

FREEDOM eGEN

⚠️ DANGER

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

This Freedom e-GEN System Troubleshooting Guide is in addition to, and incorporates by reference, the relevant product manuals for each product in the power system. After reviewing this guide you must read the relevant product manuals. Unless specified, information on safety, specifications, installation, and operation is as shown in the primary documentation received with the product. Ensure you are familiar with that information before proceeding.

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

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Important Safety Information

READ AND SAVE THESE INSTRUCTIONS

Electrical equipment shall be installed, operated, serviced, and maintained only by qualified personnel. Certain configuration tasks shall only be performed by qualified personnel in consultation with your local utility and/or an authorized dealer. Servicing of batteries and the BMS shall only be performed or supervised by qualified personnel with knowledge of lithium-ion batteries and their required precautions. Qualified personnel have training, knowledge, and experience in:

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

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

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- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- Equipment must only be installed and serviced by qualified electrical personnel.
- Equipment may be energized from multiple sources. Never operate equipment energized with covers removed.
- In case of fire, use only a Class ABC type (dry chemical) fire extinguisher. Water can be a dangerous extinguishing medium for energized equipment because of the risk of electrical shock.
- Always use a properly rated voltage sensing device to confirm all circuits are de-energized.
- Do not short-circuit the battery.
- Do not expose the battery to flames.
- Do not attempt to open or dismantle the lithium-ion battery. If the battery is damaged, do not touch the corrosive electrolyte or powder. In case battery content comes in contact with skin or eyes, immediately flush the affected area with large amount of clean water and seek medical help.
- Upon disposal, do not crush, puncture, drop, disassemble, dispose of in fire, or similar actions.

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

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⚠️ WARNING

HAZARD OF FIRE, ELECTRIC SHOCK, EXPLOSION, BURN, OR PERSONAL INJURY

- Always use the Xantrex Battery with the BMS. Never bypass the BMS. The BMS must always be connected to the lithium-ion battery and in the circuit for proper operation and safety.
- Do not connect other battery types to the system DC load or the system DC bus.
- Do not expose any of the equipment to rain, snow, or liquids of any type. Products are designed for indoor use only.
- Do not operate the battery or other equipment with damaged or substandard wiring.
- Do not replace the battery fuses or any other fuses in the system by yourself.
- Do not obstruct the air ventilation openings on the system devices. Do not install or operate any of the system devices in compartment containing flammable materials or in locations that require ignition-protected equipment.
- When the lithium-ion battery becomes damaged, it can release harmful gases. In such a case, ventilate the area whenever possible but evacuate the vicinity immediately.

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

NOTICE

RISK OF EQUIPMENT DAMAGE

- Do not physically modify the system devices, wiring harness, and accessories.
- Do not alter the factory settings on any of the system devices including the BMS.
- Do not disassemble the Xantrex Battery or the BMS. They contain non-serviceable parts.
- Only charge the Xantrex Battery with an approved charger. Contact Xantrex for details.
- Do not operate or store the battery outside of the specified environmental limits.
- Do not charge the battery in ambient temperature below freezing.
- Do not charge the battery above 14.8V.
- Do not allow the battery to be completely depleted.
- Do not disconnect the battery while it is being charged.
- Always use the Xantrex Battery with the BMS.
- Components which can be recycled must be recycled and those that cannot be recycled must be disposed of according to local, regional, and national environmental regulations.

Failure to follow these instructions can result in damage to equipment and may void the warranty.

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Introduction

This troubleshooting guide is for authorized service personnel only.

It is intended to provide a step-by-step guide for OEM service personnel to identify problems with the Freedom e-GEN System and take the next action. Before proceeding, you must read the Freedom e-GEN System Installation Guide (document number 975-0790-01-01), referred to here as the "Installation Guide", and all the safety warnings therein.

You should also read the Freedom e-GEN System User Guide (document number 975-0791-01-01) for the basic operation of the system.

Before performing any service work, ensure you are familiar with your vehicle's system setup.

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Preparation

- 1 Prior to servicing and troubleshooting, identify and isolate all energy sources from the system.
 - 2 Read and follow all the required safety precautions when working on electrical systems and high-energy battery systems.
 - 3 Wear appropriate personal protection equipment (PPE) and prepare properly rated tools and equipment.
 - 4 Ensure your work environment is well-ventilated. Ensure that there is a Class ABC fire extinguisher nearby in case of battery fire.
 - 5 De-energize the system. This includes:
 - removing AC power,
 - turning off vehicle ignition,
 - turning off the BMS using its Power button, and
 - making sure the main battery disconnect switch is in the OFF position.
- ☛ Use the system schematic in the Installation Guide and the vehicle's electrical layout (if applicable) to locate the main battery disconnect switch in the system.
- 6 Lock-out and tag-out (LOTO) all AC and DC energy sources.
 - 7 Visually inspect the vehicle's electrical system. Pay attention to damages to electrical wiring and system devices. Identify possible hazardous conditions such as exposed conductors, smoke, arcing, etc. Do not proceed if a hazardous condition exists.

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- 8 Do not attempt to energize the system unless explicitly specified in the procedure.

☛ If there is a short circuit in the system, energizing the system can cause further damage and create a hazardous work condition. Make sure the problem is identified and resolved before energizing the system.

Equipment

Prepare the following required equipment:

- PPE (personal protective equipment)
- Multimeter
- Electrically insulated tools, if applicable

Troubleshooting

- 1 Assess the problem.
 - Clearly identify the problem: Is it a performance issue or system failure?
 - Which part (or device) of the system is not working properly?
 - Is there equipment damage?
 - What was the last-seen state of the system?
 - Any warnings, errors observed or other possible hazards (smoke, sparks, etc)?
 - 2 Perform a visual inspection.
 - Inspect the exterior of system devices, cables, and wiring.
 - Look for visible damages, deformations, cuts, burn marks, loose or missing connections.
 - If wiring or cables are damaged, stop and assess the damage before proceeding further.
- ⚠ DO NOT PROCEED IF THERE IS EXPOSED CONDUCTOR.**

 - Retorque bolted connections to the specified values.
- 3 Check the fuses and circuit breakers.
 - Locate system fuses and circuit breakers using the System Schematic in the Installation Guide and the vehicle's electrical layout (if applicable).
 - Check fuses with a multimeter (Ohm).
 - Check for tripped AC breakers.
- ☛ A blown fuse or a tripped breaker indicates a fault has occurred on that branch. Investigate that branch and find out what caused the trip before replacing a fuse or resetting a breaker.
- ⚠ REPLACE A BLOWN FUSE WITH THE SAME TYPE AND RATING.**

- 4 Check the resistance across the system DC bus.
 - Without powering up the system, use a multimeter (Ohm) and measure the resistance between the pos(+) and neg(-) DC busbars.
 - If the resistance measures less than 10 Ohm then there is potentially a short circuit in the system.
 - Locate the short circuit and remove it before proceeding further.

⚠ DO NOT PROCEED UNTIL THE SHORT CIRCUIT HAS BEEN IDENTIFIED AND REMOVED.

- 5 Diagnose the Li-ion BMS and battery module.
 - If the problem is with the Li-ion battery or BMS,
 - Remove all DC loads from the system.
 - Isolate the battery and BMS from the rest of the system by keeping the main battery disconnect switch in the Off position.
 - Perform a visual inspection for visible damages to the battery module case and BMS case.
 - Ensure that the Temperature Intervention Sensor (TIS) is connected between the battery module and BMS.
 - Try turning on the BMS using its Power button.
 - If BMS can be turned On,
 - Go to the state-of-charge (SoC) gauge on the Remote Panel and use the buttons to cycle through battery information.
 - Record the status bit.
 - You may use the status bit app to interpret the status bit and identify any battery fault. Or you can contact Xantrex support for assistance on how to interpret the status bit.

- If BMS does not turn On,
 - Press the Power button on the BMS to turn it Off and
 - Disconnect the Anderson DIN connector between the BMS and the battery module.
 - Use a multimeter (Volt) and very carefully **⚠ DO NOT SHORT THE BATTERY.** measure the voltage across the two (large) power pins of the DIN connector from the battery module.

☛ If the battery voltage is measured below 5V, then the battery module needs to be serviced.

☛ If the battery voltage is measured above 10V and the BMS would not turn On, then the BMS as well as the battery module needs to be serviced.

- 6 Diagnose the Balmar regulator and alternator.

⚠ DO NOT PROCEED IF THERE IS VISIBLE DAMAGE TO THE ALTERNATOR OR ELECTRICAL WIRING.

- If the problem is with the alternator,
 - Remove all DC loads from the system.
 - Without powering up the system, perform a visual inspection of the second alternator for exterior damage.
 - Check the cables for cuts and the wiring connections for rust and corrosion.
 - Check the alternator belt tension and check that the alternator is mounted in alignment with proper drive belt operation.
 - Check that the temperature sensor (a ring lug-type thermistor) is securely installed on the alternator's chassis.

- (continued) If the problem is with the alternator,
 - Check that all the pins on the Balmar regulator, including the temperature sensor pins, are plugged in (populated) correctly.
 - ☛ Refer to the Balmar regulator's instruction manual for the pinouts.
 - Locate the three in-line fuseholders (Delphi weather-proof type) in the alternator harness. Depending on the system setup, two of them can be found close to the Balmar regulator and the other one is wired to the vehicle's engine ignition.
 - Use a multimeter (Ohm) to check the automotive (blade-type) fuses inside the fuseholders. Make sure the fuses are still intact.
 - ☛ A blown fuse indicates a fault has happened. In this case, the Balmar regulator may have failed or the alternator and regulator wiring may be damaged. It is recommended to uninstall and replace the Balmar regulator and thoroughly check the wiring.
 - If the fuses are intact, only when it is safe, turn on the battery disconnect switch and the BMS. Start the engine ignition.
 - Once the engine and alternator are running and BMS is turned on, check that the display on the Balmar regulator lights up. Skip this step, if the Balmar regulator is installed inside the engine compartment.

⚠ FOLLOW SAFETY PRECAUTIONS INCLUDING WEARING PPE NEAR ENGINES.

- (continued) If the problem is with the alternator,
 - Confirm that the alternator starts charging by checking the battery current reading on the battery SoC gauge located on the remote display panel.
 - ☛ Allow a one-minute delay before the alternator starts producing current.

- (continued) If the problem is with the alternator,
 - As long as the Li-ion battery is not fully charged, you should see a charging current (shown with "+" sign on the SoC gauge) as well as a raise in battery voltage.
 - If there is no charging current from the alternator, one possible cause is that the BMS has detected a battery fault and disabled the Balmar regulator to protect the system. To see if this is the case, use the button on the SoC gauge to read the status bit, interpret the status bit to identify any active battery fault.
 - If the status bit reads normal and the BMS has no active fault, and there is still little change in the charging current on the SoC gauge after 5 minutes, then the alternator is not producing any current and needs to be serviced.

- 7 Diagnose the Freedom SW inverter/charger (FSW).

⚠ DO NOT PROCEED IF WIRING IS DAMAGED OR THERE IS EXPOSED CONDUCTOR.

- If the problem is with the FSW,
 - Remove all DC and AC loads from the system.
 - Without powering up the system, perform a visual inspection for miswiring or damaged wiring at both the DC and AC sides of the FSW unit.

- (continued) If the problem is with the FSW,
 - Check if the circuit breakers located on the AC side of the FSW unit have tripped.
 - Only when it is safe, turn on the battery disconnect switch and BMS to apply battery power to the FSW.
 - Normally, upon applying DC power to FSW, the unit automatically goes through a power-up sequence, during which the unit's front LEDs and internal fans come on briefly.

☛ If the FSW does not automatically power up when there is 12V present across the unit's DC input terminals, then the unit needs to be serviced.

- (continued) If the problem is with the FSW,
 - If the FSW powers up, but is unable to invert, check to make sure (via a ComBox Web app or Android app),
 - the inverter function is Enabled and
 - the FSW is not set to Standby Mode.
 - If the FSW powers up, inverts, but is unable to charge when AC shore power is applied, using the ComBox Web app or Android app, check to make sure,
 - the charger function is Enabled and
 - the charging parameters, including charging voltage setpoints and power sharing limit are properly configured according to the system's Installation Guide.
 - Record any warnings/errors displayed by the ComBox Web app or Android app.

☛ If the problem cannot be resolved by following the steps above, safely power down and de-energize the whole system, and remove the FSW for service.