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Freedom SW 2012 shown

Installation Guide

Freedom SW Inverter/Charger

Product Numbers

815-2012
815-3012
815-2024
815-3024
815-2012-03
815-3012-02
815-2524-02
815-3524-02

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Document Number: 975-1188-01-01 Rev E **Date:** November 2025

Product Name and (Part Number)

Freedom SW 12V 2012 (815-2012)
Freedom SW 12V 3012 (815-3012)
Freedom SW 24V 2024 (815-2024)
Freedom SW 24V 3024 (815-3024)
Freedom SW 2012 RVC (815-2012-03)
Freedom SW 3012 RVC (815-3012-02)
Freedom SW 24V 2524 (815-2524-02)
Freedom SW 24V 3524 (815-3524-02)

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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 _____

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ABOUT THIS GUIDE

Purpose

The purpose of this Installation Guide is to provide explanations and procedures for installing and configuring a Freedom SW Inverter/Charger for recreational vehicle and commercial applications.

Scope

The guide provides safety guidelines as well as information about troubleshooting the installation the inverter/charger. It does not provide details about particular brands of batteries. You need to consult individual battery manufacturers for this information.

Audience

The guide is intended for qualified personnel of the Freedom SW Inverter/Charger.

This guide is intended for qualified personnel. Qualified personnel have training, knowledge, and experience in:

- Installing electrical equipment and 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) and following safety work code practices. See NFPA 70E or CSA Z462 or EN 50110-1.

Related Information

You can find more information about Xantrex products and services at http://www.xantrex.com/.

IMPORTANT SAFETY INSTRUCTIONS

READ AND SAVE THIS INSTALLATION GUIDE FOR FUTURE REFERENCE.

This chapter contains important safety instructions for the Freedom SW Inverter/Charger (Freedom SW). Each time, before using the Freedom SW, 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 contains no user-serviceable parts.

The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a "Danger" or "Warning" safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

NOTICE is used to address practices not related to physical injury.

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

Please Note: No responsibility is assumed by Xantrex for any consequences arising out of the use of this material.

Safety Information

1. Before using the inverter/charger, read all instructions and cautionary markings on the unit, the batteries, and all appropriate sections of this guide.
2. Use of accessories not recommended or sold by the manufacturer may result in a risk of fire, electric shock, or injury to persons.
3. The inverter/charger is designed to be connected to both DC and AC electrical systems. The manufacturer recommends that all wiring be done by a certified technician or electrician to ensure adherence to the local and national electrical codes applicable in your jurisdiction.
4. To avoid a risk of fire and electric shock, make sure that existing wiring is in good condition and that wire is not undersized. Do not operate the inverter/charger with damaged or substandard wiring.
5. Do not operate the inverter/charger if it has been damaged in any way.
6. This unit does not have any user -serviceable parts. Do not disassemble the inverter/charger except where noted for connecting wiring and cabling. See your warranty for instructions on obtaining service. Attempting to service the unit yourself may result in a risk of electrical shock or fire. Internal capacitors remain charged after all power is disconnected.
7. To reduce the risk of electrical shock, disconnect both AC and DC power to or from the inverter/charger before attempting any maintenance or cleaning or working on any components connected to the inverter/charger. Do not disconnect under load. Turning the inverter/charger to Standby using the Power button on the panel will not reduce an electrical shock hazard.
8. The inverter/charger must be provided with an equipment-ground.
9. Do not expose this unit to rain, snow, or liquids of any type. This product is designed for dry-locations-use only. Damp environments will significantly shorten the life of this product and corrosion caused by dampness will not be covered by the product warranty.
10. To reduce the chance of short-circuits, always use insulated tools when installing or working with this equipment.
11. Remove personal metal items such as rings, bracelets, necklaces, and watches when working with electrical equipment.

⚠DANGER

ELECTRIC SHOCK HAZARD

- Do not expose the Freedom SW to rain, snow, or spray water.
- 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 arbitrarily. 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.

NOTE: Turning the inverter/charger to Standby mode using the **INVERTER ENABLE** button on the front panel will not reduce an electrical shock hazard.

⚠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 12 V) lead-acid (GEL, AGM, Flooded, or lead-calcium) or other approved 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.
- When using Lithium-Ion batteries, ensure that the battery pack being used includes a certified Battery Management System (BMS) with safety controls.

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.

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, serious injury, or equipment damage.

NOTES:

1. Mount and place the Freedom SW 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. Keep battery terminals clean from corrosion. If battery acid or corrosion deposit contacts skin or clothing, wash immediately with soap and water. If battery acid or corrosion deposit enters your eye, immediately flood it with running cold water for at least twenty minutes and have someone within range of your voice or close enough to get medical attention immediately.
5. Use extra caution to reduce the risk of dropping a metal tool on the battery. It could spark or short circuit the battery or other electrical parts and could cause an explosion. Use tools with insulated handles only.
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 Unit

NOTICE

RISK OF INVERTER/CHARGER DAMAGE

- Never allow battery acid to drip on the inverter/charger when reading specific gravity, or filling battery.
- Never place the Freedom SW 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 result in equipment damage.

Regulatory

The Freedom SW (Product Numbers: 815-2012, 815-3012, 815-2024, 815-3024, 815-3012-02) is certified to appropriate US and Canadian standards. The Freedom SW (Product Numbers: 815-2524-02, 815-3524-02) is certified to appropriate European (CE) and Australian (RCM) standards. For more information see *Specifications on page 43*.

The Freedom SW is intended to be used for recreational vehicle and commercial applications.

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 or vital systems.

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

EMI Information to the User

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC and ISED CAN ICES-003 Rules. These limits are designed to provide reasonable protection against harmful interference in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular environment. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

⚠CAUTION

Unauthorized changes or modifications to the equipment could void the user’s authority to operate the equipment.

End of Life Disposal

The Freedom SW Inverter/Charger is designed with environmental awareness and sustainability in mind. At the end of its useful life, the Freedom SW can be decommissioned and disassembled. Components which can be recycled must be recycled and those that cannot be recycled must be disposed of according to local, regional, or national environmental regulations.

Many of the electrical components used in the Freedom SW Inverter/Charger are made of recyclable material like steel, copper, aluminum, and other alloys. These materials can be auctioned off to traditional scrap metal recycling companies who resell reusable scraps.

Electronic equipment such as the circuit boards, connectors, and fuses can be broken down and recycled by specialized recycling companies whose goal is to avoid having these components end up in the landfill.

For more information on disposal, contact Xantrex.

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1 INTRODUCTION

Congratulations on your purchase of the Freedom SW Inverter/Charger (Freedom SW). The Freedom SW has been designed to give you premium power, ease of use, and outstanding reliability.

Please read this chapter to familiarize yourself with the components of the Freedom SW.

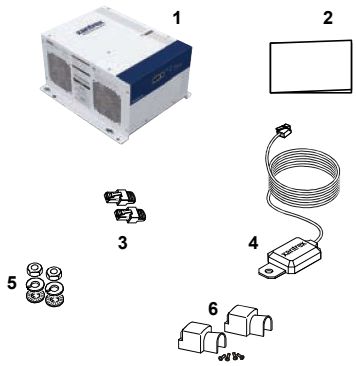
NOTE: There are eight models of the Freedom SW. Throughout the guide, Freedom SW units may be referred to according to these categories. For example, Freedom SW 110VAC models apply only to models under the 110 AC Voltage category.

Model Name	Product Number	Output Power* (watts)	AC Voltage	DC Voltage	Network
Freedom SW 12V 2012	815-2012	2000	110	12	Xanbus
Freedom SW 12V 3012	815-3012	3000	110	12	Xanbus
Freedom SW 24V 2024	815-2024	2000	110	24	Xanbus
Freedom SW 24V 3024	815-3024	3000	110	24	Xanbus
Freedom SW 2012 RVC	815-2012-03	2000	110	12	RV-C
Freedom SW 3012 RVC	815-3012-02	3000	110	12	RV-C
Freedom SW 24V 2524	815-2524-02	2500	230	24	Xanbus
Freedom SW 24V 3524	815-3524-02	3500	230	24	Xanbus

* see *"Specifications" on page 43* for detailed information.

Materials List

The Freedom SW ships with the following items:



1	one Freedom SW unit
2	Product Notice
3	two network terminators
4	one Battery Temperature Sensor (BTS)
5	two sets of 5/16"-18 nuts and washers for the DC terminals
6	DC terminal covers (one red, one black) with two sets of #6-32 screws

Figure 1 What's In The Box

NOTE: If any of the items are missing, contact customer service or any authorized Xantrex dealer for replacement. See *ABOUT THIS GUIDE on page 1*.

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

2 INSTALLATION

This section provides sample installation information as a guide for your installation. For your convenience, the overall procedure is divided into these main steps:

Before You Begin the Installation *8*
Installation Codes *8*
Basic Installation Procedures *9*

Before You Begin the Installation

Before beginning your installation:

- Read this 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 *Safety Information on page 1*.
- Be aware of all safety and electrical codes which must be met.

⚠WARNING

ELECTRICAL SHOCK AND FIRE HAZARD

- All wiring shall be done by qualified personnel to ensure compliance with all applicable installation codes and regulations.
- Do not connect to AC and DC power sources during installation. Disconnect from all power sources when servicing.
- Disable and secure all AC and DC disconnect devices and automatic generator starting devices.

Failure to follow these instructions can result in death, serious injury, or equipment damage

Installation Codes

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

- The U.S. National Electrical Code (NEC)
- The Canadian Electrical Code (CEC)
- The U.S. Code of Federal Regulations (CFRs)
- Canadian Standards Association/CSA Group (CSA) and the RV Industry Association (RVIA) standards and codes for installations in RVs
- The American Boat and Yacht Council (ABYC) standards and US Coast Guard Regulations (33CFR183, Sub Part I) for Marine installations in the U.S.

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

Basic Installation Procedures

This section provides sample installation information as a guide for your installation. For your convenience, the overall procedure is divided into these main steps:

Planning the Installation *9*
Step 1: Choosing a Location for the Unit *18*
Step 2: Mounting the Unit *19*
Step 3: Connecting the AC Input and AC Output Wires *21*
Step 4: Connecting the DC Cables *23*
Step 5: Connecting the Battery Temperature Sensor (BTS) *25*
Step 6: Connecting to the Network *27*
Step 7: Performing Checks Prior to Initial Start-Up *27*
Step 8: Testing Your Installation *28*

Planning the Installation

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

As your system configuration is determined, record the details in *Information About Your System on page 3* in this 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 *Planning the Installation on page 9*.

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 10 feet (3.1 m) 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

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

Planning Preparations

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.

AC components include:

- AC Input for Dual AC Line
- AC Input for Single AC Line
- AC Loads
- AC Disconnect and Over-Current Protection Device
- Distribution Panels
- AC Wiring
- AC Output Neutral Bonding

DC components include:

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

Xanbus Network considerations include:

Detailed information on planning and installing your Xanbus network is available in the *Xanbus System Control Panel Guide*. Refer to the 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*.

Figure 2 Typical Xanbus Network

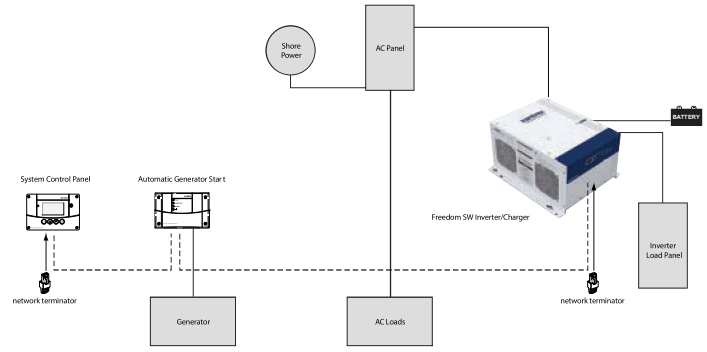
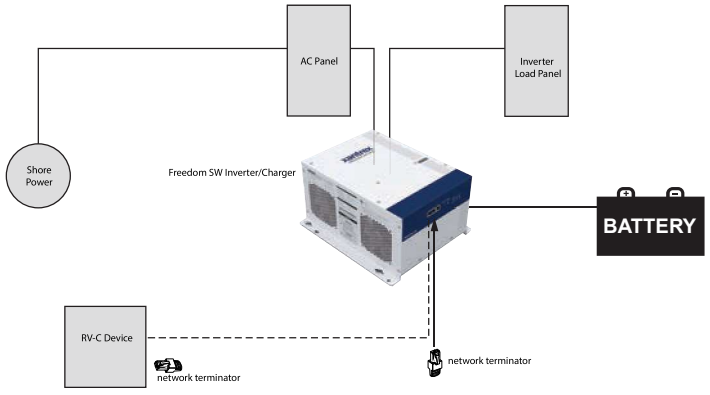
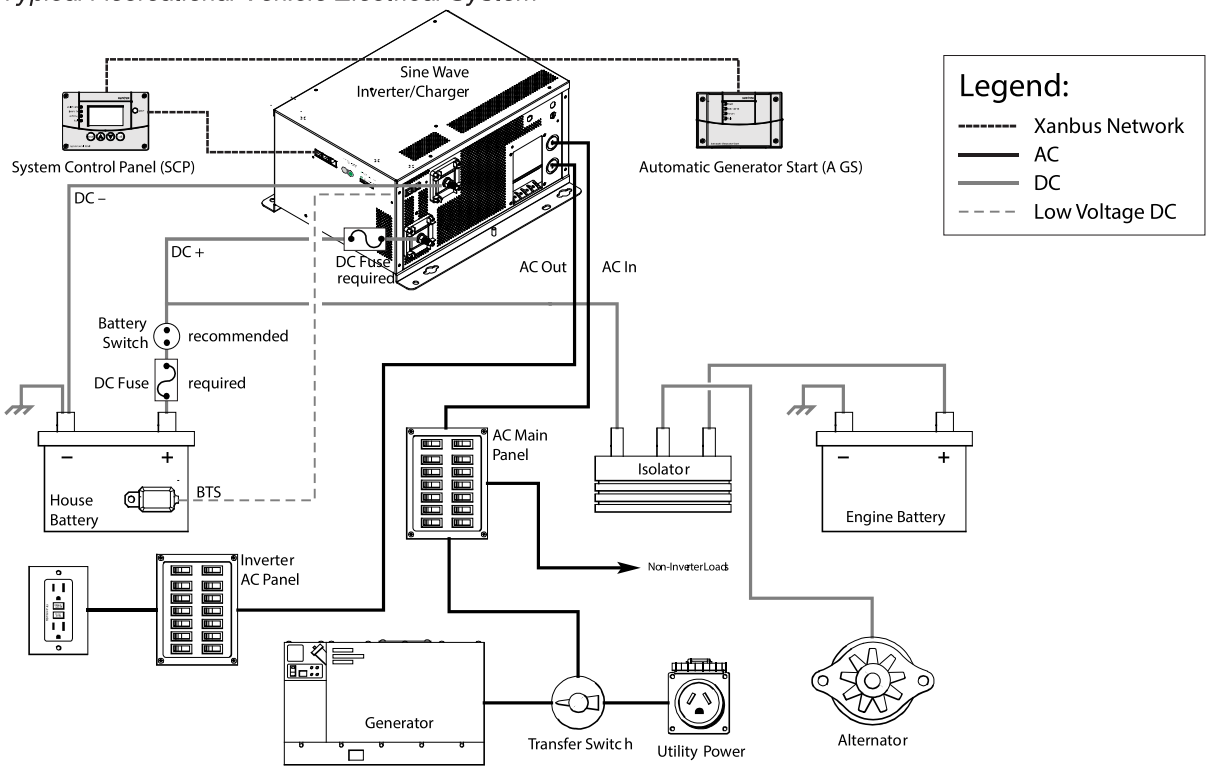


Figure 3 Typical RV-C Network



NOTE: The RV-C network is compatible with RV-C devices only.

Figure 4 Typical Recreational Vehicle Electrical System



NOTE: Features a Freedom SW 12V 3012 inverter/charger.

Figure 5 Wiring and Breakers Block Diagram for Freedom SW 12V 2012 / Freedom SW 24V 2024

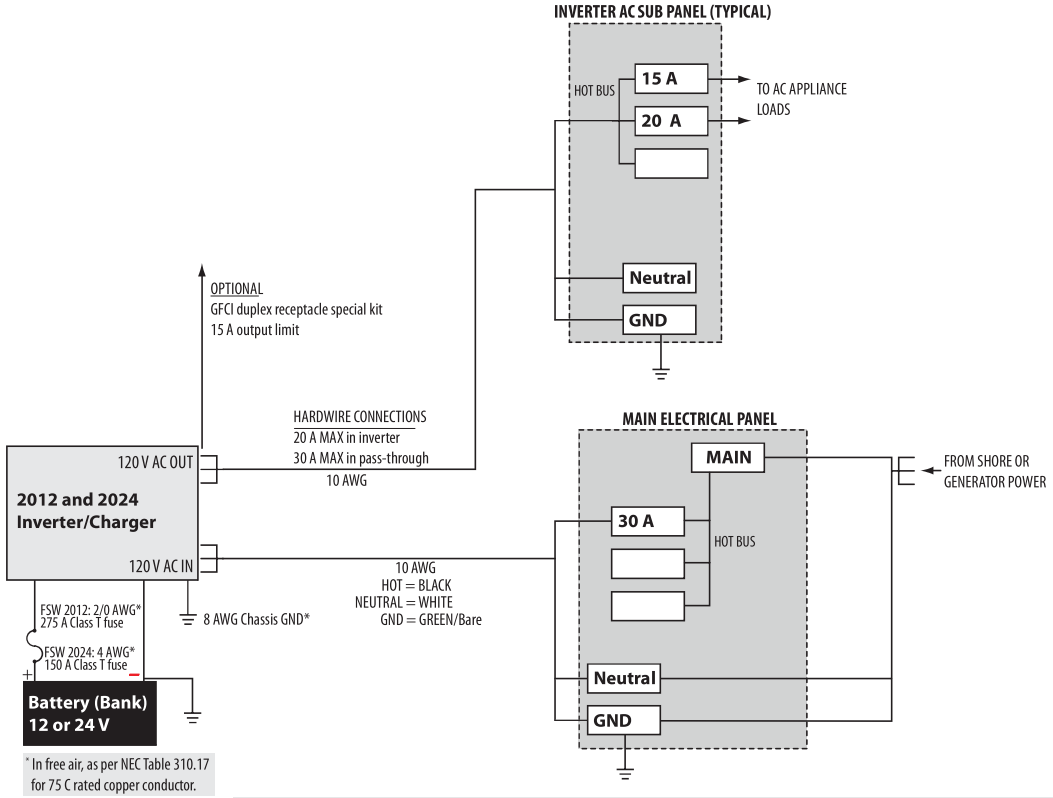
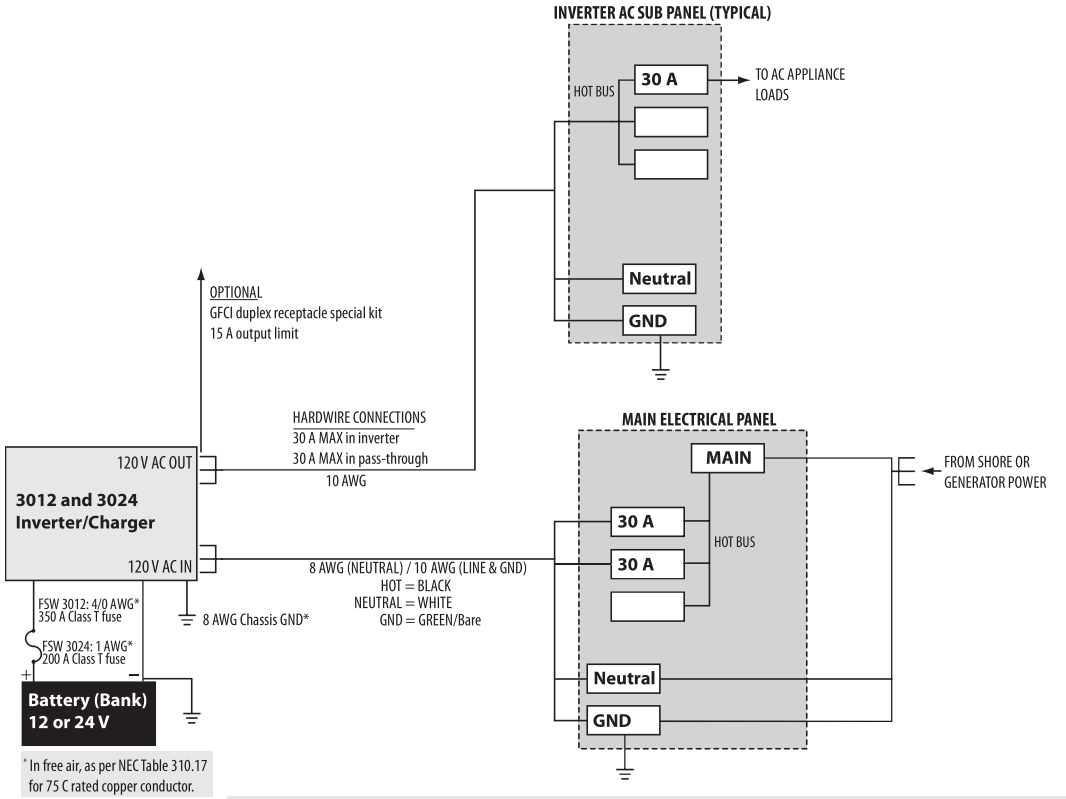


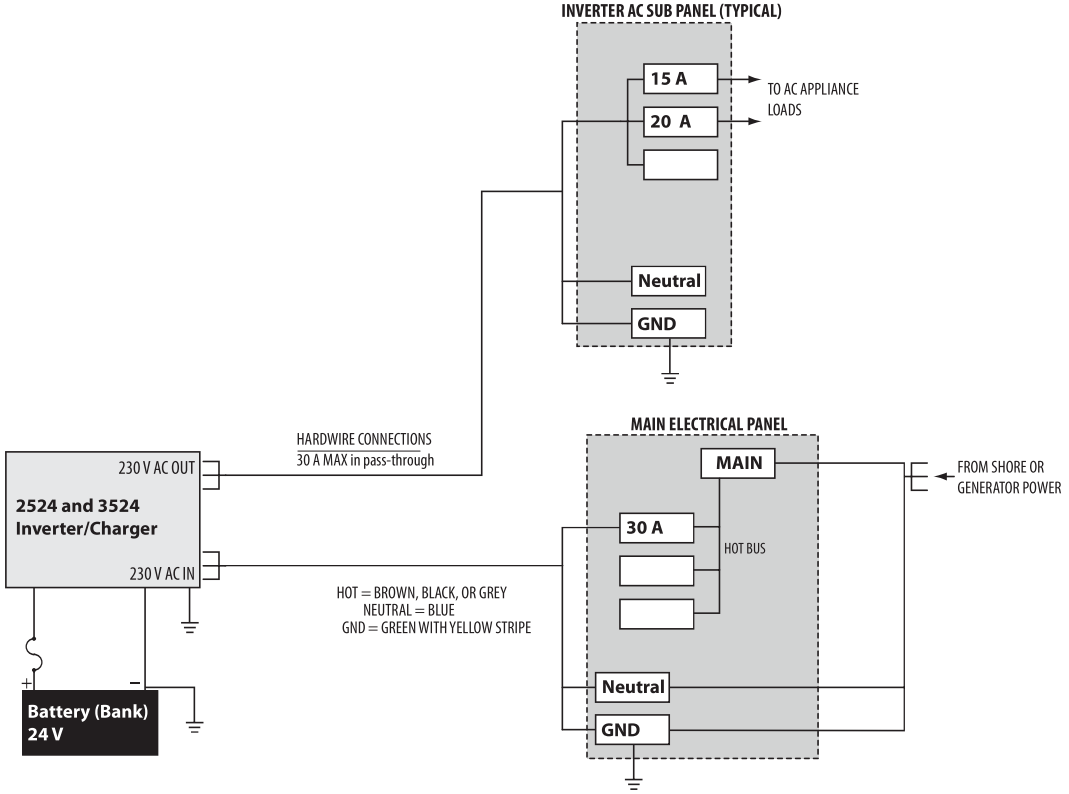
Figure 6 Wiring and Breakers Block Diagram for Freedom SW 12V 3012 / Freedom SW 24V 3024



* Recreational Vehicles only. For Marine applications see NOTE below.

NOTE: 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 16 AWG.

Figure 7 Wiring and Breakers Block Diagram for Freedom SW 24V 2524 / Freedom SW 24V 3524



NOTE: 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 2mm^2.

AC Components

NOTE: Applies to all models of the Freedom SW with some exceptions that would be referred to accordingly.

The Freedom SW has the capability of supporting several AC shore power configurations. Single-line input and dual-line input configurations. They are described as follows:

AC Input for Single AC Line

AC input to a single AC line can be supplied from a single-phase 120 volt 60 Hz AC source such as the utility grid (power company), a generator, or the output of a transfer switch.

Applicable only to Freedom SW 24V 2524 *and* Freedom SW 24V 3524*:* 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 Input for Dual AC Lines

AC inputs to a dual AC lines can be supplied from a split-phase or dual-input AC source such as the utility grid (power company), a generator, or the output of a transfer switch. The Freedom SW can be operated from the following types of 120 volt 60 Hz AC sources:

Split phase:

This source type has two lines, one neutral, and one ground. The two 120 volts AC lines are 180 degrees out of phase with each other, so that the two voltages total to 240 volts AC line to line. The voltage between each line and neutral is still 120 volts AC, and the voltage between the neutral and ground is approximately zero.

Because the two lines are out of phase, the currents from each line subtract in the neutral, and the neutral current will be approximately zero if the loads are equal. For example, if Line 1 is supplying 20 amps and Line 2 is supplying 15 amps, the current in the neutral will be 5 amps.

Dual input:

This source type has two line inputs, one neutral, and one ground. Unlike the split-phase type, the two lines are in phase (not out of phase), and must come from the same source. The voltage between the two lines is zero. The voltage between each line and the neutral is 120 volts AC, and the voltage between the neutral and ground is approximately zero.

Because the two lines are in phase, the currents from each line add together in the neutral. For example, if Line 1 is supplying 20 amps and Line 2 is supplying 15 amps, the current in the neutral will be 35 amps.

AC Output

The output voltage on Freedom SW inverter/chargers is 120VAC. Both configurations are supported - Single Input and Single Output line (SI-SO) configuration and Dual Input and Dual Output lines (DI-DO) configuration.

Applicable only to Freedom SW 24V 2524 *and* Freedom SW 24V 3524*:* 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 is intended to power loads consisting of 120 volts AC appliances.

In Invert mode, the Freedom SW connects L1 and L2 output lines together to provide 120 volts AC to loads on either line. In AC Bypass mode, the source connected to the AC input is passed through to the load. Because of the way invert mode operates, only 120 volts (or 230 volts) AC appliances can be connected to the Freedom SW output.

Applicable only to Freedom SW 24V 2524 *and* Freedom SW 24V 3524*:*The Freedom SW is intended to power loads consisting of 230 volts/50 Hz AC appliances.

In Invert mode, the Freedom SW 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 output.

AC Disconnect and Over-Current Protection Device

To meet CSA, UL, and 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 breakers protecting the AC input of the Freedom SW must be approved for use on 120 volts AC branch circuits, and must be located in each Line. The breakers must be rated as shown below:

Split phase input:

No more than 30 amps max in each line.

Because the two lines are out of phase, the currents from each line subtract in the neutral, and the neutral current will be approximately zero if the loads are equal. For example, if Line 1 is supplying 20 amps and Line 2 is supplying 15 amps, the current in the neutral will be 5 amps.

Dual input:

The neutral current in a dual-input system is the sum of the two line currents, and must be limited to 60 amps maximum to protect the transfer relay in the Freedom SW. Each breaker must not exceed 30 amps, and the total (sum) of the ratings of the two breakers must not exceed 60 amps.

Applicable only to Freedom SW 24V 2524 *and* Freedom SW 24V 3524*:* The breaker protecting the AC input of the Freedom SW 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 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 Requirement

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 requires GFCI protection of certain branch circuits. Consult all applicable codes.

Tested GFCIs

Compliance with UL standards requires that the manufacturer test and recommend specific GFCIs for use on the output of the inverter. Table 1 lists models that have been tested and will function properly when connected to the AC output of the Freedom SW.

Table 1Tested GFCI Models

Manufacturer	Model Number
Hubbell	GF15WLA
Leviton	N7599-GY
Pass & Seymour	1595-W

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 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 2 AC Wire Size In and Out of the Inverter/Chargers

Models	Single phase	Split phase	Dual input
	Freedom SW 12V 2012, Freedom SW 24V 2024 | Freedom SW 24V 2524, Freedom SW 24V 3524 | 815-2012-03	**Freedom SW 12V 3012, Freedom SW 24V 3024, Freedom SW 3012 RVC**	
Breaker Size Used	30 amps per line	30 amps per line	30 amps per line
Wire Size	No. 10 AWG | 32 mm^2	No. 10 AWG No. 8 AWG (**N** only)	
Color Coding	**L**: black, red | black, brown, grey **N**: white | blue **Gnd**: green | green/yellow stripe	**L1**: black **N**: white **L2**: red **Gnd**: green	**L1**: red or black **N**: white **L2**: red or black **Gnd**: green

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 25-amp maximum inverter current, or by the bypass current, which is determined by the overcurrent protection provided ahead of the Freedom SW.

Some conditions for Freedom SW:

- If the input wiring is split-phase, the output wiring must be sized to coordinate with the breakers used on the input. Refer to your applicable installation codes.
- If the input wiring is dual-input and the output wiring is single-input, the following rules apply: If the input breaker on L1 is greater than 25 amps, the wire size must be coordinated for that amperage. If the input breaker on L1 is less than 25 amps, the wire size must be coordinated for 25 amps. The wire size must not be sized for anything lower than 25 amps.
- If both the input and the output wiring are dual-input, the output wiring for each line (L1 and L2) must be calculated separately, following these rules: If the input breaker on the specific line is greater than 25 amps, the wire size for that line and its neutral must be coordinated for that amperage. If the input breaker on the specific line is less than 25 amps, the wire size for that line and its neutral must be coordinated for 25 amps. The wire size must not be sized for anything lower than 25 amps.

Applicable only to Freedom SW 24V 2524 *and* Freedom SW 24V 3524*:* Wire size must be coordinated with the current the wiring will carry. This current may be determined by the 15-amp (Freedom SW 24V 3524) and 11-amp (Freedom SW 24V 2524) maximum inverter current, or by the bypass current, which is determined by the overcurrent protection provided ahead of the Freedom SW.

Size of Wiring Downstream of the AC Output Breaker

The wiring used between the AC output breaker and your loads must be sized to match the output breaker.

AC Output Neutral Bonding

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.

The AC source must have its neutral conductor bonded to ground.

Bonding system

The Freedom SW provides a system that automatically connects the neutral conductor of the inverters AC output circuit to safety ground ("bonding" it) while the inverter/charger is inverting, and disconnects it ("unbonding" it) when the inverter/charger is connected to external AC power. This system is designed to conform to installation codes that require AC sources such as inverters and generators to have their neutral conductors tied to ground at the source of power in the same way that the neutral conductor from the utility is tied to ground. These same codes specify that the neutral can only be connected to ground in one place at any one time.

Suitability

This automatic neutral-to-ground bonding system requires AC input sources with bonded neutral. This will be the case in most situations: in a utility feed, at an external AC hook-up, or a generator with a bonded neutral. If not, have an electrician look into bonding the source's neutral to ground. See also *General AC Wiring Considerations on page 21*.

DC Components

Batteries

The Freedom SW system requires a 12-volt (or 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 Sizing Example on page 39* 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 Connections on page 40*.

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.

Size and Length

See *Table 3* for required DC cable length, cable size and required fuse size for the Freedom SW. Wire size is usually marked on the cables.

Table 3 Minimum Recommended Battery Cable Sizes for Copper Conductors Rated 75 °C

Model	Typical Amps (A)	Conduit *	Free Air *
		Cable Length < 10 ft.	Cable Length < 5 ft.
Freedom SW 12V 2012: 815-2012	250	250 kcmil	2/0 AWG
Freedom SW 12V 3012: 815-3012	320	400 kcmil	4/0 AWG
Freedom SW 24V 2024: 815-2024	120	1 AWG	4 AWG
Freedom SW 24V 3024: 815-3024	180	3/0 AWG	1 AWG

Table 4 Minimum Recommended Battery Cable Sizes for Copper Conductors Rated 75 °C for RV-C Models

Model	Typical Amps (A)	Conduit *	Free Air *
		Cable Length < 10 ft.	Cable Length < 5 ft.
Freedom SW 2012 RVC: 815-2012-03	250	250 kcmil	2/0 AWG
Freedom SW 3012 RVC : 815-3012-02	320	400 kcmil	4/0 AWG

Table 5 Minimum Recommended Battery Cable Sizes for Copper Conductors Rated 75 °C for 230VAC Models

Model	Typical Amps (A)	Conduit (Free Air)*	Conduit (Free Air)*
		Cable Length < 1.5 m	1.5 m < Cable Length < 3.0 m
Freedom SW 24V 2524: 815-2524-02	140	50 mm^2 (25 mm^2)	70 mm^2 (35 mm^2)
Freedom SW 24V 3524: 815-3524-02	200	240 mm^2 (120 mm^2)	300 mm^2 (150 mm^2)

* 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, serious injury, or equipment damage.

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. 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.

Recommended Fuse Size

Table 6 Recommended Fuse Size

Model	Typical Amps (A)
Freedom SW 12V 2012: 815-2012	275
Freedom SW 12V 3012: 815-3012	350
Freedom SW 24V 2024: 815-2024	150
Freedom SW 24V 3024: 815-3024	200

Table 7 Recommended Fuse Size for RV-C Models

Model	Typical Amps (A)
Freedom SW 2012 RVC: 815-2012-03	275
Freedom SW 3012 RVC : 815-3012-02	350

Table 8 Recommended Fuse Size for 230VAC Models

Model	Typical Amps (A)
Freedom SW 24V 2524: 815-2524-02	200
Freedom SW 24V 3524: 815-3524-02	250

Based on National Electrical Code (NEC) requirements. The NEC requires that the cables be protected by a fuse or breaker rated to match the cables' ampacity at 75 °C.

Marine Applications*

A charger needs to be equipped with a disconnect and an over-current protection device, usually within seven inches (18 cm) of each battery's positive terminal and another over-current protection device seven inches (18 cm) near the charger's positive terminal.

* Per ABYC E-11

DC Grounding

Recreational Vehicles

The inverter/charger DC (chassis) ground terminal needs to be connected to the vehicle chassis by a minimum No. 8 AWG copper conductor that is stranded wire rated 75 °C minimum.

Marine Applications*

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 16 AWG.

* Per ABYC A-31

DC Grounding for RV-C Models

The inverter/charger DC (chassis) ground terminal needs to be connected to the vehicle chassis by a minimum No. 8 AWG copper conductor that is stranded wire rated 75 °C minimum.

DC Grounding for 230VAC Models

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 stranded wire rated 75 °C minimum.

Marine Applications*

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.

* refer to local electrical codes

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 result in equipment damage.

Unpacking and Inspecting the Freedom SW

⚠CAUTION

PHYSICAL INJURY HAZARD

The Freedom SW Inverter/Charger is heavy. 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 injury or equipment damage.

To unpack and inspect:

NOTE: Applies to all models of the Freedom SW with some exceptions that would be referred to accordingly.

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

- Unpack the unit and check the materials list. If anything is missing from the shipping box, contact Customer Service. See *Contact Information on page 3*.
- Record the serial number of the Freedom SW and other purchase information for any future warranty issues. You will be asked for this product information if you need to call Customer Service.
- Save your purchase receipt to use as proof-of-purchase. This receipt is required if the inverter/charger should need warranty service.
- 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 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 and the battery temperature sensor.

- Wire stripper
- Crimping tools for fastening lugs and terminals on DC cables
- Phillips screwdriver: #2
- Slot screwdriver (1/4" | 6mm wide blade max.)
- Needle-nose pliers
- Wrench for DC terminals: 9/16" | 15mm

NOTE: For a list of tools and materials required to install the network, refer to the appropriate guide.

Materials

You will need the following materials to complete your installation:

- Strain-relief clamp(s) for AC cables (not provided): 3/4" and/or 1" | ø28.3mm and/or ø34.6mm
- DC battery cables
- Lugs for DC cables (for 3/8" | 10mm stud size)
- Copper wire for DC grounding: No. 8 AWG | 8 mm^2. See *DC Grounding on page 25*
- Lugs for DC grounding cable (for 1/4" | M6 stud size)
- AC and DC disconnect switches and overcurrent protective devices and connectors as required. See *General AC Wiring Considerations on page 21*
- AC output and input wire. See *General AC Wiring Considerations on page 21*.
- If the AC ground wire is stranded, each ground wire requires a ring terminal
- Six 1/4" | M6 pan-head steel screws to mount the unit to a wall
- Inverter drip shield (PN: 808-9004) if mounting in UL458-compliant marine installation

Step 1: Choosing a Location for the Unit

⚠WARNING

FIRE, EXPLOSION, AND HEAT HAZARDS

- Do not install the Freedom SW 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. This equipment contains components that tend to produce arcs or sparks.
- Do not cover or obstruct the ventilation openings. Do not install the Freedom SW in a zero-clearance compartment. Overheating may result.

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

The Freedom SW should only be installed in locations that meet 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. 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.

Use inverter drip shield (PN: 808-9004) for UL458-compliant marine installations.

Cool Normal air temperature should be between 32 °F and 140 °F (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 3 inches (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 *on page 9* and *Planning the Installation on page 9*. 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 can be mounted above the batteries if so desired (a position outlined in this guide). 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 must be mounted in one of the approved mounting orientations. See *Figure 8 on page 20*.

Step 2: Mounting the Unit

Considerations

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

The weight of the Freedom SW inverter/charger requires two people to install it. Mounting considerations are shown in *Approved Mounting Orientations on page 20*.

⚠CAUTION

PHYSICAL INJURY HAZARD

- The Freedom SW is heavy (see *Net Weight on page 43*).
- Do not lift the unit by yourself.
- Use two people to lift and mount the unit.
- Always use proper lifting techniques during installation to prevent injury.
- Make sure that the wall can support a load of up to 70 lbs (32 kg).
- Do not install in plasterboard (drywall) using drywall anchors.
- Attach the unit to wall studs. Use appropriately sized screws depending on wall material and thickness.

Failure to follow these instructions can result in injury or equipment damage.

The Freedom SW mounting orientations are shown in *Approved Mounting Orientations on page 20*.

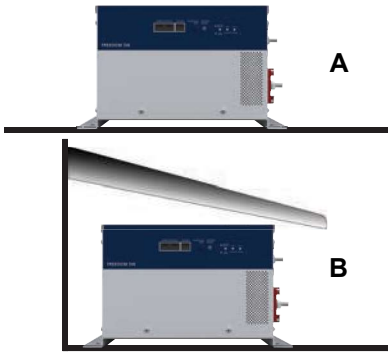
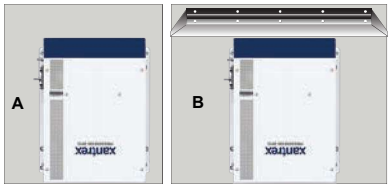
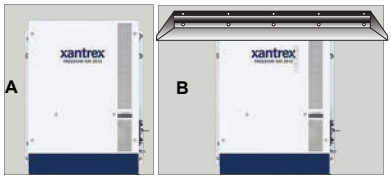
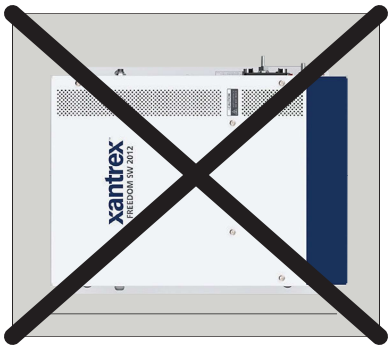
Mount your inverter/charger before you connect any wires or cables.

To mount the inverter/charger:

NOTE: Applies to all models of the Freedom SW with some exceptions that would be referred to accordingly.

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 must be mounted in one of the orientations shown in *Figure 8 on page 20*.
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 1/4" | M6 pan-head steel screws.

Figure 8 Approved Mounting Orientations

Orientation		Approved Mounting Orientation?	Comment
Desktop Mount		A - Yes B - Yes when used with inverter drip shield	A - Suitable only for non-marine applications with no risk of condensation or dripping water. B - The drip shield is installed on top of the inverter with some clearance. Suitable only for non-marine applications.
Wall Mount DC on Left		A - Yes B - Yes when used with inverter drip shield	A - On a vertical surface with DC terminals facing left. 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.
Wall Mount DC on Right		A - Yes B - Yes when used with an inverter drip shield (PN: 808-9004) for marine installations	A - On a vertical surface with DC terminals facing right. 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.
Wall Mount DC Up		Not Allowed	Not acceptable. This orientation does not meet regulatory requirements.
Wall Mount DC Down		Not allowed	Not acceptable. This orientation does not meet regulatory requirements.

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

NOTE: Applies to all models of the Freedom SW with some exceptions that would be referred to accordingly.

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 9 on page 21*.
AC Knockouts	There are two dual 1.0"/ 3/4" | ø34.6mm/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 *Planning the Installation on page 9* for required sizes.

Connecting AC Input Wires

NOTE: Applies to all models of the Freedom SW with some exceptions that would be referred to accordingly.

Figure 9 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 9 AC Wiring Compartment

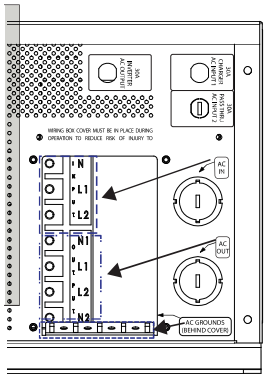


Figure 10 AC Wiring Compartment of Freedom SW 12V 2012 and Freedom SW 24V 2024

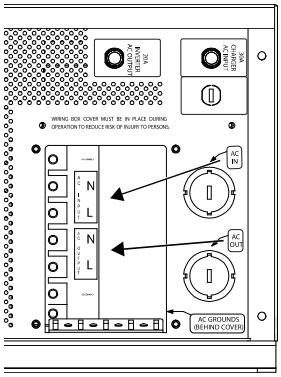
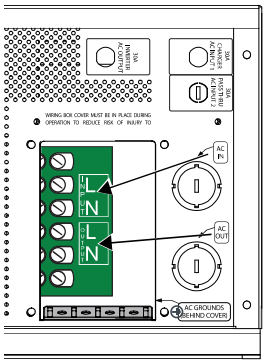


Figure 11 AC Wiring Compartment of Freedom SW 24V 2524 and Freedom SW 24V 3524



NOTICE

EQUIPMENT DAMAGE

- Connect wires to the correct terminals in the terminal block that is split into INPUT and OUTPUT sections. Damage may occur if the unit is wired incorrectly to the wrong terminals.
- Do not remove or loosen factory installed wiring.

Failure to follow these instructions can result in equipment damage.

When making the AC input and AC output connections, observe the correct color code for the appropriate AC wire, as described in *Planning the Installation on page 9*.

To make the AC input connections:

NOTE: Applies to all models of the Freedom SW with some exceptions that would be referred to accordingly.

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 2 inches (50 mm) off the jacket from the AC cable and separate the wires.
7. Using a 1/4" | 6mm 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, *General AC Wiring Considerations on page 21*):

   For Freedom SW 12V 3012/Freedom SW 24V 3024/Freedom SW 3012 RVC :

   Connect Line 1 to **L1**, Neutral to **N**, Line 2 to **L2**.

   For Freedom SW 12V 2012/Freedom SW 24V 2024:

   Connect Line to **L**, Neutral to **N**, Ground to **G**.

   For Freedom SW 24V 2524/Freedom SW 24V 3524:

   Connect Line to **L**, Neutral to **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, *AC Wiring Compartment on page 21*. 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 result in equipment damage.

To make the AC output wiring connections:

NOTE: Applies to all models of the Freedom SW with some exceptions that would be referred to accordingly.

1. Remove one of the AC knockouts from the front or side of the unit. Do not leave the knockout inside the wiring compartment.
2. The applicable installation code may not allow you to run the AC input and AC output wiring through the same AC knockout.
3. Install a strain-relief clamp in the AC knockout and run the AC wiring through the strain-relief clamp.
4. Strip approximately 2 inches (50 mm) off the jacket from the AC cable and separate the wires.
5. Using a 1/4" blade slot screwdriver, loosen the terminal screws on the AC output terminals. Do not remove the screws.
6. Connect the line and neutral wires to the output terminals (labeled AC Output on the terminal block, *Figure 9 on page 21*) as follows:

   For Freedom SW 12V 3012/Freedom SW 24V 3024/Freedom SW 3012 RVC :

Terminals	Line for Dual Output	Lines for Single Output
N2	Neutral 2	Unused
L2	Line 2	Unused
N1	Neutral 1	Neutral
L1	Line 1	Line

   For Freedom SW 12V 2012/Freedom SW 24V 2024/Freedom SW 24V 2524/Freedom SW 24V 3524:

Terminals	Lines for Single Output
N	Neutral
L	Line

7. Tighten the terminal screws. Leave some slack wire inside the wiring box.
8. Connect the ground wires to a free position on the ground bus, *Figure 9 on page 21*. 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.
9. Secure the strain-relief clamp on the AC output cable jacket.

10. Attach the wiring compartment cover panel and tighten the four screws.
11. 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 DAMAGE

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

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

Recommended Cable Sizes and Lengths and Fuse Size

For recommended DC cables and fuse sizes, see *on page 9* and *Planning the Installation on page 9*.

Preparing the Cables

To prepare the DC cables:

NOTE: Applies to all models of the Freedom SW with some exceptions that would be referred to accordingly.

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.
   It is recommended to use crimp connectors. The connector should be designed for a 3/8" (9.4mm) stud size to connect to the Freedom SW. 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.
   It is recommended to use crimp connectors. The connector should be designed for a 1/4" (6.35mm) stud size to connect to the Freedom SW. 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.

⚠DANGER

ELECTRICAL SHOCK AND FIRE DAMAGE

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

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

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 11–12 ft-lbs or 132–144 inch-lbs or 14.9–16.3 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 12 on page 24*.

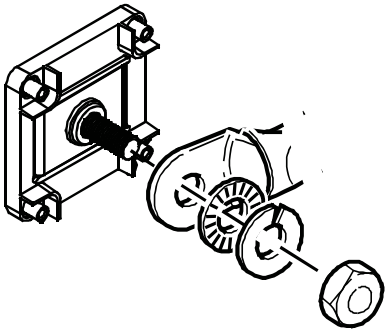
Failure to follow these instructions can result in equipment damage.

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 (–).

To connect the DC cables:

1. Route the DC cables from the battery bank to the inverter/charger. Observe the guidelines in *Planning the Installation on page 9*.
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 *Planning the Installation on page 9* 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 4. The connector goes on first, then the flat washer (steel), lock washer (steel), and 3/8" (9.52mm) bolt (brass).
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 11–12 ft-lbs or 132–144 inch-lbs or 14.9–16.3 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 14 on page 25*. The connector goes on first, then the flat washer (steel), lock washer (steel), and 3/8" bolt (brass).

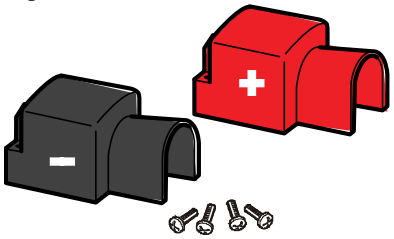
Figure 12 DC Cable Connections



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 11–12 ft-lbs or 132–144 inch-lbs or 14.9–16.3 Nm at the inverter/charger end.
10. To protect the DC terminals, attach the DC terminal covers (*Figure 13*) to the inverter/charger, using the screws provided.

Figure 13 DC Terminal Covers



⚠ Use red POS(+) cover for POS(+) terminal. Use black (NEG(-) cover for NEG(-) terminal.

DC Grounding

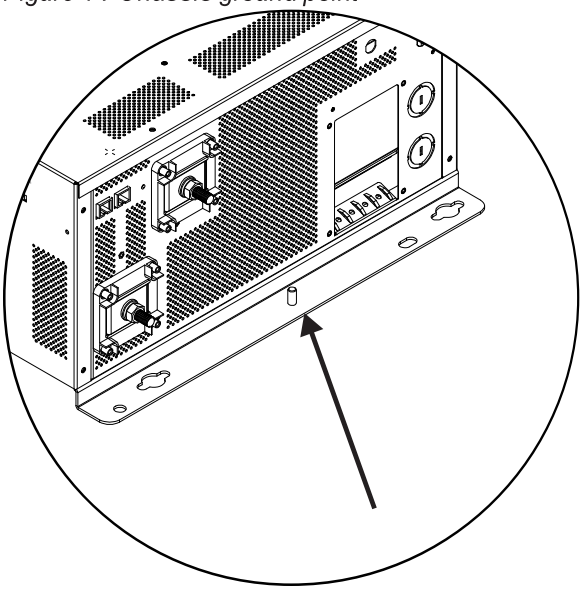
The Chassis Ground point on the inverter/charger is used to connect the chassis of the inverter/charger to your system's DC grounding point, as required by regulations for some installations. Use 8AWG minimum-sized, stranded copper wire rated minimum 75 °C and connect it between the Chassis ground point (see *Figure 14 on page 25*) and the vehicle's DC grounding point (usually the vehicle chassis or a dedicated DC ground bus).

The grounding guideline given below assumes you are using the code-compliant DC supply cable and fuse sizes indicated *on page 9*. 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 bolt of the chassis ground point shown in *Figure 14* .
2. Connect the grounding cable between the chassis ground point and the DC grounding point for your system.
3. In an RV or vehicle installation, the DC grounding point will usually be the vehicle chassis or a dedicated chassis ground bus.
4. Tighten the nut to a torque of 1.0–1.25 ft-lbs (1.47–1.7 Nm).

Figure 14 Chassis ground point



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.

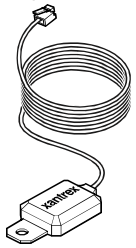
The BTS has a self-adhesive backing and attaches to the side of the battery. A 25-foot (7.6 m) cable is supplied with the BTS.

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 15 BTS with Cable



NOTICE

EQUIPMENT DAMAGE

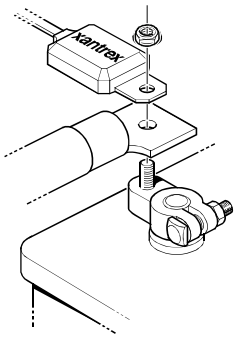
Use only the Freedom SW-compatible Battery Temperature Sensor (BTS). To order a spare BTS, call customer service and order part number 809-0946.

Failure to follow these instructions can result in equipment damage.

Mounting to the Negative Battery Terminal

To mount the sensor on the negative battery terminal:

Figure 16 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.
6. 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.
7. Mount the sensor directly on top of the ring terminal (as shown in *Figure 16*) and firmly tighten the terminal nut.

⚠WARNING

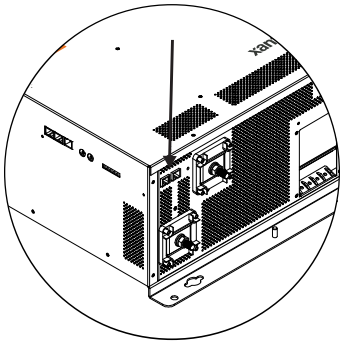
FIRE HAZARD

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, serious injury, or equipment damage.

8. Check to ensure that the sensor and all wires are held firmly and cannot be moved.
9. Turn the battery switch on again (if you opened it in Step 2.)
10. Route the sensor cable to the inverter/charger and plug it into the blue BTS port (as shown in *Figure 17*). Secure the cable along its length.

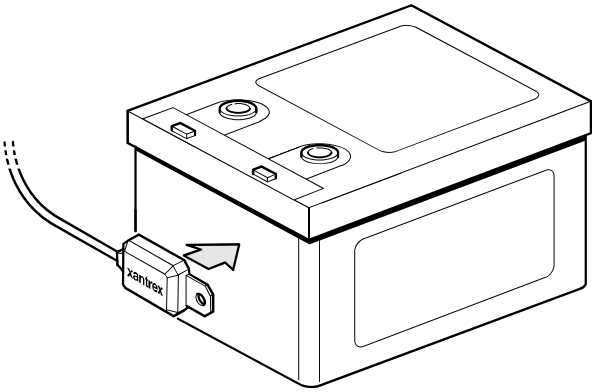
Figure 17 Connecting the BTS Cable to BTS Port



Mounting to the Side of the Battery Case

To mount the sensor on the battery case:

Figure 18 BTS Mounted on the Battery Case



1. Select the battery to be monitored.
2. The BTS should be connected to the battery bank that is directly connected to the inverter/charger.
3. Select a side suitable for attaching the sensor.
4. 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.
5. 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.
6. Peel the protective backing from the self-adhesive strip on the rear of the sensor.
7. Press the sensor firmly against the clean side of the battery to fix it in place (as shown in *Figure 18*).
8. Route the sensor cable to the inverter/charger and plug it into the Battery Temp. jack (as shown in *Figure 16*). Secure the cable along its length.

Step 6: Connecting to the Network

For your reference, *Figure 19* shows where the network connections are made on the Freedom SW.

To connect the Freedom SW to the Xanbus or RV-C network:

- Plug a network cable connected to the Xanbus or RV-C network into either one of the two network interface ports on the Freedom SW.

NOTICE

REVERSE POLARITY DAMAGE

- Connect the Freedom SW 3012 RVC only to other RV-C compatible devices. Connect the other models of Freedom SW only to Xanbus-compatible deveices.
- Do not attach the Freedom SW On/Off switch to these ports. 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.

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

Figure 19 Connecting to a Xanbus or RV-C Network Port



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 for this unit: 10–16 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

Do not use the INVERTER ENABLE button on the Freedom SW to de-energize the unit. This button and buttons on optional accessories like the Xanbus System Control Panel (PN: 809-0921), do not disconnect DC or AC power sources to the Freedom SW.

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

There are several tests to be performed for testing your installation. These tests will verify that:

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

If the test fails at any point, go to *Step 7: Performing Checks Prior to Initial Start-Up on page 27* and go through the checklist again to check the installation. Then perform the test again. If the test fails again, see the troubleshooting section in the Owner's Guide (document number: 975-1187-01-01).

Figure 20 Freedom SW Front Panel



Testing in Invert Mode

To test the Freedom SW 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.
2. 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).
3. If the bulb does not come on, make sure the voltage at the DC terminals on the Freedom SW is correct, as described in *Step 7: Performing Checks Prior to Initial Start-Up on page 27*.
4. After initialization, observe that none of the lights on the front panel should remain illuminated.
5. Press the INVERTER ENABLE button.
6. Verify that the INVERTER ENABLED LED is on.
7. Connect the Freedom SW 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.
8. Press the INVERTER ENABLE button to disable the inverter.
9. Verify that the INVERTER ENABLED LED is off.

Testing in Charge Mode and AC Bypass Mode

1. Close the AC supply breaker to supply AC power to the unit.
2. To verify that the Freedom SW starts charging:
   After a few seconds, verify that the AC IN/CHARGING LED on the front panel is turned on (indicating that the batteries are being charged).
3. To verify that Freedom SW correctly switches to Bypass mode:
   Disable the AC source and disable inverter mode 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 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 Owner's Guide (document number: 975-1187-01-01).

3 STACKING FEATURES

The Freedom SWs can support two stacking configurations. This gives the system engineer and/or installer more options to work with when tailoring a system to meet load demands. Multiple inverter/chargers of different power levels can be installed in a system as stand alone, parallel stacked, or series stacked.

NOTICE

INVERTER/CHARGER DAMAGE

Do not connect any wires to the AC INPUT L2 terminals on both units at all when stacking two Dual Input Line/Dual Output Line (DI-DO) units. The same applies to the AC OUTPUT L2 terminals on both units. Any damage sustained by non-compliance may damage the inverter/chargers and void the warranty. The only exception is AC OUTPUT N2.

Failure to follow these instructions can result in equipment damage.

The following table shows which models can be stacked together. **P** means parallel stacking is allowed, **S** means series stacking is allowed, and **X** means prohibited. The top row represents the Primary unit (`Master`). The left column represents the Secondary unit (`Slave`).

Table 9 Stacking Matrix between Models

MATCH MODELS	Freedom SW 12V 2012	Freedom SW 12V 3012	Freedom SW 24V 2024	Freedom SW 24V 3024	Freedom SW 2012 RVC	Freedom SW 3012 RVC	Freedom SW 24V 2524	Freedom SW 24V 3524
Freedom SW 12V 2012	P or S	P2 or S3	X	X	X	X	X	X
Freedom SW 12V 3012	P1 or S3	P or S	X	X	X	X	X	X
Freedom SW 24V 2024	X	X	P or S	P2 or S3	X	X	X	X
Freedom SW 24V 3024	X	X	P1 or S3	P or S	X	X	X	X
Freedom SW 2012 RVC	X	X	X	X	P or S	P2 or S3	X	X
Freedom SW 3012 RVC	X	X	X	X	P1 or S3	P or S	X	X
Freedom SW 24V 2524	X	X	X	X	X	X	P or S	P2 or S3
Freedom SW 24V 3524	X	X	X	X	X	X	P1 or S3	P or S

1 The secondary unit will start assisting if the primary unit draws more than 1200 W of power. Consequently, it will stop assisting if the primary unit draws less than 400 W of power.
2 The secondary unit will start assisting if the primary unit draws more than 1800 W of power. Consequently, it will stop assisting if the primary unit draws less than 600 W of power.
3 When configured for series stacking (dual-phase) 240 VAC, the 240 VAC loads are limited to a total of 4000 W but the higher rated units can handle an additional 1000 W of 120 VAC loads.

Parallel Stacking

A parallel stacking configuration 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 32*.

AC INPUT L2 terminals on both units must not be connected at all as they are not monitored lines.

IMPORTANT: Freedom SW models with dual AC lines do not monitor voltage and current on **AC INPUT L2** and **AC OUTPUT L2**. If any **L2** line is connected, any current flowing in this branch will not be displayed.

For Freedom SW Product Numbers: 815-2012, 815-3012, 815-2024, 815-3024, 815-3012-02

AC OUTPUT L1 of the Master unit must be connected to **AC OUTPUT L1** of the Slave unit as *Figure 21* shows.

AC OUTPUT N1 of the Master unit must also be connected to **AC OUTPUT N1** of the Slave unit as *Figure 21* also shows.

AC OUTPUT L1 and **AC OUTPUT L2** must not be connected together. However, the two output neutrals (**AC OUTPUT N1** and **AC OUTPUT N2**) can be tied together for redundancy. This reduces stress on the neutral path internal to the unit since two circuits will carry the load current.

For Freedom SW Product Numbers: 815-2524-02, 815-3524-02

AC OUTPUT L of the Master unit must be connected to **AC OUTPUT L** of the Slave unit as *Figure 22* shows.

AC OUTPUT N of the Master unit must be connected to **AC OUTPUT N** of the Slave unit as *Figure 22* also shows.

NOTE: For parallel stacking, there is no need to connect a SYNC cable to the STACKING ports of the units.

Figure 21 Parallel Stacking Using Two Freedom SW 12V 3012 units

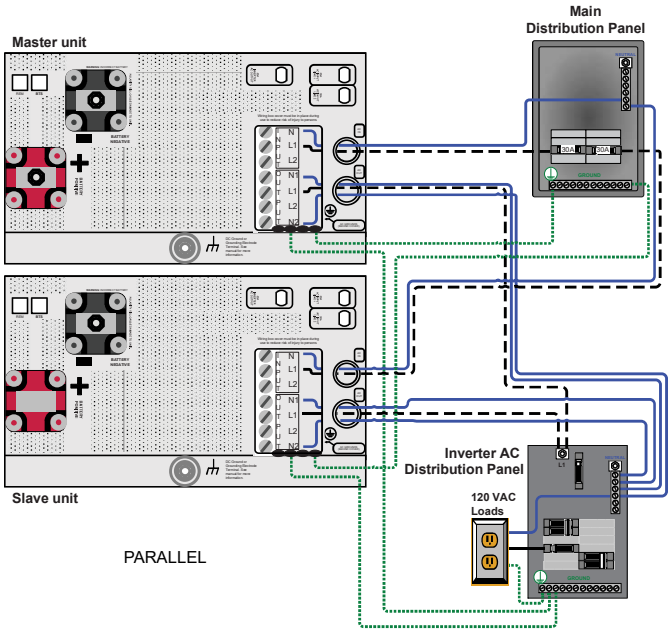
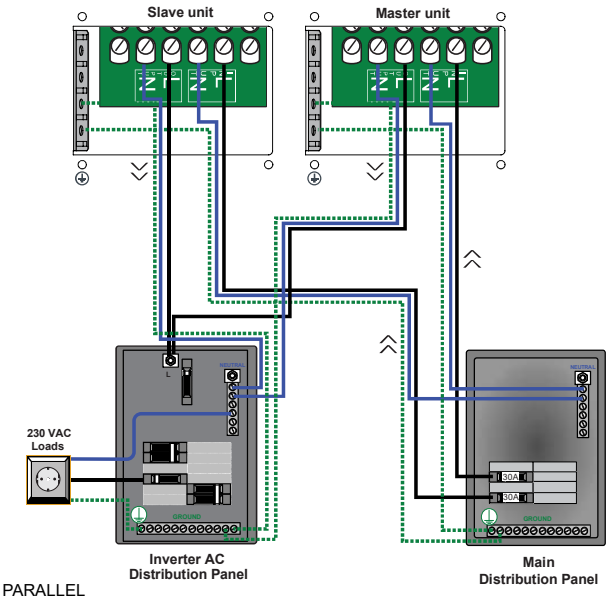


Figure 22 Parallel Stacking Using Two Freedom SW 24V 3524 units



Series Stacking

A series stacking configuration allows two inverters to be configured to produce 120 and 240 volts AC, also known as, a single-phase three-wire configuration. For example, a Freedom SW can be installed on L1 while another Freedom SW operates on L2. However, it is important to remember that for dual line AC configuration (DI-DO), only AC INPUT L1 terminal should be used and that the AC INPUT L2 terminal must have no connections at all. If L2 is connected to any incoming or outgoing AC line, the inverter/charger may suffer internal damage not covered by warranty.

NOTICE

GENERAL PRECAUTIONS

- Install stacked inverter/chargers in close proximity to each other.
- Connect AC neutrals together close to the inverters. Keep input and output neutrals isolated.
- Connect the inverter's battery negative terminals together according to instructions in *Step 4: Connecting the DC Cables on page 23*.
- Make all AC and DC connections and verify that they are made according to this guide. Make sure that all connections are tight (especially the DC side). Connect the Sync cable to each inverter's stacking port.
- Each inverter must be enabled and turned on individually before AC power becomes available.

Failure to follow these instructions can result in equipment damage.

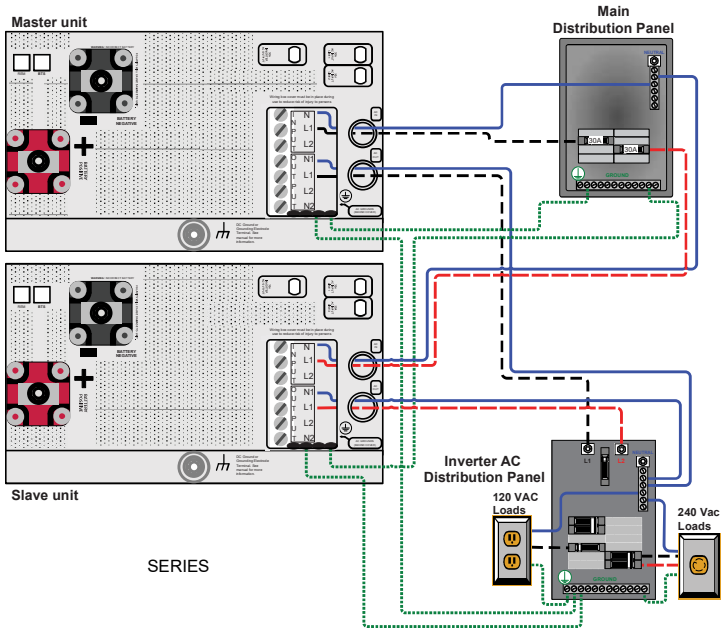
For Freedom SW Product Numbers: 815-2012, 815-3012, 815-2024, 815-3024, 815-3012-02

AC OUTPUT L1 of the Master unit must be connected to **L1** of the Inverter AC Distribution Panel. Similarly, **AC OUTPUT L1** of the Slave unit must be connected to **L2** of the Inverter AC Distribution Panel as *Figure 23* shows.

AC OUTPUT N1 of the Master unit and **AC OUTPUT N1** of the Slave unit must be connected to **NEUTRAL** of the Inverter AC Distribution Panel as *Figure 23* also shows.

NOTE:
Series Stacking is not allowed for Freedom SW Product Numbers: 815-2524-02, 815-3524-02.

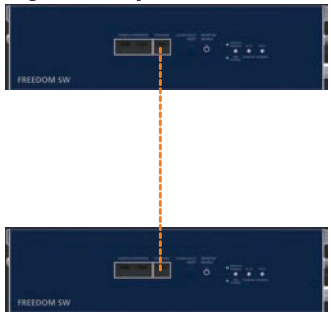
Figure 23 Series Stacking Using Two Freedom SW 12V 3012 units



Sync Cable

For series stacking (120 and 240 volts), connect the Xantrex Sync cable between the two STACKING ports.

Figure 24 Sync Cable for Series Stacking



To order the Sync cable, call customer service and order part number 808-9005.

Series Stacking Operation

The inverter is designed to accept power input from a single-phase, three-wire 120/240-volt AC system with 120 volts to each inverter. The input line (INPUT L or L1) terminal of each inverter accepts one leg of 120 volts each and the input neutral (INPUT N) terminals of both inverters are tied together and connected to the power source neutral leg.

Any AC load being powered while AC input is present to the inverters will be in addition to the power being drawn for charging the batteries. Each unit in the stack can provide a full rated pass-through current depending on the model. See *Specifications on page 43* for the unit's AC output current ratings.

When AC input power is lost, both units in the stack switch from charger to inverter mode. Once this switch is made, 120 volts AC is available from each individual inverter or 240 volts AC is available across the output line (OUTPUT L or L1) terminals of the stacked pair.

Stacked inverters will typically support about twice the surge power of one standalone unit. For example, a stacked pair of Freedom SW 12V 3012s will surge about 12000 watts. See *Specifications on page 43* for each unit's surge power ratings.

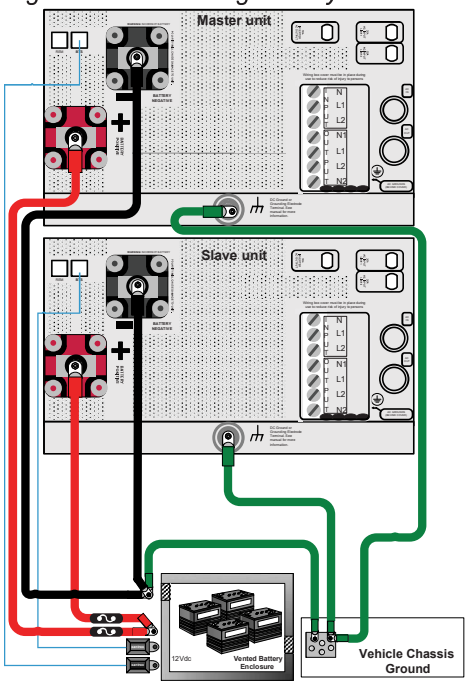
DC Connections for Stacked Inverters

Use individual overcurrent devices 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 12 inches (30.48 cm).

Connect the stacked system as follows:

1. Connect each negative terminal to the battery.
2. Connect a Grounding wire to the common negative.
3. Connect each positive terminal of the inverter to the battery through a DC disconnect and fuse combination or a DC breaker in each positive line. Do not tie the positives together between inverters.
4. Connect the 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 25 Connecting Battery Cables and DC Ground Wires



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 Neutrals be isolated from one another. In a stacked pair configuration, connect the two AC input neutrals together at the main distribution panel and the four AC output neutrals at an isolated neutral location in the inverter AC distribution panel.

Figure 26 Neutral Wiring for Stacking Two Freedom SW 12V 3012 units

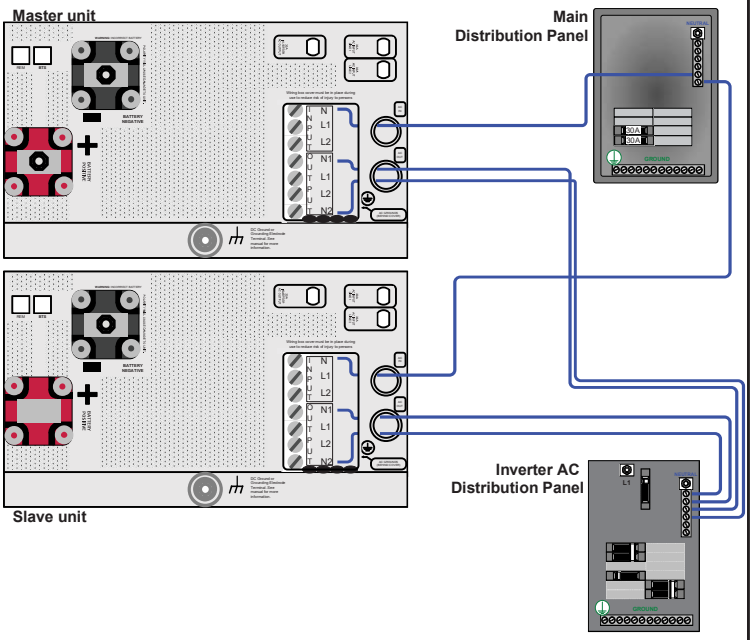
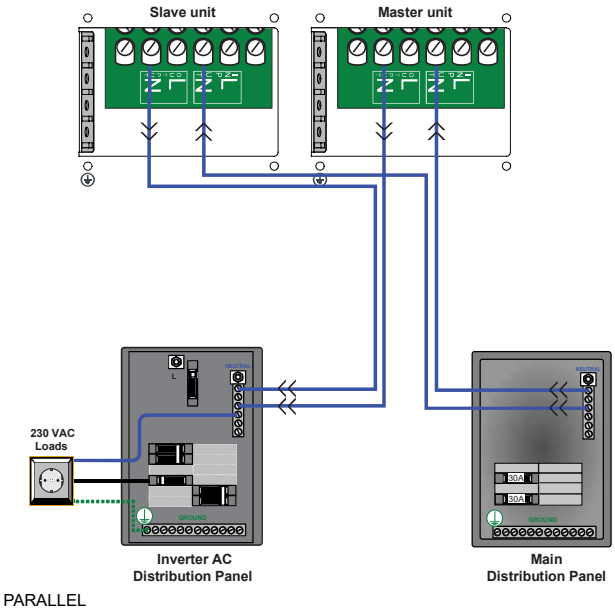


Figure 27 Neutral Wiring for Stacking Two Freedom SW 24V 3524 units



Configuring System for Stacked Operation

Verify all DC and AC connections. Check Xanbus (or RV-C) network connections and ensure that terminators are installed at devices at each end of the network. The simplest system includes the two Freedom SW inverter/chargers to be stacked and two network terminators.

For both units to operate in stacked configurations, a primary unit (`Master`) and a secondary unit (`Slave`) have to be assigned. The default out-of-box configuration for all Freedom SW inverter/chargers is `Master` which causes a conflict the first time the system is powered up. The installer will need to change the `Stack Mode` configuration on one of the inverter/chargers to a secondary unit using your Xanbus System Control Panel (PN: 809-0921) for Xanbus-enabled models.

IMPORTANT: For RV-C models, you may use a PC-based tool such as RV-C Configuration Tool to change the `Stack Mode` configuration of the secondary unit. Contact your Xantrex dealer.

To configure the system using Xanbus System Control Panel (PN: 809-0921) for stacking two Freedom SWs:

1. Apply DC power to both Freedom SWs.
2. Power up order has no impact. Because there are now two primary units in the system. The Xanbus System Control Panel (PN: 809-0921) may indicate a system configuration error.
3. From the Xanbus System Control Panel (PN: 809-0921), navigate to the device screen for the inverter you want to configure as a secondary device.
4. Navigate to the Advanced Settings screen and select Stacking.
5. Selecting `Stack Mode`, change it from `Master` to `Slave`, if you are parallel-stacking the Freedom SWs or Selecting `Stack Mode`, change it from `Master` to `L2Master`, if you are series-stacking the Freedom SWs.
6. Save the configuration and exit to the Home screen of the Xanbus System Control Panel (PN: 809-0921).

NOTES:

The only situation in which the secondary unit may shut down the primary unit is when error conditions are detected 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.

Load Sense in Series Stacking

When configured for 120/240-volt series stacking, each inverter/charger operates independently in search mode and attempts to detect loads connected to its terminals only.

Load Sense Operation in Parallel Stacking

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

Disabling Load Sense on the Primary Unit

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

Setting Load Sense on the Secondary Unit

The secondary unit will behave in one of two ways depending on whether its load sense is enabled or disabled.

`Load Sense` **enabled**	This is the recommended mode for parallel stacking and it helps minimize battery draw. The secondary unit continuously monitors the output of the primary unit. If the primary unit has more than 60% of the rated load (e.g., 1800 watts in the case of a Freedom SW 12V 3012), the secondary unit will assist the primary unit and the two will share the load equally. Should the load on the primary unit drop below 20% of rated load (e.g., 600 watts in the case of a Freedom SW 12V 3012), the secondary unit disengages and returns to a waiting state.
`Load Sense` **disabled**	The secondary unit operates continuously along with the primary 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 inverter/chargers that are stacked in parallel and in series.

IMPORTANT: Follow the same guidelines in *Basic Installation Procedures on page 9* 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 Stacked Configuration

The Freedom SW includes a maximum charger amperage depending on the model. See *Specifications on page 43* for the unit's maximum DC output current ratings.

For example, the maximum output current for Freedom SW 12V 3012 is 150A DC. When using two stacked Freedom SW 12V 3012 connected to the same battery bank, a total of 300A (150A x 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 SWs 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.

⚠DANGER

EXPLOSION HAZARD

Do not mix different battery types within the same battery bank.

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

Table 10 Preferred Charge Rates

Battery Type	Preferred charge rate × C (Total battery bank's Ah capacity)
Flooded	10-15%
AGM or Gel	50%
NOTE: The industry-accepted maximum charge rate is 25%, in rare cases even 100%.	

NOTICE

BATTERY DAMAGE

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

Failure to follow these instructions can result in battery damage.

Calculations

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

Industry accepted maximum charge rate (%)
x battery bank's total Amp-hour capacity (C)
x 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's `Max Chg Rate (%)` setting defaults to 100 (adjustable from 0 to 100). So if the Freedom SW with a maximum possible 150A charger capacity is set to a `Max Chg Rate` of 100 (%) then its full 150A 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.

NOTICE

BATTERY DAMAGE

Configure the charger to ensure that it does not exceed the battery manufacturer's recommended maximum charge specifications to prolong battery life and to exhibit best performance.

Failure to follow these instructions can result in battery damage.

Examples

Example 1:

System composed of two stacked Freedom SW 12V 3012s. Each Freedom SW 12V 3012 has a maximum charge capacity of 150A. The two stacked inverter/chargers connected to the same battery bank can possibly produce a total of 300A.

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 12V 3012s, each charger may have a maximum allowable charger output current of 50A (400 x 25% x 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 12V 3012:

1. Divide the maximum allowable charger output current of 50A by the Freedom SW 12V 3012's maximum charge capacity of 150A.
   So, 50 / 150, gets an approximate value of 0.33 (or 33%) which can be roughly reduced to 30%.
2. Set the `Max Chg Rate (%)` setting to 30 which means 30%.

In this example, the actual output current is limited to 30% of 150A which is 45A. Therefore, the actual System Total BULK output current comes out just under 90A.

Example 2:

System composed of two stacked Freedom SW 12V 3012s. Each Freedom SW 12V 3012 has a maximum charge capacity of 150A. The two stacked inverter/chargers connected to the same battery bank can possibly produce a total of 300A.

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 12V 3012s, each charger may have a maximum charger output current of 75A (that is, 600 x 25% x 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 12V 3012:

1. Divide the maximum allowable charger output current of 75A by the Freedom SW 12V 3012's maximum charge capacity of 150A.
   So, 75 / 150, gets an approximate value of 0.50 (or 50%) which can be set exactly to 50%.
2. Set the `Max Chg Rate (%)` setting to 50 which means 50%.

In this example, the actual output current is limited to 50% of 150A which is 75A. Therefore, the actual System Total BULK output current comes out to about 150A.

4 BATTERY INFORMATION

NOTE: There are eight models of the Freedom SW. Throughout the guide, Freedom SW units may be referred to according to these categories. For example, Freedom SW 110VAC models apply only to models under the 110 AC Voltage category.

Model Name	Product Number	Output Power* (watts)	AC Voltage	DC Voltage	Network
Freedom SW 12V 2012	815-2012	2000	110	12	Xanbus
Freedom SW 12V 3012	815-3012	3000	110	12	Xanbus
Freedom SW 24V 2024	815-2024	2000	110	24	Xanbus
Freedom SW 24V 3024	815-3024	3000	110	24	Xanbus
Freedom SW 2012 RVC	815-2012-03	2000	110	12	RV-C
Freedom SW 3012 RVC	815-3012-02	3000	110	12	RV-C
Freedom SW 24V 2524	815-2524-02	2500	230	24	Xanbus
Freedom SW 24V 3524	815-3524-02	3500	230	24	Xanbus

* see *"Specifications" on page 43* for detailed information.

Battery Capacity

Battery size or capacity is just as important as the battery type selected for use with the Freedom SW. 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 (<1000W) 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 RV battery rated for 100 Ah can deliver 5 amps for 20 hours (5 amps × 20 hours = 100 Ah). 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 1/2 hour), but usually the capacity figure given is only accurate for the specified duration (20 hours).

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 10 (the factor for the Freedom SW, which is a 12-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 *on page 39*.

Step 2: Calculate Battery Size

5. Complete the rest of the worksheet; see *Battery Sizing Example on page 39* 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.

Figure 28 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 a 12-volt system) [*divide by 20 for a 24-volt system*]			(486 Ah @12VDC) [*243 Ah @24VDC*]
Recommended Battery Bank Size in Ah (multiply by 2)			(972 Ah @12VDC) [*486 Ah @24VDC*)

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 Connections on page 40* 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.

⚠DANGER

EXPLOSION HAZARD

Do not mix different battery types within the same battery bank.

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

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.

Figure 29 Battery Sizing Worksheet (Blank)

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
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 10 for a 12-volt system) [divide by 20 for a 24-volt system]			_____Ah
Recommended Battery Bank Size in Ah (multiply by 2)			_____Ah

Restrictions on Motor Size

An appliance may require three to six times its normal running current in order to start. The Freedom SW 3000W model can handle surges to 6000 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 may not be able to start a motor with a higher LRA, and the Freedom SW 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 to allow the Freedom SW to start up the appliance. Again, if the circuit cannot deliver the required current, the system may shut down or the fuse may open.

5 BATTERY CABLING AND CONNECTIONS

Several smaller batteries can be connected to create a battery bank of substantial size. You can connect batteries in three ways: in parallel, series, or series-parallel.

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 4/0 AWG, the battery interconnects should be 4/0 AWG.

The best configuration is to connect the batteries in series and 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 Parallel Connection

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

Figure 30 12VDC Batteries Connected in Parallel

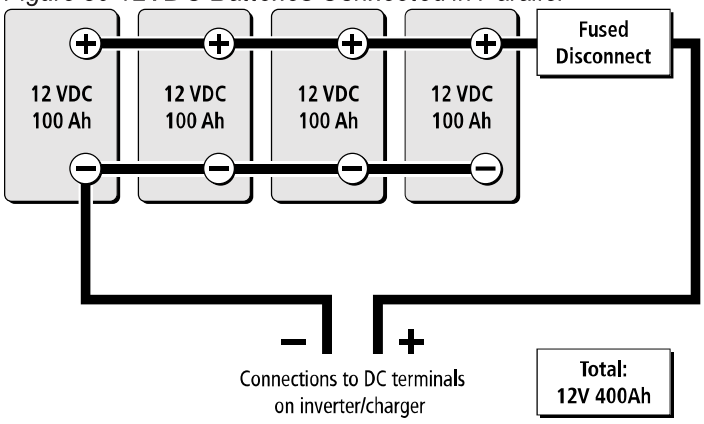
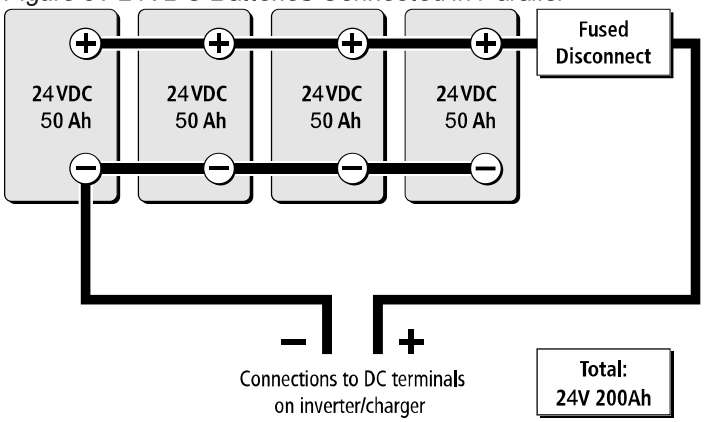


Figure 31 24VDC Batteries Connected in Parallel



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 32 6VDC Batteries Connected in Series to make a 12VDC Battery System

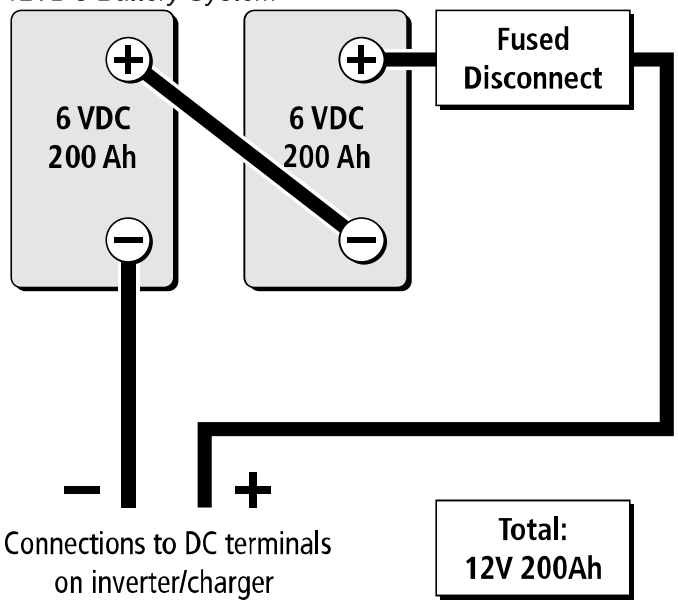
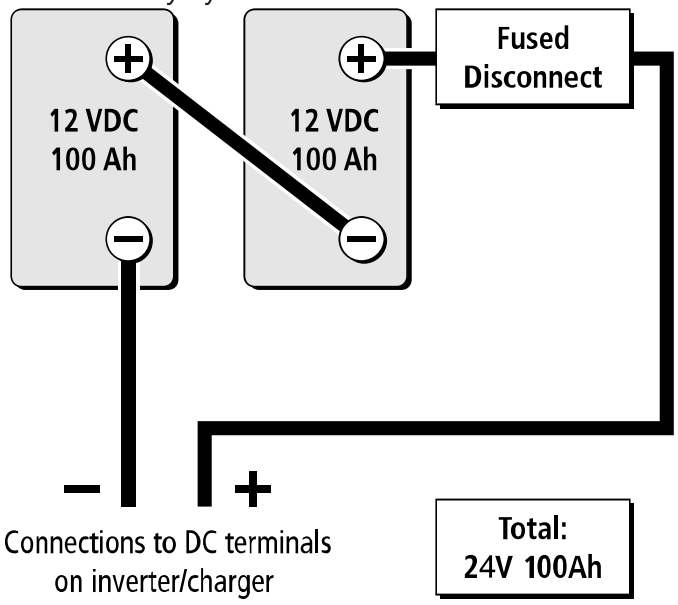


Figure 33 12VDC Batteries Connected in Series to make a 24VDC Battery System



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 34 6VDC Batteries Connected in Series-Parallel to make a 12VDC Battery System

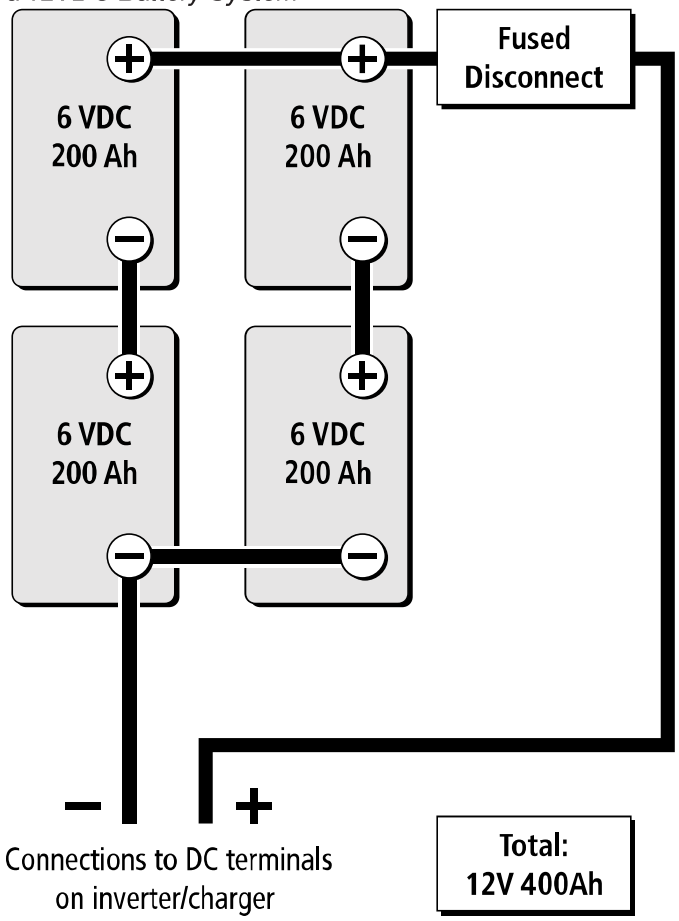
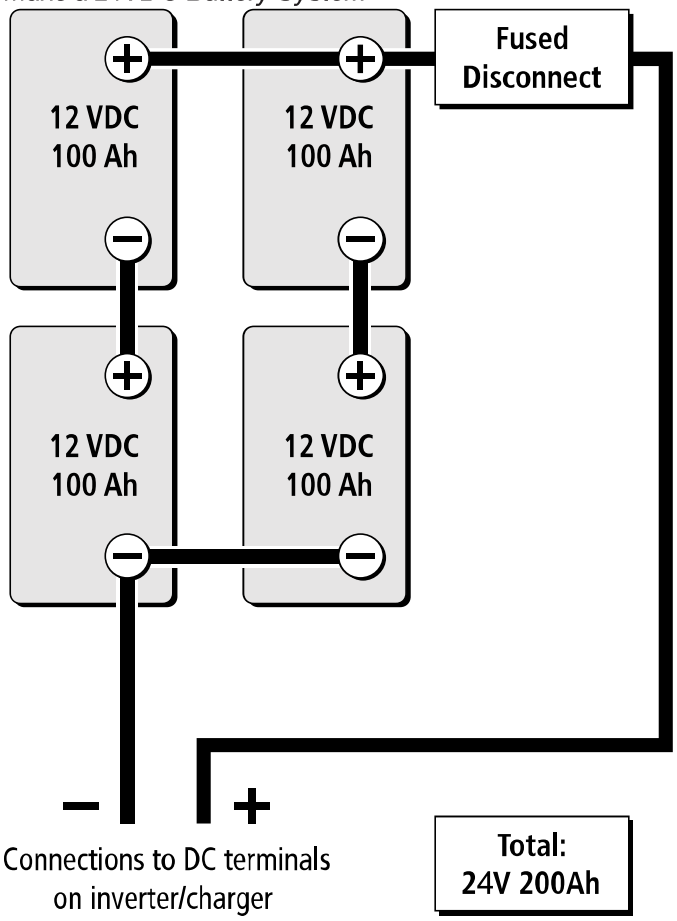


Figure 35 12VDC Batteries Connected in Series-Parallel to make a 24VDC Battery System



6 SPECIFICATIONS

NOTE: Specifications are subject to change without prior notice.

Physical Specifications								
Product Number	**815-2012**	**815-2024**	**815-2524-02**	**815-2012-03**	**815-3012**	**815-3024**	**815-3524-02**	**815-3012-02**
L × W × H	387×343×197 mm (15.25×13.5×7.75 in.)							
Net Weight	27.5 kg (60.5 lbs)	27.5 kg (60.5 lbs)	21.4 kg (47.2 lbs)	27.5 kg (60.5 lbs)	31.5 kg (69.4 lbs)	31.5 kg (69.4 lbs)	27.2 kg (60 lbs)	31.5 kg (69.4 lbs)

Environmental Specifications								
Product Number	**815-2012**	**815-2024**	**815-2524-02**	**815-2012-03**	**815-3012**	**815-3024**	**815-3524-02**	**815-3012-02**
Nominal Ambient temperature	30 °C (86 °F)	30 °C (86 °F)	25 °C (77 °F)	30 °C (86 °F)	40 °C (104 °F)	40 °C (104 °F)	25 °C (77 °F)	40 °C (104 °F)
Invert mode: Operating range (full power) Load @ maximum ambient	–20 to 30 °C (–4 to 86 °F) 1700W @ 60 °C	–20 to 30 °C (–4 to 86 °F) 1700W @ 60 °C	–20 to 25 °C (–4 to 77 °F) 2000W @ 60 °C	–20 to 30 °C (–4 to 86 °F) 1700W @ 60 °C	–20 to 40 °C (–4 to 104 °F) 2600W @ 60 °C	–20 to 40 °C (–4 to 104 °F) 2600W @ 60 °C	–20 to 25 °C (–4 to 77 °F) 3000W @ 60 °C	–20 to 40 °C (–4 to 104 °F) 2600W @ 60 °C
Charge mode: Operating range (full power) Current @ maximum ambient	–20 to 40 °C (–4 to 104 °F) 80 A @ 60 °C (140 °F)	–20 to 40 °C (–4 to 104 °F) 40 A @ 60 °C (140 °F)	–20 to 25 °C (–4 to 77 °F) 58 A @ 60 °C (140 °F)	–20 to 40 °C (–4 to 104 °F) 80 A @ 60 °C (140 °F)	–20 to 40 °C (–4 to 104 °F) 120 A @ 60 °C (140 °F)	–20 to 40 °C (–4 to 104 °F) 60 A @ 60 °C (140 °F)	–20 to 25 °C (–4 to 77 °F) 80 A @ 60 °C (140 °F)	–20 to 25 °C (–4 to 77 °F) 120 A @ 60 °C (140 °F)
Storage temperature range	–40 to 85 °C (–40 to 185 °F)	–40 to 85 °C (–40 to 185 °F)	–55 to 75 °C (–67 to 167 °F)	–40 to 85 °C (–40 to 185 °F)	–40 to 85 °C (–40 to 185 °F)	–40 to 85 °C (–40 to 185 °F)	–40 to 85 °C (–40 to 185 °F)	–40 to 85 °C (–40 to 185 °F)
Humidity: Operation/Storage	≤ 95% RH, non-condensing	≤ 95% RH, non-condensing	≤ 95% RH, non-condensing	≤ 95% RH, non-condensing	≤ 95% RH, non-condensing	≤ 95% RH, non-condensing	≤ 95% RH, non-condensing	≤ 95% RH, non-condensing
Altitude: Operating Non-operating	4,572 m (15,000 feet) 15,240 m (50,000 feet)	4,572 m (15,000 feet) 15,240 m (50,000 feet)	< 2,000 m (< 6562 feet)	4,572 m (15,000 feet) 15,240 m (50,000 feet)	4,572 m (15,000 feet) 15,240 m (50,000 feet)	4,572 m (15,000 feet) 15,240 m (50,000 feet)	< 2,000 m (< 6562 feet)	4,572 m (15,000 feet) 15,240 m (50,000 feet)
Mounting	deck mount, wall mount with fans and DC/AC sides facing sideward	deck mount, wall mount with fans and DC/AC sides facing sideward	deck mount, wall mount with fans and DC/AC sides facing sideward	deck mount, wall mount with fans and DC/AC sides facing sideward	deck mount, wall mount with fans and DC/AC sides facing sideward	deck mount, wall mount with fans and DC/AC sides facing sideward	deck mount, wall mount with fans and DC/AC sides facing sideward	deck mount, wall mount with fans and DC/AC sides facing sideward

NOTE: All inverter specifications are at nominal conditions: 12 (or 24) volts DC inverting 120 (or 230) volts AC, unless otherwise specified.

Inverter Specifications								
Product Number	**815-2012**	**815-2024**	**815-2524-02**	**815-2012-03**	**815-3012**	**815-3024**	**815-3524-02**	**815-3012-02**
Output wave form	pure sine wave (true sine wave)							
Output power (continuous)	2000 W (up to 30 °C)	2000 W (up to 30 °C)	2500 W (up to 25 °C)	2000 W (up to 30 °C)	3000 W (up to 40 °C)	3000 W (up to 40 °C)	3400 W (up to 25 °C)	3000 W (up to 40 °C)
Output power (5 seconds)	4000 W	4000 W	5000 W	4000 W	6000 W	6000 W	6800 W	6000 W
Output current	17 A	17 A	11 A	17 A	24 A	24 A	15 A	24 A
Peak output current	55 A	55 A	--	55 A	80 A	80 A	--	80 A
Output frequency	60 Hz ± 0.2 Hz	60 Hz ± 0.2 Hz	50 Hz	60 Hz ± 0.2 Hz	60 Hz ± 0.2 Hz	60 Hz ± 0.2 Hz	50 Hz	60 Hz ± 0.2 Hz
Output voltage	120 VAC	120 VAC	230 VAC	120 VAC	120 VAC	120 VAC	230 VAC	120 VAC
AC output connection/s	single phase	single phase	single phase	single phase	Split phase in/dual out, Dual in/dual out	Split phase in/dual out, Dual in/dual out	single phase	Split phase in/dual out, Dual in/dual out
Peak efficiency	90%	94%	90%	90%	90%	94%	90%	90%
No-load current draw (Inverter On)	<3 ADC	<1.5 ADC	<1.9 ADC	<3 ADC	<3 ADC	<1.5 ADC	<2.2 ADC	<3 ADC
Standby current draw (Inverter Off)	<0.25 ADC	<0.15 ADC	<0.15 ADC	<0.25 ADC	<0.25 ADC	<0.15 ADC	<0.15 ADC	<0.25 ADC
Input DC voltage range	10–16 VDC	20–32 VDC	20–32 VDC	10–16 VDC	10–16 VDC	20–32 VDC	20–32 VDC	10–16 VDC
Low battery voltage shutdown cut-off	10.5 V (selectable)	21.0 V (selectable)	21.0 V (selectable)	10.5 V (selectable)	10.5 V (selectable)	21.0 V (selectable)	21.0 V (selectable)	10.5 V (selectable)
High battery voltage shutdown cut-off	16.5 V (selectable)	33.0 V (selectable)	33.0 V (selectable)	16.5 V (selectable)	16.5 V (selectable)	33.0 V (selectable)	33.0 V (selectable)	16.5 V (selectable)

NOTE: All charging specifications are at nominal conditions: ambient temperature of 77 °F (25 °C), 120 (or 230) VAC, 60 (or 50) Hz input, unless otherwise specified.

Charger Specifications								
Product Number	**815-2012**	**815-2024**	**815-2524-02**	**815-2012-03**	**815-3012**	**815-3024**	**815-3524-02**	**815-3012-02**
Charging method	Three-stage charge (Bulk, Absorption, Float) Two-stage charge (Bulk, Absorption) The default charging method is three-stage.							
Without a battery temperature sensor	Three settings with the following temperature values: Cool 10 °C (50 °F), Warm 25 °C (77 °F), Hot 40 °C (104 °F) The default setting is Warm and it can only be changed by the factory, a dealer, or a service center.							
With a battery temperature sensor (included)	The temperature compensation coefficients are as follows:							
	Flooded: 27 mV × (25 °C – BTS °C) Gel: 27 mV × (25 °C – BTS °C) AGM: 21 mV × (25 °C – BTS °C))	Flooded: 54 mV × (25 °C – BTS °C) Gel: 54 mV × (25 °C – BTS °C) AGM: 42 mV × (25 °C – BTS °C))	Flooded: 54 mV × (25 °C – BTS °C) Gel: 54 mV × (25 °C – BTS °C) AGM: 42 mV × (25 °C – BTS °C))	Flooded: 27 mV × (25 °C – BTS °C) Gel: 27 mV × (25 °C – BTS °C) AGM: 21 mV × (25 °C – BTS °C))	Flooded: 27 mV × (25 °C – BTS °C) Gel: 27 mV × (25 °C – BTS °C) AGM: 21 mV × (25 °C – BTS °C))	Flooded: 54 mV × (25 °C – BTS °C) Gel: 54 mV × (25 °C – BTS °C) AGM: 42 mV × (25 °C – BTS °C))	Flooded: 54 mV × (25 °C – BTS °C) Gel: 54 mV × (25 °C – BTS °C) AGM: 42 mV × (25 °C – BTS °C))	Flooded: 27 mV × (25 °C – BTS °C) Gel: 27 mV × (25 °C – BTS °C) AGM: 21 mV × (25 °C – BTS °C))
Output current (maximum)	100 ADC	50 ADC	65 ADC	100 ADC	150 ADC	75 ADC	90 ADC	150 ADC
Output voltage	12 VDC	24 VDC	24 VDC	12 VDC	12 VDC	24 VDC	24 VDC	12 VDC
Output voltage range	5–16 VDC	12–32 VDC	12–32 VDC	5–16 VDC	5–16 VDC	12–32 VDC	12–32 VDC	5–16 VDC
Dead battery charge voltage	> 5 VDC	> 12 VDC	> 12 VDC	> 5 VDC	> 5 VDC	> 12 VDC	> 12 VDC	> 5 VDC
Equalization cycle	Automatic, Manual by Xanbus System Control Panel (PN: 809-0921)	Automatic, Manual by Xanbus System Control Panel (PN: 809-0921)	Automatic, Manual by Xanbus System Control Panel (PN: 809-0921)	Automatic, Manual by Xanbus System Control Panel (PN: 809-0921)	Automatic, Manual by Xanbus System Control Panel (PN: 809-0921)	Automatic, Manual by Xanbus System Control Panel (PN: 809-0921)	Automatic, Manual by Xanbus System Control Panel (PN: 809-0921)	Automatic, Manual by PC-based tool. See your Xantrex dealer.
Optimal charging efficiency	> 85%	> 85%	> 85%	> 85%	> 85%	> 85%	> 85%	> 85%
AC input power factor (at full charge rate)	> 0.98	> 0.98	> 0.98	> 0.98	> 0.95	> 0.95	> 0.98	> 0.95
AC input current	24A max. (including pass-thru)	24A max. (including pass-thru)	10.6 A max. (excluding pass-thru)	24A max. (including pass-thru)	24A max. (including pass-thru)	24A max. (including pass-thru)	14A max. (excluding pass-thru)	24A max. (including pass-thru)
AC input voltage	120 VAC	120 VAC	230 VAC	120 VAC	120 VAC	120 VAC	230 VAC	120 VAC
AC input voltage range	85–140 VAC	85–140 VAC	170–270 VAC	85–140 VAC	85–140 VAC	85–140 VAC	170–270 VAC	85–140 VAC
Supported AC input types	single input (up to 30 amps)	single input (up to 30 amps)	single input (up to 30 amps)	single input (up to 30 amps)	Split phase (up to 30 amps per line) Dual input (up to 30 amps per line)	Split phase (up to 30 amps per line) Dual input (up to 30 amps per line)	single input (up to 30 amps)	Split phase (up to 30 amps per line) Dual input (up to 30 amps per line)

NOTE: All transfer specifications are at nominal conditions: ambient temperature of 77 °F (25 °C), 120 (or 230) VAC, 60 (or 50) Hz input, unless otherwise specified.

Transfer and General Specifications

Product Number	815-2012	815-2024	815-2524-02	815-2012-03	815-3012	815-3024	815-3524-02	815-3012-02
Transfer time—utility to invert	< 20 ms	< 20 ms	< 20 ms	< 20 ms	< 20 ms	< 20 ms	< 20 ms	< 20 ms
Minimum AC input voltage for transfer	85 VAC	85 VAC	170 VAC	85 VAC	85 VAC	85 VAC	170 VAC	85 VAC
Maximum AC input voltage for transfer	135 VAC	135 VAC	270 VAC	135 VAC	135 VAC	135 VAC	270 VAC	135 VAC
Minimum AC input frequency for transfer	45 Hz	45 Hz	45 Hz	45 Hz	45 Hz	45 Hz	45 Hz	45 Hz
Maximum AC input frequency for transfer	70 Hz	70 Hz	68 Hz	70 Hz	70 Hz	70 Hz	68 Hz	70 Hz
Cooling	Fan-cooled, temperature controlled							

Regulatory Approvals

Product Number	815-2012	815-2024	815-2012-03	815-2524-02	815-3012	815-3024	815-3524-02	815-3012-02
Product Safety	CSA 107.1, UL 458 5th Ed. with marine supplement, ABYC E11 - Alternating Current and Direct Current Electrical Systems on Boats, and ABYC A31 - Battery Chargers and Inverters	CSA 107.1, UL 458 5th Ed. with marine supplement, ABYC E11 - Alternating Current and Direct Current Electrical Systems on Boats, and ABYC A31 - Battery Chargers and Inverters	CSA C22.2 No. 107.1 and UL 458, 6th Ed.	20 CE mark (Europe) EN62040-1 RCM mark (Australia) AS 62040.1.1 AS/NZS 60335.2.29	CSA 107.1, UL 458 5th Ed. with marine supplement, ABYC E11 - Alternating Current and Direct Current Electrical Systems on Boats, and ABYC A31 - Battery Chargers and Inverters	CSA 107.1, UL 458 5th Ed. with marine supplement, ABYC E11 - Alternating Current and Direct Current Electrical Systems on Boats, and ABYC A31 - Battery Chargers and Inverters	20 CE mark (Europe) EN62040-1 RCM mark (Australia) AS 62040.1.1 AS/NZS 60335.2.29	CSA C22.2 No. 107.1 and UL 458, 6th Ed.
EMI	85 FCC Part 15, Class B Industry Canada ICES-003, Class B	85 FCC Part 15, Class B Industry Canada ICES-003, Class B	CFR 47 (FCC) Part 15, Subpart B, ISED CAN ICES-003, Class B	CE (Europe) and RCM (Australia) EN 62040-2	85 FCC Part 15, Class B Industry Canada ICES-003, Class B	85 FCC Part 15, Class B Industry Canada ICES-003, Class B	CE (Europe) and RCM (Australia) EN 62040-2	CFR 47 (FCC) Part 15, Subpart B, ISED CAN ICES-003, Class B

Accessories

Cables

Name	Part number
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
Stacking cable for series stcking	808-9005

Hardware

Name	Part number
Freedom SW On/Off Switch	808-9002
GFCI receptacle	808-9003
Inverter drip shield	808-9004

7 INVERTER DRIP SHIELD INSTALLATION

Please read this section for drip shield installation instructions regarding your Freedom SW. This section includes:

Drip Shield Installation *48*

Drip Shield Installation

The inverter drip shield helps to protect the unit from dripping or splashing liquids, which will cause 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.

⚠WARNING

ELECTRICAL 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.

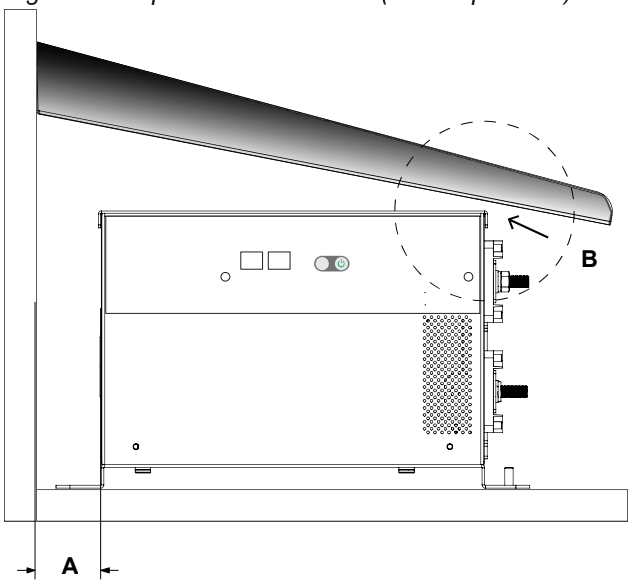
Failure to follow these instructions can result in death or serious injury.

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

To install the drip shield:

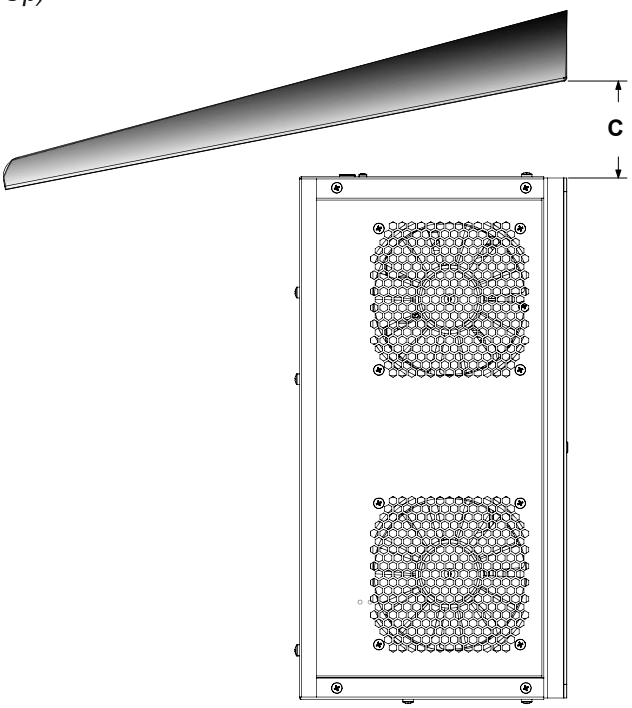
1. Acquire ten #6-3/4 screws needed to fasten the inverter drip shield to the wall.
2. Locate an appropriate setting for the drip shield above the Freedom SW making sure you cover the entire width of the unit.
3. Fasten the screws through the holes in the drip shield into the wall.

Figure 36 Drip Shield Placement (Desktop Mount)



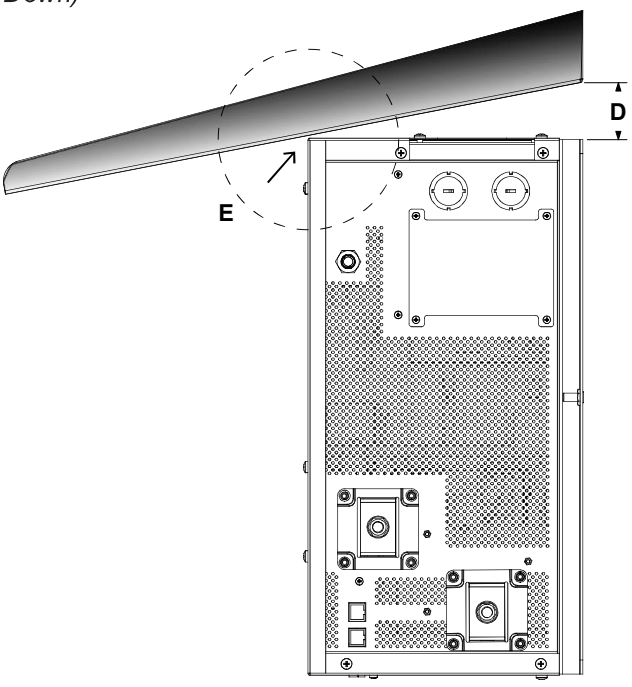
A	2½ inch. (55mm)
B	½ inch. (10mm) clearance required

Figure 37 Drip Shield Placement (Inverter Front Panel Facing Up)



C	3½ inch. (90mm)

Figure 38 Drip Shield Placement (Inverter Front Panel Facing Down)



D	¾ inch. (20mm)
E	no clearance required

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