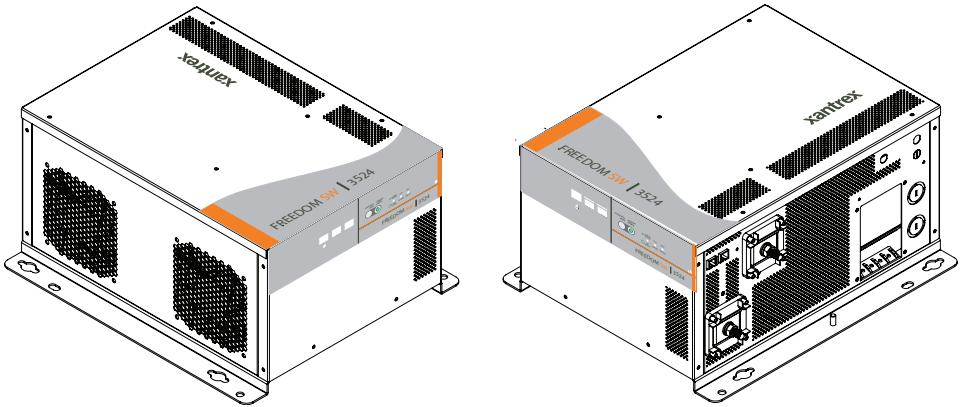
Smart choice for power™

xantrex™




Freedom SW 3524-230 shown.

# Freedom SW 230V
# Sine Wave Inverter/Chargers

**Installation Guide**

**Model Numbers**

**815-3524-02**
**815-2524-02**

xanbus™ ENABLED

This guide for use by qualified installers only.

## Exclusion for Documentation

UNLESS SPECIFICALLY AGREED TO IN WRITING, SELLER

(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 LOSSES, DAMAGES, COSTS OR EXPENSES, WHETHER SPECIAL, DIRECT, INDIRECT, CONSEQUENTIAL OR INCIDENTAL, WHICH MIGHT ARISE OUT OF THE USE OF SUCH INFORMATION. THE USE OF ANY SUCH INFORMATION WILL BE ENTIRELY AT THE USER'S RISK; AND

(C) REMINDS YOU THAT IF THIS MANUAL IS IN ANY LANGUAGE OTHER THAN ENGLISH, ALTHOUGH STEPS HAVE BEEN TAKEN TO MAINTAIN THE ACCURACY OF THE TRANSLATION, THE ACCURACY CANNOT BE GUARANTEED. APPROVED CONTENT IS CONTAINED WITH THE ENGLISH LANGUAGE VERSION WHICH IS POSTED AT WWW.XANTREX.COM.

## Document Part Number

975-0697-01-01

## Date and Revision

June 2014 Rev B

## Product Numbers

815-3524-02 (Freedom SW 3524-230)
815-2524-02 (Freedom SW 2524-230)

## Contact Information

Telephone: +1 800 670 0707
+1 408 987 6030

Web: www.xantrex.com

## Information About Your System

As soon as you open your product, record the following information and be sure to keep your proof of purchase.

Serial Number _____

Product Number _____

Purchased From _____

Purchase Date _____

*To view, download, or print the latest revision, visit the website shown under Contact Information.*

This guide for use by qualified personnel only.

# About This Guide

## Purpose

The purpose of this Installation Guide is to provide explanations and procedures for installing the Freedom SW 230V Inverter/Charger.

## Scope

The Guide provides safety and installation guidelines as well as information on tools and wiring. It does not provide details about particular brands of batteries. You need to consult individual battery manufacturers for this information.

## Audience

The information in this Guide is intended for qualified personnel. Qualified personnel have training, knowledge, and experience in:

- Installing electrical equipment and PV power systems (up to 1000 volts).
- Applying all applicable installation codes.
- Analyzing and reducing the hazards involved in performing electrical work.
- Selecting and using Personal Protective Equipment (PPE).

## Conventions Used

The following conventions are used in this guide.

**⚠ DANGER**

**DANGER** indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury.

**⚠ WARNING**

**WARNING** indicates a potentially hazardous situation, which, if not avoided, can result in death or serious injury.

**⚠ CAUTION**

**CAUTION** indicates a potentially hazardous situation, which, if not avoided, can result in moderate or minor injury.

*NOTICE*

**NOTICE** indicates a potentially hazardous situation, which, if not avoided, can result in equipment damage.

**IMPORTANT:** These notes describe things which are important for you to know, however, they are not as serious as a caution or warning.

## Related Information

You can find more information about Xantrex-branded products and services at **www.xantrex.com**.

# Important Safety Instructions

## IMPORTANT: READ AND SAVE THIS INSTALLATION GUIDE FOR FUTURE REFERENCE.

This chapter contains important safety and installation instructions for the Freedom SW 230V Inverter/Charger (Freedom SW 230V). Each time, before using the Freedom SW 230V, READ ALL instructions and cautionary markings on or provided with the inverter/charger, the batteries, and all appropriate sections of this guide.

**NOTE:** The Freedom SW 230V contains no user-serviceable parts.

### ⚠ DANGER

**ELECTRICAL SHOCK AND FIRE HAZARD**

Installation must be done by qualified personnel to ensure compliance with all applicable installation and electrical codes and regulations. Instructions for installing the Freedom SW 230V Inverter/Charger are provided here for use by qualified personnel only.

**Failure to follow these instructions will result in death or serious injury.**

### ⚠ DANGER

**ELECTRICAL SHOCK HAZARD**

- Do not expose the Freedom SW 230V to rain, snow, spray, or bilge water. This inverter/charger is designed for marine applications only when additional drip protection is installed in certain orientations. See “Mounting Orientations” on page 21.
- Do not operate the inverter/charger if it has received a sharp blow, been dropped, has cracks or openings in the enclosure including if the AC terminal cover has been lost, damaged, or will not close, or otherwise damaged in any other way.
- Do not disassemble the inverter/charger. Internal capacitors remain charged after all power is disconnected.
- Disconnect both AC and DC power from the inverter/charger before attempting any maintenance or cleaning or working on any circuits connected to the inverter/charger. The **INVERTER ENABLE** button on the front panel does not function like a power switch that energizes or de-energizes the unit. When AC and DC power sources are connected and present, the unit is always energized.
- Do not operate the inverter/charger with damaged or substandard wiring. Make sure that all wiring is in good condition and is not undersized.

**Failure to follow these instructions will result in death or serious injury.**

## ⚠ DANGER

**FIRE AND BURN HAZARD**

- Do not cover or obstruct the air intake vent openings and/or install in a zero-clearance compartment.
- Do not use transformerless battery chargers in conjunction with the inverter/charger due to overheating.

**Failure to follow these instructions will result in death or serious injury.**

## ⚠ DANGER

**EXPLOSION HAZARD**

- Charge only properly rated (such as two 12 V in series for a 24 V battery bank) lead-acid (GEL, AGM, Flooded, or lead-calcium) rechargeable batteries because other battery types may explode.
- Do not work in the vicinity of lead-acid batteries. Batteries generate explosive gases during normal operation. See note #1.
- Do not install and/or operate in compartments containing flammable materials or in locations that require ignition-protected equipment. See notes #2 and #3.

**Failure to follow these instructions will result in death or serious injury.**

**NOTES:**

1. Follow these instructions and those published by the battery manufacturer and the manufacturer of any equipment you intend to use in the vicinity of the battery. Review cautionary markings on these products and on the engine.
2. This inverter/charger contains components which tend to produce arcs or sparks.
3. Locations include any space containing gasoline-powered machinery, fuel tanks, as well as joints, fittings, or other connections between components of the fuel system.
4. Freedom SW 230V inverter/charger products are designed for deep cycle lead-acid batteries only. Charging lithium-ion batteries are currently not supported and doing so is an explosion hazard. Lithium-ion battery cells are individually monitored for voltage and temperature. The Freedom SW 230V does not support this individual cell monitoring on lithium-ion batteries.

## ⚠ CAUTION

**PHYSICAL INJURY HAZARD**

This Freedom SW 230V Inverter/Charger is not intended for use by persons (including children) with reduced physical, sensory, or mental capabilities or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety. Children should be supervised to ensure that they do not play with the appliance.

**Failure to follow these instructions can result in minor or moderate injury.**

## Precautions When Working With Batteries

**IMPORTANT:** Battery work and maintenance must be done by qualified personnel knowledgeable about batteries to ensure compliance with battery handling and maintenance safety precautions.

### ⚠ WARNING

**BURN FROM HIGH SHORT-CIRCUIT CURRENT, FIRE AND EXPLOSION FROM VENTED GASES HAZARDS**

- Always wear proper, non-absorbent gloves, complete eye protection, and clothing protection. Avoid touching your eyes and wiping your forehead while working near batteries. See note #4.
- Remove all personal metal items, like rings, bracelets, and watches when working with batteries. See notes #5 and #6 below.
- Never smoke or allow a spark or flame near the engine or batteries.
- Never charge a frozen battery.

**Failure to follow these instructions can result in death or serious injury.**

**NOTES:**

1. Mount and place the Freedom SW 230V Inverter/Charger unit away from batteries in a well ventilated compartment.
2. Always have someone within range of your voice or close enough to come to your aid when you work near a lead-acid battery.
3. Always have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.
4. 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.
5. Use extra caution to reduce the risk or dropping a metal tool on the battery. It could spark or short circuit the battery or other electrical parts and could cause an explosion.
6. Batteries can produce a short circuit current high enough to weld a ring or metal bracelet or the like to the battery terminal, causing a severe burn.
7. When removing a battery, always remove the negative terminal from the battery first for systems with grounded negative. If it is grounded positive, remove the positive terminal first. Make sure all loads connected to the battery and all accessories are off so you don't cause an arc.

## Precautions When Preparing to Charge

### ⚠ WARNING

**EXPOSURE TO CHEMICALS AND GASES HAZARD**

- Make sure the area around the battery is well ventilated.
- Make sure the voltage of the batteries matches the output voltage of the inverter/charger.
- Be careful to keep corrosion from coming into contact with your eyes and skin when cleaning battery terminals.

**Failure to follow these instructions can result in death or serious injury.**

**NOTES:**

- Study and follow all of the battery manufacturer's specific precautions, such as removing or not removing cell caps while charging, whether equalization is acceptable for your battery, and recommended rates of charge.
- For flooded non-sealed batteries, add distilled water in each cell until battery acid reaches the level specified by the battery manufacturer. This helps to purge excessive gas from cells. Do not overfill. For a battery without removable cell caps, carefully follow manufacturer's instructions.

## Precautions When Placing the Inverter/Charger

### *NOTICE*

**RISK OF DAMAGE TO THE INVERTER/CHARGER**

- Never allow battery acid to drip on the inverter/charger when reading gravity, or filling battery.
- Never place the Freedom SW 230V Inverter/Charger unit directly above batteries; gases from a battery will corrode and damage the inverter/charger.
- Do not place a battery on top of the inverter/charger.

**Failure to follow these instructions can damage the unit and/or damage other equipment.**

## Regulatory

The Freedom SW 230V Inverter/Charger is certified to appropriate European (CE) and Australian (RCM) standards. For more information see “Regulatory Approvals” on page 62.

The Freedom SW 230V Inverter/Charger is intended to be used for mobile or commercial applications. This inverter/charger is designed for marine applications only when additional drip protection is installed in certain orientations. Refer to this guide for installation instructions.

It is not intended for other applications as it may not comply with the additional safety code requirements needed for those other applications. See “Limitations On Use” below.

### ⚠ WARNING

**LIMITATIONS ON USE**

Do not use in connection with life support systems or other medical equipment or devices.

**Failure to follow these instructions can result in death or serious injury.**

This guide for use by qualified personnel only.

# Contents

# Introduction

The Installation Guide provides detailed information for installing the Freedom SW 230V Inverter/Charger and the battery temperature sensor, wiring the inverter/charger to the AC and DC circuits, and connecting the inverter/charger to the Xanbus system.

The Freedom SW 230V is a Xanbus-enabled device that typically powers the Xanbus system.

This Installation Guide provides:

- safety instructions that must be observed during installation
- a typical Xanbus system diagram (if applicable)
- information on additional required AC and DC components
- a list of installation tools and materials
- detailed procedures for a typical installation

This guide for use by qualified personnel only.

# Materials List

The Freedom SW 230V ships with the following items:

- one Freedom SW 230V unit
- owner's and installation guides
- Battery Temperature Sensor (BTS)
- DC terminal covers (one red, one black) with two sets of #6-32 screws
- two Xanbus network terminators
- two sets of 5/16"-18 nuts and washers for the DC terminals

**NOTE**: If any of the items are missing, contact customer service or any authorized Xantrex dealer for replacement. See "Contact Information" on page i.

**IMPORTANT:** Keep the carton and packing material in case you need to return the Freedom SW 230V for servicing.

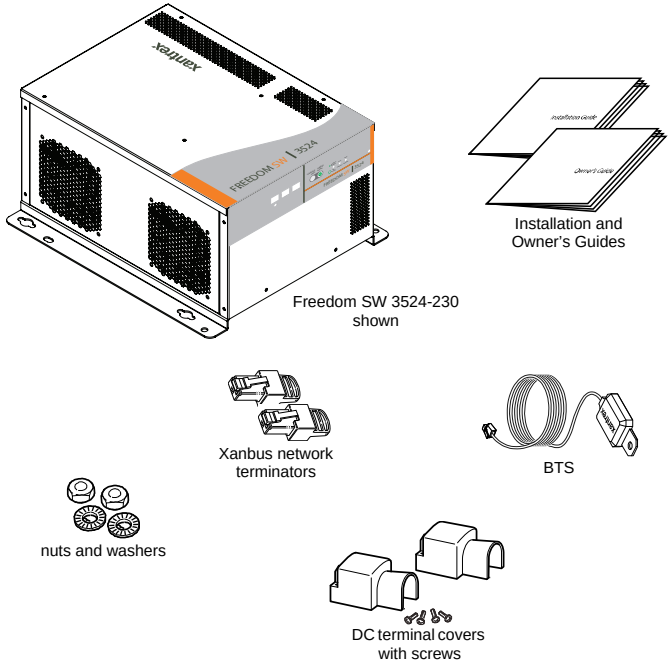



**Figure 1** Materials List

# Installation Information

## Before You Begin the Installation

Before beginning your installation:

- Read the entire Installation Guide so you can plan the installation from beginning to end.
- Assemble all the tools and materials you require for the installation.
- Review the Important Safety Instructions on page iii.
- Be aware of all safety and electrical codes which must be met.

**⚠ DANGER**

**ELECTRICAL SHOCK AND FIRE HAZARDS**

- All wiring should be done by qualified personnel to ensure compliance with all applicable installation codes and regulations.
- Disconnect all AC and DC power sources.
- Disable and secure all AC and DC disconnect devices and automatic generator starting devices.

**Failure to follow these instructions will result in death or serious injury.**

## Installation Codes

Applicable installation codes vary depending on the specific location and application of the installation.

This guide for use by qualified personnel only.

# About the Xanbus System

## Xanbus System

The Xanbus system includes the Freedom SW 230V and other Xanbus-enabled devices. The Freedom SW 230V is the device in a Xanbus system that typically provides network power—500 mA at 12 volts DC. All of the Xanbus-enabled devices, such as the Freedom SW 230V, the SCP, and the AGS are able to communicate their settings and activity to each other.

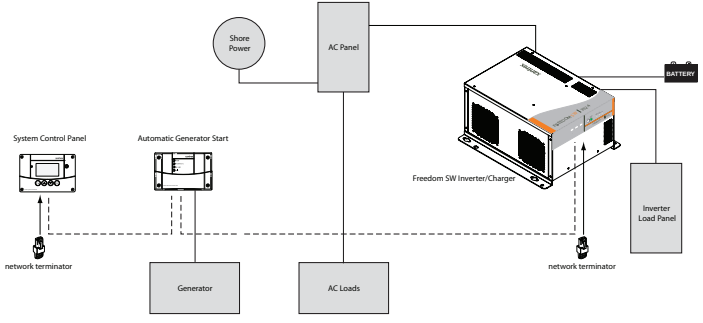



**Figure 2** Typical Xanbus System Diagram

The Xanbus-enabled designation (see below) means that this product works on a Xanbus network. Xanbus-enabled products are:

- Simple to operate and routine tasks are automated.
- Controlled by software that eliminates analog signalling errors.
- Less susceptible to interference and line loss.
- Upgradable through new software releases.

xanbus
ENABLED

For detailed instructions and a complete list of Xanbus-enabled devices, visit **www.xantrex.com**

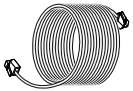
# Xanbus-enabled Products and Accessories

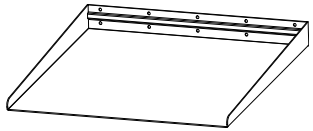

SCP


AGS


3-ft cable


25-ft cable


75-ft cable


Inverter drip shield

| Xanbus-enabled Products (Shown above) | Product Number/s |
|---|---|
| Xanbus System Control Panel (SCP) | 809-0921 |
| Xanbus Automatic Generator Start (AGS) | 809-0915 |
| 3-ft network cable (0.9 m) | 809-0935 |
| 25-ft network cable (7.6 m) | 809-0940 |
| 75-ft network cable (22.9 m) | 809-0942 |
| **Accessories (Shown above)** | **Product Number/s** |
| Freedom SW On/Off Switch (Not shown) | 808-9002 |
| Inverter drip shield | 808-9004 |

# Planning the Installation

This section provides information to help you plan for a basic installation of the Freedom SW 230V.

As your system configuration is determined, record the details in "Information About Your System" in the *Freedom SW 230V Sine Wave Inverter/Charger Owner's Guide.*

## Two Key Performance Factors

Two key factors in particular will have a major impact on system performance.

### Size and Length of DC Cables

To select the appropriate size and length of DC cables, see "DC Cabling" on page 13.

The DC 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. If there are long battery cables which are in excess of 3 meters each and not of sufficient size, the voltage drop across the cables will have a negative impact on overall system performance.

### Mounting Location of the Freedom SW 230V

To choose an appropriate location for mounting the inverter/charger, see "Step 1: Choosing a Location for the Inverter/Charger" on page 18.

## AC, DC, and Network Components

For a successful installation, you need to plan for AC, DC, and network components of the power system. The AC and DC components are described in this section and illustrated in Figure 3 on page 8.

AC components include:

- AC Input/AC Output
- AC Loads
- AC Disconnect and Over-Current Protection Device
- Distribution Panels
- AC Wiring

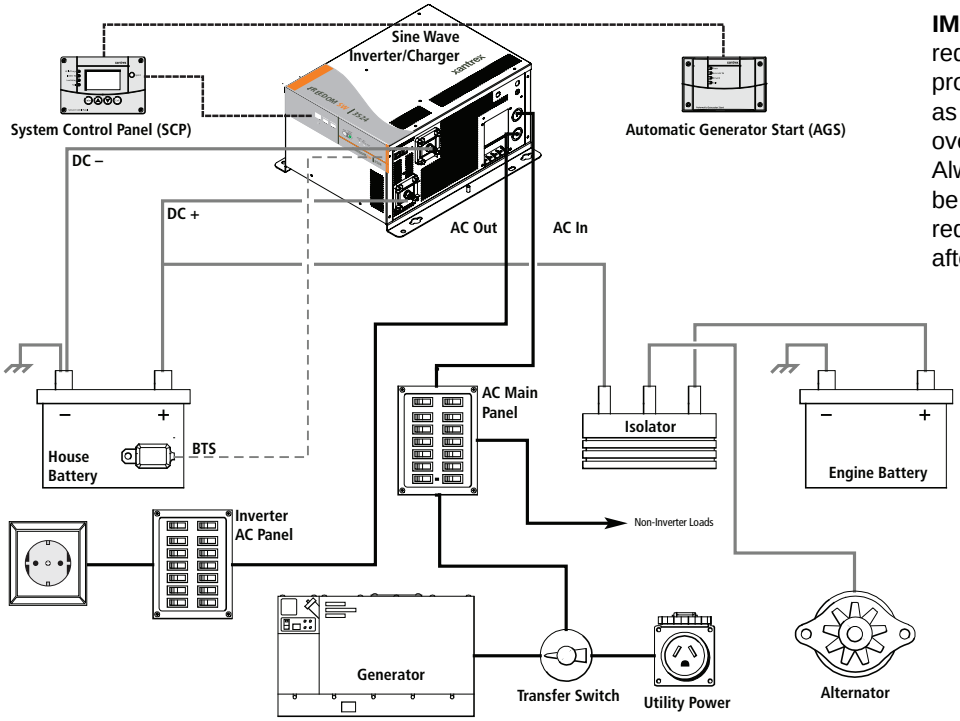
DC components include:

- 24-volt Batteries
- DC Cabling
- DC Disconnects and Over-Current Devices
- DC Grounding

Network considerations for Freedom SW only include:

- Cables, connectors, network connectors, and terminators for the SCP and Automatic Generator Start, if installing.

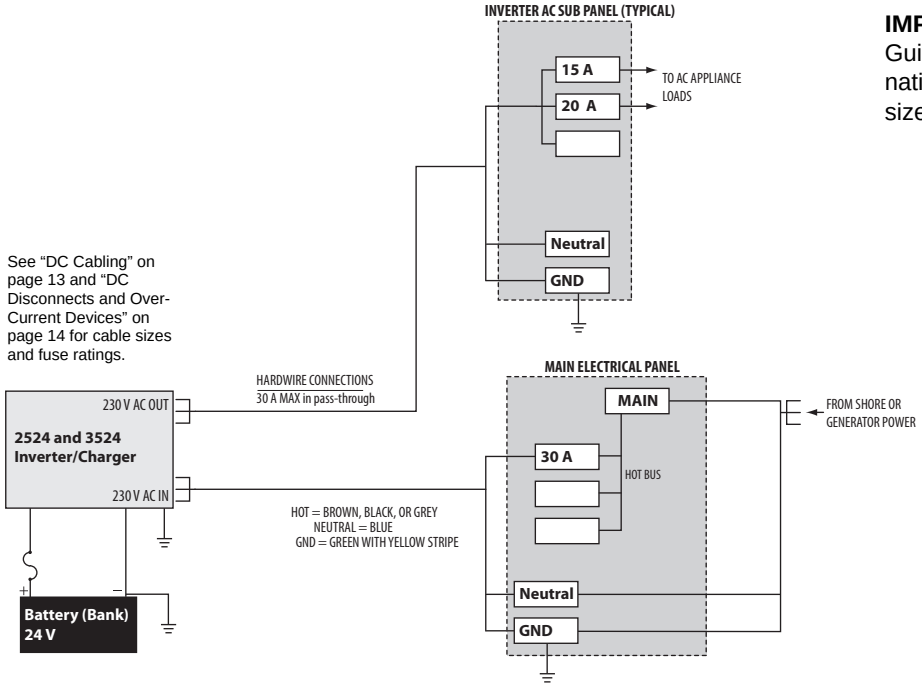
  Detailed information on planning and installing your network is available in the *Xanbus System Installation Guide*. Refer to the system guide to determine the type of network layout to install, as well as guidelines for installing the network. This guide is available for download at **www.xantrex.com**




**IMPORTANT:** Figure 3 does not show all required grounding or overcurrent protection. See the next two pages as well as on page 14 for required DC grounding or overcurrent protection.
Always hire a qualified installer or you must be the one to ensure that all electrical safety requirements are met before, during, and after installation.

**Legend:**
- Xanbus Network
- AC
- DC
- Low Voltage DC

**Figure 3** Typical Recreational Vehicle Electrical System




**IMPORTANT:** Read Owner's and Installation Guides prior to installation. Always refer to local and national electrical codes for proper wire and breaker sizes prior to installation.

**IMPORTANT:** In Australia, connection to shore power that is supplied by the utility grid, must follow local and national wiring rules.

**Figure 4** Wiring and Breakers Block Diagram for Freedom SW 230V 2524 / 3524

# AC Components

**NOTE**: Unless otherwise referenced specifically by product name, the components refer to all models of Freedom SW inverter/chargers.

## AC Input

AC input can be supplied from a single-phase 230-volt 50-Hz AC source such as the utility grid (power company), a generator, or the output of a transfer switch.

## AC Output

The output voltage on Freedom SW inverter/chargers is 230 volts AC. The Freedom SW 2524-230 and Freedom SW 3524-230 models have a Single Input and Single Output line (SI-SO) configuration.

## AC Loads

The Freedom SW 230V is intended to power loads consisting of 230 volts/50 Hz AC appliances.

In Invert mode, the Freedom SW 230V provides 230 volts/50 Hz AC to loads connected to Line out. In AC Bypass mode, the source connected to the AC input is passed through to the load. Only 230 volts/50 Hz AC appliances can be connected to the Freedom SW 230V output.

## AC Disconnect and Over-Current Protection Device

To meet mobile electrical code requirements, and to protect system wiring, the AC inputs and outputs of the inverter/charger must be provided with overcurrent protection on both the AC input and output. This protection may be a circuit breaker or a fuse with a disconnect device (for simplicity the following refers to breakers). Refer to your applicable installation codes and the following requirements:

### AC Input Protection

The breaker protecting the AC input of the Freedom SW 230V must be approved for use on 230 volts AC branch circuit. The breaker must be rated no more than 30 amps maximum.

### AC Output Protection

The breaker between the Freedom SW 230V AC output and the AC loads must be rated to protect the AC output wire size used. If the AC output wiring is based on the full 30-amp pass-through rating, then a 30-amp output breaker is acceptable. If the AC output wiring is smaller, then the breaker size will have to be smaller as well, in accordance with applicable electrical installation codes.

## GFCI Requirements

A GFCI (ground fault circuit interrupter) is a device that de-energizes a circuit when a current to ground exceeds a specified value that is less than that required to open the circuit breaker. GFCIs are intended to protect people from electric shocks and are usually required in wet or damp locations.

Installation in recreational vehicles may require GFCI protection of certain branch circuits. Consult all applicable codes.

## Disconnect Devices

Each system requires a method of disconnecting the AC circuits. If the overcurrent protection device is a circuit breaker, it will also serve as the disconnect. If fuses are used, separate AC disconnect switches will be needed between the source and the fuses.

## Distribution Panels

Some systems incorporate distribution panels both ahead of the inverter/charger (the AC source panel) and between the inverter/charger and the loads (the AC load panel). The AC source panel includes a main circuit breaker, which serves as overcurrent protection for the panel. Additional circuit breakers serve individual circuits, one of which serves the inverter/charger.

## AC Wiring

**Definition** AC wiring includes input wiring (all the wires and connectors between the AC source and the inverter/charger input) and output wiring (all the wires between the inverter/charger and the AC load panels, circuit breakers, and loads).

**Type** The type of wiring required varies according to the electrical codes or regulations applicable to your installation. For RV applications, this may be solid wire in multi-conductor cables, but stranded wire is required if single conductors are used. All wiring must be rated 75 °C or higher. In Australia, all wiring must be rated 90 °C or higher.

**Size of AC Input Wiring** Wire size must be coordinated with the overcurrent protection provided ahead of the wire involved, in accordance with the electrical codes or regulations applicable to your installation. Therefore, the wiring used between the AC input circuit breaker and the inverter/charger input must be sized to match the input breaker rating.

**Table 1** AC Wire Size In and Out of the Inverter/Chargers

| MODELS | Freedom SW 230V |
|---|---|
| Breaker Size Used | 30 amps |
| Wire Size | 4 $mm^2$ (minimum) |
| Color Coding | **L**: brown, black, or grey<br>**N**: blue<br>**G**: green with yellow stripe |

For dual input, the wire may be red or black; consult the documentation provided with the AC source (utility or generator).

**Size of AC Output Wiring** Wire size must be coordinated with the current the wiring will carry. This current may be determined by the 15-amp (Freedom SW 3524-230) and 11-amp (Freedom SW 2524-230) maximum inverter current, or by the bypass current, which is determined by the overcurrent protection provided ahead of the Freedom SW 230V.

**Size of Wiring Downstream of the AC Output Breaker** The wiring used between the AC output breaker and your loads must be sized in accordance with the rating of the output breaker.

# DC Components

## Batteries

The Freedom SW 230V system requires a 24-volt, lead-acid deep-cycle battery or group of batteries to provide the DC current that the inverter/charger converts to AC power. The battery may be a flooded, gel, or AGM type.

See “Battery Information” on page 52 for information on:

- Estimating the battery size that will meet your requirements.
- Designing battery banks.
- Restrictions on the size of appliances.

For information on cabling and hooking up batteries, see “Battery Cabling and Hook-up Configurations” on page 57.

For detailed information about specific brands of batteries, consult individual battery manufacturers.

## DC Cabling

**Definition** DC cabling includes all of the cables and connectors between the batteries, the DC disconnect and overcurrent protection device, and the inverter/charger.

**Type** All installations require multi-strand insulated cables. The DC cables must be copper and must be rated 75°C minimum. In Australia, they must be rated 90°C minimum.

**Size and Length** See Table 2 for required DC cable length and cable size and Table 3 for required fuse size for the Freedom SW 230V. Wire size is usually marked on the cables.

**Table 2** Minimum Recommended Battery Cable[a] Sizes

| | | Conduit (Free Air) | |
|---|---|---|---|
| **Model** | **Typical Amps (A)** | **Cable Length < 1.5 m** | **Cable Length 1.5 to 3.0 m** |
| Freedom SW 2524-230 | 140 | 50 $mm^2$ (25 $mm^2$) | 70 $mm^2$ (35 $mm^2$) |
| Freedom SW 3524-230 | 200 | 240 $mm^2$ (120 $mm^2$) | 300 $mm^2$ (150 $mm^2$) |

a. Copper conductors with thermoplastic insulation rated at 75C or higher. In Australia, thermoplastic insulation must be rated at 90C or higher.

**IMPORTANT:** Longer cables may cause the inverter to shut down under a heavy load.

**⚠ WARNING**

**FIRE HAZARD**

Undersized cables will overheat. Consult local electrical codes to determine minimum required size.

**Failure to follow these instructions can result in death or serious injury.**

## DC Disconnects and Over-Current Devices

The DC circuit from the battery to the inverter/charger must be equipped with a disconnect and overcurrent protection device. In Australia, disconnect and overcurrent protection devices must be approved for use in Australia. Refer to your applicable installation code for guidance.

**Type** This device 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.

**Rating** The rating of the fuse or breaker must be matched to the size of cables used in accordance with the applicable installation codes.

**Location** The breaker or fuse and disconnect 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.

**Table 3** Recommended Fuse Sizes

| Model | Minimum Fuse Size (A) |
|---|---|
| Freedom SW 2524-230 | 200 |
| Freedom SW 3524-230 | 250 |

**Marine Applications**[1] A charger needs to be equipped with a disconnect and an over-current protection device, usually within 18 cm of each battery’s positive terminal and another over-current protection device 18 cm near the charger’s positive terminal.

## DC Grounding

**Recreational Vehicles** The inverter/charger DC (chassis) ground terminal needs to be connected to the vehicle chassis by a minimum 8 $mm^2$ copper conductor that is either insulated (green with yellow stripe) wire rated 75 °C or bare copper.

**Marine Applications**[2] The DC grounding conductor may be one size smaller than the minimum size conductor required for the DC current carrying conductors providing the overcurrent protection device in the DC positive conductor is rated no greater than 135% of the ampacity of the DC grounding conductor and the conductor is no smaller than 2 $mm^2$.

1.Refer to local electrical codes.

2.Refer to local electrical codes.

# Unpacking and Inspecting the Freedom SW 230V Inverter/Charger

> ⚠ CAUTION
>
> **HEAVY ITEM**
>
> The Freedom SW 230V Inverter/Charger is heavy (see "Inverter/Charger Physical Specifications" on page 51). The unit is too heavy for one person to safely lift and mount. It is recommended that two people lift and mount the unit. Always use proper lifting techniques during installation to prevent personal injury.
>
> **Failure to follow these instructions can result in minor or moderate injury.**

**To unpack and inspect:**

**IMPORTANT:** Keep the carton and packing material in case you need to return the Freedom SW 230V for servicing.

1. Unpack the unit and check the materials list. If anything is missing from the shipping box, contact Customer Service. See "Contact Information" on page i.
2. Record the serial number of the Freedom SW 230V and other purchase information for any future warranty issues. You will be asked for this product information if you need to call Customer Service.
3. Save your purchase receipt to use as proof of purchase. This receipt is required if the inverter/charger should need warranty service.
4. Save the original shipping carton and packing materials. If the inverter/charger needs to be returned for service, it should be shipped in the original carton. Packing the Freedom SW 230V in the original shipping carton is also a good way to protect the inverter/charger if it ever needs to be moved.

# Installation Tools and Materials

## Tools

You will need the following tools to install the Freedom SW 230V and the battery temperature sensor.

- ❒ Wire stripper
- ❒ Crimping tools for fastening lugs and terminals on DC cables
- ❒ Phillips screwdriver: #2
- ❒ Slot screwdriver (6 mm wide blade max)
- ❒ Needle-nose pliers
- ❒ Wrench for DC terminals: 15 mm

## Materials

You will need the following materials to complete your installation:

- ❒ Strain-relief clamp(s) for AC cables (not provided): trade sizes are 3/4" (Ø28.3mm) and/or 1" (Ø34.6mm)
- ❒ DC battery cables
- ❒ Lugs for DC cables (for 10 mm stud size)
- ❒ Copper wire for DC grounding: 8 $mm^2$. See “DC Grounding” on page 14
- ❒ Lugs for DC grounding cable (for M6 stud size)
- ❒ AC and DC disconnect switches and overcurrent protective devices and connectors as required. See page 13.
- ❒ AC output and input wire. See Figure 3 on page 8.
- ❒ If the AC ground wire is stranded, each ground wire requires a ring terminal
- ❒ Six M6 steel screws or bolts to mount the unit
- ❒ Inverter drip shield (PN: 808-9004) if mounting in marine installation

**NOTE**: For a list of tools and materials required to install the network, refer to the *Xanbus System Installation Guide*, which is available for download at **www.xantrex.com**.

# Installing the Inverter/Charger

## Overview

This section provides detailed information on installing the Freedom SW 230V. The overall procedure is divided into eight steps:

# Step 1: Choosing a Location for the Inverter/Charger

**⚠ DANGER**

**FIRE AND EXPLOSION HAZARD**

This equipment contains components that could produce arcs or sparks. To reduce the risk of fire or explosion, do not install this equipment 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.

**Failure to follow these instructions will result in death or serious injury.**

**⚠ CAUTION**

**HEAT HAZARD**

Do not cover or obstruct the ventilation openings. Do not install this equipment in a compartment with limited airflow. Overheating may result.

**Failure to follow these instructions can result in minor or moderate injury.**

The inverter should only be installed in a location that meets the following requirements:

| | |
|---|---|
| **Ventilated** | Do not operate the inverter/charger in a closed-in area or restrict ventilation in any way. The inverter/charger requires air circulation to maintain optimum operating temperature and provide best performance. If the unit has inadequate ventilation, it may shut down due to overheating.<br>The air vented through the openings should also have a path to circulate away from the inverter/charger. |
| **Dry** | Do not allow water or other fluids to drip or splash on the inverter/charger. Do not expose to rain, snow or water.<br>Use an optional inverter drip shield (PN: 808-9004) for marine installations. |
| **Cool** | Normal air temperature should be between 0 °C and 60 °C—the cooler the better within this range. |
| **Clearance** | Allow as much space around the inverter/charger as possible. It is recommended that other objects and surfaces be at least 76 mm away from the ventilation openings for best performance. |

**Safe**

Locate the inverter/charger away from battery in a separate well ventilated compartment. Do not install the inverter/charger in any compartment containing flammable gases or liquids like gasoline.

**Close to battery compartment**

The length and size of your DC cables will affect performance. Use the DC cables recommended in Table 2 on page 13. The unit should **not** be installed in the battery compartment due to the possible presence of explosive hydrogen gas from the batteries.

**Protected from battery acid and gases**

Never place the inverter/charger directly above the batteries—gases from battery will corrode and damage the inverter/charger. If the inverter/charger is installed in a compartment above the batteries, make sure there is a solid, gas-impermeable wall dividing the two compartments.
However, flooded or wet cell batteries produce flammable gases that can potentially be ignited and therefore a safety hazard. If the batteries are sealed (no caps to add water), then the Freedom SW 230V can be mounted above the batteries if so desired (a position outlined in the manual).

Never allow battery acid to drip on the inverter/charger or its wiring when filling the batteries or reading their specific gravity.

**Orientation**

To meet regulatory requirements, the Freedom SW 230V must be mounted in one of the approved mounting orientations. See Figure 5 on page 21.

# Step 2: Mounting the Inverter/Charger

## Considerations

Before mounting the Freedom SW 230V, take the following two factors into account.

1. The weight of the inverter/charger requires two people to install it.
2. Mounting considerations are shown in Figure 5 on page 21.

> ⚠ CAUTION
>
> **HEAVY ITEM**
>
> The Freedom SW 230V Inverter/Charger is heavy (see "Inverter/Charger Physical Specifications" on page 51). The unit is too heavy for one person to install safely. It is recommended that two people lift and mount the unit. Always use proper lifting techniques during installation to prevent personal injury.
>
> **Failure to follow these instructions can result in minor or moderate injury.**

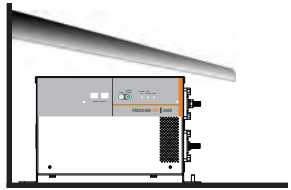
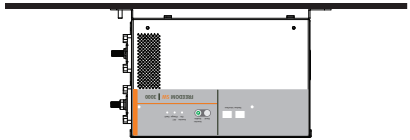
The Freedom SW 230V dimensions and location of the mounting holes are provided in Figure 5 on page 21.

Mount your inverter/charger before you connect any wires or cables.

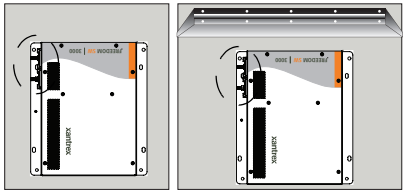
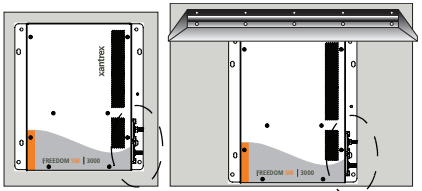
**To mount the inverter/charger:**

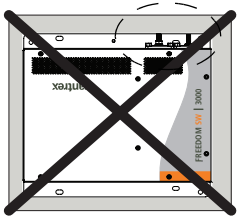
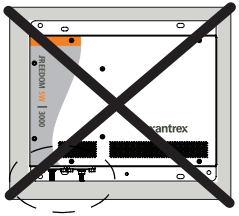
1. Remove the inverter/charger from its shipping container.
2. Verify that all components are present.
3. Select an appropriate mounting location and orientation. To meet regulatory requirements, the Freedom SW 230V must be mounted in one of the orientations shown in Figure 5 on page 21.
4. Mark the position of the mounting holes.
5. Pilot drill the six mounting holes.
6. Fasten the inverter/charger to the mounting surface with six M6 steel screws or bolts.

**Figure 5** Mounting Orientations

| Orientation | | Approved Mounting Orientation? | Comment |
|---|---|---|---|
| Desktop Mount | A  | A - Yes | A - Suitable only for non-marine applications with no risk of condensation or dripping water. |
| | B  | B - Yes when used with inverter drip shield (PN: 808-9004) for marine installations. | B - The drip shield is installed on top of the inverter with some clearance. See “Drip Shield Placement (Desktop Mount)” on page 64. |
| Upside-down Mount |  | Yes (for non-marine applications only) | Suitable only for non-marine applications with no risk of condensation or dripping water. |

This guide for use by qualified personnel only.

| Orientation | Approved Mounting Orientation? | Comment |
|---|---|---|
| Wall Mount DC on Left  A B | A - Yes | A - On a vertical surface with DC terminals facing left. |
| | B - Yes when used with inverter drip shield (PN: 808-9004) for marine installations. | B - On a vertical surface with DC terminals facing left with the front panel facing up. The drip shield is installed on top of the inverter with some clearance. See “Drip Shield Placement (Inverter Front Panel Facing Up)” on page 64. |
| Wall Mount DC on Right  A B | A - Yes | A - On a vertical surface with DC terminals facing left. |
| | B - Yes when used with an inverter drip shield (PN: 808-9004) for marine installations. | B - On a vertical surface with DC terminals facing right with the front panel facing down. The drip shield is installed directly on top of the inverter. See “Drip Shield Placement (Inverter Front Panel Facing Down)” on page 65. |

| Orientation | | Approved Mounting Orientation? | Comment |
|---|---|---|---|
| Wall Mount DC Up |  | No | Not acceptable.<br>This orientation does not meet regulatory requirements. |
| Wall Mount DC Down |  | No | Not acceptable.<br>This orientation does not meet regulatory requirements. |

This guide for use by qualified personnel only.

# Step 3: Connecting the AC Input and AC Output Wires

**⚠ DANGER**

**FIRE, ELECTRICAL SHOCK, AND ENERGY HAZARDS**

Make sure wiring being connected to the inverter/charger is de-energized by a breaker or switch upstream. Lockout/Tagout is a recommended practice by many electrical contractors. Always lockout and tag disconnect devices before making connections. All wiring must be done in accordance with local and national electrical wiring codes.

**Failure to follow these instructions will result in death or serious injury.**

## General AC Wiring Considerations

**AC and DC Wiring Separation** Do not mix AC and DC wiring in the same conduit or panel. Consult the applicable installation code for details about DC wiring and AC wiring in vicinity to each other.

**AC Input and Output Isolation** The AC input and output circuits of this inverter/charger are isolated from each other when in invert mode to ensure safe operation. This isolation must be maintained in the installation, by being sure not to connect AC input and output wiring to a common point. For example, do not route the AC input and output neutrals to a common neutral bus. It is highly recommended to use a separate inverter load panel to distribute power to inverter loads. All wiring to this panel must be through the inverter/charger and none to the main panel upstream of the inverter/charger.

**IMPORTANT**: Wiring the output inverter to back to the main panel could result in ground bonding to occur in multiple locations in contravention of applicable wiring codes and may result in nuisance tripping of Ground fault protection equipment. All wiring must be performed by a qualified electrician.

**AC Wiring Compartment** For your reference, the AC wiring compartment is shown in Figure 6 on page 25.

**AC Knockouts** There are two dual 1.0" (Ø34.6mm) and 3/4" (Ø28.3mm) trade-size knockouts on the side panel for AC wiring. Use the same trade size of strain relief as the trade size of the knockout(s) you are using.

**AC Wiring Terminals** The AC wiring terminals accept cables of a specific size. See “AC Wiring” on page 11 for required sizes.

## Connecting AC Input Wires

Figure 6 shows the wiring compartment, which contains a grounding bus (used to wire the AC input and output ground wires) and a terminal block (used to wire the AC input and AC output connections).

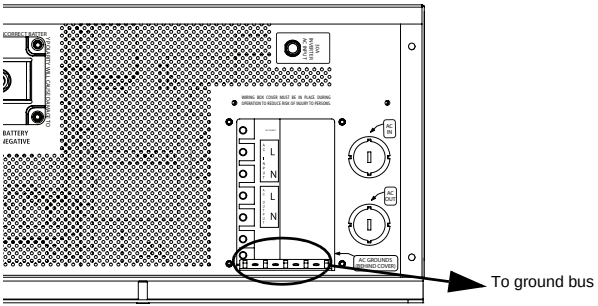



**Figure 6** AC Wiring Compartment

*NOTICE*

**EQUIPMENT DAMAGE**

The terminal block is split into INPUT and OUTPUT sections. Damage may occur if the unit is wired incorrectly.

Do not remove or loosen factory installed wiring.

**Failure to follow these instructions can damage the unit and/or damage other equipment.**

When making the AC input and AC output connections, observe the correct color code for the appropriate AC wire, as described in Table 1 on page 12.

**To make the AC input connections:**

1. Locate the wiring compartment cover panel and remove the four screws.
2. Remove the cover panel from the unit to access the wiring compartment.
3. Remove one of the AC knockouts from the front or side of the unit. Do not leave the knockout inside the wiring compartment.
4. Install a strain-relief clamp in the AC knockout.
5. Run the AC wiring through the strain-relief clamp.
6. Strip approximately 50 mm off the jacket from the AC cable and separate the wires.

7. Using a 6 mm blade slot screwdriver, loosen the terminal screws on the terminals. Do not remove the screws.
8. Connect the line and neutral wires to the input terminals (labeled AC Input on the terminal block, Figure 6 on page 25) as follows:
   Connect Line to **INPUT L**, Neutral to **INPUT N**.
9. Tighten the terminal screws. Leave some slack wire inside the wiring box.
10. Connect the ground wires to a free position on the ground bus, Figure 6 on page 25. If solid ground wire is being used, the wire can be connected directly under the screw heads. If stranded ground wire is being used, ring terminals must also be used.
11. Secure the strain-relief clamp on the AC input cable jacket.

## Connecting the AC Output Wires

*NOTICE*

**EQUIPMENT DAMAGE**

Do not connect the output of the inverter to any AC source.

**Failure to follow these instructions can damage the unit and/or damage other equipment.**

**To make the AC output wiring connections:**

1. Remove one of the AC knockouts from the front or side of the unit. Do not leave the knockout inside the wiring compartment.

**IMPORTANT:** The applicable installation code may not allow you to run the AC input and AC output wiring through the same AC knockout.

2. Install a strain-relief clamp in the AC knockout and run the AC wiring through the strain-relief clamp.
3. Strip approximately 50 mm off the jacket from the AC cable and separate the wires.
4. Using a 6 mm blade slot screwdriver, loosen the terminal screws on the AC output terminals. Do not remove the screws.
5. Connect the line and neutral wires to the output terminals (labeled AC Output on the terminal block, Figure 6 on page 25) as follows:
   Connect Line to **OUTPUT L**, Neutral to **OUTPUT N**.
6. Tighten the terminal screws. Leave some slack wire inside the wiring box.
7. Connect the ground wires to a free position on the ground bus, Figure 6 on page 25. If solid ground wire is being used, the wire can be connected directly under the screw heads. If stranded ground wire is being used, ring terminals must also be used.
8. Secure the strain-relief clamp on the AC output cable jacket.
9. Attach the wiring compartment cover panel and tighten the four screws.
10. Connect the outgoing AC wires to an AC load panel equipped with circuit breakers.

# Step 4: Connecting the DC Cables

## DC Connection Precautions

**⚠ DANGER**

**ELECTRICAL SHOCK HAZARD**

Connect and disconnect DC wiring only after opening the disconnect switches or breakers at all AC and DC sources.

**Failure to follow these instructions will result in death or serious injury.**

## Recommended Cable Sizes and Lengths and Fuse Size

For recommended DC cables and fuse sizes, see Table 2 and Table 3 on page 14.

## Preparing the Cables

**To prepare the DC cables:**

1. Cut the negative and positive cables to the required length. Strip off enough insulation so you can install the terminals you will be using.

   Use crimp connectors. The connector should be designed for a 9.5 mm stud size to connect to the Freedom SW 230V. If a crimp connector is used, it should be crimped using the tool indicated by the connector manufacturer.

2. Cut the DC ground cable to the required length. Strip off enough insulation so you can install the terminals you will be using.

   Use crimp connectors. The connector should be designed for a 6.35 mm stud size to connect to the Freedom SW 230V. If a crimp connector is used, it should be crimped using the tool indicated by the connector manufacturer.

3. Attach the connectors to the ends of both cables. Make sure no stray wire strands protrude from the connectors.

## Guidelines for Routing the DC Cables

Follow these guidelines to ensure maximum performance.

⚠ WARNING

**ELECTRICAL SHOCK AND FIRE HAZARD**

Route the cables away from sharp edges that might damage the insulation. Avoid sharp bends in the cable.

**Failure to follow these instructions can result in minor or moderate injury.**

- Do not attempt to use the chassis in place of the battery negative connection for grounding. The inverter requires a reliable return path directly to the battery.
- To reduce the chance of radio frequency interference, keep the positive and negative cables close together—ideally, held together by straps, loom, or insulated clamps at regular intervals.
- To ensure maximum performance from the inverter/charger, do not route your DC cables through a DC distribution panel, battery isolator, or other device that will cause additional voltage drops. The exception is the DC fuse and Disconnect or the DC circuit breaker which is required at the battery to protect the DC wiring.
- To help avoid damage caused by reverse polarity battery connection, it is a good idea to mark each end of each cable to identify it as a positive (red) or negative (black) cable before routing the wiring.

## Connecting the DC Cables to the Inverter/Charger

### ⚠ WARNING

**FIRE HAZARD**

Use only appropriately sized copper cable. Loose connections, improper connections, and under-rated cables will overheat. Make sure that the supplied bolts on the inverter/charger are tightened to a torque of 20.4–21.7 Nm. Torque all other connections to the manufacturer's specifications. Make sure the DC cable, washers, and bolt are assembled in the order shown in Figure 7.

**Failure to follow these instructions can result in death or serious injury.**

### *NOTICE*

**EQUIPMENT DAMAGE DUE TO REVERSE POLARITY**

Before making the final DC connection or closing the DC breaker or disconnect, check cable polarity at both the battery and the inverter/charger. Positive (+) must be connected to positive (+). Negative (–) must be connected to negative (–).

**Failure to follow these instructions can damage the unit and/or damage other equipment.**

**To connect the DC cables:**

1. Route the DC cables from the battery bank to the inverter/charger. Observe the "Guidelines for Routing the DC Cables" on page 29.
2. Install a DC fuse and disconnect switch or a DC circuit breaker between the inverter/charger and the battery. It 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 on page 14 for required fuse or breaker size.
3. Open the DC disconnect switch or turn off the DC circuit breaker.
4. Connect one connector on the POSITIVE (+) cable to the POSITIVE DC terminal on the inverter/charger, as shown in Figure 7. The connector goes on first, then the lock washer and bolt.
5. Connect the other connector to the POSITIVE (+) terminal on the fuse or breaker. Observe polarity carefully while completing the installation.

   Use a wrench to tighten the bolt to a torque of 20.4–21.7 Nm at the inverter/charger end. Observe the fuse holder or breaker manufacturer's recommendation at the other end.

6. Connect one connector on the NEGATIVE (–) cable to the NEGATIVE (–) DC terminal on the inverter/charger, as shown in Figure 7. The connector goes on first, then the lock washer and bolt.

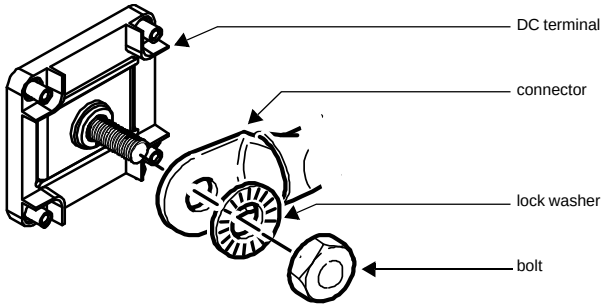



**Figure 7** DC Cable Connections

7. Before proceeding, check that the cable polarity is correct: POSITIVE (+) on the inverter/charger is connected to the POSITIVE (+) on the battery, and NEGATIVE (–) cable is connected to the NEGATIVE (–) terminal on the inverter/charger.

**IMPORTANT:** The next step is the last cable connection you need to make. A spark is normal when the DC disconnect switch is turned on or the DC circuit breaker is closed so be sure step #3 is done before proceeding.

8. Connect the other end of the cable to the NEGATIVE (–) terminal on the battery.
9. Use a wrench to tighten the bolt to a torque of 20.4–21.7 Nm at the inverter/charger end.
10. To protect the DC terminals, attach the DC terminal covers (Figure 8) to the inverter/charger, using the screws provided.

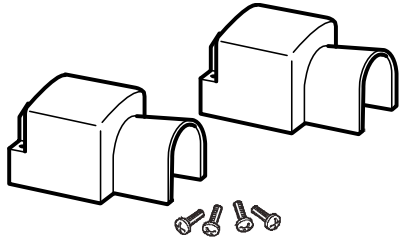


**Figure 8** DC Terminal Covers

## DC Grounding

The Chassis Ground point on the inverter/charger is used to connect the chassis of the inverter/charger 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/yellow insulation.

The grounding guideline given below assumes you are using the code-compliant DC supply cable and fuse sizes indicated on page 13. If you are using different sizes, refer to the applicable code for DC grounding detail.

**To connect the chassis ground:**

1. Using the appropriate wrench, loosen the nut on the chassis ground point bolt shown in Figure 9.
2. Connect the grounding cable between the chassis ground point and the DC grounding point for your system.

   In an RV or vehicle installation, the DC grounding point will usually be the vehicle chassis or a dedicated chassis ground bus.

   For marine installations, refer to the applicable local code for marine DC grounding detail.
3. Tighten the nut to a torque of 1.47–1.7 Nm.

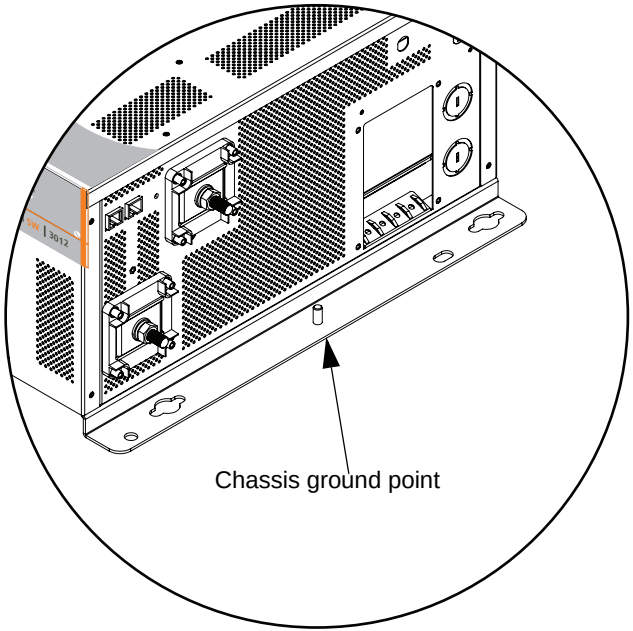



**Figure 9** DC Wiring and DC Grounding

# Step 5: Connecting the Battery Temperature Sensor (BTS)

Installing a battery temperature sensor (BTS) extends the life of a battery by preventing overcharging in warm temperatures and undercharging in cold temperatures. With a BTS monitoring the battery temperature, the voltage delivered to the battery is adjusted according to the battery's actual temperature.

The BTS has a self-adhesive backing and attaches to the side of the battery. A 7.6 m cable is supplied with the BTS.

## Mounting Options

You can mount the 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.

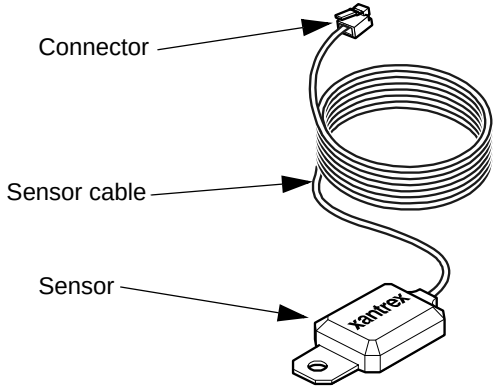



**Figure 10** BTS with Cable

*NOTICE*

**EQUIPMENT DAMAGE**

Use only the Freedom SW 230V-compatible Battery Temperature Sensor (BTS). To order a spare BTS, call customer service and order part number 809-0946.

**Failure to follow these instructions can damage the unit and/or damage other equipment.**

## Mounting to the Negative Battery Terminal

**To mount the sensor on the negative battery terminal:**

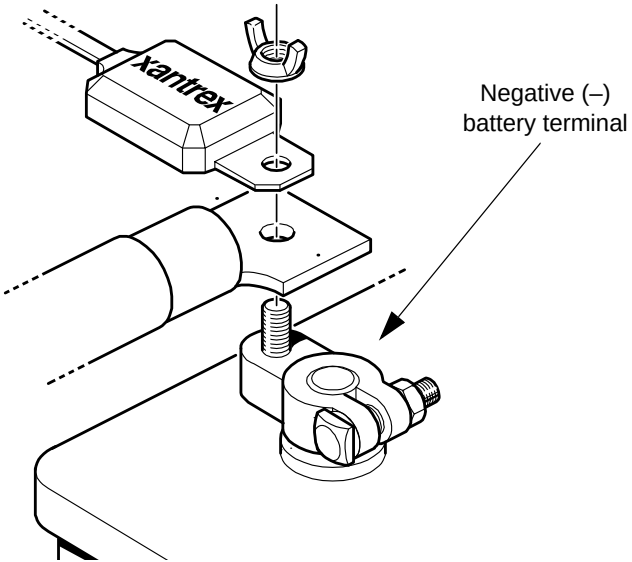



**Figure 11** BTS Mounted on the Negative Battery Terminal

1. Select the battery to be monitored. The BTS should be connected to the battery bank that is directly connected to the inverter/charger.
2. Switch off all devices operating from the battery, or open the battery switch (if present) to disconnect the battery.
3. Wait 10 minutes for any explosive battery gases to dissipate.
4. Remove the nut that connects existing wiring ring terminals to the battery negative terminal stud.
5. Move or reorient the existing wiring ring terminals on the battery negative terminal stud, so there is a flat surface on which to seat the BTS mounting plate.

   You may need to bend the ring terminal crimp and/or wires slightly downward to allow the sensor to seat flush to the top surface of the upper ring terminal.
6. Mount the sensor directly on top of the ring terminal, as shown in Figure 11, and firmly tighten the terminal nut.

> ⚠ WARNING
>
> **FIRE HAZARD**
>
> In this procedure, you must install the DC wire on the battery terminal, then install the sensor on top of the DC wire. This sequence is required to provide the best connection to the battery and to ensure correct performance of the sensor.
>
> **Failure to follow these instructions can result in death or serious injury.**

7. Check to ensure that the sensor and all wires are held firmly and cannot be moved.

8. Turn the battery switch on again (if you opened it in Step 2.)
9. Route the sensor cable to the inverter/charger and plug it into the blue BTS port, as shown in Figure 12. Secure the cable along its length.

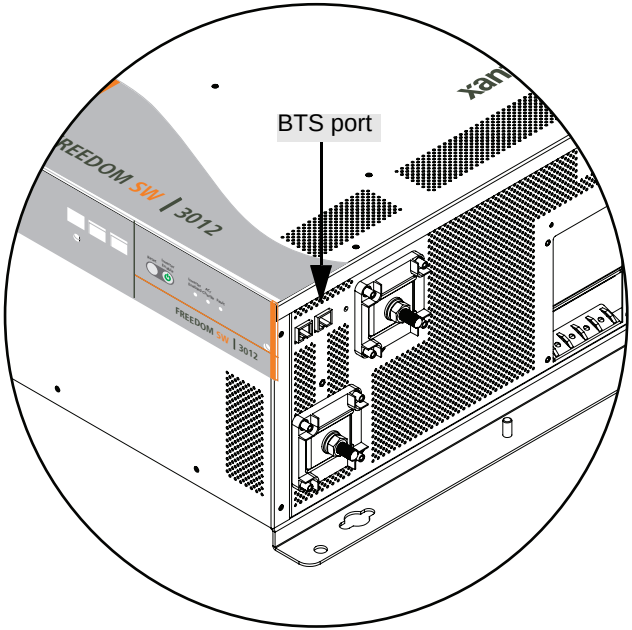



**Figure 12** Connecting the BTS Cable to BTS Port

## Mounting to the Side of the Battery Case

**To mount the sensor on the battery case:**

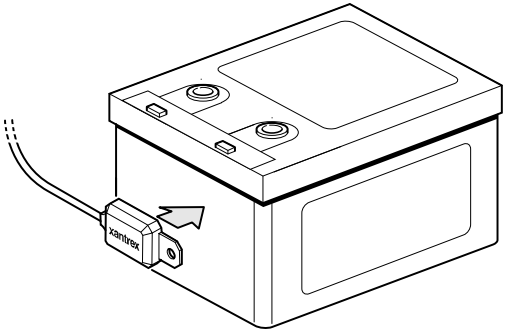



**Figure 13** BTS Mounted on the Battery Case

1. Select the battery to be monitored.

   The BTS should be connected to the battery bank that is directly connected to the inverter/charger.

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. This surface must be in direct internal contact with the battery electrolyte. Do not install the sensor 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. 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, as shown in Figure 13.
6. Route the sensor cable to the inverter/charger and plug it into the Battery Temp. jack, as shown in Figure 12. Secure the cable along its length.

# Step 6: Connecting to the Network

For your reference, Figure 14 shows where the network connections are made on the Freedom SW 230V.

**To connect the Freedom SW 230V to the Xanbus network:**

- Plug a network cable connected to the Xanbus network into either one of the two Xanbus Interface network ports on the Freedom SW 230V.

*NOTICE*

**EQUIPMENT DAMAGE**

Connect the Freedom SW 230V only to other Xanbus compatible devices.

Although the cabling and connectors used in this network system are the same as Ethernet connectors, **this network is not an Ethernet system**. Equipment damage may result from attempting to connect two different systems. Do not attach the Freedom SW 230V On/Off switch to these ports.

**Failure to follow these instructions can damage the unit and/or damage other equipment.**

Detailed information on planning and installing your network is available in the *Xanbus System Installation Guide*. Refer to the this guide to determine the type of network layout to install, as well as guidelines for installing the network.

The Xanbus System Installation Guide is available for download at **www. xantrex.com**

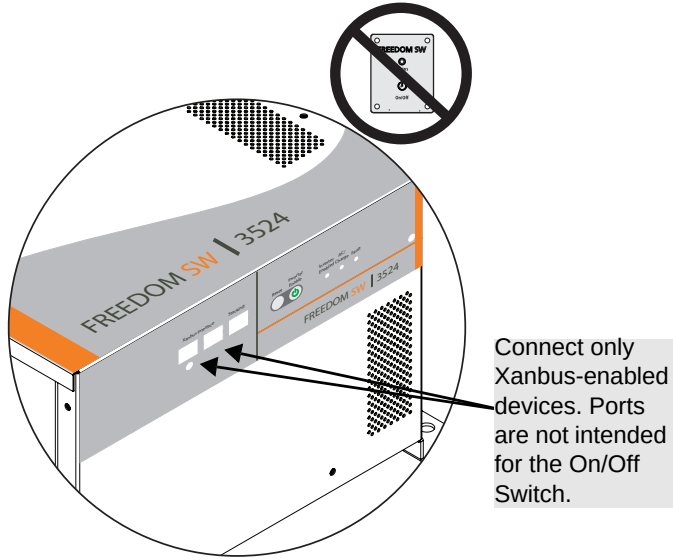



**Figure 14** Connecting to a Xanbus Network Port

This guide for use by qualified personnel only.

# Step 7: Performing Checks Prior to Initial Start-Up

Before testing your installation, ensure these conditions are met:

- ❒ Chassis and AC grounds are properly installed
- ❒ AC input connections and AC output connections are wired correctly on the terminal block and not reversed
- ❒ Positive (+) battery cable is connected to the positive (+) battery terminal through the DC fuse and disconnect switch or DC circuit breaker
- ❒ Negative (–) battery cable is connected to the negative (–) battery terminal
- ❒ Battery voltage is within the proper range of 20–32 volts DC
- ❒ DC disconnect switch or breaker is turned off
- ❒ AC input and output breakers are turned off
- ❒ All connections are tight

# Step 8: Testing Your Installation

> ⚠ WARNING
>
> **ELECTRICAL SHOCK HAZARD**
>
> The Inverter Enable button on the Freedom SW 230V and the optional accessories do not disconnect DC or AC input power to the Freedom SW 230V.
>
> **Failure to follow these instructions can result in death or serious injury.**

There are several tests to be performed to verify that the installation is successful. These tests will verify that:

- the Freedom SW 230V works in invert mode
- the Freedom SW 230V works in charge mode
- the Freedom SW 230V works in AC bypass mode

If any of the tests fails at any point, go to “Step 7: Performing Checks Prior to Initial Start-Up” on page 38 and go through the checklist again to check against the installation. Perform the tests again. If any test fails again, see the troubleshooting section in the Freedom SW 230V Sine Wave Inverter/Charger Owner’s Guide.

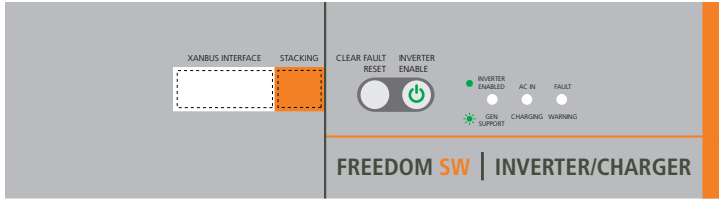



**Figure 15** Freedom SW 230V Front Panel

## Testing in Invert Mode

**To test the Freedom SW 230V in invert mode, using a 100 watt light bulb as the test load:**

1. Close the DC disconnect switch or the DC circuit breaker to supply DC power to the Freedom SW 230V.

   Wait for all the lights on the front panel to flash on and off, indicating that the unit has successfully initialized (10 to 30 seconds).

   If the light does not come on, make sure the voltage at the DC terminals on the Freedom SW 230V is correct, as described in “Step 7: Performing Checks Prior to Initial Start-Up” on page 38.

2. After initialization, observe that none of the lights on the front panel should remain illuminated.

3. Press the **INVERTER ENABLE** button. Verify that the **INVERTER ENABLED** LED status light illuminates.
4. Connect the Freedom SW 230V to the test load by closing the AC breaker that controls the circuit that the test load is connected to.

   If the light bulb illuminates, the Invert mode is working.
5. Press the Inverter Enable button to disable the inverter.

   The **INVERTER ENABLED** LED status light is off.

## Testing in Charge Mode and AC Bypass Mode

1. Close the AC supply breaker to supply AC power to the unit.

**To verify that the Freedom SW 230V starts charging:**

2. After a few seconds, verify that the AC/Charge light on the front panel is turned on (indicating that the batteries are being charged).

**To verify that Freedom SW 230V correctly switches to Bypass mode:**

3. Disable the AC source and turn off the inverter by pressing the Inverter Enable button.
4. Connect the test load to the AC output connection of the unit.
5. Enable the AC source and the test load should turn on after ten seconds.

## Installation Complete

Your installation is now complete. The Freedom SW 230V Inverter/Charger is ready for use.

The preceding tests use a light test load (a light bulb) as a test case. If you encounter problems when using a load over 1000 watts (for example, a hair dryer or microwave), see the troubleshooting information in the Freedom SW 230V Sine Wave Inverter/Charger Owner's Guide.

# Stacking Features

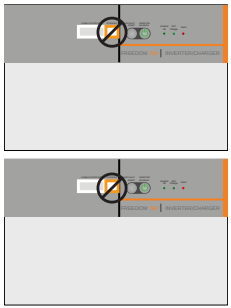
The Freedom SW 230V inverter/chargers provide support for a parallel stacking configuration. This gives the system engineer and/or installer more options to work with when tailoring a system to meet load demands.

In parallel stacking mode, only two Freedom SW 230V inverter/chargers of the same model can be parallel-stacked. For example, two Freedom SW 2524-230s can be stacked in parallel as both units each have a 24-volt rating and a power rating of up to 2500 watts.

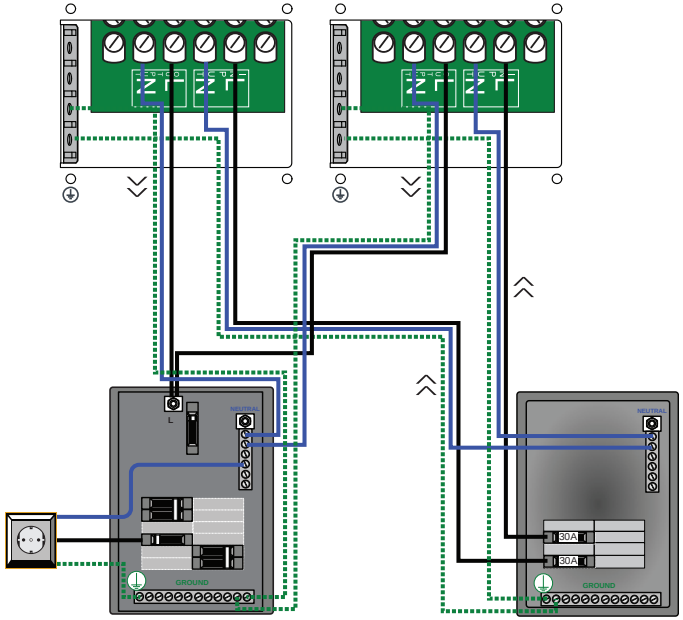
# Parallel Stacking

Allows the inverter and charger capacity of a system to be doubled. Parallel-stacked inverter/chargers can operate from different battery banks, meaning each unit is connected to its own battery bank. However, it is highly recommended to only use a single battery bank. See “DC Connections for Stacked Inverters” on page 43.

Do NOT connect a stacking cable to the **STACKING** port on the front panel of a Freedom SW 230V to configure two units for parallel stacking. The port is reserved for future use.



Two Freedom SW 3524-230 units shown.




Two Freedom SW 3524-230 units shown.

**Figure 16** Parallel Stacking Using Two Freedom SW 3524-230s

# DC Connections for Stacked Inverters

Individual overcurrent devices are to be used between the battery positive and each inverter. Keep cable lengths to the two inverter/chargers the same in order to balance cable losses. If not, the battery cable difference in length between the two inverter/chargers should not exceed 30 cm.

**Connect the stacked system as follows:**

1. Connect each negative terminal to the battery.
2. Connect a earth (ground) wire to the common negative.
3. Connect each positive terminal of the inverter to the battery through a DC disconnect in each positive line. Do not tie the positives together between inverters.
4. Connect the earth (ground) bonding wire from each inverter to the same location on the vehicle chassis. Use that same length and gauge wire for both inverter/chargers.
5. Connect the battery temperature sensors (BTS), if needed.

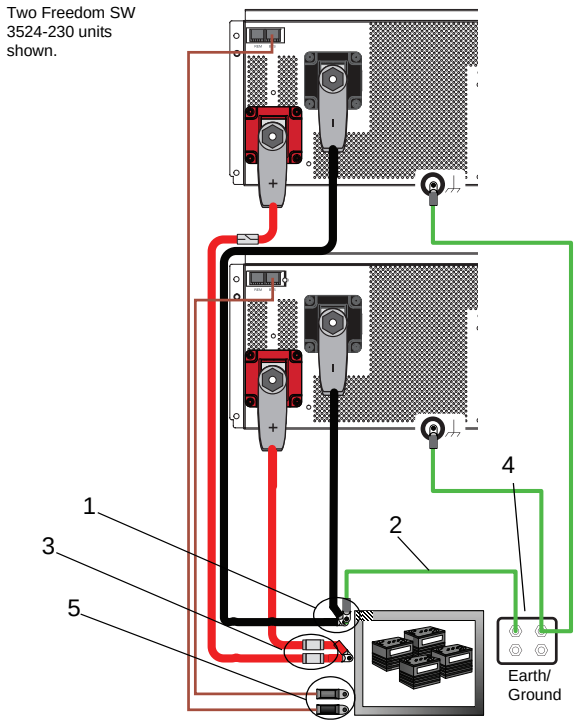
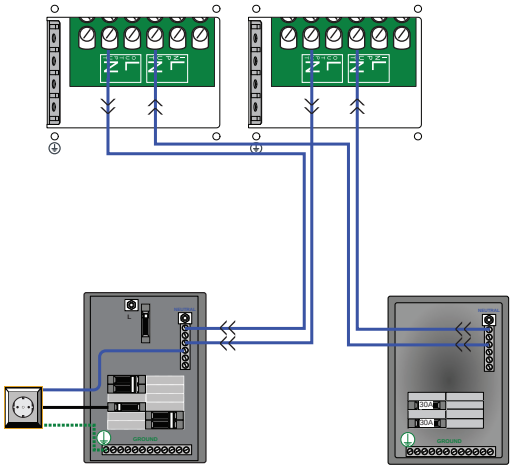



**Figure 17** Connecting Battery Cables and DC Earth/Ground Wires

This guide for use by qualified personnel only.

# Neutral Wiring for Stacked Inverters

Due to the neutral ground switching design of the Freedom SW Inverter/charger, it is mandatory that the **AC INPUT** and **AC OUTPUT N**eutrals be isolated from one another. In a stacked pair configuration, connect the two AC input neutrals together at the main distribution panel and the two AC output neutrals at an isolated neutral location in the inverter AC distribution panel.



Two Freedom SW 3524-230 units shown.

**Figure 18** Neutral Wiring for Stacking

## ⚠ WARNING

**FIRE HAZARD**

Do not power several loads in excess of 30 amps even in parallel-stacked configuration.

**Failure to follow these instructions can result in death or serious injury.**

**IMPORTANT:** In a parallel-stacked configuration, during operation, the AC transfer (pass-through) relay rating remains the same at 30 amps. The AC transfer relay rating does not double to become 60 amps.

## Configuring System for Stacked Operation

Verify all DC and AC connections. Check Xanbus network connections and ensure that terminators are installed at devices at each end of the network. The simplest system includes a Xanbus SCP, the two Freedom SW 230V inverter/chargers to be stacked and two Xanbus terminators.

For both units to operate in stacked configurations, a Master and Slave have to be assigned. The default out-of-box configuration for all Freedom SW 230V inverter/chargers is **Master** which causes a conflict the first time the system is powered up. The installer will need to change configuration on one of the inverter/chargers to **Slave** mode.

**To configure the system for stacking:**

1. Apply DC power to both inverter/chargers.
   Power up order has no impact. Because there are now two Master units in the system, the SCP will display an **F66** fault, a "system configuration fault".
2. From the SCP **System Status** screen, press **Enter**. The **Select Device** screen appears.
3. Select the inverter to configure as a Slave unit from the list, then press **Enter**.
4. Bring up the **Advanced Settings** screen by pressing **Enter**, Up, and Down arrow buttons all together.
5. Select **Advanced Settings** and press **Enter**. The Advanced Settings screen appears.
6. Scroll down to select **Stacking**.
   At this point all devices in the system will be automatically placed in standby mode. All three LEDs on the inverter to be configured will start flashing.

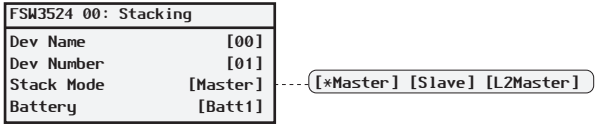



**Figure 19 Stacking** Menu Screen

7. Select **Stack Mode** and press **Enter**.
8. For Parallel Stacking: Select **Slave** and press **Enter**.
9. Press the **Func** button repeatedly until the **System Status** screen appears.

**NOTES:**

The only situation in which the Slave may shut down the Master inverter is during fault conditions such as high or low battery voltage, overcurrent, or over-temperature conditions. Both inverters will auto reset after a fault condition has been cleared. The exception is that an overcurrent condition will generate a shutdown for both inverters that will require a manual restart of the system.

# Search Mode Operation in Parallel Stacking

When two inverter/chargers are stacked for parallel operation, search mode behavior on the Slave unit is modified and is dependent on how much total load is on the system.

## Disabling Search Mode on the Master Unit

In parallel stacking, search mode on the Master unit will not function properly. When the Master sends out a load search pulse, a small current also flows into the output of the Slave unit since the two outputs are in parallel. This Master unit falsely detects a load causing erratic search mode operation. For this reason, it is highly recommended to disable search mode on the Master unit in a parallel stacking system.

## Setting Search Mode on the Slave Unit

The Slave unit will behave in one of two ways depending on whether its search mode is enabled or disabled.

**Search mode enabled** This is the recommended mode for parallel stacking and it helps minimize battery draw. The Slave unit continuously monitors the output of the Master unit. If the Master unit has more than 60% of the rated load (for example, 2100 watts on Freedom SW 3524-230), the Slave unit will assist the Master and the two will share the load equally. Should the load on the Master drop below 20% of rated load (700 watts for Freedom SW 3524-230), the Slave unit disengages and returns to a waiting state.

**Search mode disabled** The Slave unit operates continuously along with the Master unit and shares the load.

# Wiring Schematic

**NOTE**: Please refer to the Stacking Configuration sheet that shows the wiring schematic employed between two Freedom SW 230V inverter/chargers that are stacked in parallel.

**IMPORTANT**: Follow the same guidelines in “Installing the Inverter/Charger” on page 17 when choosing cables and/or wires for AC and DC connections.

**⚠ DANGER**

**FIRE, ELECTRICAL SHOCK, AND ENERGY HAZARDS**

Make sure all wiring being used to make stacking configurations between inverter/chargers is disconnected (physically or by opening the breaker) from all electrical sources before handling. All wiring must be done in accordance with local and national electrical wiring codes.

**Failure to follow these instructions will result in death or serious injury.**

# Charger Settings in a Dual Freedom SW Configuration

The Freedom SW 3524-230 includes a maximum 90A charger. When using two stacked Freedom SW 3524-230 inverter/chargers connected to the **same battery bank,** a total of 180A (90A × 2) of bulk charging is possible into that single common battery bank. For small battery banks and/or certain battery types this bulk mode current may be too high, therefore Freedom SW 230V models include a battery bank capacity **(`Batt Capacity`)** setting and a maximum charge rate (%) (**`Max Chg Rate`**) setting.

The battery bank capacity (C) is the bank's total Amp-hour capacity, which is best determined by a qualified RV electrical technician.

The **`Max Chg Rate`** depends on the battery manufacturer's maximum charge rate for the specific battery model being used to construct the bank. This total bank maximum charge rate is best determined by a qualified RV electrical technician. Suitable battery types include Flooded, GEL and AGM. Do not mix different battery types within the same battery bank.

For a Flooded type battery bank, the *preferred* charge rate (in Amps) is usually 10-15% of C where C = battery bank's total Amp-hour capacity. However, the industry-accepted *maximum* charge rate is 25% of C. Some AGM or Gel battery models may have a *maximum* charge rate as high as 50% of C and in rare cases, up to 100% of C.

Do not exceed the battery manufacturer's recommended maximum charge specifications because the resulting battery temperature rise shortens battery life.

## Calculations

Once installed and configured, each Freedom SW 230V charger in the dual configuration should be set to its own bulk charge current limit as follows:

Industry accepted *maximum* charge rate (%)
× battery bank's total Amp-hour capacity (C)
× $^1/_2$ (for one of the chargers)
= *Maximum* charger #1 **output current** (in Amps) allowed in bulk mode (also limited to the charger's maximum capacity)

To calculate the system total bulk output for the stacked pair,

Charger #1 **output current** (in Amps)
+ Charger #2 Actual **output current** (in Amps)
= System Total BULK **output current** (in Amps)

The System Total BULK **output current** flows into the battery bank. As such, this total bulk current is split/distributed within the bank through each individual parallel and/or series connected battery. Therefore, the current each battery "sees" **must not exceed each individual battery's maximum allowed charge current** as specified by the battery manufacturer. Since most battery banks are comprised of the same battery type, model and length of interconnecting cables, current sharing is roughly equal through

each parallel branch of batteries. Therefore, the above generalizations of *maximum* charge rate (%) can be made for the entire battery bank.

The Freedom SW 230V's **Max Chg Rate** (%) setting defaults to **100** (adjustable from **0** to **100**). So if the Freedom SW 3524-230 charger with a maximum possible 90A charger capacity is set to a **Max Chg Rate** of **100** (%) then its full 90A of current can be delivered into the battery bank. However, if this is too high, the installer/operator may reduce the **Max Chg Rate** setting to suit the system battery type and bank requirements (and limitations), to avoid overheating the battery bank.

The user/installer is responsible of configuring the charger to ensure that the **battery manufacturer's recommended maximum charge rate current** (in Amps) is not exceeded to prolong battery life and to exhibit best performance.

## Examples

**Example 1:** System composed of two stacked Freedom SW 2524-230s. Each Freedom SW 2524-230 has a maximum charge capacity of 65A.

The industry's commonly accepted practice suggests a typical Flooded battery bank capacity (**C**) of 400Ah should not be charged beyond 25% of its capacity (100A). Therefore, when configuring the two stacked Freedom SW chargers, each charger may have a *maximum* allowable charger output current of 50A ($400 \times 25\% \times {}^{1}/_{2}$) into the common battery bank as described in the Calculations section. Also, the System Total BULK **output current** is calculated as 100A (50A + 50A).

**To set the Max Chg Rate (%) setting in each Freedom SW 2524-230:**

1. Divide the *maximum* allowable charger output current of 50A by the Freedom SW 2524-230's maximum charge capacity of 65A.

   So, 50 ÷ 65, gets an approximate value of 0.77 (or 77%) which can be roughly reduced to 75%.

2. Set the **Max Chg Rate (%)** setting to **75** which means 75%.

In this example, the **actual** output current is limited to 75% of 65A which is 48A. Therefore, the **actual** System Total BULK **output current** comes out to just under 100A.

**Example 2:** System composed of two stacked Freedom SW 3524-230s. Each Freedom SW 3524-230 has a maximum charge capacity of 90A. The two stacked Freedom SW 3524-230 inverter/chargers connected to the **same battery bank** can possibly produce a total of 180A.

The industry's commonly accepted practice suggests a typical Flooded battery bank capacity (**C**) of 400Ah should not be charged beyond 25% of its capacity (100A). Therefore, when configuring the two stacked Freedom SW chargers, each charger may have a *maximum* allowable charger output current of 50A (400 × 25% × $^1/_2$) into the common battery bank as described in the Calculations section. Also, the System Total BULK **output current** is calculated as 100A (50A + 50A).

**To set the `Max Chg Rate (%)` setting in each Freedom SW 3524-230:**

1. Divide the *maximum* allowable charger output current of 50A by the Freedom SW 3524-230's maximum charge capacity of 90A.

   So, 50 ÷ 90, gets an approximate value of 0.56 (or 56%) which can be roughly reduced to 55%.

2. Set the **`Max Chg Rate (%)`** setting to **`55`** which means 55%.

In this example, the **actual** output current is limited to 55% of 90A which is 49A. Therefore, the **actual** System Total BULK **output current** comes out just under 100A.

**Example 3:** System composed of two stacked Freedom SW 3524-230s. Each Freedom SW 3524-230 has a maximum charge capacity of 90A. The two stacked Freedom SW 3524-230 inverter/chargers connected to the **same battery bank** can possibly produce a total of 180A.

The industry's commonly accepted practice suggests a typical Flooded battery bank capacity (**C**) of 1000Ah should not be charged beyond 25% of its capacity (250A). Therefore, when configuring the two stacked Freedom SW chargers, each charger may have a *maximum* charger output current of 125A (that is, 1000 × 25% × $^1/_2$) into the common battery bank as described in the Calculations section. Also, the System Total BULK **output current** is calculated as 250A (that is, 125A + 125A).

**To set the `Max Chg Rate (%)` setting in each Freedom SW 3524-230:**

1. Divide the *maximum* allowable charger output current of 125A by the Freedom SW 3524-230's maximum charge capacity of 90A.

   So, 125 ÷ 90, gets an approximate value of 1.39 (or 139%) which means that even when the charger is operating at 100% full power, the battery bank can more than adequately accept the current the charger is delivering.

2. Set the **`Max Chg Rate (%)`** setting to **`100`** which means 100%. There is no setting beyond 100%.

In this example, the **actual** output current is limited to 100% of 90A which is 90A. Therefore, the **actual** System Total BULK **output current** comes out to 180A.

**Example 4:** System composed of two stacked Freedom SW 3524-230s. Each Freedom SW 3524-230 has a maximum charge capacity of 90A. The two stacked Freedom SW 3524-230 inverter/chargers connected to the **same battery bank** can possibly produce a total of 180A.

The industry's commonly accepted practice suggests a typical Flooded battery bank capacity (**C**) of 600Ah should not be charged beyond 25% of its capacity (150A). Therefore, when configuring the two stacked Freedom SW chargers, each charger may have a *maximum* charger output current of 75A (that is, 600 × 25% × $^{1}/_{2}$) into the common battery bank as described in the Calculations section. Also, the System Total BULK **output current** is calculated as 150A (that is, 75A + 75A).

**To set the `Max Chg Rate (%)` setting in each Freedom SW 3524-230:**

1. Divide the *maximum* allowable charger output current of 75A by the Freedom SW 3524-230's maximum charge capacity of 90A.

   So, 75 ÷ 90, gets an approximate value of 0.83 (or 83%) which can be set exactly to 83%.

2. Set the **`Max Chg Rate (%)`** setting to **83** which means 83%.

In this example, the **actual** output current is limited to 83% of 90A which is 74A. Therefore, the **actual** System Total BULK **output current** comes out to just under 150A.

# Inverter/Charger Physical Specifications

For complete inverter/charger specifications, refer to the *Freedom SW 230V Sine Wave Inverter/Charger Owner's Guide*.

The physical specifications of the Freedom SW 230V are described in Table 4 below.

**Table 4** Freedom SW Physical Specifications

| | |
|---|---|
| Length | 387 mm |
| Width | 343 mm |
| Height | 197 mm |
| Weight | 21.4 kg<br>(Freedom SW 2524-230) |
| | 27.2 kg<br>(Freedom SW 3524-230) |

## Battery Bank Sizing

**Battery capacity** Battery size or capacity is just as important as the battery type selected for use with the Freedom SW 230V. The batteries are the most important part of your system, so It is recommended that you purchase as much battery capacity as possible. A large battery will extend running time and ensure that your inverter/charger delivers full rated surge.

**It is recommended a minimum battery size of 200 amp-hours (Ah) for moderate loads (< 1000 watts) and greater than 400 Ah for heavy loads.**

See “Estimating Battery Requirements” for information on a more detailed calculation.

**About Amp-hours** A number of different standards are used to rate battery energy storage capacity. Automotive and marine starting batteries are normally rated in cranking amps. This is not a relevant rating for continuous loads like an inverter. Deep-cycle batteries use a more suitable rating system such as amp-hours (Ah).

Amp-hour capacity is the number of amps a battery can continuously deliver during a specified number of hours. It is represented by the product of the two —amps multiplied by hours.

A typical single marine or RV battery rated for 100 Ah can deliver 5 amps @12 volts for 20 hours (5 amps × 20 hours = 100 Ah @12 volts). This same battery can deliver a higher or lower current for less or more time, limited approximately by the 100 Ah figure (50 amps for 2 hours or 200 amps for a half hour), but usually the capacity figure given is only accurate for the specified duration (20 hours).

For Freedom SW 230V inverter systems requiring a 24-volt battery bank,

- a pair of 200 Ah@12 volts batteries may be connected in series to create a 24-volt bank of 200 Ah@24 volts capacity,
- while two of these series pair branches may be connected in parallel to create a higher capacity 400 Ah@24 volts battery bank.

# Estimating Battery Requirements

## Calculating Battery Size

**Step 1: Compute Amp-hours**

For each appliance, compute the number of amp-hours that will be used between charging cycles, as follows:

1. Obtain the wattage. If the wattage is marked on the nameplate rating, use that. Otherwise, multiply the marked voltage and amperage:
   **WATTS = VOLTS × AMPS**.
2. Obtain the Watt-hours by multiplying that amount by the hours the appliance will be used:
   **WATT-HOURS = WATTS × HOURS**.
3. Obtain the amp-hours that the appliance requires by dividing that amount by 20 (the factor for the Freedom SW 230V, which is a 24-volt system):
   **BATTERY AMP-HOURS USED = AC WATT-HOURS÷10**

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

4. Enter this information on the blank calculation worksheet (page 56).

**Step 2: Calculate Battery Size**

5. Complete the rest of the worksheet; see Table 5, “Battery Sizing Example” on page 54 for an example.

Size the batteries at approximately twice the estimated total amp-hour usage. Doubling the expected amp-hour usage ensures that the batteries will not be overly discharged and extends battery life.

Do not skip this doubling step. More capacity is better since you will have more reserve capacity, be better able to handle large loads and surge loads, and your battery won’t be discharged as deeply. Battery life is directly dependent on how deeply the battery is discharged. The deeper the discharge, the shorter the battery life.

**Troubleshooting** If you find that the system shuts down when appliances with large motors are started, the problem may be that this motor is too much for the battery. Even though you calculated the amp-hour requirements appropriately, the startup of a large motor makes high demands on the battery. You may find that adding more amp-hours (in the form of extra batteries or replacement with a bigger battery) solves the problem.

**Table 5** Battery Sizing Example

| Appliance | (A) Power Consumption (Watts) | (B) Operating Time per Day (Hours) | Daily watt-hours needed for this appliance (= A × B) |
|---|---|---|---|
| TV & VCR | 200 W | 2 hours | 400 Wh |
| Small microwave oven | 800 W | 15 min = 1/4 hour | 200 Wh |
| 3 lamps, 60 W each | 180 W | 4 hours | 720 Wh |
| Coffee maker | 600 W | 15 min = 1/4 hour | 150 Wh |
| Hair dryer | 1500 W | 6 min = 1/10 hour | 150 Wh |
| **Total daily watt-hours of AC load** | | | 1620 Wh |
| | | | |
| **× Number of days between charges** | | | 3 |
| **= Total watt-hours of AC load between charges** | | | 4860 Wh |
| **Battery Ah used between charges (divide by 10 for 12 volt system; divide by 20 for 24 volt system)** | | | 243 Ah @24 V |
| **Recommended Battery Bank Size in Ah (multiply by 2)** | | | 486 Ah @24 V |

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

## Battery Banks

As your power requirements increase, you may need to use more than one battery to obtain sufficient capacity. Batteries can be connected in parallel, in series, or in series-parallel to create higher capacity systems.

See “Battery Cabling and Hook-up Configurations” on page 57 for more information about battery inter-connection schemes.

**Mixing Batteries** Batteries connected in parallel should be of the same type and amp-hour rating and from the same manufacturer.

It is not recommended to connect batteries of different types, amp-hour ratings or manufacturers. Improper charging and decreased battery life will result.

## Battery Bank Sizing Worksheet

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

# Restrictions on Motor Size

An appliance may require three to six times its normal running current in order to start. The Freedom SW 3524-230 can handle surges to 6800 watts for five seconds, which translates to a locked-rotor-amp rating of no more than 50 amps. The locked rotor amp may be specified on the motor nameplate as “LRA” or “LRI”.

When considering appliances with large motors, follow these guidelines:

- Make sure that the motor’s LRA rating is no more than 50 amps. The Freedom SW 230V may not be able to start a motor with a higher LRA, and the Freedom SW 230V will shut down if the attempt is made.
- Make sure the battery bank, DC cables and DC fuses are capable of handling up to 600 amps DC for five seconds. A weaker circuit may not be able to provide sufficient power to the Freedom SW 230V to allow the Freedom SW 230V to start up the appliance. Again, if the circuit cannot deliver the required current, the system may shut down or the fuse may open.

**Table 6** Battery Sizing Worksheet

| Appliance | (A) Power Consumption (Watts) | (B) Operating Time per Day (Hours) | Daily watt-hours needed for this appliance (= A × B) |
|---|---|---|---|
| | W | hours | Wh |
| | W | hours | Wh |
| | W | hours | Wh |
| | W | hours | Wh |
| | W | hours | Wh |
| | W | hours | Wh |
| | W | hours | Wh |
| | W | hours | Wh |
| **Total daily watt-hours of AC load** | | | Wh |
| **× Number of days between charges** | | | |
| **= Total watt-hours of AC load between charges** | | | Wh |
| **Battery Ah used between charges (divide by 20 for 24 volt system)** | | | Ah |
| **Recommended Battery Bank Size in Ah (multiply by 2)** | | | **Ah** |

# Battery Cabling and Hook-up Configurations

Several smaller batteries can be connected to create a battery bank of substantial size. You can connect batteries in **series** (see "Battery Series Connection" on the right) or **series-parallel** (see "Battery Series-Parallel Connections" on the next page).

To make a larger battery bank, connect individual batteries with heavy cables. The actual size of the cable depends on whether the batteries are connected in parallel or series. Generally, the cable should not be smaller than the inverter cables—if the main cables are 120 $mm^2$, the battery interconnects should be 120 $mm^2$.

The best configuration is to connect the batteries in series-parallel. This requires additional cables, but reduces imbalances in the battery bank and can improve the overall performance. Consult your battery supplier for more information regarding the hook-up configuration required for your system.

## Battery Series Connection

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

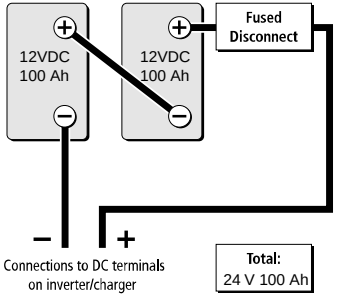



**Figure 20** Batteries Connected in Series

## Battery Series-Parallel Connections

As the name series-parallel implies, both the series and parallel configurations are used in combination. The result is an increase in both the voltage and the capacity of the total battery bank. This is common with all battery-inverter system voltages. The smaller, lower voltage batteries are first connected in series to obtain the necessary voltage, and then these “batteries connected in series” sets are connected in parallel to increase the battery bank capacity. See below.

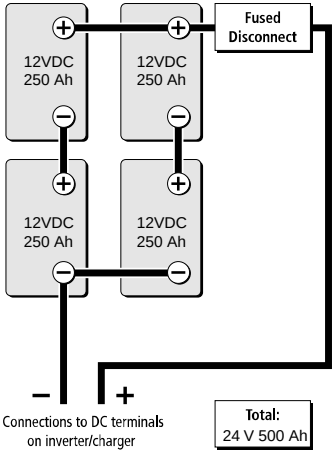



**Figure 21** Batteries in Series-Parallel Connections

# Specifications

**NOTE:** Specifications are subject to change without prior notice.

| Physical Specifications | Freedom SW 2524-230 | Freedom SW 3524-230 |
|---|---|---|
| L × W × H | 387×343×197 mm | 387×343×197 mm |
| Net Weight | 21.4 kg | 27.2 kg |

| Environmental Specifications | Freedom SW 2524-230 | Freedom SW 3524-230 |
|---|---|---|
| Nominal Ambient temperature | 25 °C | 25 °C |
| Invert mode:<br>• Operating range (full power)<br>• Load @ maximum ambient | <br>–20 to 25 °C<br>2000W @ 60 °C | <br>–20 to 25 °C<br>3000W @ 60 °C |
| Charge mode:<br>• Operating range (full power)<br>• Current @ maximum ambient | <br>–20 to 25 °C<br>58 A @ 60 °C | <br>–20 to 25 °C<br>80 A @ 60 °C |
| Storage temperature range | –55 to 75 °C | –40 to 85 °C |
| Humidity: Operation/Storage | ≤ 95% RH, non-condensing | |
| Altitude (Operating) | < 2,000 m | |
| Mounting | deck mount, wall mount with fans and DC/AC sides facing sideward | |

This guide for use by qualified personnel only.

**NOTE**: All inverter specifications are at nominal conditions: 24 VDC unless otherwise specified.

| Inverter Specifications | Freedom SW 2524-230 | Freedom SW 3524-230 |
|---|---|---|
| Output waveform | sine wave | sine wave |
| Output power (continuous) | 2500 W (up to 25 °C) | 3400 W (up to 25 °C) |
| Output power (5 seconds) | 5000 W | 6800 W |
| Output current | 11 A | 15 A |
| Output frequency | 50 Hz | 50 Hz |
| Output voltage | 230 VAC | 230 VAC |
| AC output connection | Single phase | Single phase |
| Peak efficiency | 90% | 90% |
| No-load current draw (Inverter On) | <1.9 ADC | <2.2 ADC |
| Standby current draw (Inverter Off) | <0.15 ADC | <0.15 ADC |
| Input DC voltage range | 20–32 VDC | 20–32 VDC |
| Low battery voltage shutdown cut-off | 21.0 V (selectable) | 21.0 V (selectable) |
| High battery voltage shutdown cut-off | 33.0 V (selectable) | 33.0 V (selectable) |

**NOTE**: All charging specifications are at nominal conditions: ambient temperature of 25 °C, 230 VAC, 50 Hz input, unless otherwise specified.

| Charger Specifications | Freedom SW 2524-230 | Freedom SW 3524-230 |
|---|---|---|
| Charging method | Three-stage charge (Bulk, Absorption, Float)<br>Two-stage charge (Bulk, Absorption)<br>The default charging method is three-stage. | |
| Without a battery temperature sensor | Three settings with the following temperature values:<br>Cool 10 °C<br>Warm 25 °C<br>Hot 40 °C<br>The default setting is Warm and it can only be changed by the factory, a dealer, or a service centre. | |
| With a battery temperature sensor (included) | The temperature compensation coefficients on a 24-volt battery are as follows:<br>Flooded: 54 mV × (25 °C – BTS °C)<br>Gel: 54 mV × (25 °C – BTS °C)<br>AGM: 42 mV × (25 °C – BTS °C) | |
| Output current (maximum) | 65 ADC | 90 ADC |
| Output voltage | 24 VDC | 24 VDC |
| Output voltage range | 12.0–32.0 VDC | 12.0–32.0 VDC |
| Equalization cycle | Automatic, Manual by Xanbus SCP | Automatic, Manual by Xanbus SCP |
| Optimal charging efficiency | > 85% | > 85% |
| AC input power factor (at full charge rate) | > 0.98 | > 0.98 |
| AC input current | 10.6A max. (excluding pass-through) | 14A max. (excluding pass-through) |
| AC input voltage | 230 VAC | 230 VAC |
| AC input voltage range | 170–270 VAC | 170–270 VAC |
| Dead battery charge voltage | > 12.0 VDC | > 12.0 VDC |
| AC input type | Single input (up to 30A) | Single input (up to 30A) |
| Circuit breaker (resettable) | 30A | 30A |

**NOTE**: All transfer specifications are at nominal conditions: ambient temperature of 25 °C, 230 VAC, 50 Hz input, unless otherwise specified.

| Transfer and General Specifications | All Models |
|---|---|
| Transfer time—utility to invert | < 20 ms |
| Minimum AC input voltage for transfer | 170 VAC |
| Maximum AC input voltage for transfer | 270 VAC |
| Minimum AC input frequency for transfer | 45 Hz |
| Maximum AC input frequency for transfer | 68 Hz |
| Cooling | Fan-cooled, temperature controlled. |

| Regulatory Approvals | All Models |
|---|---|
| Safety | CE mark (Europe)<br>EN62040-1<br>RCM mark (Australia)<br>AS 62040.1.1<br>AS/NZS 60335.2.29 |
| EMC | CE (Europe) and RCM (Australia)<br>EN 62040-2 |

# Inverter Drip Shield Installation

The inverter drip shield helps to protect the unit from dripping or splashing liquids, which causes a shock hazard. The inverter drip shield is especially useful in marine installations where water from condensation, rain, or sea may come into contact with the Freedom SW 230V.

> ⚠ WARNING
>
> **SHOCK HAZARD**
>
> Do not operate the unit under wet conditions and when the unit is wet. This product is intended only for use in dry areas. Installing the inverter drip shield may not entirely protect you from this hazard.
>
> **Failure to follow these instructions can result in death or serious injury.**

You may purchase the inverter drip shield by contacting an authorized dealer. When ordering, mention part number 808-9004.

**To install the drip shield:**

1. Acquire ten #6-3/4 screws needed to fasten the inverter drip shield to the wall.
2. Locate an appropriate setting for the drip shield above the Freedom SW 230V making sure you cover the entire width of the unit.
3. Fasten the screws through the holes in the drip shield into the wall.

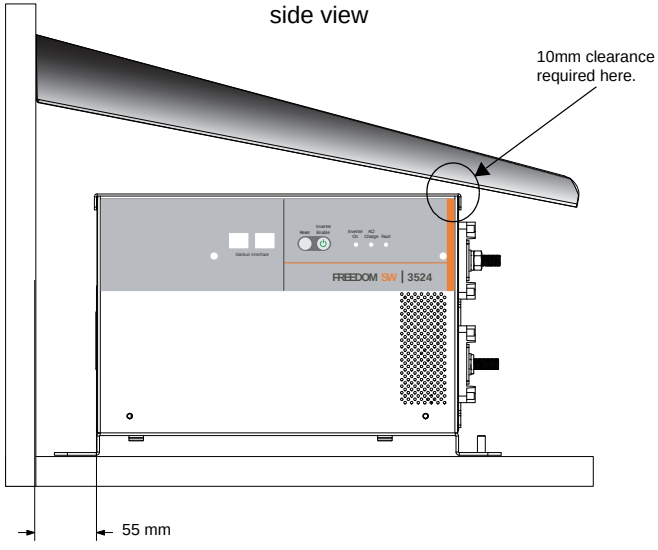



**Figure 22** Drip Shield Placement (Desktop Mount)

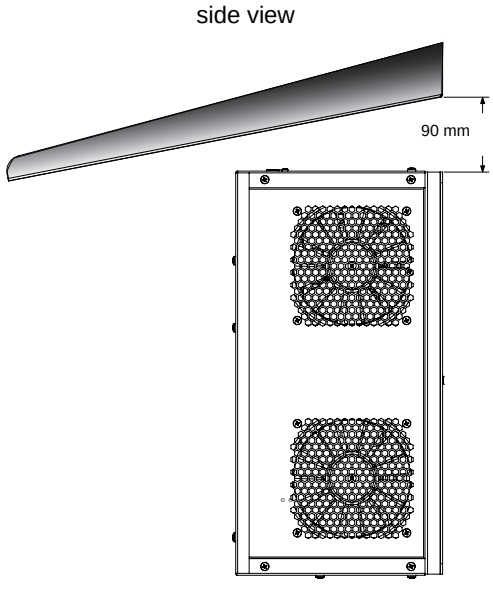



**Figure 23** Drip Shield Placement (Inverter Front Panel Facing Up)

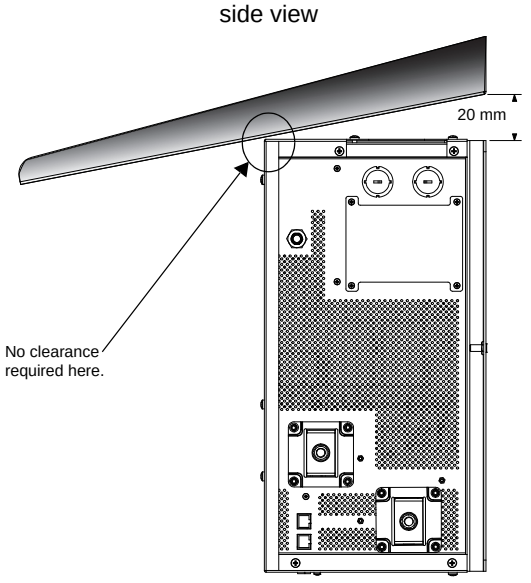



**Figure 24** Drip Shield Placement (Inverter Front Panel Facing Down)

**Schneider Electric Solar Inverters USA Inc.**

+1 800 670 0707
+1 408 987 6030
www.xantrex.com

**975-0697-01-01**

**Printed in China.**