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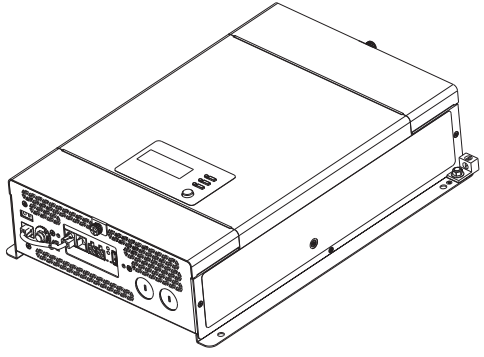

Owner's Guide

Freedom X 1200 PRO 120VAC 12VDC Sine Wave Inverter

Freedom X 1200 PRO

806-1212-05

Exclusion for Documentation

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Product Name and Part Number

Freedom X 1200 PRO (806-1212-05)

Contact Information

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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	_____

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

Purpose

The purpose of this Owner's Guide is to provide explanations and procedures for installing, operating, configuring, maintaining, and troubleshooting a Freedom X 1200 PRO 120VAC 12VDC Sine Wave Inverter for Recreational, Commercial, and Fleet Vehicle installations.

Scope

The guide provides safety and operating guidelines as well as information on installing and configuring the inverter. It also provides information about troubleshooting the unit. 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 X 1200 PRO 120VAC 12VDC Sine Wave Inverter.The Installation section starting *on page 25* is intended for qualified personnel.

Qualified personnel have training, knowledge, and experience in:

- Installing electrical equipment.
- Applying all applicable installation codes.
- Analyzing and reducing the hazards involved in performing electrical work.
- Selecting and using Personal Protective Equipment (PPE).

Abbreviations and Acronyms

A	Amperes
Ah	Amp-hours (a unit of battery capacity)
AC	Alternating Current [⏦]
ACC	Accessory in vehicle ignition system
AGM	Absorbed Glass Mat (a battery type)
BTS	Battery Temperature Sensor
DC	Direct Current [⎓]
GFCI	Ground Fault Circuit Interrupter
Hz	Hertz (a unit of frequency)
in-lb	inch-pound force (a unit of torque)
kW	Kilowatts (1000 watts)
LBCO	Low Battery Cutout (or Cutoff)
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LFP	$LiFePO_4$ (lithium iron phosphate – a battery type)
N-m	Newton-meters (a unit of torque)
PN	Product Number
PPE	Personal Protective Equipment
RV-C	Recreational Vehicle CAN Bus Communications protocol
s	Seconds (a unit of time)
V, VAC, VDC	Voltage, Volts AC, Volts DC
W	Wattage, watt (a unit of power)

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 guide contains important safety instructions for the Freedom X 1200 PRO that must be followed during installation, operation, maintenance, and troubleshooting.

Read these instructions carefully and look at the equipment to become familiar with the device before installing, operating, configuring, maintaining, and troubleshooting it. The following special messages may appear throughout this documentation 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.

Product Safety Information

1. Before using the inverter, 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 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 with damaged or substandard wiring.
5. Do not operate the inverter if it has been damaged in any way.
6. This unit does not have any user-serviceable parts. Do not disassemble the inverter 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 before attempting any maintenance or cleaning or working on any components connected to the inverter. Do not disconnect under load. Turning the inverter to Standby using the Power button on the front panel will not reduce an electrical shock hazard.
8. The inverter must be provided with an equipment-grounding conductor connected to the AC input 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.
12. This unit is an inverter only and is not intended for charging batteries.

⚠DANGER

ELECTRICAL SHOCK AND FIRE HAZARD

Installation must be done by qualified personnel to ensure compliance with all applicable installation and electrical codes and regulations. Instructions for installing the Freedom X 1200 PRO 120VAC 12VDC Sine Wave Inverter are provided here for use by qualified personnel only.

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

⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, BURN, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Never operate energized with the wiring compartment cover removed.
- Energized from multiple sources. Before removing the wiring compartment cover - identify all sources, de-energize, and wait 2 min for circuits to discharge.
- Always use a properly rated voltage sensing device to confirm all circuits are de-energized.
- Replace all devices, doors, and covers before turning on power to this equipment.

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

⚠WARNING

FIRE AND EXPLOSION HAZARD

- Unit's components may produce arcs or sparks.
- Do not install near batteries, in machinery space, or in an area in which ignition-protected equipment is required.

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

Areas include any space containing gasoline-powered machinery, fuel tanks, as well as joints, fittings, or other connections between components of the fuel system.

⚠WARNING

ELECTRICAL SHOCK HAZARD

- Replace the wiring compartment cover before turning on power to this equipment.
- Use a torque screwdriver to tighten the captive nut panel screw to 5 in-lb (0.56 N-m) torque to ensure a proper ground connection and a required tool access to the wiring compartment.

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

⚠CAUTION

ELECTRICAL SHOCK AND FIRE HAZARD

- Do not open. No serviceable parts inside. Provided with integral protection against overloads. Bonding between conduit connections is not automatic and must be provided as part of the installation.
- Read guide before installing or using.
- Do not cover or obstruct ventilation openings.
- Do not mount in zero-clearance compartment – overheating may result.
- Do not expose to rain or spray. For indoor use only.
- Do not connect AC OUT to any source of power. Damage to unit may occur.
- For AC IN and AC OUT, use wires suitable for at least 75°C.

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

NOTES:

- 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.
- Freedom X 1200 PRO 120VAC 12VDC Sine Wave Inverter products are designed for deep cycle lead-acid batteries. See warning below when connecting to lithium ion batteries.
- Do not use transformerless battery chargers in conjunction with the inverter due to overheating.

⚠CAUTION

LITHIUM ION BATTERY TYPE HAZARD

Make sure to use a lithium ion battery pack that includes a certified Battery Management System (BMS) with built-in safety protocols. Follow the instructions published by the battery manufacturer.

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

⚠CAUTION

PHYSICAL INJURY HAZARD

This Freedom X 1200 PRO 120VAC 12VDC Sine Wave Inverter is not intended for use by persons (including children) with reduced physical, sensory, or mental capabilities or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety. Children should be supervised to ensure that they do not play with the appliance.

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

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 below.
- 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.
- Never charge a Lithium Ion type battery with an ambient of 0 °C (-32 °F) or colder.

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

NOTES:

1. Mount and place the Freedom X 1200 PRO 120VAC 12VDC Sine Wave Inverter 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 Placing the Unit

⚠WARNING

FIRE HAZARD

- Do not install the inverter or any part of its supplied wiring in engine compartments.
- Locate the inverter away from the battery and mounted separately in a well-ventilated compartment with adequate space.

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

⚠CAUTION

BURN HAZARD

Avoid touching the external surfaces - heatsink may be hot.

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

NOTICE

RISK OF INVERTER DAMAGE

- Never allow battery acid to drip on the inverter when reading specific gravity, or filling battery.
- Never place the Freedom X 1200 PRO unit directly above batteries; gases from a battery will corrode and damage the inverter.
- Do not place a battery on top of the inverter.

Failure to follow these instructions can result in equipment damage.

Regulatory

The Freedom X 1200 PRO inverter is certified to appropriate US and Canadian standards.

The Freedom X 1200 PRO inverter is intended to be used for Recreational, Commercial, and Fleet Vehicle installations.

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 / 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 installation. 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 X 1200 PRO 120VAC 12VDC Sine Wave Inverter is designed with environmental awareness and sustainability in mind. At the end of its useful life, the Freedom X 1200 PRO 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 X 1200 PRO 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.

CONTENTS

1 INTRODUCTION

The Freedom X 1200 PRO 120VAC 12VDC Sine Wave Inverter is designed with integrated inverting functions and power management features suitable for Recreational, Commercial, and Fleet Vehicle installations.

Please read this section to familiarize yourself with the main performance and protection features of the Freedom X 1200 PRO. This section includes:

Materials List

The Freedom X 1200 PRO base package includes the following items:

- one Freedom X 1200 PRO unit
- one Owner's Guide and extra safety labels
- one pre-installed DC ground enclosure lug

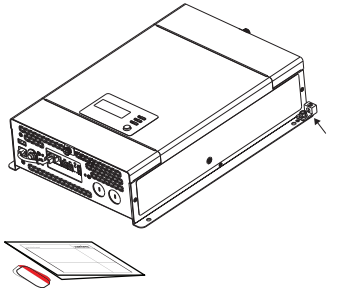


Figure 1 What's In The Box

NOTE: If any of the items are missing, contact Xantrex or any authorized Xantrex dealer for replacement. See *Contact Information on page 2*.

Key Features

Power for Most Appliances

The Freedom X 1200 PROinverter provides up to 1200 watts of continuous utility grade, sine wave power derived from a battery bank. It is designed to handle loads such as microwave ovens, TVs, DVD/Blu-ray players, and power tools. In addition, the Freedom X 1200 PRO's high-surge capability lets you handle many hard-to-start loads, including full size residential refrigerators.

The built-in transfer switch automatically transfers between inverter power and shore power from recreational facilities such as campsites to ensure power is always available.

Back-up Capability

If incoming shore power is interrupted by external events like brownouts, the Freedom X 1200 PRO automatically becomes an independent power source[1] that supplies utility grade AC power to your loads.

[1] Assuming the inverter is connected to a battery source with an adequate charge at the time of the power interruption.

Comprehensive Protection

The Freedom X 1200 PRO's built-in protection features safeguard your batteries (from unnecessary drain) such as the low battery voltage alarm and shutdown and protect equipment such as a configurable AC transfer speed.

- **Selectable Low Battery Shutdown**: The low battery shutdown for the inverter can be manually selected by the user from 10.5 to 12.1 VDC.
- **Voltage Shutdown Delay Timer**: Configurable from 1 to 300 s to reduce an unnecessary shutdown of inverter operation such as during cranking or other brief but heavy discharge of battery.
- **Inverter Power Save**: The Freedom X 1200 PRO can be programmed to automatically turn off after 1 to 25 h of continued operation of loads that are under 50 W. It is designed, with LBCO (low battery cut off), to prevent the battery from deep discharge.

Configurable AC Transfer Speed

The Freedom X 1200 PRO allows two speed settings for the AC transfer from AC Mode to Battery Mode and vice versa which avoids nuisance resetting of appliances. The normal transfer rate is for common appliances and the faster transfer rate is designed for more sensitive digital equipment like a desktop computer.

Overload Alarm and Shutdown

During Battery Mode (also called Inverter Mode), the Freedom X 1200 PRO automatically alerts you if the loads that are connected and drawing power from the unit are close to approaching the maximum operating limit. If so, the Freedom X 1200 PRO automatically shuts down when the maximum operating limit is exceeded. See *Troubleshooting Reference on page 78* for precautions.

Over temperature Alarm and Shutdown

During Battery Mode, the Freedom X 1200 PRO automatically alerts you if it is overheating and approaching the over-temperature shutdown limit. The Freedom X 1200 PRO automatically shuts down when the limit is exceeded. See *Troubleshooting Reference on page 78* for precautions.

Ignition Control

The Freedom X 1200 PRO provides two user-selectable options for ignition control:

- **Ignition Auto-on**: The Freedom X 1200 PRO can automatically turn the inverter on and off in tandem with the vehicle's ignition circuit or a manually operated remote switch.
- **Ignition Lockout**: The Freedom X 1200 PRO features the ability to inhibit the inverter from operating in the absence of a voltage signal from a vehicle's ignition circuit. This is particularly useful if the inverter is required to operate only when a vehicle's engine is running.

AC Output Frequency

The Freedom X 1200 PRO is factory set to 60 Hz AC output frequency. It can be configured to 50 Hz for use in regions outside the USA and Canada that operate on 110–125 VAC/50 Hz.

2 FEATURES

This section identifies the default settings and the hardware features of the Freedom X 1200 PRO 120VAC 12VDC Sine Wave Inverter. This section includes:

AC/DC Panel and Communication Ports

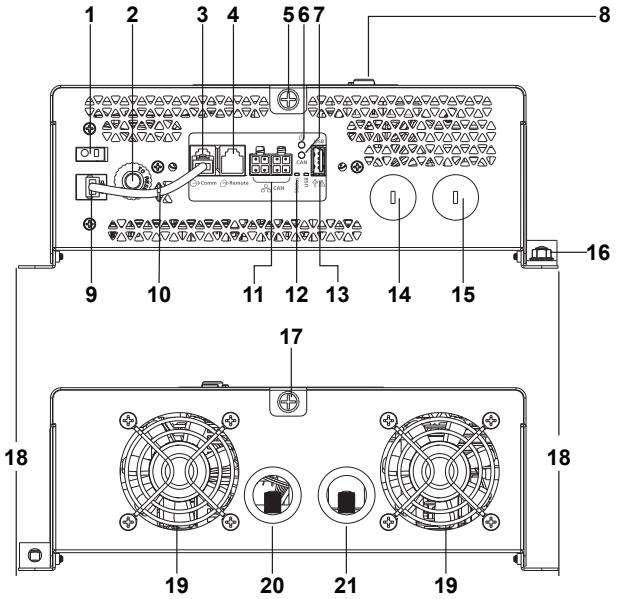


Figure 2 AC/DC Panel and Communication Ports

⚠WARNING

ELECTRICAL SHOCK HAZARD

Use a torque screwdriver to tighten the captive nut panel screw to 5 in-lb (0.56 N-m) torque of force to ensure a proper ground connection and a required tool access to the wiring compartment.

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

Table 1 AC/DC Panel Features

Item	Description
1	**ACC input terminal** for connecting ignition control wiring.
2	**15 A supplementary protector with reset button** Not applicable for this unit.
3	**COMM port** ⚠ DO NOT REMOVE THE CABLE CONNECTED TO THIS PORT.
4	**RJ12 Remote port** if needed, you may connect to the Remote display accessory.
5	**Captive nut panel screw** holds the wiring compartment cover in place. See WARNING *on page 20*.

Item	Description
6	**CAN LED** CAN activity. See *Communication Ports LED Indicators on page 55* for details.
7	**Power LED** Power activity. See *Communication Ports LED Indicators on page 55* for details.
8	**Display panel.** See succeeding pages for a description.
9	**COMM port** ⚠ DO NOT REMOVE THE CABLE CONNECTED TO THIS PORT.
10	**COMM cable** ⚠ DO NOT REMOVE
11	**CAN RV-C ports** (2x) connect to an auxiliary device such as a compatible RV controller and monitor.
12	**Status LED.** Combox App activity. See *Communication Ports LED Indicators on page 55* for details.
13	**USB LED** with **USB Host port** USB-related activities include loading and applying firmware updates, copying and applying device configurations, and data logging. See *Communication Ports LED Indicators on page 55* for details. ⚠ DO NOT USE TO POWER OR CHARGE USB DEVICES.
14	**AC input terminal opening** for routing AC input wiring.
15	**AC output terminal opening** for routing AC output wiring.
16	**DC Grounding lug** provides a ground path for the Freedom X 1200 PRO chassis to the DC system ground. See WARNING *on page 22*.
17	**Captive nut panel screw** holds the wiring compartment cover in place. See WARNING *on page 20*.
18	**Mounting flanges** on both sides allow you to mount the inverter permanently on the interior deck or on a wall.
19	**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. **Cooling fans** turn on when the internal temperature reaches a set point temperature.

Item	Description
20	**DC terminal** opening for routing (+) positive DC cable.
21	**DC terminal** opening for routing (–) negative DC cable.

⚠WARNING

ELECTRICAL SHOCK HAZARD

- Use a torque screwdriver to tighten the bolt on the DC ground lug to a torque of 23 in-lb (2.6 N-m) of force.
- Apply an anti-corrosion compound to the copper wire prior to connecting to the DC ground lug.

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

Display Panel

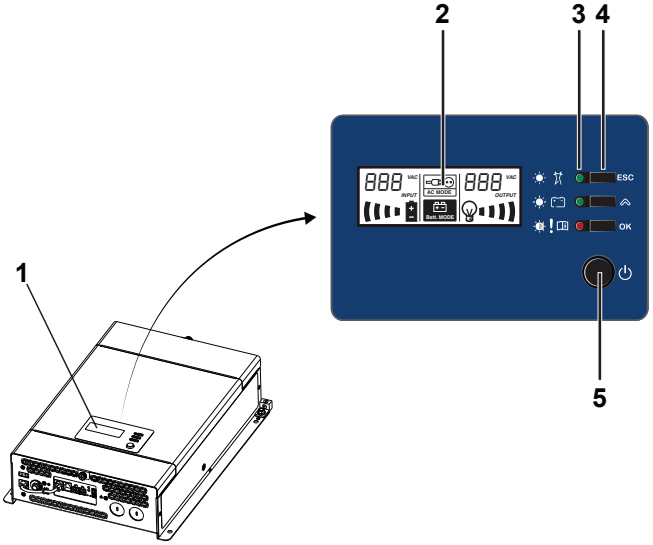


Figure 3 Display Panel

Table 2 Display Panel Features

Item	Description
1	**Display panel** displays status information on the screen. It is comprised of a display screen, LEDs, and buttons.
2	**Multi-function LCD screen** shows status information and error codes.
3	**Status LEDs** indicate the mode of operation.
4	Three **function buttons** change status information displayed on the screen. Also, changes inverter settings. See *Freedom X 1200 PRO Display Panel on page 54* for detailed information on the panel's buttons.
5	**Power [Standby] button** is pressed for turning on the unit. The inverter turns on for the loads automatically.

Side Panel

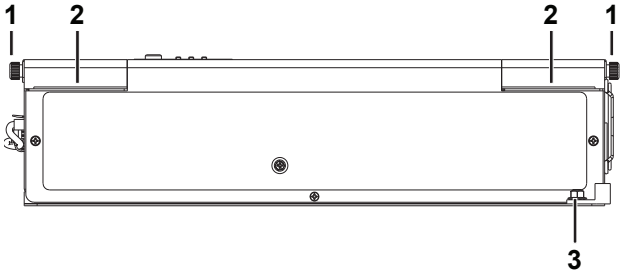


Figure 4 Side Panel

⚠WARNING

ELECTRICAL SHOCK HAZARD

- For **item 1**: Use a torque screwdriver to tighten the captive nut panel screw to 5 in-lb (0.56 N-m) torque to ensure a proper ground connection and a required tool access to the wiring compartment.
- For **item 3**: Use a torque screwdriver to tighten the bolt on the DC ground lug to a torque of 23 in-lb (2.6 N-m) of force.
- For **item 3**: Apply an anti-corrosion compound to the copper wire prior to connecting to the DC ground lug.

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

Table 3 Side Panel Features

Item	Description
1	**Captive nut panel screw** holds the wiring compartment cover in place. See WARNING *on page 24*.
2	**Wiring compartment cover** protects the wiring compartment from debris and keeps the cables secure. Using the captive nut panel screw, the cover can be opened and lifted out during wiring. See WARNING on the left.
3	**DC Grounding lug** provides a ground path for the Freedom X 1200 PRO chassis to the DC system ground. See WARNING *on page 22*.

3 INSTALLATION

Please read this section for safety information and installation instructions regarding your Freedom X 1200 PRO. This section includes:

Before You Begin the Installation

⚠WARNING

ELECTRICAL SHOCK AND FIRE HAZARD

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

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

Before beginning your installation:

- Read this entire Installation guide so you can plan the installation from beginning to end.
- Assemble all the tools and materials you require for the installation.
- Review the *Important Safety Instructions on page 5*
- Be aware of all safety and electrical codes which must be met.

Installation Codes

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

- The U.S. National Electrical Code (NEC)
- The Canadian Electrical Code (CEC)
- The U.S. Code of Federal Regulations (CFRs)
- Canadian Standards Association/CSA Group (CSA) and the RV Industry Association (RVIA) standards and codes for installations in RVs

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

Basic Installation Procedures

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

Installation Tools and Materials

You will need the following to install the Freedom X 1200 PRO:

- Wire stripper
- Mounting (#2) screws or bolts
- #2 Phillips torque screwdriver
- Torque wrench for DC terminals (½" or 13mm socket wrench)
- DC cable, sized appropriately for load and application
- Lugs for DC cables to fit $^{5}/_{16}$" DC stud terminals as well as appropriate tools (like a crimping tool)
- AC and DC disconnects and over-current protective devices

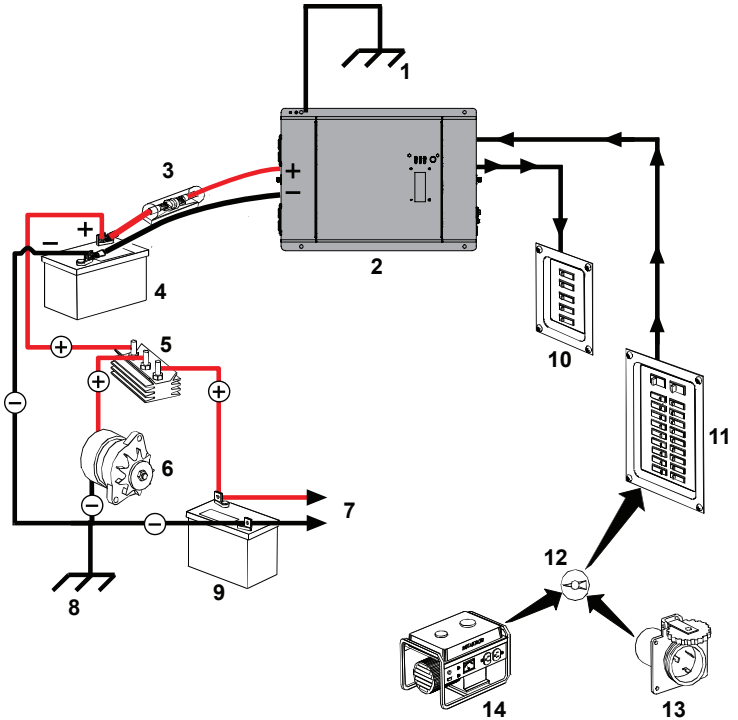
Step 1: Designing the Installation

Most Freedom X 1200 PRO installations share common components, and some of these are briefly described in *Step 1: Designing the Installation*.

Figure 5 shows some components and their relationship to each other in a typical recreational vehicle or fleet vehicle installation.

1	DC Equipment ground
2	Freedom X 1200 PRO
3	DC fuse/disconnect/DC circuit breaker
4	12V deep cycle battery [house]
5	Battery isolator
6	Alternator
7	To engine
8	DC Equipment ground
9	Starting battery
10	AC load panel
11	AC source panel
12	Selector switch
13	Shore power
14	Generator

Figure 5 Typical Recreational Vehicle and Fleet Vehicle Installation



AC Shore Power

A source of 120 volts AC 60Hz sine wave alternating current provides energy to pass power through to AC loads. This source is usually the utility grid (power company) or an AC generator. An automatic or manual AC source selector switch can be used to switch between the multiple sources of shore power to the Freedom X 1200 PRO system.

The AC source feeding the Freedom X 1200 PRO must have the neutral conductor bonded to ground. When the inverter passes shore power through, it will lift its internal bonding relay on the output and will rely on the input neutral being bonded in order to ensure that the power delivered to a sub panel is properly bonded. See *AC Output Neutral Bonding on page 31* for more information on bonding relay operation.

NOTE: Throughout this guide, the term “shore power” refers to AC input power from a utility grid, generator, or other AC source.

AC Disconnect and Over-Current Protection Device

Most safety requirements and electrical codes require the Freedom X 1200 PRO’s AC and DC inputs and outputs to be provided with over-current protection (such as branch-rated circuit breakers or fuses) and disconnect devices.

AC Input The branch-rated circuit breaker or fuse (connected through hard wiring) that is used to supply the Freedom X 1200 PRO must be rated at no more than 30A and must be approved for use on 120 volts AC branch circuits. The wire used between the breaker and the Freedom X 1200 PRO input must be sized adequately to carry current up to the rating of the input breaker and in accordance with the electrical codes or regulations applicable to your installation.

AC Output The branch-rated circuit breaker or fuse must be rated at no more than the rating of the input breaker in the installation and must be approved for use on 120 volts AC branch circuits. The wire used between the Freedom X 1200 PRO and the AC output breaker must be of adequate size to match the AC input circuit breaker’s rating. The wiring from each AC output breaker to each of the loads must be adequately sized to carry the current rating of the individual AC output breaker.

Disconnect Devices Each system requires a method of disconnecting the AC circuits. If the over-current protection devices are circuit breakers, they will also serve as the disconnects. If fuses are used, separate AC disconnect switches will be needed ahead of the fuses. These will have to be a branch circuit rated for 120 volts AC and have an appropriate current rating.

AC Distribution Panels

Most systems incorporate distribution centers both ahead of the Freedom X 1200 PRO (the AC source panel) and between the Freedom X 1200 PRO and the loads (the AC load panel). An AC source panel includes a main circuit breaker, which serves as over-current protection and as a disconnect for the AC shore power supply line. Additional circuit breakers serve individual circuits, one of which serves the Freedom X 1200 PRO. The AC load panel can incorporate an AC output circuit breaker and breakers for individual load circuits.

AC Cabling

AC cabling includes all the wires and connectors between the AC source and the Freedom X 1200 PRO, as well as all AC cabling between the Freedom X 1200 PRO and the AC output panels, circuit breakers, and loads. The type and size of the wiring varies with the installation and load. For example, in high vibration environments, such as RV applications, wire nuts may not be acceptable, so crimp splices would be required. In other applications, flexible multiple-strand wire may be required. Installation codes usually specify solid or stranded, overall size of the conductors, and type and temperature rating of the insulation around the wire.

AC breakers and fuses must be sized to adequately protect the wiring that is installed on the input and output AC circuits of the Freedom X 1200 PRO. All breakers and wiring must be sized and connected in accordance with the electrical codes or regulations applicable to your installation. *Table 4* gives some examples of wiring sizes based on the U.S. National Electrical Code and the Canadian Electrical Code. These examples are based on using a two-conductor-plus-ground copper cable rated at 60 °C, and assuming an ambient temperature of up to 30 °C. Ensure that your breakers and fuses have suitable temperature ratings for your wiring. Other codes and regulations may also be applicable to your installation.

Table 4 Required AC Wire Size vs Breaker Rating

Breaker Size (A)	10A	15A	20A	30A
Minimum Wire Size (AWG)	14AWG	14AWG	12AWG	10AWG

AC Output Neutral Bonding

The neutral conductor of the Freedom X 1200 PRO's AC output circuit (that is, AC Output Neutral) is automatically connected to the safety ground during inverter operation. When AC utility power is present this connection is not present, so that the utility neutral (that is, AC Input Neutral) is only connected to utility ground at your source. This conforms to the National Electrical Code (NEC), which requires that separately derived AC sources (such as inverters and generators) have their neutral conductors tied to ground in the same way that the neutral conductor from the utility is tied to ground in only one place. Check the regulations for your specific application to ensure that the installation will comply with the necessary requirements. In other words, the AC Input Neutral ground bonding and Output Neutral ground bonding must be isolated from each other.

AC Grounding

As per UL458, for all permanently connected inverters: The Freedom X 1200 PRO should be connected to a grounded, metal, permanent wiring system. Also, make sure that an AC ground wire is connected to the AC ground terminal on the unit. Do not just connect the line and neutral wires.

DC Cabling

This includes all the cables and connectors between the batteries, the DC disconnect and over-current protection device, and the Freedom X 1200 PRO. Most mobile installations require multi-strand insulated copper cables for flexibility and durability in high vibration environments and require disconnects and over-current devices. Electrical wiring sizes in North America are indicated by AWG notation. In other parts of the world, the metric system is used. Under the AWG standard, a larger gauge number indicates a smaller wire diameter. Wire size is usually marked on the larger sized cables. *Table 5* specifies the minimum recommended DC cable size and maximum fuse size for the Freedom X 1200 PRO. **The DC cables must be stranded, copper, and must be rated 90 °C minimum.** The cables should be terminated with lugs that fit the DC stud terminals snugly ($^{5}/_{16}$" hole size) and properly torqued according to manufacturer-specified torque setting.

Table 5 Required Cable Sizes

Inverter	Cable Length: Battery to Inverter (one way)	Minimum Cable Size	Maximum battery Fuse Size
Freedom X 1200 PRO	Less than 5 feet (1.5 meters)	No. 2 AWG	150 A DC
NOTE:It is not recommended using a cable longer than 5 feet (1.5 meters) in each direction. North American cable sizes above are based on the US National Electrical Code Table 310.15(B) (17), 90 °C cables, assuming an ambient temperature of 30 °C cables.			

IMPORTANT: Using the correct cable size is critical to achieving the rated performance of the Freedom X 1200 PRO unit. When starting a heavy load the Freedom X 1200 PRO can draw current surges from the battery of up to 400A. If the DC wiring is too small the voltage drop from this surge will result in a voltage at the Freedom X 1200 PRO terminals that is too low for the Freedom X 1200 PRO to operate correctly. The Freedom X 1200 PRO may appear to operate correctly with smaller cables until a heavy load such as a microwave or refrigerator attempts to start - then the unit may work correctly sometimes and not work correctly other times.

DC Disconnects and Over-Current Devices

The DC circuit from the battery to the Freedom X 1200 PRO must be equipped with a disconnect and over-current device. This usually consists of a circuit breaker, a “fused-disconnect”, or a separate fuse and DC disconnect. **Do not confuse AC circuit breakers with DC circuit breakers.** They are not interchangeable. The rating of the fuse or breaker must be matched to the size of cables used in accordance with the applicable installation codes. The breaker or disconnect and fuse should be located as close as possible to the battery, in the positive cable. Applicable codes may limit how far the protection can be from the battery.

Batteries

The Freedom X 1200 PRO uses 12-volt battery banks. Every Freedom X 1200 PRO system is recommended to have a deep-cycle battery (house) or group of batteries with a total capacity of 100 Ah or more which provides the DC current that the Freedom X 1200 PRO converts to AC.

Step 2: Choosing a Location for the Unit

⚠WARNING

FIRE AND EXPLOSION HAZARDS

- Do not install the Freedom X 1200 PRO in compartments containing batteries or flammable materials, or in locations that require ignition-protected equipment. This includes any space containing gasoline-powered machinery, fuel tanks, or joints, fittings, or other connections between components of the fuel system. This equipment contains components that tend to produce arcs or sparks.
- Do not install on or over combustible surfaces.
- Do not cover or obstruct the ventilation openings.
- Do not install the Freedom X 1200 PRO in a zero-clearance compartment. Overheating may result.

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

The Freedom X 1200 PRO should only be installed in locations that meet the following requirements:

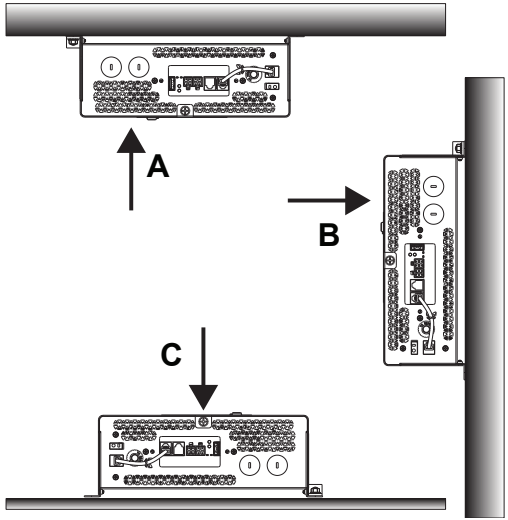
- **Dry.** Do not allow water or other fluids to drip or splash on the Freedom X 1200 PRO. **Do not mount the Freedom X 1200 PRO in an area subject to splashing water.**
- **Cool.** Normal air temperature should be between -20 °C and 40 °C (-4 °F and 104 °F)—the cooler the better, for increased efficiency and product life extension.
- **Ventilated.** Allow at least 5 inches of clearance at the fan end of the Freedom X 1200 PRO for air flow, 1 inch on each side, and 2 inches at the wiring access (AC and DC) end. The more clearance for ventilation around the unit, the better the performance. Do not allow the ventilation openings on the ends of the unit to become obstructed.
- **Safe.** Do not install the Freedom X 1200 PRO in the same compartment as batteries or in any compartment capable of storing flammable liquids like gasoline.
- **Close to the battery compartment and the AC source and load panels.** Avoid excessive cable lengths (which reduce input and output power due to wire resistance). Use the recommended cable lengths and sizes, especially between the battery banks and the Freedom X 1200 PRO.
- **Protected from battery acid and gases.** Never allow battery acid to drip on the Freedom X 1200 PRO or its wiring when reading specific gravity or filling the battery. Also do not mount the unit where it will be exposed to gases produced by the batteries. These gases are very corrosive, and prolonged exposure will damage the Freedom X 1200 PRO.

Step 3: Mounting the Unit

To mount the Freedom X 1200 PRO:

1. Remove the Freedom X 1200 PRO from its shipping container, verify that all components are present, and record relevant product information on *Information About Your System on page 2*.
2. Select an appropriate mounting location and orientation (see *Figure 6*). To meet regulatory requirements, for use in on-land applications, the Freedom X 1200 PRO must be mounted in one of the following orientations:
   a. Under a horizontal surface (see A)
   b. In a horizontal position on a vertical surface (see B)
   c. On a horizontal surface (see C)

Figure 6 Approved Mounting Orientations



3. Mark the desired number of mounting holes on the wall by placing the unit on the wall.
4. Pilot-drill the mounting holes.
5. Fasten the Freedom X 1200 PRO to the mounting surface. If you are mounting the unit on a wall or bulkhead, use #12 or #14 pan-head wood or sheet metal screws to secure it to the framing behind the wall or bulkhead. Alternatively, use nut inserts and ¼"-20 machine screws.

Connecting the DC Equipment Ground

⚠WARNING

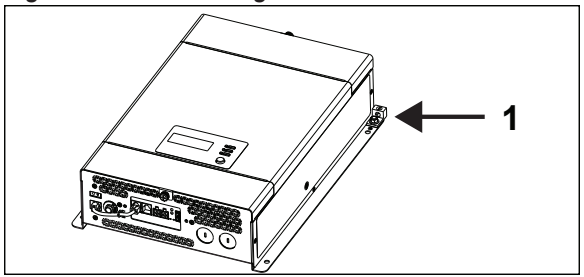
ELECTRIC SHOCK HAZARD

Never operate the Freedom X 1200 PRO without properly connecting the DC equipment ground. A shock and energy hazard could result from improper grounding.

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

The Freedom X 1200 PRO has a DC ground lug on the side of the unit as shown in *Connecting the DC Equipment Ground*. Follow the guidelines in *Connecting the DC Equipment Ground* to connect the inverter's chassis to the ground.

Figure 7 DC Grounding Connection



1	DC grounding lug

DC Grounding Locations

You must connect the equipment DC ground lug to a grounding point—usually the vehicle's chassis or DC negative bus ground—using recommended copper wire size (if insulated then green insulation with or without one or more yellow stripes) or larger.

Make sure to tighten the bolt on the DC ground lug to a torque of 23 in-lb (2.6 N-m) of force. Apply an anti-corrosion compound to the copper wire prior to connecting to the DC ground lug.

For recommended equipment ground cable size, see below.

Table 6 DC Equipment ground cable size

Application	Minimum equipment ground cable size (Stranded copper cable is required)
Recreational Vehicle[a]	No. 8 AWG
NOTE: There are no restrictions on length for the equipment ground cable but try to make it as short as practical to a secure chassis connection.	

[a]Based on US National Electrical Code NFPA70, Article 551, par. 551-20c and ANSI/RVIA LV, § 2-5.1.

Step 4: Connecting the AC Input Wires

⚠WARNING

ELECTRIC SHOCK AND FIRE HAZARDS

Make sure wiring is disconnected from all electrical sources before handling. All wiring must be done in accordance with local and national electrical wiring codes. Do not connect the output terminals of the Freedom X 1200 PRO to any incoming AC source.

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

General AC Wiring Considerations

The AC input terminal is located inside the unit through the AC panel's ½" trade-size hole and is labeled properly as **AC IN** or **AC INPUT**. The unit comes with spring clamp-type terminals where individual wires can be attached securely.

NOTICE

EQUIPMENT DAMAGE

Make sure the wires are connected properly. The AC wiring terminal blocks are split into input and output sections.

Failure to follow these instructions can result in equipment damage.

AC Wiring Connectors

Where applicable, connect AC wires with crimp-on splice connectors. The amount of insulation you strip off individual wires will be specified by the connector manufacturer and is different for different types of connectors.

AC and DC Wiring Separation

Do not mix AC and DC wiring in the same conduit or panel. Where DC and AC wires must cross, make sure they do so at 90° to one another. Consult applicable codes for details about DC and AC wiring in close proximity to each other.

AC Wiring

AC wiring includes all the wires and connectors between the AC source and the Freedom X 1200 PRO and all wiring between the inverter, the AC panels, and circuit breakers. The type and size of the wiring varies with the installation and load. For some RV applications, flexible multiple-strand copper wire is required.

AC wiring must be sized appropriately using conductors with insulation rated at least 90 °C to carry full load current on the input and output AC circuits in accordance with the electrical codes or regulations applicable to your installation. *Table 7* is based on the U.S. National Electrical Code and the Canadian Electrical Code, assuming two-conductor-plus-ground cable, using 75 °C wiring, at an ambient temperature of 30 °C (with correction factor). Other codes and regulations may be applicable to your installation.

Table 7 Required AC wire size vs. required breaker rating

	Required Breaker Size (A)	Required Wire Size (AWG)
Freedom X 1200 PRO	30 A maximum	10 AWG

When making the AC input and AC output connections, observe the correct color code for the appropriate AC wire, as described in *Table 8* below.

Table 8 Color codes for typical AC wiring

Color	AC Wire
Black/Red/Brown	Line
White/light blue	Neutral
Green, green/yellow, or bare copper	Ground

NOTICE

REVERSE POLARITY DAMAGE

Make sure the wires are connected properly. Improper connections (connecting a line conductor to a neutral conductor, for example) will cause the Freedom X 1200 PRO to malfunction and may permanently damage the inverter. Damage caused by a reverse polarity connection is not covered by your warranty.

Failure to follow these instructions can result in equipment damage.

Wiring Knockouts

When installing wires to the AC terminals, the AC input and output holes are provided to accommodate ½" trade-size strain relief clamps[a].

[a]Compatible strain-relief clamp with manufacturer part number: 3302-TB.

AC Input Connections

To make a permanent connection to existing AC wiring:

1. Ensure AC and DC power sources are turned off.
2. Install the required circuit breaker in the AC distribution panel supplying AC power to the unit.
3. Remove the wiring compartment cover by loosening the captive nut panel screw and lifting the cover up and out.

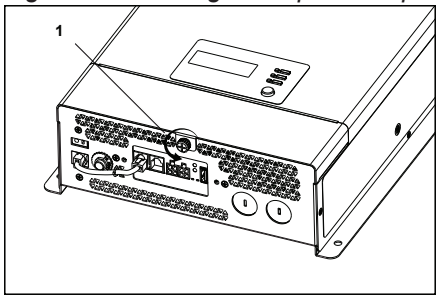
⚠WARNING

ELECTRIC SHOCK HAZARD

Use a screwdriver to loosen the captive nut panel screw.

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

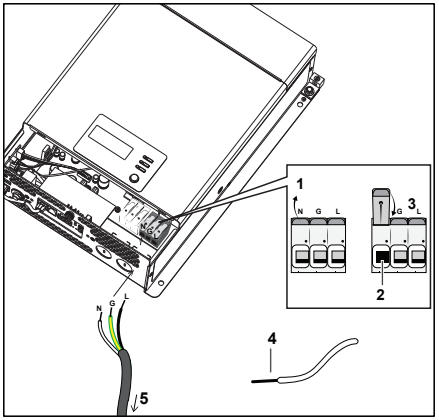
Figure 8 Loosening the captive nut panel screw



1	Captive nut panel screw

4. Strip a single AC input wire, as appropriate. Strip 15 mm off the ends of each of the three the wires (tin the exposed copper wire with lead-free solder using a soldering iron).
5. Remove the knockout and install a ½" strain relief clamp.
6. Route the wires through the strain relief clamp (not shown in the figure).

Figure 9 Routing the AC input wires



1	step 8a	4	15mm
2	step 8b	5	to circuit breaker
3	step 8c		**NOTE**: AC Input hole - install a strain relief clamp (not shown)

7. Locate the Neutral, Ground and Line terminals on the AC input terminal labeled as **N**, **G**, and **L** respectively.

8. Connect each AC wire into its corresponding terminal on the no-tool cage clamp terminal block.
   a. Lift the terminal lever (as shown in the previous figure).
   b. Insert the wire fully into the open slot.
   c. Lower the terminal lever to secure the wire in the slot.
9. Make sure that each AC wire is matched and connected to the Neutral (**N**), Ground (**G**), and Line (**L**) connections.
10. Tighten the strain relief clamp to secure the wires.
11. Replace the wiring compartment cover onto the unit (using a #2 Phillips torque screwdriver - see WARNING), if you are not connecting other wires such as for the AC Output. Otherwise, keep the AC compartment open and proceed to the next step.

⚠WARNING

ELECTRICAL SHOCK HAZARD

Use a torque screwdriver to tighten the captive nut panel screw to 5 in-lb (0.56 N-m) torque of force to ensure a proper ground connection and a required tool access to the wiring compartment.

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

12. Connect the other end of the wires to the circuit breaker in the AC distribution panel supplying AC power to the unit.

Step 5: Connecting AC Output to an Existing AC Circuit

⚠WARNING

ELECTRIC SHOCK AND FIRE HAZARDS

- Make sure wiring is disconnected from all electrical sources before handling. All wiring must be done in accordance with local and national electrical wiring codes.
- A manufacturer-tested and approved GFCI must be connected downstream from the Freedom X 1200 PRO AC output within the RV electrical wiring system to protect all branch circuits. GFCI protection must be provided on every branch circuit feeding a receptacle connected to the AC hard wired installation. Other types may fail to operate properly when connected to the Freedom X 1200 PRO.

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

NOTICE

EQUIPMENT DAMAGE

- Do not connect any AC source (such as a generator or utility power) to the **AC output wiring** of the Freedom X 1200 PRO.
- The Freedom X 1200 PRO will not operate if its output is connected to AC voltage from a source, and potentially hazardous or damaging conditions may occur. These conditions can occur even if the inverter is off.

Failure to follow these instructions can result in equipment damage.

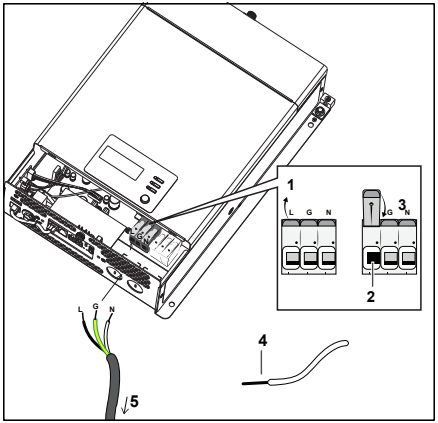
Do not connect the Freedom X 1200 PRO to an AC branch circuit that has high-power consumption loads that exceed its output wattage rating.

The Freedom X 1200 PRO will not operate electric heaters, air conditioners, stoves, and other electrical appliances that consume more than its rated output wattage.

Connect to an existing permanent AC output circuit. Follow the instructions on *AC Output Connections on page 42* and finish the installation there in that section.

AC Output Connections

Figure 10 Routing and connecting the AC output wires



1	step 7a	4	15mm
2	step 7b	5	to circuit breaker
3	step 7c		**NOTE**: AC Output hole - install a strain relief clamp (not shown)

To make a permanent connection to existing AC wiring:

1. Ensure AC and DC power sources are turned off, if not already done from *AC Input Connections on page 39*.
2. Install the required circuit breaker in the inverter distribution panel receiving AC power from the inverter.
3. Remove the wiring compartment cover, if not already done from *AC Input Connections on page 39*.

⚠WARNING

ELECTRIC SHOCK HAZARD

Use a screwdriver to loosen the captive nut panel screw.

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

4. Strip a single AC output wire, as appropriate. Strip 15 mm off the ends of each of the three the wires (tin the exposed copper wire with lead-free solder using a soldering iron).
5. Remove the knockout and install a ½" strain relief clamp.
6. Route the wires through the strain relief clamp (not shown in the figure).
7. Connect each AC wire into its corresponding terminal on the no-tool cage clamp terminal block.
   a. Lift the terminal lever (as shown on the figure).
   b. Insert the wire fully into the open slot.
   c. Lower the terminal lever to secure the wire in the slot.
8. Make sure that each AC wire is matched and connected to the Line (**L**), Ground (**G**), and Neutral (**N**) connections.
9. Tighten the strain relief clamp to secure the cable jacket.
10. Replace the wiring compartment cover (using a #2 Phillips torque screwdriver - see WARNING), if you are finished with connecting all the AC wires in the unit.

⚠WARNING

ELECTRICAL SHOCK HAZARD

Use a torque screwdriver to tighten the captive nut panel screw to 5 in-lb (0.56 N-m) torque of force to ensure a proper ground connection and a required tool access to the wiring compartment.

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

11. Connect the other end of the wires to a circuit breaker in AC distribution panel providing AC power to the loads.
12. End of *AC Output Connections*.

Step 6: Connecting the DC Cables

NOTICE

REVERSE POLARITY

- Check cable polarity at both the battery and the Freedom X 1200 PRO before making the final DC connection. Positive must be connected to positive; negative must be connected to negative.
- Reversing the positive and negative battery cables will blow a fuse in the Freedom X 1200 PRO and void your warranty.

Failure to follow these instructions can result in equipment damage.

⚠WARNING

FIRE HAZARD

Use only stranded, copper wire rated minimum 90 °C. Make sure all DC connections are tight to a torque of 71–80 in-lb (8–9 Nm) of force. Loose connections will overheat.

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

Follow the procedure given below to connect the battery leads to the terminals on the DC end. The cables should be as short as possible and large enough to handle the required current, in accordance with the electrical codes or regulations applicable to your installation. *Table 5* specifies the minimum DC cable size and maximum fuse size for the Freedom X 1200 PRO.

If at all possible, minimize routing your DC cables through an electrical distribution panel, battery isolator, or other device that will cause additional voltage drops which can degrade the inverter's ability to operate the loads.

To make the DC connections:

1. Make sure the inverter is off and no AC or DC is connected to the unit.
2. Remove the wiring compartment cover by loosening the captive nut panel screw.

⚠WARNING

ELECTRIC SHOCK HAZARD

Use a screwdriver to loosen the captive nut panel screw.

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

3. Loosen the DC terminal nuts from the terminal bolts and set them aside for later.
4. Strip ½" (13 mm) to ¾" (19 mm) insulation from one end of each cable. The amount stripped off will depend on the terminals chosen.
5. Attach the connectors that will secure the cables to the battery, to the disconnect/battery selector switch, and the fuse block. The connectors you use must create a permanent, low-resistance connection. It is recommended to use approved and certified cable ring lugs. Use the tool recommended by the terminal manufacturer. Make sure no stray wires protrude from the lug or terminal.
   NOTE: You may find it more convenient to have the cable lugs attached by the company that sells you the cable and/or connectors.
6. Strip ½" (13 mm) to ¾" (19 mm) of insulation from each cable end that will be connected to the inverter. The amount stripped off will depend on the terminals chosen.
7. Attach the cable ring lug that will join the cable to the inverter DC terminal. Cover the lug stem with heat shrink insulation (see *Step 6: Connecting the DC Cables*) to ensure that the lug does not touch the enclosure.
8. Install a fuse and fuse holder in the cable that will be used for the positive side of the DC circuit. The fuse must:
   a. be as close to the battery positive terminal as possible
   b. be rated for DC circuits
   c. have an Ampere Interrupting Capacity (AIC) that exceeds the short-circuit current available from the battery (that is, Class T fuse)
9. To prevent sparking when making the connection, ensure the disconnect/battery selector switch is off.
10. Route the positive cable through the left side strain relief clamp and attach the cable lug on the positive cable to the positive DC terminal on the inverter.
11. Fasten the DC terminal nut (set aside earlier) to the terminal bolt. Tighten the nut to a torque of 8–9 N-m (71–80 in-lb) of force. Do not overtighten. Make the connection snug enough so the cable lug does not move around on the DC terminal. Center it through the DC knockout hole and do not let it touch the edge. See *Step 6: Connecting the DC Cables on page 44*.

⚠WARNING

ELECTRICAL SHOCK HAZARD

- Tighten the nuts on the DC terminals properly. Loose connections cause excessive voltage drop and may cause overheated wires and melted insulation.
- Do not over-tighten the nut on the DC input terminals because damage to the DC input terminals may result. Use a torque screwdriver to tighten the nut to a maximum torque of 80 in-lb (9 N-m) of force.

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

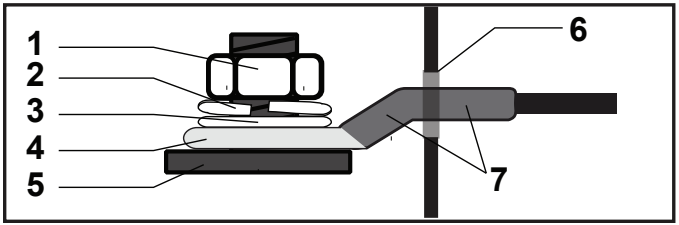
NOTICE

REVERSE POLARITY

- Check cable polarity at both the battery and the Freedom X 1200 PRO before making the final DC connection. Positive must be connected to positive; negative must be connected to negative.
- Reversing the positive and negative battery cables will blow a fuse in the Freedom X 1200 PRO and void your warranty.

Failure to follow these instructions can result in equipment damage.

Figure 11 DC Cable Connections



1	DC terminal bolt nut
2	lock washer
3	flat washer
4	cable ring lug
5	DC terminal
6	DC knockout hole
7	DC cable with heat shrink insulation covering the lug stem
NOTE: The DC cable lug stem must be fully insulated with the heat shrink.	

12. Before proceeding, double check that the cable you have just installed connects the positive DC terminal of the inverter to the disconnect/battery selector switch, fuse holder, and that the other end of the fuse holder is connected to the positive terminal of the battery.

⚠WARNING

FIRE HAZARD

Do not complete the next step if flammable fumes are present. Explosion or fire may result if the disconnect/battery selector switch is not in the off position. Thoroughly ventilate the battery compartment before making this connection.

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

13. Route the negative cable through the right side strain relief clamp and connect the cable from the negative post of the battery to the negative DC terminal of the inverter.
14. Fasten the DC terminal nut (set aside earlier) to the terminal bolt. Tighten the nut to a torque of 8–9 N-m (71–80 in-lb) of force. Do not overtighten. Make the connection snug enough so the cable lug does not move around on the DC terminal. Center it through the DC knockout hole and do not let it touch the edge.
15. Replace the wiring compartment cover by tightening the captive nut panel screw. See the following electrical shock hazard warning.

⚠WARNING

ELECTRICAL SHOCK HAZARD

Use a torque screwdriver to tighten the captive nut panel screw to 5 in-lb (0.56 N-m) torque of force to ensure a proper ground connection and a required tool access to the wiring compartment.

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

DC Equipment Grounding

To connect the DC equipment ground:

1. The DC equipment grounding lug (DC ground lug) on the DC end of the Freedom X 1200 PRO is used to connect the chassis of the Freedom X 1200 PRO to your system's DC negative connection or grounding bus point as required by electrical regulations.
2. Use copper wire that is either bare or provided with green insulation. Do not use the DC ground lug for your AC grounding. See the AC wiring instructions in this section.
3. Follow the guidelines below that correspond to the specific type of installation. These guidelines assume you are using the DC supply cable and fuse sizes recommended in this guide. If you are using different sizes, refer to the applicable installation code for DC grounding details.
4. See for the location of the DC ground lug. Make sure to tighten the bolt on the DC ground lug to a torque of 23 in-lb (2.6 N-m) of force. Apply an anti-corrosion compound to the copper wire prior to connecting to the DC ground lug.

Recreational Vehicle

Use 8AWG minimum-sized, stranded copper wire and connect it between the Chassis Ground lug and the vehicle's DC grounding point (usually the vehicle chassis or a dedicated DC ground bus). See regulatory references below.

Regulatory references	For DC voltage systems 60 VDC or less in an RV installation, an 8AWG copper bonding conductor would be acceptable for the inverter enclosure ground bonding only per UL458 §63.6; §30.10 standard [≤ 150 mV @ 30A connection, per §63.9; §63.10] and per ANSI/RVIA LV code §2-5.1 Bonding Voltage Converter Enclosures. The "house" battery system must, however, be ground bonded per ANSI/RVIA LV code §2-4 Auxiliary Battery Grounding;

Step 7: Connecting to Port(s) on the Freedom X 1200 PRO

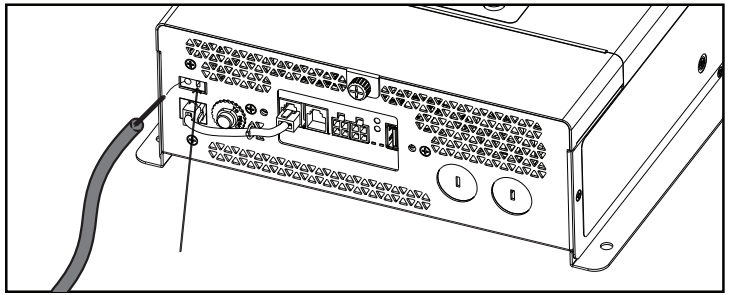
Connecting to ACC Signal

The Freedom X 1200 PRO can be wired to inhibit inverter operation in the absence of a vehicle's ignition control signal. This feature can avoid unnecessary battery drain that would otherwise occur if the inverter was operated without a charging source such as the vehicle alternator.

To enable ignition control:

1. Ensure that AC and DC power are both OFF.
2. Ensure the vehicle's ignition is turned to OFF position. It is highly recommended to remove battery power by disconnecting the vehicle's battery cables. Refer to the vehicle's user manual for proper instructions on how to disconnect the battery cables.
3. Locate the vehicle's ignition control wire from the vehicle's ignition circuit. This wire must be fused appropriately at no more than 5 A. Refer to the vehicle's user manual for guidance.
4. Locate the ACC input (ignition signal input) terminal on the left side of the connector. The rectangular slot on the right is used to release the spring clamp. See *Figure 12*

Figure 12 Ignition signal (ACC) input terminal



5. Using a 3mm slot long neck screwdriver, push into the rectangular slot to release the spring clamp.
6. Insert the ignition control wire into the round ACC input terminal slot.
7. Pull the screwdriver out to engage the spring clamp and secure the wire to the terminal.

NOTE: The mechanical elements of the ACC input terminal works in conjunction with the Ignition Control features set separately from the display panel.

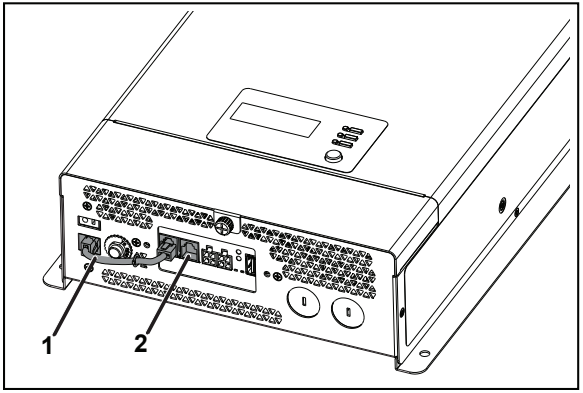
Description of Ignition Control Features
For information about the features and instructions on changing the ignition control features, see *Operation on page 53*.

Table 9 Ignition Control Features

Ignition Auto-on (AtO)	This setting allows the inverter to operate (Battery mode) automatically when an ignition control wire is connected to the ACC input and a valid ignition signal is constantly detected. The inverter works in tandem with the vehicle's ignition circuit.
Ignition Lock-out (LOt)	This setting allows the inverter to operate (Battery mode) when an ignition control wire is connected to the ACC input terminal and a valid ignition signal is constantly detected. When enabled, you have to manually press the Power button on the display panel to operate the inverter.
Off (OFF)	To completely disable the ignition control features do the following: Set Ignition Control to Off (OFF) using the Select buttons on the Display panel.

Connecting to the Remote

- By default, this cable connection [1] is done at the factory. Do not remove the cable connection or change port locations in order to maintain inverter control via the Combox App.
- If needed, plug the remote panel unit's cable connector to the RJ12 Remote port [2] as indicated below.



1	COMM cable connection
2	RJ12 Remote port

NOTE: When the remote panel is connected, turn the inverter's Power button to Standby (up position). This allows the remote panel to control the inverter's power status.

Step 8: Testing Your Installation

⚠ WARNING

ELECTRIC SHOCK HAZARD

Pressing the Power button to turn the Freedom X 1200 PRO inverter to Standby on the display panel does not disconnect DC or AC input power to the Freedom X 1200 PRO. If shore power is present at AC input terminals, it will pass through to the AC output.

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

There are two tests to be performed. The first test verifies that the Freedom X 1200 PRO is inverting DC battery power and delivering AC power to its output.

The second test is intended for installations where AC input and output is hard wired to the Freedom X 1200 PRO. This test verifies that the Freedom X 1200 PRO transfers from inverter power to shore power when shore power is present.

NOTE: Shore power (pass-through) refers to the AC input power from a utility grid, generator or external AC source.

When you are ready to test your installation and operate the Freedom X 1200 PRO, close the DC fuse and Disconnect or the DC circuit breaker to supply DC power to the Freedom X 1200 PRO.

Testing in Battery Mode

To test the Freedom X 1200 PRO:

1. For hard wired installations, ensure shore power is not present.
2. Press the Power button to turn the inverter on.
3. Connect a test load, such as a lamp within the power rating of the inverter into the Freedom X 1200 PRO AC outlet hard wired to the Freedom X 1200 PRO.
4. Turn the lamp on to verify that it operates.

If the lamp operates, your installation is successful. If your installation has AC input and output hard wired to the Freedom X 1200 PRO, proceed to *Testing in AC Mode*.

If the status LED on the display panel glows red, see the Troubleshooting chapter.

Testing in AC Mode

To test the Freedom X 1200 PRO:

- With the test load from the previous test still connected and operating, connect the shore power source.
- The Freedom X 1200 PRO transfers the test load to shore power. The green LED indicating AC mode turns on and the LCD screen displays the **AC MODE** icon.
- If the test load operates, your installation is successful.

NOTE: If the Power button on the Freedom X 1200 PRO is turned ON, the Freedom X 1200 PRO will automatically supply the appliances with inverter power if the shore power source fails or becomes disconnected.

If the Power button on the Freedom X 1200 PRO is turned ON and shore power voltage is too low (less than 90 volts AC), the unit will transfer to inverter power (Battery Mode) to continue running your appliances.

NOTE: Whether or not the Power button is turned ON, shore power will pass through the Freedom X 1200 PRO to the output when shore power is within normal operating range.

NOTE: In the event of low or no battery voltage, shore power will pass through the Freedom X 1200 PRO to the output even when shore power is outside the normal operating range.

4 OPERATION

This section includes descriptions of the different modes and settings of the Freedom X 1200 PRO 120VAC 12VDC Sine Wave Inverter. This section includes:

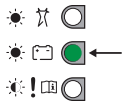
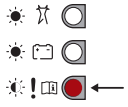
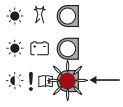
Freedom X 1200 PRO Display Panel

Figure 13 Display Panel

1	LCD screen	
2	Status LED indicators	
3	ESC	Return to default screen or exit setting mode.
4	^	Scroll to next screen or next selection. Press and hold for three seconds to scroll back one step.
5	OK	To enter the Configuration mode or to confirm the setting.
6	⏻	Turns on inverter operation or to Standby.

NOTE: Briefly pressing any function button activates backlight illumination. After 60 seconds of inactivity, backlight illumination turns off.

Status LED Indicators

Indicator	Definition
	Solid green. Indicates Battery mode (Inverter mode) in which the inverter is running and supplying power to the loads from the battery.
	Solid red. Indicates error or fault mode and is accompanied by an error code displayed on the LCD screen. For a list of error codes, see *Long Transfer Times on page 82*.
	Flashing red. Indicates a Warning condition and is accompanied by an error code and a sounding alarm. For a list of error codes, see *Long Transfer Times on page 82*.

Communication Ports LED Indicators

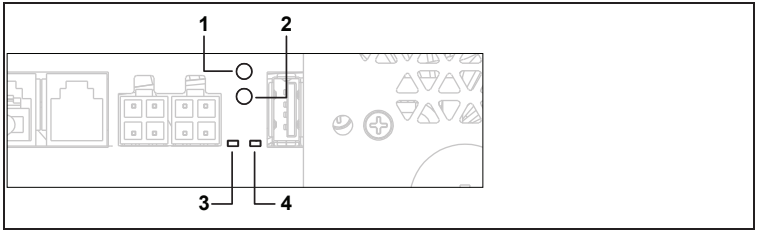


Figure 14 Communication Panel

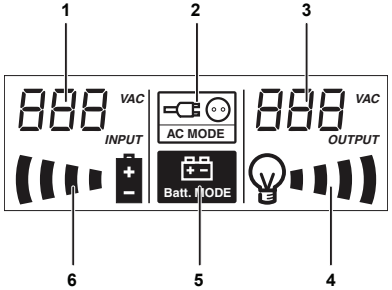
1	CAN	Green / Flashing green	CAN device detected and operating
		Off	No device detected
2	Power	Green	The unit is ON.
		Flashing green	The unit is on Standby.
		Off	The unit is disconnected from its battery source.
3	Status	Green	App activity
		Flashing red	Freedom X 1200 PRO detected a USB and is loading up new firmware
4	USB	Green	USB-related operation[1] is successful
		Flashing green	Active USB-related operation
		Red	USB-related operation is unsuccessful
		Flashing red	Active USB-related operation
		Amber	USB drive is plugged in
		Flashing amber	Active USB-related operation
		Off	No USB drive detected

1 USB-related operations include loading and applying firmware updates, copying and applying device configurations, and data logging.

LCD Screen

The LCD Screen changes depending on the operating mode of the inverter.

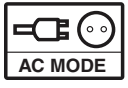
Figure 15 Parts of the LCD Screen



1	AC IN level (source voltage) in Battery mode. Displays the Setting number in Configuration mode.	**4**	load level indicator (4 levels)
2	AC mode indicator - turns on when AC shore power is available as input and the power is passing through as output.	**5**	Battery (Inverter) mode indicator - turns on when the inverter is running and supplying power to the loads from the battery.
3	AC OUT level (output voltage) Displays Error code when error or fault condition is detected. Displays the Setting value in Configuration mode.	**6**	battery level indicator (5 levels)

LCD Screen Icons

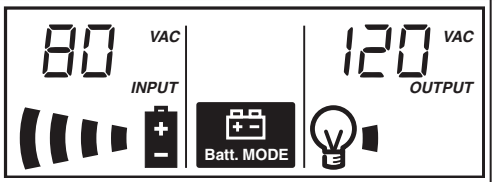
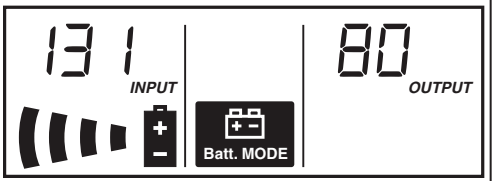
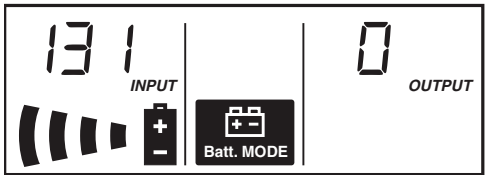
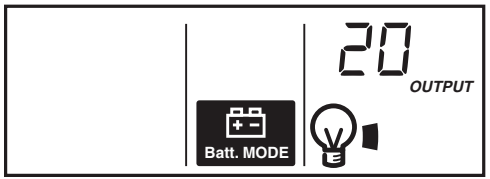
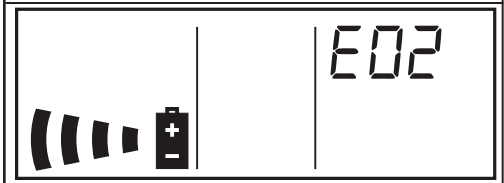
Icon	Definition
	Appears in all modes. Indicates ~ 75–100% battery capacity.
	Appears in all modes. Indicates ~ 50–75% battery capacity.
	Appears in all modes. Indicates ~ 25–50% battery capacity.
	Appears in all modes. Indicates ~ 1–25% battery capacity.
	Appears in all modes. Indicates 0% battery capacity.
	Appears in AC mode only and sometimes in Fault mode. Indicates ~ 75–100% load capacity.

Icon	Definition
	Appears in AC mode only and sometimes in Fault mode. Indicates ~ 50–75% load capacity.
	Appears in AC mode only and sometimes in Fault mode. Indicates ~ 25–50% load capacity.
	Appears in AC mode only and sometimes in Fault mode. Indicates ~ 0–25% load capacity.
	Indicates AC mode in which shore power is available and passing through to the loads.
	Indicates Battery mode (Inverter mode) in which the inverter is running and supplying power to the loads from the battery.

Viewing Information During Battery Mode

The LCD screen displays information related to battery mode operation.

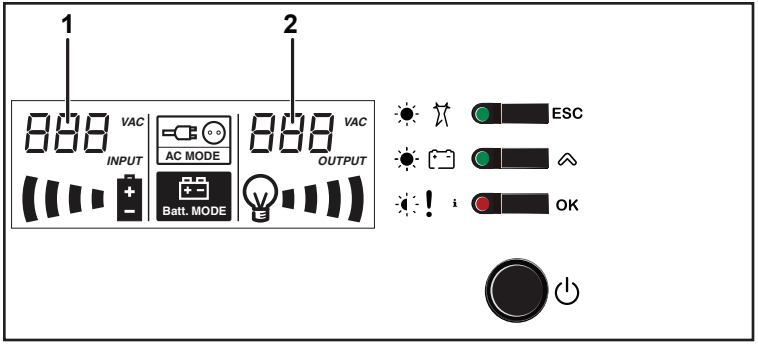
- Press the Scroll button to move from screen to screen. Press and hold for three seconds to go back one step.

Display	Definition
	Default screen during battery mode. AC source power is at 80 VAC and the output power is 120 VAC.
	The display shows battery voltage at 13.1 VDC and battery discharge current at 80 ADC.
	The display shows battery voltage at 13.1 VDC and battery discharge current at 0 ADC.
	The display shows load percentage at 20%.
	The display shows an error condition E02 which means DC Input Over Voltage shutdown. For more information on error codes, see *Error Code on page 1*.

Adjusting Settings in Configuration Mode

The OK, Scroll, and ESC buttons can be used to cycle through the various settings:

1. Press and hold the OK button for three seconds to enter Configuration mode and change general settings. Press the OK button to enter sub-settings, if applicable.
2. Press the Scroll button to scroll through the different settings. Press and hold for three seconds to scroll back one step.



1	setting number is displayed here
2	setting value is displayed here

To change the default value to a different value:

1. Press and hold the OK button for three seconds to enter the Configuration mode.
2. Press the Scroll button to scroll through the different settings. Press and hold for three seconds to scroll back one step. See *Settings on page 60*.
3. Press the OK button to select a general setting and change its value.
4. Press the Scroll button to change the value until you reach the desired value. Press and hold for three seconds to scroll back one step.
5. Press the OK button to confirm the change.
6. Repeat the previous steps to set other settings.
7. Press the ESC button to exit the Configuration mode.

Settings

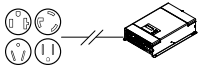
Setting (with default values)	LCD Screen (Left Side)	LCD Screen (Right Side)	Range of values	Description
Exit Mode	00	ESC	n/a	
Power Save Timer	02	25	1 to 25	When the load is 50 watts or under, this value represents the number of hours inverter operation is going to continue before it is automatically turned off to preserve the battery.
			OFF	Power save time setting is OFF.
Load Sensing	03	dI S	EnA	Feature is enabled. See *Power Save Mode on page 64*.
			dI S	Feature is disabled.
LBCO Voltage Setting	04	105	10.5 to 12.1 V	This range is from 10.5 to 12.1 volts with increments of 0.1.
LBCO Shutdown Delay	05	300	1 to 300 seconds	This range is from 1 to 300 seconds with increments of 1 (from 1 to 20) then increments of 10 (from 20 to 300).
Ignition Control	06	OFF	AtO LOt OFF	See *Description of Ignition Control Features on page 50*.

Setting (with default values)	LCD Screen (Left Side)	LCD Screen (Right Side)	Range of values	Description
Transfer Mode	07	APL	APL	This default setting is for typical household appliances. It allows the transfer of shore power (AC MODE) to the loads from battery power (Batt. MODE) within 20 milliseconds and vice versa.
			UPS	This faster setting is for sensitive digital equipment like desktop computers. The transfer time is similar to a UPS in which it allows the transfer of shore power (AC MODE) to the loads from battery power (Batt. MODE) within 10 milliseconds and vice versa.
Output Frequency	08	60	60 Hz	This default AC output frequency setting of 60 Hz is commonly used in North American jurisdictions.
			50 Hz	This AC output frequency setting of 50 Hz is used in jurisdictions such as in some Latin American countries operating from 115 VAC/50 Hz. If the utility and inverter are set to 50 Hz, load appliances must also be rated to operate from 115 VAC/50 Hz power.

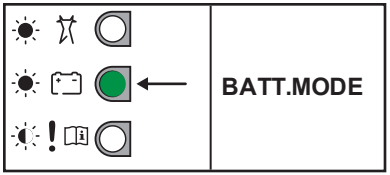
Setting (with default values)	LCD Screen (Left Side)	LCD Screen (Right Side)	Range of values	Description
Alarm Buzzer	09	bOn	bOn	Audible
			bOF	Silent
Reset to Factory Default	19	dEF	n/a	
Firmware version	U 1		n/a	

Operating in Battery Mode

The Freedom X 1200 PRO is in Battery Mode (also called Inverter Mode) when all the following conditions exist:

- inverter power button is ON  (down position) or ignition auto-on is activated
- shore power is not presently available 
- battery has sufficient power

Inverter operation means that DC battery power is presently being converted to utility grade AC power, powering equipment and appliances connected to the AC output terminal of the unit. The green status LED lights up to indicate the Freedom X 1200 PRO is using the battery to power the equipment and appliances.



Turning Inverter Operation ON

There are two ways to operate the Freedom X 1200 PRO's inverter function.

1. Press the Power button to a down position (it is in Standby in the up position).
2. When the inverter's Ignition Control feature is set to Auto-on (AtO)[a], a +12VDC signal is present on the ACC input[b].

⚠WARNING

ELECTRICAL SHOCK HAZARD

Turning the Power ⏻ button to Standby does not disconnect DC battery power from the Freedom X 1200 PRO. You must disconnect from all power sources before working on any circuits connected to the unit.

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

To prevent unnecessary battery discharge, press the Power button to Standby when you are not using the Freedom X 1200 PRO.

[a] See *Adjusting Feature Settings in Configuration Mode*.

[b] When the vehicle's ignition switch is On or the vehicle's engine is running.

Power Save Timer

The Power Save Timer is an adjustable countdown timer from 1 to 25 h (25 h is the default) that automatically shuts down inverter operation to reduce battery discharge and preserve battery life. During continuous inverter operation, the countdown is initiated when power from the AC load drops to less than approximately 50 W and remains below this level. After reaching the end of the countdown timer the inverter automatically shuts down.

To change the countdown timer, see .

Power Save Mode

By enabling the power save mode, also called load sensing, the inverter can automatically go to power save mode by sending short pulses to further reduce the battery discharge. Power save mode ends when a load greater than 25 W is connected.

NOTE: Certain types of loads can cause power save mode to work unexpectedly. These types of loads are described in *Problem Loads on page 1*.

Checking Battery Status

During inverter operation (in battery mode), you can check the battery status by observing the battery capacity indicator on the LCD screen. The battery voltage appears in the left side of LCD screen.

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

Checking Output Power

When the inverter is in operation (in battery mode), you can check how much power (displayed in kW) the Freedom X 1200 PRO is supplying to the connected loads by observing the load capacity indicator on the LCD screen. The battery discharge amperage appears in the right side of the LCD screen.

Operating Several Loads at Once

If you are going to operate several loads from the Freedom X 1200 PRO, 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 X 1200 PRO's audible alarm can be muted. See *Adjusting Feature Settings in Configuration Mode*. See *Adjusting Settings in Configuration Mode on page 59*.

Any warnings such as error or fault conditions or imminent shutdown are both displayed on the LCD screen and sounded on the alarm speakers. See *To manually reset the alarm: on page 65*.

Audible alarm for warning: The unit beeps once when a warning condition is detected.

Audible alarm for error: The unit beeps once every 5 s for 1 min.

To mute the alarm:

- Press any one of the three function buttons.

The alarm is automatically muted after 1 min. But the error code continues to be displayed until the error is cleared.

To manually reset the alarm:

1. Press the Power button to turn it to Standby (from a down position to up) and press again to turn it On to reset an active alarm and clear the error.
2. If the Inverter Ignition Control is set to auto-on, toggle the ignition signal to clear the alarm and error.
3. Toggle the AC input power to force the transition between AC mode and battery mode. This action clears the alarm and error.

Operating During Transition Between AC Mode and Battery Mode

The Freedom X 1200 PRO'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 X 1200 PRO automatically detects when shore power is present and when it becomes unavailable or drops to less than 106 volts AC.

NOTICE

EQUIPMENT DAMAGE

- When the transfer mode is set to UPS, connect only sensitive digital equipment that requires fast AC transfer times.
- Appliances with motors, compressors, and heating elements do not require a transfer mode of UPS. Set APL for these devices to avoid damaging the transfer relay.

Failure to follow these instructions can result in equipment damage.

Transitioning from AC Mode to Battery Mode

When the unit is operating in AC mode and shore power is lost, the Freedom X 1200 PRO has less than 20 milliseconds (default is APL) to switch to operating in battery mode (if the Power button is pressed in the On position) and starts drawing power from the battery.

The operating mode indicator will change to Battery Mode and the green Status LED for Battery Mode will light up.

However, if the Power button is in Standby, this transition does not happen and the display panel turns off.

Transitioning from Battery Mode to AC Mode

When the unit is operating in Battery Mode and shore power becomes available, the Freedom X 1200 PRO begins a 20-second countdown to verify the stability of the shore power. If shore power remains stable for a 20-second countdown, at the end of the countdown, the Freedom X 1200 PRO will switch to (shore power) AC mode within 20 milliseconds and start drawing power from the AC source.

The operating mode indicator will change to AC mode and the green Status LED for AC mode will light up.

Operating Limits

These are the operating limits of the Freedom X 1200 PRO:

- *Power Output*
- *Input Voltage*
- *Overload Conditions*
- *High Surge Loads*
- *Over-temperature Conditions*

Power Output

The Freedom X 1200 PRO can deliver up to 1200 W of continuous utility grade sine wave AC power. The wattage rating applies to resistive loads such as a portable electric heater.

Input Voltage

The allowable Freedom X 1200 PRO input battery voltage ranges are shown in the following table:

Table 10 Input battery voltage range

Operating Condition	Battery Voltage	Comment
Full Operating Range	LBCO – 16.5 V	Assuming the battery is full, the inverter will operate until battery voltage goes past below LBCO[c] and LBCO Shutdown delay timer[d].
Low Voltage Recovery	< LBCO+0.5 V	Inverter is able to recover and continue to operate.
Low Voltage Shutdown	< LBCO	The buzzer sounds a single 1 s low battery alarm beep and the LCD screen shows error code E01. After LBCO Shutdown delay timer runs out, the unit shuts down inverter output. The buzzer stops beeping and the LCD screen shows error code E01.
Instant Low Voltage Shutdown	< 10.2 V	After 2 s below the limit, the unit shuts down inverter output completely. LCD screen turns off completely.

[c] To set LBCO, see *Adjusting Feature Settings in Configuration Mode on page 1*.

[d] To set LBCO Shutdown Delay Timer, see *Input Voltage on page 68*.

Operating Condition	Battery Voltage	Comment
High Voltage Shutdown	16.7 V	The display shows error code E02 alternating with the battery voltage. The red status LED turns on.  **NOTE:** Although the Freedom X 1200 PRO incorporates over-voltage protection, it can still be damaged if input voltage exceeds 16.7 V⎓.

Overload Conditions

There are two kinds of overload conditions – an overload warning and an overload shutdown.

Overload Warning When the Freedom X 1200 PRO's AC load is approximately 100 W below the overload shutdown limit of rated watts, the audible alarm beeps once and the LCD screen shows a warning code E06.

Overload Shutdown When the Freedom X 1200 PRO's AC load increases to near ~1300 W, the audible alarm beeps every five seconds for one minute and the LCD screen shows a error code E03. The Status LED turns solid RED.

High Surge Loads

Some induction motors used in freezers, pumps, and other motor-operated equipment require high surge currents to start. The Freedom X 1200 PRO 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.

Over-temperature Conditions

During inverter operation, when the Freedom X 1200 PRO's internal temperature starts to approach its preset shutdown limit, the display will show error code E07. If the over-temperature condition persists, the display will show error 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 X 1200 PRO will recover automatically and will continue inverting.

5 ROUTINE MAINTENANCE

Regular maintenance is required to keep your Freedom X 1200 PRO operating properly. This section includes:

Maintaining the Freedom X 1200 PRO Unit

⚠WARNING

ELECTRICAL SHOCK HAZARD

Turning the Power ⏻ button to Standby does not disconnect DC battery power from the Freedom X 1200 PRO. You must disconnect from all power sources before working on any circuits connected to the unit.

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.

6 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 in *Pre-service Checklist on page 74*. This section includes:

Pre-service Checklist

⚠WARNING

ELECTRICAL SHOCK HAZARD

Do not disassemble the Freedom X 1200 PRO. 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, serious injury, or equipment damage.

NOTE: To obtain service go to *Contact Information on page 2*.

Prior to obtaining service, see below:

1. Check for any error codes displayed on the LCD screen. If a message is displayed, record it before doing anything further.
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 X 1200 PRO was running or attempting to run
   - What the battery condition was at the time (voltage, 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 X 1200 PRO 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 all disconnects and AC breakers closed and operable?
   - Have any of the fuses/circuit breakers blown in the installation?
4. 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.

Warning Messages

Warning messages in the form of audible alarms and error codes that appear on the LCD 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 *Turning the Audible Alarm ON or OFF on page 65* to change the alarm settings.

The error codes are listed in *Table 11*. The text in the **Error Code** column appears on the LCD screen of the display panel.

Table 11 Error codes displayed on the LCD screen

Error Code	Condition	Mode	Action
E01	Low battery voltage shutdown is imminent depending on the setting, see *Maintaining the Freedom X 1200 PRO Unit on page 72*.	Battery mode (inverting)	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 > 16.7 V⎓	Battery mode (inverting)	Check for external charging sources, such as a PV charger and an over voltage alternator. Disconnect, if necessary.
E03	AC output overload shutdown	Battery mode (inverting)	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	Battery mode (inverting)	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.
E06	AC output overload warning	Battery mode (inverting)	Reduce the loads connected to the AC outlet of the unit.

Error Code	Condition	Mode	Action
E07	Fan lock alarm	Battery mode (inverting)	Check the fan for any obstruction and remove it. Large debris which may enter through the fan grille may impede the fan blades from turning. When removing debris, do not insert your fingers inside the grille. Remove power from the inverter first before attempting to remove the debris.
E08 to E 10	General error detected	Battery and other modes	Check the fan for any obstruction and remove it. If there is no issue with the fan, disconnect the unit from its DC and AC power sources, then reconnect, and then restart the unit. Perform *Connecting to the Remote Port on page 1*. If error detection persists, contact customer service.

For error code E01, after the LBCO shutdown delay, the unit will immediately stop inverting.

For error codes E02 to E04, the unit will stop inverting.

Troubleshooting Reference

⚠WARNING

ELECTRICAL SHOCK HAZARD

Do not disassemble the Freedom X 1200 PRO. 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, serious injury, or equipment damage.

NOTICE

INVERTER DAMAGE

Avoid continually overloading the inverter and subjecting it to over temperature conditions. Although provided with integral protection against overloads continual overloading can damage the circuitry.

Failure to follow these instructions can result in damage to the inverter.

Table 12 Troubleshooting reference

Problem	Possible Cause	Solution
Alarm does not sound when an error is encountered.	Alarm is turned OFF.	See *Turning the Audible Alarm ON or OFF on page 65* and follow instructions to turn the alarm buzzer on again.
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 LCD screen showing one of the following error codes:	
	Low input voltage (error code E01)	Verify the unit is connected to a 12V battery. Check the DC connections and the cable. Recharge the battery.
	High input voltage (error code E02)	Verify the unit is connected to a 12V battery. Check the voltage regulation of the external charging system (if any).
	Unit overload or AC output short circuit (error code E03)	Reduce the load. Make sure the load does not exceed the output rating.
	Thermal shutdown (error code E04)	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.

Problem	Possible Cause	Solution
No output voltage is shown in the LCD screen but the green status LED for Battery mode is illuminated.	Circuit breaker on the AC load panel or AC output disconnect has tripped.	Reset the circuit breaker or check the AC output disconnect circuits.
	Battery voltage is too low (depending on setting, see *Maintaining the Freedom X 1200 PRO Unit on page 72*) to start inverting. LCD screen may show DC voltage as 000.	Check DC connections and cable. Recharge battery.
No output voltage is shown in the LCD screen and neither of the green status LEDs (for AC mode and Battery mode) is illuminated.	AC shore power is not available or out of operating range and the inverter is OFF.	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 s.	Check AC shore power and battery voltage. Turn the inverter ON and look at the LCD screen for any error code. See *" Error codes displayed on the LCD screen" on page 1*.
No output voltage. The status LED is not lighting up.	Ignition lock (ACC) signal is not present.	If the ignition control feature is in use, ensure the vehicle's ignition is On and the ignition control switch on the front of the Freedom X 1200 PRO unit is On (|).

Problem	Possible Cause	Solution
The fan turns on and off during AC shore power mode.	The battery is discharged. AC pass-through current is high.	Do not be alarmed, the unit is performing normally.
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.

Inverter Applications

The Freedom X 1200 PRO 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 (that is, in step with one another). Resistive loads usually generate heat in order to accomplish their tasks. Toasters, coffee pots, and heater elements 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.

Long Transfer Times

The Freedom X 1200 PRO may take a long time (~ 0.1–0.2 s) to transfer to Battery Mode when shore power is cut off while powering a motor load. Motor loads typically “freewheel” when power is removed (for example, a grinder) and causes a longer transfer time. The longer transition from shore power to inverter power may cause connected computers or other sensitive equipment to operate incorrectly. To avoid this effect, do not connect motor loads together with sensitive equipment to the inverter for power.

7 SPECIFICATIONS

This section summarizes the hardware and electrical specifications of the Freedom X 1200 PRO 120VAC 12VDC Sine Wave Inverter.

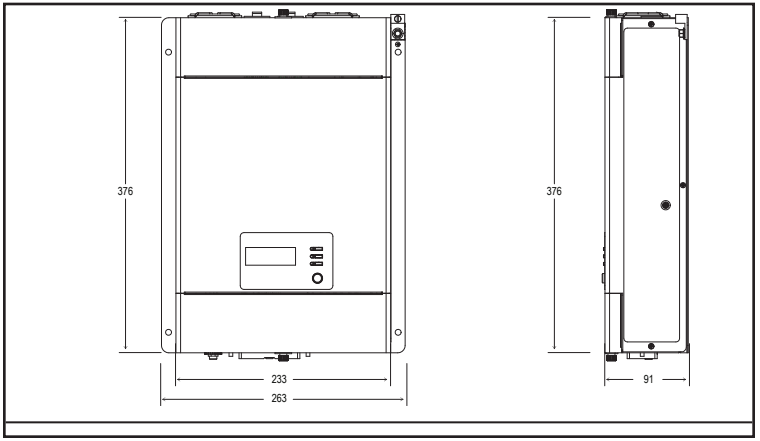
NOTE: Specifications are subject to change without prior notice.

Physical Specifications

Table 13 Physical specifications

	Freedom X 1200 PRO
L × W × H	14.8” × 10.4” × 3.5” (376mm × 263mm × 91mm)
	NOTE: Includes flanges.
Net Weight	10.4 lbs (4.7 kg)

Table 14 Product dimensions



Environmental Specifications

Table 15 Environmental specifications

	Freedom X 1200 PRO
Ambient Temperature:	
Operating Temperature Range[a]	-4 –140 ºF (-20 –60 ºC), with output derated above 104 ºF (40 °C)
Storage Temperature Range	-40 –158 ºF (-40 –70 ºC)
Humidity: Operation/Storage	5–95% RH, non-condensing

[a]Operation may be limited based on the battery chemistry. For example, Lithium Iron Phosphate batteries have a limited temperature range. Follow specific battery manufacturer recommendations for the applicable chemistry.

System Specifications

Table 16 System specifications

	Freedom X 1200 PRO
Transfer relay rating (A[a])	30A surge (24A continuous)
Transfer time (milliseconds[b])	
Shore to inverter: Inverter to shore:	<20 milliseconds <20 milliseconds with a 20-second delay
Transfer voltage (V)	
Shore to inverter: Inverter to shore:	<95 V and >135 V <130 V and >100 V
Cooling	Fan, activated by any of the following: High internal temperature High AC output power

[a] Circuit breakers shall not carry more than 80% of their UL current rating continuously.

[b] To change the AC Transfer time (mode), see *Adjusting Settings in Configuration Mode on page 59*.

Table 17 DC input for inverting

	Freedom X 1200 PRO
Operating voltage range	LBCO voltage[a]–16.5 VDC
Maximum non-operating voltage	0–24 VDC
Nominal voltage	12.0 VDC
Nominal current at full load	115 ADC

Table 18 AC output for inverting

	Freedom X 1200 PRO
Output voltage options	110–125 VAC
Continuous power [b]	1200 W @ 25 °C
Continuous current	10 A
Frequency	60 (or 50) Hz
Wave shape	True Sine Wave
Peak efficiency	91%
Full load efficiency	≥ 86%

[a] To set LBCO, see *Adjusting Settings in Configuration Mode on page 59*.

[b] Power derates to 85% when output voltage is set to 110/108 VAC. .

Regulatory Approvals

Table 19 Regulatory approvals

	Freedom X 1200 PRO
Product Safety	NRTL-listed complies to CSA 107.1 UL458
EMI	CFR 47, (FCC) Part 15, Subpart B, Class B; ISED CAN ICES-003, Class B

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