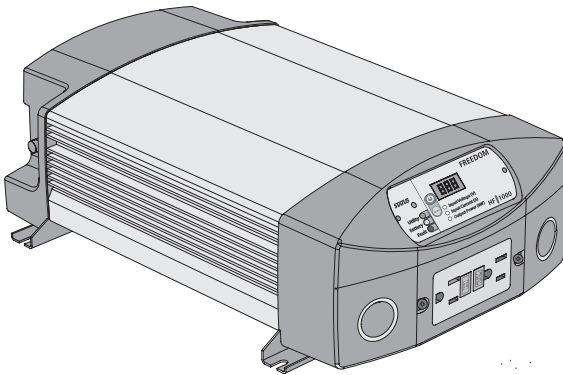


Smart choice for power™

xantrex™



Freedom HF 1000
Freedom HF 1800

Owner's Guide

Freedom HF
Inverter/Charger

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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 HF Installation***.

For complete information to help in setting up a **Freedom HF Installation** see the **Freedom HF Inverter/Charger Installation Guide (Doc. Part Number: 975-0395-01-01)**.

* *Recreational, Fleet Vehicle, or [Marine](#) installation.*

Scope

The **Guide** provides safety guidelines, as well as information about operating and troubleshooting the installation. 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 anyone who needs to operate a **Freedom HF Inverter/Charger** unit.

Organization

This **Guide** is organized into five chapters and one appendix.

Chapter 1 introduces you to the Freedom HF, explains the inverting, charging, and power system management functions.

Chapter 2 contains information and labeled illustrations to help identify the various features of the Freedom HF.

Chapter 3 explains how to configure the Freedom HF to best meet your electrical system requirements.

Chapter 4 explains how to operate the Freedom HF efficiently and effectively.

Chapter 5 describes how to troubleshoot the Freedom HF Inverter/Charger during operation.

Appendix A contains electrical performance information and product specifications.

Conventions Used

The following conventions are used in this guide.

DANGER

STATEMENT OF HAZARD

Contains statements of avoidance or strict compliance.

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

WARNING

STATEMENT OF HAZARD

Contains statements of avoidance or strict compliance.

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

CAUTION

STATEMENT OF HAZARD

Contains statements of avoidance or strict compliance.

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

CAUTION

STATEMENT OF HAZARD

Contains statements of avoidance or strict compliance.

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

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

Important Safety Instructions

IMPORTANT: Read and save this **Owner's Guide** for future reference.

This chapter contains important safety and operating instructions for the **Freedom HF Inverter/Charger** units—**Freedom HF 1000** and **Freedom HF 1800**.

WARNING

LIMITATIONS ON USE

The **Freedom HF** is not intended for use in connection with life support systems or other medical equipment or devices.

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

1. BEFORE INSTALLING AND USING THE **FREEDOM HF**, READ ALL INSTRUCTIONS AND CAUTIONARY MARKINGS ON THE **FREEDOM HF**, THE BATTERIES, AND ALL APPROPRIATE SECTIONS OF THIS GUIDE.

CAUTION

RISK OF INJURY

To reduce the risk of injury, charge only 12 Vdc lead-acid (GEL, AGM, or Flooded) rechargeable batteries. Other battery types may burst, causing personal injury and damage.

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

2. Do not expose the **Freedom HF** to rain, snow, spray, or bilge water. To reduce risk of fire hazard, do not cover or obstruct the ventilation openings. Do not install the **Freedom HF** in a zero-clearance compartment. Overheating may result.
3. 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 **Freedom HF** with damaged or substandard wiring.
4. The use of any attachments not recommended or sold by Xantrex, may result in risk of fire, electric shock, or injury to persons.

5. Do not operate the **Freedom HF** if it has received a sharp blow, been dropped, or otherwise damaged in any way.
6. Do not disassemble the **Freedom HF**. It contains no user-serviceable parts. Attempting to service the **Freedom HF** yourself may result in a risk of electrical shock or fire and will void your warranty. Internal capacitors remain charged after all power is disconnected.
7. To reduce the risk of electrical shock, disconnect both AC and DC power from the **Freedom HF** before attempting any maintenance or cleaning or working on any circuits connected to the **Freedom HF**. Turning off controls will not reduce this risk.
8. The **Freedom HF** must be provided with an equipment-grounding conductor connected to the AC input ground.

 **WARNING**

EXPLOSION HAZARD

Working in the vicinity of batteries is dangerous. Batteries generate explosive gases during normal operation. Before servicing the unit in the vicinity of the battery, read this manual and follow the notes below exactly.

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

NOTES:

1. This equipment contains components which tend to produce arcs or sparks. To prevent fire or explosion, do not install the **Freedom HF** in compartments containing batteries or flammable materials, or in locations that require ignition-protected equipment. This includes any space containing gasoline-powered machinery, fuel tanks, as well as joints, fittings, or other connections between components of the fuel system.
2. To reduce the risk of battery explosion, follow these instructions and those published by the battery manufacturer and the manufacturer of any unit you intend to use in the vicinity of the battery.

Personal Precautions When Working With Batteries



WARNING: BATTERIES PRESENT RISK OF ELECTRICAL SHOCK, BURN FROM HIGH SHORT-CIRCUIT CURRENT, FIRE OR EXPLOSION FROM VENTED GASES. OBSERVE PROPER PRECAUTIONS.

 WARNING
ELECTRICAL SHOCK, BURN, FIRE, AND EXPLOSION HAZARDS Study and follow all of the battery manufacturer's specific precautions. See notes below. Failure to follow these instructions can result in death or serious injury.

NOTES:

1. Remove (or do not remove) cell caps while charging and follow recommended rates of charge.
2. 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 cell caps, carefully follow manufacturer's recharging instructions.
3. Make sure the area around the battery is well ventilated.
4. Never smoke or allow a spark or flame near the engine or batteries.
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.
6. Remove all metal items, like rings, bracelets, and watches when working with batteries. Batteries can produce a short circuit current high enough to weld metal to skin, causing a severe burn.

7. Have someone within range of your voice or close enough to come to your aid when you work near a lead-acid battery.
8. Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.
9. Wear complete eye protection and clothing protection. Avoid touching your eyes while working near batteries.
10. If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters your eye, immediately flood it with running cold water for at least twenty minutes and get medical attention immediately.
11. If you need to remove a battery, always remove the ground terminal from the battery first. Make sure all accessories are off so you don't cause an arc.
12. Never charge a frozen battery.
13. Clean battery terminals. Be careful to keep corrosion from coming into contact with your eyes.

MARINE UNIT LOCATION

14. Locate the **Freedom HF** unit away from batteries in a separate, well ventilated compartment.
15. Never place the **Freedom HF** unit directly above batteries; gases from a battery will corrode and damage the unit
16. Never allow battery acid to drip on the unit when reading gravity, or filling battery.
17. Do not operate the unit in a closed in area, or restrict the ventilation in any way.

DC CONNECTION PRECAUTION

18. Connect and disconnect DC output connections only after setting any marine unit switches to off position and opening AC disconnect
19. FOR MARINE INSTALLATIONS, EXTERNAL CONNECTIONS TO THE UNIT SHALL COMPLY WITH THE UNITED STATES COAST GUARD ELECTRICAL REGULATIONS(33CFR183, SUB PART I)
20. PROPER DISPOSAL OF BATTERIES IS REQUIRED. REFER TO YOUR LOCAL CODES FOR DISPOSAL REQUIREMENTS.

Precautions for Using Rechargeable Appliances

CAUTION
<p>EQUIPMENT DAMAGE</p> <p>Most rechargeable battery-operated equipment uses a separate charger or transformer that is plugged into an AC receptacle and produces a low voltage charging output.</p> <p>Failure to follow these instructions can damage the unit and/or damage other equipment.</p>

Some chargers for small rechargeable batteries can be damaged if connected to the **Freedom HF**. Do not use the following with the **Freedom HF**:

- Small battery-operated appliances like flashlights, razors, and night lights that can be plugged directly into an AC receptacle to recharge.
- Some chargers for battery packs used in power hand tools. These affected chargers display a warning label stating that dangerous voltages are present at the battery terminals.

Important: if you are unsure about using your rechargeable appliance with the **Freedom HF**, contact the equipment manufacturer to find out if the appliance is acceptable for use with modified sine wave input voltage. See the detailed description of the **Freedom HF** waveform in [Appendix A, “Specifications”](#) under [“Electrical Specifications: Inverter Mode”](#) on page A-2.

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1

Introduction

Chapter 1 introduces you to the **Freedom HF**, explains the inverting, charging, and power system management functions.

It covers the following:

- **Freedom HF**'s major features, and
- **Freedom HF**'s function as an independent power system.

Freedom HF Inverter/Charger

Congratulations on your purchase of the **Freedom HF Inverter/Charger (Freedom HF)**. As part of the Freedom Inverter/Charger family, the **Freedom HF 1000** and **Freedom HF 1800** give you quality power, worry-free operation, and outstanding reliability. The **Freedom HF**'s integrated inverting–charging functions and numerous power management features make it ideal for marine installations, recreational and commercial vehicles.

Quality Power

The **Freedom HF** provides up to 1000 watts (**Freedom HF 1000**) or up to 1800 watts (**Freedom HF 1800**) of continuous modified sine wave power from a battery bank. It is designed to handle loads such as a 600-watt microwave (**Freedom HF 1000**) or 1000-watt microwave (**Freedom HF 1800**), TVs, VCRs, and midsized power tools.

The **Freedom HF**'s high surge capability lets you handle many hard-to-start loads, including large TVs and small refrigerators.

The built-in transfer switch automatically transfers between inverter power and incoming AC power (shore power) to ensure power is always available.

The built-in charger automatically charges the battery bank when the **Freedom HF** is connected to incoming AC power (shore power).

Comprehensive Protection

The **Freedom HF**'s built-in protection features safeguard your batteries and equipment to give you worry-free operation:

- The **low battery voltage alarm and shutdown** prevents your batteries from becoming completely discharged.
- The **three-stage charging capability** ensures that batteries receive the “best” charge with minimal wear and tear.
- If the **Freedom HF** detects “bad” AC voltage, it **switches automatically** to Inverter mode and supplies your equipment with modified sine wave power derived from the batteries. When “good” AC becomes available again, the **Freedom HF** allows the AC to pass through to your loads and automatically begins to recharge the batteries.

Reliable Back-up

If incoming shore power fails, the **Freedom HF** automatically detects the failure and instantly becomes an independent power source that supplies quality AC to your loads.

**Overload
Alarm and
Shutdown**

During Inverter mode, the **Freedom HF** automatically alerts you if the loads that are connected and drawing power from the unit are close to the maximum operating limit.

The **Freedom HF** automatically shuts down when the maximum operating limit is exceeded.

**Over-temp
Alarm and
Shutdown**

During Inverter mode, the **Freedom HF** automatically alerts you if it is overheating and approaching the over-temperature shutdown limit.

The **Freedom HF** automatically shuts down when the limit is exceeded.

Independent Power System

Your **Freedom HF** has been designed to be the heart of a sophisticated, independent power system. While the **Freedom HF** is an extremely “friendly” product to operate, Xantrex wants to ensure that you get the best performance from your system.

Inverting

Freedom HF produces 120 Vac from your 12V batteries and is capable of starting heavy loads like refrigerators and pumps.

When the **Freedom HF** is inverting (producing 120 Vac output) without a load, it draws less than 1A of current from the battery (or battery bank).

This feature allows the unit to operate without draining too much stored energy.

Charging

For the inverter to perform effectively, the batteries must be charged correctly. The unit has a built-in three-stage charging system that extends the life and optimizes the performance of the batteries.

In addition to the numerous features which let you maximize your battery’s life and performance, the **Freedom HF**—unlike many chargers—also has the ability to recharge batteries even if the voltage is near zero (sometimes called dead battery charging).

2

Features

Chapter 2 contains information and labeled illustrations to help identify the various features of the **Freedom HF**.

It covers the following:

- Materials list,
- Default settings list,
- Front panel features,
- Side panel features,
- Rear panel features, and
- Display panel features

Materials List

Your **Freedom HF Inverter/Charger** package includes the items listed below.

- 1 **Freedom HF Inverter/Charger** unit
- 1 Display panel with 7-inch (0.17 m) cable
- 1 Communications cable (25 feet) (7.5 m)
- 2 DC terminal covers
- 2 Strain-relief clamps (for AC input and output wiring)
- 1 Blanking plate
- 2 Reference materials—an Owner's Guide and an Installation Guide
- 1 Set of mounting templates
- 1 Set of lock washers and nuts (not shown)

Freedom HF unit

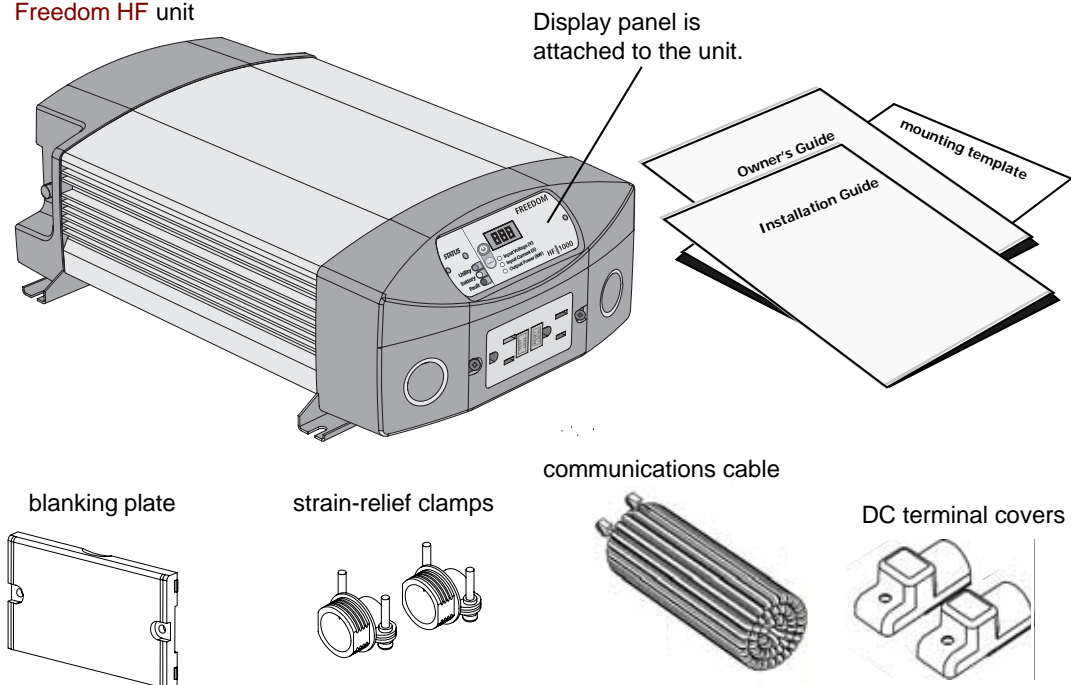


Figure 2-1 What's In The Box

Default Settings for the Freedom HF System

Table 2-1 lists the default settings for the Freedom HF system.

You may record your settings in the right-hand column after you have configured the Freedom HF.

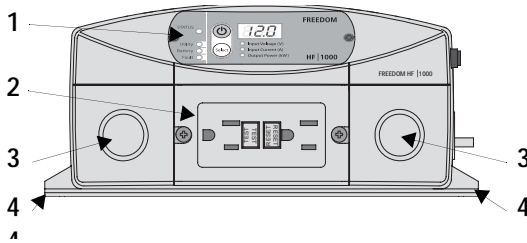
Table 2-1 Freedom HF Default Values

Item	Default Setting	Your Setting
Alarm*	ON	
Charger Current*	20A (Freedom HF 1000)	
	40A (Freedom HF 1800)	
Battery Type **	Flooded(14.4/13.5)	

* adjustable from the display panel.

** adjustable from the main unit behind the display panel assembly.

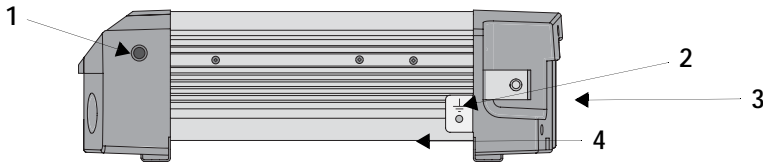
Front Panel



Freedom HF 1000 shown

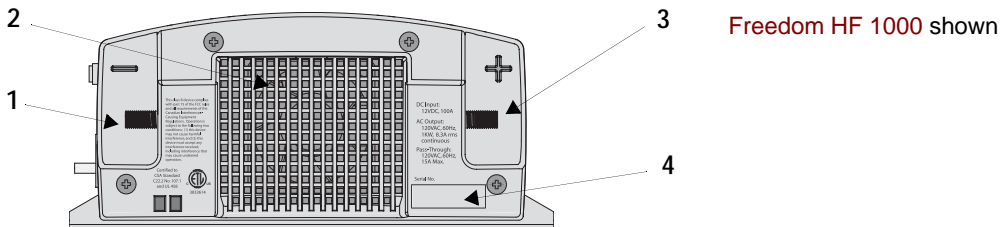
Feature	Description
1	Display panel displays inverter status and battery status information on the screen. The panel can be detached to expose the dip switches behind it and to extend and mount the panel on a wall or other location.
2	GFCI receptacles provide 1000 W (Freedom HF 1000) or 1800 W (Freedom HF 1800) of power to operate AC devices. The GFCI receptacles can be removed to access the AC wiring compartment for hard wiring the inverter to an existing AC power system.
3	Knockouts for routing AC input and output wiring in hard wired installations.
4	Mounting flange allows you to mount the inverter permanently.

Side Panel



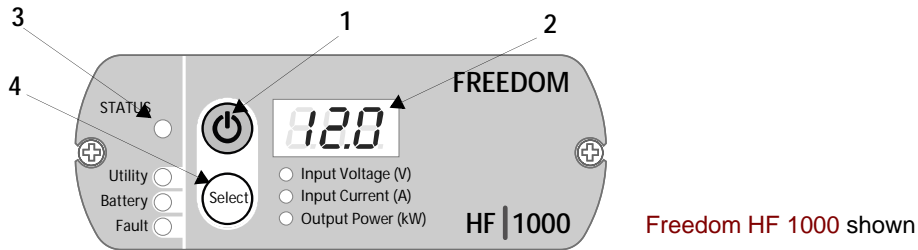
Feature	Description
1	15 A supplementary protector provides overload protection for the GFCI receptacles. In a hard wired installation, the supplementary protector does not protect output wiring.
2	Grounding stud provides a ground path for the Freedom HF chassis to the DC system ground.
3	Main cooling fan turns on when powering loads above 500 W or when the internal temperature reaches a set point temperature.
4	Auxiliary cooling fan (Freedom HF 1800 only) performs the same function as the main cooling fan.

Rear Panel



Feature	Description
1	Negative DC cabling terminal connects to the negative terminal of the battery using a battery cable.
2	Ventilation grille (openings) must not be obstructed for the proper operation of the cooling fan and inverter. When the inverter is mounted, the ventilation grille must not point up or down.
3	Positive DC cabling terminal connects to the positive terminal of the battery using a battery cable.
4	Serial number of your unit.

Display Panel



Feature	Description
1	Inverter button is the main unit switch that turns the Freedom HF's inverter function ON or OFF. See page 4–2 for additional information.
2	Three-digit LED display screen shows status information and fault codes. See page 4–2 for additional information.
3	Status LED indicates the mode of operation with a three-color LED. See page 4–2 for additional information.
4	Select button changes status information displayed on the display screen. See page 4–2 for additional information.
IMPORTANT: See Chapter 4, “Display Panel Operation” starting on page 4–2 for detailed information on operating the panel’s buttons.	

3

Configuration

Chapter 3 explains how to configure the **Freedom HF** to best meet your electrical system requirements.

It covers the following:

- Setting battery types on the main unit on [page 3-2](#).
- Adjusting display, alarm, and charging current settings on [page 3-3](#).

Setting Battery Types on the Main Unit

You can attach different types of lead-acid batteries to the **Freedom HF**. Before installing batteries make sure that you configure the unit to optimize the charging process.

⚠ WARNING

FIRE HAZARD

Incorrectly setting the battery type can lead to battery damage and a risk of fire.

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

The settings can be changed by adjusting the dip switches found on the main unit behind the display panel.

Battery Type	Dip Switch Setting Switch 1 Switch 2	Bulk/Absorption	Float
Fixed	OFF OFF	13.5	13.5
Flooded	OFF ON (default)	14.4	13.5
GEL	ON OFF	14.2	13.8
AGM	ON ON	14.3	13.4

To adjust the battery type setting:

By default the battery type is set to Flooded (OFF|ON).

1. Detach the Display Panel to expose the Dip Switches.
2. Use the tip of your fingernail or a small screw driver with a flat tip to adjust the switches.

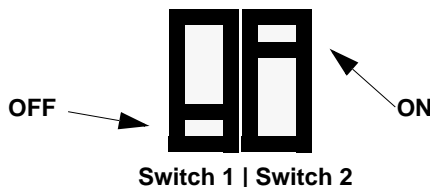


Figure 3-1 Dip Switches (Default Settings Shown)

Adjusting Feature Settings

The Power and Select buttons can be used to:

- change the charging current setting,
- change the inverter mode setting,
- disable or enable the audible alarm,
- change the shutdown setting, and
- return to factory default settings.

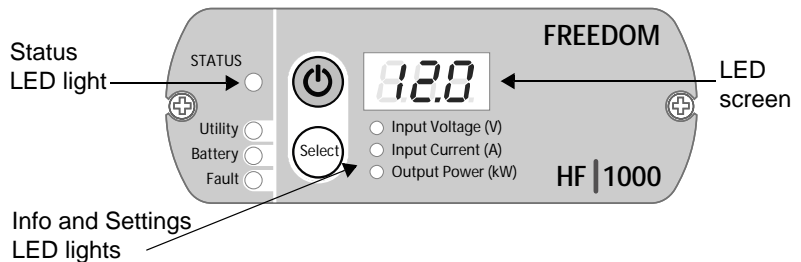


Figure 3-2 Display Panel

To cycle through the various feature settings:

1. Press and hold the Power button for five seconds to enter the feature settings mode.
2. Press the Power button to toggle between the following information:

Setting	LED Screen
Charging Current Setting	<i>CUr</i>
Inverter Mode Setting	<i>In</i>
Alarm Setting	<i>AL</i>
Shutdown Setting	<i>Sd</i>
Factory Setting	<i>dEF</i>

By default the charging current is set to 55 A.

To change the charger’s charging current setting:

1. Press and hold the Power button for five seconds.
The LED screen will flash “**CUr**” intermittently.
2. Press the Select button once.
The LED screen will display the present charging current setting. Example, “**40A**” for a 40 A setting.
3. Press the Select button again to change to the next setting.
The LED screen shows the next setting. Example, “**2A**” for a 2 A setting.
4. Continue pressing the Select button to cycle through each of the four settings – “**2A**”, “**10A**”, “**20A**”, and “**40A**” until you reach the desired setting.
5. Press and hold the Select button for five seconds to make the setting permanent.

Table 3-1 Charging Current Guidelines

AC Input Circuit Breaker or fuse size (Amps)	Charger DC Current Setting (Amps)	Maximum By-pass AC Current Available (Amps)
15	5	12.5
	15	9.5
	35	4.0
	55	0
20	5	17.5
	15	14.5
	35	9.0
	55	5.0
30	5	27.5
	15	24.5
	35	19.0
	55	15.0

By default the inverter mode is set to ON.

To change the inverter mode setting:

ON (“**I n I**”) will put the inverter on standby. This means when shorepower is present, AC shorepower will pass through as AC output. And when shorepower is not available, the inverter function will take power from the battery and provide AC output power. When the inverter mode is ON, you can manually turn the inverter function ON or OFF by using the Power button. See [“Operating in Inverter Mode” on page 4–4](#).

OFF (“**I n 0**”) will completely disable inverter function. This means when shorepower is present, AC shorepower will still pass through as AC output. However, when shorepower is not available, the inverter function remains disabled and therefore no AC output power. When the inverter mode is OFF, you cannot manually turn the inverter function ON or OFF by using the Power button.

1. Press and hold the Power button for five seconds.
2. Press the Power button once.
The LED screen will flash “**I n**” intermittently.
3. Press the Select button once.
The LED screen will display the present (or most recent) inverter mode setting.
Example, “**I n I**” for an inverter mode setting of ON or “**I n 0**” for an inverter mode setting of OFF.
4. Continue pressing the Select button to cycle through the two settings – “**I n I**” and “**I n 0**” until you reach the desired setting.
5. Press and hold the Select button for five seconds to make the setting permanent.

To adjust the alarm setting:

By default the alarm is set to ON.

ON (“**AL I**”) will sound the alarm on all warning and fault conditions.

OFF (“**AL 0**”) will mute the alarm.

1. Press and hold the Power button for five seconds.
2. Press the Power button twice.
The LED screen will flash “**AL**” intermittently.
3. Press the Select button once.
The LED screen will display the present (or most recent) alarm setting.
Example, “**AL I**” for an inverter mode setting of ON.

-
4. Continue pressing the Select button to cycle through the two settings – “**AL 0**” and “**AL 1**” until you reach the desired setting.
 5. Press and hold the Select button for five seconds to make the setting permanent.

To adjust the under voltage shutdown setting:

By default the low voltage setting is set to Low.

Low (“**SdL**”) sets the under voltage shutdown threshold to 10.5 V.

High (“**SdH**”) sets the under voltage shutdown threshold to 11.8 V.

1. Press and hold the Power button for five seconds.
2. Press the Power button three times.
The LED screen will flash “**Sd**” intermittently.
3. Press the Select button once.
The LED screen will display the present (or most recent) low voltage setting.
Example, “**SdL**” for a low shutdown voltage setting.
4. Continue pressing the Select button to cycle through the two settings – “**SdH**” and “**SdL**” until you reach the desired setting.
5. Press and hold the Select button for five seconds to make the setting permanent.

To return all feature settings to factory default settings:

1. Press and hold the Power button for five seconds.
2. Press the Power button four times.
The LED screen will flash “**dEF**” intermittently.
3. Press and hold the Select button for five seconds to return all feature settings to their factory default settings.

4

Operation

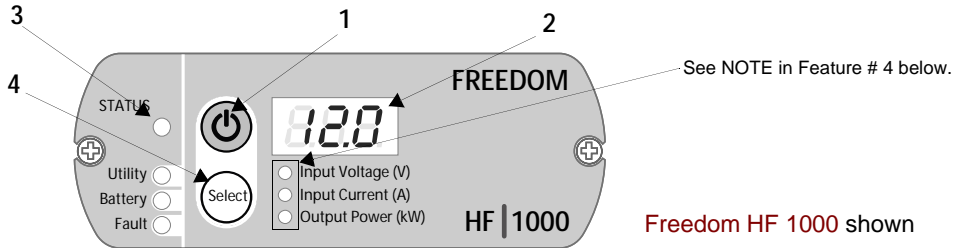
Chapter 4 explains how to operate the Freedom HF efficiently and effectively.

It covers the following:

- Procedures for operating the inverter from the display panel,
- Operating limits and inverter loads,
- Battery charging, and
- Information about routine maintenance.

Display Panel Operation

The **Freedom HF** features a display panel with three-digit LED display to show inverter, AC source, and battery status information.



Feature	Description
1	<p>Inverter button</p> <ul style="list-style-type: none"> Press and hold for one second to turn the Freedom HF's Inverter function ON or OFF (when AC Shore Power is NOT present.) Press and hold for five seconds to go into Charger Current Select Mode.
2	<p>Three-digit LED display screen shows status information and fault codes.</p>
3	<p>Status LED Indicates the mode of operation with a three-color LED.</p> <ul style="list-style-type: none"> Green pertains to Utility status. <ul style="list-style-type: none"> Solid indicates the Freedom HF is in shore power mode and battery is fully charged. Flashing indicates the Freedom HF is in shore power mode and the unit is currently charging the battery. Yellow pertains to Battery status. <ul style="list-style-type: none"> Solid indicates the Freedom HF is in inverter mode and using the battery to provide AC power. Flashing indicates the Freedom HF is in inverter mode but AC shore power is detected thus transferring to shore power mode within 20 seconds. Red indicates a Fault condition and the Freedom HF has shut down. See “Troubleshooting Reference” on page 5–8.
4	<p>Select button</p> <ul style="list-style-type: none"> In Inverter mode, press the button to choose what appears in the three-digit LED display: Input Voltage, Input Current, or Output Power. See “To change the inverter mode setting:” on page 3–5. NOTE: A corresponding LED lights up for each of the three items. In an Alarm condition, press and hold for two seconds to disable (or enable) the audible alarm. See “To adjust the alarm setting:” on page 3–5. In Charger Current Select Mode, press to select the charger current. See “To change the charger’s charging current setting:” on page 3–4.

Operating in Shore Power Mode

The **Freedom HF** operates in shore power mode when an AC source (a generator or utility power) is present at the AC input terminals. When the AC source is within operating range, the **Freedom HF** unit bypasses inverter function and powers the appliances connected to the unit. See “[Transitioning from Inverter Mode to Shore Power](#)” on page 4–7.

The **Freedom HF** also automatically charges the battery bank that is connected while in shore power mode. See “[Battery Charging](#)” on page 4–11.

The Green status LED lights up to indicate that the **Freedom HF** is using utility (or generator) power and the battery is full. A flashing Green LED indicates that the unit is charging the battery.

When shore power is present, AC power will automatically pass through the **Freedom HF**. Pressing the Inverter button on the display panel will not interrupt the supply of shore power. Shore Power mode supersedes Inverter mode.

When the **Freedom HF** ‘s Inverter button is turned ON and the AC source is outside the operating range or is disconnected, the transfer switch automatically switches to inverter mode. See “[Transitioning from Shore Power to Inverter Mode](#)” on page 4–7.

Operating in Inverter Mode

The **Freedom HF** is in inverter mode when shore power is not presently available and the unit is using the battery (inverting DC to AC) to power the appliances connected to the **Freedom HF**.

The Yellow status LED lights up to indicate the **Freedom HF** is using the battery to power the appliances.

The table below illustrates the battery status during inverter mode as shown on the display panel.

Turning the Inverter Function On and Off

The Inverter button on the display panel turns the **Freedom HF**'s Inverter function ON and OFF. To operate, press the button and hold for one second.

When shore power is NOT present:

- the AC outlets will supply power to any attached appliances when the Inverter button is turned ON, and
- the AC outlets will not supply power to any attached appliances when the Inverter button is turned OFF.

 WARNING
--

ELECTRICAL SHOCK HAZARD

Turning the Inverter button OFF does not disconnect DC battery power from the Freedom HF . You must disconnect both AC and DC power before working on any circuits connected to the Freedom HF .
--

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

To prevent unnecessary battery discharge, turn the Inverter button off when you are not using the **Freedom HF**.

Status LED During Inverter Mode

The following summarizes the behavior of the Status LED during Inverter mode.

Table 4-1 Status LED during Inverter Mode

Status LED	Display Screen	Condition
Solid YELLOW	12.8 (where 12.8 is an example of battery voltage)	Select button is pressed to display Input Battery Voltage. The Input Battery Voltage LED lights up. Value in display screen is shown as Volts.
	11 (where 11 is an example of current)	Select button is pressed to display Input Current. The Input Current LED lights up. Value in display screen is shown as Amps.
	0.85 (where 0.85 is an example of output power in Kilowatts)	Select button is pressed to display Output Power. The Output Power LED lights up. Value in display screen is shown as Kilowatts.
	E05 through E07	Warning condition detected while AC output power is still available. See Table 5-1, “Error Codes Displayed on the Display Panel Screen” on page 5-5.
Solid RED	E01 through E04	Fault condition detected and AC output power is not available. The unit will sound an alarm and will shutdown completely within 30 seconds. See Table 5-1, “Error Codes Displayed on the Display Panel Screen” on page 5-5.
Off	Off	Inverter is OFF.
Off (or Yellow)	00.0	No communication between the Freedom HF and the Display Panel because the battery voltage was too low to start the Inverter.

Checking Battery Status

During inverter mode, you can check the battery status by pressing the Select button until the Input Voltage LED (or Input Current LED) illuminates. The battery voltage (or battery current) appears in the three-digit LED display screen when the Input Voltage LED (or Input Current LED) illuminates.

The normal operating battery voltage range is between 11 and 15 volts.

Checking Output Power

During Inverter mode, you can check how much power (displayed in kW) the **Freedom HF** is supplying to the connected loads by pressing the Select button until the Output Power LED illuminates.

Operating Several Loads at Once

If you are going to operate several loads from the **Freedom HF**, turn them on one at a time after you have turned the inverter on.

Turning loads on separately helps to ensure that the inverter does not have to deliver the starting current for all the loads at once, and will help prevent an overload shutdown.

Turning the Audible Alarm ON or OFF

The **Freedom HF**'s audible alarm can be turned ON or OFF. Any warnings such as fault conditions or imminent shutdown are both displayed on the display panel's screen and sounded on the alarm speakers.

It is not possible to turn OFF the screen and prevent it from displaying error codes but it is possible to turn OFF the audible alarm.

Note: The alarm setting will reset to its default setting when the **Freedom HF**'s Inverter button is turned OFF then turned ON again.

Operating During Transition Between Shore Power and Inverter Mode

The **Freedom HF**'s advanced power management is capable of transitioning power from an AC source to DC source within a fraction of a second and vice-versa.

The **Freedom HF** automatically detects when shore power is present and when it becomes unavailable or drops to less than 90 Vac.

Transitioning from Shore Power to Inverter Mode

When the unit is operating in shore power mode and shore power is lost, the **Freedom HF** has less than 30 ms (milliseconds) to switch to inverter mode and start drawing power from the battery.

The Status LED will turn from solid or flashing GREEN to a solid YELLOW.

Transitioning from Inverter Mode to Shore Power

When the unit is operating in inverter mode and shore power becomes available, the **Freedom HF** begins a 20-second countdown to verify the stability of the shore power. If shore power remains stable within 20 seconds, at the end of the countdown, the **Freedom HF** has less than 30 ms (milliseconds) to switch to shore power mode and start drawing power from the AC source.

The Status LED will turn from solid YELLOW to flashing YELLOW during the 20-second countdown, then turn to GREEN when battery power is transitioned successfully to shore power.

Operating Limits

Power Output

The **Freedom HF** can deliver up to 1000 watts (**Freedom HF 1000**) or 1800 watts (**Freedom HF 1800**) continuous power. The wattage rating applies to resistive loads such as incandescent lights.

Input Voltage

The allowable **Freedom HF** input voltage ranges are shown in the following table:

Operating Condition	Voltage Range	Comment
Normal	11–15.0 V	
Optimum Performance	12.0–13.0 V	
Low Voltage Alarm	11.0 V or less	The low battery alarm beeps once every two seconds and the display shows fault code <i>E05</i> .
Low Voltage Shutdown	Less than 10.5 V	The low battery alarm beeps every second and the display shows fault code <i>E01</i> . The status LED turns red and the display screen is turned OFF within 30 seconds to protect the battery from being over-discharged.
High Voltage Shutdown	15.5 V or more	The over-voltage alarm beeps every second and the display shows fault code <i>E02</i> alternating with the battery voltage. The status LED turns red and the display screen is turned OFF within 30 seconds to protect itself from excessive input voltage. Note: Although the Freedom HF incorporates over-voltage protection, it can still be damaged if input voltage exceeds 16 V.

Inverter Loads

The **Freedom HF** will operate most AC loads within its power rating of 1000 watts (**Freedom HF 1000**) or 1800 watts (**Freedom HF 1800**). However, some appliances and equipment may be difficult to operate, and other appliances may actually be damaged if you try to operate them with the **Freedom HF**. Please read “**High Surge Loads**” and “**Trouble Loads**” carefully.

Overload Conditions

There are two kinds of overload conditions:

- An overload warning and
- An overload shutdown.

Overload
Warning

When the **Freedom HF**'s AC load is approximately 100 W below the overload shutdown limit of ~1000 W (**Freedom HF 1000**) and ~1800 W (**Freedom HF 1800**), the audible alarm beeps once every two seconds and the display screen shows a fault code `E05`.

Overload
Shutdown

When the **Freedom HF**'s AC load increases to near ~1100 W (**Freedom HF 1000**) and ~2000 W (**Freedom HF 1800**), the audible alarm beeps every second and the display screen shows a fault code `E03`. The Status LED turns solid RED and in 30 seconds, both the unit and the display screen will shut down to prevent damage to the inverter and protect the battery from being over-discharged.

High Surge Loads

Some induction motors used in freezers, pumps, and other motor-operated equipment require high surge currents to start. The **Freedom HF** may not be able to start some of these motors even though their rated steady state current draw is within the inverter's limits. The unit will shut down and indicate an overload shutdown.

Trouble Loads

CAUTION

STATEMENT OF HAZARD

Some equipment may be damaged by the **Freedom HF**'s modified sine wave output, which has a different wave form than utility-supplied electricity.

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

Some appliances, including the types listed below, may be damaged if they are connected to the **Freedom HF**:

- Speed controllers found in some fans, power tools, kitchen appliances, and other loads may be damaged.
- Some chargers for small rechargeable batteries can be damaged. See [“Precautions for Using Rechargeable Appliances”](#) on page xi for details.
- Metal halide arc (HMI) lights can be damaged.

Important: If you are unsure about operating any device with the **Freedom HF**, contact the manufacturer of the device to ensure that it is compatible with the modified sine waveform.

Over-temperature Conditions

During Inverter mode, when the **Freedom HF**'s internal temperature starts to approach its preset shutdown limit, the alarm will beep every two seconds and the display will show fault code **E07**. If the over-temperature condition persists, the alarm will beep once per second and the display will show fault code **E04**. The Status LED turns solid RED and the inverter will shut down to prevent damage to the inverter and protect the battery from being over-discharged. However, when the internal temperature drops and falls within normal operating temperature, the **Freedom HF** will recover automatically and will continue inverting.

During AC shore power mode, when the **Freedom HF**'s charger temperature starts to approach its limit, the charging current will be reduced to 10A (**Freedom HF 1000**) or 20A (**Freedom HF 1800**).

The **Freedom HF** also monitors the internal transfer relay temperature. It automatically turns on the fan when the relay starts to approach its preset temperature limit and turns off when it cools down. If the relay exceeds its preset temperature limit, the display shows a fault code **E11**. See [“To reset error codes E10 to E12:”](#) on page 5–7.

Battery Charging

Battery charging is possible only when shore power is present and the **Freedom HF** unit is connected to a battery (or battery bank).

The frequency of battery charging is determined by how much energy in the battery is used up during inverting. Whenever the **Freedom HF** detects a battery voltage that falls below 12.8 Vdc, the unit will begin charging the battery, i.e., enter into bulk and absorption stages then settle in float stage. If battery voltage does not reach 5 Vdc after 1 minute or 10 Vdc after 15 minutes as shown in the graph, the unit will terminate the charging process and the error code $E 12$ will show on the display screen.

Figure 4-1 below illustrates the three-stage charging process used to maximize **Freedom HF**'s charging efficiency.

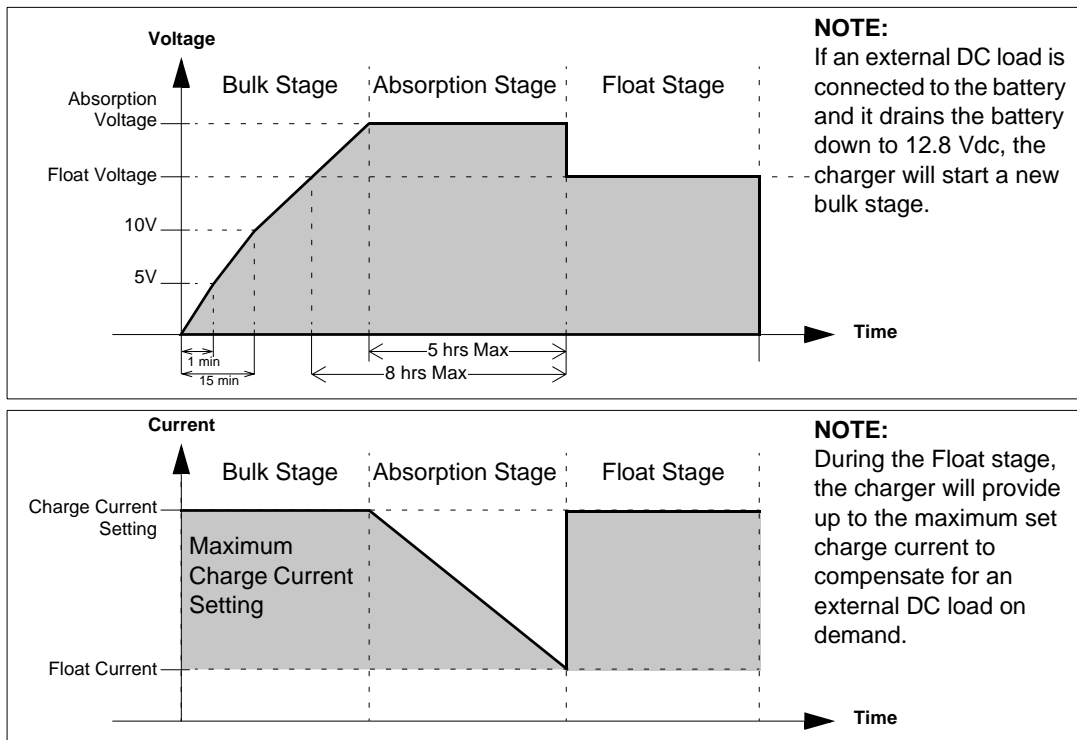


Figure 4-1 Three-stage Charging Process

Table 4-2 below illustrates the battery charging status as shown on the Status LED and display screen.

Table 4-2 Battery Charging Status LED

Status LED	Display Screen	Condition
Solid GREEN	<i>FUL</i>	Battery is FULL.
Flashing GREEN	<i>bUL — CH9 — 12.8</i> (where 12.8 is an example of battery voltage)	Battery is in BULK CHARGE.
	<i>AbS — CH9 — 14.2</i> (where 14.2 is an example of battery voltage)	Battery is in ABSORPTION CHARGE.
Solid RED	<i>E 10</i> to <i>E 12</i>	See Table 5-1, “Error Codes Displayed on the Display Panel Screen” on page 5-5.

Table 4-3 below illustrates the battery charging voltage and current settings.

Table 4-3 Battery Charging Voltage and Current Settings

Battery Type	Bulk/Absorption Voltage (Volts)	Float Voltage (Volts)	Charge Current (Amps)	Float Current (Amps)
Flooded	14.4	13.5	2 5, 10, 20 40	2 2 5
GEL	14.2	13.8	2 5, 10, 20 40	2 2 5
AGM	14.3	13.4	2 5, 10, 20 40	2 2 5
Fixed	13.5	13.5	2, 5, 10, 20, 40	2, 5, 10, 20, 40

Routine Maintenance

Freedom HF Unit

Minimal maintenance is required to keep your **Freedom HF** operating properly. Periodically you should:

- 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.

Batteries

When possible, you should recharge your batteries whenever a low voltage warning or a shutdown occurs with the **Freedom HF**. This gives the batteries a much longer life than recharging when the batteries have been almost completely discharged.

5

Troubleshooting

Chapter 5 describes how to troubleshoot the **Freedom HF Inverter/Charger** during operation.

It covers the following:

- General troubleshooting guidelines,
- Common problems,
- Warning messages,
- Troubleshooting references, and
- Inverter applications (loads).

General Troubleshooting Guidelines

WARNING

ELECTRICAL SHOCK AND ENERGY HAZARD

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

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

Important: If you need to obtain service, see [page WA-1](#).

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

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

1. Check for any error codes displayed on the display screen. If a message is displayed, record it before doing anything further.
2. As soon as possible, record (on [page WA-4](#)) the conditions at the time the problem occurred so you can provide details when you contact customer service for help. Include the following as well as details noted on [page WA-4](#):
 - What loads the **Freedom HF** was running or attempting to run
 - What the battery condition was at the time (voltage, state of charge, etc.) if known
 - Recent sequence of events
 - Any known unusual AC shore power factors such as low voltage, unstable generator output, etc.
 - Whether any extreme ambient conditions existed at the time (temperature, vibrations, moisture, etc.)

3. If your **Freedom HF** is not displaying an error code, check the following to make sure the present state of the installation allows proper operation:
 - Is the inverter located in a clean, dry, adequately ventilated place?
 - Are the battery cables adequately sized 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 the display panel and the communications cable properly connected and undamaged?
 - Are all disconnects and AC breakers closed and operable?
 - Have any of the fuses blown in the installation?
4. Contact Xantrex for further assistance. Please be prepared to describe details of your system installation and to provide the model and serial number of the unit.

Common Problems

Buzz in Audio Equipment

Some inexpensive stereo systems may emit a buzzing noise from their loudspeakers when operated from the **Freedom HF**. This occurs because the power supply in the audio system does not adequately filter the modified sine wave produced by the inverter. The only solution is to use a sound system that has a higher quality power supply.

Television Reception

When the **Freedom HF** is operating, it can interfere with television reception on some channels. If interference occurs, try the following:

1. Make sure that the chassis ground stud on the **Freedom HF** is solidly connected to the ground system of your vehicle or vessel.
2. Make sure that the television antenna provides an adequate (“snow-free”) signal, and that you are using good quality cable between the antenna and the television.
3. Keep the cables between the battery and the **Freedom HF** as short as possible, and twist them together with two to three twists per foot. (This minimizes radiated interference from the cables.)
4. Move the television as far away from the **Freedom HF** as possible.
5. Do not operate high power loads with the **Freedom HF** while the television is on.

Warning Messages

Warning messages in the form of audible alarms and error codes that appear on the display panel screen to alert you to an impending system change. Warnings do not affect operation.

With the exception of the error codes displayed on the screen, only the audible alarm can be turned ON or OFF. Follow the steps in [Chapter 3](#), “[To adjust the alarm setting:](#)” on [page 3–5](#) to change the alarm settings.

The error codes are listed in [Table 5-1](#) below. The text in the **Error Code** column appears on the display screen of the display panel.

Table 5-1 Error Codes Displayed on the Display Panel Screen

Error Code	Condition	Mode	Action
E01	Low battery voltage shutdown (< 10.5 Vdc)	Inverting	<ul style="list-style-type: none"> • Check battery status and recharge if necessary. • Check for proper DC cable sizing. • Check for loose connections and tighten if necessary.
E02	High battery voltage shutdown (> 15.5 Vdc)	Inverting	<ul style="list-style-type: none"> • Check for external charging sources, such as an over voltage alternator, and disconnect if necessary.
E03	AC output overload shutdown	Inverting	<ul style="list-style-type: none"> • Reduce the loads connected to the AC outlet of the unit. • Check appliances that have high-surge ratings and disconnect if necessary.
E04	Over-temperature shutdown	Inverting	<ul style="list-style-type: none"> • Reduce the loads connected to the AC outlet of the unit. • Check that the ventilation grille is not blocked. • Check for ambient temperature and move the unit to a cooler location whenever possible.
E05	Low battery voltage detected (< 11.0 Vdc)	Inverting	<ul style="list-style-type: none"> • Check battery status and recharge if necessary. • Check for proper DC cable sizing. • Check for loose connections and tighten if necessary.
E06	AC output overload warning	Inverting	<ul style="list-style-type: none"> • Reduce the loads connected to the AC outlet of the unit.

Table 5-1 Error Codes Displayed on the Display Panel Screen

Error Code	Condition	Mode	Action
E07	Over-temperature warning	Inverting	<ul style="list-style-type: none"> • Reduce the loads connected to the AC outlet of the unit. • Check that the ventilation grille is not blocked. • Check for ambient temperature and move the unit to a cooler location whenever possible.
E08	not used		
E09	not used		
E 10	High battery voltage (> 15.5 V)	AC shore power	<ul style="list-style-type: none"> • Check for external charging sources, such as an over voltage alternator, and disconnect if necessary. • Confirm that the external charging source is not the cause. The error may be caused by the internal battery charger system. Call Xantrex for support.
E 11	Over-temperature detected on the AC transfer relay	AC shore power	<ul style="list-style-type: none"> • Reduce the loads connected to the AC outlet of the unit. • Check that the ventilation grille is not blocked. • Check for ambient temperature and move the unit to a cooler location whenever possible.
E 12	Battery is bad or external DC load is connected to the battery.	AC shore power	<ul style="list-style-type: none"> • Check the battery bank. NOTE: The battery voltage did not rise above 5 Vdc after 1 minute or 10 Vdc after 15 minutes. • Check that the external DC load current consumption is below the charging current setting. • Disconnect the DC load or increase the charger current setting.

For error codes $E01$ to $E04$:

- the unit will stop inverting, and
- the display screen and the alarm will turn off after 30 seconds.

For error codes $E10$ and $E11$:

- the unit will stop charging, but
- the error code will still show on the display screen and the alarm will remain on, and
- AC power will continue to pass through to the AC outlets.

For error code $E12$

- the unit will stop charging and shut down, and
- the error code will show on the display screen briefly, and
- AC power will not pass through to the AC outlets.

To reset error codes $E10$ to $E12$:

1. Remove the AC input, and
2. Turn the unit OFF and then turn ON again using the Inverter button on the display panel.

Troubleshooting Reference


 WARNING
ELECTRICAL SHOCK AND ENERGY HAZARD Do not disassemble the Freedom HF . It does not contain any user-serviceable parts. Attempting to service the unit yourself could result in an electrical shock or burn. Failure to follow these instructions can result in death or serious injury.

Table 5-2 Troubleshooting Reference

Problem	Possible Cause	Solution
Low output voltage (96 Vac–104 Vac) during Inverter mode.	You are using a voltmeter that cannot accurately read the RMS voltage of a modified sine wave.	Use a true RMS reading voltmeter such as the Fluke 87.
No output voltage. The status LED is red.	AC shore power is not available or out of operating range and the inverter has shut down with the display screen showing one of the following error codes:	
	<ul style="list-style-type: none"> Low input voltage (fault code $E01$) 	<ul style="list-style-type: none"> Check the DC connections and the cable. Recharge the battery.
	<ul style="list-style-type: none"> High input voltage (fault code $E02$) 	<ul style="list-style-type: none"> Verify the unit is connected to a 12V battery. Check the voltage regulation of the external charging system (if any).
	<ul style="list-style-type: none"> Unit overload or AC output short circuit (fault code $E03$) 	<ul style="list-style-type: none"> Reduce the load. Make sure the load does not exceed the output rating.
	<ul style="list-style-type: none"> Thermal shutdown (fault code $E04$) 	<ul style="list-style-type: none"> Allow the unit to cool off. Reduce the load if continuous operation is required. Improve ventilation. Make sure the inverter's ventilation openings are not blocked.
	<ul style="list-style-type: none"> AC transfer relay has overheated (during shore power mode). 	<ul style="list-style-type: none"> Improve ventilation. Make sure the inverter's ventilation grille is not blocked. Reduce the load.

Table 5-2 Troubleshooting Reference

Problem	Possible Cause	Solution
No output voltage. The Status LED is green or yellow.	<p>GFCI has tripped or 15A supplementary breaker has tripped.</p> <p>Circuit breaker on the AC load panel or AC output disconnect has tripped.</p> <p>Battery voltage is too low (<10.5 Vdc) to start inverting. Display screen may show DC voltage as $\square\square.\square$.</p>	<p>Check load and reset the GFCI or supplementary breaker.</p> <p>Reset the circuit breaker or check the AC output disconnect circuits.</p> <p>Check DC connections and cable. Recharge battery.</p>
No output voltage. The status LED is not lighting up.	AC shore power is not available or out of operating range and the inverter is OFF.	<ul style="list-style-type: none"> • Check AC shore power. • Turn the inverter ON.
	AC shore power is not available and the inverter is OFF due to a shutdown for more than 30 seconds.	<ul style="list-style-type: none"> • Check AC shore power and battery voltage. • Turn the inverter ON and look at the display panel for any error code. • See Table 5-1, “Error Codes Displayed on the Display Panel Screen” on page 5-5.
	The inverter’s DC input polarity is reversed.	<p>The inverter was probably damaged due to the reverse polarity. This type of damage is NOT covered by the warranty.</p> <ul style="list-style-type: none"> • Return the unit. • See “Return Material Authorization Policy” on page WA-3 for information on returning the unit.
The fan turns on and off during AC shore power mode.	<ul style="list-style-type: none"> • The battery is discharged and demands high current from the charger. • AC pass-through current is high. 	Do not be alarmed, the unit is performing normally.

Table 5-2 Troubleshooting Reference

Problem	Possible Cause	Solution
The fan turns on and off during inverter mode.	The inverter is running continuously at high power.	Do not be alarmed, the unit is performing normally. The fan is activated automatically.
Battery charging current is lower than the charging set point during bulk charge mode.	Ambient (environment) temperature is high.	Do not be alarmed, the unit is performing normally. The charging current automatically de-rates at high ambient temperature. Improve ventilation. Make sure the unit's ventilation openings are not blocked.
Alarm does not sound when an error is encountered.	Alarm is turned OFF.	Press and hold the Select button for two seconds to disable (or enable) the audible alarm. See “Display Panel Operation” on page 4-2.

Inverter Applications

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

Resistive Loads

These are the loads that the inverter finds the simplest and most efficient to drive. Voltage and current are in phase (i.e. in step with one another). Resistive loads usually generate heat in order to accomplish their tasks. Toasters, coffee pots, and incandescent lights are typical resistive loads. It is usually impractical to run larger resistive loads—such as electric stoves and water heaters—from an inverter due to their high current requirements. Even though the inverter can most likely accommodate the load, the size of battery bank required would be impractical if the load is to be run for long periods.

Motor Loads

Induction motors (motors without brushes) require two to six times their running current on start up. The most demanding are those that start under load (e.g. compressors and pumps). Of the capacitor start motors (typical in drill presses, band saws, etc.), the largest you can expect to run is 1/2 to 1 hp (the transfer relays are rated at 2 hp.) Universal motors are generally easier to start. Since motor characteristics vary, only testing will determine whether a specific load can be started and how long it can be run.

If a motor fails to start within a few seconds or loses power after running for a time, it should be turned off. When the inverter attempts to start a load that is greater than it can handle, it will turn itself off after a few seconds.

Long Transfer Times

Xantrex has observed a specific situation where the **Freedom HF** may take a long time to transfer to inverter mode when shore power fails - maybe 0.1-0.2 seconds. This can occur when the **Freedom HF** is power motor loads where the motor is able to freewheel when power is removed (e.g. a grinder). This long transfer may cause computers or other sensitive equipment to operate incorrectly. If power glitches must be minimized then Xantrex recommends that motor loads not be operated when sensitive equipment is being used.

A

Specifications

[Appendix A](#) contains electrical performance information and product specifications.

NOTE: Specifications are subject to change without notice.

Electrical Specifications: Inverter Mode

DC Input	Freedom HF 1000	Freedom HF 1800
Operating voltage range	10.5V–15.5V	10.5V–15.5V
Safe non-operating voltage range	0–16 Vdc	0–16 Vdc
Normal voltage	12.5V	12.5V
Nominal current at full load	100A	180A
AC Output	Freedom HF 1000	Freedom HF 1800
Output voltage	115 Vac	115 Vac
Continuous power	1.0kW @ 25 °C	1.8kW @ 25 °C
Surge power	17A (2kW for 200 ms)	30A (3.6kW for 300 ms)
Max short-circuit current	55A peak	55A peak
Frequency	60 Hz	60 Hz
Wave shape	Modified Sinewave	Modified Sinewave
Power derating above 40 °C ambient temp	See “ Invert Power Derating vs. Ambient Temperature ” on page A–6.	
Peak efficiency	≥87%	≥87%
Full load efficiency	≥80%	≥80%
Other	Freedom HF 1000	Freedom HF 1800
No load input power (producing output voltage)	≤10W	≤10W
Off mode current draw	≤1mA	≤1mA

Electrical Specifications: Charge Mode

AC Input	Freedom HF 1000	Freedom HF 1800
Operating voltage range	90–130 Vac	90–130 Vac
Nominal current	5Aac at 20A charge, 120 Vac in	10Aac at 40A charge, 120 Vac in
Nominal frequency	60 Hz	60 Hz
DC Output	Freedom HF 1000	Freedom HF 1800
Nominal voltage	12.0 Vdc	12.0 Vdc
Min battery voltage for charging	0.0 Vdc	0.0 Vdc
Max output voltage	14.4 Vdc	14.4 Vdc
Nominal output current	User selectable: 2A, 5A, 10A, 20A	User selectable: 2A, 10A, 20A, 40A
Charger current derating	Automatically reduce charger current as internal temperature exceeds 80 °C, and input Vac approaches low transfer.	
Efficiency at nominal output	≥75%	≥75%
Other	Freedom HF 1000	Freedom HF 1800
Battery type settings	Flooded (default), Gel, AGM, or Fixed (13.5V)	
Charge algorithms	Three stages (Bulk, Absorption, and Float)	
Independent battery banks	1	1

Environmental Specifications

Ambient Temperature: Operating Temperature Range Storage Temperature Range	0–40 °C -20–60 °C, with output derated above 25 °C -40–70 °C
Humidity: Operation/Storage	5–95% RH, non-condensing

System Specifications

Transfer relay rating	30A, 2.0hp
Transfer time	<30ms (milliseconds)
Transfer on bad voltage	90–100V for low AC and 130–140 for high AC
Cooling	Fan, activated by any of the following: <ul style="list-style-type: none">• High internal temperature• High AC output power

Physical Specifications

Unit Dimensions and Weight	Freedom HF 1000	Freedom HF 1800
Length	15.5" (393mm)	18.0" (457mm)
Width	9.5" (241mm)	9.5" (241mm)
Height	4.2" (106mm)	4.2" (106mm)
Weight	10 lbs (4.5 kg)	12.8 lbs (5.8 kg)

Regulatory Approvals

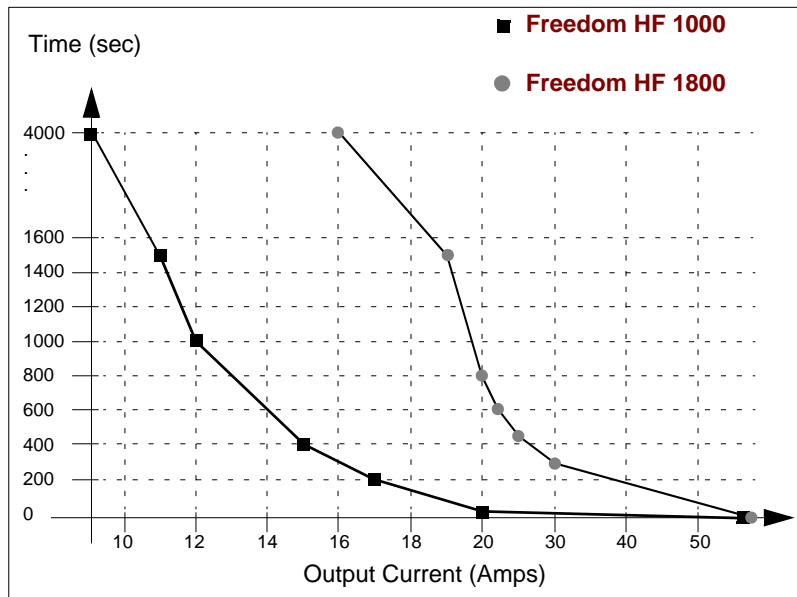
ETL approved to CSA 107.1, UL458, and UL458 Marine Supplement (drip shield with product number 808-9531 required).
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Inverter Overload Operation

This graph shows how long (measured in seconds) the **Freedom HF** will operate for a given output current (measured in Amps).

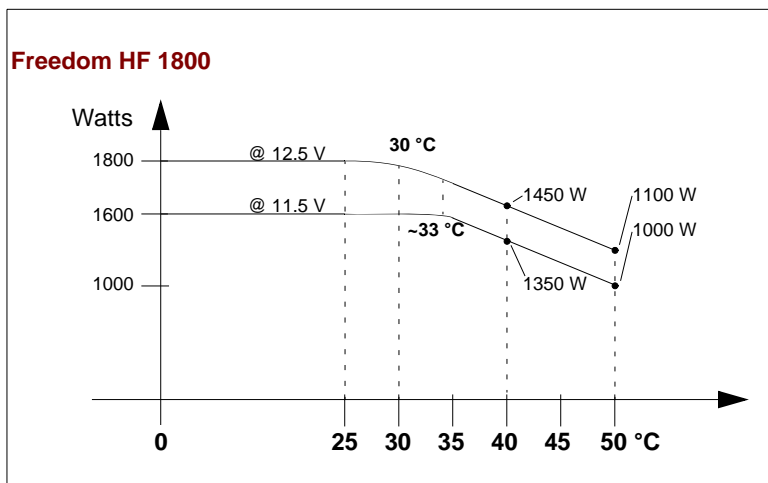
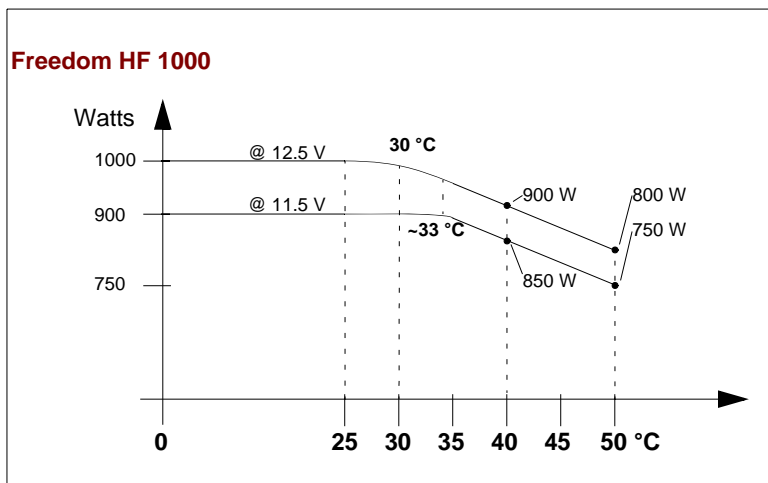
Both **Freedom HF 1000** and **Freedom HF 1800** are represented in the illustration below.

The graph illustrates inverter operation at 25 °C.



Invert Power Derating vs. Ambient Temperature

If the unit is in inverter mode and in elevated ambient temperature above 25 °C, you will have to reduce power draw according to the following chart to avoid over-temperature shutdown.



Charger Output Current vs. AC Input Voltage

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

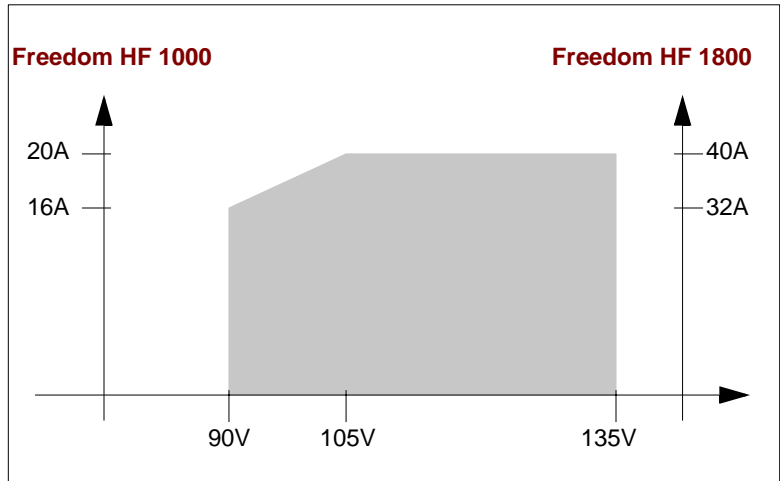


Table A-1 Charging Voltage

Battery Type	Bulk/Absorption (Volts)	Float (Volts)
Flooded	14.4	13.5
GEL	14.2	13.8
AGM	14.3	13.4
Fixed	13.5	13.5