

Smart choice for power

**xantrex**



**Installation Guide**

# Inverter Stacking Control Series (ISC-S) Cable

[www.xantrex.com](http://www.xantrex.com)



# **Inverter Stacking Control Series (ISC-S) Cable**

## **Installation Guide**

## **About Xantrex**

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

## **Trademarks**

Inverter Stacking Control – Series Cable is a trademark of Xantrex International. Xantrex is a registered trademark of Xantrex International.

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

## **Notice of Copyright**

*Inverter Stacking Control Series (ISC-S) Cable Installation Guide* © January 2004 Xantrex International. All rights reserved.

## **Disclaimer**

UNLESS SPECIFICALLY AGREED TO IN WRITING, XANTREX TECHNOLOGY INC. (“XANTREX”)

(a) MAKES NO WARRANTY AS TO THE ACCURACY, SUFFICIENCY OR SUITABILITY OF ANY TECHNICAL OR OTHER INFORMATION PROVIDED IN ITS MANUALS OR OTHER DOCUMENTATION.

(b) ASSUMES NO RESPONSIBILITY OR LIABILITY FOR LOSS OR DAMAGE, WHETHER DIRECT, INDIRECT, CONSEQUENTIAL OR INCIDENTAL, WHICH MIGHT ARISE OUT OF THE USE OF SUCH INFORMATION. THE USE OF ANY SUCH INFORMATION WILL BE ENTIRELY AT THE USER’S RISK.

## **Date and Revision**

January 2004 Rev A

## **Part Number**

975-0059-01-01 Rev A

## **Contact Information**

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](mailto:customerservice@xantrex.com)

Web: [www.xantrex.com](http://www.xantrex.com)

# About This Guide

## Purpose

The purpose of this Installation Guide is to provide explanations and procedures for installing the Inverter Stacking Control – Series Cable and provides information regarding stacking two identical Sine Wave Plus inverters.

## Scope

The Guide provides safety guidelines, detailed planning and setup information for stacking inverters, and procedures for installing the ISC-S cable.

## Audience

The Guide is intended for anyone who needs to install series-stacked, Sine Wave Plus inverters using the Inverter Stacking Control – Series Cable. Installers should be certified technicians or electricians.

## Organization

This Guide is organized into three chapters.

Chapter 1, “Introduction” provides information on stacking of Sine Wave Plus inverters.

Chapter 2, “Installation” provides information on installing the DC wiring, AC Wiring, and the ISC-S for Sine Wave Plus inverters.

Chapter 3, “Operation” contains information on startup and functional testing procedures for series-stacked Sine Wave Plus inverters.

Warranty and Product Information is provided at the end of the Guide.

## Conventions Used

The following conventions are used in this guide.



### WARNING

Warnings identify conditions 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

The following acronyms and abbreviations are used in this guide:

AC	Alternating Current
ASC	Authorized Service Center
BTS	Battery Temperature Sensor
DC	Direct Current
DCCB	DC Conduit Box
DVM	Digital Voltage Meter
GSM	Generator Start Module
ISC-S cable	Inverter Stacking Control – Series Cable
Hz	Hertz
RMA	Return Material Authorization
Vac	AC Voltage

## Related Information

You can find more information about Xantrex Technology Inc. as well as its products and services at [www.xantrex.com](http://www.xantrex.com)

# Important Safety Instructions



## **WARNING**

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

---

1. Before installing and using the ISC-S cable, read all instructions and cautionary information in this guide.
2. Do not expose the ISC-S cable to rain, snow, spray, or water.
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. Do not operate the ISC-S cable if it has been damaged in any way. If the ISC-S cable is damaged, see the Warranty section.
5. Do not disassemble the ISC-S cable. It contains no user-serviceable parts. See Warranty for instructions on obtaining service. Attempting to service the ISC-S cable yourself will void your warranty.
6. To reduce the risk of electrical shock, disconnect both AC and DC power from the inverters before attempting any maintenance or cleaning or working on any circuits connected to the ISC-S cable. Turning off the inverters will not reduce this risk.





# Contents

<b>Important Safety Instructions</b> .....	v
<b>1 Introduction</b>	
Stacking Inverters .....	1-2
The ISC-S Cable .....	1-5
<b>2 Installation</b>	
DC Wiring .....	2-2
Battery Requirements for Series-stacked Inverters .....	2-2
Battery-Bank Configuration for Series-stacked Inverters .....	2-2
Grounding Series-stacked Inverters .....	2-3
Connecting the Battery Bank to the Inverters .....	2-4
AC Wiring - General .....	2-6
Inverter AC Distribution Panel (Sub-Panel) Wiring (if used) .....	2-6
Neutral Bonding .....	2-7
Grounding .....	2-7
AC Wiring - Specific .....	2-8
Off-Grid AC Wiring for Sine Wave Plus Inverters .....	2-8
On-Grid AC Wiring for Sine Wave Plus Inverters .....	2-10
Generator AC Wiring to Series-stacked Inverters .....	2-12
Wiring for a 240 Vac-Only Input Source .....	2-14
Connecting the ISC-S Cable .....	2-16
<b>3 Operation</b>	
Start-up and Testing .....	3-2
Setting Changes .....	3-4
Automatic and Manual Generator Control .....	3-4
Bulk and Float Charging Parameters .....	3-4
Equalize Charging .....	3-4
Automatic Generator Equalize Charging .....	3-5
Manual Equalize Charging .....	3-5
<b>Warranty and Return Information</b> .....	WA-1
<b>Index</b> .....	IX-1



# Figures

Figure 1-1	Off-Grid Applications with Series-Stacked Inverters- - - - -	1-3
Figure 1-2	On-Grid Applications with Series-stacked Inverters - - - - -	1-4
Figure 1-3	Inverter Stacking Control – Series Cable (ISC-S cable)- - - - -	1-5
Figure 2-1	Example of Battery Connections for Series-stacked Inverters (24 Vdc shown) - - - - -	2-2
Figure 2-2	DC Grounding of Series-stacked Inverters - - - - -	2-3
Figure 2-3	DC Connections for Dual Inverters, Series-stacked- - - - -	2-5
Figure 2-4	AC Wiring for Series-stacked SW Plus Inverters Off Grid- - - - -	2-9
Figure 2-5	AC Wiring for Series-stacked SW Plus Inverters OnGrid - - - - -	2-11
Figure 2-6	Generator Wiring to Series-stacked SW Plus Inverters - - - - -	2-13
Figure 2-7	AC Wiring for a 240 Vac-Only Input Source - - - - -	2-15
Figure 2-8	The 25-pin D-connector on the ISC-S Cable - - - - -	2-16
Figure 2-9	Stacking Port Locations on SW Plus Inverters - - - - -	2-16
Figure 2-10	The ISC-S Cable Connected to Dual Sine Wave Plus Inverters- - - - -	2-17
Figure 3-1	Testpoints for Confirming Voltages - - - - -	3-3



# 1

## Introduction

Chapter 1, “Introduction” provides information on stacking of Sine Wave Plus inverters.

The following topics are covered in this chapter.

<b>For this topic:</b>	<b>See:</b>
“Stacking Inverters”	page 1–2
“The ISC-S Cable”	page 1–5

## Stacking Inverters

Two identical, series-stacked, inverters can be connected together for the following purposes.

- The voltage output of a single inverter is insufficient to power the 240 Vac loads attached to the system;
- Multi-wire branch circuits exist in the current structure. *Please see Appendix F, “Multi-wire Branch Circuit Wiring”, in the Sine Wave Plus Owner’s Manual for additional information.*

---

**Important:** Inverter types and models must be identical for stacking configurations. In other words, you can use two SW Plus 2548 inverters, or two SW Plus 4048 inverters. You cannot stack a SW Plus 2548 with a SW Plus 4048. Different types of inverters cannot be intermixed in a stacking configuration. Models with 230 Vac, 50 Hz, output cannot be series-stacked.

---

Stacking inverters in a “series” configuration can double the output voltage at the same current level as an individual inverter.

Series-stacking connects the neutral outputs of each inverter together and enables the inverters to synchronize their hot outputs to be 180 degrees out-of-phase with each other. This maintains the wattage output at the rated level, but doubles the voltage output available, thereby allowing 240 Vac loads to be supported by the system.

*Example: Two series-stacked, Sine Wave Plus 4024 Vac inverters can run both 120 Vac and 240 Vac loads at 33 amps continuous output.*

Stacking inverters in a series configuration requires the use of the Inverter Stacking Control-Series (ISC-S) Cable.

## Renewable Energy (RE) Sources

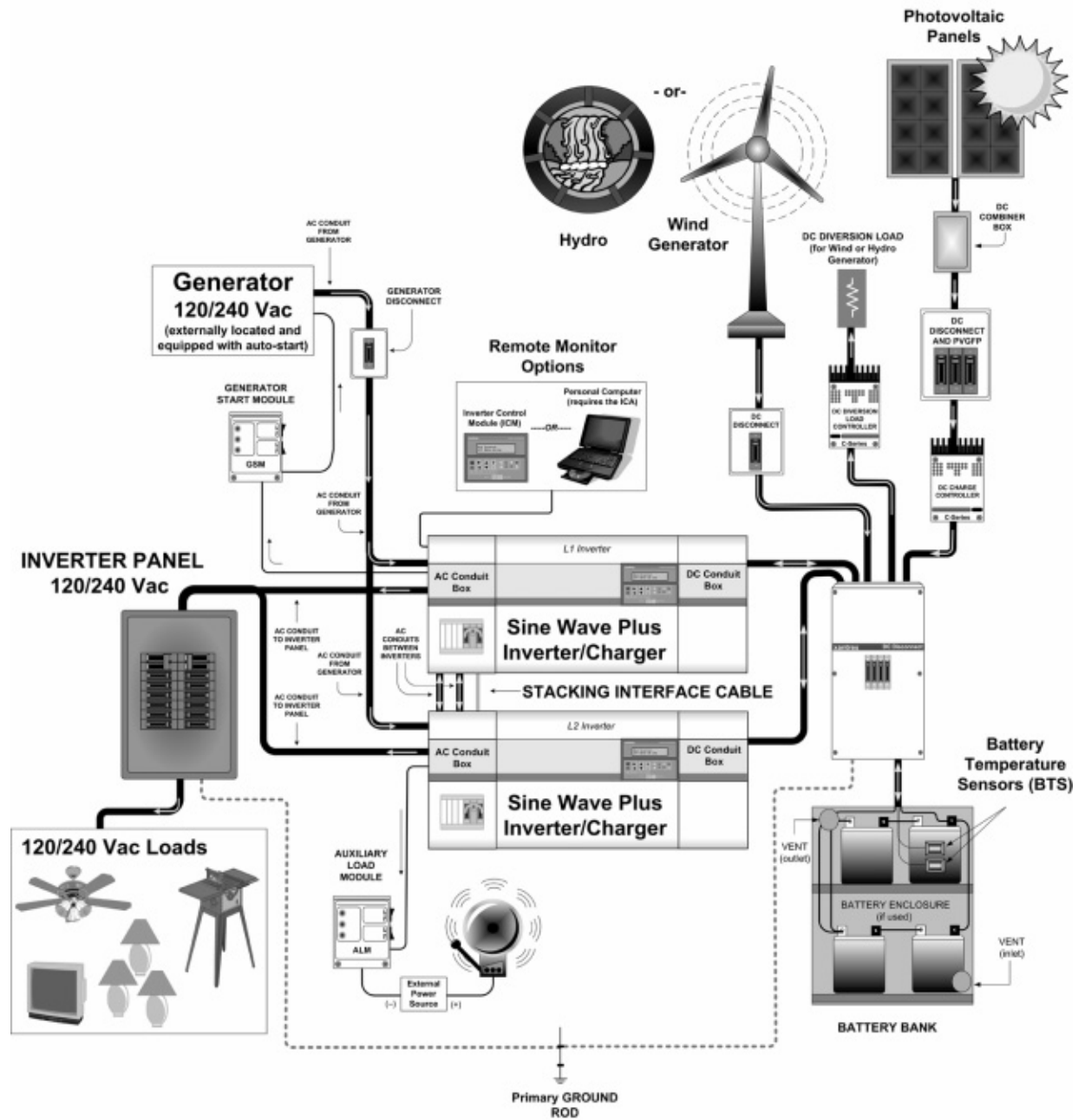


Figure 1-1 Off-Grid Applications with Series-Stacked Inverters

## Renewable Energy (RE) Sources

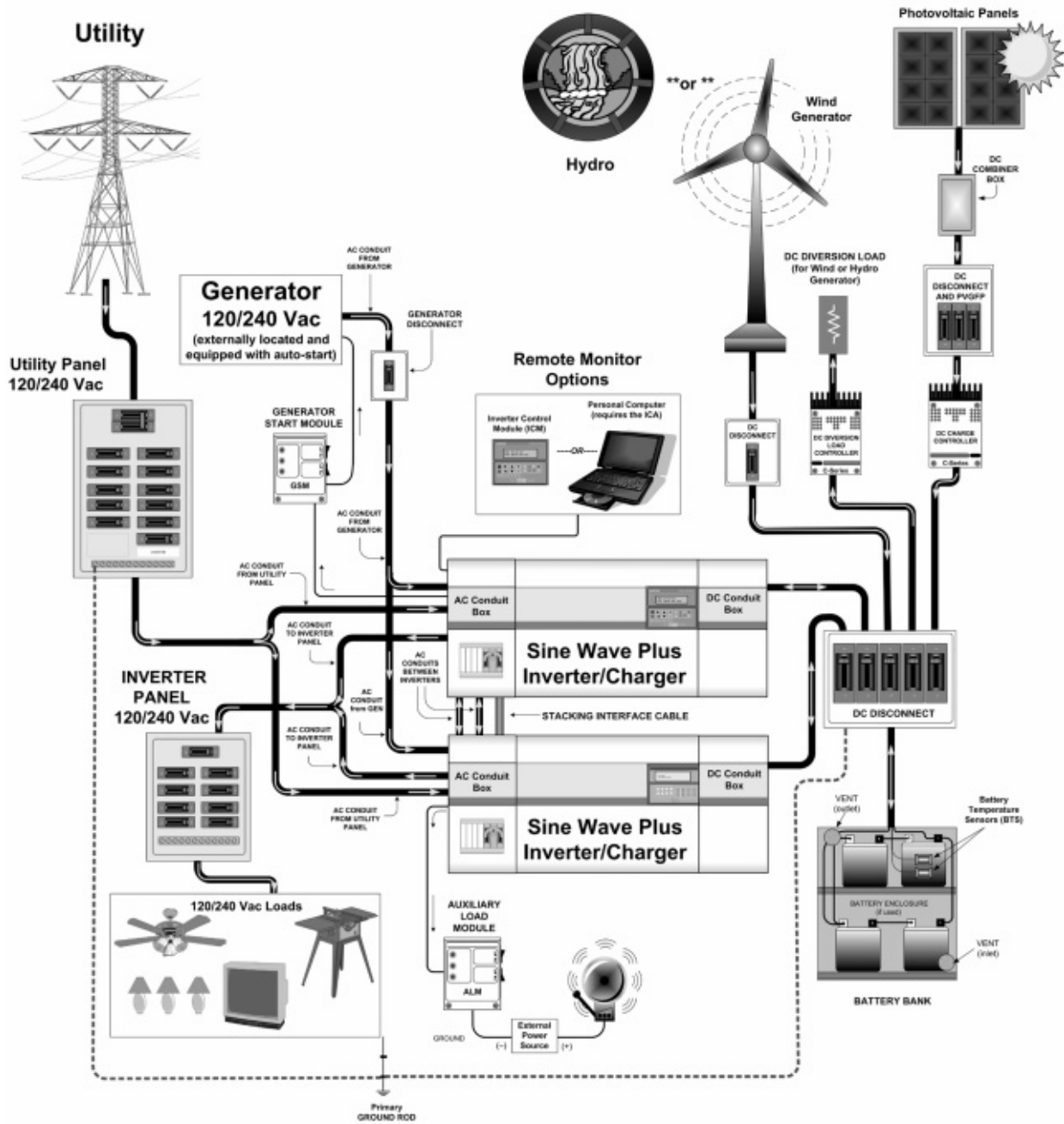


Figure 1-2 On-Grid Applications with Series-stacked Inverters



## The ISC-S Cable

Required accessory  
cable

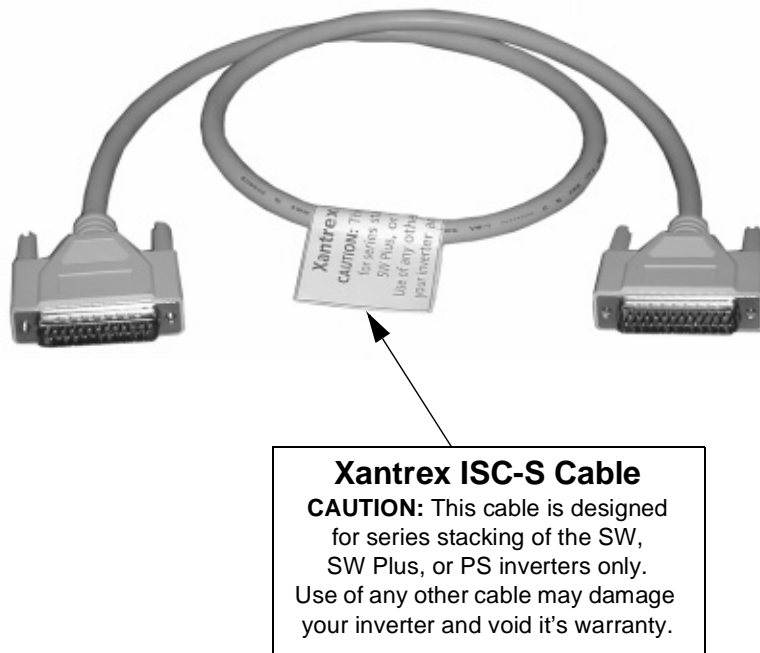
Stacking two identical inverters requires the use of the Inverter Stacking Control – Series Cable (ISC-S cable). The ISC-S cable is a special cable specifically designed for series-stacking two identical inverters. It consists of one 36-inch stacking control cable with two 25-pin D connectors. It connects to the “Stacking Ports” on the respective inverters and allows the AC output of two (identical) inverters to provide both 120 and 240 Vac, 60 Hz.



### CAUTION: Damage to Equipment

Do not use a standard computer cable in place of the ISC-S cable. This ISC-S cable is custom made for Xantrex to allow series-stacking with the SW Plus Inverter/charger. Look for the label as shown in Figure 1-3 to properly identify the cable.

Use of any other cable may damage your inverters and will not be covered by Warranty/ Repair.



**Figure 1-3** Inverter Stacking Control – Series Cable (ISC-S cable)

What it does	<p>The ISC-S cable provides communication between the two stacked inverters for two purposes.</p> <ul style="list-style-type: none"><li>• It provides synchronization information for inverting and charging.</li><li>• It provides a method for one inverter detecting an error condition to send a shut-down command to the other inverter, to prevent a 240Vac load from only receiving one leg of power.</li></ul>
What it does not do	<p>The ISC-S cable does not allow programming or access to the display from one inverter to the other. If there are changes to the default setting necessary, each inverter must be programmed separately. This includes selecting “On” in the “On/Off” menu.</p>

# 2

## Installation

Chapter 2, “Installation” provides information on installing the DC wiring, AC Wiring, and the ISC-S for Sine Wave Plus inverters.

The following topics are covered in this chapter.

<b>For this topic:</b>	<b>See:</b>
“DC Wiring”	page 2-2
“AC Wiring - General”	page 2-6
“AC Wiring - Specific”	page 2-8
“Connecting the ISC-S Cable”	page 2-16

## DC Wiring

The success of series-stacked, inverter systems is dependent on the quality and maintenance of the DC connections. Stacked inverter sets are far less forgiving to long, undersized, uneven, and/or poor connections than are single inverters.

### Battery Requirements for Series-stacked Inverters

When inverters are “stacked” they must operate from a common battery bank. In other words, the DC negative of one inverter must be common with the second inverter and likewise for the DC positive.

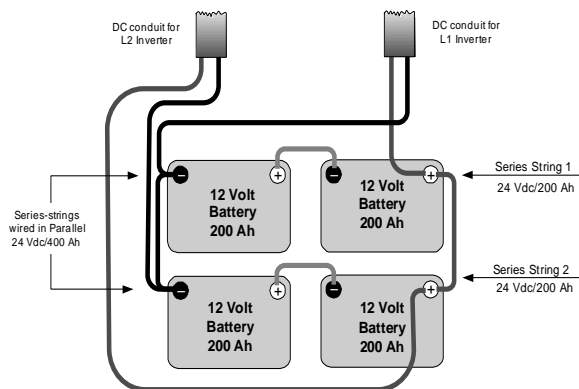
*For example:*

*If you have eight 6-volt batteries in a 24-volt configuration, they would be arranged in two rows of four batteries (see Appendix C of the Sine Wave Plus Owner’s Manual for diagrams of various arrangements). The negative ends of the two “strings” of batteries must be jumpered together to become common with each other. Likewise, the positive ends of the two “strings” must also be jumpered together so that they are also common with each other.*

### Battery-Bank Configuration for Series-stacked Inverters

When using inverters in a stacked configuration, the same battery bank must be used for both inverters. To ensure even charging of the batteries, each inverter must be connected to both strings (i.e., positive cable to string two, and negative cable to string one for inverter 1, and positive cable to string one and negative cable to string two for inverter 2) as shown in Figure 2-1. In other words, a separate positive (+) and negative (–) cable pair is required for each inverter in the series-stacked configuration. This means there will be four battery cables from the stacked inverters to the battery bank.

Refer to the Owner’s Manual for the Sine Wave Plus to determine the correct size and length of cable required.



**Figure 2-1** Example of Battery Connections for Series-stacked Inverters (24 Vdc shown)

## Grounding Series-stacked Inverters

### To ground series-stacked inverters:

1. Connect the ground bond in the DC disconnect between the inverters and the batteries to the primary grounding electrode, in accordance with local and national electrical codes.
2. Connect an appropriately sized ground wire from the chassis bonding ground lug on the L1 inverter DC end to the ground bond inside the DC disconnect.
3. Connect a second appropriately sized ground wire from the chassis bonding ground lug on the L2 inverter DC end to a different terminal in the ground bond inside the DC disconnect.

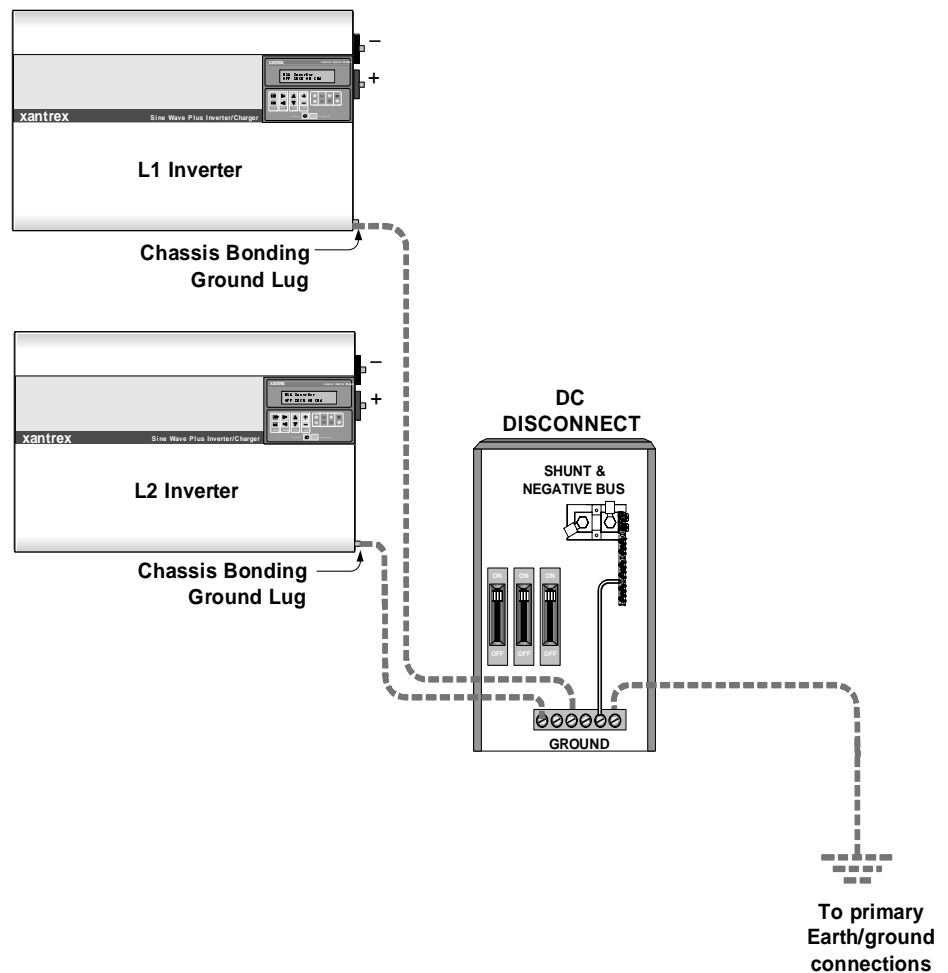


Figure 2-2 DC Grounding of Series-stacked Inverters

## Connecting the Battery Bank to the Inverters

The following instructions are illustrated in Figure 2-3.

### To connect the battery (or battery bank) to the inverters:

1. Connect POSITIVE cables:
  - a) one cable from the battery POSITIVE terminal to a circuit breaker in the DC disconnect (torque to manufacturer's recommendations). The DC disconnect should be located as close to the batteries as possible.
  - b) a second cable from the same battery POSITIVE terminal to another circuit breaker in the DC disconnect.
  - c) a third cable from the first circuit breaker in the DC disconnect to the L2 inverter POSITIVE (+) terminal.
  - d) a fourth cable from the second DC disconnect to the L1 inverter POSITIVE (+) terminal.
2. Connect NEGATIVE cables:
  - a) one cable from the same battery NEGATIVE terminal (torque to manufacturer's recommendations) to the ground bond in the DC disconnect.
  - b) a second cable from the same battery NEGATIVE terminal (torque to manufacturer's recommendations) to the ground bond in the DC disconnect.
  - c) a third cable from the ground bond in the DC disconnect to the L2 inverter NEGATIVE (–) terminal.
  - d) a fourth cable from the ground bond in the DC disconnect to the L1 inverter NEGATIVE (–) terminal.
3. Ensure the correct polarity of the cables with a DC voltmeter (DVM).
4. Use an insulated 1/2 inch wrench or socket to tighten the 5/16 SAE nuts to 10-15 foot/lb for each inverter input terminal.
5. After tightening the connections on the batteries, apply antioxidant paste to the battery terminals, if desired. *Do not apply antioxidant paste to the inverter terminals.*
6. Install the battery terminal covers (if used)—red for positive, black for negative—over the inverter DC terminals and secure with the screws and washers provided.

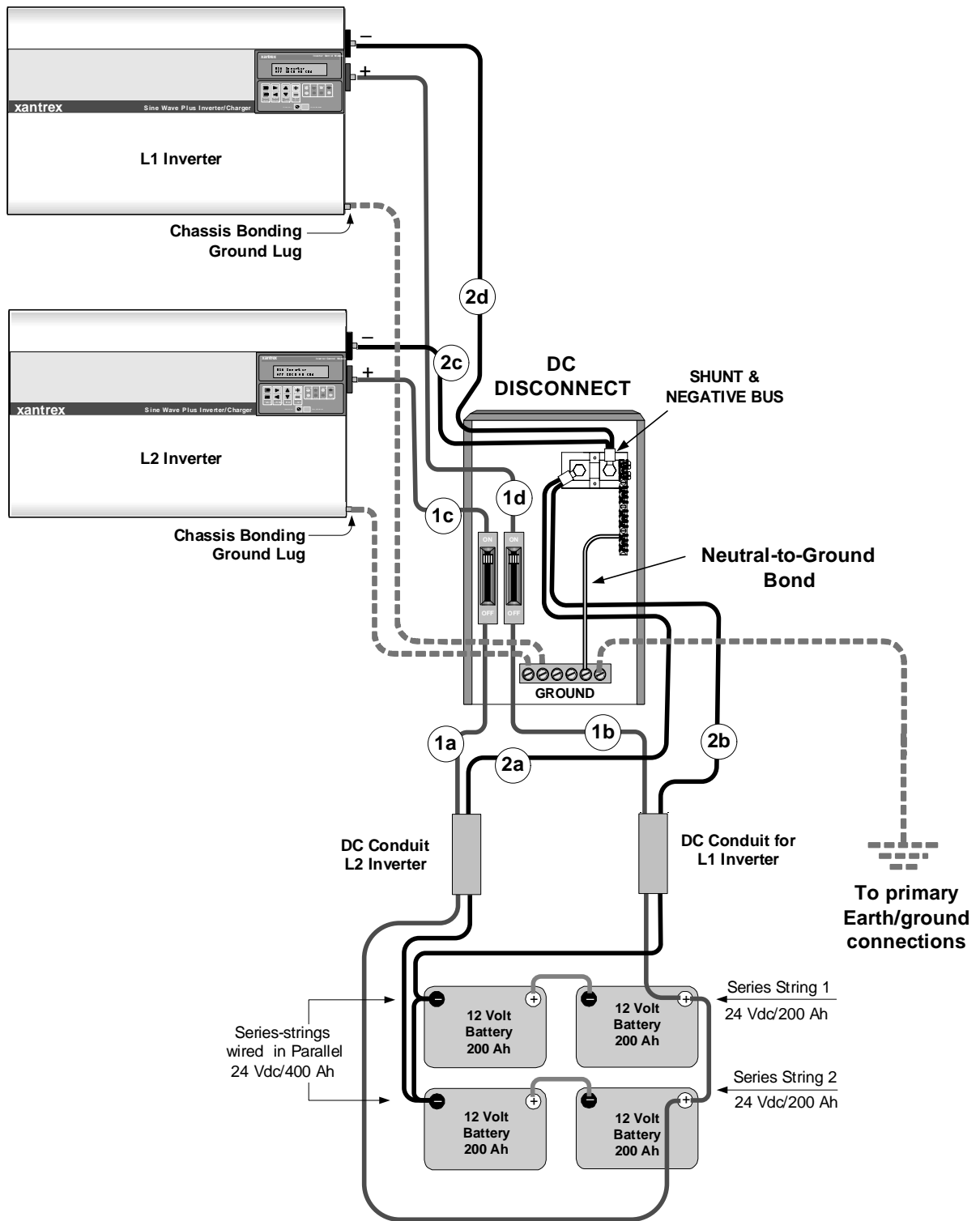


Figure 2-3 DC Connections for Dual Inverters, Series-stacked

## AC Wiring - General

Be sure to use the recommended wire and disconnect size as recommended in the Owner's Manual for the Sine Wave Plus Inverter.



### **WARNING**

Before connecting any AC wiring, ensure that there is no DC energy accessible by the inverter by opening the DC disconnect switch(es).

---

### **Inverter AC Distribution Panel (Sub-Panel) Wiring (if used)**

An Inverter AC Distribution Panel (referred to here as the inverter panel) and AC conduit must be installed before AC output wiring is connected to the dual inverters. The inverter panel is a sub-panel to the main utility panel.

#### **Install the Inverter AC Distribution Panel and conduit as follows:**

1. Determine the location for the Inverter AC Distribution Panel (i.e., the sub-panel) and install it according to the manufacturer's directions.
2. Install an AC conduit to the inverter panel and the inverter.
3. Determine which circuits the inverter will power and install the appropriate circuit breakers into the inverter panel.
4. For On-Grid systems, remove wires for circuits to be backed up from the main utility panel and install them in the new inverter (sub) panel.
5. Install a double pole 60-amp maximum (disconnect) main circuit breaker in the inverter panel: one for each leg of the circuit for L1 and L2.
6. Verify that under no circumstances can utility power or generator power energize the inverter panel directly while the inverter also energizes the inverter panel.



### **WARNING: Shock Hazard**

Verify that only one neutral/ground bond exists in the system. Having more than one neutral to ground bond in a system may create a shock hazard and cause some sensitive equipment to malfunction.

On-Grid systems always have a ground-to-neutral bond provided by the utility meter or service entrance, therefore do not need a ground-to-neutral bond made in the inverter panel. Remove it if present in the sub-panel.

---



## Neutral Bonding

The HOT output of each inverter provides 120 Vac to neutral. The voltage between the HOT outputs from the L1 and L2 inverter is 240 Vac when the ISC-S cable is used.

When using a series-stacked, inverter configuration, it is important to provide a neutral bond between both inverters. Accomplish this bond by establishing an inverter-to-inverter neutral bond.

Keep the neutral bonding jumper as short as possible to provide a better AC “zero volt” reference for each inverter to measure AC voltages from, as well as saving on wire. The neutral bond wire must be the same gauge as the other AC wires attached to the inverter.

## Grounding

Ensure all components are grounded properly for safety and for code-compliance.



### **WARNING: Hazardous Voltage**

When stacking inverters, ensure the chassis of each inverter is connected to the same common ground (i.e., in the utility or inverter panels); otherwise a hazardous voltage may be present between the chassis.

---

## AC Wiring - Specific

The following AC connections are specific to installing the Sine Wave Plus Inverter/chargers in a series-stacked configuration for off-grid and on-grid applications.

### Off-Grid AC Wiring for Sine Wave Plus Inverters

The following steps are illustrated in Figure 2-4.

#### **To connect the AC wiring for an off-grid application using Sine Wave Plus Inverters:**

- |                                   |  |
|-----------------------------------|--|
| Grounding                         | 1. Connect GROUND (green) wires: <ul style="list-style-type: none"><li>a) from the primary earth/ground to the AC distribution panel,</li><li>b) from the L1 inverter AC ground bar to the inverter panel ground bar,</li><li>c) from the L2 inverter AC ground bar to the inverter panel ground bar.</li></ul>  |
| Neutral Bonds                     | 2. Connect NEUTRAL (white) wires: <ul style="list-style-type: none"><li>a) from the NEUTRAL bus in the inverter panel, to the ground bar in the inverter panel, (Neutral-to-Ground Bond),</li><li>b) from the L1 inverter NEUTRAL OUT terminal, to the L2 inverter NEUTRAL 2 terminal. (Inverter-to-inverter neutral bond),</li><li>c) from the L2 inverter NEUTRAL OUT terminal to the inverter panel NEUTRAL bus. (Common neutral bond in inverter panel).</li></ul> |
| Inverter to AC Distribution Panel | 3. Connect a HOT wire: <ul style="list-style-type: none"><li>a) (black) from the L1 inverter AC HOT OUTPUT (120 Vac) to the inverter panel L1 terminal,</li><li>b) (red) from the L2 inverter AC HOT OUTPUT (120 Vac) to the inverter panel L2 terminal.</li></ul>   |
|                                   | 4. Torque all inverter terminal block connections to 25 inch-pounds.   |

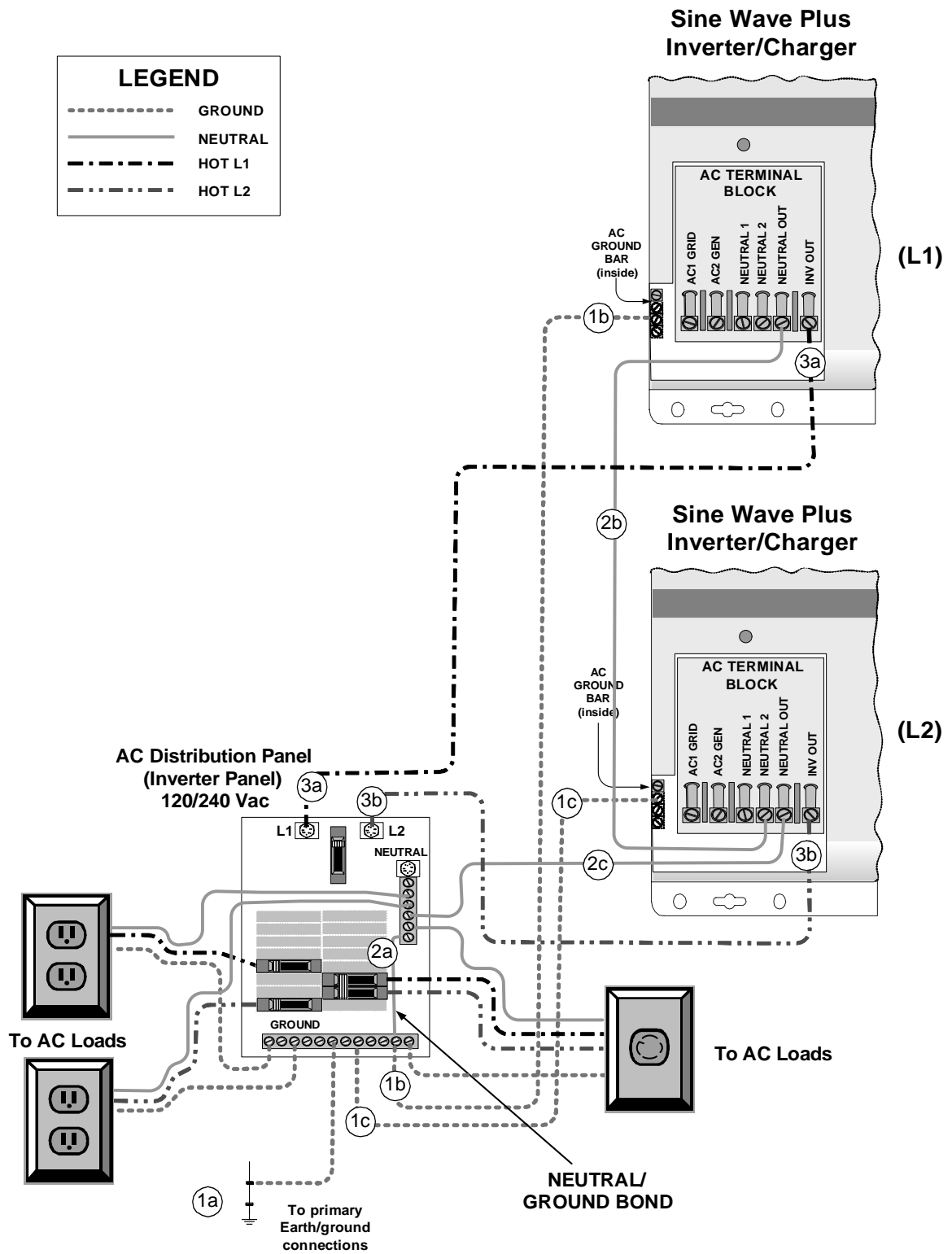


Figure 2-4 AC Wiring for Series-stacked SW Plus Inverters Off Grid

## On-Grid AC Wiring for Sine Wave Plus Inverters

Prepare the AC wiring as follows for an on-grid application using series-stacked, Sine Wave Plus Inverterchargers. The following steps are illustrated in Figure 2-5.

- |                                   |   |
|-----------------------------------|---|
| Grounding                         | 1. Connect GROUND (green) wires: <ul style="list-style-type: none"><li>a) from the primary earth/ground to the main utility panel,</li><li>b) from the main utility panel to the AC distribution panel (Sub-panel),</li><li>c) from the L1 inverter AC ground bar to the utility panel ground bar,</li><li>d) from the L2 inverter AC ground bar to the utility panel ground bar.</li></ul>   |
| Neutral Bonds                     | 2. Connect NEUTRAL (white) wires: <ul style="list-style-type: none"><li>a) from the Neutral bus in the utility panel to the ground bar in the utility panel. (Neutral-to-ground bond),<sup>1</sup></li><li>b) from the L1 inverter NEUTRAL OUT terminal to the L2 inverter NEUTRAL 2 terminal (Interter-to-inverter neutral bond),</li><li>c) from the L1 inverter NEUTRAL OUT terminal to the utility or utility panel neutral bus (Common neutral bond in utility panel),</li><li>d) from the L2 inverter NEUTRAL OUT terminal to the AC distribution panel neutral bus (Common neutral bond in sub-panel),</li></ul> |
| Inverter to AC Distribution Panel | 3. Connect HOT wires: <ul style="list-style-type: none"><li>a) (black) from the L1 inverter AC HOT OUTPUT (120 Vac) to the inverter panel L1 terminal.</li><li>b) (red) from the L2 inverter AC HOT OUTPUT (120 Vac) to the inverter panel L2 terminal.</li></ul>   |
| Inverter to Utility Panel         | 4. Connect HOT wires: <ul style="list-style-type: none"><li>a) (black) from the utility panel HOT L1 terminal to the L1 inverter's AC1 GRID terminal.</li><li>b) (red) from the utility panel HOT L2 terminal to the L2 inverter's AC1 GRID terminal.</li></ul>   |
|                                   | 5. Torque all inverter terminal block connections to 25 inch-pounds.  |

---

1. This connection may already exist from the original installation of AC service to the building.

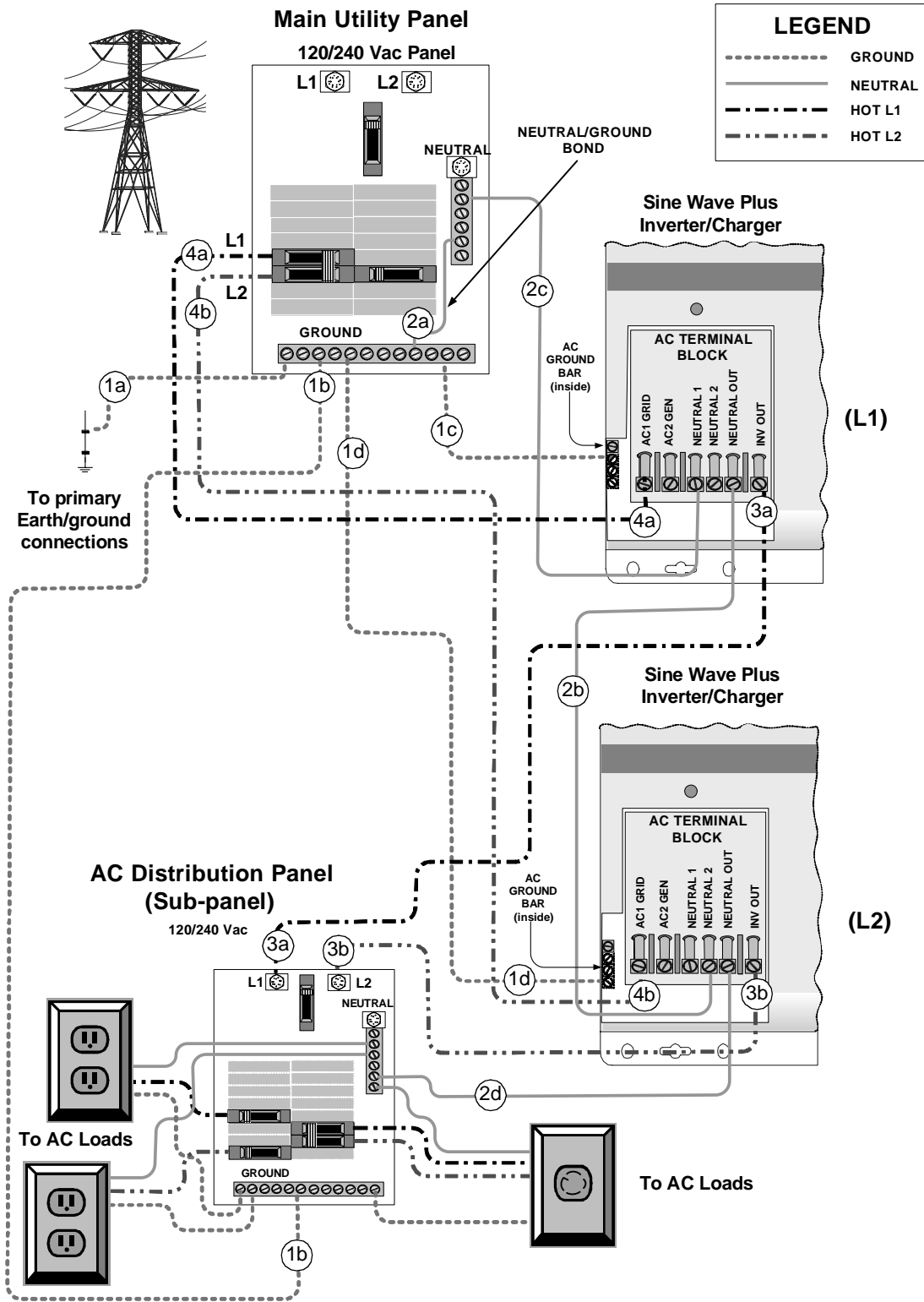


Figure 2-5 AC Wiring for Series-stacked SW Plus Inverters OnGrid

## Generator AC Wiring to Series-stacked Inverters

The following wiring diagrams show the AC wiring from an AC generator to the inverters.

The following procedures are illustrated in **Figure 2-6**.

---

**Important:** Ensure that an inverter-to-inverter neutral bond is in place before proceeding with this procedure.

---

With a generator disconnect switch

### To install the AC wiring from a generator with a (GDS):

1. Connect GROUND (green) wires:
  - a) from the generator GROUND to the generator disconnect switch GROUND terminal,
  - b) from the generator disconnect switch GROUND to the AC Ground bar in the utility panel\*.
2. Connect NEUTRAL (white) wires:
  - a) from the generator NEUTRAL to the GDS NEUTRAL terminal,
  - b) from the generator disconnect switch NEUTRAL to the L1 INVERTER NEUTRAL 2 terminal.
3. Connect HOT (L1- black) wires:
  - a) from the generator L1 GEN HOT OUT to the GDS L1 HOT terminal,
  - b) from the generator disconnect switch L1 HOT to the L1 INVERTER AC2 GEN terminal.
4. Connect HOT (L2 - red) wires:
  - a) from the generator L2 HOT OUT to the generator disconnect switch L2 HOT terminal,
  - b) from the generator disconnect switch L2 HOT to the L2 INVERTER AC2 GEN terminal.
5. Torque all inverter terminal block connections to 25 inch-pounds.

---

**Important:** \*If this is an off-grid installation, then all connections that would normally go to the Main Utility Panel should be routed to the AD Distribution Panel instead.

---

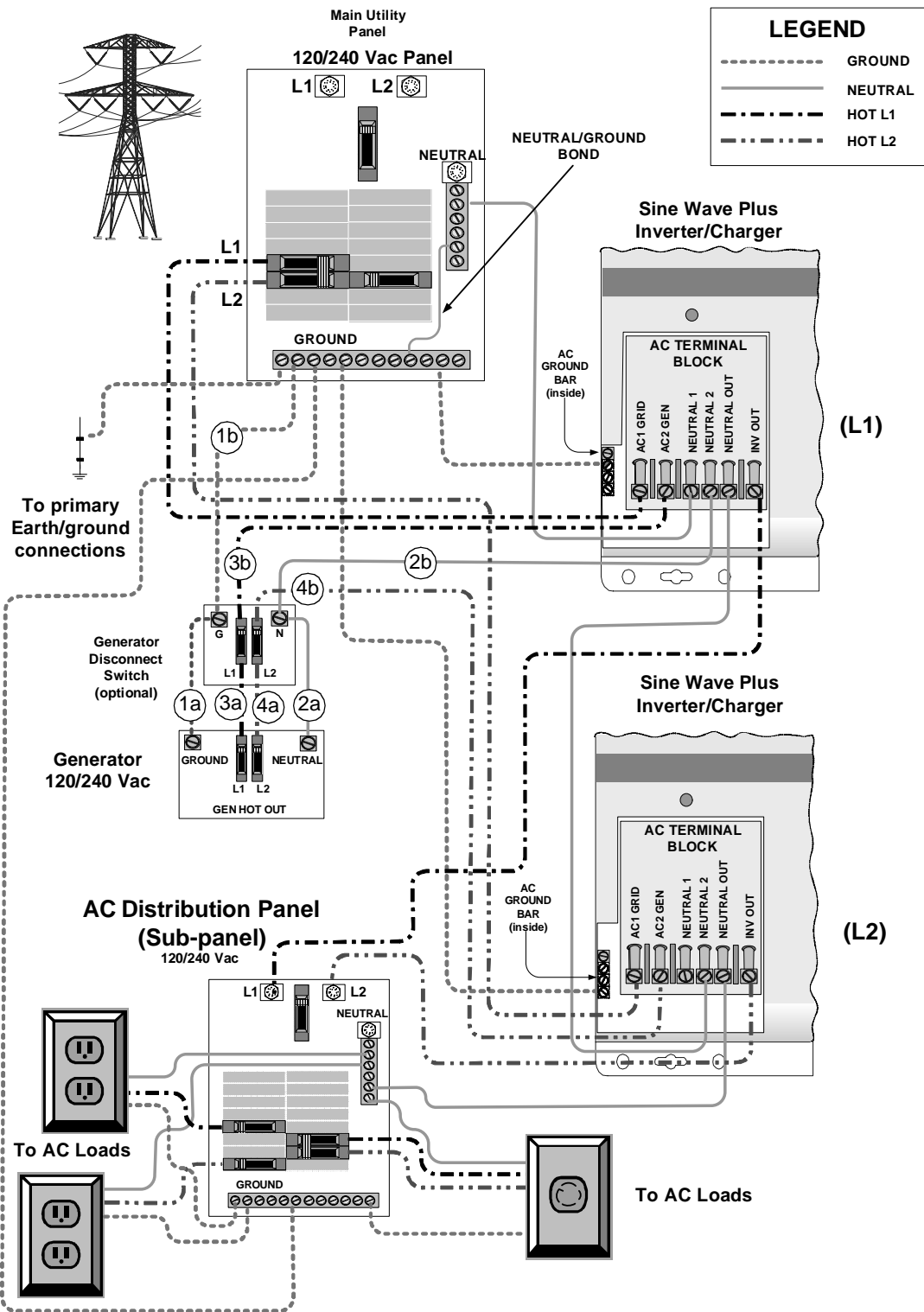


Figure 2-6 Generator Wiring to Series-stacked SW Plus Inverters

## Wiring for a 240 Vac-Only Input Source

A 240 Vac source does not allow for the connection to the input of a 120 Vac inverter as no neutral line is supplied from the utility or generator. In order to use stacked inverters, a neutral line must be added by using a center-tapped autotransformer (such as a T240) on the inverter's input. This will create the necessary neutral return line for the inverters, and half the voltage for each inverter to 120 Vac. The output of the inverter supplies both 120 and 240 Vac to the loads.

The ISC-S cable and autotransformer (capable of handling the system's power requirements) are required in this configuration..

### To wire the inverters for a 240-Vac only input source:

1. Run GROUND wires (green):
  - a) from the AC Distribution Panel to the primary earth/ground connection.
  - b) from the generator ground to the AC Distribution Panel ground.
  - c) from the ground terminal in the Autotransformer to the AC Distribution Panel.
  - d) from the AC Distribution Panel to the Ground bar in the L1 inverter.
  - e) from the AC Distribution Panel to the Ground bar in the L2 inverter.
2. Run NEUTRAL wires (white):
  - a) from the center-tapped neutral connection in the autotransformer to the NEUTRAL 1 terminal in the L1 inverter.
  - b) from the center-tapped neutral connection in the autotransformer to the NEUTRAL 1 terminal in the L2 inverter.
  - c) from the NEUTRAL OUT on the L1 inverter to the NEUTRAL 2 terminal on the L2 inverter.
  - d) from the Neutral OUT on the L2 inverter to the Neutral terminal in the AC Distribution Panel.
3. Run HOT wires:
  - a) (black) from the L1 Output in the generator to the L1 terminal in the Autotransformer.
  - b) (black) from the L1 output terminal in the Autotransformer to the AC2 GEN terminal in the L1 inverter.
  - c) (black) from the INV OUT terminal in the L1 inverter to the L1 input terminal in the AC Distribution Panel.
  - d) (red) from the L2 Output in the generator to the L2 terminal in the Autotransformer.
  - e) (red) from the L2 output terminal in the Autotransformer to the AC2 GEN terminal in the L2 inverter.
  - f) (red) from the INV OUT terminal in the L2 inverter to the L2 input terminal in the AC Distribution Panel.
4. Torque all inverter terminal block connections to 25 inch-pounds.



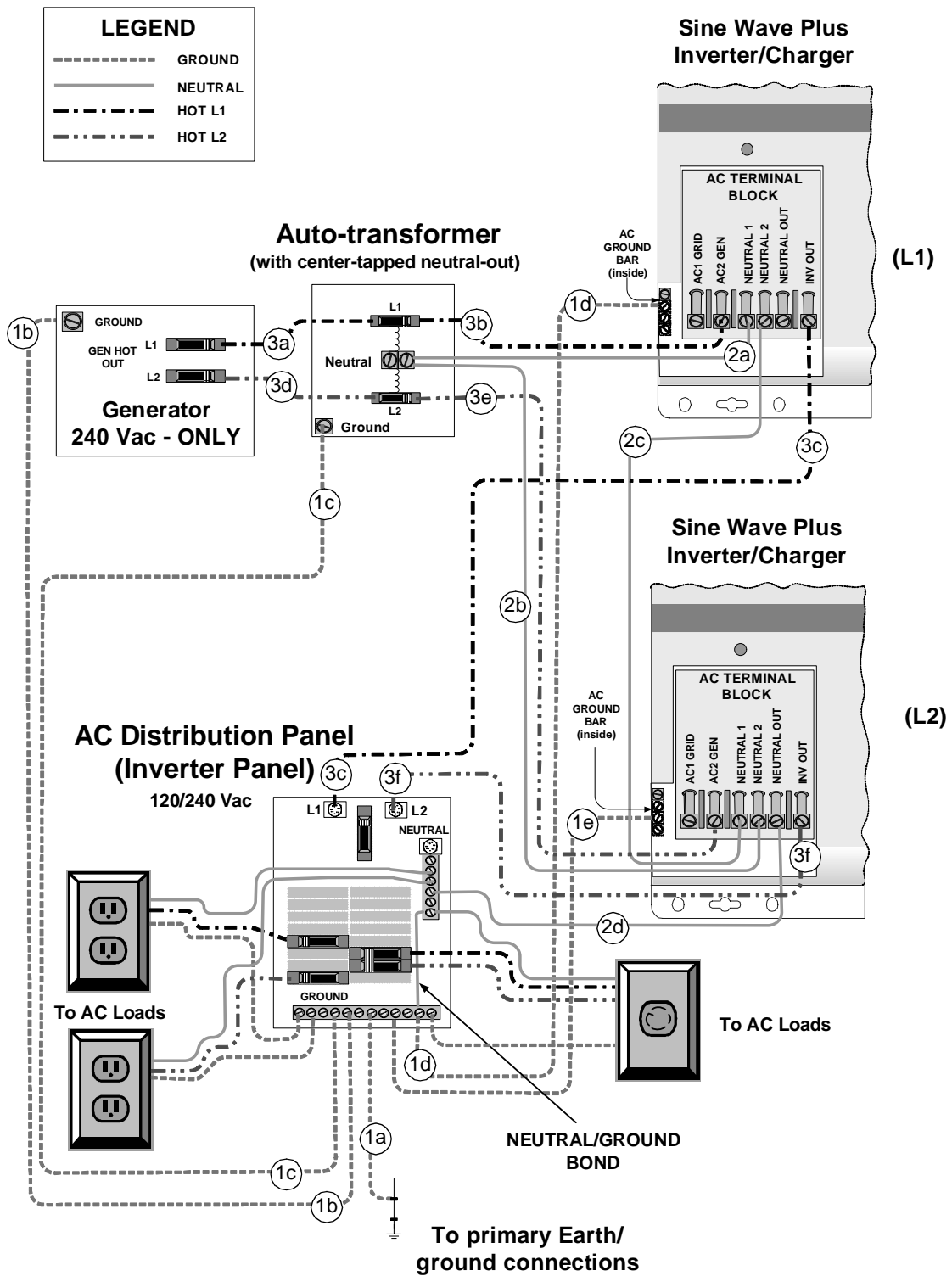


Figure 2-7 AC Wiring for a 240 Vac-Only Input Source

## Connecting the ISC-S Cable

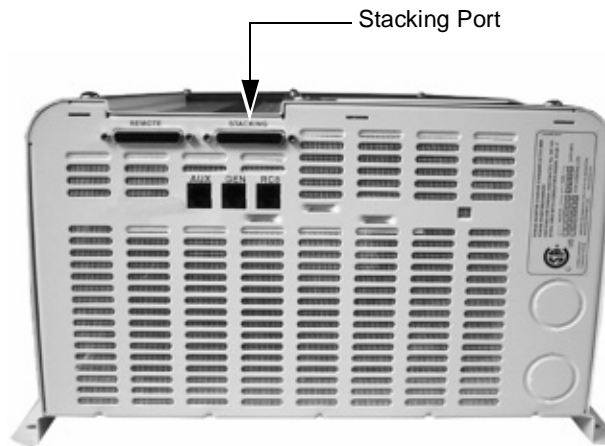
The ISC-S Cable connects to the Stacking Port on the AC end of the Sine Wave Plus Inverter/charger. The Stacking Port is a 25-pin receptacle for the 25-pin D-connector on the ISC-S Cable. Once the connector is in place, it is secured by two screws on the sides of the connector.

Align the head of the connector with the Stacking Port on the inverter and insert into the port.

Gently tighten these two screws to secure in place.



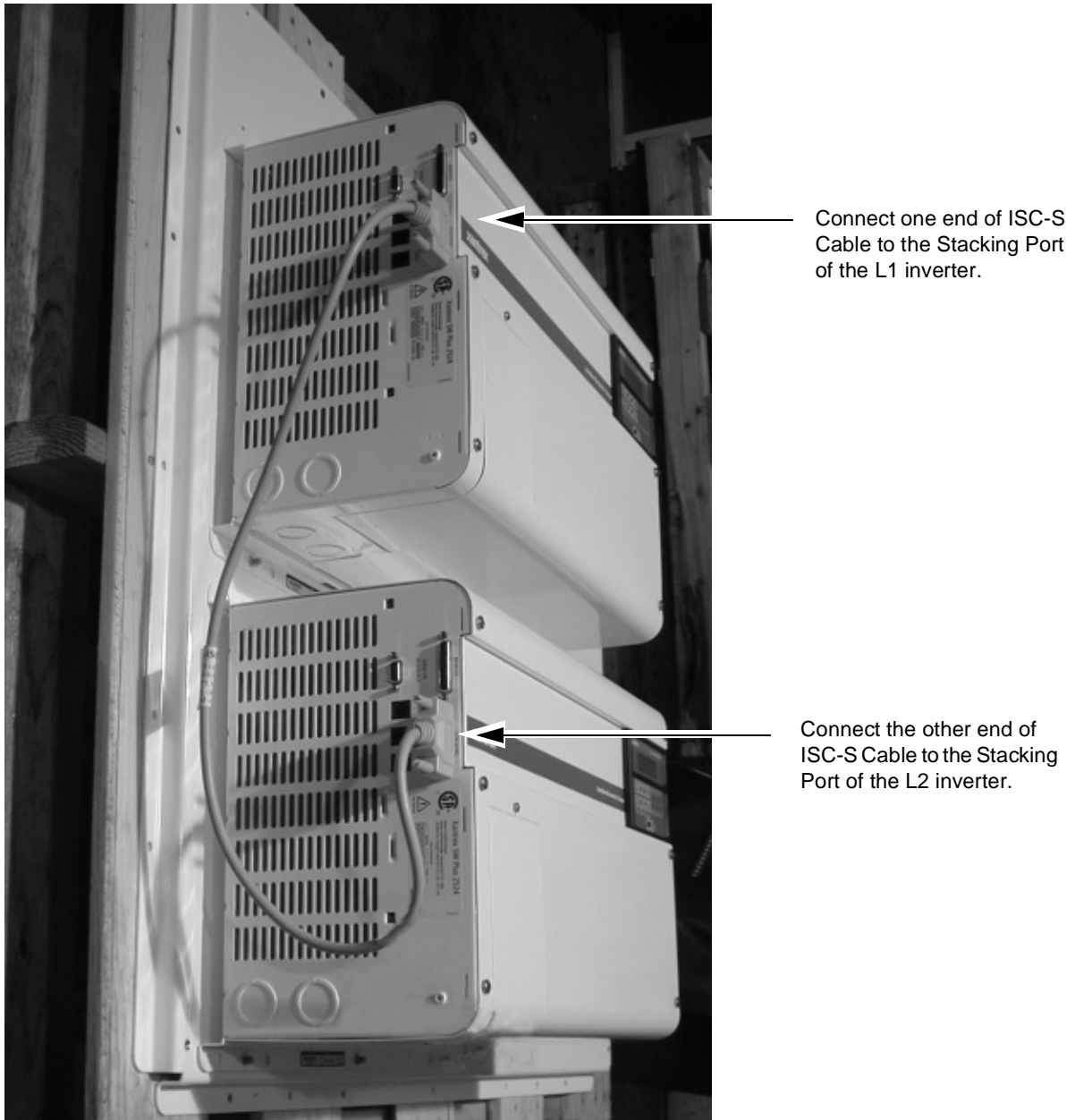
**Figure 2-8** The 25-pin D-connector on the ISC-S Cable



**Figure 2-9** Stacking Port Locations on SW Plus Inverters

### To connect the ISC-S cable:

1. Orient the 25-pin D-connector to align with the Stacking Port on the Inverter and gently press the connector into the port. Use caution not to bend the pins inside the connector head.
2. Tighten the screws on the connector to secure the cable to the port.
3. Connect the other end of the ISC-S cable to the second inverter's Stacking Port as instructed in step 1 and 2.



**Figure 2-10** The ISC-S Cable Connected to Dual Sine Wave Plus Inverters



**CAUTION; Damage to Loads**

Until the units are tested, do not connect any loads to the inverters. Proceed to the next chapter for Start up and Functional Testing Procedures.



# 3

## Operation

Chapter 3, “Operation” contains information on startup and functional testing procedures for series-stacked Sine Wave Plus inverters.

The following topics are covered in this chapter.

<b>For this topic:</b>	<b>See:</b>
“Start-up and Testing”	page 3-2
“Setting Changes”	page 3-4

## Start-up and Testing

Stacked inverters must operate together in order to provide the 120/240 Vac to the loads. The ISC-S cable ensures the output from each inverter is 180 degrees out-of-phase for operating 240 Vac loads.

### **To start up and test the inverters:**

1. Ensure the circuit breakers on all AC sources (utility or generator, if any) feeding the inverters are OFF.
2. Ensure the circuit breakers in the AC distribution panel (sub-panel) are OFF.
3. Switch ON both inverters. The inverters should be providing 120/240 Vac to the AC distribution panel.
4. In the AC distribution panel, use an AC voltmeter and measure the voltage between the L1 (HOT) terminal and the neutral bus. This voltage should be 120 Vac ( $\pm 3\%$ ). See Figure 3-1 for testpoint locations.
5. In the AC distribution panel, use an AC voltmeter and measure the voltage between the L2 (HOT) terminal and the neutral bus. This voltage should be 120 Vac ( $\pm 3\%$ ). See Figure 3-1 for testpoint locations.
6. In the AC distribution panel, measure the voltage between the L1 (HOT) and L2 (HOT) terminals. This voltage should be 240 Vac ( $\pm 3\%$ ). See Figure 3-1 for testpoint locations.
7. If all voltages/tests are correct,
  - a) switch on the circuit breakers in the AC distribution panel, and
  - b) switch on the generator or utility circuit breakers feeding the inverters.
8. Verify the inverters are charging the batteries and powering the AC distribution panel.
9. Switch both inverters OFF and open the circuit breakers to ensure all AC and DC power is turned OFF to the inverters.
10. Replace all covers and panels on the inverters and sub-panel.
11. The series-stacked inverter system is now tested and ready for use.

If the inverters are not operating properly, please refer to the Sine Wave Plus Operator's Manual for setup and troubleshooting information.

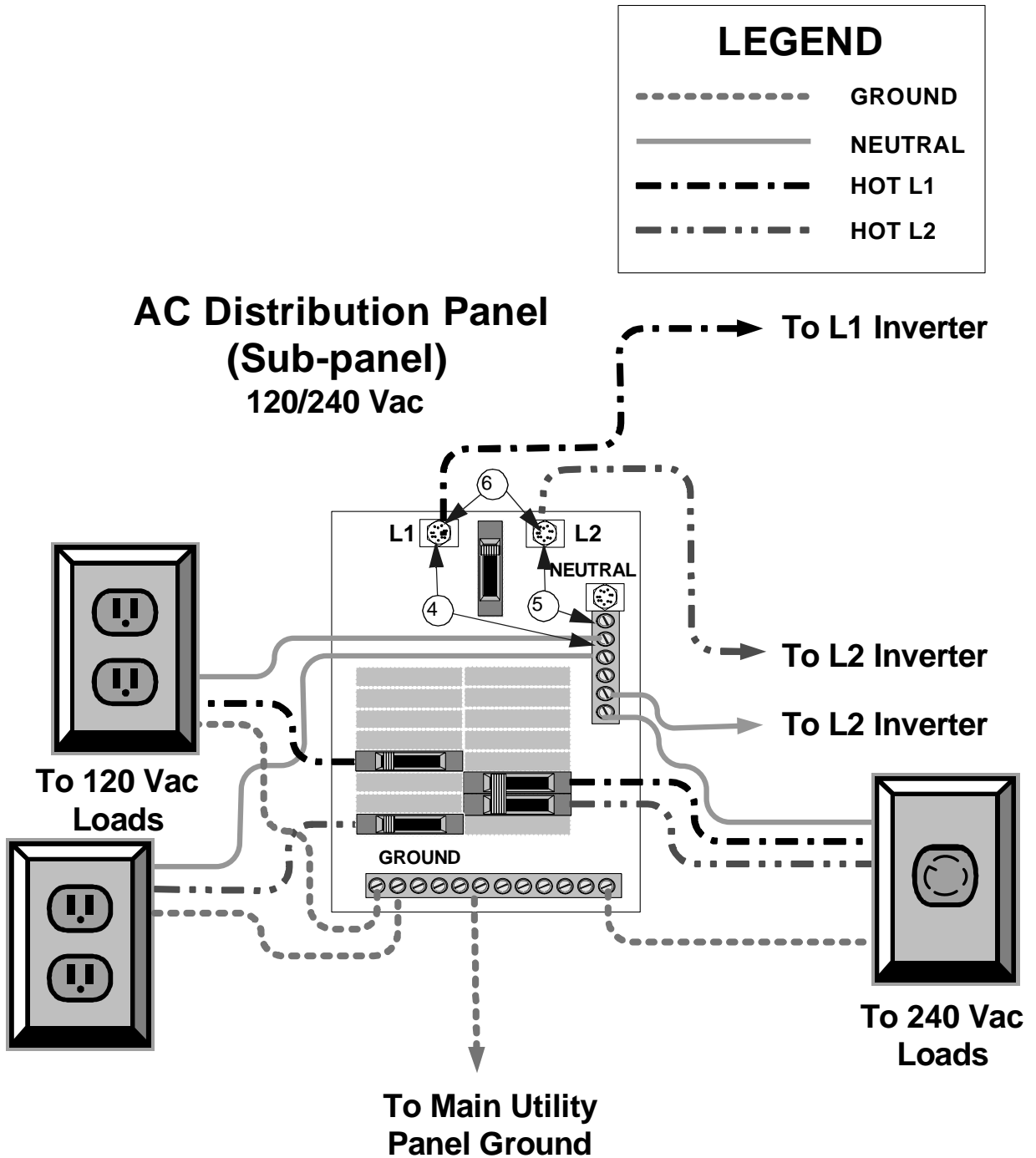


Figure 3-1 Testpoints for Confirming Voltages

## Setting Changes

When operating a Sine Wave Plus in a series-stacked configuration, the following settings must be changed for proper operation.

See the Owner's Manual for the Sine Wave Plus for detailed instructions on accessing and changing the settings using the Inverter Control Module (ICM) on the inverter.

## Automatic and Manual Generator Control

When multiple inverters are used with a generator, the inverter connected to the generator via the Generator Start Module (GSM) is designated as the "generator controlling" inverter. The most efficient battery charging is achieved by setting the charging parameters of each inverter slightly differently.

## Bulk and Float Charging Parameters

### **Change the Bulk and Float Charging settings as follows:**

- Set the 12B BULK VOLTS DC to the same setting on both inverters.
- Set the 12C FLOAT VOLTS DC to the same setting on both inverters.
- On the non-generator-controlling inverter (the inverter not connected to a GSM), set the charging time for a shorter period than on the generator controlling inverter. This is accomplished by setting the 12F BULK DONE AMPS to a higher setting. If the 12F BULK DONE AMPS is set to zero (0), then the 12H MAX BULK/EQ Timer h:m should be set to a shorter time period on the non-generator-controlling inverter.

## Equalize Charging

### **Change the Equalize Charging settings as follows:**

- Set both inverters to the same 12D EQUALIZE VOLTS DC setting.
- Set the 12G EQ VDC DONE TIMER H:M on the "generator controlling" inverter to a shorter equalize time.

To start an Equalize charge (manually or automatically), set both inverters to EQ by scrolling to 01B EQ CHARGE ON/OFF and selecting ON.

During the equalize charge, the Bulk LED will slowly flash on each inverter, indicating the EQ selection has been enabled.



### Automatic Generator Equalize Charging

If the inverters are set to automatically charge the batteries using the generator, the equalize process will begin during the next, automatically started, generator run period. When the equalizing process has completed, the generator automatically stops and the cursor returns to the OFF position in the 01B EQ CHARGE menu item on the generator-controlling inverter. The non-generator-controlling inverter must be set from EQ to OFF from the 01B EQ CHARGE menu item or it will start another equalize charge the next time the generator is started.

### Manual Equalize Charging

If the batteries were equalized using a manually started generator or from the utility grid, the FLOAT LED illuminates, indicating the equalization process is complete. Set the cursor to OFF on both inverters under the 01B EQ CHARGE menu item when the equalization process is complete.

---

**Important:** If using multiple battery temperature sensors (BTS) ensure they are all connected to the same location (battery).

---



# 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 Inverter Stacking Control – Series Cable. This warranty period lasts for two (2) years 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

## Warranty and Return

---

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

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

## Disclaimer

### Product

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

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

### Exclusions

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

### Warning: Limitations On Use

Please refer to your product manual for limitations on uses of the product.

SPECIFICALLY, PLEASE NOTE THAT THE INVERTER STACKING CONTROL – SERIES CABLE SHOULD NOT BE USED IN CONNECTION WITH LIFE SUPPORT SYSTEMS OR OTHER MEDICAL EQUIPMENT OR DEVICES. WITHOUT LIMITING THE GENERALITY OF THE FOREGOING, XANTREX MAKES NO REPRESENTATIONS OR WARRANTIES REGARDING THE USE OF THE XANTREX INVERTER STACKING CONTROL – SERIES CABLE IN CONNECTION WITH LIFE SUPPORT SYSTEMS OR OTHER MEDICAL EQUIPMENT OR DEVICES.

Please note that the Inverter Stacking Control – Series Cable is not intended for use as an uninterruptible power supply and Xantrex makes no warranty or representation in connection with any use of the product for such purposes.

---

## Return Material Authorization Policy

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

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

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

Record these details in 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 Inverter Stacking Control – Series Cable 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 inverter may be serviced or replaced for a flat fee.

To return your Inverter Stacking Control – Series Cable 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 Inverter Stacking Control – Series Cable package, record the following information and be sure to keep your proof of purchase.

- Purchased From \_\_\_\_\_
- 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.

- Type of installation \_\_\_\_\_
- Length of time inverter has been installed \_\_\_\_\_
- Battery/battery bank size \_\_\_\_\_
- Battery type (e.g. flooded, sealed gel cell, AGM) \_\_\_\_\_
- DC wiring size and length \_\_\_\_\_
- Alarm sounding? \_\_\_\_\_
- Description of indicators on front panel \_\_\_\_\_
- Appliances operating when problem occurred \_\_\_\_\_
- Description of problem \_\_\_\_\_

---

---

# Index

## Numerics

240 Vac-Only Input Source 2–14

## A

Abbreviations and Acronyms iv  
AC Wiring - General 2–6  
AC Wiring - Specific 2–8

## B

Battery Requirements 2–2  
Battery-Bank Configuration 2–2  
Bulk and Float Charging Parameters 3–4

## C

Connecting the Battery Bank 2–4  
Customer Service  
    preparing to call WA–4

## D

DC Wiring 2–2

## G

Generator AC Wiring 2–12  
Generator Control 3–4  
Grounding 2–3, 2–7

## I

Information about Your System form WA–4  
inverter  
    purchase date WA–4  
    serial number WA–4  
Inverter Stacking Control – Series (ISC-S) cable 1–5  
ISC-S Cable 1–5  
ISC-S Cable Connections 2–16

## M

Multi-wire branch circuits 1–2

## N

Neutral Bonding 2–7

## O

Off-Grid AC Wiring 2–8  
Off-Grid Applications with Series-Stacked Inverters  
    1–3  
On-Grid AC Wiring 2–10  
On-Grid Applications with Series-stacked Inverters  
    1–4

## P

proof of purchase WA–4  
purchase date WA–4

## S

Stacking Inverters 1–2  
Start-up 3–2  
Sub-Panel 2–6

## T

Testing 3–2  
testpoints 3–2

## W

warranty  
    out of warranty service WA–3  
    terms and conditions WA–1

## X

Xantrex  
    web site iv







**Xantrex Technology Inc.**

1 800 670 0707 Tel toll free NA  
1 360 925 5097 Tel direct  
1 800 994 7828 Fax toll free NA  
1 360 925 5143 Fax direct  
customerservice@xantrex.com  
www.xantrex.com