



NOVATM Series

PURE SINE WAVE INVERTER CHARGER

BUILT-IN TRANSFER SWITCH

USER MANUAL



NOVA SUPERCHARGER 2K (RS-V2P12C 2000W 120VAC 12VDC)

NOVA SUPERCHARGER 3K (RS-V3P12C 3000W 120VAC 12VDC)

THIS MANUAL CONTAINS IMPORTANT SAFETY AND OPERATING INSTRUCTIONS FOR THE INVERTER. PLEASE READ THIS MANUAL AND FOLLOW THE INSTRUCTIONS EXACTLY.

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Product Names for the 12VDC Models

NOVA SUPERCHARGER 2K (RS-V2P12C 2000W 120VAC 12VDC)

NOVA SUPERCHARGER 3K (RS-V3P12C 3000W 120VAC 12VDC)

Contact Information

Toll-Free: 1-800-831-9889

Email: support@richsolar.com

Website: www.richsolar.com

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 RICH SOLAR NOVA Inverter Charger for Recreational, Commercial and Fleet Vehicle, or Marine 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 RICH SOLAR NOVA Inverter Charger. The Installation section starting on page 18 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	max	Maximum
Ah	Amp-hours (a unit of battery capacity)	min	Minimum
AC	Alternating Current	ms	Milliseconds (a unit of time)
ACC	Accessory in vehicle ignition system	N·m	NewtoN-meters (a unit of torque)
AGM	Absorbed Glass Mat (a battery type)	PN	Product Number
CCCV	Constant Current Constant Voltage	PPE	Personal Protective Equipment
DC	Direct Current	PV	Photovoltaic (Solar)
in-lb	inch-pound force (a unit of torque)	s	Seconds (a unit of time)
kW	Kilowatts (1000 watts)	V, VAC, VDC	Voltage, Volts AC, Volts DC
LBCO	Low Battery Cutout (or Cutoff)	W	Wattage, Watt (a unit of power)
LCD	Liquid Crystal Display	°	Degrees symbol commonly used for temperature
LED	Light Emitting Diode	°C	Unit of degrees in Celsius scale
Li-ion	LiFePO ₄ (lithium iron phosphate – a battery type)	°F	Unit of degrees in Fahrenheit scale
m	Minutes (a unit of time)	%	Percent, percentage

Related Information

You can find more information about RICH SOLAR products and services at www.richsolar.com.

Important Safety Instructions

Read and save this owner’s guide for future reference.

This guide contains important safety instructions for the RICH SOLAR NOVA Inverter Chager 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.

1.1 Product Safety Information

1. Before using the inverter charger, read all instructions and cautionary markings on the unit, the batteries, and all appropriate sections of this guide.
2. Use of accessories not recommended or sold by the manufacturer may result in a risk of fire, electric shock, or injury to persons.
3. The inverter charger is designed to be connected to both DC and AC electrical systems. The manufacturer recommends that all wiring be done by a certified technician or electrician to ensure adherence to the local and national electrical codes applicable in your jurisdiction.
4. To avoid a risk of fire and electric shock, make sure that the existing wiring is in good condition and that the wire is not undersized. Do not operate the inverter charger with damaged or substandard wiring.
5. Do not operate the inverter charger if it has been damaged in any way.
6. This unit does not have any user-serviceable parts. Do not disassemble the inverter charger except where noted for connecting wiring and cabling. See your warranty for instructions on obtaining service. Attempting to service the unit yourself may result in a risk of electrical shock or fire. Internal capacitors remain charged even after all power is disconnected.
7. To reduce the risk of electrical shock, disconnect both AC and DC power to or from the inverter charger before attempting any maintenance, cleaning, or work on any components connected to the inverter charger. Do not disconnect under load. Turning the inverter charger to Standby mode using the Power button on the front panel will not reduce an electrical shock hazard.
8. The inverter charger 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 its life 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. For marine applications, this unit must be installed with a drip shield. Refer to Marine Installation on page 42 for details.



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 RICH SOLAR NOVA Inverter Charger 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 minutes 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 5in-lb (0.56N·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 the guide before installing or using.
- Do not cover or obstruct ventilation openings.
- Do not mount in zero-clearance compartment — overheating may occur.
- Do not expose to rain or spray. This inverter charger is designed for marine applications only when additional drip protection is installed in certain orientations. See “Approved Mounting Orientations” on page 26 guide for more information.
- Install GFCIs only as specified in this guide. Other types may fail to operate.
- 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 167°F (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 the engine.
- RICH SOLAR NOVA Inverter Charger 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 charger to prevent 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 RICH SOLAR NOVA Inverter Charger 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 death, serious injury, or equipment damage.

1.2 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

HAZARDS: BURNS FROM HIGH SHORT-CIRCUIT CURRENT, FIRE AND EXPLOSION FROM VENTED GASES

- Always wear proper, non-absorbent gloves, complete eye 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 -32°F (0°C) or colder.

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

NOTES:

1. Mount and place the RICH SOLAR NOVA Inverter Charger unit away from batteries in a well-ventilated compartment.
2. Always have someone within earshot or close enough to help when working 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 free of corrosion. If battery acid or corrosion deposit contacts skin or clothing, wash immediately with soap and water. If it enters your eye, immediately flood it with running cold water for at least twenty minutes and have someone nearby 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 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 connected loads and accessories are off to prevent an arc.

1.3 Precautions When Placing the Unit



WARNING

FIRE HAZARD

- Do not install the inverter charger or any part of its supplied wiring in engine compartments.
- For marine installation, always locate the inverter charger away from the battery and mount it 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 charger when reading gravity, or filling battery.
- Never place the RICH SOLAR NOVA unit directly above batteries; gases from a battery will corrode and damage the inverter charger.
- Do not place a battery on top of the inverter charger.

Failure to follow these instructions can result in equipment damage.

1.4 Regulatory

The RICH SOLAR NOVA Inverter Charger is certified to appropriate US and Canadian standards. For more information, see Regulatory Approvals on page 18.

The RICH SOLAR NOVA Inverter Charger is intended to be used for recreational, commercial, or other mobile applications. Only for marine use with additional drip protection in certain orientations. See the Marine Installation section for details.

1.5 End of Life Disposal

The RICH SOLAR NOVA Inverter Charger is designed with environmental awareness and sustainability in mind. At the end of life, it 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 are made from recyclable materials like steel, copper, aluminum, and other alloys. These materials can be sold to traditional scrap metal recycling companies who resell reusable metals. Electronic components 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 RICH SOLAR.

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Introduction

The RICH SOLAR NOVA Inverter Charger is designed with integrated inverting and charging functions and power management features suitable for marine, recreational, and commercial/fleet vehicle installations.

Please read this section to familiarize yourself with the main performance and protection features of the RICH SOLAR NOVA.

2.1 Materials List

The RICH SOLAR NOVA base package includes the following items:

- one RICH SOLAR NOVA unit
- one Owner's Guide and extra safety labels
- one pre-installed DC ground enclosure lug (not shown)

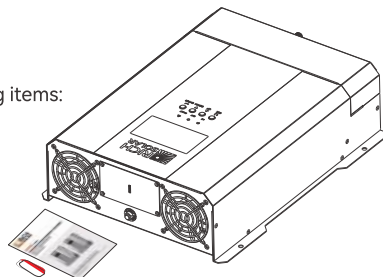


Figure 1 What's in the box

NOTE: If any of the items are missing, contact RICH SOLAR or any authorized dealer for replacement. See Contact Information on page 01.

2.2 Key Features

Power for Most Appliances

The RICH SOLAR NOVA Inverter Charger provides up to 2000 watts (NOVA SUPERCHARGER 2K 120VAC 12VDC) or 3000 watts (NOVA SUPERCHARGER 3K 120VAC 12VDC) of continuous utility grade, sine wave power derived from a battery bank.

It is designed to handle loads such as microwave ovens, TV, DVD/Blu-ray players, and power tools. In addition, its 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 boat docks or campsites to ensure power is always available.

Back-up Capability

If incoming shore power is interrupted by external events like brownouts, the RICH SOLAR NOVA automatically becomes an independent power source[△] that supplies utility grade AC power to your loads.

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

Comprehensive Protection

The RICH SOLAR NOVA's built-in protection features safeguard your batteries (from unnecessary drain) like 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 can be manually selected by the user from 10.5 to 12.8VDC.

Configurable AC Transfer Speed

The RICH SOLAR NOVA allows two speed settings for the AC transfer from Grid Mode to Battery Mode, and vice versa, which avoids nuisance resetting of appliances. The normal transfer rate is for common appliances and the faster for more sensitive digital equipment like a desktop computer.

Overload Alarm and Shutdown

During Battery Mode (also called Inverter Mode), the RICH SOLAR NOVA automatically alerts you if the loads that are connected and drawing power from the unit are close to the maximum operating limit. If so, it automatically shuts down when the maximum operating limit is exceeded. See Troubleshooting Reference on page 67 for precautions.

Over-temperature Alarm and Shutdown

During Battery Mode, the RICH SOLAR NOVA automatically alerts you if overheating and approaching the over-temperature shutdown limit. It automatically shuts down when the limit is exceeded. See Troubleshooting Reference on page 67 for precautions.

Built-in Charge Formulas

For the inverter/charger to perform at the highest level, the batteries must be charged correctly. The RICH SOLAR NOVA has optimized algorithms for AGM, custom, and lithium iron phosphate [Li-ion (or LiFePO₄)] batteries.

Dead Battery Charging

Another feature of the RICH SOLAR NOVA is dead battery charging. This is the ability to recharge batteries, even if the battery voltage has reached 0VDC.

Ignition Control

The RICH SOLAR NOVA provides two user-selectable options for ignition control.

Ignition On: The RICH SOLAR NOVA can automatically turn the inverter charger on and off in tandem with the vehicle's ignition circuit or a manually operated remote switch.

Configurable AC Output Frequency and Voltage

The RICH SOLAR NOVA is factory set to 60Hz AC output frequency and 120VAC output voltage. It can be configured to 50Hz for use in regions outside the USA and Canada. The AC voltage can also be set to: 108, 110, or 120 volts.

Load Management

The RICH SOLAR NOVA has a built-in 30A transfer relay that connects the inverter/charger output or AC input from the AC generator to the loads. Because the usual AC power sources such as small generators often have limited current availability, having the capability to manage your AC loads is extremely valuable. The RICH SOLAR NOVA provides a number of features to facilitate this.

- The charger is power factor corrected to use AC current as efficiently as possible. Minimizing the AC current used by the charger means more current is available for your AC loads.
- The RICH SOLAR NOVA has a power share feature which prioritizes your AC loads by reducing the charge current and maintaining the total input current to less than the breaker setting.

Features

This section identifies the default settings and the hardware features of the RICH SOLAR NOVA Inverter Charger.

3.1 AC/DC and GFCI Panel

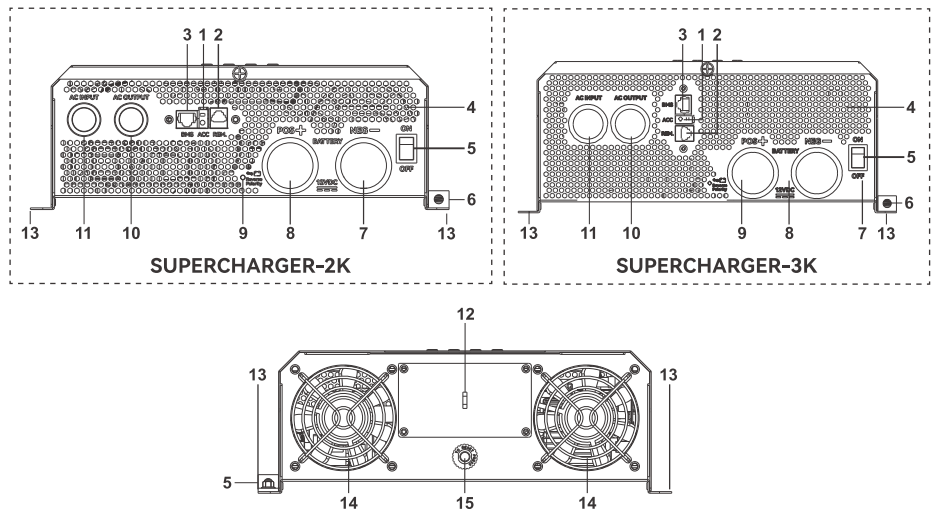


Figure 2 AC/DC and GFCI panel



WARNING

ELECTRICAL SHOCK HAZARD

Use a torque screwdriver to tighten the wiring cover screw to 5in-lb (0.56N·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.

Table 1 AC/DC and GFCI Panel Features

Feature	Description
1	ACC input terminal for connecting ignition control wiring. Ignition Control Switch (ACC) for connecting [ON (I)] and disconnecting [OFF (O)] the ignition signal.
2	Remote port allows you to connect an accessory remote control display device.
3	BMS.
4	Ventilation grille (openings) must not be obstructed.

Feature	Description
5	Switch.
6	Grounding lug provides a ground path for the RICH SOLAR NOVA chassis to the DC system ground. See WARNING.
7	DC terminal opening for routing (-) negative DC cable.
8	DC terminal opening for routing (+) positive DC cable.
9	LED alert indicator for reverse DC polarity.
10	AC output terminal opening for routing AC output wiring.
11	AC input terminal opening for routing AC input wiring.
12	GFCI cover is removed when installing a qualified GFCI device such as the optional GFCI kit (sold separately).
13	Mounting flanges on both sides allow you to mount the inverter charger permanently on deck or wall.
14	Ventilation grille (openings) must not be obstructed for the proper operation of the cooling fan and inverter charger. When the inverter charger is mounted, the ventilation grille must not point up or down. Cooling fans turn on when the internal temperature reaches a set temperature.
15	20A supplementary protector with reset button provides overload protection for the optional GFCI kit (sold separately). Press to recover from an overload condition. In a hardwired installation, the supplementary protector does not protect output wiring.



WARNING

ELECTRICAL SHOCK HAZARD

- Use a torque screwdriver to tighten the bolt on the DC ground lug to a torque of 23in-lb (2.6N·m).
- 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.

3.2 Display Panel

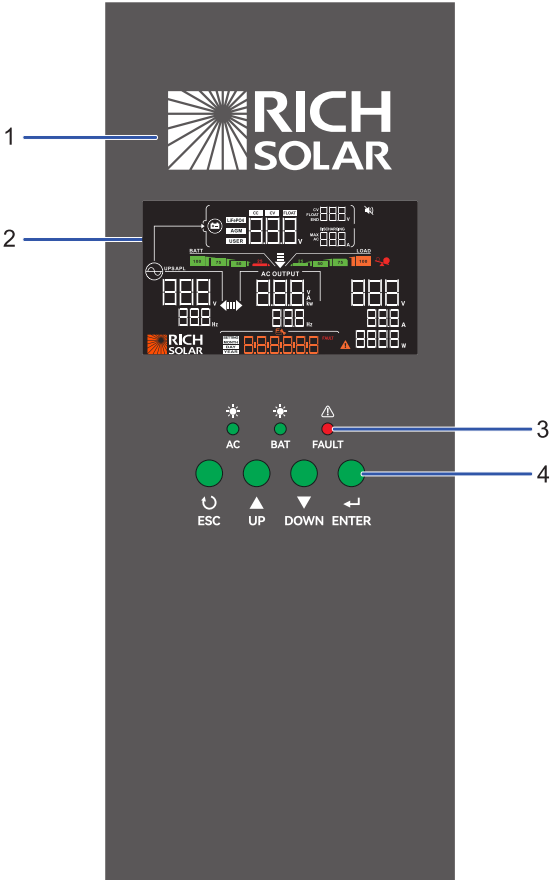


Figure 3 Display panel

Table 2 Display Panel Features

Feature	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	Four function buttons change status information displayed on the screen. Also, changes inverter/charger settings. See RICH SOLAR NOVA Display Panel on page 45 for detailed information on the panel's buttons.

3.3 Side Panel

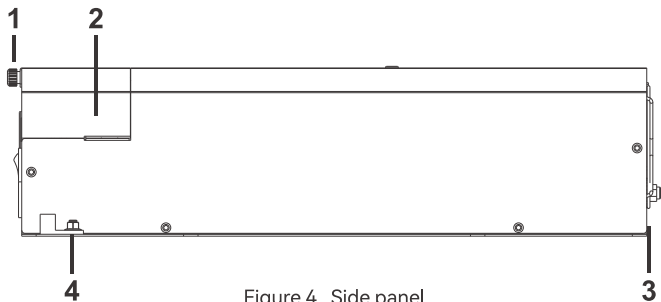


Figure 4 Side panel



WARNING

ELECTRICAL SHOCK HAZARD

- Use a torque screwdriver to tighten the captive nut panel screw to 5in-lb (0.56N·m) torque to ensure a proper ground connection and a required tool access to the wiring compartment.
- Use a torque screwdriver to tighten the bolt on the DC ground lug to a torque of 23in-lb (2.6N·m).
- 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

Feature	Description
1	Captive nut panel screw holds the wiring compartment cover in place. See WARNING above.
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 above.
3	20A supplementary protector with reset button provides overload protection for the optional GFCI kit (sold separately). Press to recover from an overload condition. In a hardwired installation, the supplementary protector does not protect output wiring.
4	Grounding lug provides a ground path for the RICH SOLAR NOVA chassis to the DC system ground. See WARNING.

Installation

Please read this section for safety information and installation instructions regarding your RICH SOLAR NOVA.

4.1 Before You Begin the Installation

Before beginning your installation:

- Read this entire Installation section 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 03.
- Be aware of all safety and electrical codes which must be met.



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.**

4.2 Installation Codes

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

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

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

4.3 Installation Tools and Materials

You will need the following to install the RICH SOLAR NOVA:

- Wire stripper
- Mounting (#2) screws or bolts
- #2 Phillips torque screwdriver
- Torque wrench for DC terminals (1/2" or 13mm socket wrench)
- AC cable (that is, two-conductor-plus-ground cable), sized appropriately for load and application
- 1/2" (or 3/4") trade-size strain relief clamps (for the AC cable clamp holes)
- Wire nuts or crimp connectors for AC wire and appropriate tools
- 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

4.4 Basic Installation Procedures

This section provides sample installation information as a guide for your installation.

NOTE: For marine applications, see additional installation instructions on page 42.

Step 1: Designing the Installation

Most RICH SOLAR NOVA 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. Also, see Marine Installation on page 42.

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

AC Disconnected and Over-current Protection Device

Most safety requirements and electrical codes require the RICH SOLAR NOVA AC and DC inputs and outputs to be provided with over-current protection (such as circuit breakers or fuses) and disconnect devices.

AC Input

The circuit breaker or fuse (connected through hard wiring) that is used to supply the RICH SOLAR NOVA 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 RICH SOLAR NOVA 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 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 RICH SOLAR NOVA 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 RICH SOLAR NOVA (the AC source panel) and between the RICH SOLAR NOVA 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 RICH SOLAR NOVA. The AC load panel can incorporate an AC output circuit breaker and breakers for individual load circuits.

AC Cabling

AC cabling includes all wires and connectors between the AC source and the RICH SOLAR NOVA, as well as all AC cabling between the RICH SOLAR NOVA 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 marine or 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 RICH SOLAR NOVA. 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 cable rated at 140°F (60°C), and assuming an ambient temperature of up to 86°F (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 (Amps)	10A	15A	20A	30A
Minimum Wire Size	14AWG	14AWG	12AWG	10AWG

AC Output Neutral Bonding

The neutral conductor of the RICH SOLAR NOVA 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 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 SA29.5, for all permanently connected marine inverters:
The RICH SOLAR NOVA 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.
All connections to the unit should comply with all regulations, directives, local codes and ordinances.

Ground Fault Circuit Interrupters (GFCIs)

A GFCI is a device that de-energizes a circuit when a current to ground exceeds a specified value, which is lower than the current required to blow the circuit breaker. GFCIs are intended to protect people from electric shocks and are usually required in wet or damp locations.
Installations in marine and recreational vehicles require GFCI protection of branch circuits connected to the AC output of the RICH SOLAR NOVA.
The following GFCI receptacle will work correctly with the RICH SOLAR NOVA in the inverter/charger's AC output distribution wiring system.

Alternatively, the RICH SOLAR NOVA GFCI kit (sold separately) option is also available to use with the RICH SOLAR NOVA inverter unit. See item 12 on page 15.

Table 5 GFCI Compatibility

Type	Specification
Standard GFCI Receptacle	Compatible with RICH SOLAR NOVA AC output circuits
RICH SOLAR NOVA GFCI Kit	Optional accessory for marine/RV installations

DC Cabling

This includes all the cables and connectors between the batteries, the DC disconnect and over-current protection device, and the RICH SOLAR NOVA. Most mobile installations require multi-strand insulated 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 6 specifies the minimum recommended DC cable size and maximum fuse size for the RICH SOLAR NOVA. **The DC cables must be stranded, copper, and must be rated 194°F (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 6 Required Cable Sizes

Inverter Charger	Cable Length: Battery to Inverter (one way)	Minimum Cable Size	Maximum Battery Fuse Size
NOVA SUPERCHARGER 2K	Less than 5 feet (1.5 meters)	No.2/0 AWG	250ADC
NOVA SUPERCHARGER 3K		No.3/0 AWG	350ADC
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 U.S. National Electrical Code Table 310.17 - 167 °F (75°C) cables, assuming an ambient temperature of 86°F (30°C) cables.			

IMPORTANT: Using the correct cable size is critical to achieving the rated performance of the RICH SOLAR NOVA unit. When starting a heavy load, the RICH SOLAR NOVA can draw current surges from the battery of up to 370A. If the DC wiring is too small, the voltage drop from this surge will result in a voltage at the RICH SOLAR NOVA terminals that is too low for the inverter to operate correctly. The RICH SOLAR NOVA 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 at times and fail to do so at others.

DC Disconnects and Over-current Devices

The DC circuit from the battery to the RICH SOLAR NOVA 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 and DC circuit breaker. 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, on the positive cable. Applicable codes may limit how far the protection can be from the battery.

Batteries

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

Step 2: Choosing a Location for the Unit



WARNING

FIRE AND EXPLOSION HAZARDS

- Do not install the RICH SOLAR NOVA 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 RICH SOLAR NOVA in a zero-clearance compartment. Overheating may occur.

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

The RICH SOLAR NOVA 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 RICH SOLAR NOVA. **Do not mount in an area subject to splashing water or bilge water.**

Cool. Normal air temperature should be between -40°F and 160°F (-40°C and 70°C)—the cooler, the better.

Ventilated. Allow at least 5 inches of clearance at the fan end 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 performance. Do not allow the ventilation openings on ends to become obstructed.

Safe. Do not install the RICH SOLAR NOVA 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 RICH SOLAR NOVA.

Protected from battery acid and gases. Never allow battery acid to drip on the RICH SOLAR NOVA 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 RICH SOLAR NOVA.

Step 3: Mounting the Unit

To mount the RICH SOLAR NOVA

1. Remove the RICH SOLAR NOVA from its shipping container, verify that all components are present, and record relevant product information on “Information About Your System” in the Owner’s Guide.

2. Select an appropriate mounting location and orientation (see Figure 6). To meet regulatory requirements, for use in on-land applications, the RICH SOLAR NOVA 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)

NOTE: For marine installations, only this orientation is allowed, due to the probability of moisture finding access into the enclosure.

- c. On a horizontal surface (see C)

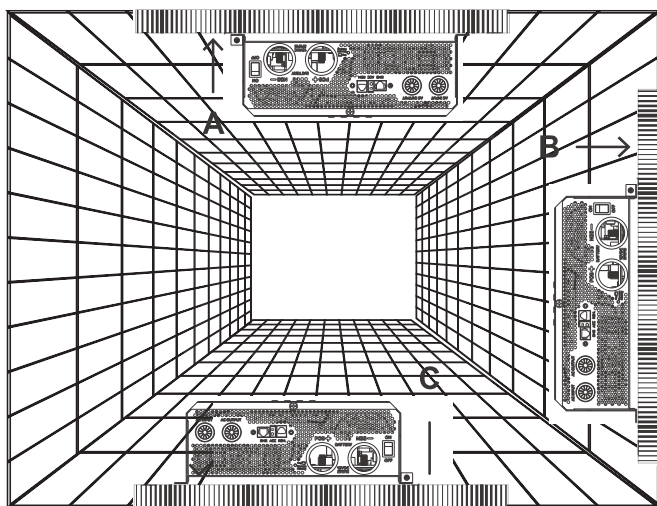


Figure 6 Approved mounting orientations

3. Mark the desired number of mounting holes by placing the unit on the wall.

4. Pilot-drill the mounting holes.

5. Fasten the RICH SOLAR NOVA to the mounting surface. 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 1/4"-20 machine screws.

Connecting the Equipment Ground

 WARNING

ELECTRIC SHOCK HAZARD

Never operate the RICH SOLAR NOVA without properly connecting the 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 RICH SOLAR NOVA has a ground lug on the side as shown in Connecting the Equipment Ground. Follow its guidelines to connect the inverter charger’s chassis to the ground.

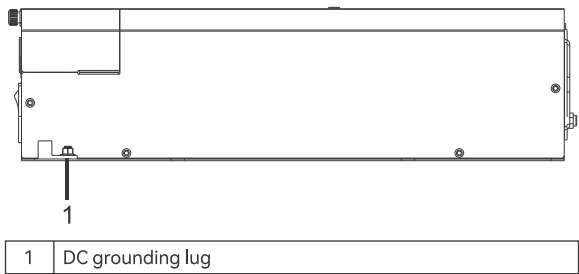


Figure 7 DC panel connections

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 (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 23in-lb (2.6N·m). 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 7 Equipment DC Ground Cable Size

Application	Minimum equipment ground cable size (Stranded copper cable is required)
Recreational Vehicle	No.8 AWG
Marine	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. In general, the equipment ground cable size must not be smaller than one AWG size than the supply cable.

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 RICH SOLAR NOVA to any incoming AC source.

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

General AC Wiring Considerations

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 close to each other.

AC Wiring and GFCIs

You can plug loads of up to 20 amps directly into the GFCI receptacle on the front panel of the RICH SOLAR NOVA. If installed, you can also connect the inverter to an existing AC installation and then plug loads into GFCI receptacles connected to that circuit. If you plan to use the RICH SOLAR NOVA GFCI kit on the unit, proceed to General AC Wiring Considerations on page 28.

AC wiring includes all the wires and connectors between the AC source and the unit, as well as all wiring between the inverter charger, AC panels, GFCI, and circuit breakers. The type and size of the wiring vary 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 167°F (75°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 8 is based on the U.S. National Electrical Code and the Canadian Electrical Code, assuming two-conductor-plus-ground cable, using 167°F (75°C) wiring, at an ambient temperature of 86°F (30°C). Other codes and regulations may be applicable to your installation.

Table 8 Required AC Wire Size VS. Required Breaker Rating

	Required Breaker Size (A)	Required Wire Size
RICH SOLAR NOVA	30A maximum 20A maximum through a GFCI	10AWG

When making the AC input and AC output connections, observe the correct color code for the appropriate AC wire, as described in Table 9 below.

Table 9 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 RICH SOLAR NOVA to malfunction and may permanently damage the inverter charger. Damage caused by a reverse polarity connection is not covered by your warranty.

Failure to follow these instructions can result in equipment damage.

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 [1] and lifting the cover up and out. Maximum torque for wiring cover screw is 6.2in-lb (0.7N·m).

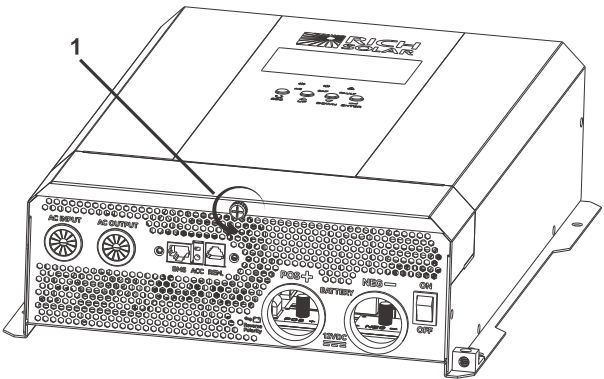


WARNING

ELECTRICAL 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.



1	Captive nut panel screw
---	-------------------------

Figure 8 Loosening the captive nut panel screw

4. Strip a single AC input wire as appropriate. Strip 10mm off the ends of each of the three wires (tin the exposed copper wire with lead-free solder using a soldering iron).
5. Route the wires through the strain relief clamp (not shown in the figure).

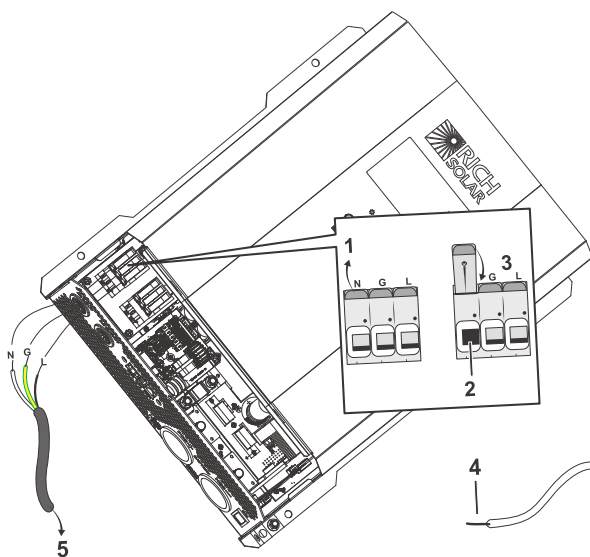


Figure 9 Routing the AC input wires

1	Step 8a
2	Step 8b
3	Step 8c
4	15mm
5	to circuit breaker
NOTE: AC input hole—install a strain relief clamp (not shown).	

6. Locate the Neutral, Ground and Line terminals on the AC input terminal labeled as **N**, **G**, and **L** respectively.
7. 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.
8. Make sure that each AC wire is matched and connected to the Neutral (**N**), Ground (**G**), and Line (**L**) connections.
9. Tighten the strain relief clamp to secure the wires.
10. 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 5in-lb (0.56N·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.

11. Connect the other end of the wires to the circuit breaker in the AC distribution panel that supplies 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 to the RICH SOLAR NOVA AC output, and GFCI protection must be provided on every receptacle connected to the AC hardwired installation. Other types may fail to operate properly when connected to the RICH SOLAR NOVA. See Ground Fault Circuit Interrupters (GFCIs) on page 23.

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 RICH SOLAR NOVA.
- The unit 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 charger is off.

Failure to follow these instructions can result in equipment damage.

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

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

AC Output Connections

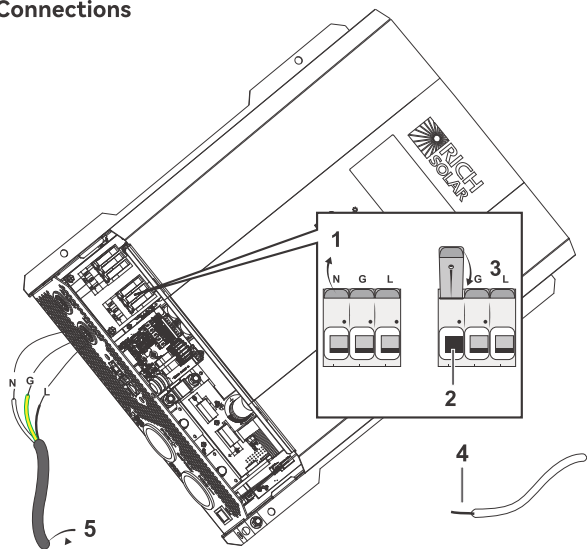


Figure 10 Routing and connecting the AC output wires

1	Step 7a
2	Step 7b
3	Step 7c
4	15mm
5	to circuit breaker

NOTE: AC output hole—install a bushing (supplied) or a strain relief device.

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 Output Connections on page 33.
2. Install the required circuit breaker in the inverter charger distribution panel receiving AC power.
3. Remove the wiring compartment cover, if not already done from AC Output Connections on page 33.



WARNING

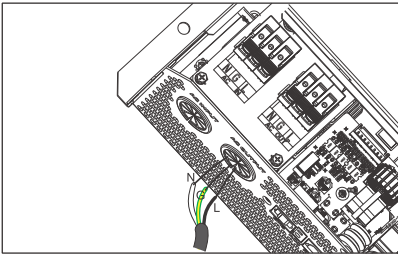
ELECTRIC SHOCK AND FIRE HAZARDS

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 10mm off the ends of each of the three wires (tin the exposed copper wire with lead-free solder using a soldering iron).

- 5. Install a 1/2" 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 Neutral (N), Ground (G), and Line (L) connections.



- 9. Tighten the strain relief clamp to secure the wires.
- 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

ELECTRIC SHOCK AND FIRE HAZARDS

Use a torque screwdriver to tighten the captive nut panel screw to 5in-lb (0.56N·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.

- 11. Connect the other end of the wires to a circuit breaker in AC distribution panel providing AC power to the loads.

Step 6: Connecting the DC Cables

NOTICE

REVERSE POLARITY

- Check cable polarity at both the battery and the RICH SOLAR NOVA before making the final DC connection. Positive must be connected to positive; negative must be connected to negative. Check to see if the reverse polarity LED (see Step 6: Connecting the DC Cables) is not illuminated.
- Reversing the positive and negative battery cables will blow a fuse in the unit and void your warranty.

Failure to follow these instructions can result in equipment damage.



WARNING

FIRE HAZARD

Use only stranded, copper wire rated minimum 167°F/75 °C (221°F/105 °C for marine installations). Make sure all DC connections are tight to a torque of 27-35in-lb (3-4N·m).

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 6 specifies the minimum DC cable size and maximum fuse size for the RICH SOLAR NOVA.

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 charger's ability to operate the loads.

To make the DC connections:

1. Make sure the inverter charger 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 1/2" (13mm) to 3/4" (19mm) 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 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 1/2" (13mm) to 3/4" (19mm) of insulation from each cable end that will be connected to the inverter charger. The amount stripped off will depend on the terminals chosen.
7. Attach the cable ring lug that will join the cable to the inverter charger 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:
- be as close to the battery positive terminal as possible
 - be rated for DC circuits
 - 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 charger.
11. Fasten the DC terminal nut (set aside earlier) to the terminal bolt. Tighten the nut to a torque of 27-35in-lb (3-4N·m).
- 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 hole and do not let it touch the edge.



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 overtighten the nut on the DC input terminals because damage to them may result. Use a torque screwdriver to tighten the nut to a maximum torque of 35in-lb (4N·m).

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 RICH SOLAR NOVA before making the final DC connection. Positive must be connected to positive; negative must be connected to negative. Check to see if the reverse polarity LED (see Step 6: Connecting the DC Cables) is not illuminated.
- Reversing the positive and negative battery cables will blow a fuse in the RICH SOLAR NOVA and void your warranty.

Failure to follow these instructions can result in equipment damage.

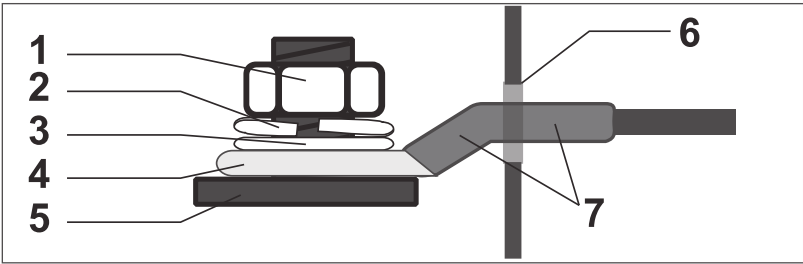


Figure 11 DC cable connections

1	DC terminal bolt nut (Torque: 2.94–3.92N·m)
2	Lock washer
3	Flat washer
4	Cable ring lug
5	DC terminal
6	Snap bushing
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 charger 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 charger.

14. Fasten the DC terminal nut (set aside earlier) to the terminal bolt. Tighten the nut to a torque of 27-35in-lb (3-4N·m).

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 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 5in-lb (0.56N·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.

DC Grounding

To connect the DC ground:

1. The equipment grounding lug (DC ground lug) on the DC end of the RICH SOLAR NOVA is used to connect the chassis 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 Figure 7 on page 27 for the location of the DC ground lug. Make sure to tighten the bolt on the DC ground lug to a torque of 23in-lb (2.6N·m). 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.

Marine

Use stranded copper wire that is bare or has insulation rated minimum 221°F (105 °C), and connect it between the chassis ground lug and the boat's DC grounding bus or engine negative bus. For the NOVA SUPERCHARGER 2K, NOVA SUPERCHARGER 3K, use a wire of gauge 8AWG minimum. See regulatory references below.

Regulatory references

For DC voltage systems under 50VDC in an RV installation, an 8AWG copper bonding conductor would be acceptable for the inverter enclosure ground bonding only, as ≤150mV @ 30A connection, bonding voltage converter enclosures.

The "house" battery system must, however, be ground bonded for Auxiliary Battery Grounding;

For DC voltage systems under 50VDC in a marine installation, a DC grounding conductor shall not be smaller than one size under that required for current carrying conductors supplying the device, but not less than 8AWG.

Step 7: Connecting to Port(s) on the RICH SOLAR NOVA

Connecting to ACC Signal

The RICH SOLAR NOVA can be wired to inhibit inverter operation in the absence of a vehicle's (or vessel's) ignition control signal. This feature can avoid unnecessary battery drain that would otherwise occur if the inverter charger 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 amps. Refer to the vehicle's user manual for guidance.
4. Locate the ACC input (ignition signal input) terminal. See Figure 12.

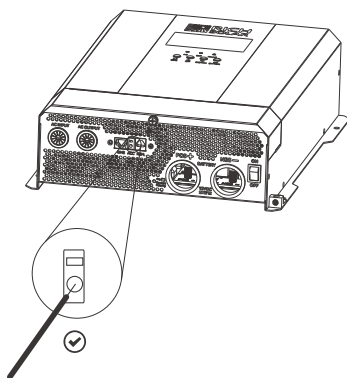


Figure 12 Ignition signal (ACC) input terminal

- 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.

Description of Ignition Control Features

For information about the features and instructions on changing the ignition control features, see Operation on page 40.

Table 10 Ignition Control Features

Ignition On ()	This setting allows the inverter charger 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.
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.

To connect the remote panel to the remote port:

Plug the remote panel unit's cable connector to the RJ12 remote port on the unit.

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

Step 8: Testing Your Installation



WARNING

ELECTRIC SHOCK HAZARD

Pressing the Power button to turn the RICH SOLAR NOVA Inverter to Standby mode on the display panel does not disconnect DC or AC input power. 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 RICH SOLAR NOVA is inverting DC battery power and delivering AC power to its output.

The second test is intended for installations where AC input and output are hardwired to the unit. It verifies that the unit 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 other external AC source.

When you are ready to test your installation and operate the unit, ensure the DC fuse is closed and the DC circuit breaker is disconnected to supply DC power to the unit.

Testing in Battery Mode

To test the RICH SOLAR NOVA

1. For hardwired installations, ensure shore power is not present.
2. Press the Power button to turn the inverter charger on. The green LED indicating Battery Mode (Inverter Mode) turns on and the LCD screen displays the **BATT. MODE** icon.
3. Plug a test load, such as a lamp within the power rating of the inverter charger into the RICH SOLAR NOVA GFCI or an AC outlet wired to the RICH SOLAR NOVA.
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 hardwired to the RICH SOLAR NOVA, proceed to testing in Grid Mode. If the status LED on the display panel glows red, see the Troubleshooting chapter.

Testing in Grid Mode

To test the RICH SOLAR NOVA

1. With the test load from the previous test still connected and operating, connect the shore power source.
2. The RICH SOLAR NOVA transfers the test load to shore power. The green LED indicating Grid Mode turns on and the LCD screen displays the **AC MODE** icon.
3. If the test load operates, your installation is successful.

NOTE: If the Power button on the unit is turned ON, it will automatically supply the appliances with inverter power when the shore power source fails or becomes disconnected.

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

NOTE: Whether or not the Power button is turned ON, shore power will pass through the unit to the output when it is within normal operating range. The unit also starts charging the battery after the transfer to Grid Mode.

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

Marine Installation

Figure 13 Illustrates a typical marine installation with the following components:

1	Equipment ground – Engine negative bus/DC ground bus
2	RICH SOLAR NOVA Inverter Charger
3	DC fuse/disconnect/DC circuit breaker
4	12V deep-cycle battery bank (house) and protected by a DC fuse in the positive cable
5	Battery isolator
6	DC alternator
7	To engine
8	Equipment ground – Engine negative bus/DC ground bus
9	Starting battery
10	AC load panel with branch circuit breakers that supply only loads that run off the RICH SOLAR NOVA
11	AC source panel that includes a max 30A (or a 15A if using a GFCI) circuit breaker that supplies the RICH SOLAR NOVA
12	Shore power – AC power supplied from a shore power connector
Not shown	Drip shield (see page 44)

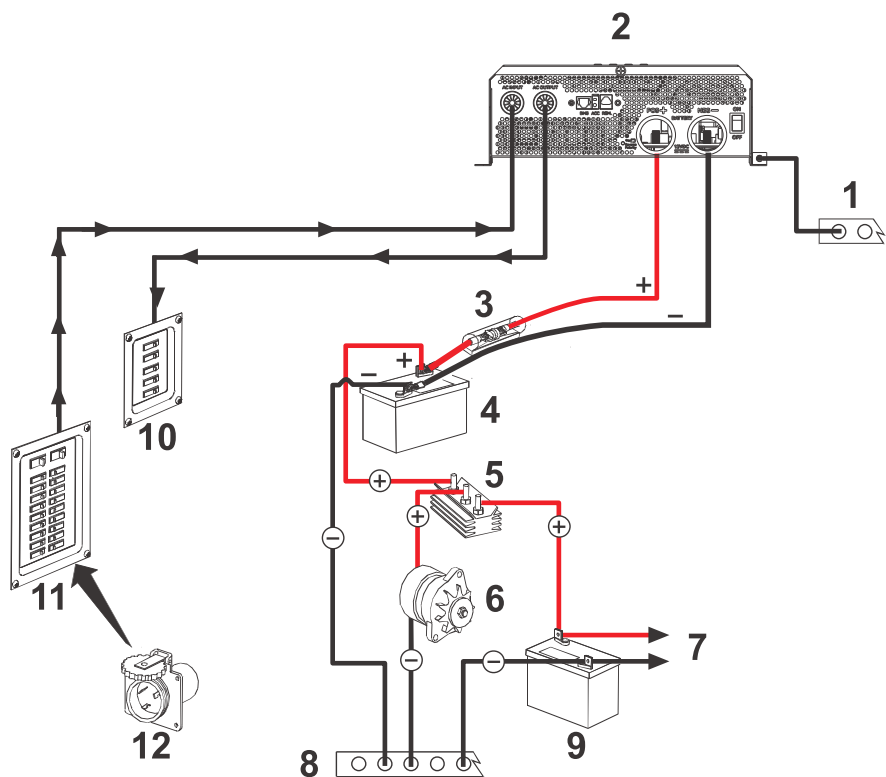


Figure 13 Typical marine installation

Drip Shield Installation

The drip shields help to protect the unit from dripping or splashing liquids, which will cause a shock hazard when moisture comes into contact with the electrical circuits. The drip shields are especially useful in marine installations, where water from condensation, rain, or sea may come into contact with the RICH SOLAR NOVA.

 WARNING

ELECTRIC SHOCK HAZARD

Place this unit in normally dry areas only. Operating it under wet conditions may expose you to a shock hazard. Installing drip shields may not entirely protect you from this hazard. Do not operate the unit when it is wet.

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

You may purchase the drip shield set by contacting customer support.

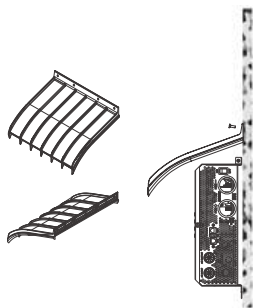


Figure 14 Drip shields

- To install the drip shields:
1. Gather the four screws needed to fasten a single drip shield to a wall.
 2. Locate an appropriate setting for the drip shields above the RICH SOLAR NOVA, making sure you cover the entire width of the unit.
You can overlay the shields as shown in Figure 15.
 3. Fasten the screws through the holes in the drip shield into the wall. See Figure 14.

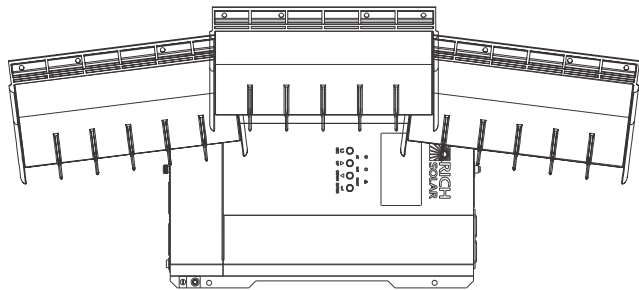


Figure 15 Typical drip shield placement on a RICH SOLAR NOVA

Operation

This section includes descriptions of the different modes and settings of the RICH SOLAR NOVA Inverter Charger.

5.1 RICH SOLAR NOVA Display Panel

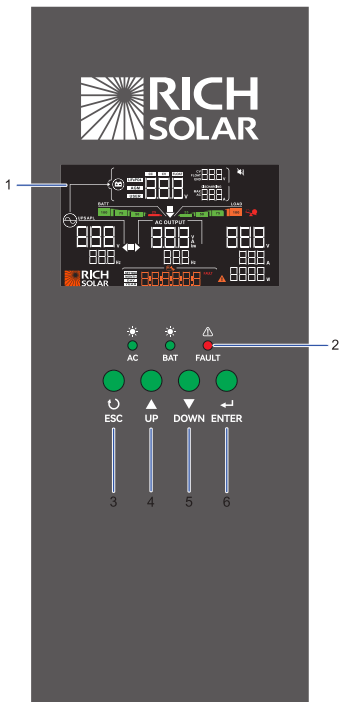
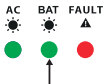
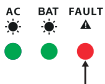
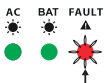


Figure 16 Display panel

1	LCD screen
2	Status LED indicators
3	 see “Function Buttons” on the facing page
4	 see “Function Buttons” on the facing page
5	 see “Function Buttons” on the facing page
6	 see “Function Buttons” on the facing page

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 Grid Mode in which shore power is available and passing through to the loads and charging the battery.
	Solid green. Indicates Battery Mode (Inverter Mode) in which the inverter charger 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 Motor Loads on page 69.
	Flashing red. Indicates a warning condition and is accompanied by an error code and a sounding alarm. For a list of error codes, see Motor Loads on page 69.

Function Buttons

Button	Definition
	Return to default screen or exit setting mode.
	To go to previous selection.
	To go to next selection.
	To enter the setting mode or to confirm the setting. Press and hold for three seconds to return to the previous step.

LCD Screen

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

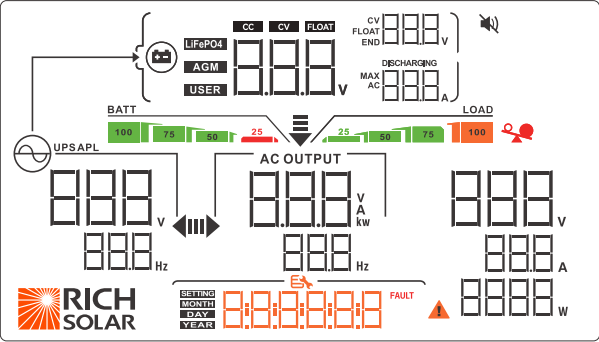
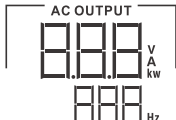
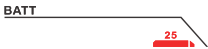
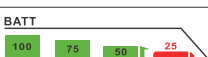
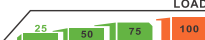
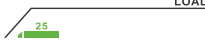
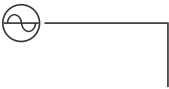


Figure 17 Parts of the LCD screen

LCD Screen Icons

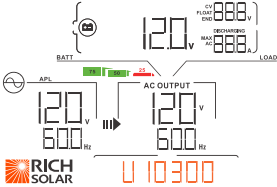
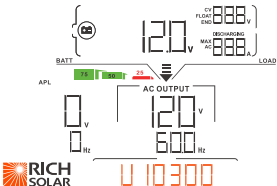
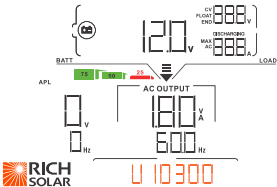
Icon	Definition	
Input Source Information		
	Indicates the AC input voltage and frequency.	
	Indicates the battery voltage.	
Configuration Program and Fault Information		
	Indicates the setting programs.	
	Indicates the warning and fault codes.	
	Warning:  flashing with warning code.	
	Fault:  lighting with fault code.	
Output Information		
	Indicate the output voltage, load in VA, load in Watt and output frequency.	
Battery Information		
	Indicates battery level by 0~24%, 25~49%, 50~74% and 75~100% in Battery Mode and charging status in line mode.	
In Battery Mode, it will present battery capacity. Battery type: Li-ion (LiFePO ₄) /USER		
Battery type	Battery voltage V/cell	LCD Display
Li-ion (LiFePO ₄) /USER	<12.8	
	12.8~13.1	
	13.1~13.3	
	>13.3	

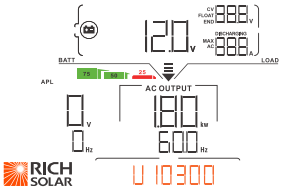
Icon	Definition	
Battery type: AGM		
Load Percentage	Battery voltage V/cell	LCD Display
Load>50%	<10.8	
	10.8~11.2	
	11.2~11.5	
	>11.5	
50%>Load >20%	<11.4	
	11.4~11.8	
	11.8~12.1	
	>12.1	
Load<20%	<11.8	
	11.8~12.2	
	12.2~12.5	
	>12.5	
Load Information		
	Indicates overload	
	Indicates the load level by 0~24%, 25~49%, 50~74% and 75~100%.	
	0%~24%	25%~49%
		
	50%~74%	75%~100%
		

Icon	Definition
Mode Operation Information	
	Indicates unit connects to the mains.
Mute Operation	
	Indicates unit alarm is disabled.

LCD Display

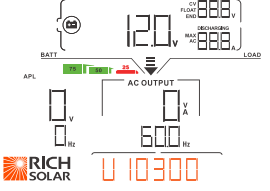
The LCD display information will be switched in turn by pressing the ▲ or ▼ button. The selectable information is switched as the following table in order.

Content	Definition
Utility voltage, Utility frequency, Battery voltage.	Input Voltage=120V, Input frequency=60Hz, Battery voltage=12.0V 
Information	Definition
Output voltage, Output frequency, Load in VA, Load in Watt, Switch every 10 second.	Output voltage=120V, Output frequency=60Hz 
	Load in VA=1.8kVA, Output frequency=60Hz 

Information	Definition
Output voltage, Output frequency, Load in VA, Load in Watt, Switch every 10 second.	Load in Watt=1.8kW, Output frequency=60Hz 

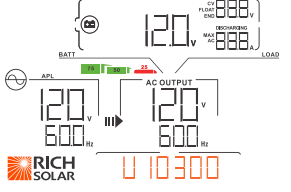
5.2 Viewing Information During Battery Mode

The unit will provide output power from battery.

Information	LCD Screen
Power from battery only	

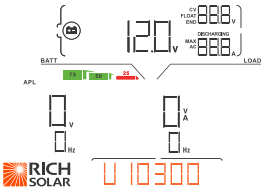
5.3 Viewing Information During Grid Mode

The unit will provide output power from the mains.

Information	LCD Screen
Power from mains only	

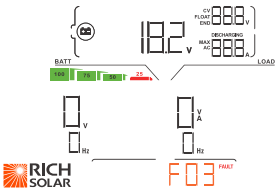
5.4 Viewing Information During Standby Mode

The inverter is not turned on yet.

Information	LCD Screen
No output is supplied by the unit	

5.5 Viewing Information During Fault Mode

Errors are caused by inside circuit issues or external reasons such as over-temperature, output short circuits, and so on.

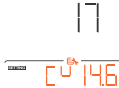
Information	LCD Screen
No output is supplied by the unit	

5.6 LCD Setting

After pressing and holding ENTER button for 3 seconds, the unit will enter setting mode. Press “UP” or “DOWN” button to select setting programs. And then, press “ENTER” button to confirm the selection or ESC button to exit.

Code	Content	Icon	
00	Exit setting mode	Escape	
01	Inverter ignition control	Off (default)	On
			

Code	Content		Icon		
03	AC input voltage range		Appliances (default) 03 EA APL If selected, transfer requirements <20ms		
			UPS 03 EA UPS If selected, transfer requirements <10ms		
04	Battery type		Li-ion (default) 04 EA LiB	AGM 04 EA AGM	
			USER 04 EA USE	If "User-Defined" is selected, low DC cut-off voltage and low DC Recovery voltage can be set up in program 15 and 16	
05	Auto restart when overload occurs		Restart disable 05 EA Lfd	Restart enable (default) 05 EA LfE	
06	Auto restart when over-temperature occurs		Restart disable 06 EA Lfd	Restart enable (default) 06 EA LfE	
07	Output frequency		50Hz 07 EA 50	60Hz (default) 07 EA 60	
08	Output Voltage		108VAC 08 EA 108	110VAC 08 EA 110	120VAC (default) 08 EA 120
09	Charger Current	NOVA SUPERCHARGER 2K	80A (default) 09 EA 80	Range if from 5A to 80A. Increment of each click is 5A	
		NOVA SUPERCHARGER 3K	150A (default) 09 EA 150	Range if from 5A to 150A. Increment of each click is 5A	

Code	Content	Icon	
13	Buzzer alarm	Alarm On 	Alarm Off (default) 
14	Backlight of LCD	Backlight On (default) 	Backlight Off 
15	Low DC Cut-off Voltage for USER battery	11.9V (default)  Range if from 10.5V to 12.8V. Increment of each click is 0.1V	
16	Low DC Recovery Voltage for USER battery	13.1V (default)  Range if from 12.0V to 16.0V/Off. Increment of each click is 0.1V	
17	Bulk Charging Voltage for USER battery	14.6V (default)  Range if from 12.0V to 15.3V. Increment of each click is 0.1V	
18	Floating Charging Voltage for USER battery	13.6V (default)  Range if from 12.0V to 15.3V. Increment of each click is 0.1V	
21	Load Search Mode	Normal (default) 	Enable 

5.7 Fault Code

Code	Fault Event	Icon
01	Fan is locked when inverter is off.	F01
02	Over-temperature.	F02
03	Battery voltage is too high.	F03
05	Output short circuited.	F05
06	Output voltage is too high.	F06
07	Overload time out.	F07
08	Bus voltage is too high.	F08
09	Bus soft start failed.	F09
10	NTC is no connected.	F10
51	Over-current.	F51
52	Bus voltage is too low.	F52
53	Inverter soft start failed.	F53
55	Over DC voltage in AC output.	F55
57	Current sensor failed.	F57
58	Output voltage is too low.	F58

5.8 Warning Indicator

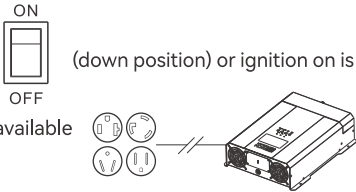
Code	Warning Event	Audible Alarm	Icon
01	Fan is locked when inverter is on.	Beep three times every second	01 
02	Over-temperature.	None	02 
04	Low battery.	Beep once every second	04 

Code	Warning Event	Audible Alarm	Icon
07	Overload.	Beep once every 0.5 second	
BP	Battery is no connected.	None	

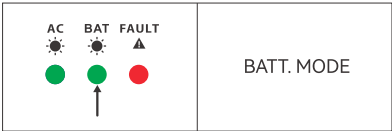
5.9 Operating in Battery Mode

The RICH SOLAR NOVA is in Battery Mode (also called Inverter Mode) when all the following conditions exist:

- inverter Power button is ON (down position) or ignition 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 RICH SOLAR NOVA is using the battery to power the equipment and appliances.



Turning Inverter Operation ON and OFF

There are two ways to operate the RICH SOLAR NOVA Inverter Charger function.

1. Press the Power button to a down position.
2. When the Inverter Charger's Ignition Control feature is set to on (ON^a), a+ 12VDC signal is present on the ACC input^b.

a. See LCD Setting in Configuration Mode on page 51.
b. When the vehicle's ignition switch is on or its engine is running.



WARNING

ELECTRIC SHOCK HAZARD

Turning the Power button to Standby mode does not disconnect DC battery power from the RICH SOLAR NOVA. 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 mode when not using the unit.

LOAD Search Mode

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

NOTE: Certain types of loads can cause load search mode to work unexpectedly. These types of loads are described in Problem Loads on page 69.

Checking Battery Status

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

Checking Output Power

When the inverter charger is in operation (in Battery Mode), you can check how much power (displayed in kW) the RICH SOLAR NOVA is supplying to the connected loads by observing the load capacity indicator on the LCD screen. The battery discharge amperage appears on the right side of the LCD screen.

Operating Several Loads at Once

If you are going to operate several loads from the RICH SOLAR NOVA, turn them on one at a time after you have turned the inverter charger on.

Turning loads on separately helps to ensure that the inverter charger 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 RICH SOLAR NOVA's audible alarm can be muted.

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 57.

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

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

To manually reset the alarm:

- 1. Press the Power button to turn it off (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 on, toggle the ignition signal to clear the alarm and error.
- 3. Toggle the AC input power to force the transition between Grid Mode and Battery Mode. This action clears the alarm and error.

5.10 Operating in Grid Mode

Battery Charger Functions

When AC power is available, the RICH SOLAR NOVA can operate as a 12V battery charger. Different battery types and chemistries require different charging voltage levels. Not charging batteries at the required levels can shorten battery life or damage the batteries. The RICH SOLAR NOVA is configured at the factory to work with the battery types recommended for inverter applications. If the default settings do not work for your specific installation, you can adjust the charge stage settings (as recommended by the battery manufacturer) on the User Battery Settings menu (see on page 60).

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

Battery Types

The RICH SOLAR NOVA Inverter Charger charges AGM (Absorbed Glass Mat), User, and lithium iron phosphate (Li-ion) batteries.

- AGM (Absorbed Glass Mat) batteries are similar to Gel batteries except that the electrolyte is absorbed into a fiberglass matting.
- User battery is configured by the dealer, factory, or service center for battery types other than those listed above.
- Lithium iron phosphate (Li-ion) must only be selected with a lithium iron phosphate battery module with a certified/listed Battery Management System (BMS).

NOTICE

BATTERY DAMAGE

Do not mix battery types. The RICH SOLAR NOVA can only select one battery type setting for all batteries connected to its bank. All connected batteries should either be: AGM or User or Li-ion.
Failure to follow these instructions can result in equipment damage.

3-Stage Charging Algorithm

The RICH SOLAR NOVA will charge batteries in a sequence known as three-stage charging. Whenever qualified AC power is present at the inverter/charger's input, it passes power through to the connected load and begins charging the batteries. The charging voltage delivered to the battery depends on the battery's:

- Type setting
- Temperature (by switch setting)
- State of charge

The three automatic stages are:

- Bulk
- Absorption
- Float

See 3-Stage Charging Algorithm for a graph of the three-stage charging profile.

The charging cycle is a multistage (three-stage) process. Whenever qualified AC power is present at the inverter/charger's input, it passes power through to the connected load and begins charging the batteries.

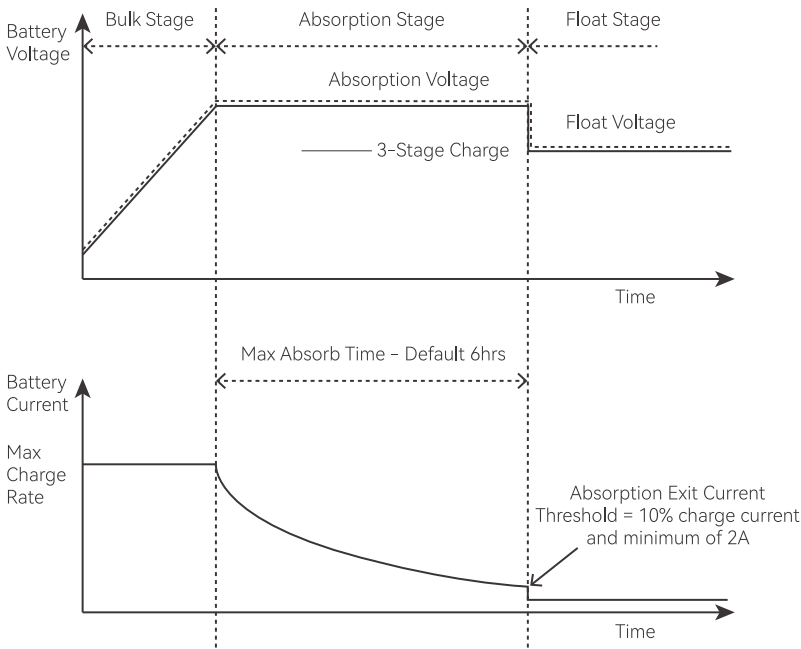


Figure 18 Three-stage battery charging cycle

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

Bulk Stage

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

Absorption Stage

During the absorption stage, the RICH SOLAR NOVA begins operating in constant voltage mode and the current falls gradually as the amp hours are returned to the battery.

Table 11 Preset Absorption Voltage Settings

Battery Type	Preset Absorption Voltage
Li-ion	14.4V
AGM	14.0V
User	14.6V (default), changeable between 12.0 to 15.3V

The RICH SOLAR NOVA transitions to the float stage if either one of the following two conditions are met:

The charge current allowed by the batteries falls below the exit current threshold, which is equal to 10% of the programmed charge current and a minimum of 2A.

The RICH SOLAR NOVA has been in absorption for the programmed maximum absorption time limit. The default is 6h.

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

Float Stage

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

Table 12 Preset Float Voltage Settings

Battery Type	Preset Absorption Voltage
Li-ion	13.6V
AGM	13.4V
User	13.6V (default), changeable between 12.0 to 15.3V

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

User Battery Settings Menu

NOTICE

REVERSE POLARITY

To avoid damaging your batteries during charging, consult your battery manufacturer and associated documentation before setting a User battery type.

Failure to follow these instructions can result in equipment damage.

User battery type can be selected by the setting number 04 (see User Battery Settings Menu on page 60). After the user battery is selected, you can then adjust the value of user absorption (setting number 17) and user float (setting number 18) accordingly.

5.11 Operating During Transition Between Grid Mode and Battery Mode

The RICH SOLAR NOVA 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 RICH SOLAR NOVA automatically detects when shore power is present and when it becomes unavailable or drops to less than 106 volts AC.

The transfer time can be set to two settings.

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 Grid Mode to Battery Mode

When the unit is operating in Grid Mode and shore power is lost, the RICH SOLAR NOVA has less than 20 milliseconds (default) to switch to Battery Mode (if the Power button is 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 mode, this transition does not happen and the display panel turns off.

Transitioning from Battery Mode to Grid Mode

When the unit is operating in Battery Mode and shore power available, the RICH SOLAR NOVA will switch to shore power mode within 20 milliseconds and start drawing power from the AC source.

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

5.12 Operating Limits

These are the operating limits of the RICH SOLAR NOVA

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

Power Output

The RICH SOLAR NOVA can deliver up to:

- 2000 watts NOVA SUPERCHARGER 2K
- 3000 watts NOVA SUPERCHARGER 3K

of continuous utility grade sine wave AC power. The wattage rating applies to resistive loads such as incandescent lights.

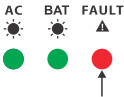
Input Voltage

The allowable RICH SOLAR NOVA input battery voltage ranges are shown in the following table:

Table 13 Input Battery Voltage Range

Operating Condition	Battery Voltage	Comment
Full Operating Range	LBCO~18.0 volts	Assuming the battery is fully charged, the inverter charger will operate until battery voltage drops below LBCO ^a threshold and LBCO Shutdown delay timer expires ^b .
Low Voltage Recovery	>LBCO Recovery	Inverter is able to recover and continue to operate.

a. To set LBCO, see LCD Setting in Configuration Mode on page 51.
b. To set LBCO Shutdown Delay Timer, see Input Voltage on page 62.

Operating Condition	Battery Voltage	Comment
Low Voltage Shutdown	<LBCO	The buzzer sounds a single one-second low battery alarm beep, and the LCD screen shows warning code 04. After LBCO Shutdown delay timer runs out, the unit shuts down inverter output. The buzzer stops beeping, and the LCD screen shows warning code 04.
Instant Low Voltage Shutdown	<9.8 volts	After two seconds below the limit, the unit completely shuts down inverter output, and the LCD screen turns off.
High Voltage Shutdown	18.0 volts	The display shows error code F03 alternating with the battery voltage. The red status LED turns on.  NOTE: Although the RICH SOLAR NOVA incorporates over-voltage protection, it can still be damaged if input voltage exceeds 18.0 (or 32.0) volts.

Overload Conditions

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

Overload Warning

When the RICH SOLAR NOVA AC load is approximately 100W below the overload shutdown limit of rated watts, the audible alarm beeps once and the LCD screen shows an warning code 07.

Overload Shutdown

When the RICH SOLAR NOVA AC load increases to near NOVA SUPERCHARGER 2K and NOVA SUPERCHARGER 3K, the audible alarm beeps all the time and the LCD screen shows an error code F07. 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 RICH SOLAR NOVA may not be able to start some of these motors even though their rated steady state current draw is within the inverter charger's limits. The unit will shutdown and indicate an overload shutdown.

Over-temperature Conditions

During inverter operation, when the RICH SOLAR NOVA internal temperature starts to approach its preset shutdown limit, the display will show error code F02. If the over-temperature condition persists, the display will show error code F02. The status LED turns solid RED and the inverter charger will shut down to prevent damage and protect the battery from being over-discharged.

Routine Maintenance

Regular maintenance is required to keep your RICH SOLAR NOVA operating properly.

6.1 Maintaining the RICH SOLAR NOVA Unit



WARNING

ELECTRIC SHOCK HAZARD

Turning the Power button to Standby mode does not disconnect DC battery power from the RICH SOLAR NOVA. 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.

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 64.

7.1 Pre-service Checklist



WARNING

ELECTRIC SHOCK HAZARD

Do not disassemble the RICH SOLAR NOVA. 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 01. 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 when the problem occurred, so you can provide details when contacting customer service for help. Include the following information:
 - What loads the RICH SOLAR NOVA 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 RICH SOLAR NOVA is not displaying an error code, check the following to make sure the present state of the installation allows proper operation:
- Is the inverter charger located in a clean, dry, adequately ventilated place?
 - Are the battery cables adequately sized as recommended in the installation guide?
 - Is the battery in good condition?
 - Are all DC connections tight?
 - Are the AC input and output connections and wiring in good condition?
 - Are the configuration settings correct for your particular installation?
 - Are all disconnects and AC breakers closed and operable?
 - Have any of the fuses blown in the installation?
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.

7.2 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 56 to change the alarm settings.

The error codes are listed in Table 14. The text in the **Error Code** column appears on the LCD screen of the display panel.

Table 14 Error Codes Displayed on the LCD Screen

Error Code	Condition	Mode	Action
F01	Fan lock error	Grid Mode (bypass)	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 Drip Shield Installation on page 44. If error detection persists, contact customer service.
F02	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.
F03	High battery voltage shutdown >18.0 volts DC (12VDC models)	All Mode	Check for external charging sources, such as a PV charger and an over-voltage alternator. Disconnect, if necessary.

Error Code	Condition	Mode	Action
F05	Output short circuited	Battery Mode (inverting)	Check for the AC output connection is reversed.
F06	Output voltage is too high	Battery Mode (inverting)	If error detection persists, contact customer service.
F07	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.
F08	Bus voltage is too high	Battery and Grid Modes	If error detection persists, contact customer service.
F09	Bus soft start failed	Battery and Grid Modes	If error detection persists, contact customer service.
F10	NTC is no connected	Battery and Grid Modes	If error detection persists, contact customer service.
F51	Over-current	Battery and Grid Modes	If error detection persists, contact customer service.
F52	Bus voltage is too low	Battery and Grid Modes	If error detection persists, contact customer service.
F53	Inverter soft start failed	Battery Mode (inverting)	If error detection persists, contact customer service.
F55	Over DC voltage in AC output	Battery Mode (inverting)	If error detection persists, contact customer service.
F57	Current sensor failed	Battery Mode (inverting)	If error detection persists, contact customer service.
F58	Output voltage is too low	Battery and Grid Modes	If error detection persists, contact customer service.

The unit will immediately stop inverting when error code occur.

7.3 Troubleshooting Reference

 WARNING
ELECTRICAL SHOCK HAZARD Do not disassemble the RICH SOLAR NOVA. 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 CHARGER DAMAGE Avoid continually overloading the inverter charger 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 charger.

Table 15 Troubleshooting Reference

Problem	Possible Cause	Solution
Alarm does not sound when an error is encountered.	Alarm is turned OFF.	Turning the Audible ON or OFF on page 56 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 charger has shut down with the LCD screen showing one of the following error codes:	
	Low input voltage (warning code 04)	Verify the unit is connected to a 12V battery. Check the DC connections and the cable. Recharge the battery.
	High input voltage (error code F03)	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 F07)	Reduce the load. Make sure the load does not exceed the output rating.
	Thermal shutdown (error code F02)	Allow the unit to cool off. Reduce the load if continuous operation is required. Improve ventilation. Make sure the inverter charger's ventilation openings are not blocked.

Problem	Possible Cause	Solution
No output voltage is shown on the LCD screen but the green status LED for Battery Mode is illuminated.	GFCI (when installed) has tripped or supplementary breaker has tripped.	Check load and reset the GFCI or supplementary breaker.
	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 RICH SOLAR NOVA Unit on page 64) to start inverting. LCD screen may show DC voltage as 000.	Check DC connections and cable. Recharge battery.
No output voltage is shown on the LCD screen and neither of the green status LEDs (for Grid Mode and Battery Mode) is illuminated.	AC shore power is not available or out of operating range and the inverter charger is OFF.	Check AC shore power. Turn the inverter charger ON.
	AC shore power is not available and the inverter charger is OFF due to a shutdown for more than 30 seconds.	Check AC shore power and battery voltage. Turn the inverter charger ON and look at the LCD screen for any error code. See "Error codes displayed on the LCD screen" on page 65.
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 RICH SOLAR NOVA unit is on (I).
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.

7.4 Inverter Applications

The RICH SOLAR NOVA 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 charger 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 to accomplish their tasks. Toasters, coffee pots, and incandescent lights are typical resistive loads. It is usually impractical to run larger resistive loads—such as electric stoves and water heaters—from an inverter due to their high current requirements. Even though the inverter charger can most likely accommodate the load, the size of battery bank required would be impractical if the load is to be run for long periods.

Motor Loads

Induction motors (that is, motors without brushes) require two to six times their running current at startup. The most demanding are those that start underload, for example, compressors and pumps. Of the capacitor start motors (typical in drill presses, band saws, etc.), the largest you can expect to run is 1/2hp (the transfer relays are rated at 2hp). Universal motors are generally easier to start. Since motor characteristics vary, only testing will determine whether a specific load can be started and how long it can be run. If a motor fails to start within a few seconds or loses power after running for a time, it should be turned off. When the inverter charger attempts to start a load that is greater than it can handle, it will turn itself off after a few seconds.

Long Transfer Times

The RICH SOLAR NOVA may take a time (~0.1–0.2 seconds) 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 issue, do not connect motor loads and sensitive equipment to the inverter charger for power.

Problem Loads

Very Small Loads

If the power consumed by a device is less than the 25-watt threshold of the load search mode circuitry, and load search mode is enabled, the RICH SOLAR NOVA will not run. Most likely the solution will be to disable load search mode.

Fluorescent Lights and Power Supplies

Some devices cannot be detected when load sensing. Small fluorescent lights are the most common example. Some computers and sophisticated electronics have power supplies that do not present a load until line voltage is available. When this occurs, each unit waits for the other to begin. To drive these loads, either a small companion load like a light bulb rated for more than 25W must be used to bring the RICH SOLAR NOVA out of load search mode, or the RICH SOLAR NOVA may be programmed to remain on by disabling load search mode.

Clocks

You may notice that your clocks are not accurate. Some of the clocks on your appliances may reset when the RICH SOLAR NOVA is in load search mode.

When the RICH SOLAR NOVA is in load search mode, it may fail to start some loads even though the rated wattage on the load is more than 25W. If these kinds of loads are in the system, follow the suggestions given to eliminate the problem.

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

- 1. Disable load search mode from Settings on page 51, causing the RICH SOLAR NOVA to always remain at full output voltage.
- 2. Use a search-friendly companion load whose only purpose is to be switched on to wake up the RICH SOLAR NOVA to power the load that is unable to bring the RICH SOLAR NOVA out of power save mode.

NOTES:

- Load search mode, by function, cannot work with clocks and timers or devices that need power 24 hours a day. Examples of devices with timers include cable TV boxes, coffee makers with brew timers, refrigerators, and freezers with defrost timers. Examples of devices that need power 24 hours a day include telephone answering machines, alarm systems, motion detection lights, and some thermostats.
- When the RICH SOLAR NOVA is load sensing the output for loads, lights that have a wattage lower than 25-watt threshold, may flash momentarily.

Specifications

This section summarizes the hardware and electrical specifications of the RICH SOLAR NOVA Inverter Charger.

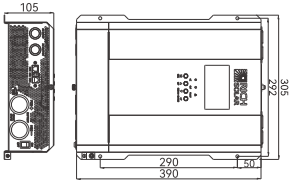
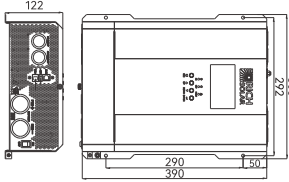
NOTE: Specifications are subject to change without prior notice.

8.1 Physical Specifications

Table 16 Physical Specifications

	NOVA SUPERCHARGER 2K	NOVA SUPERCHARGER 3K
L×W×H	15.4"×12.0"×4.1" (390mm×305mm×105mm)	15.4"×12.0"×4.8" (390mm×305mm×122mm)
	NOTE: Width include flanges	NOTE: Width include flanges
Net Weight	16.53lbs (7.5kg)	18.52lbs (8.4kg)

Table 17 Product Dimensions

	
NOVA SUPERCHARGER 2K	NOVA SUPERCHARGER 3K

8.2 Environmental Specifications

Table 18 Environmental Specifications

		NOVA SUPERCHARGER 2K	NOVA SUPERCHARGER 3K
Ambient Temperature	Operating Temperature Range ^a	-40-160°F (-40-70°C), with output derated above 122°F (50°C)	
	Storage Temperature Range	-40-160°F (-40-70°C)	
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 charging temperature range. Follow specific battery manufacturer recommendations for the applicable chemistry.

8.3 System Specifications

Table 19 System Specifications

		NOVA SUPERCHARGER 2K	NOVA SUPERCHARGER 3K
Transfer relay rating (A ^a)		30A	50A
Transfer time (milliseconds)	Shore to inverter	<20 milliseconds	<20 milliseconds
	Inverter to shore	<20 milliseconds with a 20-second delay	<20 milliseconds with a 20-second delay
Transfer voltage (V)	Shore to inverter	<90V and >140V	<90V and >140V
	Inverter to shore	<140V and >90V	<140V and >90V
Cooling		Fan, activated by any of the following: High internal temperature High AC output power	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 rating continuously.

Table 20 DC Input for Inverting

	NOVA SUPERCHARGER 2K	NOVA SUPERCHARGER 3K
Operating voltage range	LBCO voltage~18.0VDC	LBCO voltage~18.0VDC
Nominal voltage	12.0VDC (12VDC models)	12.0VDC
Nominal current at full load	192ADC (12VDC models)	288ADC

a. To set LBCO, see LCD Setting in Configuration Mode on page 51.

Table 21 AC Output for Inverting

	NOVA SUPERCHARGER 2K	NOVA SUPERCHARGER 3K
Output voltage options	120, 110, 108VAC	120, 110, 108VAC
Continuous power (W ^b)	2000W@122°F (50°C)	3000W@122°F (50°C)
Continuous current	16.7A	25A
Surge power (5 sec)	4000W	6000W
Frequency ^c	60 (or 50) Hz	60 (or 50) Hz
Wave shape	True Sine Wave	True Sine Wave
Peak efficiency	91% (12VDC models)	91%
Full load efficiency	>87.5% (12VDC models)	>85%

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

c. To set the AC Frequency, see LCD Setting on page 51.

Table 22 AC Input for Charging

	NOVA SUPERCHARGER 2K	NOVA SUPERCHARGER 3K
Operating voltage range	100-130VAC	100-130VAC
Safe non-operating voltage range	UP TO 240VAC	UP TO 240VAC
Full load current (RMS)	11A	24A
Nominal frequency	60 (or 50) Hz	60 (or 50) Hz
Power factor at full charge	> 98%	> 98%

Table 23 DC Output for Charging

	NOVA SUPERCHARGER 2K	NOVA SUPERCHARGER 3K
Nominal voltage	12.0VDC	12.0VDC
Min battery voltage for charging	0.0VDC	0.0VDC
Max output voltage	18.0VDC (custom battery type)	18.0VDC (custom battery type)
Nominal output current	User selectable: 5 to 80A ^e	User selectable: 5 to 150A ^f
Charger current derating	May reduce charger current depending on ambient temperature	May reduce charger current depending on ambient temperature
Efficiency at nominal output	>89%	>89%

d. Charger current is rated to 14.4VDC output only. The charger derates if a high DC output voltage is selected.

e. Charger current is rated to 14.4VDC output only. The charger derates if a high DC output voltage is selected.

f. Charger current is rated to 14.4VDC output only. The charger derates if a high DC output voltage is selected.

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