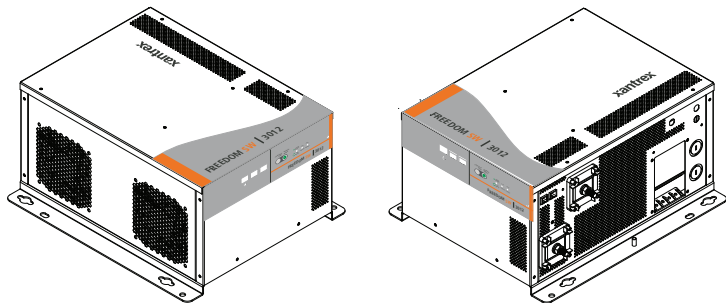


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A MISSION CRITICAL ELECTRONICS BRAND



Owner's Guide

Freedom SW-RVC Inverter/Charger

Product Model Number
815-3012-02

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NOTE: Visit <http://www.xantrex.com/>, click Products, select a Product category, select a Product, and search the Product Documents panel for a translation of the English guide, if available.

Document Number: 975-1056-01-01

Rev A

Date: March 2022

Product Name and Part Number

Freedom SW-RVC (815-3012-02)

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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 Owner's Guide is to provide explanations and procedures for operating, maintaining, and troubleshooting a Freedom SW-RVC Inverter/Charger for recreational vehicle and commercial applications.

Scope

The guide provides safety guidelines as well as information about operating and 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 users and operators of the Freedom SW-RVC Inverter/Charger.

The guide (Installation Guide (document number: 975-1057-01-01)) 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.

Related Information

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

IMPORTANT SAFETY INSTRUCTIONS

READ AND SAVE THIS OWNER'S GUIDE FOR FUTURE REFERENCE.

This chapter contains important safety instructions for the Freedom SW-RVC Inverter/Charger (Freedom SW-RVC). Each time, before using the Freedom SW-RVC, 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-RVC 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-RVC 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-RVC 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-RVC 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-RVC is certified to appropriate US and Canadian standards. For more information see *Specifications on page 68*.

The Freedom SW-RVC 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-RVC Inverter/Charger is designed with environmental awareness and sustainability in mind. At the end of its useful life, the Freedom SW-RVC 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-RVC 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-RVC Inverter/Charger (Freedom SW-RVC). The Freedom SW-RVC 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-RVC.

Materials List

The Freedom SW-RVC ships with the following items:

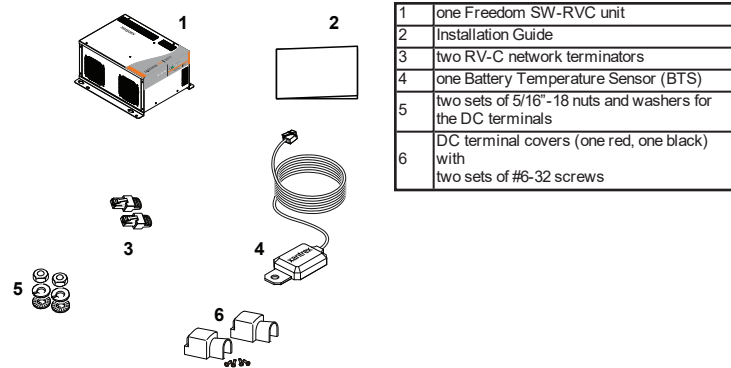


Figure 1 What's In The Box

NOTE: If any of the items are missing, contact customer service or any authorized Xantrex dealer for replacement. See *ABOUT THIS GUIDE* on page 3.

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

Key Features

The Freedom SW-RVC is a true sine wave inverter/charger that can be used for recreational vehicle and commercial applications. The Freedom SW-RVCs are designed to operate with a wide variety of generators and are capable of operating in parallel with a generator for short durations to assist with starting large loads. The Freedom SW-RVC is a convenient combination of an inverter, multistage battery charger, and transfer switch in one electronic device.

- As an inverter, the Freedom SW-RVC provides true sine wave power for your microwave, entertainment system, computer, and other loads. This power is identical to the AC source provided from the utility grid (power company).
- Some of the benefits of true sine wave power include consistent cooking in your microwave, handling of sensitive loads such as your TV set, dimmer switches, and appliances with speed controls.
- Highly versatile platform capable of series stacking for 120/240V line configurations and parallel stacking to increase power levels.
- High efficiency true sine wave output to power sensitive electrical and electronic equipment.
- Surge capacity to start difficult loads like refrigerators or A/C compressors.
- Power factor-corrected (PFC) input minimizes AC input current required for charging, increasing AC pass-through capacity.

- As a charger, it has high output, multistage charging capability minimizing charging time.
- Capable of operating from 50 Hz and 60 Hz power source by extending AC qualification frequency range. See *AC/n Settings on page 41*.

IMPORTANT: With a dual line configuration, only the Line 1 Input needs to be energized in order to qualify the AC. Line 2 Input does not have to be powered with a single phase system.

- Temperature-controlled, variable-speed internal cooling fans. The fans turn on when the internal temperature reaches 45 °C (113 °F) and reaches maximum speed at 70 °C (158 °F). The fan turns off when the internal temperature falls to 40 °C (104 °F).
- Designed with serviceability in mind via Xantrex Authorized Service Centers (ASC).
- The Freedom SW-RVC is RV-C protocol-enabled which allows network compatibility and communication with other RV-C devices.

Key Features Explained

Built-in Charge Formulas

For the unit to perform at the highest level, the batteries must be charged correctly. The Freedom SW-RVC has optimized algorithms for flooded, gel, and AGM batteries.

Battery Temperature Sensor

Since battery temperature is a key factor in correct charging, the charging formula must be adjusted (automatically and in real time) according to the actual battery temperature to ensure that batteries are fully charged, but not overcharged. For this reason, a battery temperature sensor is included with your Freedom SW-RVC and has temperature compensated the charge formula.

Manual Equalization

Over a period of time, the cells in a flooded battery can develop uneven chemical states. This can result in a weak (undercharged) cell which, in turn, can reduce the overall capacity of the battery. To improve the life and performance of a non-sealed, flooded battery, the Freedom SW-RVC's multistage charging cycle includes a manual equalize mode that can be used, if recommended by the battery manufacturer.

Dead Battery Charging

Another feature that the Freedom SW-RVC includes is dead battery charging. The Freedom SW-RVC—unlike many chargers—has the ability to recharge batteries even if the battery voltage is very low (5 volts).

Load Management The Freedom SW-RVC has a built-in transfer relay that connects your inverter output or AC input from the utility grid or generator to your loads. Because the usual AC power sources such as campground outlets or small generators often have limited current availability, having the capability to manage your AC loads is extremely valuable.

The Freedom SW-RVC provides a number of features to facilitate this:

- The charger is power factor corrected to use AC current as efficiently as possible. Minimizing the AC current used by the charger means more current is available for your AC loads.

- Freedom SW-RVC has a power share feature which prioritizes your AC loads by reducing the charge current in an attempt to limit the total input current to less than the breaker setting.

Occasionally, AC input sources have low voltage. To avoid loading these weak sources any further, the charger automatically reduces its AC current draw as the AC voltage approaches the minimum acceptable level.

Stacking

Supports stacking of two inverter/chargers to increase capacity. This also requires the installer to select a Master and Slave in order for the inverters to stack. Two configurations of stacking are supported: Parallel stacking and Series stacking.

Parallel Stacking

Parallel stacking allows two inverter/chargers to operate in parallel thereby doubling the capacity in inverter mode. The two inverters communicate over the network and intelligently share the load and to balance the load between the two units. The primary Freedom SW-RVC broadcasts pulses on the RV-C network to synchronize operation between the other paralleled unit. When AC loads are present, both units produce power, effectively sharing the load. When Load Sense is enabled, only the primary unit produces the AC output.

Series Stacking

Two units can be configured to generate 120/240 Split-phase power for load configurations that require both 120 and 240 volts. In this configuration, the AC source must be split-phase as well.

Stack Charging

Two Freedom SW-RVCs synchronize charging stages to ensure efficient charging of the battery bank. When a single unit transitions from bulk to absorption so do all other units. In absorption, all units must complete the absorption stage before transitioning to the next stage. Note that units do not load share when charging except during the bulk stage. The Freedom SW-RVCs stop sharing charge current just before completing the bulk stage. The units do not share charge current during the absorption and float stages.

Each unit charges batteries based on the Max Charge Rate setting and active internal (temperature-based) deratings.

If equalization is enabled on one or more devices capable of equalization charging, only those devices perform an equalize cycle after absorption. Other devices transition to float (if three-stage charging is selected) or transition to AC pass-through (if two-stage charging is selected).

Generator Assist

The Freedom SW-RVC inverter/chargers can operate in tandem with a generator (or shore power) to temporarily assist power loads with large start-up demands such as air conditioners, water pumps etc.

When the Gen Support mode is enabled and the generator's or shore power's current capacity defined (in amps) is above the GenSupport current threshold, the inverter will come on-line and assist the generator or shore power with starting and operating the load (drawing power from the battery). The battery bank must be well charged in order for the inverter to engage this mode. For more details, see *Gen Support on page 42*.

Basic Protection Features

The Freedom SW-RVC has the following protection features:

- Over temperature shutdown for critical components such as the transformer and the power board
- Battery temperature sensor (BTS) failure/battery temperature out-of-range fault protection
- DC output over voltage protection during charge mode
- AC transfer relay failure detection
- AC output overload and short circuit protection during invert mode
- AC backfeed^a protection
- Short circuit protection for the BTS and communication connector ports including protection from incorrectly inserting the remote panel communication cable plug into the BTS port and vice versa

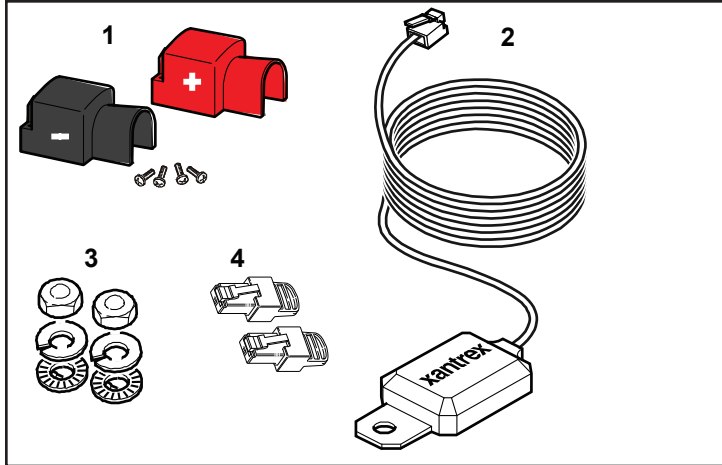
The Battery Temperature Sensor (BTS) provides these protection features:

- Battery over temperature charging protection preventing battery charging at 60 °C (140 °F) or higher
- Charging voltage compensation based on the temperature of the battery where the BTS is connected

^aAn AC backfeed error occurs when the AC output of the inverter/charger is connected or routed back to the inverter/charger's AC input terminal or if the internal transfer relay fails.

Freedom SW-RVC Supplied Accessories

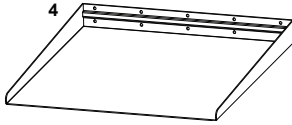
Figure 2 Supplied Accessories



NOTE: If any of the supplied accessories are missing, contact customer service or any authorized dealer for replacement.

Item	Description
1	Two DC terminal covers are supplied to prevent accidental contact with the DC cable connectors after installation. The red cover is for the positive cabling terminal, and the black cover is for the negative cabling terminal.
2	BTS , the Battery Temperature Sensor consists of: <ul style="list-style-type: none"> ■ Connector plugs into the BTS jack on the Freedom SW-RVC. ■ Sensor cable is 25 feet (7.6 meters). ■ Sensor can be mounted on the side of the battery case or on the negative battery terminal. <p>NOTE: The BTS continuously measures the temperature of the battery and adjusts the charger output for a more accurate, temperature-compensated charge.</p>
3	Two sets of nuts and washers are used to secure DC cable ends to the DC terminals.
4	Two RV-C network terminators are used to properly terminate each of the two ends of the daisy-chained RV-C network. IMPORTANT: The RV-C network may perform erratically if it is not properly terminated.

Other Accessories



#	Product/Accessory	Product Number/s
1	3-ft network cable (0.9 m)	809-0935
2	25-ft network cable (7.6 m)	809-0940
3	75-ft network cable (22.9 m)	809-0942
4	Inverter drip shield	808-9004

Product/Accessory (Not Shown)	Product Number/s
Freedom SW-RVC On/Off Switch	808-9002
GFCI receptacles	808-9003
Stacking cable	808-9005

2 MECHANICAL FEATURES

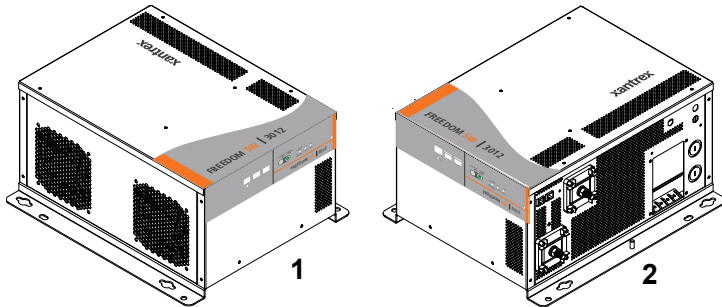


Figure 3 Freedom SW Front and Side Panels

1	Front and Side Panels
2	AC and DC Side Panels

Freedom SW-RVC Front and Side Panels

Before you begin to operate the Freedom SW-RVC, review the front panel features shown in *Figure 4* and described in the next table. A detailed view of the LEDs and buttons on the front panel is shown "*Freedom SW-RVC Front and Side Panels*" above and described in the table next to it.

Item	Description
1	Front Panel contains the RV-C interface ports for connecting RV-C-enabled devices, the INVERTER ENABLE and CLEAR FAULT RESET buttons, as well as various status LEDs.
2	Mounting holes are used for mounting the unit. A total of eight holes are provided on the unit.
3	Two variable-speed cooling fans are used to cool the unit. Fan speed control is based on internal temperature of critical components. The two cooling fans draw airflow into the inverter around the transformer and power compartments of the unit then exhaust through the other vents. Ensure at least 3 inches (76 mm) of clearance for proper ventilation.

Figure 4 Isometric View of the Front Panel and Fans

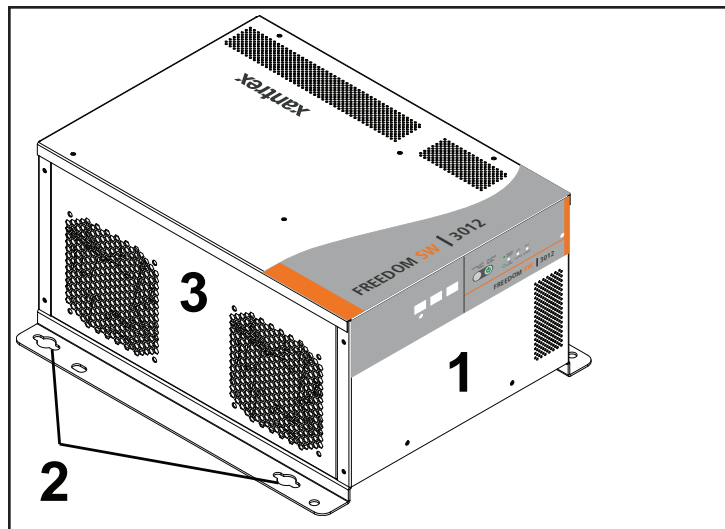
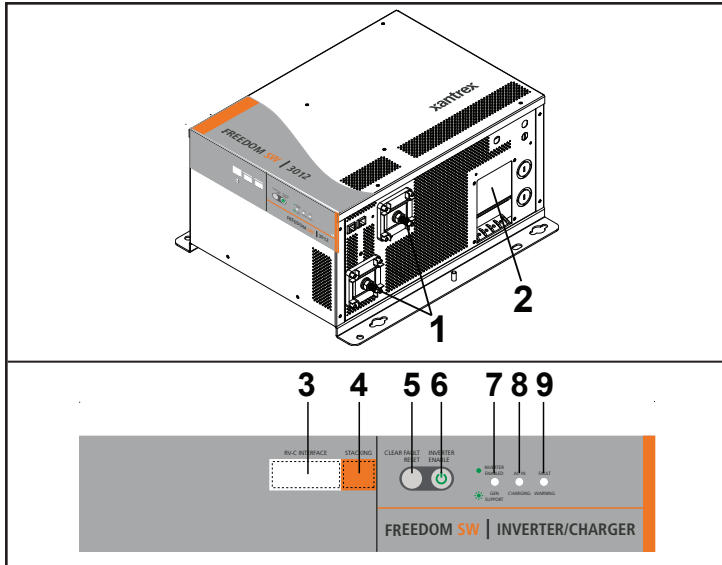


Figure 5 Isometric View of the Front Panel and AC/DC Side Panel



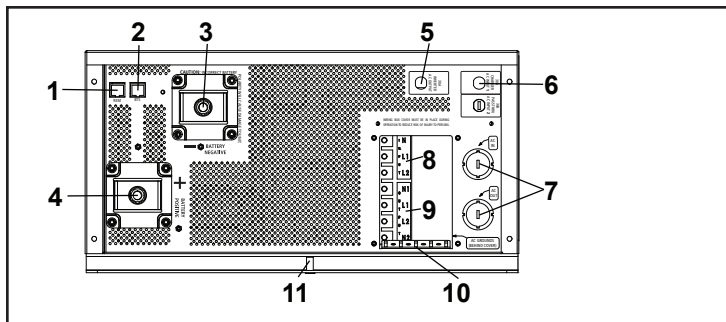
Item	Description
1	DC terminals
2	AC wiring compartment access panel with compartment cover on.

Item	Description
3	RV-C INTERFACE ports are used to connect RV-C devices including a RV-C system device controller, if available.
4	STACKING port is used to connect two inverter/chargers together for stacked operation. This is required only for stacking in series.
5	CLEAR FAULT RESET button is used to clear any active faults if pressed momentarily. If held down for more than three seconds, the unit will reset (reboot) itself.
6	INVERTER ENABLE button is used to enable or disable the inverter.
7	INVERTER ENABLED indicates the invert mode is enabled. This is different from the inverter being “on”. When enabled the inverter can be on or off. When disabled, the inverter is always off. If AC is present and invert mode is enabled, this LED remains illuminated even though AC power is being passed through. GEN SUPPORT LED flashes intermittently when the inverter is in generator support mode and is assisting the generator.
8	When AC is present and qualified, the AC IN LED will turn on solid indicating also that AC is passing through. CHARGING LED flashes intermittently when the Freedom SW-RVC is in charge mode and is producing DC output to charge your batteries.
9	FAULT LED turns on solid if a fault condition occurs and flashes intermittently when a WARNING condition is active.

Freedom SW-RVC AC and DC Side Panel

The DC side of the Freedom SW-RVC has the DC equipment ground lug, the positive (+) battery terminal, and the negative (-) battery terminal plus the remote network com port and battery temperature sensor com port.

Figure 6 AC and DC Side Panel



Item	Description
1	Remote (REM) jack provides connection for the Freedom SW-RVC remote panel. See <i>Freedom SW-RVC On/Off Switch</i> on page 20.
2	Battery temperature sensor (BTS) jack provides connection for the battery temperature sensor (supplied).

Item	Description
3	Negative (-) DC terminal (black). Use a qualified personnel for connecting cables.
4	Positive (+) DC terminal (red). Use a qualified personnel for connecting cables.
5	AC Output circuit breaker reset button
6	AC Input circuit breaker reset button.
7	AC knockouts provide access for AC cables (both input and output wiring).
8	AC Input screw-type terminal block . Use a qualified personnel for connecting wires.
9	AC Output screw-type terminal block . Use a qualified personnel for connecting wires.
10	AC Ground terminals along the tab at the bottom of the opening to the AC wiring compartment access panel. Use a qualified personnel for connecting wires.
11	Chassis DC ground lug connects the chassis of the Freedom SW-RVC to your system's chassis DC grounding point. Use a qualified personnel for connecting wires.

3 OPERATION

Start Up Behavior

When the Freedom SW-RVC is powered up or has been reset, all of the front panel LEDs turn on and remain on for a minimum of five seconds. During this interval, the fans are also turned on as the unit executes internal diagnostics.

Out of the box from the factory, when the Freedom SW-RVC is powered up (that is, when AC and DC power sources are connected) for the first time, the inverter function is disabled by default. After powering up, the INVERTER ENABLE button can be used to enable or disable inverter function. See "*Start Up Behavior*" above.

Enable versus Disable

When a function is enabled, it is allowed to occur but other conditions may have to be met before the function actually works. For example, the charger function on the Freedom SW-RVC may be enabled, but will not charge the battery unless qualified AC power is present.

IMPORTANT:

Review the *Important Safety Instructions* before operating the inverter/charger.

Inverter Operation Using the Front Panel

IMPORTANT:

Review the *Important Safety Instructions* before operating the inverter/charger.

Once the inverter/charger is installed, you can operate it in invert mode.

To operate in invert mode from the front panel:

1. Press the INVERTER ENABLE button on the Freedom SW-RVC on the front panel. The INVERTER ENABLED LED turns on and connected loads will be energized.
2. Note that if AC is present and being passed through, the INVERTER ENABLED LED will still turn on to indicate inverter mode has been enabled. However, AC will continue to be passed through to the loads until conditions exist that cause AC to be disqualified, in which case the unit will transition to invert mode and power up critical loads.
3. Connect AC input power.
The charger automatically starts up when qualified AC power is connected.
4. Disconnect AC power from inverter input by opening the breaker or disconnect.
5. Place a load on the inverter. For example, plug a 100-watt light bulb into an outlet that the inverter is powering. Press the INVERTER ENABLE button on the Freedom SW-RVC.

The INVERTER ENABLED LED turns on. The inverter should run the load using battery power.

6. To test the charger, reconnect the AC input power to allow AC to the AC input. The AC In/Charging LED should start flashing after a brief delay. Any AC loads previously powered by the inverter will also work at this time.
NOTE: With dual input, only AC Input L1 needs to be powered for the unit to operate.
7. Remove the AC input power. The inverter/charger should transfer to invert mode immediately. (The transfer relay will make a clicking sound and the INVERTER ENABLED LED will turn on.) Loads should continue to operate uninterrupted.
If any part of this test fails, determine the cause before using the unit.
8. Monitor the Freedom SW-RVC Front Panel.
The indicator LEDs on the front panel show you the operating status of the Freedom SW-RVC. A description of the LEDs is provided in *Table 1*.
If none of the front panel LEDs are on, see *Troubleshooting on page 55*.

Table 1
Front Panel LEDs

LED Label	Color	Status	Action (or Status Item)
Inverter ENABLED	Steady Green	If utility and generator AC is unavailable and operating conditions are met, the Freedom SW-RVC will produce AC voltage to power loads.	You can run your appliances from the inverter.
Gen Support	Flashing Green	The inverter is assisting a generator in powering loads.	You can run your appliances from the inverter.
AC IN	Steady Green	When the Freedom SW-RVC is connected to a qualified AC source or a generator, the AC IN LED turns on.	You can run your appliances from an AC source like the utility grid or a generator.
Charging	Flashing Green	Freedom SW-RVC is connected to a qualified AC source, is charging and passing power to AC loads.	Your battery bank is being replenished and AC loads are receiving power.
Fault	Steady Red	A fault condition was detected on the network.	Investigate and clear the fault condition.
Warning	Flashing Red	A warning is detected.	Investigate by examining warning logs on RV-C system device controller, if available.

Faults and Warnings

A fault affects the operation of the unit. A manual fault requires user intervention by clearing the condition and then pressing the CLEAR FAULT RESET button on the inverter/charger's front panel.

A warning alerts you to a condition that could possibly affect operation of the unit.

IMPORTANT

If you are having problems with any of your loads, refer to *Inverter Applications*.

Operating Limits for Inverter Operation

Temperature The Freedom SW-RVC inverter/charger will operate (in invert mode) at rated power continuously and then at derated power at a higher ambient temperature (such as at 40 °C). See *Specifications* for full details. In higher ambient temperatures, if the loads draw full power for an extended period of time, the unit may shut down to protect itself against overheating.

The Freedom SW-RVC features a surge rating of 200% of rated power for five seconds at 25 °C. Operating the inverter/charger in conditions outside of power and temperature limits, however, will result in thermal shutdown and/or significantly decreased performance. In addition, operation in this range is outside the ratings covered by the regulatory approvals of the product.

Difficulty on starting loads

The inverter/charger should be able to operate all AC loads rated at or below its power rating. Some high horsepower induction motors used in pumps and other motor-operated equipment require very high surge currents to start, and the inverter/charger may have difficulty starting these loads.

If you have problems starting certain loads, ensure that:

- Battery connections are tight and clean.
- DC cabling is no longer than the recommended length. Refer to the Installation Guide (document number: 975-1057-01-01) for this information.
- AC wiring is of recommended size. Refer to the Installation Guide (document number: 975-1057-01-01) for this information.
- Battery is of sufficient capacity and is fully charged.

NOTE: Many 12 V inverter battery banks have a capacity between 400–800 Ah. Refer to the Installation Guide (document number: 975-1057-01-01) for sizing requirements.

Operating Limits for Charger Operation

By default, the maximum charger output current is the rated charger output current.

The charger can operate within an AC input range of 95–135 volts. The default settings are 85 and 135, which are the ACIn Lo Volt and ACIn Hi Volt respectively. The ACIn Lo Volt setting has a range of 78–115 volts and the ACIn Hi Volt setting has between 125–140 volts.

AC Frequency The charger can also be configured to accept and operate from a wide AC source frequency of 40–68 Hz. Therefore, the Freedom SW-RVC can charge your batteries even when incoming AC voltage is less than ideal. The default settings are 45 and 70 Hz, which are the ACIn Lo Freq and ACIn Hi Freq settings respectively.

Power sharing The Freedom SW-RVC charger uses incoming AC or shore power (see following note) to charge the batteries. The charger shares incoming AC power with AC loads on Line 1 only. The AC loads have priority, which means that the charger will reduce its output with large AC loads and increase the output again when the AC load decreases. The regulatory maximum for continuous AC loads is 80% of the breaker rating (see “AC1 Breaker” on page 51) that the loads are connected to. The Freedom SW-RVC senses pass-through current going to the AC load. The difference between the pass-through (load) and 80% of the AC1 Breaker setting is the current that is available for charging the batteries.

For example, if the AC input of the Freedom SW-RVC is from an AC panel with a 30-amp breaker, the AC1 Breaker setting should be selected as 30 amps. Based on this, the charger will control the charge current so that the total current draw is equal to or less than 24 amps in this case. Should the load current be more than 24 amps, the charger output will reduce to 0 amp, but the Freedom SW-RVC will continue to supply the loads. The Freedom SW-RVC will continue to pass-through power to the loads, even if the load current exceeds the AC1 Breaker setting. In this case, it will be up to the user to remove/disconnect loads if tripping the AC input breaker supplying the Freedom SW-RVC is to be avoided.

NOTE: The AC1 Breaker setting can also be changed using a RV-C system device controller, if available.

Configuring the Freedom SW-RVC

This section contains information about all configurable settings and procedures for the Freedom SW-RVC.

Please refer to the user guide of the RV-C system device controller, if available for detailed information on how to use it in order to change these settings.

Table 2 Configurable Settings

Item	Description
Inverter	Enables or disables the inverter function of the Freedom SW-RVC. When enabled, the unit will invert power from the batteries assuming there is enough charge in the batteries. Default value is Enabled.
Load Sense	Enables or disables the Load Sense function of the Freedom SW-RVC. Default value is Disabled.
Charger	Enables or disables the charger function of the Freedom SW-RVC. When enabled, the unit will charge the batteries when AC is available. For more information on configuring the charger settings go to <i>Charger Settings on page 38</i> . Default value is Enabled.
Auto Chg Enable	Forces the Freedom SW-RVC to charge the batteries when qualified input AC is detected even when the charger function is disabled.

Equalize	Initiates the battery equalization process. See <i>Equalization Procedure on page 33</i> to enable the procedure. Default value is Disabled.
Desired Mode	Switches between Operating and Safe modes. Default value is Operating.
Clear Faults Warning	Clears any active faults and warnings.
Basic Settings	See <i>Changing Freedom SW-RVC Basic Settings on page 34</i> for more information.
Advanced Settings	See " <i>Configuring the Freedom SW-RVC</i> " above for more information.

Using Load Sense

Why use Load Sense?

Load Sense allows the inverter to selectively power only items that draw more than a certain amount of power, which can result in power savings. The Freedom SW-RVC has a no-load power draw of about 28 watts. Enabling Load Sense reduces this power draw to less than 8 watts. Load Sense operates differently in single-unit and multi-unit installations.

Single units

When a single Freedom SW-RVC has Load Sense enabled, the inverter sends electrical search pulses through its AC output. These search pulses look for connected AC loads. The delay between search pulses is set using the **Search Delay** setting. After a load larger than the **Search Watts** setting is detected, the inverter starts producing AC output.

Double units

When configured for 120/240-volt series stacking, each inverter/charger operates independently in Load Sense and attempts to detect loads connected to its terminals only. To use Load Sense in parallel stacking, the **Master** unit must have **Load Sense** disabled. The **Slave** unit must have **Load Sense** enabled.

NOTE:

The **Slave** unit continuously monitors the output of the **Master** unit. If the **Master** unit has more than 60% of the rated load (for example, 1800 watts), the **Slave** unit will assist the **Master** and the two will share the load equally. Should the load on the **Master** drop below 20% of rated load (600 watts), the **Slave** unit disengages and returns to a waiting state.

When to set up Load Sense

The Load Sense feature is only valuable if the inverter can spend a fair amount of time “sleeping” each day. Therefore, if Load Sense is to be used it must be adjusted properly. The initial adjustment should be made so that the inverter comes on only when needed.

Certain types of loads can cause Load Sense to work unexpectedly. These types of loads are described in *Problem Loads on page 67*. If these kinds of loads are in the system, follow the suggestions given to eliminate the problem.

If the problem loads cannot be eliminated, there are two work-around solutions:

Disable Load Sense from the main Freedom SW-RVC device setup, causing the inverter to always remain at full power.

Use a search-friendly companion load whose only purpose is to be switched on to wake up the inverter to power the load that is unable to bring the inverter out of Load Sense.

NOTE:

Load Sense, by function, cannot work with clocks and timers or devices that need power 24 hours a day. Examples of devices with timers include video recorders, coffee makers with brew timers, refrigerators, and freezers with defrost timers.

Examples of devices that need power 24 hours a day include telephone answering machines, alarm systems, motion detection lights, and some thermostats.

When the inverter is searching the output for loads, lights that have a wattage lower than this setting may flash momentarily.

Equalization Procedure

To start equalizing the batteries, do one of the following:

- Apply AC voltage and ensure that the inverter/charger transfers AC and starts charging.
- On the RV-C system device controller, if available navigate to the charger device setting, enable Equalization (*Equalize on page 31*).

The unit will proceed and execute a complete bulk and absorption charge before transitioning to equalize.

IMPORTANT: The inverter/charger will not perform equalization if AC is not present, the charger is disabled, or the selected battery type does not support equalization. If any of these cases happen, a warning is issued

If the Freedom SW-RVC will not perform the equalization, see *Equalize Charging on page 52*.

WARNING

EXPLOSION HAZARD

Equalize charge flooded or vented batteries only. Hydrogen and oxygen gases are produced when batteries are equalize charged. Provide adequate ventilation and remove all sources of ignition to prevent explosion.

Failure to follow these instructions can result in equipment damage.

IMPORTANT: In a system where more than one device is capable of equalizing batteries (such as stacked Freedom SW-RVCs), there is no system-wide equalization command for all devices. To equalize with two devices, each would have to be enabled individually. Alternatively, equalization can be performed using only one device. During the equalization process, one device applies the equalization charge while the other devices continue to operate in synchronized charge mode, typically in float (three-stage charging) or no-float (two-stage charging).

Changing Freedom SW-RVC Basic Settings

Temporary versus permanent

The Freedom SW-RVC unit stores its configuration in its onboard memory which holds configuration values even during power cycling or restart events. The Freedom SW-RVC allows the user to make changes to the configuration settings at any time the unit is powered and communicates with the RV-C system device controller, if available.

Any configuration setting changes will be temporary, that is, they will be lost after a power cycle or restart. In order to make the setting permanent, they must be saved in the onboard memory by placing the unit in Safe mode. While the unit is in the Safe mode the configuration changes will be immediately saved in the onboard memory.

The Freedom SW-RVC basic settings include the following:

- Battery type
- Battery capacity
- Maximum charging rate
- Charging cycle
- Recharging volts
- AC In breaker rating
- Low battery cutout value

Table 3
Setting Defaults and Ranges

Model	Freedom SW-RVC		
Item	Default	Min	Max
Batt Type	Flooded	Flooded, Gel, AGM, Custom	
Batt Capacity	440Ah	50Ah	2000Ah
Max Chg Rate	100%	10%	100%
Charge Cycle	3Stage	3Stage, 2StgNoFloat	
ReCharge Volts	12.5V	11.0V	13.5V
AC1 Breaker	30A	5A	30A
Low Batt Cut Out	10.5V	10.0V	12.0V

Table 4
Basic Settings

Item	Description
Batt Type	Sets the system battery chemistry and type: Flooded , AGM , Gel , and Custom . Selecting Custom displays the Custom Settings item, which allows you to adjust the settings for each charging stage.
Batt Capacity	Selects the system battery capacity in amp hours. Setting the battery capacity to 0 resets the charging current to its default values. Zero Ah battery capacity implies there is no absorption exit current criteria and absorption only exits when the absorption timer (default 3hrs, range 1min-8hr) expires.

Item	Description
Max Chg Rate	Sets the percentage of the maximum DC output current that is available to the charger. The maximum DC output current is 150 ADC If two Freedom SW-RVCs are charging the same battery bank, set each inverter's Max Chg Rate to 1/n of the desired charge rate (where n is the number of inverter/chargers).
Charge Cycle	Sets the charging method: 3-Stage (bulk, absorption, float) or 2StgNoFloat (bulk, absorption, no float).
ReCharge Volts	Sets the recharging volts to tell the charger to initiate charging when the battery drains past the value setting.
AC In Breaker	Set the breaker limit of incoming AC.
Low Batt Cut Out	Low Battery Cut Out (LBCO) controls when the inverter stops producing AC output due to a low battery voltage condition. The inverter will stop producing AC output only after this level has been reached for the period of time set by the LBCO Delay . This setting is not temperature compensated.

Changing Freedom SW-RVC Advanced Settings

The advanced settings option gives you access to the full range of Freedom SW-RVC settings, including everything displayed under Basic settings.

NOTICE

EQUIPMENT DAMAGE

Familiarize yourself with advanced settings and the system-wide impact of changing those settings. The advanced settings are intended for qualified installation/service personnel only. Setting parameters incorrectly could damage connected equipment (such as batteries) or could severely affect the performance of your system. Incorrect charging configuration can lead to battery damage and risk of fire.

Failure to follow these instructions can result in equipment damage.

Advanced Settings

Inverter Settings

Under Inverter Settings you can control when the Freedom SW-RVC starts and stops producing AC output.

*Table 5
Setting Defaults and Ranges*

Item	Default	Min	Max
Low Batt Cut Out	10.5V	10.0V	12.0V
LBCO Delay	10sec	0sec	600sec
Hi Batt Cut Out	16.5V	14.5V	17.0V
Search Watts	50W	25W	250W
Search Delay	2sec	1sec	25sec

*Table 6
Inverter Settings Description*

Item	Description
Low Batt Cut Out	Low Battery Cut Out (LBCO) controls when the inverter stops producing AC output due to a low battery voltage condition. The inverter will stop producing AC output only after this level has been reached for the period of time set by the LBCO Delay. This setting is not temperature compensated.

Item	Description
LBCO Delay	<p>LBCO Delay controls how long the inverter is allowed to operate at or below the Low Batt Cut Out level before turning off due to a low battery voltage condition. The inverter will stop producing AC output only after the Low Batt Cut Out level has been reached for this uninterrupted period of time.</p> <p>Once the inverter has shut off, the battery voltage must rise 2 volts above the Low Batt Cut Out setting for inverter operation to resume.</p>
Hi Batt Cut Out	<p>Hi Batt Cut Out sets the maximum battery voltage at which the inverter will operate. If the battery voltage exceeds this limit for more than one minute, the Freedom SW-RVC displays a fault message and shuts down. The inverter will not support AC loads when in this condition. If a qualified AC source is present, the unit passes AC through to the loads. The inverter automatically restarts when the voltage drops to 1.5 volts below the Hi Batt Cut Out setting. If battery voltage continues to rise after shutdown, an external charger may still be charging the batteries. The Freedom SW-RVC cannot control how external chargers operate.</p>
Search Watts	<p>Search Watts sets the Freedom SW-RVC's search sensitivity when Load Sense is enabled. When a load larger than this setting is present, the inverter starts producing AC output. Enabling Load Sense can minimize power draw from the battery during periods of low demand from loads.</p>
Search Delay	<p>Search Delay sets the time between search pulses. When searching for loads, the Freedom SW-RVC sends out search pulses to determine if a load is present. If the Freedom SW-RVC finds a load above the Search Watts setting, the inverter turns on. Freedom SW-RVC power draw while in Load Sense decreases when Search Delay is increased, but the Freedom SW-RVC's response time to active loads is slower.</p>

Using the Low Battery Cut Out and LBCO Delay Settings

The **Low Batt Cut Out** setting is the lowest battery voltage level acceptable for use by the inverter. When the batteries discharge to the **Low Batt Cut Out** setting, and are held at or below this level for the **LBCO Delay** time, the inverter output shuts down and transfers any available AC source (generator or grid) to the charger to bring the battery level back above the **Low Batt Cut Out** setting. After shutdown, the inverter does not support any AC loads, and AC loads must be powered by either a generator or utility power.

Charger Settings

With Charger Settings you can configure the Freedom SW-RVC to operate from your battery bank.

Table 7
Setting Defaults and Ranges

Item	Default	Min	Max
Batt Type	Flooded	Flooded, Gel, AGM, Custom	
Batt Capacity	440Ah	50Ah	2000Ah
Max Chg Rate	100%	10%	100%
Charge Cycle	3Stage	3Stage, 2StgNoFloat	
ReCharge Volts	12.5V	11.0V	13.5V
Absorb Time	180min	1min	480min
Auto ReCharge	Enabled	Enabled, Disabled	
Default Batt Temp	Warm	Hot, Warm, Cold	

Table 8
Charger Settings Description

Item	Description
Batt Type	Sets the system battery chemistry and type: Flooded , AGM , Ge1 , and Custom . Selecting Custom displays the Custom Settings item, which allows you to adjust the settings for each charging stage.
Batt Capacity	Selects the system battery capacity in amp hours. Setting the battery capacity to 0 resets the charging current to its default values. Zero Ah battery capacity implies there is no absorption exit current criteria and absorption only exits when the absorption timer (default 3hrs, range 1min-8hr) expires.
Max Chg Rate	Sets the percentage of the maximum DC output current that is available to the charger. The maximum DC output current is 150 ADC If two Freedom SW-RVCs are charging the same battery bank, set each inverter's Max Chg Rate to 1/n of the desired charge rate (where n is the number of inverter/chargers).
Charge Cycle	Sets the charging method: 3Stage (bulk, absorption, float) or 2StgNoFloat (bulk, absorption, no float).
ReCharge Volts	Sets the recharging volts to tell the charger to initiate charging when the battery drains past the value setting.
Auto ReCharge	Enables or disables automatic charging. When there are two or more power sources for charging batteries, Auto ReCharge can be disabled to allow manual charging of batteries.

Item	Description
Absorb Time	Sets the maximum time spent in the absorption stage, before transitioning to float or no float. NOTE: The Absorb Time setting resets to its default value of 180 minutes when the Battery Type is changed except when changing to Custom Settings. In Custom Settings, the Absorb Time setting will not reset to its default value.
Default Batt Temp	Selects the battery temperature charging compensation if a battery temperature sensor is not installed. In the absence of a battery temperature sensor, the charger uses one of three settings: Cold (5 °C/41 °F), Warm (25 °C/77 °F), or Hot (40 °C/104 °F).

Battery Charger Functions

When AC power is available, the Freedom SW-RVC can operate as a battery charger. Different battery types and chemistries require different charging voltage levels. Not charging batteries at the required levels can shorten battery life or damage the batteries. The Freedom SW-RVC is configured at the factory to work with the battery types recommended for inverter applications. If the default settings do not work for your specific installation, you can adjust the charge stage settings (as recommended by the battery manufacturer) on the Custom (Battery) Settings.

NOTE:

This information is provided for guidance only. Variations in battery chemistry and site-specific environmental considerations mean that you should consult your system designer or battery manufacturer for specific recommendations for appropriate battery voltage and current settings.

Custom Battery Settings

NOTICE

EQUIPMENT DAMAGE

Consult your battery manufacturer and associated documentation before setting a custom battery type to avoid damaging your batteries during charging or equalization.

Failure to follow these instructions can result in equipment damage.

*Table 9
Setting Defaults and Ranges*

Item	Default	Min	Max
Eqlz Support	Enabled	Enabled, Disabled	
Eqlz Voltage	15.5V	13.5V	16.0V
Bulk Voltage	14.4V	11.2V	16.0V
Bulk Termination Voltage	14.2V	11.0V	15.8V
Absorb Voltage	14.4V	12.0V	16.0V
Float Voltage	13.5V	11.0V	16.0V
Batt Temp Comp	27-mV	0-mV	45-mV

Custom Battery Settings can be viewed if Custom is selected as the Batt Type. You can adjust charging and equalization voltage for batteries with specifications that fall outside the default settings for the battery types the Freedom SW-RVC offers. You can also adjust the temperature compensation constant for the battery temperature sensor.

NOTE: All settings for configuring a custom battery type are based on the default settings for a flooded battery type.

*Table 10
Custom Battery Settings Description*

Item	Description
Eqlz Support	Enables or disables the ability to enter an equalization cycle. Refer to the battery manufacturer's specifications to determine whether equalization is recommended.
Eqlz Voltage ^a	Selects the equalization voltage. Consult your battery manufacturer for equalization voltage setting.
Bulk Voltage	Sets the bulk voltage for a custom battery type. This setting must be 0.2 or higher than Bulk Termination Voltage. See note below.
Bulk Termination Voltage	Sets the bulk termination voltage for a custom battery type. This setting must be 0.2 or lesser than Bulk Voltage. See note below.

^aThe Eqlz Voltage setting is displayed when Eqlz Support is set to On.

Item	Description
Absorb Voltage	Sets the absorption voltage for a custom battery type.
Float Voltage	Sets the float voltage for a custom battery type. See note below.
Batt Temp Comp	Battery temperature compensation for a custom battery type. This setting is the reference that the BTS uses to adjust the charging voltage when the temperature is above or below 25 °C (77 °F).

NOTE: If a warning is received indicating that a setting is not accepted by the RV-C system device controller, if available, gradually increase the value of the setting until the RV-C system device controller, if available accepts it. This type of warning means that an internal minimum threshold value is being crossed and therefore the setting cannot be saved.

ACIn Settings

ACIn Settings configures the voltage and frequency limits for AC Input quantification range. These are the limits at which the Freedom SW-RVC considers input voltage qualified—that is, suitable for charging batteries or powering loads. If the input voltage is not qualified according to these settings, the Freedom SW-RVC transfers from using AC input to inverting.

Table 11
Setting Defaults and Ranges

Item	Default	Min	Max
AC1 Breaker	30A	5A	30A
AC1 Lo Volt	95V	78V	115V
AC1 Hi Volt	135V	125V	140V
AC1 Lo Freq	55Hz	44Hz	59Hz
AC1 Hi Freq	65Hz	61Hz	70Hz

Table 12
ACIn Settings Description

Item	Description
AC1 Breaker	Sets the AC1 (Grid) breaker size, based on the size of the breaker installed on AC1. The installed breaker size must not exceed the capacity of the upstream distribution panel. The Freedom SW-RVC limits the maximum input current to this setting by derating its charging current to an equivalent of 80% of the AC breaker size. If the connected loads exceed the AC1 breaker setting, the AC breaker trips.
AC1 Lo Volt	Minimum acceptable input voltage level from the utility mains. NOTE: It is recommended to leave this setting to its default value and not to set it to the maximum allowed. Doing so might inadvertently derate charging power in jurisdictions where the nominal AC mains voltage or generator output is at 110 volts.
AC1 Hi Volt	Maximum acceptable input voltage level from the utility mains.
AC1 Lo Freq	Minimum acceptable utility mains input frequency.
AC1 Hi Freq	Maximum acceptable utility mains input frequency.

Gen Support

GEN Support is basically generator (and also shore power) support for the Freedom SW-RVC that allows power to be automatically drawn from the batteries to assist an AC generator or shore power to support heavy loads (for example, loads that exceed the available current from either a generator or shore power).

Generators and shore power have a limited output current and it is possible to reach this limit when operating heavy loads. When heavy current demand from the load is needed, additional power from the batteries can supply the needed energy.

In addition, the battery charger can reduce its charging current to the batteries so the combined charge AC current and total load current do not exceed the capacity of the generator (and shore power) or trip its output breakers or fuses.

Table 13
GEN Support Description and Values

Setting	Description	Default	Range
GenSup Mode	Turns the generator or shore power support feature on and off.	Disabled	Disabled, Enabled

Setting	Description	Default	Range
GenSup Amps	Sets the generator or shore power load level at which the Freedom SW-RVC supplies power from the batteries to support the generator or shore power.	24A	4A to 24A

The Freedom SW-RVC supports the generator or shore power when the AC load current drawn from the generator or shore power exceeds the GenSup Amps setting for one to two seconds.

Stacking Configuration

Stacking configures the Freedom SW-RVC to operate as a part of a multi-unit installation.

When installing a stacked system, every setting on the Stacking setting must be configured for each Freedom SW-RVC in the system.

Table 14

Stacking Description and Values

Item	Description	Default	Range
Stack Mode	Series Stacking: For this to operate, one Freedom SW-RVC must be configured to Master and the other as L2Master, otherwise a system-wide fault is asserted.	Master	Master, Slave, L2Master
	Parallel Stacking: For this to operate, one Freedom SW-RVC must be configured to Master and the other as Slave, otherwise a system-wide fault is asserted.	Master	Master, Slave, L2Master
AC In	Identifies to the system the kind of AC input the inverters are accepting.	SHORE1	SHORE1–SHORE5 GEN1–GEN5 NONE
Battery	Points the system to which battery bank is used.	Batt1	Batt1–Batt5

Resetting the Freedom SW-RVC to Default Settings

The Restore Defaults command returns the Freedom SW-RVC to factory default settings. After using the Restore Defaults command, the Freedom SW-RVC is no longer configured for the power system.

To restore Freedom SW-RVC default settings navigate to this device using the RV-C system device controller, if available.

NOTICE

EQUIPMENT DAMAGE

Do not restore defaults while the Freedom SW-RVC is operating. De-energize the power system and disconnect the Freedom SW-RVC AC input before restoring defaults. Reconfigure the Freedom SW-RVC before reconnecting the AC input and re-energizing the power system.

Failure to follow these instructions can result in equipment damage.

Battery Charging Reference

This section describes the multistage charging algorithm (formula) of the Freedom SW-RVC.

Battery Types

Freedom SW-RVC charges Flooded (or wet) lead-acid, Gel, AGM (absorbed glass mat), and Custom batteries.

- **Flooded (or wet)** batteries have removable battery caps for refilling with distilled water and testing the electrolyte.
- **Gel** batteries have the electrolyte in the form of a gel rather than a liquid and do not require topping up. Gel batteries are sealed and the battery caps are not removable.
- **AGM (Absorbed Glass Mat)** batteries are similar to gel batteries except that the electrolyte is absorbed into a fiberglass matting.
- **Custom** battery is configured by the dealer, factory, or service center for battery types other than those listed above.

NOTICE

BATTERY DAMAGE

Do not mix battery types. The Freedom SW-RVC can only select one battery type setting for all batteries connected to its bank. All connected batteries should either be: Flooded (or wet) *or* Gel *or* AGM *or* Custom.

Failure to follow these instructions can result in equipment damage.

Charge Algorithm Stages

Three-Stage charging

If three-stage charging is enabled, the Freedom SW-RVC will charge batteries in a sequence known as three-stage charging. Whenever qualified AC power is present at the inverter's input, it passes power through to the connected load and begins charging the batteries. See *"Battery Charging Reference" on the previous page* for a graph of the three-stage charging profile.

The charging voltage delivered to the battery depends on the battery's:

- Type setting
- Temperature (by switch setting or battery temperature sensor)
- State of charge

The three automatic stages are:

- Bulk
- Absorption
- Float

Two-Stage charging

Two-stage (or no float) mode differs from an ordinary three-stage charge mode in that it does not continuously maintain the battery at float voltage. It is sometimes called no-float charging. See *"Battery Charging Reference" on the previous page* for a graph of the two-stage charging profile.

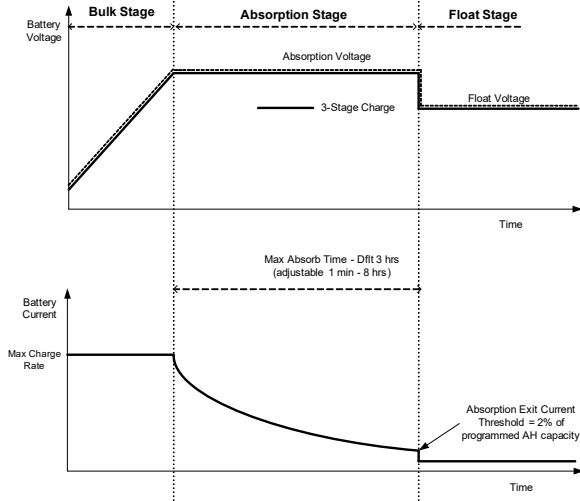
The charging voltage delivered to the battery depends on the battery's:

- Type setting
- Temperature (by switch setting or battery temperature sensor)
- State of charge

The two automatic stages are:

- Bulk
- Absorption

Figure 7 Three-Stage Battery Charging Cycle

**NOTE:**

When the charge cycle is interrupted, the charger will restart charging at the beginning of the multistage algorithm.

Exit Current Threshold can be effectively disabled by programming the amp-hour capacity to the minimum. In this case, absorption will only exit once the Max Absorption timer expires.

Charge current during equalize state (optional state not shown here) is normally limited to 10% of the programmed amp-hour capacity setting. If this setting is programmed to the maximum, the charge current during equalize is instead limited to whatever is programmed for the maximum current limit of the unit.

Synchronized charge states are active when more than one charging device is connected in the system via the RV-C network.

The first unit (Freedom SW-RVC) to enter bulk, causes all other chargers to enter bulk.

The first Freedom SW-RVC to enter absorption causes all other Freedom SW-RVCs to enter absorption.

The last Freedom SW-RVC ready to exit absorption triggers all Freedom SW-RVCs to exit absorption and exit charge.

Bulk Stage

Bulk charge is the first stage in the charging process and provides the batteries with a controlled, constant current. Once the battery voltage rises to the absorption voltage threshold, the charger switches to the absorption stage.

Table 15 Preset Bulk Voltage Settings

Battery Type	Termination Voltage	Preset Bulk Voltage
Flooded	14.2	14.4
Gel	14.0	14.2
AGM	14.1	14.3
Custom	14.4 (changeable)	14.4 (changeable)

Absorption Stage

Absorption charge is the second stage of battery charging and provides the batteries with a controlled, constant voltage. During this stage, the current drawn by the batteries slowly decreases. When this current falls below 2% of the battery capacity, or when the configurable Absorb Time expires, the charger switches to the Float or NoFloat stage, depending on the selected charge cycle. The timer begins when the battery voltage is above the bulk termination voltage for three minutes.

Table 16 Preset Absorption Voltage Settings

Battery Type	Preset Absorption Voltage
Flooded	14.4
Gel	14.2
AGM	14.3
Custom	14.4 (changeable)

The Freedom SW-RVC transitions to the float stage if either one of the following two conditions are met:

- The charge current allowed by the batteries falls below the exit current threshold, which is equal to 2% of the programmed battery capacity (for a 500 amp-hour battery bank, this would be 10 amps), for three minutes.
- The Freedom SW-RVC has been in absorption for the programmed maximum absorption time limit. The default is 3 hours, but the time limit is programmable from 1 minute to 8 hours.

NOTE:

If there are DC loads on the batteries, the charger's current may never decrease to a level to initiate the next stage of charging. In this case, the charger would stay in absorption until the Absorb Time setting is reached.

To make sure the charger does not remain in absorption for too long, adjust Absorb Time on the Charger Settings. The timer begins at the start of the absorption stage and terminates absorption charging if the charge current does not decrease to below 2 per cent of the battery capacity before the Absorb Time setting expires. The Absorb Time setting may be increased if the charge cycle continually runs the full Absorb Time in the absence of DC loads. This is an indication of too large a battery bank for the selected Absorb Time setting.

Float Stage

Float charge maintains the batteries slightly above the self discharge voltage of the batteries. The charge current in float is the current necessary to maintain the batteries at the Float Voltage setting, limited only by the inverter's capability or other settings that limit the inverter's maximum charge rate. Float charging reduces battery gassing, minimizes watering requirements (for flooded batteries), and makes sure the batteries are in a constant state of readiness. When three-stage charging is selected, the charger automatically switches to the float stage after the batteries have received a bulk and absorption charge (see *Figure 8 on page 51*). The batteries are maintained at the default float voltage level for the selected battery type or the voltage selected under Float Voltage on the Custom Battery Settings.

Table 17 Preset Float Voltage Settings

Battery Type	Preset Float Voltage
Flooded	13.5
Gel	13.8
AGM	13.4
Custom	13.5 (changeable)

WARNING

ELECTRIC SHOCK HAZARD

The battery voltage can increase above the float voltage when using an external charging device such as PV arrays, wind turbines, and micro-hydro generators. Be sure to include appropriate charge management equipment with all external DC sources.

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

Two-Stage Charging Process

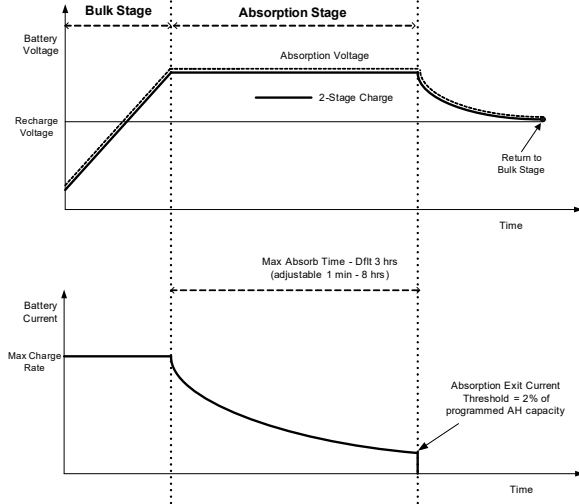
Two-stage (or no float) mode differs from an ordinary three-stage charge mode in that it does not continuously maintain the battery at float voltage. Instead, the Freedom SW-RVC begins charging the battery in bulk mode whenever the battery voltage drops below the recharge level. While the battery voltage is above the recharge level the inverter's AC transfer switch continues to pass power through from the utility grid to the loads, but does not actively charge the batteries.

Two-stage mode increases efficiency of utility connected systems by reducing the amount of power consumed by the inverter and batteries compared to when the battery is continuously maintained at Float Voltage. This feature can extend the life of most batteries.

NOTE:

If the AC input fails or drops below the lower VAC limit (as set in AC Settings), the complete multistage charge cycle (bulk, absorption, float/no float) restarts once the source AC recovers to within the acceptable range. If the batteries are already nearly full, the charge cycle will take little time to complete.

Figure 8 Two-Stage Charging Cycle

**NOTE:**

When the charge cycle is interrupted, the charger will restart charging at the beginning of the multistage algorithm.

Exit Current Threshold can be effectively disabled by programming the amp-hour capacity to the minimum. In this case, absorption will only exit once the **Max Absorption** timer expires.

Charge current during equalize state (optional state not shown here) is normally limited to 10% of the programmed amp-hour capacity setting. If this setting is programmed to the maximum, the charge current during equalize is instead limited to whatever is programmed for the max current limit of the unit.

Synchronized charge states are active when more than one charging device is connected in the system via the RV-C network.

The first unit to enter bulk, causes all other chargers to enter bulk.

The first Freedom SW-RVC to enter absorption causes all other Freedom SW-RVCs to enter absorption.

The last Freedom SW-RVC ready to exit absorption triggers all Freedom SW-RVCs to exit absorption and exit charge.

Equalize Charging

NOTE: There is a fourth stage, equalization, which is initialized manually as it is only performed occasionally and only on flooded (or wet) batteries.

Many battery manufacturers recommend periodic equalize charging to counter cell charge imbalance and capacity-robbing electrolyte stratification. Equalizing helps to improve battery performance and lifespan by encouraging more of the battery material to become active.

Battery equalization is a controlled overcharging method that mixes up stratified electrolyte and reactivates unused areas of the plate material. Periodic equalizing can help to regularly restore batteries to a full and healthy state of charge.

WARNING

HEAT HAZARD

Consult the battery manufacturer's recommendation for equalize charging settings. Sealed batteries should **never** be equalized. Consult the battery manufacturer for optimal charging procedures when using sealed batteries.

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

When **Equalize** mode is enabled, the battery is charged from bulk to absorption, and then to the equalize phase. The Freedom SW-RVC will transition from the absorption phase to equalize if:

- the DC charge current is below 2% of the configured battery capacity (for example, 8.8A for 440Ah)
- the absorption time is exceeded (for example, 180 min)

After absorption, the maximum charge DC current is set to 10% of battery capacity (for example, 44A for 440Ah). This constant current charge will continue until the voltage has increased to the equalize voltage at which point the battery will be regulated at the temperature-compensated equalize voltage.

If the battery capacity is set to zero (Ah=0 effectively disables the exit current criteria for the absorption charge stage making the absorption stage defined by time only), the equalize charge current is fixed at maximum 100% of the charge rate.

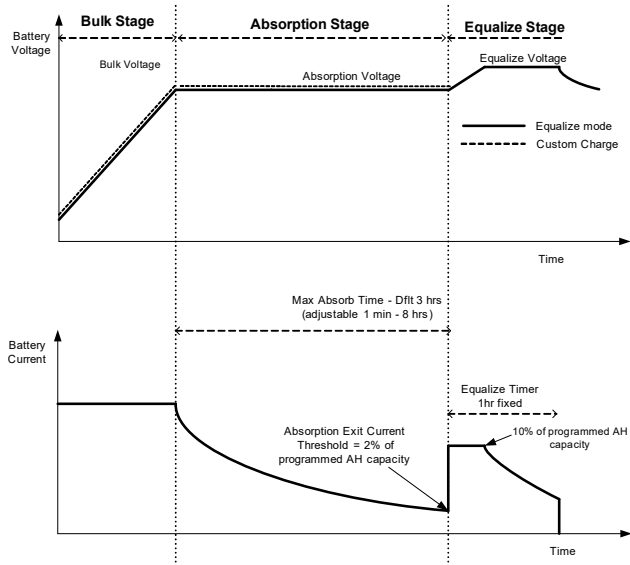
Equalization duration is fixed at one hour.

Table 18 Preset Equalization Voltage

Settings

Battery Type	Preset Equalization Voltage
Flooded	16.0
Ge1	n/a
AGM	n/a
Custom	16.0 (changeable)

Figure 9 Equalize Charging




4 ROUTINE MAINTENANCE

Maintaining the Freedom SW-RVC Unit

 WARNING
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ELECTRICAL SHOCK HAZARD

Turning the Power  button to Standby does not disconnect DC battery power from the Freedom SW-RVC. You must disconnect from all power sources before working on any circuits connected to the unit.
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Failure to follow these instructions can result in death, serious injury, or equipment damage.

Periodically you should:

- With all sources of power off, clean the exterior of the unit with a damp cloth to prevent the accumulation of dust and dirt.
- Ensure that the DC cables are secure and fasteners are tight.
- Make sure the ventilation openings are not clogged.

5 TROUBLESHOOTING

This section will help you narrow down the source of any problem you encounter.

Before contacting customer service, please work through the steps listed below.

1. Check for a warning or fault message on the RV-C system device controller, if available or a fault code on the inverter information panel. If a message is displayed, record it immediately.
2. As soon as possible, record the conditions at the time the problem occurred so you can provide details when you contact customer service for help. Include the following information:
 - What loads the Freedom SW-RVC was running or attempting to run
 - What the battery condition was at the time (voltage, etc.) if known
 - Recent sequence of events (for example, charging had just finished, utility grid had failed but the inverter did not come on)
 - Any known unusual AC input factors such as low voltage or unstable generator output
 - Whether any extreme ambient conditions existed at the time (temperature, vibrations, moisture, etc.)
3. Attempt the solution indicated in these guidelines.
4. If your inverter information panel is not displaying a Fault LED, check the following list to make sure that the present state of the installation allows proper operation of the unit. Read these

guidelines carefully.

- Is the inverter/charger located in a clean, dry, adequately ventilated place?
 - Are the battery cables adequately sized as recommended in the Installation guide?
 - Is the battery in good condition?
 - Are all DC connections tight?
 - Are the AC input and output connections and wiring in good condition?
 - Are the configuration settings correct for your particular installation?
 - Are all disconnects and AC breakers closed and operable?
 - Have any of the fuses blown in the installation?
5. Contact customer support for further assistance. Please be prepared to describe details of your system installation and to provide the model and serial number of the unit. See the front and/or back of the manual for contact information.

Troubleshooting the Freedom SW-RVC

The Freedom SW-RVC is designed with a number of protection features to provide efficient operation. If, however, you have any problems operating your inverter/charger read this troubleshooting chapter.

If you cannot resolve the problem, record the information about your system. This information will help your dealer or customer service to assist you better when you contact them.

WARNING

ELECTRICAL SHOCK HAZARD

Do not disassemble the Freedom SW-RVC. It does not contain any user-serviceable parts.

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

When a detected fault or warning message appears on a RV-C system device controller, if available, try to clear the message first by pressing the Clear Fault Rest button on the unit. If the message persists, see *Table 21 on page 58* or possible explanations.

Detected Fault Types

There are three types of detected fault messages: automatic faults, manual faults, and escalating automatic faults. The following table describes how they differ in their behavior and how you can respond to them when they appear on the RV-C system device controller, if available.

Table 19 Detected Fault Types and Behaviors

Fault type	Behavior
Automatic fault	Clears automatically if the detected condition that generated the message goes away. You can also acknowledge automatic faults via RV-C system device controller, if available or by pressing the Clear Fault Reset button on the unit.
Manual fault	Requires you to clear it by: <ul style="list-style-type: none"> • Pressing the Clear Fault Reset button on the unit. • Correcting the condition that detected the fault.

Escalating automatic faults	<p>Clears automatically if the detected fault condition goes away, just like an automatic fault.</p> <p>However, if an escalating automatic fault occurs several times within a defined time period, the escalating automatic fault becomes a manual fault, requiring user intervention. For example, if three detected faults occur in one minute, it will no longer clear itself but becomes a manual fault. Then, you must identify the problem, correct the condition that detected the fault, and clear the fault or reset the device.</p>
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Detected Warning Types There are two types of warnings: automatic and manual warnings. Table 1 describes how they differ in their behavior and how you can respond to them when they appear on the RV-C system device controller, if available.

Table 20 Detected Warning Types and Behaviors

Warning type	Behavior
Automatic warning	Clears automatically if the detected condition that generated the message goes away.
Manual warning	<p>Requires you to acknowledge it before you can proceed with configuring or operating the Freedom SW-RVC.</p> <p>Refer to the RV-C system device controller, if available User Guide for more information.</p>

Table 21 provides a detailed description of the detected fault messages and solutions. If you are unable to resolve the problem after referring to this table, contact your dealer or Customer Service.

Table 21 Detected Fault Messages

Fault Number	Message	Fault Type	Cause	Solution
F1	AC Output under voltage	Escalating Auto Fault. Must occur 3 times in 30 seconds before becoming a manual fault.	Inverter voltage is under 100 volts.	Remove excessive load.

Fault Number	Message	Fault Type	Cause	Solution
F2	AC Output over voltage	Escalating Auto Fault. Must occur 3 times in 30 seconds before becoming a manual fault.	Inverter voltage is over 135 volts.	Check if there is an external power source that is running parallel to the inverter's output.
F17 F18 F22	Relays Welded	Manual	AC backfeed from welded relay.	Service required.

Fault Number	Message	Fault Type	Cause	Solution
F44	Battery Over Temperature	Automatic	Battery temperature is over 140 °F (60 °C).	Poor battery compartment ventilation. Stop charging if necessary. Check cable connections. Check battery voltage/current and temperature. If battery is not accepting charge, it may need to be replaced. Check for excessive ambient temperature and adequate ventilation in the battery compartment.
		Automatic	BTS may be damaged.	If the unit displays a temperature of over 212 °F (100 °C), the BTS will need to be replaced.
F45	Capacitor Over-temperature	Automatic	Same as F57.	Same as F57.

Fault Number	Message	Fault Type	Cause	Solution
F46	Controller Error	Manual	Unit's control board may be damaged.	Service is required.
F47	DC Under Voltage (Immediate)	Automatic	Immediate battery under voltage fault.	Check battery condition (short or open cells) and ensure correct voltage. Battery state charge or capacity is so low that the DC voltage collapses when inverter load is applied. Inverter load is so large that the DC voltage collapses when inverter load is applied.

Fault Number	Message	Fault Type	Cause	Solution
F48	DC Under Voltage (Fault)	Automatic	Voltage at the DC input terminals is below the Low Battery Cut Out (LBCO) setting for 10 seconds.	<p>Check for the correct battery voltage at the inverter's DC input terminals.</p> <p>Check for external DC loads on the batteries.</p> <p>Check condition of batteries and recharge if necessary.</p> <p>Reduce the Low Battery Cut Out (LBCO) setting.</p> <p>Battery bank capacity may be inadequate for the loads in the system.</p>
F49	DC Over Voltage	Automatic	Voltage at the DC input terminals is above the High Battery Cut Out Setting	<p>Clear the fault and attempt restart.</p> <p>Ensure battery voltage is 10–16 VDC at Freedom SW-RVC terminals. Check all other charging source outputs, battery cables.</p>

Fault Number	Message	Fault Type	Cause	Solution
F52–F56	EEPROM ERROR	Manual	A problem has been detected with the internal memory.	<p>Clear the fault and check the latest configuration made or any recent configurations. If fault detection reoccurs or occurs frequently, service is required.</p>

Fault Number	Message	Fault Type	Cause	Solution
F57	FET1 Over Temperature	Automatic	Ambient temperature may be too high.	Ensure adequate ventilation around the Freedom SW-RVC. Allow inverter to cool down and try restarting.

Fault Number	Message	Fault Type	Cause	Solution
			Operating too large of a load for too long while inverting.	Remove excessive inverter loads.
			Inverter cooling fan may have failed.	If the temperature is above 104 °F (40 °C), the fan should be on. Hold your hand or a piece of paper to the inverter vent to check if the fan is working. Both fans should be active at the same time. Inverter airflow intake may be blocked. Increase the clearance around the inverter and/or unclog the airflow intake vents.
			Inverter airflow intake may be blocked.	Increase the clearance around the inverter and/or unclog the airflow intake vents.

Fault Number	Message	Fault Type	Cause	Solution
F58	FET2 Over Temperature	Automatic	Same as F57.	Same as F57.
F60 F61 F62	Invalid Interrupt	Manual	Unit's control board may be damaged.	Service is required.
F63	Power Board Temp unreadable	Automatic	Temperature sensor is damaged.	Service required.
F64	AC overload	Escalating Auto Fault. Must occur 3 times in 60 seconds before becoming a manual fault.	Persistent excessive inverter current above rated current.	Avoid loads with long surge current.
F66	System Cfg shutdown	Manual	Internal error.	Service is required.
F67	Watchdog Error	Manual	Unit's control board may be damaged.	Service is required.

Fault Number	Message	Fault Type	Cause	Solution
F68	Transformer Over Temperature	Automatic	Same as F57.	Same as F57.
F69	External Sync Failed	Automatic	When Series stacking—the Stacking cable is not installed.	Install the Stacking cable to connect the two Freedom SW-RVCs.
F70	Unique Dev# Needed	Automatic	When stacking (Series or Parallel)—if two units have the same Device Number.	Change the Device Number of one unit.
F71	Too Many Masters	Automatic	When stacking (Series or Parallel)—if two units are configured as Master units.	Change one unit to a Slave unit.
F72	System AC Assoc Cfg	Automatic	When stacking (Series or Parallel)—if two units are configured as Master units.	Change one unit to a Slave unit.

Fault Number	Message	Fault Type	Cause	Solution
F73	Transformer Temp unreadable	Automatic	Temperature sensor is damaged.	Service required.
F74	Stacking mode config	Automatic	When stacking (Series or Parallel)—if one of the units encounters a fault that needs to be resolved.	Clear the primary fault on the unit that caused this fault.
F75	Stacking mode config	Automatic	When Parallel stacking—if the S1ave unit cannot detect the Master unit in the RV-C network.	Make sure that the two units are connected in the same RV-C network. Check cable connections and ensure that the plugs are neatly inserted in the ports. Check if the RV-C network is properly installed with network terminators.
F76 F77	Stacking mode config	Automatic	When stacking (Series or Parallel)—if all units are configured as S1ave .	Assign the other unit as Master .

Fault Number	Message	Fault Type	Cause	Solution
F79	Battery Sensor Short	Automatic	The BTS has been damaged.	Replace the BTS.
F85	PowerBoard Over Temperature	Automatic	Same as F57.	Same as F57.
F87	Inconsistent Frequencies	Automatic	In a stacking configuration—the AC input low and high frequency settings are not the same for both units.	Change the AC input low and hi frequency settings of both units in the stacking configuration to be the same. See <i>AC/In Settings on page 41</i> .

Table 22 provides a detailed description of the detected warning messages and solutions. If you are unable to resolve the problem after referring to this table, contact your dealer or Customer Service.

Table 22 Detected Warning Messages

Warning Number	Message	Cause	Solution
W44	Battery Over Temperature	Battery temperature is over 140 °F (60 °C).	<p>Poor battery compartment ventilation. Stop charging if necessary.</p> <p>Check cable connections.</p> <p>Check battery voltage/current and temperature. If battery is not accepting charge, it may need to be replaced.</p> <p>Check for excessive ambient temperature and adequate ventilation in the battery compartment.</p>
		BTS may be damaged.	If the unit displays a temperature of over 212 °F (100 °C), the BTS will need to be replaced.

Warning Number	Message	Cause	Solution
W47	DC Under Voltage (Immediate)	Immediate battery under voltage warning.	<p>Check battery condition (short or open cells) and ensure correct voltage.</p> <p>Battery state charge or capacity is so low that the DC voltage collapses when inverter load is applied.</p> <p>Inverter load is so large that the DC voltage collapses when inverter load is applied.</p>
W48	DC under voltage (Warning)	Voltage at the DC input terminals is below the Low Battery Cut Out (LBCO) setting.	<p>Check for the correct battery voltage at the inverter's DC input terminals.</p> <p>Check for external DC loads on the batteries.</p> <p>Check condition of batteries and recharge if necessary.</p> <p>Reduce the Low Battery Cut Out (LBCO) setting.</p> <p>Battery bank capacity may be inadequate for the loads in the system.</p>

Warning Number	Message	Cause	Solution
W49	DC Over Voltage	Voltage at the DC input terminals is above the High Battery Cut Out Setting	Clear the fault and attempt restart. Ensure battery voltage is 10–16 VDC at Freedom SW-RVC terminals. Check all other charging source outputs, battery cables.
W57	FET1 Over Temperature	Similar to F57.	Similar to F57.
W58	FET2 Over Temperature	Similar to F57.	Similar to F57.
W68	Transformer Over Temperature	Similar to F57.	Similar to F57.
W72	System AC Assoc Cfg	Similar to F72.	Similar to F72.
W73	Transformer Temp unreadable	Similar to F73.	Similar to F73.
W79	Battery Sensor Short	Similar to F79.	Similar to F79.

Warning Number	Message	Cause	Solution
W87	Inconsistent Frequencies	In a stacking configuration—the AC input low and high frequency settings are not the same for both units.	Change the AC input low and hi frequency settings of both units in the stacking configuration to be the same. See <i>AC In Settings</i> on page 41.
W92 W95 W96	Input Connected to 3-Phase AC	Input Connected to 3-Phase AC	Connect to single-phase only.

Inverter Applications

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

Resistive Loads

Resistive loads are the easiest and most efficient to drive. Voltage and current are in phase, which means they are in step with one another. Resistive loads generate heat in order to accomplish their tasks. Toasters, coffee pots, and incandescent lights are typical resistive loads. It is usually impractical to run larger resistive loads—such as electric stoves and water heaters—from an inverter due to their high current requirements. Even though the inverter may be able to accommodate the load, the size of battery bank will limit inverter run time.

Motor Loads

Induction motors (AC motors without brushes) require up to six times their running current on startup. The most demanding are those that start under load (for example, compressors and pumps). Of the capacitor start motors (typical in drill presses and band saws, for example), the largest you can expect to run is one horsepower. Universal motors are generally easier to start. Check that the Locked Rotor Amps (LRA) rating of the motor load does not exceed the maximum surge current rating of the inverter. Since motor characteristics vary, only testing will determine whether a specific load can be started and how long it can be run. If a motor fails to start within a few seconds or loses power after running for a time, it should be turned off. When the inverter attempts to start a load that is greater than it can handle, the inverter may shut down from an AC overload fault.

Problem Loads

Very Small Loads If the power consumed by a device is less than the threshold of the load sense circuitry, and **Load Sense** is enabled, the inverter will not run. Most likely the solution will be to disable load sense or lower the sense threshold.

Fluorescent Lights and Power Supplies Some devices cannot be detected when scanned by load sense circuitry. Small fluorescent lights are the most common example. Some computers and sophisticated electronics have power supplies that do not present a load until line voltage is available. When this occurs, each unit waits for the other to begin. To drive these loads, either a small companion load like a light bulb rated for more than the **Search Watts** setting must be used to bring the inverter out of load sense, or the inverter may be programmed to remain on by disabling load sense. See *Using Load Sense on page 32*.

Clocks You may notice that your clocks are not accurate. Some of the clocks on your appliances may reset when the Freedom SW-RVC is in load sense.

Searching

When the inverter is in load sense, it may fail to start some loads even though the rated wattage on the load is more than the **Search Watts** setting. Disable load sense or apply an additional load (companion load) to make the inverter exit load sense.

6 SPECIFICATIONS

NOTE: Specifications are subject to change without prior notice.

Physical Specifications	
L × W × H	387×343×197 mm (15.25×13.5×7.75 in.)
Net Weight	31.5 kg (69.4 lbs)

Environmental Specifications	
Nominal Ambient temperature	40 °C (104 °F)
Invert mode:	
Operating range (full power)	–20 to 40 °C (–4 to 104 °F)
Load @ maximum ambient	2600W @ 60 °C
Charge mode:	
Operating range (full power)	–4 to 77 °F (–20 to 25 °C)
Current @ maximum ambient	120 A @ 140 °F (60 °C)
Storage temperature range	–40 to 185 °F (–40 to 85 °C)
Humidity: Operation/Storage	≤ 95% RH, non-condensing
Altitude:	
Operating	4,572 m (15,000 feet)
Non-operating	15,240 m (50,000 feet)
Mounting	deck mount, wall mount with fans and DC/AC sides facing sideward

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

Inverter Specifications	
Output wave form	pure sine wave (true sine wave)
Output power (continuous)	3000 W (up to 40 °C)
Output power (5 seconds)	6000 W
Output current	24 A
Peak output current	80 A
Output frequency	60 Hz ± 0.2 Hz
Output voltage	120 VAC
AC output connection/s	Split phase in/dual out, Dual in/dual out
Peak efficiency	90%
No-load current draw (Inverter On)	<3 ADC
Standby current draw (Inverter Off)	<0.25 ADC
Input DC voltage range	10–16 VDC
Low battery voltage shutdown cut-off	10.5 V (selectable)
High battery voltage shutdown cut-off	16.5 V (selectable)

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

Charger Specifications	
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 50 °F (10 °C), Warm 77 °F (25 °C), Hot 104 °F (40 °C) The default setting is Warm.
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)
Output current (maximum)	150 ADC
Output voltage	12 VDC
Output voltage range	5–16 VDC
Dead battery charge voltage	> 5 VDC
Equalization cycle	Automatic, Manual by RV-C system device controller, if available

Charger Specifications

Optimal charging efficiency	> 85%
AC input power factor (at full charge rate)	> 0.95
AC input current	24A max. (including pass-thru)
AC input voltage	120 VAC
AC input voltage range	85–140 VAC
Supported AC input types	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 VAC, 60 Hz input, unless otherwise specified.

Transfer and General Specifications

Transfer time—utility to invert	< 20 ms
Minimum AC input voltage for transfer	85 VAC
Maximum AC input voltage for transfer	135 VAC
Minimum AC input frequency for transfer	45 Hz
Maximum AC input frequency for transfer	70 Hz
Cooling	Fan-cooled, temperature controlled

Regulatory Approvals

Product Safety	CSA C22.2 No. 107.1 and UL 458, 6th Ed.
EMI	CFR 47 (FCC) Part 15, Subpart B, ISED CAN ICES-003, Class B

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975-1056-01-01 Rev A

Printed in: