panel is disconnected or if its communication cable is damaged. **Run Without Panel** is factory-set to **OFF**.

Materials List

Your PROsine 2.0 Inverter/Charger package includes the items listed below. See Table 1-1.

- 1 PROsine 2.0 Inverter/Charger
- 1 Display panel
- 1 Communications cable (70ft; 21m)
- 1 Battery temperature sensor with a 25ft (8m) cable
- 2 DC terminal covers
- 1 User's Manual
- 1 Quick Installation Guide (includes PROsine mounting template)
- 1 Mounting template for display panel
- 1 Quick Reference Guide
- 1 ABYC Warning label

Important:**p DC Wiring Enclosure**

For residential installations, some installation codes may require a wiring enclosure for DC connections and cables. (Installation procedures are shipped with the DC Wiring Enclosure.)

p Crimp-On Ring Terminals (for DC Wiring Enclosure)

If you are using the DC Wiring Enclosure, you should use crimp-on ring terminals on the PROsine end of your DC cables. Most box connectors (set screw types) are too large to fit in the enclosure without the risk of the connector shorting to the wall of the DC Wiring Enclosure. Do not use any connector that does not provide at least 2mm clearance to the inside wall with the wire in place and the set screw tightened.

p Series Sync Cable

If you are connecting two PROsine's in series, you will need a Series Sync cable. This is a standard 4-connector telephone cable and may be purchased from most electronics retailers.

Contact Xantrex or your distributor about the Wiring Enclosure. Purchase the crimp-on ring terminals from a local supplier.

If any of these materials are missing or are unsatisfactory in any manner, please contact Customer Service. See page WA-1.

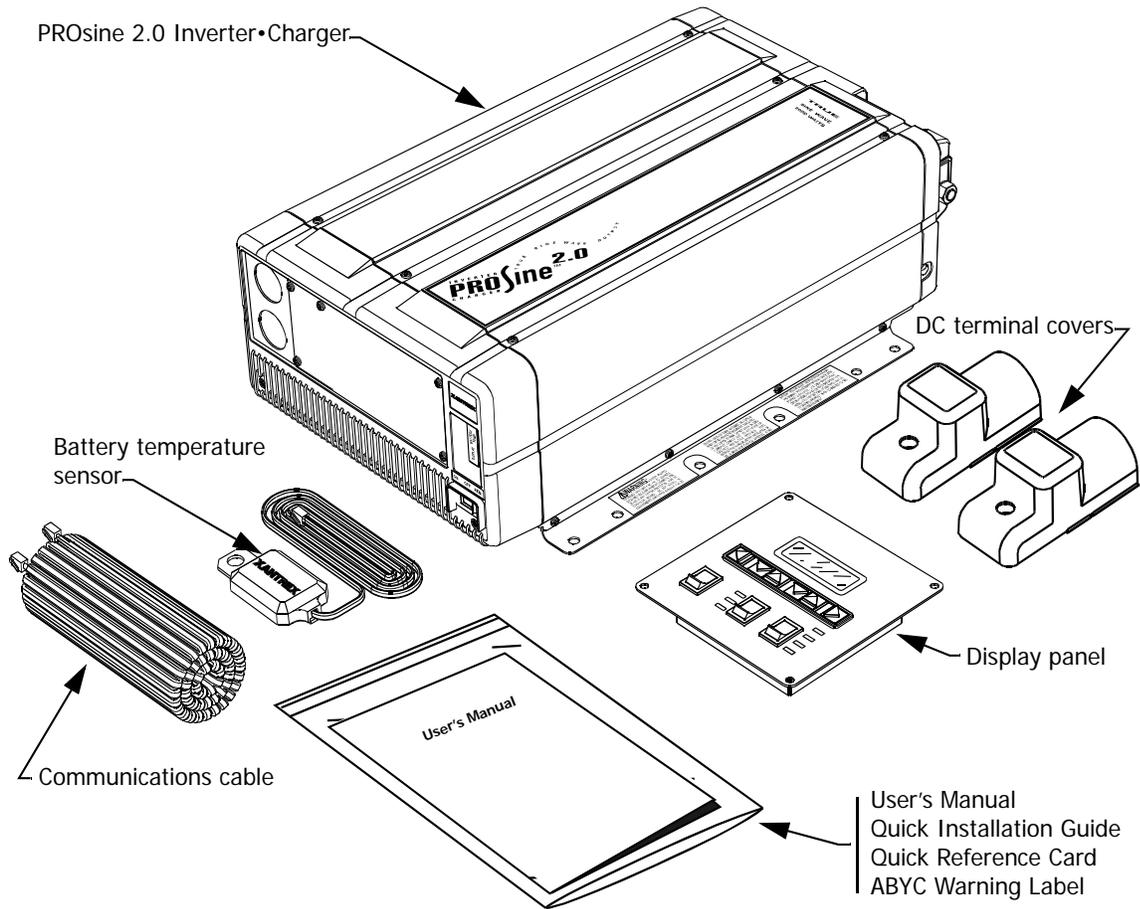


Figure 1-1 PROsine Materials as Shipped

Important:: For Marine Installations

For marine installations, you must attach the ABYC Warning label in a conspicuous location on the AC load panel. The Warning label is supplied with your PROsine and is illustrated below.

WARNING. SHOCK HAZARD. VESSEL IS EQUIPPED WITH A DC TO AC POWER INVERTER. DISCONNECT ALL ELECTRICAL SOURCES INCLUDING THE INVERTER'S AC AND DC INPUTS BEFORE SERVICING VESSEL'S ELECTRICAL SYSTEMS.

Default Values for the PROsine System

Table 1-1 lists the default settings for the PROsine system. Record your settings in the right-hand column after you have configured the PROsine. This information will be valuable if you need to reconfigure your system or call Xantrex Customer Service

Table 1-1 PROsine Default Values

Item	Default Value	Your Settings
NOTE		
At a minimum, configure the items marked with a ** after installation.		
Adjustable From the Configure PROsine—Basic Menu		
AC Breaker Size	15 amps	**
Adjustable From the Configure PROsine—Advanced Menu		
Load Sensing	Disabled	
Load Sense Power	100 Watts	
Load Sense Interval	1 second	
Low AC Transfer (V)	90V	
Low AC Transfer (Hz)	55Hz	
Hi AC Transfer (V)	130V	
Hi AC Transfer (Hz)	65Hz	
AC Series Mode	Standalone	
Inverter Low V Shutdown	10V	
Inverter Low V Warning	+0.5V	
Inverter Low V Restart Hysteresis	2.5V	
Run Without Panel	NO	
Inverter Enabled on Reset Without Panel	Disabled	
Charger Enabled on Reset Without Panel	Disabled	
Auto Restart After Error	NO	**
Adjustable From the Configure Display Panel Menu		
Audible Alarm	OFF	
LCD Backlight Mode	Auto	
LCD Backlight Brightness	50%	
LCD Backlight Timeout	20 seconds	
Temperature	Fahrenheit	

Table 1-1 PROsine Default Values

Item	Default Value	Your Settings
Adjustable From the Configure Battery Menu		
NOTE Settings below are for Battery Type = Generic Gel.		
Battery Size	200Ah	**
Default Battery Temperature	Warm	
Battery Type	Generic Gel	**
Battery Temp. Coefficient	-27mV/°C	
Bulk Mode Settings: • Max Voltage • Max Current (%C) • Threshold Voltage • Threshold Timeout	• 14.2V • 25% • 13.8V • 3min	
Absorption Mode Settings: • Max Voltage • Max Current (%C) • Max Timeout • Threshold Current (%C) • Threshold Timeout	• 14.2V • 25% • 8hr • 1% • 3min	
Overcharge Mode Settings: • Max Voltage • Max Current (%C) • Max Timeout	• 14.2V • 20% • 0	
Float Mode Settings: • Max Voltage • Max Current (%C) • Max Timeout • Threshold Voltage • Threshold Timeout	• 13.8V • 200% • 21days • 12.5V • 15min	
Equalize Mode Settings: • Max Voltage • Max Current (%C) • Max Timeout • Threshold Voltage • Threshold Timeout	• 13.8V • 200% • 0 • 0 • 0	
Constant Mode Settings: • Voltage Setpoint • Current Setpoint	• 13.5V • 100A	
Charger Mode	Standalone	
Charger Type	3-Step	
Charger High Battery V Warning Offset	1.0V	

NOTE

The values opposite the gray bar are set when you select a battery type. If you did not subsequently change these settings, they do not need to be recorded.

2

Product Orientation

Chapter 2 will familiarize you with the following components of a PROsine system:

- PROsine features. (Start on page 2–2.)
- Display panel features. (Start on page 2–6.)
- Battery temperature sensor. (See page 2–12.)

PROsine Features

AC End

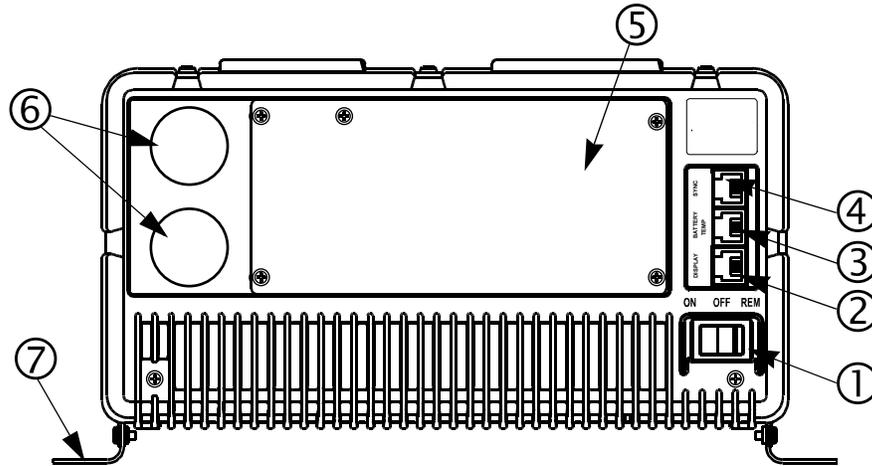


Figure 2-1 AC End View (Blank Panel Option)

Feature	Description
1	<p>ON/OFF/REM Switch:</p> <p>ON: Normal operation according to the way the unit has been configured via the display panel.</p> <p>OFF: The inverter and charger are off; shorepower is not passed through to the loads. The unit draws the lowest battery current possible (less than 2mA).</p> <p>REM: With the switch in this position, the unit can be turned on and off remotely. (For details, see “ON/OFF/REMote Control of PROsine Operation” on page 5–3.)</p>
2	<p>DISPLAY: Jack for the display panel.</p>
3	<p>BATTERY TEMP/REMOTE: Jack for the battery temperature sensor. Also provides a connection for remote shutdown. See “Step 10: Connecting the Remote Shutdown” on page 3–24.</p>
4	<p>SYNC: Jack for synchronizing a second PROsine to produce 120/240V split phase AC. For details, see Chapter 7, “Series Operation”.</p>
5	<p>Removable panel. The blank panel option is shown. For details, see “AC Panel Options” on page 2–3. The AC wiring compartment is located behind the panel.</p>
6	<p>Knockouts for AC wiring</p>
7	<p>Mounting flange</p>

AC Panel Options

The PROsine has two AC panel options, each of which includes one 30A hardwire output circuit:

- Blank access panel: one hardwire output circuit. See Figure 2-1.
- Panel equipped with 15A GFCI receptacle and one hardwire output circuit. See Figure 2-2.

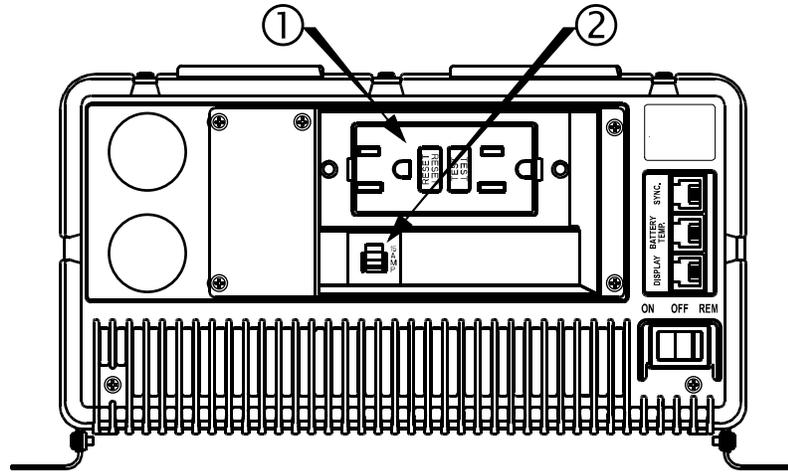


Figure 2-2 Panel Equipped With GFCI and Circuit Protector

Feature	Description
1	GFCI Duplex Receptacle
2	15A circuit protector for GFCI

DC End

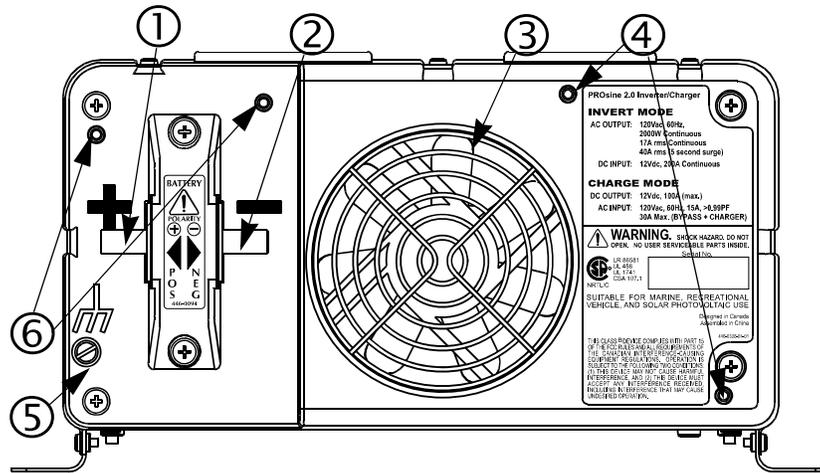


Figure 2-3 DC End

Feature	Description
1	Positive DC cabling terminal, 8 mm stud
2	Negative DC cabling terminal, 8 mm stud
3	Cooling fan. (For details, see “Fan Operation” on page 5–3.)
4	Screw holes for mounting accessory modules
5	Chassis ground lug. Provides a ground path for the PROsine chassis to the DC system ground.
6	Screw holes for mounting the optional DC wiring enclosure. See “Materials List” on page 1–6 for information about the crimp-on ring terminals to be used with this option.

DC Terminal Covers

Two covers—red for positive and black for negative—are supplied to prevent accidental contact with the cabling connectors after installation.

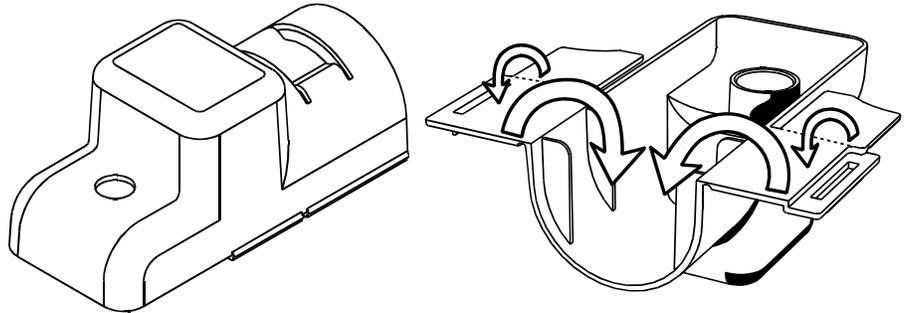


Figure 2-4 DC Terminal Cover: Top View on Left; Bottom View on Right

Display Panel Features

The display panel lets you monitor and control the PROsine system. For convenience, the liquid crystal display (LCD) is backlit and the panel can be configured so an audible tone alerts you to any warnings or system faults that occur. The panel's features are described below.

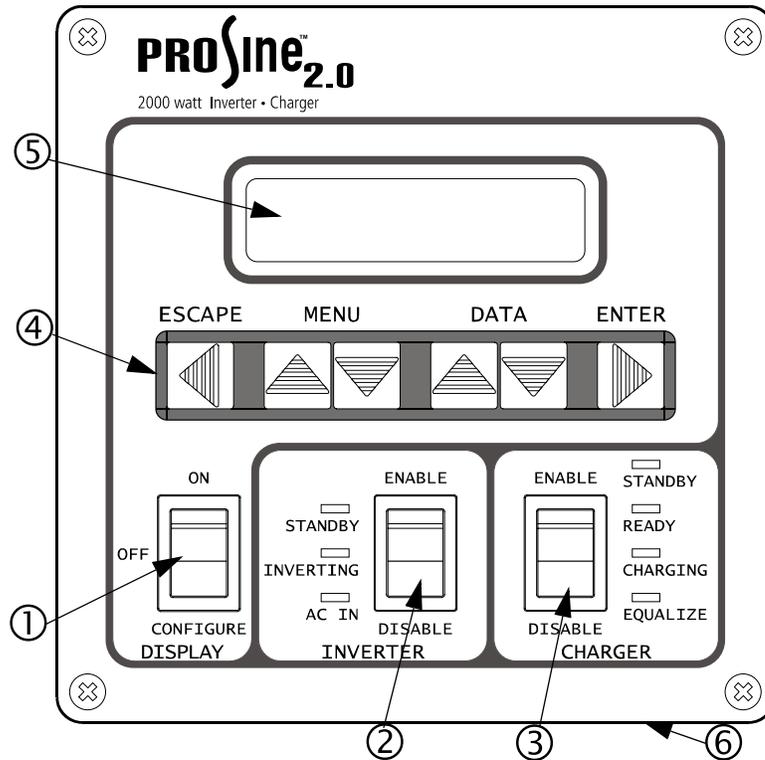


Figure 2-5 PROsine Display Panel

Feature	Description
1	DISPLAY mode switch
2	INVERTER switch and status LEDs
3	CHARGER switch and status LEDs
4	Menu navigation and data selection buttons
5	LCD display
6	Two input jacks (not illustrated) on the bottom of the unit behind the faceplate. Either jack can be used for the communication cable that connects the panel to the PROsine. The second jack can be used to connect future accessories.

DISPLAY Mode Switch

Switch Position	Description
ON	Puts the unit in Display mode. Data Display screens are shown so you can monitor system performance.
OFF	Power continues to be available to the panel so vital data like system errors and warning statuses can be checked.
CONFIGURE	Puts the inverter in Configure mode. Configuration screens are available, and you can configure the system without turning on the inverter and charger functions.

INVERTER Switch

This switch is active in all Display modes: ON, OFF, CONFIGURE.

Switch Position	Description
ENABLE	The inverter is enabled and will run if there is no shorepower. (NOTE: Throughout this manual, the term “shorepower” refers to AC input power from a utility grid, generator, or other source.)
DISABLE	When the AC power does not meet configuration parameters (i.e. is “bad”), the inverter is off and will consume minimal power. When the AC power is good, the inverter is off and will consume minimal power. The PROsine’s transfer relay is in the “Pass Through” position. (The transfer relay allows shorepower to pass through the PROsine to the AC output terminals whenever AC is connected unless there is an error, or the PROsine is turned Off with the PROsine ON/OFF/REM switch.)

INVERTER LEDs

The LEDs are continuously updated whenever the Display Mode switch is set to ON or CONFIGURE.

LED	Description		
STANDBY and INVERTING	STANDBY LED Status	INVERTING LED Status	
	OFF	OFF	Inverter is not running because it has not been enabled or a system error has occurred.
	OFF	ON	The unit is inverting.
	ON	OFF	Invert is enabled, but the unit is not inverting because of an error or because shorepower is “good.”
	INVERT FLASHING		Unit is searching in Load Sense mode.
AC IN	OFF		“Good” shorepower has not been detected.
	ON		“Good” shorepower has been detected.
	FLASHING		Shorepower line and neutral are reversed or neutral is disconnected. Have an electrician check the wiring.

CHARGER Switch

This switch is active in all Display modes: ON, OFF, CONFIGURE.

Switch Position	Description
ENABLE	The charger is enabled and will charge the battery according to the way the unit is configured if shorepower is “good.”
DISABLE	The charger is off and will consume minimal power.

CHARGER LEDs

The LEDs are continuously updated whenever the Display Mode switch is set to ON or CONFIGURE.

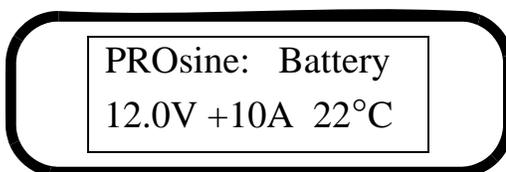
LED	Description		
STANDBY and CHARGING	STANDBY LED Status	CHARGING LED Status	
	OFF	OFF	The charger is not running because it is not enabled, the charge cycle has been completed, or a system error has occurred.
	OFF	ON	The charger is running.
	ON	OFF	The charger is enabled but is not running because shorepower is not “good.”
EQUALIZE	OFF		Equalize mode has not been selected.
	ON		The charger is in Equalize mode and the batteries are charging. CAUTION: Battery voltage may go up to 17V.
	FLASHING		Equalize mode has been selected; the charger is presently executing the basic charge cycle in preparation for Equalization mode. (The CHARGING LED is also on in this stage.)
READY	OFF		The charger is not running, or the Charge cycle is not finished.
	ON		The Charge cycle is complete. The battery is fully charged.

LCD Panel

The LCD panel lets you monitor the PROsine system and change its configuration settings. It operates in two basic modes: Data Display and Configuration.

Data Display Mode

- In Data Display mode the screens provide information about PROsine system performance.
- You can cycle through them by pressing the Up \uparrow and Down \downarrow Menu buttons. (In Data Display mode, the other buttons have no function.)
- Typically, the top line indicates the type of data being displayed and the actual data appears on the bottom line. A sample screen is shown below:



- Examples of all the Display screens are shown on page 5–10.

Configuration Mode

- In Configuration mode, the screens show data that can be changed as well as read-only data. (For details about each Configuration screen, see, Chapter 4, “Configuration”.) Using these screens, you can:
 - Define the operating parameters of the PROsine (including AC breaker size, battery size, battery type, types of charge, load sense capability, etc.)
 - Adjust the display characteristics of the panel (including an audible alert, screen contrast, and screen backlighting)
 - View current operational data, Warning messages, Error messages, and Panel fault messages in order to monitor and troubleshoot system performance
- Two sample screens are shown below:



Menu Navigation and Data Selection Buttons

When the DISPLAY switch is set to CONFIGURE, the menu navigation and data selection buttons operate as follows:

Press This Button	To
ESCAPE 	<ul style="list-style-type: none"> • Cancel changes made to data • Back up one menu level
MENU Up 	Back up one menu item
MENU Down 	Proceed to next menu item
DATA Up 	Increase data value or cycle through available options
DATA Down 	Decrease data value or cycle through available options
ENTER 	Save changes or proceed to next menu level

Examples of how to change configuration settings are given on page 4–3.

Further information about viewing Display mode screens is provided on page 5–10

Battery Temperature Sensor

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

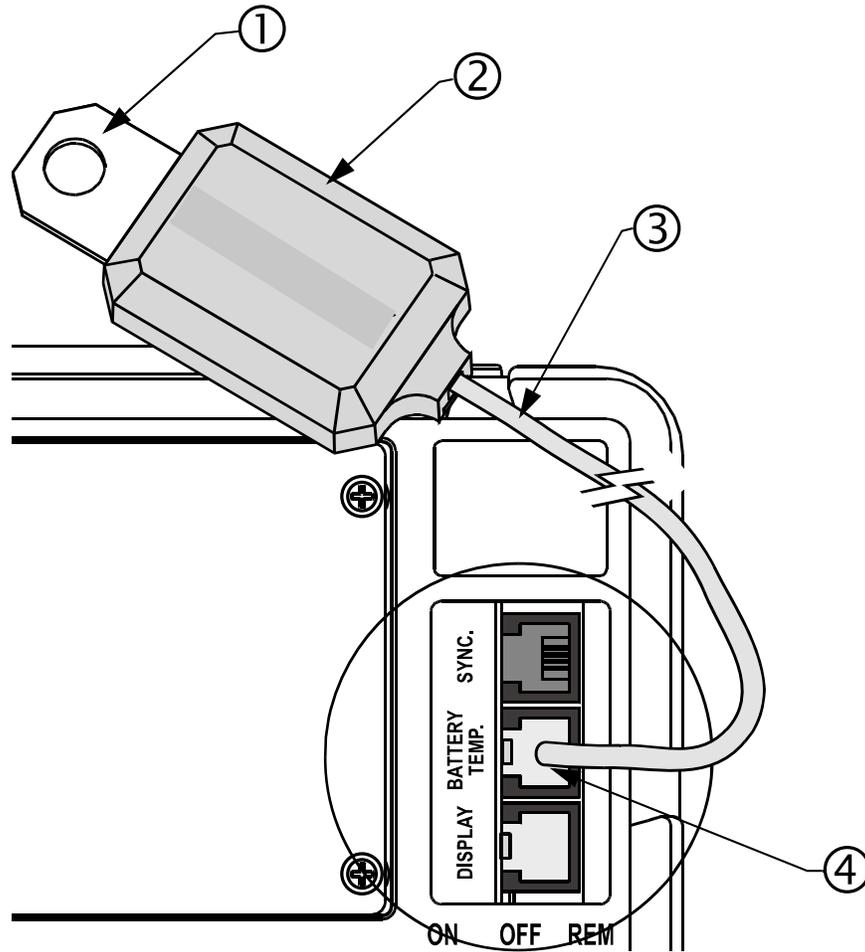


Figure 2-6 Battery Temperature Sensor

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).
4	Connector. Plugs into the Battery Temp jack on the PROsine.
NOTE: The battery temperature sensor is electrically isolated from the mounting plate.	

3

Installation

Chapter 3 This section gives complete information for installing a PROsine system.

Specifically, this section describes:

- Safety instructions and installation codes that must be observed during installation
- Installation tools and materials
- Appropriate locations and environments for mounting the PROsine, display panel, and battery temperature sensor
- AC cabling, DC cabling, and grounding information
- Detailed installation procedures on page 3–3.

For information about installing two PROsines in series, see Chapter 7, “Series Operation”.

Safety Instructions



WARNING: Shock hazard

Xantrex Technology recommends that all wiring be done by a certified technician or electrician to ensure adherence to approved electrical wiring regulations.

- Before you begin the installation, review the “Important Safety Instructions” on “Important Safety Instructions” on page vii, and read the entire “Installation” section so you can plan your installation from beginning to end.
- Disconnect all AC and DC power sources to prevent accidental shock. Disable and secure all AC and DC disconnect devices and automatic generator starting devices.

Installation Codes

Governing installation codes vary depending on the specific location and application of the installation. Some examples include the following:

- The U.S. National Electrical Code (NEC)
- The Canadian Electrical Code (CEC)
- The American Boat and Yacht Council (ABYC) and the US Coast Guard requirements for installations on marine vessels
- The U.S. Code of Federal Regulations (CFRs)
- Canadian Standards Association (CSA) and the RV Industry Association (RVIA) for installations in RVs

It is the installer’s responsibility to ensure that all applicable installation requirements are met.

Installation Tools and Materials

You will need the following to install the PROsine, display panel, and battery temperature sensor:

- p Wire stripper
- p Mounting screws or bolts
- p #2 Phillips screwdriver
- p Wrench for DC terminals (1/2 inch or 13mm or adjustable)
- p AC cable (i.e. 2-conductor-plus-ground cable), sized appropriately for load and application
- p Wire nuts or crimp connectors for AC wire and appropriate tools
- p Two 1/2 inch strain-relief clamps for AC cables
- p DC cable, sized appropriately for load and application
- p Lugs for DC cables to fit 8 mm (5/16 in.) DC stud terminals) as well as appropriate tools (e.g. crimping tool)
- p AC and DC disconnects and over-current protective devices

Important: For residential installations, installation codes may require a wiring enclosure for DC connections and cables. Contact Xantrex or your distributor for this part.

Installation Procedures

This section provides detailed installation information. For your convenience, the overall procedure is divided into ten main steps:

- p **Step 1:** Designing an installation. (Start on page 3–4.)
- p **Step 2:** Choosing a location for the PROsine. (Start on page 3–9.)
- p **Step 3:** Mounting the PROsine. (Start on page 3–10.)
- p **Step 4:** Connecting the AC input wiring. (Start on page 3–11.)
- p **Step 5:** Configuring the output neutral bonding system. (Start on page 3–13.)
- p **Step 6:** Connecting the AC output wires. (Start on page 3–15.)
- p **Step 7:** Connecting the DC cables. (Start on page 3–17.)
- p **Step 8:** Mounting the display panel. (Start on page 3–20.)
- p **Step 9:** Connecting the battery temperature sensor. (Start on page 3–21.)
- p **Step 10:** Connecting the remote shutdown feature. (Start on page 3–24.)

Step 1: Designing the Installation

All types of PROsine installations share common components, and these are briefly described below. Figure 3-1 shows these components and their relationship to each other in a typical recreational vehicle or fleet vehicle installation. (For diagrams of typical residential backup and marine systems as well as series installations, see Appendix B, “System Diagrams”.)

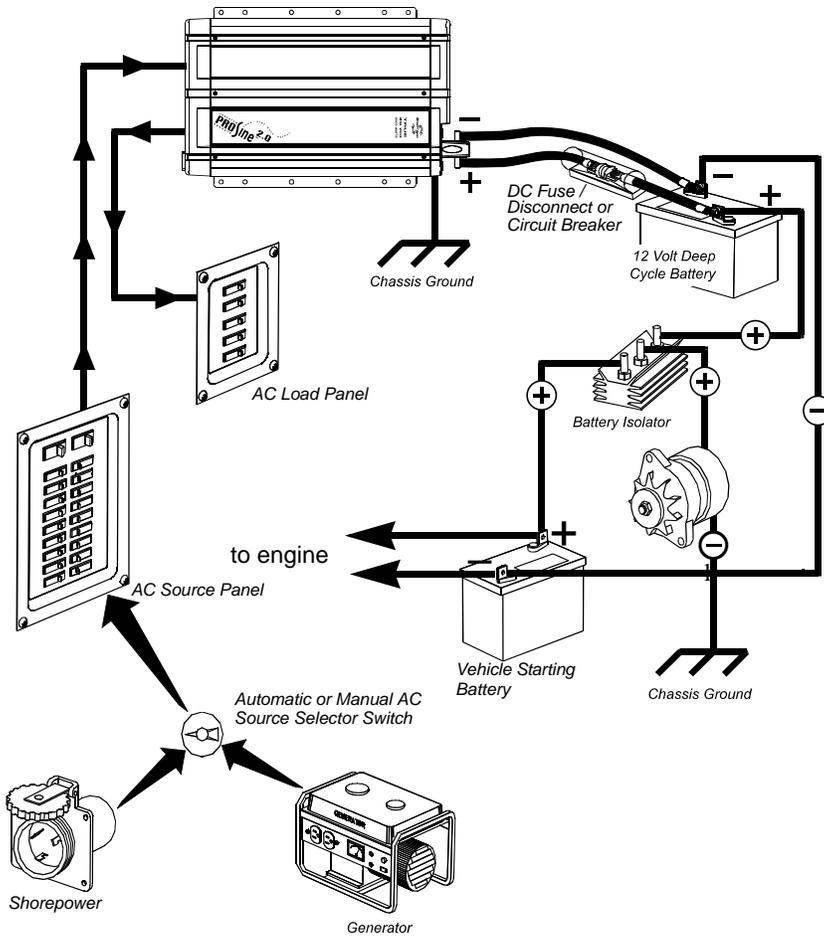


Figure 3-1 Typical Recreational Vehicle and Fleet Vehicle Installation

AC shorepower A source of 120 volt, 60Hz alternating current is needed to provide energy for charging batteries and to pass through to AC loads. This source could be the utility grid (power company) or an AC generator. An automatic or manual AC source selector switch can be used to connect one of the multiple sources of shorepower to the PROsine system.

Important: Throughout this manual, the term “shorepower” refers to AC input power from a utility grid, generator, or other source.

Generator The PROsine is compatible with virtually all generators which produce nominally 120Vac 60Hz power. The best generators produce a sinewave output, others produce a distorted sinewave, and the lower quality generators produce a "modified sinewave" (MSW) or squarewave output. The PROsine will operate correctly on sinewave or distorted-sinewave generators; it will also operate correctly on most MSW or squarewave generators but some models of these generators may prove incompatible. See Chapter 6, “Troubleshooting” for errors related to generator incompatibility.

Since the charging current limit of the PROsine may be configured all the way down to 0A it is possible to use very small generators with the PROsine to charge batteries. Xantrex has operated the PROsine from a generator as small as 700W. To do this, configure the "AC Breaker Size" (found in **Configure PROsine — Basic Menu** on page 4–7) to a current rating compatible with the generator size. For example, 6A should work well with a 700W generator, 8A should work with a 1000W generator - experiment to find the largest setting that the generator can accommodate. To operate the PROsine at the full 100A charging current rating Xantrex recommends a 2kW generator or larger and a breaker size setting of 20A.

AC Disconnect and Over-Current Protection Device To meet CSA, UL, and electrical code requirements, the PROsine’s AC and DC inputs and outputs must be provided with over-current protection (such as a circuit breaker or fuse) and a disconnect device, as follows:

AC Input: The circuit breaker or fuse used to protect the PROsine must be rated no more than 30A and must be approved for use on 120Vac branch circuits. The wire used between the breaker and the PROsine 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 must also be set to match the size of the breaker provided. (See Chapter 4, “Configuration” and the following section.)

AC Output: The circuit breaker or fuse must be rated at no more than 30A and must be approved for use on 120Vac branch circuits. The wire used between the PROsine and the AC output breaker must be sized to match the AC input circuit breaker’s rating. The wire from the AC output breaker to your loads must be matched to the rating of the AC output breakers.

Disconnect Devices: Each system requires a method of disconnecting the AC circuits. If the over-current protection device is a circuit breaker, it will also serve as the disconnect. If fuses are used, separate AC disconnect switches will be needed ahead of the fuses.

AC Distribution Panels

Most systems incorporate distribution centers both ahead of the PROsine (the AC source panel) and between the PROsine and the loads (the AC load panel). A source panel includes a main circuit breaker, which serves as over-current protection and as a disconnect for the AC shorepower supply line. Additional circuit breakers serve individual circuits, one of which serves the PROsine. The AC load panel can incorporate both the main 30A AC output circuit breaker and breakers for individual load circuits.

Important: Do not connect the output of a single PROsine to what is known as a “multi-wire branch circuit”. These are 4-wire circuits consisting of a ground, neutral, and two lines that are 180 degrees out of phase with each other (from a standard 120/240V “split phase” circuit). These circuits are commonly used in kitchens to power “split receptacles” where the top and bottom halves of a duplex receptacle are connected to different lines. If you need to run multi-wire branch circuits from your inverter system, you will need to use two PROsine units in a series system to create 120/240Vac split-phase power. For details, see Chapter 7, “Series Operation”. For more information about multi-wire branch circuits, refer to the US National Electrical Code (NFPA 70, 1999) para 210–4 and the Canadian Electrical Code (CSA C22.1-1998) section 26–710.

AC Cabling

AC cabling includes all the wires and connectors between the AC source and the PROsine and all cabling between the PROsine and the AC panels, circuit breakers, and loads. The type and size of the wiring varies with the installation and load. For marine and some RV applications, flexible multiple-strand wire is required. For residential installations, solid Romex™ cable is often used. Installation codes may specify solid or stranded, overall size of the conductors, and type and temperature rating of the insulation around the wire.

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. Table 3-1 is based on the U.S. National Electrical Code and the Canadian Electrical Code, assuming 2-conductor-plus-ground cable. Other codes and regulations may be applicable to your installation.

Table 3-1 Required AC Wire Size vs Breaker Rating

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

AC Output Neutral Bonding

The neutral conductor of the PROsine’s AC output circuit is automatically connected to the safety ground during inverter operation. When AC utility power is present and the PROsine is in Charger mode, this connection is not present, so that the utility neutral is only connected to ground at your source panel. This conforms to National Electrical Code requirements that separately derived AC sources (such as inverters 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 source panel.

DC Cabling

This includes all the cables and connectors between the batteries, the DC disconnect and over-current protection device, and the PROsine. All installations require multi-strand insulated cables as well as disconnect and over-current devices. DC cable sizes are indicated by AWG notation or MCM notation. Under the AWG standard, a larger gauge number indicates a smaller wire diameter. Under the MCM standard, a larger number indicates a larger cable. Wire size is usually marked on the cables for sizes this large. Table 3-2 specifies the minimum DC cable size and maximum fuse size for the PROsine. **The DC cables must be copper and must be rated 75°C minimum.** The cables should be terminated with lugs that fit the DC stud terminals snugly (8 mm or 5/16 in. hole size).

Table 3-2 Required DC Cable and Fuse Size

DC Cable Length	Cable Size	Fuse Amps
Less than 6 feet	250MCM	300A class T
Between 6 and 12 feet	350MCM	300A class T

Important: Using the correct cable size is critical to achieving the rated performance of the PROsine unit. When starting a heavy load the PROsine can draw current surges from the battery of up to 600A. If the wire is too small the voltage drop from this surge will result in a voltage at the PROsine terminals that is too low for the PROsine to operate correctly. The PROsine may appear to operate correctly with smaller cables until a heavy load such as an air conditioner attempts to start - then the unit may work correctly sometimes and not work correctly other times.

DC Disconnects and Over-Current Devices

The DC circuit from the battery to the PROsine must be equipped with a disconnect and over-current device. This usually consists of a circuit breaker, a “fused-disconnect,” or a separate fuse and DC disconnect. Do not confuse AC circuit breakers with DC circuit breakers. They are not interchangeable. The rating of the fuse or breaker must be matched to the size of cables used in accordance with the applicable installation codes. The breaker or disconnect and fuse should be located as close as possible to the battery, in the positive cable. Applicable codes may limit how far the protection can be from the battery.

Batteries

Every PROsine system requires a deep-cycle battery or group of batteries that provide the DC current that the PROsine converts to AC. Different battery types and sizes are available; many of these are discussed in Application Note: Battery Banks for Inverter Systems (976-0114-01-01). Automotive-type starting or “cranking” batteries are not recommended, except for temporary emergency use. The PROsine uses 12-volt battery banks.

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 and are usually required in wet or damp locations.

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

While the true sine wave output of the PROsine is equivalent to the waveform provided by utilities, compliance with UL standards requires that Xantrex test and recommend specific GFCIs. As of October 2005, Xantrex has tested the GFCI-protected 15A receptacles listed in Table 3-3 and found that they function properly when connected to the AC output of the PROsine.

Table 3-3 Tested GFCI Models

Manufacturer	Model Number ^a
Leviton	8598, 8599, 8898, 8899, 6598 ^b , 6599 ^b
Cooper/Eagle	XGF15, XGF20, GF15 ^b , GF20 ^b
Pass & Seymore	1594, 2094, 1591 ^b
Hubbell/Bryant	GF52* ^A ^c , GF53* ^A ^c , GF82* ^A ^c , GF83* ^A ^c , GFR5252* ^A ^c , GFR5352* ^A ^c , GF8200* ^A ^c , GF8300* ^A ^c , GF52 ^b , GF53 ^b , GF82 ^b , GF83 ^b , GF5252 ^b , GF5352 ^b , GF8200 ^b , GF8300 ^b

a.GFCI models may change over time. Refer to the Application Note “Using GFCI Receptacles on Xantrex Inverters and Inverter Chargers” on the Xantrex website for up-to-date test results.

b.This is an old model and is generally no longer sold as it does not offer the same level of protection as the newer models.

c.The asterisk * represents one or two letters to indicate the front color of the receptacle. The A indicates that this is the newer model which meets the latest safety standard.

Step 2: Choosing a Location for the PROsine



WARNING: Fire and explosion hazard

This equipment contains components that tend to produce arcs or sparks. To prevent fire or explosion, do not install the PROsine in compartments containing batteries or flammable materials or in locations that require ignition-protected equipment. This includes any space containing gasoline-powered machinery, fuel tanks, or joints, fittings, or other connections between components of the fuel system.



WARNING: Fire hazard

To reduce the risk of fire, do not cover or obstruct the ventilation openings. Do not install the PROsine in a zero-clearance compartment. Overheating may result.

The PROsine should only be installed in locations that meet the following requirements:

- p **Dry.** Do not allow water or other fluids to drip or splash on the PROsine. **Do not mount the PROsine in an area subject to splashing water or bilge water.**
- p **Cool.** Normal air temperature should be between 32°F and 104°F (0°C and 40°C)—the cooler the better.
- p **Ventilated.** Allow at least 5 in. (13cm) of clearance at the DC end of the PROsine for air flow, 1 in. (2.5cm) on each side, and 2 in. (5cm) at the AC end. For cooling, the volume of the enclosure is not as important as the overall supply of air. The more clearance for ventilation around the unit, the better the performance. Do not allow the ventilation openings on the ends of the unit to become obstructed.
- p **Safe.** Do not install the PROsine in the same compartment as batteries or in any compartment capable of storing flammable liquids like gasoline.
- p **Close to the battery compartment and the AC source and load panels.** Avoid excessive cable lengths (which reduce input and output power due to wire resistance). Use the recommended cable lengths and sizes.
- p **Protected from battery acid and gases.** Never allow battery acid to drip on the PROsine or its wiring when reading specific gravity or filling the battery. Also do not mount the unit where it will be exposed to gases produced by the batteries. These gases are very corrosive, and prolonged exposure will damage the PROsine.

Step 3: Mounting the PROsine

To mount the PROsine:

1. Remove the PROsine from its shipping container, verify that all components are present, and record relevant product information on “Information About Your System” on page WA-4.
2. Turn off the ON/OFF/REM switch on the AC end.
3. Select an appropriate mounting location and orientation. (See Figure 3-2.) To meet regulatory requirements, the PROsine must be mounted in one of the following orientations:
 - In a horizontal position on a vertical surface with the AC knockouts near the top as shown in Figure 3-2
 - On a horizontal surface
 - Under a horizontal surface

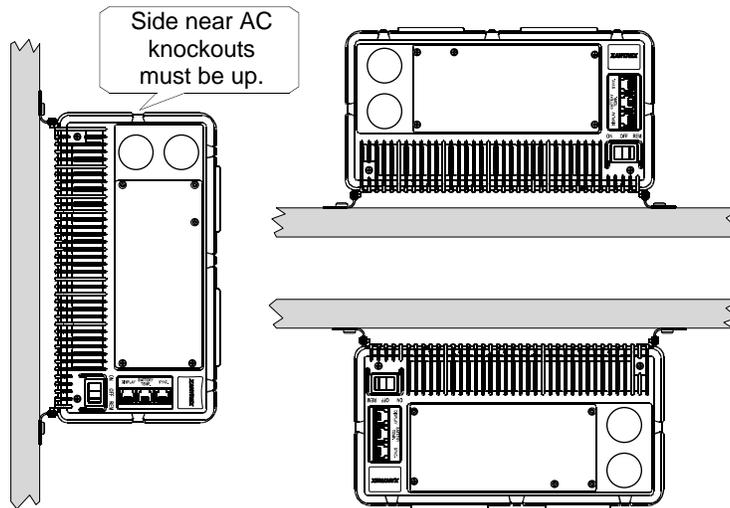


Figure 3-2 Approved Mounting Orientations

4. The *PROsine Quick Installation Guide* has a mounting template printed on it. Tape it to the mounting surface and pilot-drill the desired number of mounting holes. Remove the template.
5. Fasten the PROsine to the mounting surface. If you are mounting the unit on a wall or bulkhead, use #12 or #14 pan-head wood or sheet metal screws to secure it to the framing behind the wall or bulkhead. Alternatively, use nut inserts and 1/4-20 machine screws.

Step 4: Connecting the AC Input Wires



WARNING: Fire, Shock and Energy hazards

Make sure wiring is disconnected from all electrical sources before handling. All wiring must be done in accordance with local and national electrical wiring codes. Do not connect the output terminals of the PROsine to any incoming AC source.

General AC Wiring Considerations

AC Wiring Connectors

Connect AC wires with twist-on wire nuts or crimp-on splice connectors according to the type of installation:

- On a boat, use crimp-on splice connectors to meet the American Boat and Yacht Council's Standards and Recommended Practices for Small Craft, which do not allow twist-on connectors for AC connections.
- For non-marine installations subject to vibration, you should still use crimp-on connectors.
- For non-marine installations in locations not subject to vibration, twist-on wire nuts may be used instead of crimp-on connectors.
- The amount of insulation you strip off individual wires will be specified by the connector manufacturer and is different for different types of connectors.

AC and DC Wiring Separation

Do not mix AC and DC wiring in the same conduit or panel. Where DC and AC wires must cross, make sure they do so at 90° to one another. Consult code for details about DC and AC wiring in vicinity to each other.

AC Wiring Compartment

For your reference, the AC Wiring Compartment is shown in Figure 3-3.

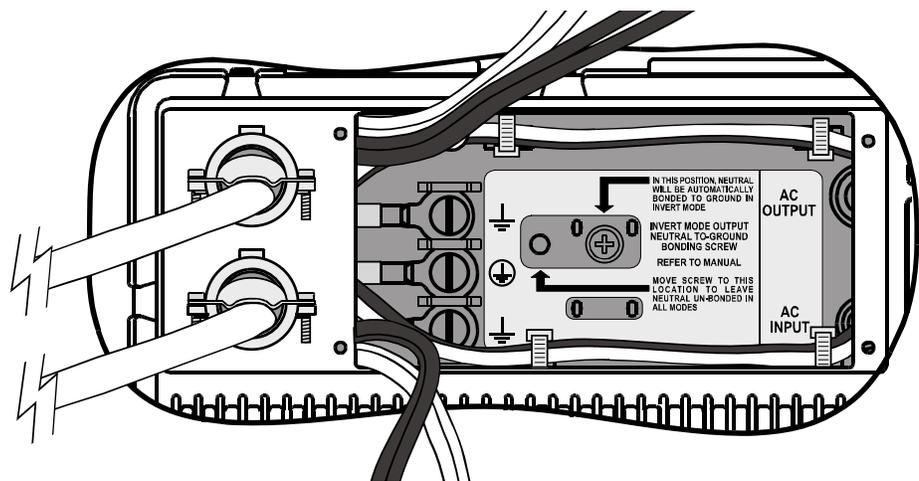


Figure 3-3 Interior of AC Wiring Compartment

AC Input Connections

Figure 3-4 is a cutaway top view of the PROsine wiring compartment. It shows one incoming AC cable and its connections to the PROsine wires.

To make the AC input connections:

1. Run 10AWG 2-conductor-plus-ground cable through one of the cable clamps on the AC end.
2. Strip about two inches of the jacket from the AC cable and separate the three wires.
3. Connect the incoming black and white (line and neutral) wires to the PROsine AC input black and white wires.
4. Connect the incoming ground wire to the screw on the chassis marked . Use a crimp-on ring terminal if the AC input ground wire is stranded. Solid wire can be screwed directly under the head of the screw.

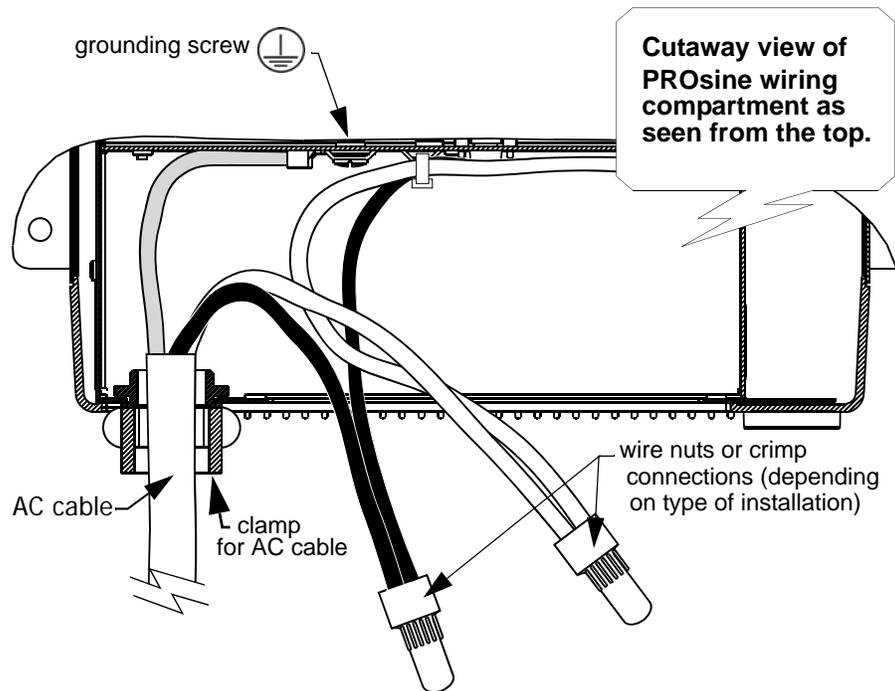


Figure 3-4 Incoming AC Cable (Top, cutaway view of wiring compartment)

Step 5: Configuring the Output Neutral Bonding System

AC Output Neutral-to-Ground Bonding System

The PROsine provides an installer-defeatable system that automatically connects the neutral conductor of the inverter AC output circuit to safety ground (“bonding” it) during inverter operation, and disconnects it (“un-bonding” it) when the PROsine has connected to AC shorepower. This system is designed to conform to installation codes that require single-phase AC sources such as inverters and generators to have their neutral conductors tied to ground in the same way that the neutral conductor from the utility is tied to ground.

These same codes specify that the neutral can only be connected to ground in one place at any one time. Any AC source feeding the PROsine is required to have its neutral already connected to ground. Therefore, to keep from connecting the neutral to ground in a second place, the PROsine transfer relay breaks its own neutral ground connection when connected to shorepower.

This automatic neutral-to-ground bonding system is suited for installations in which the AC shorepower source is known to have a bonded neutral. This will be the case in most situations: in a utility feed after the AC source panel, at an RV park hook-up, at a marina’s shorepower hook-up, or with a generator with a bonded neutral.

In some installations, however, the AC shorepower source will not have a bonded neutral. This is true on some generators and it is true in certain utility-feed situations. To accommodate these situations, the PROsine automatic neutral bonding system can be defeated, so the PROsine will not bond the neutral in any mode of operation. This allows the installer to bond the neutral in the AC load panel to provide the required single-point bonding of the neutral.

To enable and disable the automatic AC output neutral-to-ground bonding system



WARNING: Fire and Shock hazard

AC neutral bonding system settings should only be changed by a qualified installer aware of the implications of the changes. Disconnect all AC and DC sources before working in the AC wiring compartment or before making a setting change.

You enable and disable the system using a screw in the AC wiring compartment, identified as the “Invert Mode Output Neutral-to-Ground Bonding Screw”. (See Figure 3-3.) This screw is identified with a label that indicates two different holes that the screw can be mounted in. One hole is identified as the one that enables the automatic bonding system, and the other hole defeats it so that the neutral is not bonded by the PROsine in any mode.

The PROsine is shipped with the screw in the position that enables the automatic bonding system.

- To disable the system, move the screw to the other hole.
- Do not remove the screw from the product: make sure it is always installed in one position or the other, as appropriate for the configuration of the rest of the system.

Table 3-4 AC Output Neutral-to-Ground Bonding Screw Settings

Bonding Screw Setting	Status of Bonding Internal to the PROsine		Neutral Bonding Required External to the PROsine	
	AC shorepower not present (unit Inverting or in Standby)	AC shorepower present (unit Charging or in Standby)	In the AC input shorepower source	In the AC load panel
Automatic bonding	Output neutral bonded	Output neutral un-bonded	Yes	No
Un-bonded in all modes	Output neutral un-bonded	Output neutral un-bonded	No	Yes

Step 6: Connecting the AC Output Wires

Two options are available for AC output wiring:

- Hardwire output.
- Single hardwire output plus GFCI receptacle.

Connections for Hardwire Option

To make the AC output wiring connections

1. Run 10AWG 2-conductor-plus-ground cable through one of the cable clamps on the AC end.
2. Strip about two inches of the jacket from the AC cable and separate the three wires. Strip insulation from each of the wires according to the guidelines given by the connector manufacturer.
3. Connect the outgoing black and white (line and neutral) AC wires to the PROsine AC output black and white wires.
4. Connect the incoming ground wire to the chassis using one of the screws marked \perp .
5. Connect the outgoing AC wires to an AC load panel equipped with circuit breakers.

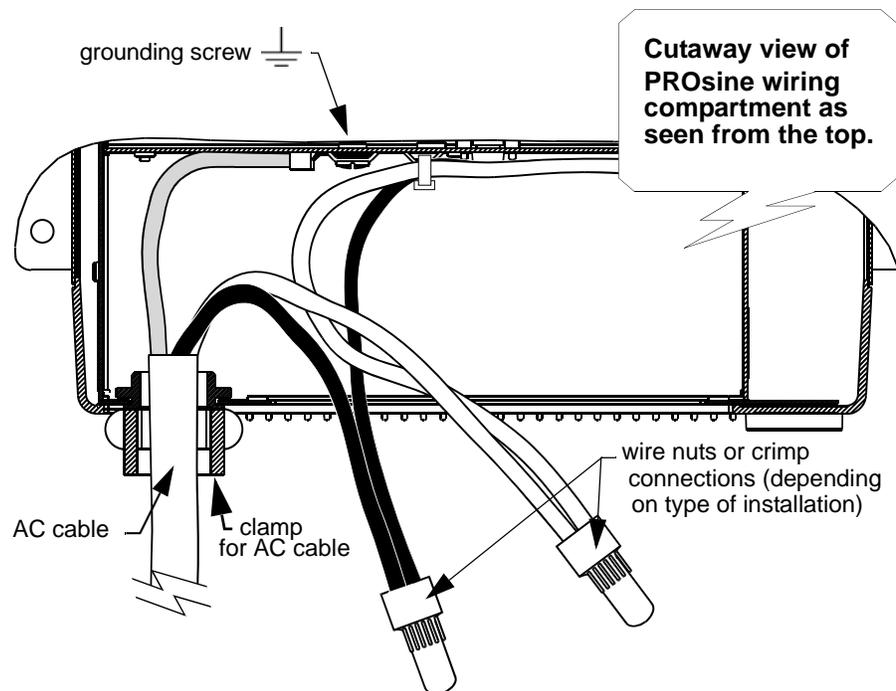


Figure 3-5 Hardwire AC Output Option (Top, cutaway view of wiring compartment)

Connections for Single Hardwire Output With GFCI

Figure 3-6 is a cutaway top view of the PROsine wiring compartment showing one set of outgoing AC wires with the GFCI option.

To make the AC output wiring connections

1. Run 10AWG 2-conductor-plus-ground through one of the cable clamps on the AC end.
2. Strip about two inches of the jacket from the AC cable and separate the wires. Strip insulation from each of the wires according to the guidelines given by the connector manufacturer.
3. Connect the outgoing black and white (line and neutral) AC wires to the PROsine black and white AC output wires.
4. Connect the outgoing ground wire to the chassis using one of the screws marked .
5. Tuck the wires into the left-hand side of the wiring compartment so they don't interfere with the GFCI assembly.



WARNING: Shock hazard

If you are not using the hardwire output circuit, you must cap off its line and neutral wires. Use twist-on wire nuts where allowed; use crimp-on wire caps in other applications.

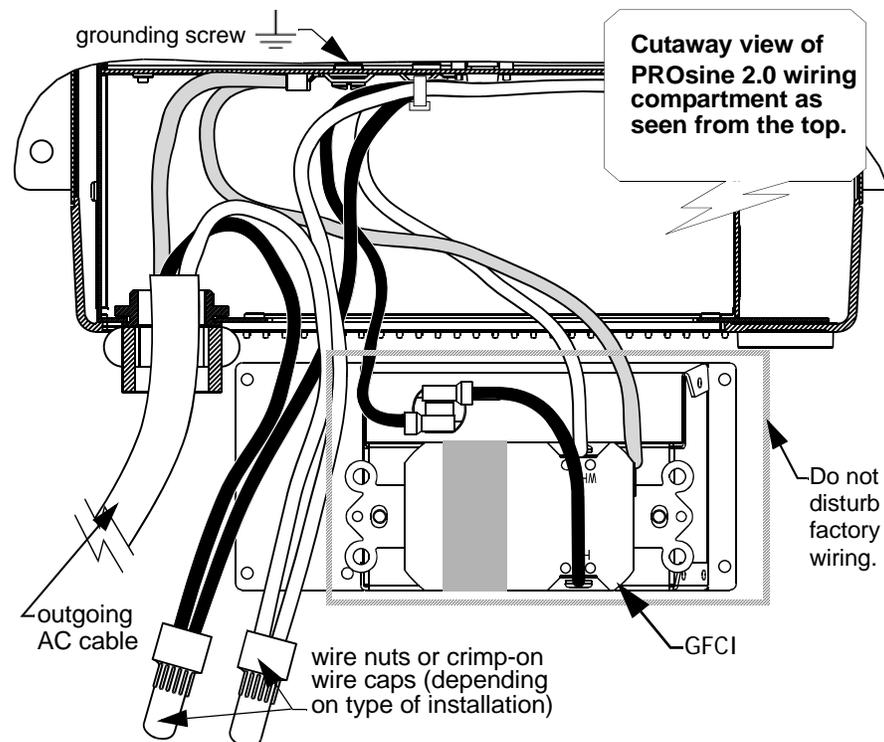


Figure 3-6 Single Hardwire Output With GFCI

Step 7: Connecting the DC Cables



CAUTION

Before making the final DC connection, check cable polarity at both the battery and the PROsine. Positive must be connected to positive; negative must be connected to negative. Reversing the positive and negative battery cables will damage the PROsine and void your warranty. This type of damage is easily detected.



WARNING: Fire hazard

Use only copper wire rated 75°C minimum. Make sure all DC connections are tight to a torque of 216–240 inch-pounds (24–27Nm). Loose connections will overheat.

Follow the procedure given below to connect the battery leads to the terminals on the DC end. The cables should be as short as possible and large enough to handle the required current, in accordance with the electrical codes or regulations applicable to your installation. <Xref>Table 3-2 on page 7 specifies the minimum DC cable size and maximum fuse size for the PROsine.

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

Figure 3-7 shows the DC end for your reference.

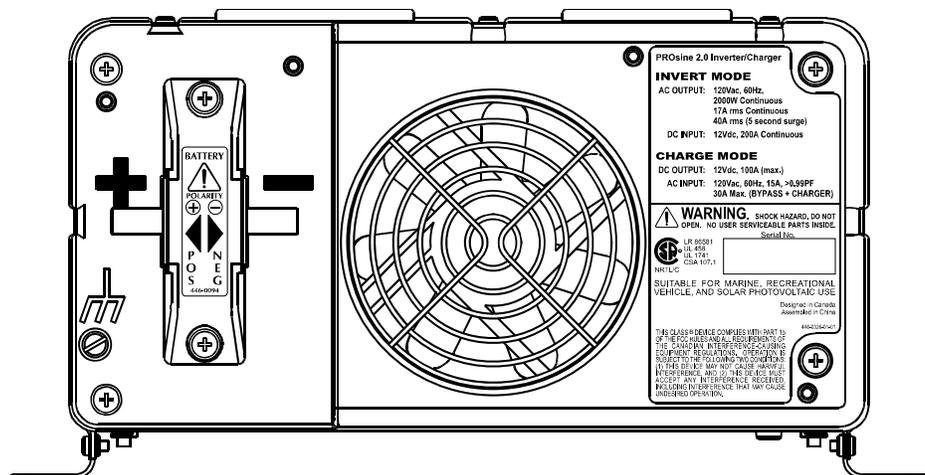


Figure 3-7 DC End

To make the DC connections

Refer to Figure 3-8.

1. Cut the cables to the correct length with enough insulation stripped off so you can properly install the type of terminals you will be using.

The terminals on the DC end are designed to fit up to 500MCM crimp-on ring terminals (either AMP or ILSCO) or box connectors.

2. Attach the connectors to both cables.

If you are using crimp connectors, use the tool recommended by the terminal manufacturer. Make sure no stray wire strands protrude from the terminals.

Important: For residential installations, the installation code may require a DC wiring enclosure for DC connections and cables. If you are using this accessory, secure it to the PROsine before routing cables. Be sure to use crimp-on ring terminals on the PROsine end of the DC cables (as specified on “Materials List” on page 1–6), and follow the installation procedure provided with the wiring enclosure. Contact Xantrex or your distributor for this part.

3. Route the DC supply cables from the battery bank to the PROsine.
4. Install a fuse and disconnect or breaker between the PROsine and the battery. They must be installed in the positive side of the DC circuit, as close as possible to the battery. This protects your battery and wiring in case of accidental shorting. (See Table 3-2 on page 3–7 for required fuse size.)
5. Attach one connector on the positive cable to the positive DC terminal on the DC end, and then attach the other connector to the POSITIVE (+) terminal on the fuse or breaker.

Observe the polarities carefully while completing the installation. Use a wrench to tighten to a torque of 216–240 inch-pounds (24–27Nm). Test that the cable is secure.

6. Connect one connector on the negative cable to the negative terminal on the DC end. Before proceeding, check that cable polarity is correct, and then connect the other end of the cable to the NEGATIVE (–) terminal on the battery.

This is the last cable connection you make. A spark is normal when it is made. Use a wrench to tighten to a torque of 216–240 inch-pounds (24–27Nm). Test that the cable is secure.

7. Attach the DC terminal covers. (See Figure 3-8.)

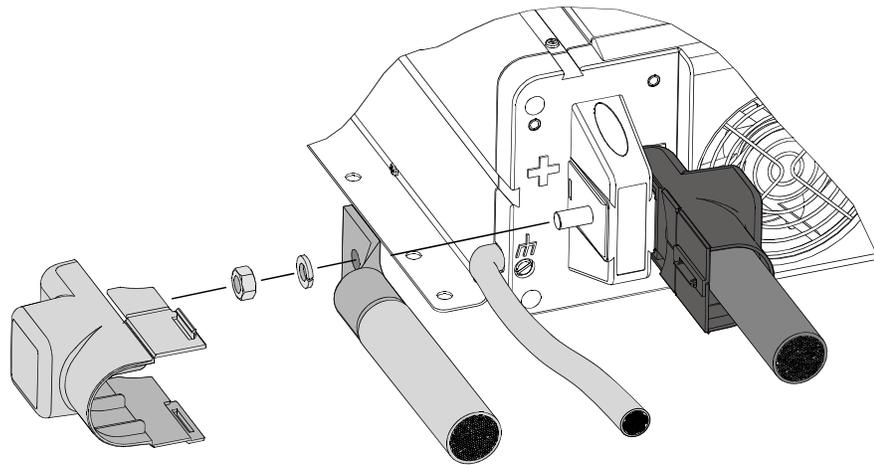


Figure 3-8 DC Cable Connections

DC Grounding

To connect the DC ground:

The Chassis Ground lug on the DC end of the PROsine is used to connect the chassis of the PROsine to your system's DC grounding point as required by regulations for some installations. Use copper wire that is either bare or provided with green insulation. Do not use the DC Ground Lug for your AC grounding. (See the AC wiring instructions in this section.)

Follow the guidelines below that correspond to your type of installation. These guidelines assume you are using the code-compliant DC supply cable and fuse sizes indicated in this manual. If you are using different sizes, refer to the applicable code for DC grounding details.

- **Recreational Vehicle** Use 8AWG copper wire and connect it between the Chassis Ground lug and the vehicle's DC grounding point (usually the vehicle chassis or a dedicated DC ground bus).
- **Marine** Use 2AWG copper wire that is bare or has insulation rated min. 105°C, and connect it between the Chassis Ground lug and the boat's DC grounding bus or engine negative bus.
- **Residential** Use 4AWG wire and connect it between the Chassis Ground lug and your system's DC grounding point. This will usually be the AC service entrance grounding point or a separate ground rod. For a solar PV installation, this will usually be the same ground rod used to ground the PV array.

Step 8: Mounting the Display Panel

The communications cable supplied with the display panel is 70 feet long (21 meters). If you want to replace the cable with one that is longer or shorter, use a high quality, 6-wire telephone extension cable. You can install the panel up to 100 feet (30 meters) away from the PROsine.

Flush mounting the panel on a wall, bulkhead, or panel requires an opening that is approximately 4 inches x 4 inches (10cm x 10cm). About 1 1/4 inches (3cm) of free space is required within the wall to accommodate the depth of the panel. Be sure there is no wiring or other obstructions within the wall before you make an opening.

To mount the display panel:

1. Choose a location that is dry, out of direct sunlight, free from corrosive or explosive fumes, and otherwise appropriate for mounting an electronic device.
2. Tape the mounting template (in the PROsine package) to the mounting surface and mark the locations of the mounting holes and the area to be cut away.
3. Pilot-drill the mounting holes and cut out the hole in which the panel will be inserted.
4. Route the communications cable(s) inside the wall and through the opening.
5. Insert one of the cable's connectors in either jack on the bottom of the panel.
6. Place the panel in the opening and secure it with appropriate fasteners.
7. Route the communications cable to the PROsine and insert the connector in the jack labelled DISPLAY.

Step 9: 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 vii.

Mounting to the Negative Battery Terminal

To mount the sensor on the negative battery terminal:

See Figure 3-9.

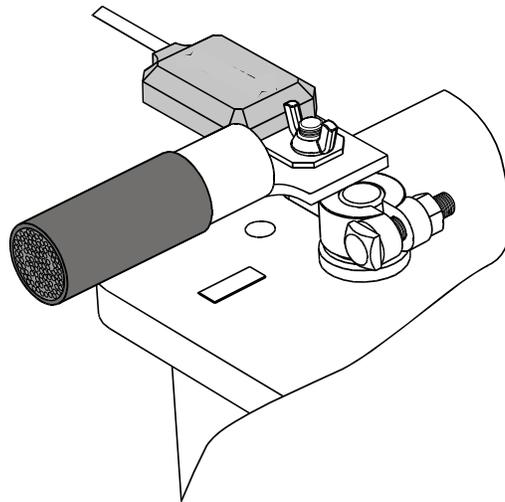


Figure 3-9 BTS Attached to Negative Battery Terminal

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 3-9, 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 PROsine and plug it into the BATTERY TEMP jack. Secure the cable along its length.

Important: In this procedure, you must install the DC wire on the battery terminal first. Then the sensor is installed on top of the DC wire. 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 3-10.

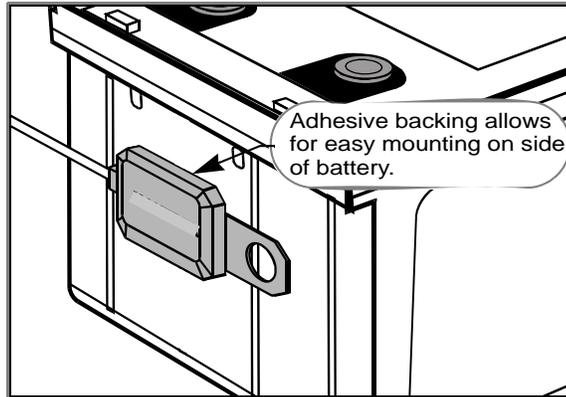


Figure 3-10 BTS Attached to Battery Case

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 PROsine and plug it into the BATTERY TEMP jack. Secure the cable along its length.

Step 10: Connecting the Remote Shutdown



WARNING: Shock hazard

This step should only be completed by qualified installers or technicians who have a knowledge of DC circuits.
Connect only to an isolated Class 2 extra-low voltage power source as described below.

Some installations may require remote shutdown capability. This feature enables you disable all circuitry in the PROsine and remove all power from the display panel using a remote shutdown switch (e.g. the ignition switch in a vehicle). This also removes all power (inverter and shorepower) from the AC loads.

The remote shutdown signal (RS+/RS-) requires a source of 5–18Vdc, which is capable of supplying 5–18mA, to enable the PROsine. This power source must be limited to Class 2 levels by an approved 1A fuse. The power source will often be one of the existing system batteries: the vehicle starting battery or the PROsine battery. In this case, the 1A fuse must be located in the positive (+) side of the circuit, as close as possible to the power source.

Note that the remote shutdown feature will only function when the ON/OFF/REM switch is set to REM.

Materials Required

You need two high quality 26AWG, 4-conductor telephone cables with connectors attached (one 10 feet maximum; one 100 feet maximum), one 1:2 phone line splitter, and a 1A fuse and in-line fuseholder. In addition, you might require a single pole, single throw switch (or alternatively, you can use a vehicle ignition-switched circuit). You can obtain these from local hardware, electronics, and automotive stores.

Installation Steps

See Figure 3-11 and Figure 3-12.

To connect the remote shutdown feature

1. Select one of the two cables and cut it at a convenient location for connecting to your Remote Shutdown Switch.
2. See Figure 3-11 to identify the RS+ and RS- wires.
3. Insulate the two middle wires so they don't short.
4. Connect RS+ to the positive of a switched, fused voltage source of 5–18V.
5. Connect the RS- to the return of this voltage source.
6. Plug the cables into the splitter and connect to the PROsine as shown in Figure 3-11.

The Remote Shutdown feature is now ready for use. For operating information, see “ON/OFF/REMOte Control of PROsine Operation” on page 5–3.

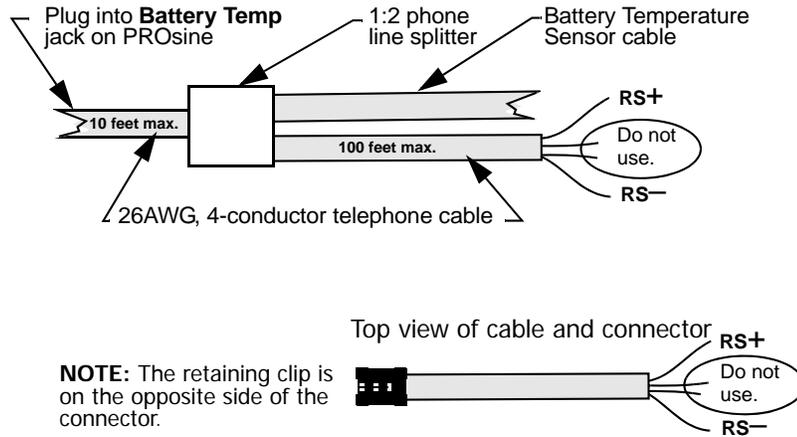


Figure 3-11 Cabling Details for Remote Shutdown Feature

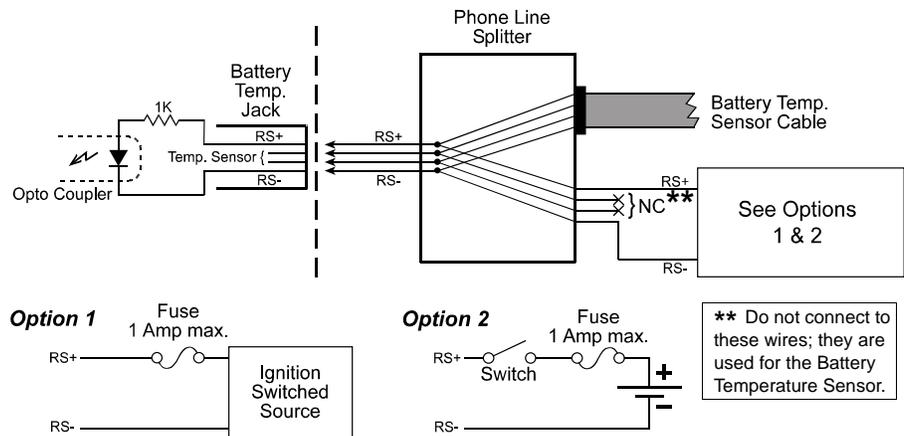


Figure 3-12 Schematic for Remote Shutdown Feature

Next Steps

At this point, you have installed the PROsine system and are now ready to configure it.

1. Read the configuration procedures in Chapter 4, “Configuration”.
2. Reconnect the AC shorepower supply.
3. Use the display panel to configure the PROsine.

4

Configuration

Chapter 4 explains how to configure the PROsine to best meet your electrical system requirements. It is divided into three parts:

- **General Configuration Information** on page 4–2.
Tells you how to enter Configure mode and Installer mode, how to scroll through the configuration screens, and how to change configuration settings.
- **Configuration Screens** on page 4–4.
Shows how the configuration menus and screens are organized.
- **Configuration Options** on page 4–6.
Lists all the configuration options as well as the available configuration values or settings. Refer to Part 3 when you want to set specific configuration values.

Important: The PROsine Quick Reference Guide supplied with your PROsine provides an overview of the configuration menus and options as well as a list of selected default settings.

Part 1: General Configuration Information

All changes to the operation of the PROsine are made via the display panel. The unit must be in Configure mode or Installer-Only mode before you can change system settings. It is essential that you understand the implications of changing User and Installer settings. Be sure to study Chapter 3, “Installation” before you configure your system. Procedures for changing modes and values are given below.

Entering Configure Mode

To enter Configure mode:

- Set the DISPLAY switch to CONFIGURE.
This gives you access to all user-configurable items.

Entering Installer-Only Mode



WARNING: Fire hazard

The following information is for qualified installation/service personnel only. Incorrect configuration can lead to battery damage and risk of fire. If a parameter is “Installer-Only,” it is meant to be configured by a professional installer who is not only familiar with the system settings on the inverter but also the ramifications of changing those settings. Setting these parameters incorrectly could damage connected equipment (e.g. batteries) or could severely affect the performance of your system. You will not be able to change parameters that are Installer-Only unless you place the display panel in Installer-Only mode.

If you try to change settings on a screen that contains installer-only data and the panel is not in Installer mode, this message appears for one second:

To Change; Enter Installer Mode

To enter Installer-Only mode:

- While the unit is in Configure mode, hold down the ESCAPE and DATA Down buttons for 3–4 seconds.

A message cautions you that the panel is now in Installer mode and explains how to exit Installer mode.

The next time you press a key, a message appears to remind you that the panel is still in Installer mode.

Exit Installer-Only mode before you put the PROsine into service.

Changing Settings

Important: All configuration settings are stored in the PROsine's memory and will not be lost even if all power is disconnected.

To change system settings:

1. Set the DISPLAY switch to CONFIGURE.
2. Press Up **s** MENU or Down **t** MENU to display the menu you want.
3. Press ENTER once, and then press Up **s** MENU or Down **t** MENU until the menu item you want appears.
4. Press Up **s** DATA or Down **t** DATA until the value you want appears.
5. Press Up **s** MENU or Down **t** MENU until the setting you want appears.
6. When the correct value is displayed, you can do one of three things:
 - Press ENTER to save the new setting.
 - Press ESCAPE to restore the old setting.
 - Press Up **s** MENU or Down **t** MENU to restore the old setting and move to another item on the same menu.

Important: Wherever you are in the menu structure, you can return to the highest level by repeatedly pressing ESCAPE.

Changing Settings:
Example 1

The Audible Alarm is set to Disabled by default.

To change the Audible Alarm to All Faults:

1. Set the DISPLAY switch to CONFIGURE.
2. Press Down **t** MENU until **Configure Display Panel** appears.
3. Press ENTER once. The **Audible Alarm** menu item appears with an asterisk (*) beside **Disabled**.
4. Press down **t** DATA until **All Faults** appears.
5. Press ENTER to save this setting. (An * appears to the left of **All Faults**.)

Changing Settings:
Example 2

To adjust the Breaker Size setting:

1. Set the DISPLAY switch to CONFIGURE.
2. Press Down **t** MENU until **Configure PROsine—Basic Menu** appears.
3. Press the ENTER button once. **AC Breaker Size** appears.
4. Press Down **t** DATA or Up **s** DATA until the value you want appears.
5. Press ENTER to save this setting.

Resetting to Factory Defaults

To reset the PROsine to the factory defaults:

1. Disable Invert and Charge mode.
2. Set the DISPLAY switch to CONFIGURE.
3. Press Down t MENU until **Configure PROsine—Advanced Menu** appears.
4. Press the ENTER button once.
5. Press Down t MENU until **Reset to Dflts** appears.
6. Press the ENTER button once.
7. Hold down the ESCAPE and DATA Down t buttons for 3–4 seconds to enter Installer mode.
8. Press Down t DATA or Up s DATA until **Load Factory** appears.
9. Press the ENTER button once.

Part 2: Configuration Menus and Screens

Table 4-1 shows the organization of the configuration menus and screens. The screens are grouped into five menus:

- Configure PROsine—Basic
- Configure PROsine—Advanced
- Configure Display Panel
- Configure Battery
- Diagnostics

Table 4-1 Menu Structure—Overview

Configure PROsine—Basic	Configure PROsine—Advanced	Configure Display Panel	Configure Battery	Diagnostics
AC Breaker Size Load Sensing Equalize	Load Sensing Load Sense Power Load Sense Interval Low AC Transfer (V) Low AC Transfer (Hz) High AC Transfer (V) High AC Transfer (Hz) AC Series Mode Inverter Low V Shutdown Inverter Low V Warning Inverter Low V Restart Hysteresis Run Without Panel Inverter After Reset Without Panel Charger After Reset Without Panel Auto Restart After Error Reset to Defaults	Audible Alarm LCD Backlight Mode LCD Backlight Brightness LCD Backlight Timeout Temperature (C/F)	Battery Size Default Battery Temp Battery Type View/Change Battery Details: <ul style="list-style-type: none"> • Battery Temp. Coefficient • Bulk Charge Mode Settings <ul style="list-style-type: none"> • Max Voltage • Max Current (%C) • Threshold Voltage • Threshold Timeout • Absorption Mode Settings: <ul style="list-style-type: none"> • Max Voltage • Max Current (%C) • Max Timeout • Threshold Current (%C) • Threshold Timeout • Overcharge Mode Settings: <ul style="list-style-type: none"> • Max Voltage • Max Current (%C) • Max Timeout • Float Mode Settings: <ul style="list-style-type: none"> • Max Voltage • Max Current (%C) • Max Timeout • Threshold Voltage • Threshold Timeout • Equalize Mode Settings: <ul style="list-style-type: none"> • Max Voltage • Max Current (%C) • Max Timeout • Threshold Change • Threshold Timeout • Constant Mode Settings: <ul style="list-style-type: none"> • Voltage Setpoint • Current Setpoint Charger Mode Charger Type Charger High Battery V Warning Offset	PS System Mode View Last 20 PROsine Faults Clear PROsine Fault Log View Last 10 Panel Faults AC Bad Cause View Software Versions: <ul style="list-style-type: none"> • LVP Software Revision • HVP Software Revision • Display Software Revision • Display EEPROM Revision View System Temperatures: <ul style="list-style-type: none"> • Temperature at Panel • PROsine Unit Temp. 1 • PROsine Unit Temp. 2 PROsine HVDC

Part 3: Configuration Options

This section gives you information about the options on each configuration menu. Refer to this section when you are changing system settings.

The information in this section is arranged as follows:

- Each configuration menu is identified by a heading (e.g. **Configure PROsine—Basic Menu**).
- The heading is followed by a two-column table that gives you a “thumb nail” overview of the menu.
 - The left column lists the items on this menu.
 - The right column indicates whether the access mode is: **User**, **Installer-Only**, or **Read-Only**.
 - The menu items or information displayed is explained after the table.

Important: If you try to change data on a screen that contains read-only data, the following message appears for one second:

u Read-Only Data

Press any key to remove this message.

Clear Errors in PROsine

Menu Item	Access
Clear Errors Note: This configuration menu only appears when an error is active in the PROsine.	User

Menu Choices or Information Displayed When an error has occurred, you can select:

- Yes
- No

This acknowledges the error and tells the PROsine that you have attempted to clear the error condition and it should attempt a restart.

Whichever action you choose, the last twenty faults are recorded, and you can view them for diagnostic or troubleshooting purposes. For information about Warnings, Errors, and Panel Faults, see Chapter 6, “Troubleshooting”.

Configure PROsine—Basic Menu

Menu Items	Access
AC Breaker Size	User
Load Sensing	User
Equalize	User

Menu Choices or Information Displayed

AC Breaker Size	Set the AC breaker size to match the shorepower circuit breaker size to reduce circuit breaker “nuisance” tripping. Values range from 0–30 amps .
Load Sensing	Select Enabled if you want the unit to only turn on when a load is present. In Load Sense mode, the unit will periodically search for the presence of an AC load while it is inverting. The unit will “sleep” if the load it detects is less than the Load Sensing setting or if there is no load. Select Disabled if you want the inverter on full-time rather than only when a load is present. For further information about load sensing, see “Load Sensing Mode” on page 5–5.
Equalize	Select Enabled or Disabled . You can only select Enabled when the unit is charging and battery type is set to Flooded . An equalization charge must only be performed on flooded (non-sealed or “wet”) batteries and only as often as recommended by the battery manufacturer.



WARNING: Fire hazard

If you select **Enabled**, you must monitor the electrolyte specific gravity and level during the equalization phase to prevent over-heating and battery damage.



CAUTION

During the equalization phase, the DC system voltage may exceed 17VDC, and therefore you should disconnect any sensitive DC loads.

Configure PROsine—Advanced Menu

Menu Display (if different from Menu Item)	Menu Items	Access
	Load Sensing	User
	Load Sense Power	User
	Load Sense Interval	User
	Low AC Transfer (V)	User
	Low AC Transfer (Hz)	User
High AC Transfr (V)	High AC Transfer (V)	User
High AC Transfr (Hz)	High AC Transfer (Hz)	User
	AC Series Mode	Installer
	Inverter Low V Shutdown	User
	Inverter Low V Warning	User
INV Low V Restrt Hyst	Inverter Low V Restart Hysteresis	User
	Run Without Panel	User
	Inverter After Reset (Without Panel)	User
	Charger After Reset (Without Panel)	User
	Auto Restart After Error	User
Reset to Dflts	Reset to Defaults	Installer

Menu Choices or Information Displayed

- Load Sensing** Select **Enabled** if you want the unit to periodically search for the presence of an AC load while it is inverting. The unit will “sleep” if the load it detects is less than the Load Sensing setting.
Select **Disabled** if you do not want the unit to search for an AC load.
For further information about load sensing, see “Load Sensing Mode” on page 5–5.
- Load Sense Power** This setting determines what power the inverter needs to detect before it will start automatically (if Load Sensing is **Enabled**). Settings range between **10** and **255W**.
- Load Sense Interval** This is the amount of time between checks for the presence of an AC power load. To save power while the unit is load sensing, increase the interval. The range is **0.5** to **25** seconds.

Low AC Transfer (V)	This is the voltage below which the unit will no longer recognize AC as “good”, will open the relay, and will attempt to transfer to Invert mode if Invert is Enabled . The range of values is 85–110Vac .
Low AC Transfer (Hz)	This the frequency at which the unit will no longer recognize AC as “good” and will attempt to transfer to Invert mode. The range is 40–59Hz .
High AC Transfer (V)	This is the voltage above which the unit will no longer recognize AC as “good” and will attempt to transfer to Invert. The range is 120–135Vac .
High AC Transfer (Hz)	This the frequency at which the unit will no longer recognize AC as “good” and will attempt to transfer to Invert. The range is 61–70Hz .
AC Series Mode	Select Standalone if you are operating a single PROsine to produce 120V single phase. If you are installing two PROsines as a 240 split-phase system, set one PROsine as Master and the other as Slave .
Inverter Low V Shutdown	At or below this battery voltage, the inverter will shut down. The values range from 10–16Vdc .
Inverter Low V Warning	This is an offset voltage ranging from 0 to 3.0V . When the battery voltage drops below the sum of Low V Shutdown and Low V Warning , the PROsine will sound a warning.
Inverter Low V Restart Hysteresis	This is an offset voltage ranging from 0.5 to 2.5V . When the unit has shut down due to low battery voltage it will not automatically restart until the battery voltage recovers to the sum of Inverter Low V Shutdown and Inverter Low V Restart Hysteresis . When the PROsine shuts down the battery voltage will rise and may cause the PROsine to restart, which drops the voltage again so the PROsine shuts down, etc. This hysteresis setting reduces this problem. The default value is 2.5V and should not be changed unless there is a special reason for doing so or this problem will return.
Run Without Panel	Select Yes if you want the PROsine to continue running if the display panel is disconnected or the communication cable is damaged.
Inverter Enabled on Reset Without Panel	Select Yes if you want the inverter to be enabled on startup if no panel is detected after 10 seconds.
Charger Enabled on Reset Without Panel	Select Yes if you want the charger to be enabled on startup if no panel is detected after 10 seconds.

Auto Restart After
Error



WARNING: Shock hazard

If **Auto Restart** is selected, AC voltage can reappear at the loads without notice after a fault has occurred and cleared.

If you select **Yes**, the PROsine will attempt to restart (five attempts) after a fault has occurred.

If you select **No**, the PROsine ceases operation when an error occurs. It then requires that you manually restart the unit by going to the **Configuration** menu and clearing the error.

Exception: If the PROsine shuts down in Invert mode because of low battery and the charger is enabled and AC is then supplied to the PROsine, it will automatically charge the battery.

Reset to Defaults You can only apply **Load Factory**, **Save as Custom**, or **Load Custom** if both the charger and the inverter are disabled. The display panel should respond with **OK**. If **Error** appears, disable invert and charge and try again.

Load Factory If you select **Load Factory**, all PROsine settings will be reset to their default values.

Save Custom If you want to change the settings temporarily, you may want to save your current system settings. To save the current configuration of the PROsine, select **Save Custom**. You can then restore this configuration to the PROsine at a later time.

Load Custom Select **Load Custom** to restore your custom settings to overwrite the current PROsine settings.

Configure Display Panel Menu

Menu Items	Access
Audible Alarm	User
LCD Backlight Mode	User
LCD Backlight Brightness	User
LCD Backlight Timeout	User
Temperature (C/F)	User

Menu Choices or Information Displayed

This menu lets you change display panel settings to suit your preferences and environment.

Audible Alarm	Select All Faults if you want a beeper to alert you to each Warning and Error that occurs. If you prefer, choose Errors Only . Or choose Off if you don't want to hear any alerts.
LCD Backlight Mode	The default setting is Auto , which means that the display remains off until an Error or a Warning occurs or until you press any button on the display panel. Auto is a power-save feature. You can also choose to have the backlight On at all times or Off at all times.
LCD Backlight Brightness	Depending on the location of the display panel, you may want to adjust the brightness of the LCD. The default setting is 50% , and you can adjust this down to 0% or up to 100% in 10% increments.
LCD Backlight Timeout	If you set the LCD Backlight Mode to Auto , you can then choose when the display will turn off automatically. Time ranges are from 15 seconds to 10 minutes .
Temperature	Choose to display temperatures in Celsius or Fahrenheit (default) according to your preference.

Configure Battery Menu

Menu Display (if different from Menu Item)	Menu Items	Access
	Battery Size	Installer
Dflt Batt Temp	Default Batt Temp	User
	Battery Type	Installer
View / Change Battery Details: Batt Temp Coeff Mode Settings: Bulk Charge <ul style="list-style-type: none"> Bulk - Maximum Voltage Bulk - Maximum Current (%C)^a Bulk - Threshold Voltage Bulk - Threshold Timeout 	View / Change Battery Details: Battery Temp. Coefficient Mode Settings: Bulk Charge <ul style="list-style-type: none"> Max Voltage Max Current (%C)^a Threshold Voltage Threshold Timeout 	Installer Installer Installer Installer
Mode Settings: Absorption Chrg <ul style="list-style-type: none"> Absorption - Max Voltage Absorption - Max Current (%C)^a Absorption - Max Timeout Absrptn - Threshld Current (%C)^a Absrptn - Threshld Timeout 	Mode Settings: Absorption <ul style="list-style-type: none"> Max Voltage Max Current (%C)^a Max Timeout Threshold Current (%C)^a Threshold Timeout 	Installer Installer Installer Installer
Mode Settings: Overcharge <ul style="list-style-type: none"> OverChg - Maximum Voltage OverChg - Maximum Current (%C)^a OverChg - Maximum Timeout 	Mode Settings: Overcharge <ul style="list-style-type: none"> Max Voltage Max Current (%C)^a Max Timeout 	Installer Installer Installer
Mode Settings: Float <ul style="list-style-type: none"> Float - Maximum Voltage Float - Maximum Current (%C)^a Float - Maximum Timeout Float - Threshold Voltage Float - Threshold Timeout 	Mode Settings: Float <ul style="list-style-type: none"> Max Voltage Max Current (%C)^a Max Timeout Threshold Voltage Threshold Timeout 	Installer Installer Installer Installer
Mode Settings: Equalize Charge <ul style="list-style-type: none"> Equalize - Maximum Voltage Equalize - Maximum Current (%C)^a Equalize - Maximum Timeout Equalize - Threshld Change Equalize - Threshld Timeout 	Mode Settings: Equalize <ul style="list-style-type: none"> Max Voltage Max Current (%C)^a Max Timeout Threshold Change Threshold Timeout 	Installer Installer Installer Installer
Mode Settings: Constant Charge <ul style="list-style-type: none"> Constant Voltage Setpoint Constant Current Setpoint 	Mode Settings: Constant <ul style="list-style-type: none"> Voltage Setpoint Current Setpoint 	Installer Installer
Charger Mode	Charger Mode	Installer
Charger Type	Charger Type	Installer
CHG Hi V Warning Offset	Charger Hi V Warning Offset	Installer

a.%C is used as the unit of measure for the current setpoints in the Configure Battery menu. The meaning of %C is as follows: Charging current generally varies with battery bank size. Therefore, current setpoints are generally expressed as %C where C is the capacity (Ah) of the battery bank. For example, to charge a 200Ah battery bank at 40A, a setting of 20% should be used.

Menu Choices or Information Displayed



WARNING: Risk of Fire or Explosion

Incorrect settings can damage or destroy your batteries. When making any battery configuration settings, ensure that the values are correct according to the battery manufacturer's specifications. Settings should be changed by qualified personnel only.

The **Configure Battery** menu lets you read (as a user) and change (installer-only) settings associated with the battery system. The parameters that can be set include battery size, temperature, and type.

Battery Size	This is the capacity of the battery or battery bank in ampere-hours. The PROsine will alter the charging rate based on battery bank size. Charging at a rate that is too high for your batteries can damage or destroy them. Select the appropriate value between 50 and 2000 Ah.
Default Batt Temp	Select a battery temperature that is closest to the average ambient temperature in the location where the battery is installed. The choices are: <ul style="list-style-type: none"> p Cold: 5°C (41°F) p Warm: 20°C (68°F) p Hot: 35°C (95°F) When the battery temperature sensor is installed, this setting is ignored and the actual battery temperature is used.
Battery Type	From the list of options available, select the type of battery(s) that you have installed. See Application Note: Battery Banks for Inverter Systems (976-0114-01-01). When you select a charging algorithm, the battery details listed below (see “View / Change Battery Details” on page 4–13) are automatically given default settings. These default values are the most appropriate for the selected battery type. If you have a battery type that isn't on the list, you can modify the charging algorithm settings according to the manufacturer's guidelines. (This requires you to be in Installer mode.)
View / Change Battery Details	The screens associated with these menu items display information about the way the PROsine will charge the battery.
Battery Temp Coefficient	This is the relationship between temperature and voltage levels on the battery. The correct value depends on battery type. For the correct value, consult the battery manufacturer.

Configuration

- Bulk Charge Mode Settings**
- **Max Voltage**
This is the maximum available charging voltage for the Bulk charging stage.
 - **Max Current (%C)**
The maximum available charging current (in A) as a percentage of battery capacity (in Ah) for the Bulk charging stage.
 - **Threshold Voltage and Timeout**
When the battery voltage goes above this value for the Threshold Timeout specified, the unit goes into Absorption charging stage.
- Absorption Mode Settings**
- **Max Voltage**
This is the maximum charging voltage for the Absorption charging stage. Typically, the battery will be at this voltage for the duration of this stage.
 - **Max Current (%C)**
The maximum available charging current (in A) as a percentage of battery capacity (in Ah) for the Absorption charging stage.
 - **Max Timeout**
This is the maximum amount of time that the unit will stay in the Absorption stage.
 - **Threshold Current (%C) and Timeout**
When battery current goes below this value (A as % of battery capacity in Ah) for the Threshold Timeout, the unit goes into the next charging stage.
- Overcharge Mode Settings**
- **Max Voltage**
This is the maximum charging voltage for the Overcharge charging stage. Typically the battery will be at this voltage for the duration of this stage.
 - **Max Current (%C)**
The maximum available charging current (in A) as a percentage of battery capacity (in Ah) for the Overcharge charging stage.
 - **Max Timeout**
The amount of time that the Overcharge stage will run.
- Float Mode Settings**
- **Max Voltage**
This is the maximum available charging voltage for the Float charging stage. Typically the battery will be at this voltage for the duration of this stage.
 - **Max Current (%C)**
The maximum available charging current (in A) as a percentage of battery capacity (in Ah) for the Float charging stage.
 - **Max Timeout**
This is the maximum amount of time that the charger will be in Float stage.
 - **Threshold Voltage and Timeout**
When the battery voltage goes below this value for the Threshold Timeout specified, the unit goes into Bulk charging mode.

Equalize Mode Settings	<ul style="list-style-type: none"> • Max Voltage This is the maximum available charging voltage for the Equalize charging stage. • Max Current (%C) This is the maximum available charging current (in A) as % of battery capacity in (Ah) for the Equalize charging stage. • Max Timeout This is the maximum amount of time that the unit will stay in Equalize stage. • Threshold Change and Timeout When the battery voltage changes by less than the change value over the Threshold Timeout specified, the unit goes to Float charging.
Constant Mode Settings	<p>Voltage and current setpoints will be set, but the unit will likely be able to satisfy only one of these setpoints at any given time.</p> <p>Example: For setpoints of 13.5V and 50A, the unit will supply 13.5V up to 50A and at higher loads, the current is held at 50A and the voltage will drop.</p> <ul style="list-style-type: none"> • Voltage Setpoint The PROsine will attempt to charge the battery at this target voltage. The default value is 13.5V. • Current Setpoint The PROsine will attempt to charge the battery at this target current. The default value is 100A. • Exit Criteria None. Unless a fault occurs, the unit will run continuously. Care must be taken to ensure that the voltage and current setpoints are correct for your battery type and loads to avoid damage.
Charger Mode	<p>Select Standalone when a single PROsine is being used to charge a battery. When multiple PROsines are charging a single battery bank, the secondary chargers only operate during the Bulk charge phase, and the primary charger finishes charging the battery. In this situation, select one charger as primary and all others as secondary.</p> <ul style="list-style-type: none"> p Standalone p Primary p Secondary

Configuration

Charger Type	<p>Choose one of the three charger types listed below. For information about multi-stage charging, see Application Note: Battery Banks for Inverter Systems (976-0114-01-01).</p> <ul style="list-style-type: none">p 3-step The PROsine will perform the Bulk, Absorption/Overcharge, and Float stepsp 2-step The PROsine will only perform the Bulk, Absorption/Overcharge, and Standby steps. Some battery manufacturers and users believe that batteries should not be Float charged.p CVCC Constant Voltage Constant Current mode (also called “Constant Mode”). This mode is not intended as a standalone battery charger. It may be used as a power supply mode but still requires the presence of a battery in the system.
Charger Hi V Warning Offset	<p>This is an offset voltage ranging from 1.0 to 4.0V. If the battery voltage exceeds the sum of the Maximum Voltage in the present charging stage and the Charge Hi V Warning Offset the PROsine will sound a warning. If there are other sources charging the battery this value can be increased from the default 1.0V value to prevent nuisance warnings from the PROsine. High voltages can reduce the life of the batteries and pose a safety hazard; the charge high battery voltage warning is intended to warn of an unsafe condition.</p>

Diagnostics Menu

Menu Items	Access
PS System Mode	Read-Only
View Last 20 PROsine Faults <ul style="list-style-type: none"> • PROsine Fault #0 • — • PROsine Fault #19 	Read-Only
Clear PROsine Fault Log	User
View Last 10 Panel Faults <ul style="list-style-type: none"> • Panel Fault #0 • — • Panel Fault #9 	Read-Only
AC Bad Cause	Read-Only
View Software Versions: <ul style="list-style-type: none"> • LVP Software Revision • HVP Software Revision • Display Software Revision • Display EEPROM Revision 	Read-Only
View System Temperatures: <ul style="list-style-type: none"> • Panel ambient temp • Unit Temp #1 • Unit Temp #2 	Read-Only
PROsine HVDC	Read-Only

Menu Choices or Information Displayed

The screens on the **Diagnostics** menu are **Read-Only**. They let you monitor and troubleshoot the status of your PROsine system. For example, if the unit is continually recording Warnings about low battery voltage, you can view the messages and take appropriate corrective action.

The following items appear on this menu:

PS System Mode	This screen indicates the present operating mode of the PROsine: invert, bulk charge, absorption charge, etc.
View Last 20 PROsine Faults	The PROsine records the last twenty PROsine Warnings and Errors. You can examine these for diagnostic and troubleshooting purposes. See Chapter 6, “Troubleshooting”. Warnings end with these characters: -W (e.g., Batt too hot -W). Error messages are displayed in the same way without the -W at the end.
Clear PROsine Fault Log	When reviewing a log containing errors it is not always clear what faults are recent and which are old and not relevant. Select "OK" to clear all entries in the PROsine fault log - after this any errors in the log must be recent.

Configuration

View Last 10 Panel Faults	The display panel records the last ten faults that have occurred in the display panel. You can view these for diagnostic and troubleshooting purposes. See “Display Panel Faults” on page 6–9.
AC Bad Cause	If the input AC is not acceptable according to the configuration values you set, this screen indicates why: causes included low frequency, low voltage, etc. For a complete list of causes, see “AC Bad Causes” on page 6–3.
View Software Versions	This information can help Xantrex Customer Service Representatives troubleshoot problems you might have with the PROsine. <ul style="list-style-type: none">p LVP Software Revisionp HVP Software Revisionp Display Software Revisionp Display EEPROM Revision
View System Temperatures	These readings show temperatures in the PROsine and the display panel.
PROsine HVDC	This shows the voltage on the internal DC bus of the PROsine, when it’s operating in Invert mode, Bypass, or Charge mode. This parameter will show 0V when the unit is faulty or off mode. This can be helpful when troubleshooting with Xantrex technical support.

Next Steps

At this point, you have configured the PROsine and display panel, and you are now ready test and use the unit.

Go to “Part 1: System Startup Check” on page 5–2.

5

Operation

Chapter 5 begins with a system startup check that you carry out after installation and configuration to verify that the PROsine is operating correctly. The chapter also provides information that will guide you during routine, ongoing operations.

For your convenience, the information is divided into four parts:

- System Startup Check on page 5–2.
- Operating Considerations on page 5–3.
- Operation in Inverter Mode on page 5–5.
- Operation in Charger Mode on page 5–7.
- Display Mode Screens on page 5–10.

Part 1: System Startup Check



WARNING

Review the “Important Safety Instructions” on page vii before operating the PROsine.

To test the charging and inverting functions:

1. Close the battery disconnect and turn on the PROsine’s ON/OFF/REM switch.
2. To test the inverter, set the INVERTER switch to ENABLE and disconnect the AC input source breaker.
3. Place a load on the inverter (e.g. plug a light into an outlet that the inverter is powering) and make sure it works. The INVERTING LED should come on and the inverter should run the load using battery power.
4. To test the charger, connect the AC input source breaker. Set the display’s CHARGER switch to ENABLE. After a short delay, the CHARGING LED should come on. Any AC loads powered by the inverter will also work at this time.
5. Remove the AC shorepower. The PROsine should transfer to Inverter mode immediately. (The transfer relay will make a clicking sound and the INVERTING LED will come on.) Loads should continue to operate uninterrupted.

If any part of this procedure fails, determine the cause before using the PROsine. Consult the Chapter 6, “Troubleshooting”.

Part 2: Operating Considerations

Fan Operation

The internal cooling fan operates for a number of conditions:

- One of the internal operating temperatures is greater than 55°C.

Important: This temperature may be caused by heat in the PROsine or by high ambient temperature.

The fan will continue to run until one minute after the temperature drops to 45°C.

- The AC input or output current is greater than 20A (15A if the internal temperature is greater than 40°C)—even in bypass mode, to keep the relay cool. It will shut off one minute after the current drops below 13A.

ON/OFF/REMOte Control of PROsine Operation

The ON/OFF/REM switch is located on the AC end of the PROsine.

- **ON:** The PROsine operates normally according to the configuration and Display switch settings.
- **OFF:** The inverter and charger are disabled regardless of configuration or Display switch settings. Shorepower will not be passed to the AC loads. In this state, the battery current is minimal (less than 2mA). This state guarantees that the PROsine does not discharge the battery bank.
- **REMOte:** In this position, the remote control signal that the user provides to the BATTERY TEMP jack turns the PROsine on or off. (For details about the Remote Shutdown switch, see page 3–24.) When this signal is active, the PROsine operates normally according to the configuration and Display switch settings.

Important: The PROsine will enter Invert or Charge modes only if enabled from the display panel (or if it is configured to run without panel). When the remote control signal is inactive, the PROsine is OFF, as described above.

Hysteresis

Consider a scenario: the PROsine is operating in charge mode from shorepower. The shorepower voltage falls below the transfer point of 90V. The PROsine transfers to invert mode and the shorepower voltage rises to 95V - but the PROsine does not transfer back to shorepower even though the shorepower voltage is now above the transfer point. In this instance the PROsine applies 10V of "hysteresis" to the transfer voltage before accepting the shorepower again (that is, the PROsine will require 100V on the shorepower before transferring back).

Without this hysteresis the PROsine might continually transfer between invert and charge mode as the shorepower voltage goes up and down a small amount. This concept is applied to the following:

- Invert Low Voltage Shutdown Hysteresis: 2.5V, if the unit stopped inverting due to low battery voltage, it will not restart until the battery voltage has increased to 2.5V above the Invert Low Voltage Shutdown level.
NOTE, this hysteresis is adjustable, see Chapter 4, "Configuration"
- Over/under Temperature Hysteresis: 10°C, if the unit shuts down due to over or under temperature (at the battery or internal to the unit) then it will not automatically restart until the temperature has decreased or increased by 10°C (that is, moved 10°C into the allowable range).

Note that, in general, the unit will not automatically restart unless the "Restart After Error" option has been configured to YES. Also, the effect of the hysteresis can be cancelled by turning the unit off and back on, if the parameter is within range the unit will restart.

For example if the unit transferred (opened the AC input relay) due to the shorepower voltage dropping below 90Vac and then the voltage rises to 95V the unit will not automatically transfer back to shorepower. Turn the unit off briefly and back on and it will accept the 95V shorepower and transfer.

Part 3: Operation in Inverter Mode



WARNING

Review the “Important Safety Instructions” on page vii before operating the PROsine.

Once the PROsine is installed, you can operate it in Inverter mode.

To operate in Inverter mode:

1. Place PROsine’s ON/OFF/REM switch in the ON position.
2. Set the INVERTER switch to ENABLE.
3. If AC is present, the STANDBY LED will come on. If AC is present, remove it and the inverter will come on.

Once the INVERTING LED is on, the PROsine is ready to deliver AC power to the loads.

Important: If you are having problems with any of your loads, refer to “Inverter Applications” on page 6–11.

Load Sensing Mode

The PROsine’s Load Sensing mode reduces power consumption in order to conserve battery capacity.

When the inverter is ENABLED, the PROsine can be configured to search for an acceptable AC load. (It does this when you Enable **Load Sensing** on the “Configure PROsine—Basic Menu” on page 4–7 and set **Load Sensing** parameters on the “Configure PROsine—Advanced Menu” on page 4–8.) The unit will “sleep” if it doesn’t detect a load that meets the Load Sense parameters. This “sleep” mode shuts off much of the PROsine’s power control circuitry and thereby reduces the standby current draw considerably. When an acceptable load is detected, full output power is available.

In Load Sense mode, the INVERTING LED flashes approximately once a second.

Operating Limits for Inverter Operation

Power Output

The continuous output rating for the PROsine is 2000 watts or 17 amps @ 120Vac; surge to 4.5kW. It can deliver this power in an ambient (surrounding) temperature that is up to 40°C. Above this temperature, you must reduce the demand or the unit may shut down. (See the chart on page A–6 for details.)

The PROsine should be able to operate all AC loads rated at or below its power rating. Some high horsepower induction motors used in pumps and other motor-operated equipment require very high surge currents to start, and the PROsine may have difficulty starting these loads. (See page 6–11 for more information.) If

you have problems starting certain loads, ensure that the battery connections are solid, the DC cabling is short and of sufficient size, the AC wiring is of sufficient size, and the battery is of sufficient capacity and is fully charged.

As with all inverters, the amount of continuous power that the PROsine can deliver without overheating is limited by the ambient air temperature. It will operate and deliver its continuous power rating at higher temperatures, but the ambient temperature as well as the input voltage from the battery limits the extent to which it can do this. Operating the PROsine 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 product. (See page A-6.)

Input Voltage

The input voltage limits are shown in Table 5-1

Table 5-1 PROsine Operating Voltage Limits

Operating Condition	Voltage Range	Comment
Normal	10V–16V	
Peak Performance	12V–16V	
High Voltage Alarm	$\geq 15.5V$	
Unit Shuts Down	$\geq 16V$	Protects inverter against excessive input voltage.
Low Voltage Alarm	$\leq 10.5V$	
Unit Shuts Down	$\leq 10.0V$	Protects battery from being over-discharged.
Unit Restarts	$\geq 12.5V$	The PROsine will not restart unless input voltage exceeds 12.5V or the inverter is turned ON manually with the DISABLE/ENABLE switch. If the inverter is already enabled (STANDBY LED is on), move the switch to DISABLE to turn the inverter OFF, and then move it to ENABLE again to restart the inverter (as long as the battery voltage is between 10–16 volts).

Part 4: Operation in Charger Mode



WARNING: Explosion hazard

Review the “Important Safety Instructions” on page vii before operating the PROsine. During charging, batteries may generate explosive gasses. Thoroughly ventilate the area around the batteries and ensure that there are no sources of flames or sparks in the vicinity. Study all battery manufacturer’s precautions such as removing or not removing cell caps while charging and recommended rates of charge.

To operate the PROsine in Charger mode:

1. Turn on the PROsine’s ON/OFF/REM switch.
 2. Connect AC shorepower.
 - The batteries are charged according to the three-step algorithm you have selected.
 - The READY LED comes on when the charge cycle is complete.
 - You can interrupt the charge cycle any time if you don’t have time to wait for a full charge.
 - To maintain optimal performance in flooded batteries, an occasional equalize cycle may be required.
 3. While the batteries are being charged, you can monitor which stage they are in by viewing **PROsine System Mode** on the **PROsine—Diagnostics** menu. See page 4–17.
-

Important: If you are charging a non-sealed battery, add distilled water to each cell until battery acid reaches the level specified by the manufacturer. This helps prevent overheating and purges excessive gases from the cells. Do not overfill. For a battery without cell caps, follow the manufacturer’s recharging instructions carefully.

Operation in Equalization Mode



WARNING: Explosion hazard

Equalization generates explosive gases. Ensure adequate ventilation.



CAUTION

Sealed lead-acid batteries and gel batteries must NEVER be equalized or premature battery failure will result. Equalize mode is disabled if you have selected “Gel” as the Battery Type.

Only flooded lead-acid batteries should be equalized. As a general rule, do not equalize a battery unless there are provisions to add water to it and the manufacturer recommends equalization.

Important: If carried out too frequently or done improperly, equalization can damage your batteries. Never equalize a battery more than necessary. Always check electrolyte level before AND after equalization. Fill with distilled water only. Monitor electrolyte specific gravity (S.G.) throughout the equalization phase.

Follow the battery manufacturer's recommendations for equalizing your batteries. 10 provides some background on different batteries. As a guide, a heavily used flooded battery may need to be equalized once a month and a battery in light service every two to four months.

The PROsine delivers a high quality charge so batteries do not need to be equalized as often as may be necessary when a lower quality charger is used.

Equalization Procedure

To equalize your batteries:

1. Turn off or disconnect all loads on the battery.

The voltage applied to the battery during equalization may damage some electronic equipment. As well, equalization won't proceed correctly if loads are drawing current from the battery.

2. Check electrolyte level.

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

3. To request the equalization charge, the charger must already be in operation. Set the CHARGER switch to ENABLE, and then select **Equalize** on the **Configure PROsine—Basic** menu (see page 4–7).

Equalization will be carried out after an absorption charge (if the batteries are not fully charged) or right away if fully charged. When equalization has been requested, the CHARGING LED is on and the EQUALIZE LED is flashing. When the system is in equalization, CHARGING is on and EQUALIZE is on.

4. The PROsine will apply a constant low current to the batteries to perform an equalize charge. This current and the maximum voltage values can be configured, see Chapter 4, "Configuration". The voltage of the batteries will rise as the current is forced into the batteries. When the voltage is rising very slowly (as configured in Chapter 4, "Configuration") the PROsine will declare an end to the equalize phase. A maximum time in the equalize phase may also be configured. Some users may have trouble with the PROsine not completely equalizing the batteries before exiting this stage. In this case the "Threshold Change" can be configured to 0.0V and the "Threshold Timeout" can be set to a long time (even several hours).

**WARNING: Fire hazard**

In this situation it is very important to check the electrolyte level and S.G. in each cell at least once per hour. The charger should be turned off and the batteries allowed to rest a few minutes to do this check as the electrolyte will be bubbling if the charger is active. If further equalization is needed the equalize cycle may be restarted.

5. During equalization, measure the S.G.

When all cells have an S.G. of approximately 1.265, terminate the charge by setting the CHARGER switch to DISABLE. As a safety feature, the PROsine will exit Equalize mode after a specified period (depending on battery type). If the S.G. is still rising just before the charger exits equalization, restart the process by requesting an equalization charge.

6. When equalization is finished, check the battery electrolyte level. Top up as necessary with distilled water only.

Operating Limits for Charger Operation

Output Current: The maximum output current for the PROsine is 100 amps. You can reduce the total output if you change the **Battery Size** setting on the **Configure Battery** menu (see page 4–12) or the maximum **AC Breaker Size** setting on the **Configure PROsine— Basic** menu (see page 4–7).

Input Voltage: The charger can operate over the range of 90–135Vac. This wide range allows the PROsine to deliver a maximum current to your batteries even when incoming AC voltage is less than ideal. A built-in surge protector protects the PROsine from surges and spikes on the AC power line.

Power Share

The PROsine shares power with AC loads. It senses pass-through current going to AC loads and subtracts this current from 80% of the breaker setting. The current that is left over is available for charging the batteries.

In Charge mode, the PROsine operates from a breaker-protected 120Vac circuit. Therefore the total power for AC loads and charger operation is limited to 80% of the breaker rating (80% is the regulatory maximum permitted for continuous loads). In this limited power environment, the PROsine gives priority to user-connected AC loads (pass-through current).

Example A 30 amp circuit breaker is allowed to have a 24 amp continuous load. If you have AC loads of 15 amps, the PROsine will give priority to your loads and allow the charger to draw up to 9 amps AC.

Part 5: Display Mode Screens

When the DISPLAY switch is ON, you can view the screens shown below. (The values shown here are examples only.) Display Mode screens are updated continuously to show current PROsine operating data. You can scroll through them by pressing the Up **s** and Down **t** MENU buttons.

Important: In the screens below current polarity is indicated as follows:
+ indicates current going into the battery (i.e. + indicates charging).
– indicates current coming out of the battery (i.e. – indicates that the battery is supplying loads or the PROsine is inverting).

Screen 1

PROsine: Battery 12.0V +10A 22°C	OR	PROsine: Battery 12.0V +10A
-------------------------------------	----	--------------------------------

Shows the PROsine's voltage and current readings from the battery as well as the battery temperature. If the battery temperature sensor is not installed, the screen on the right is displayed.

Screen 2

PROsine: AC In 118.0V 5A 58Hz

Shows the voltage, current, and frequency of the shorepower (i.e. input AC).

Screen 3

PROsine: AC Out 120.0V 10A 60Hz

Shows the voltage, current, and frequency of the output AC.

Screen 4

12.0V –120A 22°C 120V 10A 60Hz	OR	12.0V –120A 120V 10A 60Hz
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Combines the battery display (Screen 1) with the AC output display (Screen 3). The left-hand screen appears if the battery temperature sensor is installed. Output AC is shown on the bottom. The PROsine's voltage and current readings from the battery as well as the battery temperature appear on top. The bottom of the right-hand screen shows the output AC. The top shows battery voltage and current as read by the PROsine. (This is the screen that appears if the battery temperature sensor is not installed.)

6

Troubleshooting

Chapter 6 describes how to troubleshoot the PROsine

This section is divided the following parts:

- General Troubleshooting Guidelines on page 6–2.
- Shutdown / Restart Without Error Message on page 6–3.
- AC Bad Causes on page 6–3.
- Warning Messages on page 6–4.
- Error Messages on page 6–6.
- Display Panel Faults on page 6–9.
- Inverter Applications (Loads) on page 6–11.

General Troubleshooting Guidelines



WARNING: Shock and Energy hazard

Do not disassemble the PROsine. It does not contain any user-serviceable parts. Attempting to service the unit yourself could result in an electrical shock or burn.

Important: If you need to obtain service, see page WA-1.

Before you call Xantrex Customer Service, record the information that is asked for in “Information About Your System” on page WA-4.

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

1. Check for a Warning, Error, or Panel Fault message. (See Table 6-2, Table 6-3, and Table 6-4 for descriptions of these messages and specific actions to take.) If a message is displayed, record it before doing anything further.
2. As soon as possible, record (on page WA-4) the conditions at the time the problem occurred so you can provide details if you need to contact Xantrex. These details should include the following as well as anything else asked for on page WA-4:
 - What loads the PROsine was running or attempting to run
 - What the battery condition was at the time (voltage, state of charge, etc.) if known
 - Recent sequence of events
 - Any known unusual AC shorepower factors such as low voltage, unstable generator output, etc.
 - Whether any extreme ambient conditions existed at the time (temperature, vibrations, moisture, etc.)
3. Attempt the solution indicated in Table 6-2, Table 6-3, or Table 6-4.
4. If your PROsine is not displaying a Warning, Error, or Panel Fault message, check the following to make sure the present state of the installation allows proper operation:
 - Is the inverter located in a clean, dry, adequately ventilated place?
 - Are the battery cables adequately sized and short enough and is the battery in good condition, and are all DC connections tight?
 - Are the AC input and output connections and wiring in good condition?
 - Are the configuration settings correct for your particular installation?
 - Are the display panel and the communications cable properly connected and undamaged?
 - Are the battery temperature sensor and its cable properly connected and undamaged?
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.

Shutdown / Restart Without Error Message

While inverting, the PROsine could shut down for a few seconds and then restart inverting without reporting an error.

This has likely been caused by a reset of the internal microprocessor, which was probably caused by a discharged and/or weak battery. In particular, this may occur when the battery is weak and the unit is starting loads which demand a high surge (e.g. air compressor, air conditioner, fridge).

You can try recharging the battery bank. If the problem persists, an equalize cycle (only on batteries which permit equalization) may help. If this does not correct the situation, the battery bank may require upgrading or replacement.

Resetting PROsine Operation

If the PROsine does not appear to be operating correctly it may require a system reset to properly restart, this will clear any hysteresis (Chapter 5, “Operation”), most errors and warnings (but these may recur if the condition that caused them persists). Note that this will not change any configuration settings within the unit. Locate the ON/OFF/REM switch on the PROsine, just below the connector for the display panel. Set the switch to OFF for 5 seconds and then back to ON (or REM if you are using a remote switch with the PROsine).

AC Bad Causes

If the input AC is not acceptable according to the configuration values you have set, the **AC Bad Cause** screen in the **Diagnostics** menu indicates why. Specific causes are listed in Table 6-1. You have the option of leaving the values or changing them depending on your circumstances. If you want to change configuration settings, see **Configure PROsine—Advanced Menu** on page 4–8.

Table 6-1 AC Bad Causes

AC Bad Cause	Details
None	There is no problem with the AC input.
Low Cycle V In	The rms voltage as calculated over one cycle (0.016s) was less than the user-set minimum acceptable operating voltage.
High Cycle V In	The rms voltage as calculated over one cycle (0.016s) was greater than the user-set maximum acceptable operating voltage.
Low Average V In	The rms voltage as calculated over 16 cycles (0.25s) was less than the user-set minimum acceptable operating voltage.
Hi Average V In	The rms voltage as calculated over 16 cycles (0.25s) was greater than the user-set maximum acceptable operating voltage.
Low Frequency	The frequency was less than the user-set minimum acceptable operating frequency.
High Frequency	The frequency was greater than the user-set maximum acceptable operating frequency.

Warning Messages

Warning messages appear on the display panel LCD to alert you to an impending system change. Warnings do not affect operation.

- You can retrieve the previous twenty Warning and/or Error messages by placing the unit in Configure mode and then selecting **View Last 20 PROsine Faults** from the **Diagnostics** menu. Warnings end with the characters **-W** (e.g. **Batt too hot -W**).
- To clear a Warning message, press the ESCAPE key.
- If the audible alarm is enabled, press ESCAPE twice. The first key press deactivates the alarm and the second removes the message from the screen. (The warning is not cleared from the system, however.)

Warnings are listed in Table 6-2. The text in the **Warning Message** column appears as the second line on the LCD; the first line displays the text: **PROsine Warning**.

Table 6-2 Warning Messages

Warning Message	Details	Action
Batt Too Hot -W	PROsine battery temperature too high.	Check the tightness of all connections. Check electrolyte level. Check charger and battery settings.
Batt Too Cold -W	PROsine battery temperature too low.	Extreme cold may require a battery heater. If the battery is frozen, thaw it gradually to avoid damage.
Temp1 Too Hot -W	PROsine internal temperature 1 too high.	Reduce loads on the system. Ensure that the PROsine is being adequately ventilated.
Temp2 Too Hot -W	PROsine internal temperature 2 too high.	
Temp1 Too Cold -W	PROsine internal temperature 1 too low.	Raise the ambient temperature.
Temp2 Too Cold -W	PROsine internal temperature 2 too low.	
Temp1 Short -W	These warnings indicate a problem with an internal temperature sensor but may also be caused by excessive cold or heat	See if the warning persists when the PROsine is in a normal temperature environment of 32°F to 104°F (0°C to 40°C). The internal temperatures can also be checked on the display panel (in Configuration Mode) in the Diagnostic Menu (see page 4–17). If the problem persists contact Xantrex.
Temp1 Open-W		
Temp2 Short -W		
Temp2 Open -W		
Inv Lo Bat V - W	Low battery voltage, invert mode.	Check battery state of charge and re-charge if necessary. Check for proper DC cable size. Check all connections for tightness.

Table 6-2 Warning Messages

Warning Message	Details	Action
Inv Hi Bat V -W	High battery voltage, invert mode.	Check for external charging sources and disable if necessary.
Chg Hi Bat V -W	Battery voltage exceeds 15.5V in charge mode.	
AC In Rev Pol -W	Input AC line and neutral wiring polarity is reserved. Check to see that the Line side of the AC source (shorepower) has a voltage to ground and the neutral side does not. May also occur if the shorepower neutral is floating (not connected to earth)	The unit will continue to operate. For safest operation, however, you should correct the AC input wiring
AC Out Ovrload -W	AC output overload.	Reduce the AC load so that even for short times, AC output current does not exceed 26A.
Low AC In V -W	AC input voltage too low.	Check for bad cabling. There may be too many loads on the AC supply line. Reduce the AC dropout level.
High AC In V -W	AC input voltage too high.	Check the AC input (shorepower) source voltage and correct if necessary or raise the AC input high voltage limit.
Bat Temp Short -W	Battery temperature sensor short detected.	Install a new sensor.
Memory Warning	EEPROM memory CRC is incorrect	Call Xantrex.
Equalizing!	The unit is equalizing.	Refer to page 5–8: disconnect any sensitive loads and monitor battery electrolyte level and S.G. throughout.
Unit attempting to restart.	Auto Restart After Error has been enabled, the error has cleared, and the unit is restarting.	The unit will re-start and provide 120VAC output without warning. Disconnect any AC loads that could be hazardous if they were to become re-energized without warning.

Error Messages

Error messages indicate that there has been a change in system operation due to a detected condition.

- You can retrieve the previous twenty Error messages by placing the unit in Configure mode and then selecting **View Last 20 PROsine Faults** from the **Diagnostics** menu.
- To clear an Error message, press the ESCAPE key.
- If the audible alarm is enabled, press ESCAPE twice. The first key press deactivates the alarm and the second removes the message from the screen. (The error is not cleared from the system, however.)

Some Error messages appear as

Internal nnnn

where **nnnn** is the number of the error.

If one of these errors causes the PROsine to shut down, attempt to restart the unit. If the error occurs again, call Xantrex.

Other errors are listed in <Xref>Table 6-3. The text in the **Error Message** column appears as the second line on the LCD; the first line displays **PROsine Error**.

Table 6-3 Error Messages

Error Message	Details	Action
Low Bus Voltage	Low bus voltage detected	Clear the error in the Configure menu and then recharge the batteries. If the batteries are fully charged then verify that the DC cables are the correct size and that all connections are tight.
Invert Lo Bus V		
Bypass Lo Bus V		
Battery Too Hot	PROsine battery temperature too high.	Check the tightness of all connections. Check electrolyte level. Check charger and battery settings.
Battery TooCold	PROsine battery temperature too low.	Extreme cold may require a battery heater. If the battery is frozen, thaw it gradually to avoid damage.
Temp1 Too Hot	PROsine internal temperature 1 too high.	Reduce the loads on the system. Ensure that the PROsine is being adequately ventilated.
Temp2 Too Hot	PROsine internal temperature 2 too high.	
Temp1 Too Cold	PROsine internal temperature 1 too low.	Raise the ambient temperature.
Temp2 Too Cold	PROsine internal temperature 2 too low.	
Invert Lo Bat V	Inverter battery voltage low (below configured shutdown level or below 8V for Fault Shutdown).	Check battery state of charge and re-charge if necessary. Check for proper DC cable size. Check all connections for tightness.
Inv Low Bat V FS		

Table 6-3 Error Messages

Error Message	Details	Action
Invert Hi Bat V	Inverter battery voltage greater than 16V.	Check for external charging sources and disable if necessary.
AC Out Overload	AC output overload.	Reduce the AC load so that even for short times, the AC output current does not exceed 26A.
Ext Comm Timeout	PROsine external communications timeout	Check that the connections on the communications cable between the PROsine and the display panel are secure. Check whether the communications cable has been damaged. Check the proximity of the communications cable to DC and AC cables. If the cable crosses DC or AC cables, ensure that it does so at right angles.
Charge Lo Bat V	Battery voltage did not rise above 10V within 30 seconds of the charger starting. This may indicate a problem with the battery (e.g. a damaged battery), but will also occur if the battery was very dead at the start of the charge cycle.	Clear the error and restart the charging process. If battery V does not come to 10V after a few of charging cycles, have your battery tested.
SeriesComTimeout	Series communication timeout	Ensure that both PROsines have power. Ensure that the ON/OFF/REM switch for both units is ON (or REM if Remote Shutdown is being used). Ensure that both PROsines are configured correctly and are enabled.
RelayWeldDetect0	The internal transfer relay is unable to switch between shorepower and inverter output. Charge/passthrough or Invert modes may be unavailable.	Call Xantrex.
RelayWeldDetect1		
RelayWeldDetect2		
AC Backfeed	You have applied an AC source (shorepower) to the inverter output. This has been caused by improper wiring. This error can also be caused by a short circuit on the AC output wiring.	Check AC input and output wiring. The AC output wiring should not be connected to an AC source at any time.

Table 6-3 Error Messages

Error Message	Details	Action
Chg Bad AC Qlty	<p>In Charger or Bypass mode the PROsine is being powered from an incompatible AC source, probably a very low quality generator. The PROsine is compatible with virtually all nominal 120V 60Hz AC sources (including Modified Sine Wave) but it is possible that a very low quality source may cause a problem in some operating conditions. If these errors occur the PROsine will disconnect from the AC source because it is unsafe to continue to operate the PROsine from that source - and it may cause problems for some AC loads as well.</p>	<p>Test the PROsine with a good quality generator or the AC utility to verify whether the normal generator is the problem. If so, enabling charge mode and turning on a DC load (e.g. a light) should allow the PROsine to operate correctly from any generator which is not defective. If it is a small generator and is unable to supply all the current the PROsine might demand, the AC Breaker Size rating in the Configure PROsine — Basic Menu can be lowered so as not to overload the generator.</p>
Byp Bad AC Qlty		

Display Panel Faults

A message is displayed for any fault that is detected in the display panel. If a Panel Fault message appears, you can clear it from the screen by pressing any button on the panel. Since this type of fault does not trigger a shutdown, operation of the system after the error occurs depends on the type of fault and the setup of the system.

You can view the last ten Panel Fault messages by placing the unit in Configure mode and then selecting **View Last 10 Panel Faults** from the **Diagnostics** menu. The most recent fault is displayed first.

The majority of Panel Fault messages appear as

Internal Error nnnn

where **nnnn** is the number of the error.

If one of these errors causes the PROsine to shut down, attempt to restart the unit. If the error occurs again, call Xantrex.

Other faults are listed in Table 6-4.

Table 6-4 Panel Faults

Panel Faults	Error	Details
Panel Fault: COMM1 Timeout	External communications timeout Comm. Port 1	No transmission has been received for 2 seconds. Check the communications cable between the display panel and the PROsine as well as the connectors.
Panel Fault: COMM2 Timeout	External communications timeout Comm. Port 2	No transmission has been received for 2 seconds. Check the communications cable between the display panel and the PROsine as well as the connectors.
Panel Fault: Data Not Sent	Menu data failed to be sent.	After 5 retries, the data being altered on a menu could not be updated to the destination device.
Panel Fault: Panel Unusable	The panel's internal memory has been corrupted.	The panel will not work. The PROsine itself is not affected and will continue to operate if you have selected Run Without Panel.

Unexplained Faults

Sometimes the PROsine may not show a fault at the panel, but may be acting in an unexplained way.

Table 6-5 Unexplained Faults

Error	Details
Shorepower is present but the PROsine will not transfer	The voltage or frequency of the shorepower is not within the transfer limits configure in the PROsine under the Configure PROsine — Advanced menu . To view the shorepower quality set the DISPLAY switch to ON and select the AC In screen. If desired, you can switch to Configure mode and alter the transfer limits to accept the shorepower but some loads may be damaged if the shorepower deviates too far from the standard values. The factory settings are safe. Otherwise, the shorepower is not acceptable and you may need to consult an electrician or check with the manager of the facility providing the shorepower.
Shorepower quality is within the transfer settings but the PROsine is still not transferring.	This may be due to hysteresis. See “Hysteresis” on page 5–3, for details.
The PROsine stopped inverting due to low battery voltage and will not restart even though battery voltage is above the shutdown level and the "Auto Restart After Error" has been set	See “Hysteresis” on page 5–3. If the PROsine shuts down due to low battery voltage then it will not restart until the battery voltage exceeds 12.5Vdc.
The PROsine sometimes will not start inverting, or may stop inverting and report no error or unusual errors	Check battery condition and wiring. It is important to have battery wiring that is of the correct size as the unit may require up to 600A to start heavy loads. See Chapter 3, “Installation”, for details.
PROsine not providing rated charge current	The battery charging current can be limited for a number of reasons: Small battery bank size. To avoid damaging the batteries the PROsine will generally charge in the FLOAT or ABSORPTION stages at only 25-30% (in Amps) of the configured battery bank capacity (in A-hr) - this varies with the battery type configured in the PROsine. Battery does not accept full current due to being partially charged or damaged. Other AC loads are present on the PROsine output and the unit is reducing the charging current so that the total AC input is kept below 80% of the AC Breaker Size setting (per UL and CSA requirements). Or the AC Breaker Size has been configured to a low value to limit the charging current so the PROsine can charge batteries from a weak AC source. With no additional AC output loads this breaker setting must be 19A or greater so that the PROsine can draw 15Aac to provide 100A of battery current. The PROsine internal temperature is high. To avoid overheating the PROsine will reduce the allowable charging current if one of the internal temperatures exceeds 75°C.

Table 6-5 Unexplained Faults

Error	Details
Unexpected behaviours	It is possible to cause the PROsine to behave in an unexpected fashion by configuring it incorrectly. If the unit appears to be working, but not correctly, and the reason is not clear, try resetting the configuration to the factory defaults (see page 4–4) and test the unit further: Xantrex may request that this procedure be performed before doing further troubleshooting or authorizing the return of the unit for warranty service.

Inverter Applications

The PROsine performs differently depending on the AC loads connected to it. If you are having problems with any of your loads, read this section.

Resistive Loads

These are the loads that the inverter finds the simplest and most efficient to drive. Voltage and current are in phase (i.e. 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. It is usually impractical to run larger resistive loads—such as electric stoves and water heaters—from 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 if the load is to be run for long periods.

Motor Loads

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 can expect to run is 1/2 to 1 hp (the transfer relay is rated at 1 1/2 hp.) Universal motors are generally easier to start. Since motor characteristics vary, only testing will determine whether a specific load can be started and how long it can be run.

If a motor fails to start within a few seconds or loses 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 a few seconds.

Long Transfer Times

Xantrex has observed a specific situation where the PROsine may take a long time to transfer to invert mode when shorepower fails - maybe 0.1-0.2 seconds. This can occur when the PROsine is power motor loads where the motor is able to

freewheel when power is removed (e.g. a grinder). This long transfer may cause computers or other sensitive equipment to operate incorrectly. If power glitches must be minimized then Xantrex recommends that motor loads not be operated when the sensitive equipment is being used.

Problem Loads

Very Small Loads	If the power consumed by a device is less than the threshold of the Load Sense mode circuitry, the device will not run. See the Configure PROsine—Basic Menu on page 4–7 and the Configure PROsine—Advanced Menu on page 4–8 for ways to solve this problem. Most likely the solution will be to defeat the Load Sense mode feature.
Fluorescent Lights & Power Supplies	Some devices cannot be detected when scanned by Load Sense circuitry. Small fluorescent lights are the most common example. 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 on by defeating the search mode feature. See the Configure PROsine—Basic Menu on page 4–7 and the Configure PROsine—Advanced Menu on page 4–8 for ways to solve this problem.
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 Configure PROsine—Basic Menu on page 4–7 and the Configure PROsine—Advanced Menu on page 4–8 for ways to do this. 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 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. The solution is to reduce the load sense power threshold.
Electronics	AM radios will pick up noise, especially on the lower portion of their band. Inexpensive tape recorders are likely to pick up a buzz.
Computers	When the inverter is called on to start a large load—particularly a motor load—the output voltage may dip briefly. This dip may cause computers powered by the inverter to crash.

7

Series Operation

Chapter 7 provides information about installing and operating two PROsines in series:

- Designing a series system on page 7-2.
- Installing a series system on page 7-5.
- Configuring a series system on page 7-9.
- Series system startup test on page 7-10.
- Series system operation on page 7-11.

Designing a Series System

System Overview

Series operation refers to a specific wiring configuration that allows you to connect two PROsines in a way that produces two 120V phases which are synchronized to produce 240V. This is commonly referred to as a “120/240Vac split-phase” supply or “240V single-phase with a center-tap neutral” and is the same as the utility connection to most houses. This series system can power both 120Vac and 240Vac single-phase loads. Two PROsines connected in series can provide up to 4kW continuous power to almost any combination of 120V and 240V loads.

Important: Each PROsine is still limited to 17A continuous. For example, you cannot put 9A of load on one phase and 25A of load on the other.

System Components

A two-unit series operation system requires the same components that a single PROsine system requires. In many cases, however, two components are required, some are applied differently, and a 10 foot series sync cable is required. See Figure 7-1.

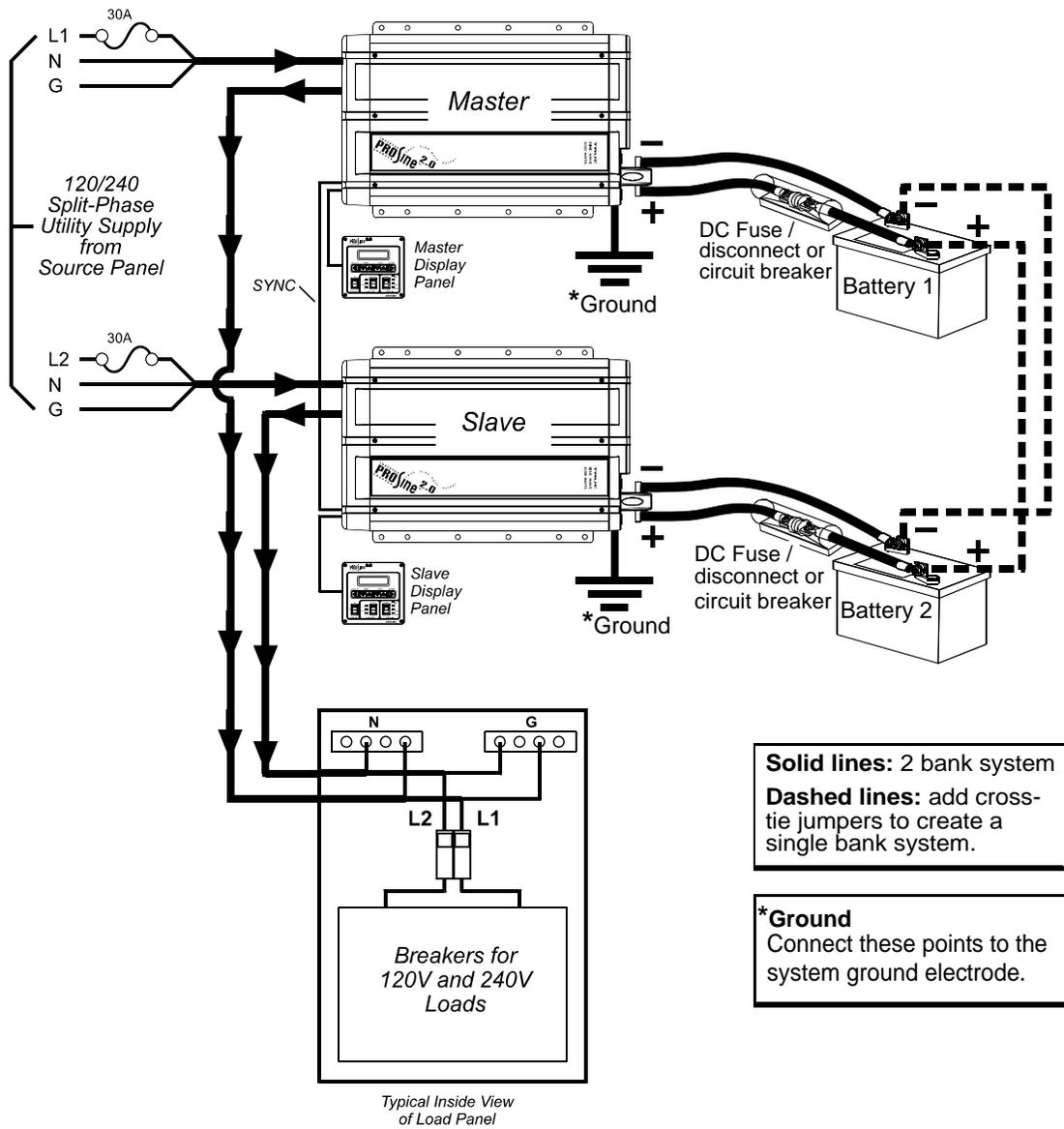


Figure 7-1 Two PROsine Series Operation System

AC Input

The AC input (shorepower) supply to the system must be a 120/240Vac split-phase system that provides two line conductors (referred to as L1 and L2), a neutral, and ground. Each PROsine requires a line, neutral, and ground run to it, so 2-conductor-plus-ground cable is needed with a 30A max circuit breaker installed in the line conductor. Typically these AC input cables originate in a distribution panel, providing a main disconnect and the separate 30A circuit breaker required for the AC input of each PROsine. That distribution panel, referred to as the “source panel,” also provides neutral and ground busses, allowing for easy connection of the neutral and ground conductors in the cables.

AC Output

The AC output of each PROsine requires a separate 2-conductor-plus-ground cable (line, neutral, and ground) run from the PROsine to a 120/240Vac split-phase sub-panel for the loads. The sub-panel, referred to as the “load panel,” must be equipped with a double-pole circuit breaker rated 30A max, 240Vac for the two line conductors (L1 and L2), and neutral and ground busses for the neutral and ground conductors from each unit. The load panel then provides circuit breakers for the 120Vac and 240Vac branch circuits powering the loads. Since the neutral-to-ground bonding is provided upstream (by one of the PROsines in Invert mode, and by the utility otherwise) this load panel must not bond the neutral to ground. Most panels have a removable screw that allows the neutral to be unbonded.

Battery Disconnect and Over-Current Protection Requirements

As with a single PROsine system, batteries must have a fuse and disconnect or a DC-rated circuit breaker in the positive side, matched to the cable size. The recommendations about wire sizes, over-current protection, disconnection means, and other important details discussed in Chapter 3, “Installation” apply here. Refer to “Step 1: Designing the Installation” on page 3–4 for details. Each PROsine must be wired to the battery separately (whether a single bank or two banks are used).

Series Sync Connection

The SYNC connectors on the PROsines are connected by a series sync cable. This cable is a standard 4-conductor telephone cable of ten feet or less and may be purchased from most electronic retailers.

Important: The series sync cable is an option and is not supplied with the PROsine PROsine. Contact Xantrex or your distributor for this part.

Installing a Series System



WARNING

Xantrex Technology recommends that all wiring be completed by a certified technician or electrician to ensure adherence to approved electrical wiring regulations.



WARNING: Fire, Shock, and Energy hazard

Make sure wiring is disconnected from all electrical sources before you handle. All wiring must be done in accordance with local and national electrical wiring codes. Do not connect the output terminals of the PROsines to any incoming AC sources.

- Xantrex recommends that you have an electrician set up the two PROsines because knowledge of the electrical code, split-phase systems, and load balancing is required.
- See page 3–3 for a list of tools and materials required for installation.
- See “Step 1: Designing the Installation” on page 3–4 for information about wire sizes, over-current protection, and disconnection means.
- Connect the system as shown in Figure 7-1 on page 7–3.

Detailed procedures for setting up an AC series system are given below.

Connecting AC Input Wiring

To connect each PROsine to the utility 120/240Vac split-phase supply:

1. Assign one PROsine to Line 1 and one to Line 2 and maintain the same assignment throughout the AC input and AC output wiring steps.
2. Connect 2-conductor-plus-ground cable to a 30A breaker on Line 1 in the source panel, and to the panel’s neutral bus and ground bus.
3. Run the 2-conductor-plus-ground cable to the Line 1 PROsine and connect:
 - The Line 1 conductor to its AC Input Line conductor (black)
 - The neutral to its AC Input neutral conductor
 - The ground to its AC Input ground terminal 
4. Repeat steps 2 and 3, connecting the 30A breaker on Line 2, neutral, and ground from the source panel to the input wires and ground  of the L2 PROsine.

Connecting AC Output Wiring

To connect each PROsine to the load panel:

1. Connect 2-conductor-plus-ground cable to the Line 1 PROsine's AC Output line and neutral conductors, and connect the cable's ground wire to one of the output ground screws  on the PROsine.
2. Run the 2-conductor-plus-ground cable to the load panel and connect:
 - The Line 1 conductor to the panel's Line 1 input breaker
 - The neutral to the panel's neutral bus
 - The ground to the panel's ground bus
3. Repeat steps 2 and 3, connecting the Line 2, neutral, and ground from the Line 2 PROsine to the load panel's Line 2 input breaker, neutral bus, and ground bus.

Configuring the Inverter Output Neutral Bonding

Electrical codes require that you unbond the neutral-ground connection of one of the PROsines. Otherwise when the units are inverting, they will both connect the neutral to safety ground through a relay. Installation codes stipulate that the neutral be connected to safety ground in one—and only one—location.

To unbond the neutral in one of the PROsines:

1. Select one PROsine in which to unbond the neutral.

Generally, it does not matter which PROsine you select, but your system may dictate that one unit in particular be unbonded.
2. Locate and remove the neutral-ground bonding screw at the back of the AC wiring compartment.
3. Install the screw in the extra hole (identified as the position in which the neutral is NOT automatically bonded) so it is available for future use if you change your system.
4. Tighten the screw so it will not back out over time.
5. Leave the other PROsine's neutral-ground bonding screw in the automatic bonding position.

Connecting the DC Cables



WARNING: Fire hazard

Make sure all DC connections are tight to a torque of 216–240 inch-pounds (24–27Nm). Loose connections will overheat.

**CAUTION**

Before making the final DC connection, check cable polarity at both the battery and the PROsine. Positive must be connected to positive; negative must be connected to negative. Reversing the positive and negative battery cables will damage the PROsine and void your warranty. This type of damage is easily detected.

The system can be run from a single battery bank or from two separate banks. A large single bank provides better surge capability for 120V loads and ensures that unbalanced 120V loads don't run down the battery on one inverter before the other. The two PROsines charge the single battery bank cooperatively. If you prefer to run separate battery banks, the units can be configured to charge the batteries separately. In either case, Xantrex recommends that you use batteries of the same type, size, and condition.

- Connect each PROsine to the battery, making sure the polarity is correct. For DC wiring steps, refer to “Step 7: Connecting the DC Cables” on page 3–17.
- Do not attempt to run the DC cabling from the battery to one PROsine and then from that PROsine to the next. The cable and fuse sizes required would be much larger than are practical, and performance would suffer.

Your system may include some kind of battery monitor (e.g. a current sensing shunt) where all battery current must pass through one terminal for the sake of accurate data. If this is the case, the wires between the battery and the shunt must be very short and heavy because they carry the current of two PROsines: up to 500A continuous, which will require extremely large wire. The wires from the shunt to each PROsine must be 250MCM with a 300A fuse in each of the positives to protect the wiring.

Connecting the DC Ground

Ground both PROsines according to the procedures given on page 3–19.

Installing the Display Panels

Mount and connect the display panel for each PROsine. (For details, see “Step 8: Mounting the Display Panel” on page 3–20.)

Important: Each PROsine must have its own panel so you can properly monitor and control the system.

Installing the Battery Temperature Sensors

For optimal charging, each PROsine must have its own battery temperature sensor.



WARNING: Explosion hazard

If the charger has been operating, wait ten minutes for any explosive battery gases to dissipate.

- **Single Bank:** If your system has a single bank, install both sensors on the battery (or batteries) which will be the hottest.
- **Two Separate Banks:** If your system has two separate battery banks, connect one sensor to either PROsine and then to the battery it is charging; connect the second sensor to the second PROsine and then to the battery it is charging.
- For additional installation details, see page 3–21.

Installing the Series Sync Cable

To install the series sync cable

1. Connect the series sync cable from the SYNC jack on one PROsine to the SYNC jack on the other unit.
2. Secure the cable to prevent strain on the connections.

Configuring a Series System

Configure each PROsine through its display panel. Refer to “Part 2: Configuration Menus and Screens” on page 4–4 for an overview of configuration options. Refer to “Part 3: Configuration Options” on page 4–6 for specific configuration items.

To configure the series system

1. Set up the usual parameters (battery size and type, AC transfer conditions, etc.) and make sure both PROsines are configured the same.
2. Select one unit to be the “master” and the other to be the “slave”. Configure **AC Series Mode** (on the **PROsine Advanced** menu) as **master SP** and **slave SP** respectively. (**SP** refers to “Split Phase.”)

Any 120Vac loads that require the fastest possible transfer should be powered by the “master” unit.

3. If the two PROsines are connected to the same battery bank, configure **Charger Mode** (on the **Battery** menu) to be **Primary** for the master and **Secondary** for the slave. If the two PROsines are connected to separate battery banks, set **Charger Mode** to **Standalone** for both PROsines.

Your system is now ready for operation.

Series System Startup Test

To test the system's inverting and charging functions

1. Apply DC to both PROsines by closing the battery disconnect(s). Remove AC by opening the AC input source breaker. On both PROsines, set the ON/OFF/REM switch to On.
2. Set the INVERTER switch on one display to ENABLE.
The INVERTER STANDBY LED on that display should light.
3. Enable the inverter on the second display.
The INVERTING LED on both displays should light.
4. Place a 120V load on the master inverter (e.g. plug a light into an outlet that it is powering) and make sure it works. Place a second 120V load on the output of the slave inverter and verify that both loads work. Place a 240V load on the 240V circuit formed by the two series inverters and verify that it works correctly.
5. To test Charge mode, apply AC to both PROsines by closing the AC input source breaker.

After a few seconds both units should transfer: the INVERTING LEDs will go dark and the AC IN LEDs will light. Enable the charger on both displays: the CHARGING LED on both displays should light and battery current should be registered. Any AC loads powered by the inverter will also work from shorepower at this time.
6. Check a transfer by opening the AC source breaker. The PROsines should transfer to Invert mode immediately: the transfer relays will make a clicking sound and the INVERTING LED on both displays will come on. Loads will continue to operate uninterrupted.

If any part of this procedure fails, determine the cause before using the PROsines. Consult Chapter 6, "Troubleshooting" as necessary.

Series System Operation

Invert Mode

The two PROsines will operate strictly as a pair in Invert mode. Before each cycle of AC output, the two units confer over the sync cable to verify that the other unit has no errors and is ready to put out the next cycle. A number of conditions must be met for the pair of PROsines to invert:

- Invert mode must be enabled on *both* displays.
- No errors can be present *in either unit*.
- The sync cable must be good.
- One (or both) sides of the AC input (shorepower) must be outside the transfer limits you have configured (e.g., low voltage).

If shorepower becomes valid on both phases when the PROsine is inverting, both units will synchronize to it and, as a pair, transfer to shorepower. Any transfers or shutdowns, etc. will occur on both phases within one cycle of each other.

Charge Mode

Both phases of the shorepower must be “good” before either unit will transfer to shorepower and be able to charge. Therefore neither unit will charge unless both phases of shorepower are good. However it is not necessary that both units have Charge mode enabled for one to operate.

Important: If both PROsines are connected to one battery bank and are configured as primary/secondary, the charge operation is somewhat different than normal:

- The primary charger performs the entire charge cycle.
 - The secondary charger completes the Bulk stage only, allowing the primary charger to accurately finish the charging cycle.
-

A

Specifications

Appendix A contains specifications and performance graphs for the PROsine and the display panel.

Specifications subject to change without notice.

Electrical Specifications: Invert Mode

DC Input	
Operating voltage range	10.0V–16.0V
Safe non-operating voltage range	0–18Vdc
Nominal current at full load	200A
AC Output	
Output voltage	117Vac
Continuous power	2.0kW, 2.0kVA to 40°C max. ambient
Surge power	4.5kW for 5s
Max short-circuit current	55Arms, 55Apk
Frequency	60.0Hz \pm 0.05%
Wave shape	Sine
THD (over load range of 0–2.0kW resistive)	\leq 2%
Power derating above 40°C ambient temp	See “Invert Power Derating vs. Ambient Temperature” on page A–6.
Peak efficiency	\geq 87%
Full load efficiency	\geq 83%
Other	
Load power factor range	0–1, inductive, capacitive, or nonlinear, to 2kVA
No load input power (producing output voltage)	\leq 25W
Load sense power	\leq 4W (1s interval) \leq 2W (3s interval)
Standby mode power draw (no output, display off)	\leq 0.5W
Off mode current draw	\leq 2mA

Electrical Specifications: Charge Mode

AC Input	
Operating voltage range	90–135Vac
Nominal current	15Aac at 100A charge, 120Vac in
Power factor (100A charge, 120Vac in)	≥0.98 on sine input
Nominal frequency	60Hz
DC Output	
Nominal voltage	12.0Vdc
Min battery voltage for charging	0.0Vdc
Max output voltage	17.5Vdc
Nominal output current	100A @ ≤15.0Vdc
Equalize mode max current	≥10A @ ≤17.5Vdc
Charger current derating	Automatically reduce charger current as internal temperature exceeds 80°C, input Vac approaches low transfer, and ac input current approaches 80% of breaker setting.
Efficiency at nominal output	≥84%
Other	
Battery type settings	Gel, Flooded, AGM, Pb-Ca
Battery size settings	50–2000 Ahr
Charge algorithms	Custom 3-stage with factory default set points. Custom 2-stage as above. Manually engaged, equalize, with factory defaults. CV/CC. User programmable setpoints.
Independent battery banks	1

Environmental Specifications

Ambient Temperature: Operating Temperature Range Storage Temperature Range	-20–60°C, with output derated above 40°C -40–70°C
Humidity: Operation/Storage	5–95% RH, non-condensing

System

Transfer relay rating	30A, 1.5hp
Transfer time	16ms
Transfer on bad voltage	85–110V for low AC and 120–135 for high AC, user-adjustable.
Transfer on bad frequency	40–70Hz user-adjustable for high and low frequency limits.
Inverter synchronized to line before transfer	Yes
Remote ON/OFF	An isolated input to the unit where, with 5–18V applied the unit operates normally, with <1V the unit is off.
Cooling	Fan, activated by any of the following: High internal temperature High AC input current High AC output current

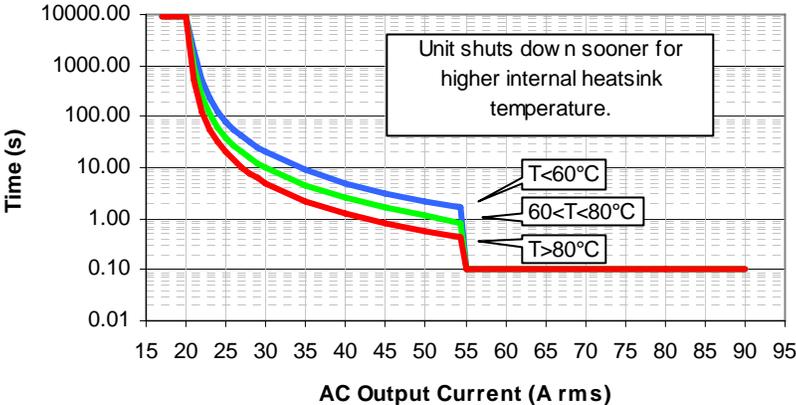
Regulatory Approvals

CSA/NRTL approved to CSA 107.1, UL458 (including Marine Supplement), and UL1741
Complies with ABYC recommended practices E-8, E-9, A-20, and A-25 for marine use
Compliance to KKK-A-1822D for use in “Star-of-Life” ambulances available on request

Inverter Overload Operation

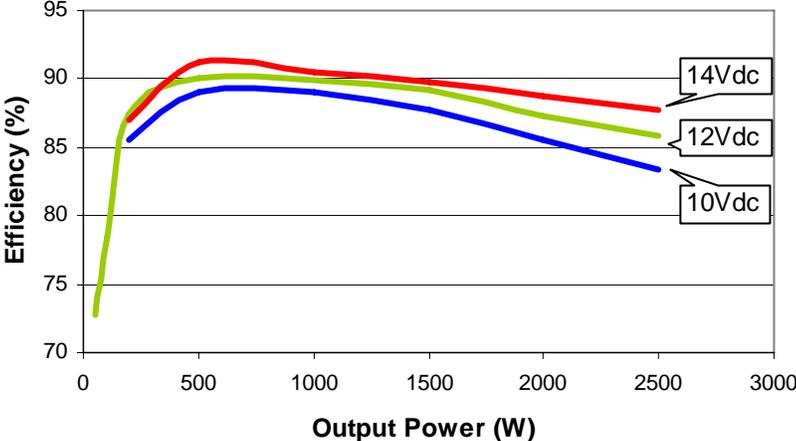
This graph shows how long the PROsine will operate for given output current.

Time to Shutdown vs. Current



Typical Inverter Efficiency

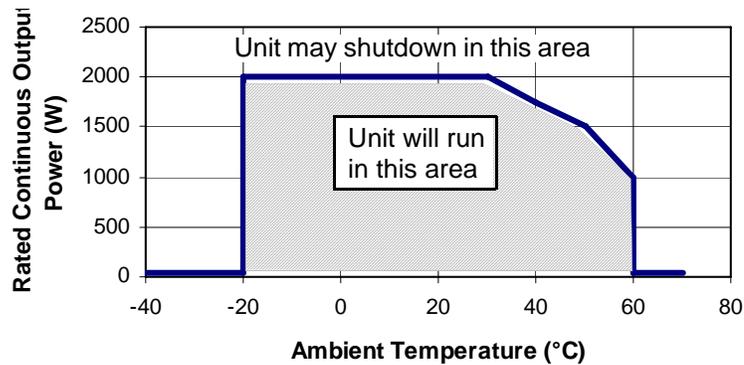
Inverter Efficiency



Invert Power Derating vs. Ambient Temperature

If the unit is in elevated ambient temperature above 40°C, you are required to reduce power draw according to the following chart to maintain regulatory compliance and to avoid over-temperature shutdown.

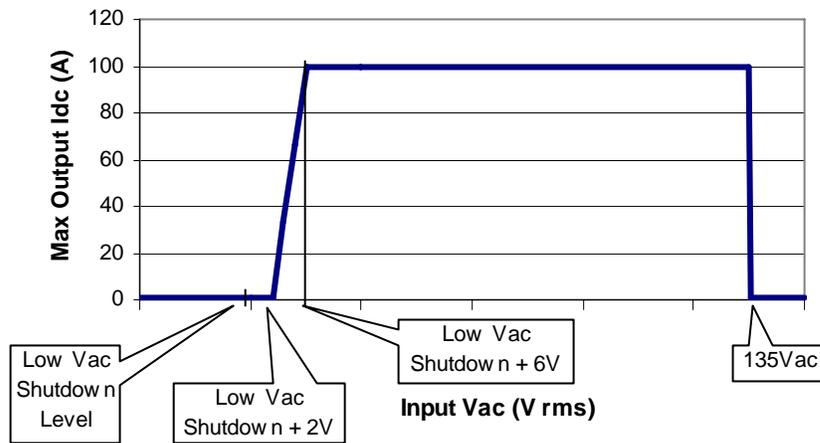
Inverter Output Power vs. Ambient Temperature



PROsine Charger Output Current vs. AC Input Voltage

When the PROsine is charging batteries from a weak shorepower source the AC voltage may fall as the PROsine draws current. To reduce the chance of the shorepower voltage collapsing below the configured transfer level the PROsine will reduce the charging current at low shorepower voltage according to the following graph:

Max Charge Current vs. Input AC Voltage



PROsine Dimensions

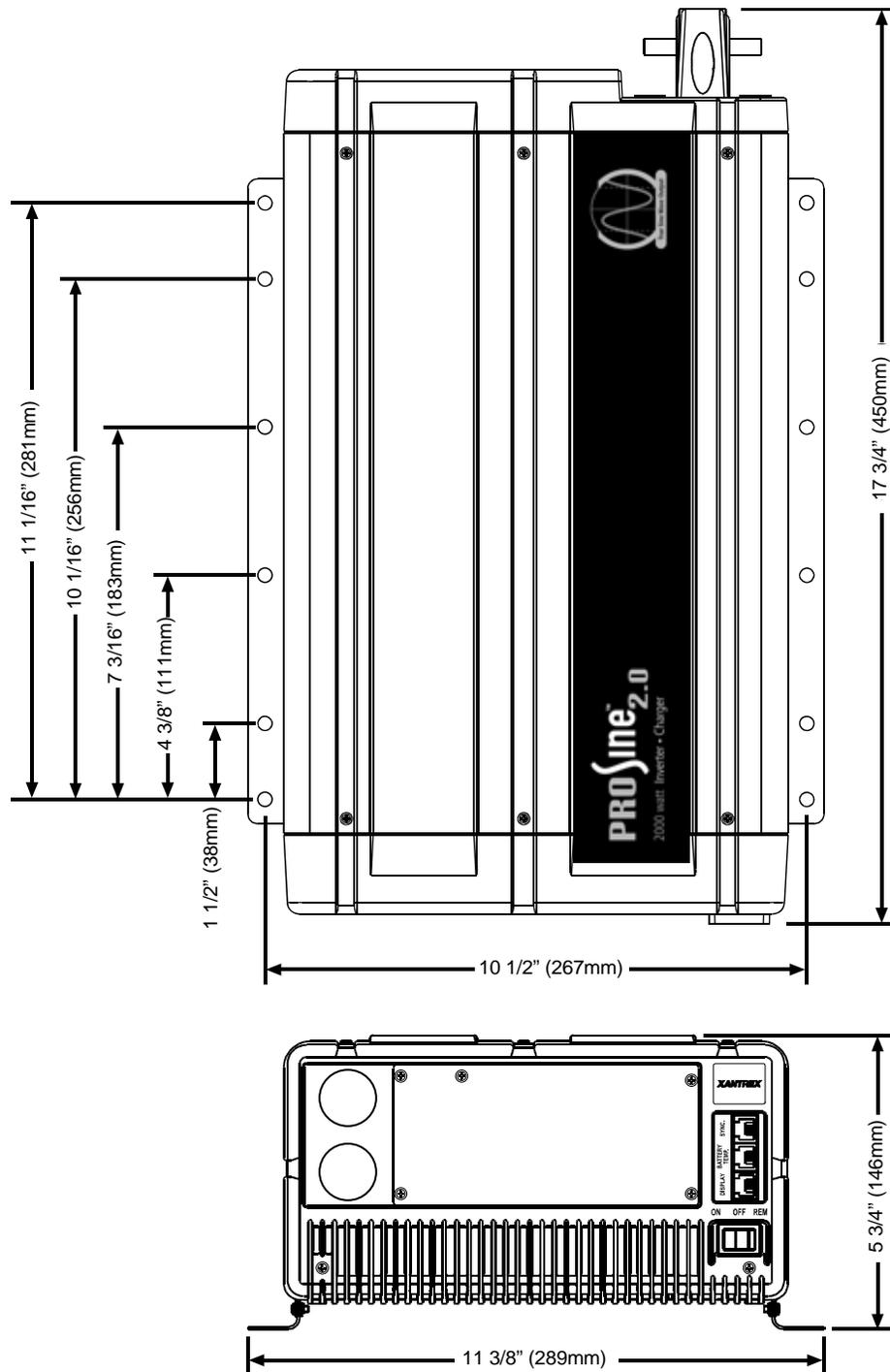


Figure A-1 PROsine Dimensions

B

System Diagrams

Appendix B illustrates typical designs for PROsine custom-designed systems.

- Residential backup. (See page B-2.)
- Marine installations. (See page B-3.)

For a typical RV or Fleet Vehicle installation, see Figure 3-1 on page 3-4.

Residential Backup System

Figure B-1 illustrates a typical residential backup system with the following 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. An AC source panel that includes a Max 30A circuit breaker that supplies the PROsine
4. An AC load panel with branch circuit breakers that supply only loads that run off the PROsine
5. An earth ground

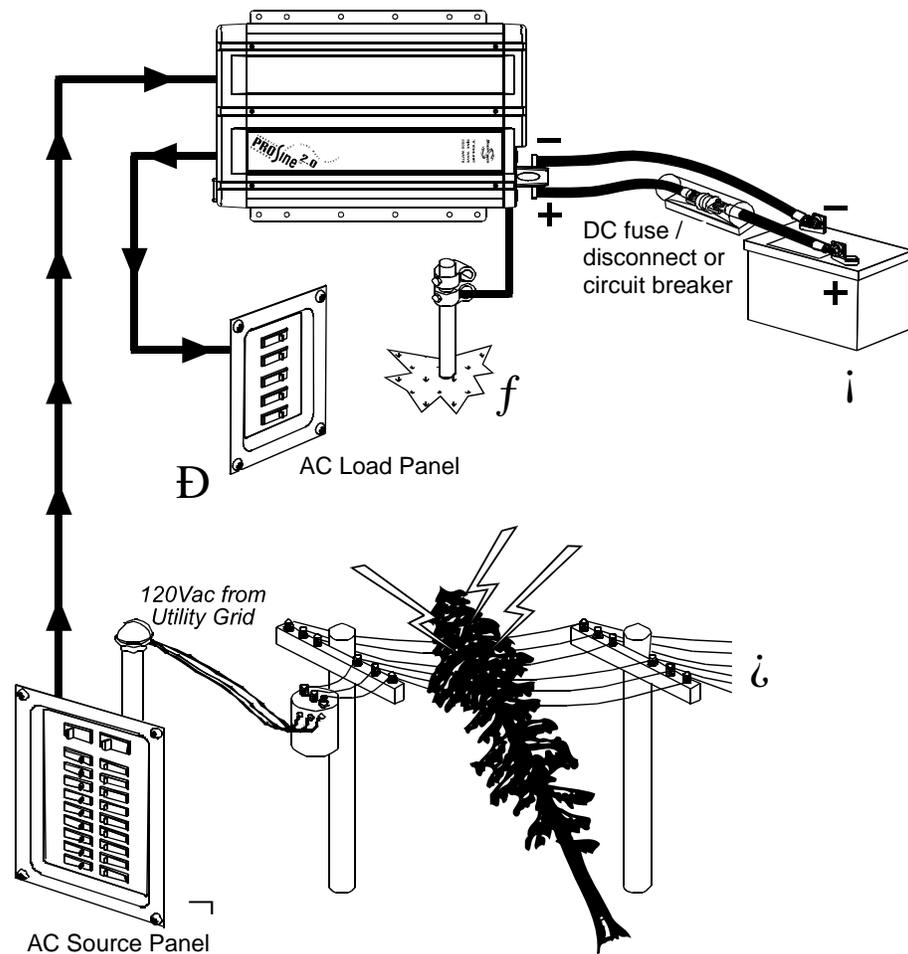


Figure B-1 Residential Backup System

Marine System

Figure B-2 illustrates a typical marine system with the following components:

1. AC power supplied from a shorepower connector
2. An AC source panel that includes a Max 30A circuit breaker that supplies the PROsine
3. An AC load panel with branch circuit breakers that supply only loads that run off the PROsine
4. Engine negative bus or DC ground bus
5. DC power supplied by a battery bank and protected by a DC fuse in the positive cable
6. Battery isolator
7. DC alternator
8. Starting battery

See the Note on page 1–8 for information about the ABYC Warning label that must be used in marine installations.

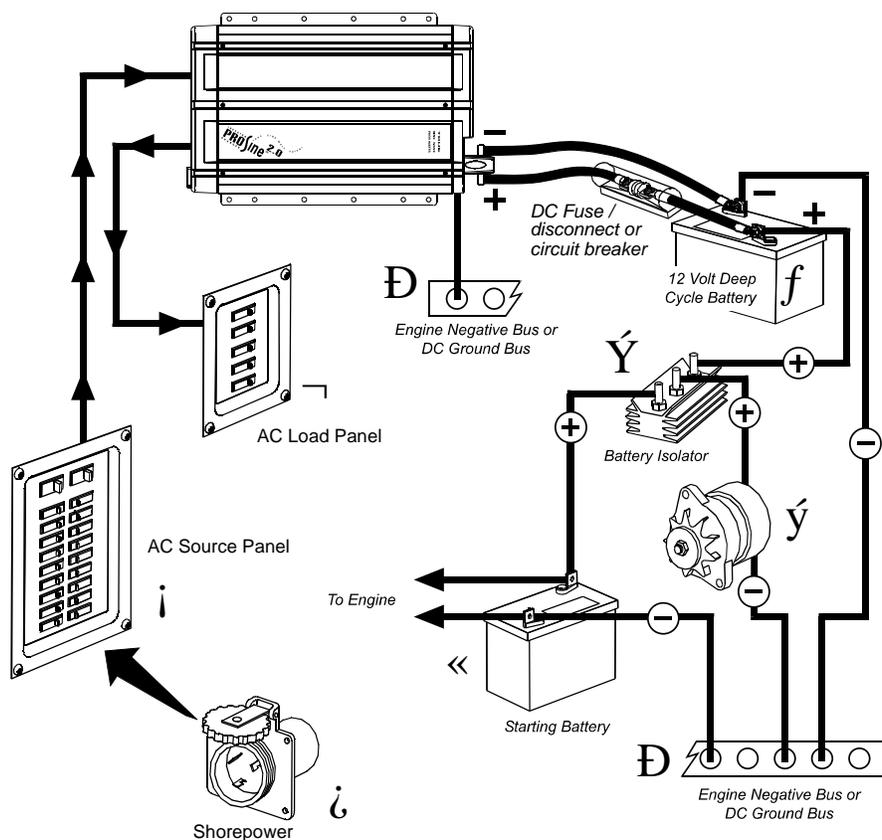


Figure B-2 Typical Marine System

C

Charging Algorithms

Appendix C provides information about the charging algorithms for PROsine 2.0.

- Charge Algorithms. (See page C-2.)
- Battery Type—Charge Algorithm Guide. (See page C-3.)

Charge Algorithms

Table C-1 summarizes the voltage and current setpoints for the charging algorithms. These voltage setpoints are applied for a battery temperature of 20°C. To determine the voltage setpoints at other temperatures, apply the temperature coefficient as follows:

$$V_{T_X} = V_{20^\circ} + \frac{TC \times (T_X - 20^\circ)}{1000}$$

For example, generic gel float voltage at 50° will be

$$V_{50^\circ} = 13.8V + \frac{-27 \frac{mV}{^\circ C} \times (50^\circ - 20^\circ)}{1000} = 13.0V$$

Table C-1 Charge Algorithms

Charge Algorithm	Comment	Temp Coeff.	Bulk / Absorption		Float*	Equalize
			Max V	Max I	Max V	Max V
		(MV/°C)	(V)	(%C)**	(V)	(V)
1	Generic Flooded	-27	14.4	30	13.5	17.5
2	Generic Gel	-27	14.2	25	13.8	***
3	Generic AGM	-21	14.3	30	13.45	***
4	Generic PB-Ca	-27	15.5	30	13.5	17.5
5		-27	14.1	25	13	17.5
6		-27	14.2	25	13.5	***
7		-30	14.5	25	13.5	17.5
8		-30	15.3	25	14.3	17.5
9		-30	14.4	30	13.5	17.5
10		-30	14.15	30	13.5	14.2
11		-27	14.4	30	13.8	***
12		-21	15.5	25	13.75	16
13		-21	14.8	25	13.6	15.5
14		-27	15	200	13.7	***
15		-21.66	14.2	12.5	13.7	16.5
16		-21.66	14	10	13.5	16.5
17		-27	16	20	13.5	17.5
18		-16	14.2	20	13.2	15.5
19		-15	14.7	200	13.5	17.5
20		-15	13.5	200	13.5	17.5
21		-27	14.6	20	13.5	17.5

* The charger delivers maximum available current to power the DC loads: it is not limited by battery size.
 ** See “Max Current (%C)” in your manual.
 *** The algorithms marked *** do not permit Equalize.

Battery Type—Charge Algorithm Guide

Use the information in Table C-2 to match your battery type with the appropriate Charge Algorithm and Charger Type.

Different battery manufacturers suggest different battery charging algorithms. The following information has been provided to Xantrex by the associated battery manufacturer. This list is provided as a reference only. It is highly recommended that you confirm the actual charging algorithm with your battery manufacturer. If your battery is not listed, please choose one of the preprogrammed algorithms listed in Table C-1, or customize the settings to match your battery manufacturer's suggestion (see your PROsine 2.0 User Guide).

Table C-2 Battery Type – Charge Algorithm Guide

If you have this kind of battery	Select Charge Algorithm	Set Charger Type to
Canadian Tire Nautilus by Exide	5	3 Step
Canadian Tire, Gel by Exide	6	3 Step
Concorde AGM Valve Regulated	3	3 Step
Delco 1150 by Delphi	17	3 Step
Delco 1200 by Delphi	17	3 Step
Delco 2000 by Delphi	17	3 Step
Delco Voyager by Delphi	17	3 Step
Douglas Marine/Deep Cycle	21	3 Step
Dulast Deep Cycle Flooded, Deep Cycle/Starting (by Johnson Controls)	13	3 Step
Dulast Deep Cycle Flooded, Starting/Deep Cycle (by Johnson Controls)	12	3 Step
Energizer Deep Cycle Flooded, Deep Cycle/Starting (by Johnson Controls)	13	3 Step
Energizer Deep Cycle Flooded, Starting/Deep Cycle (by Johnson Controls)	12	3 Step
Eveready Deep Cycle Flooded, Deep Cycle/Starting (by Johnson Controls)	13	3 Step
Eveready Deep Cycle Flooded, Starting/Deep Cycle (by Johnson Controls)	12	3 Step
Exide Flooded	5	3 Step
Exide Gel Master	6	3 Step
GNB Action Pac	7	3 Step
GNB Evelyte	9	3 Step
GNB Stowaway	8	3 Step
GNB Sunlyte	10	3 Step
Hawker Energy, Genesis	14	3 Step
Interstate Deep Cycle Flooded, Deep Cycle/Starting (by Johnson Controls)	13	3 Step
Interstate Deep Cycle Flooded, Starting/Deep Cycle (by Johnson Controls)	12	3 Step
Interstate Optima, Normal	19	3 Step
Johnson Controls Flooded - Deep Cycle/Starting	13	3 Step

Table C-2 Battery Type – Charge Algorithm Guide

Johnson Controls Flooded - Starting/Deep Cycle	12	3 Step
Keystone Solid Energy (Flooded)	16	3 Step
Keystone Solid Energy (Gel)	15	3 Step
Metra Electronic - Tsunami, Normal	19	3 Step
Optima Blue Top	19	3 Step
Optima Red Top	19	3 Step
Optima Yellow Top	19	3 Step
Rolls Deep Cycle by Surrrette	18	3 Step
Sears Canada, Marine by Delco	17	3 Step
Sears Canada, Marine Flooded by Exide	5	3 Step
Sears USA, by Johnson Controls, Flooded Deep Cycle/Starting	13	3 Step
Sears USA, by Johnson Controls, Flooded Starting/Deep Cycle	12	3 Step
Sears USA, Gel by Johnson Ctls	11	3 Step
Sonnenshein P300/500, SP300 Powerfit AGM	2	3 Step
Sonnenshein A400 Dryfit Gel	2	3 Step
Sonnenshein A500 Dryfit Cyclic Gel	2	3 Step
Sonnenshein A600 Dryfit OpzV Gel	2	3 Step
Sonnenshein A700 Dryfit Gel	2	3 Step
Sonnenshein Gel A200/300 Dryfit	2	3 Step
Sonnenshein L400 Powerfit, Long Life AGM	2	3 Step
Sonnenshein S300/500 Powerfit AGM	2	3 Step
Surrrette Deep Cycle	18	3 Step
Trojan Gel Safe	1	3 Step
Trojan Golf	1	3 Step
Trojan Mileage Master	1	3 Step
Trojan Mustang	1	3 Step
Trojan Pacer	1	3 Step
Trojan Rider	1	3 Step
Trojan Sea Stallion	1	3 Step
Westmarine Sea Gel by Sonnenshien	2	3 Step
Westmarine Sea Volt by Trojan	1	3 Step

Warranty and Return Information

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 PROsine 2.0 Inverter/Charger. This warranty period lasts for 2 years (24 months) from the date of purchase at the point of sale to you, the original end user customer. You require proof of purchase to make warranty claims.

This Limited Warranty is transferable to subsequent owners but only for the unexpired portion of the Warranty Period. Subsequent owners also require proof of purchase.

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:

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

1 360 925 5097 (direct)

Fax: 1 800 994 7828 (toll free North America)

1 360 925 5143 (direct)

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.

What proof of purchase is required? 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, 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.

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

Record these details on page WA-4.

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.

Out of Warranty Service

If the warranty period for your PROsine 2.0 Inverter/Charger has expired, if the unit was damaged by misuse or incorrect installation, if other conditions of the warranty have not been met, or if no dated proof of purchase is available, your unit may be serviced or replaced for a flat fee.

To return your PROsine 2.0 Inverter/Charger for out of warranty service, contact Xantrex Customer Service for a Return Material Authorization (RMA) number and follow the other steps outlined in "Return Procedure" on page WA-3.

Payment options such as credit card or money order will be explained by the Customer Service Representative. In cases where the minimum flat fee does not apply, as with incomplete units or units with excessive damage, an additional fee will be charged. If applicable, you will be contacted by Customer Service once your unit has been received.

Information About Your System

As soon as you open your PROsine 2.0 Inverter/Charger package, record the following information and be sure to keep your proof of purchase.

- p FGA 805-2000, 805-2020
- p Model Number (on DC end) _____
- p Serial Number (on DC end) _____
- p Purchased From _____
- p Purchase Date _____

If you need to contact Customer Service, please record the following details before calling. This information will help our representatives give you better service.

- p Type of installation (e.g. RV, boat, home) _____
- p Length of time PROsine has been installed _____
- p Battery/battery bank size _____
- p Battery type (e.g. flooded, sealed gel cell, AGM) _____
- p AC service setting _____
- p AC wiring size and length _____
- p DC wiring size and length _____
- p Options installed with PROsine _____
- p Charge or invert mode when problem occurred _____
- p Warning, Error or Panel Fault message if any _____
- p Appliances operating when problem occurred _____
- p Description of problem _____

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