RICH SOLAR

NOVA™ Series

PURE SINE WAVE INVERTER

BUILT-IN TRANSFER SWITCH

USER MANUAL

NOVA 1K12 (RS-V1P12TS 1200W 120VAC 12VDC)

NOVA 2K12 (RS-V2P12TS 2000W 120VAC 12VDC)

NOVA 3K12 (RS-V3P12TS 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 1K12 (RS-V1P12TS 1200W 120VAC 12VDC)
NOVA 2K12 (RS-V2P12TS 2000W 120VAC 12VDC)
NOVA 3K12 (RS-V3P12TS 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 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. 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	Amps
AC	Alternating Current
ACC	Accessory in vehicle ignition system
AGM	Absorbed Glass Mat (a battery type)
DC	Direct Current
in-lb	inch-pound force (a unit of torque)
kW	Kilowatts (1000 watts)
LBCO	Low Battery Cutout (or Cutoff)
LCD	Liquid Crystal Display
LED	Light Emitting Diode
Li-ion	$LiFePO_4$ (lithium iron phosphate-a battery type)
N-m	Newton-meters (a unit of torque)
PN	Product Number
PPE	Personal Protective Equipment
PV	Photovoltaic (Solar)
V	Volts
VAC	Volts AC
VDC	Volts DC
W	Watts

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 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, read all instructions and cautionary markings on the unit, the batteries, and all appropriate sections of this guide.

2. Use of accessories not recommended or sold by the manufacturer may result in a risk of fire, electric shock, or injury to persons.

3. The inverter is designed to be connected to both DC and AC electrical systems. The manufacturer recommends that all wiring be done by a certified technician or electrician to ensure adherence to the local and national electrical codes applicable in your jurisdiction.

4. To avoid a risk of fire and electric shock, make sure that the existing wiring is in good condition and that the wire is not undersized. Do not operate the inverter with damaged or substandard wiring.

5. Do not operate the inverter if it has been damaged in any way.

6. This unit does not have any user-serviceable parts. Do not disassemble the inverter except where noted for connecting wiring and cabling. See your warranty for instructions on obtaining service. Attempting to service the unit yourself may result in a risk of electrical shock or fire. Internal capacitors remain charged even after all power is disconnected.

7. To reduce the risk of electrical shock, disconnect both AC and DC power from the inverter before attempting any maintenance, cleaning, or work on any components connected to the inverter. Do not disconnect under load. Turning the inverter to Standby mode using the Power button on the front panel will not reduce an electrical shock hazard.

8. The inverter must be provided with an equipment-grounding conductor connected to the AC input ground.

9. Do not expose this unit to rain, snow, or liquids of any type. This product is designed for dry-locations-use only. Damp environments will significantly shorten 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. This unit is an inverter only and is not intended for charging batteries.

13. 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 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

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 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.

⚠ 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.

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 is designed for marine applications only when additional drip protection is installed in certain orientations. See “Approved Mounting Orientations” in the Installation 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 other source of power. Damage to unit may occur.
• For AC IN and AC OUT, use wires suitable for at least 167°F.

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 products and the engine.
• RICH SOLAR NOVA Inverter products are designed for deep-cycle lead-acid batteries. See warning below when connecting to lithium ion batteries.
• Do not use transformerless battery chargers in conjunction with the inverter 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 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.

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

NOTES:

1. Mount and place the RICH SOLAR NOVA Inverter 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, short circuit, or 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 Inverter

WARNING

FIRE HAZARD

• Do not install the inverter or any part of its supplied wiring in engine compartments.

• For marine installation, always locate the inverter 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 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.

• Do not place a battery on top of the inverter.

Failure to follow these instructions can result in equipment damage.

1.4 Regulatory

The RICH SOLAR NOVA Inverter is certified to appropriate US and Canadian standards.

The RICH SOLAR NOVA Inverter is suitable for mobile and commercial applications. Only for marine use with additional drip protection in certain orientations. See the Specifications section for details.

1.5 End of Life Disposal

The RICH SOLAR NOVA Inverter 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 is designed with integrated inverting 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)

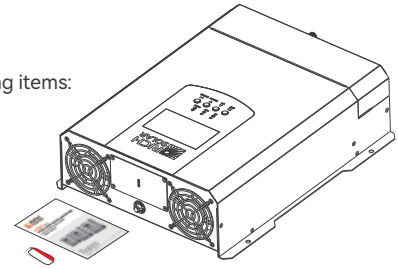


Figure 1 What's In The Box

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 provides up to 1200 watts (NOVA 1K12 120VAC 12VDC), 2000 watts (NOVA 2K12 120VAC 12VDC) or 3000 watts (NOVA 3K12 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 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 (12VDC models).

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 62 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 62 for precautions.

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 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.

Features

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

3.1 Default Settings

Table 1 lists the default settings for the RICH SOLAR NOVA system.
You may record your settings in the right-hand column after you have configured the RICH SOLAR NOVA.

Table 1 Default Values

Program	Item	Default Setting	Setting
01	Inverter ignition control	Off	OFF
03	AC input voltage range	UPS	UPS
04	Battery type	Li-ion	L Ib
05	Auto restart when overload occurs	Enable	LrE
06	Auto restart when over-temperature occurs	Enable	trE
07	Output frequency	60	60
08	Output Voltage	120	120
13	Buzzer alarm	Off	bOF
14	Backlight of LCD	On	LON
15	Low DC Cut-off Voltage	11.9	CDV 11.9
16	Low DC Recovery Voltage	13.1	rCV 13.1
21	Load Search Mode	Disable	PdS

3.2 AC/DC and GFCI Panel

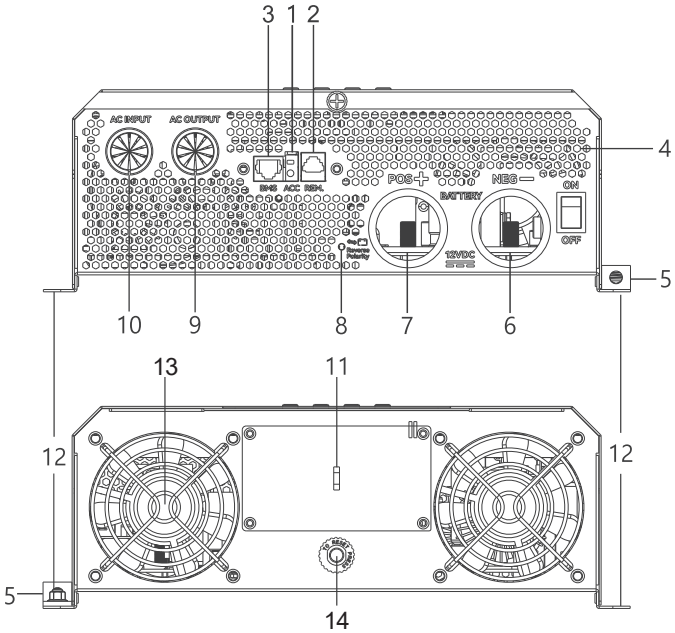


Figure 2 AC/DC and GFCI Panel

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Use a torque screwdriver to tighten the wiring cover screw to 5in-lb torque of force to ensure a proper ground connection and a required tool access to the wiring compartment.

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

Table 2 AC/DC and GFCI Panel Features

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

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

• Apply an anti-corrosion compound to the copper wire prior to connecting to the DC ground lug.

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

3.3 Display Panel

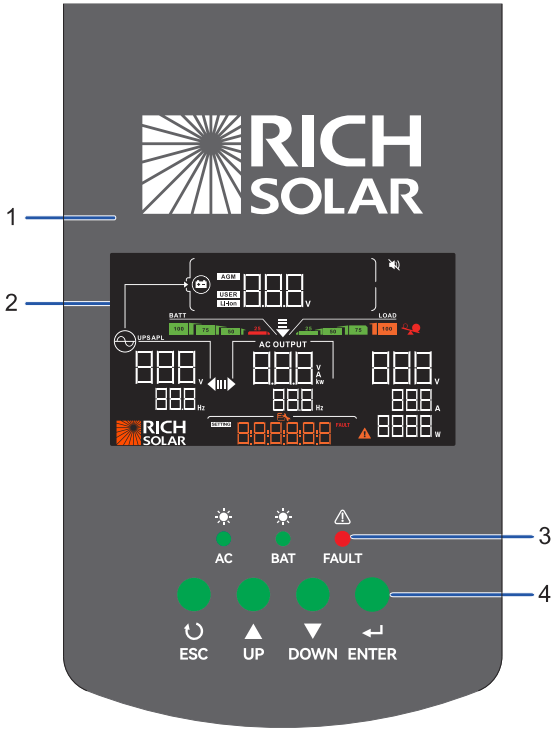


Figure 3 Display Panel

Table 3 Display Panel Features

Feature	Description
1	Display panel displays status information on the screen. It is comprised of a display screen, LEDs, select and Power 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 and inverter settings.
IMPORTANT: See RICH SOLAR NOVA Display Panel on page 45 for detailed information on the panel's buttons.	

3.4 Side Panel

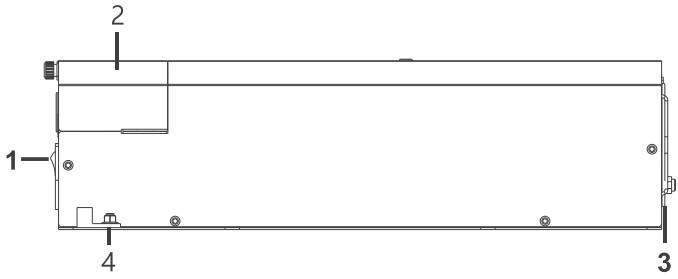


Figure 4 Side Panel

WARNING

ELECTRICAL SHOCK HAZARD

• Use a torque screwdriver to tighten the wiring cover screw to 5in-lb 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) of force.

• Apply an anti-corrosion compound to the copper wire prior to connecting to the DC ground lug.

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

Table 4 Side Panel Features

Feature	Description
1	Switch.
2	Wiring compartment cover protects the wiring compartment from debris and keeps the cables secure. Using the captive nut panel screw, the cover can be opened and lifted out during wiring. See WARNING on the above.
3	GFCI Kit option.
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 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.

• To prevent risk of fire, do not cover or obstruct ventilation openings. Do not mount in a zero-clearance compartment. Overheating may occur.

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
• 3mm slot long neck screwdriver for spring clamp AC terminals
• 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
3	DC fuse/disconnect/DC circuit breaker
4	12V deep-cycle battery
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

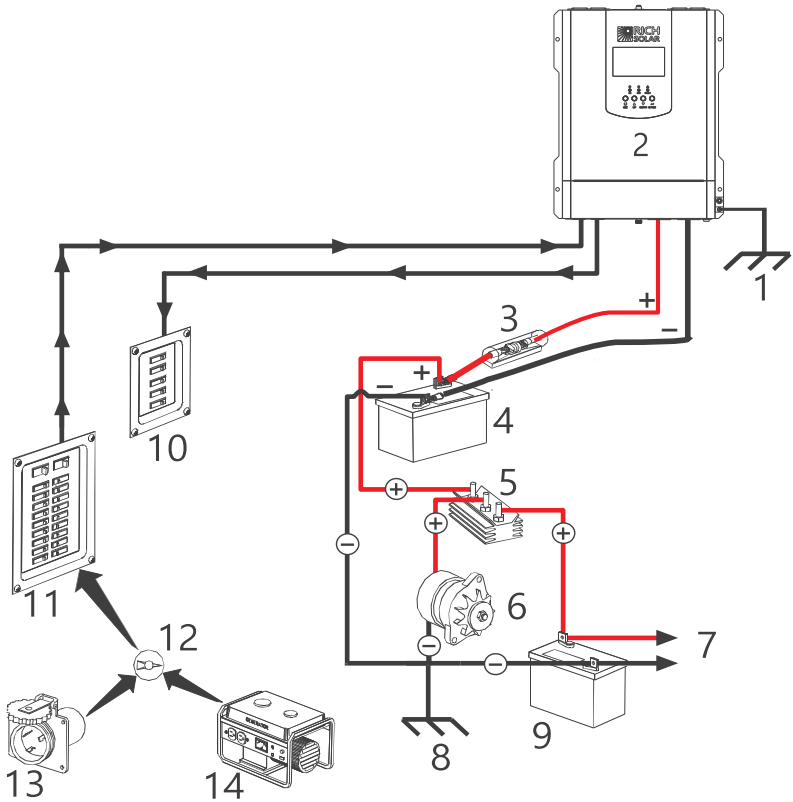


Figure 5 Typical Recreational Vehicle and Fleet Vehicle Installation

AC Shore Power

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

The AC source feeding the RICH SOLAR NOVA must have the neutral conductor bonded to ground. When the inverter passes shore power through, it will lift its internal bonding relay on the output and will rely on the input being bonded in order to ensure that the power delivered to a sub panel is properly bonded.

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

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.

NOTICE

RISK OF INVERTER DAMAGE

Do not connect the RICH SOLAR NOVA to a 120V, 3-pole, 4-wire circuit.

Failure to follow these instructions can result in equipment damage.

AC Cabling

AC cabling includes all the wires and connectors between the AC source and the RICH SOLAR NOVA as well as all 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 5 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 167°F, and assuming an ambient temperature of up to 86°F. 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 5 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

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 local codes and ordinances.

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 copper and rated 167°F minimum.**

The cables should be terminated with lugs that fit the DC stud terminals snugly (5/16" hole size).

Table 6 Required Cable Sizes

Inverter	Cable Length: Battery to Inverter (one way)	Minimum Cable Size	Maximum Battery Fuse Size
NOVA 1K12	Less than 5 feet (1.5 meters)	No. 2 AWG	150ADC
NOVA 2K12		No.2/0 AWG	250ADC
NOVA 3K12		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 US National Electrical Code Table 310.17 - 167 °F cables, assuming an ambient temperature of 86°F 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 350A (in 12VDC models). 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 typically, RICH SOLAR NOVA system is recommended to have a deep-cycle battery 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.

Ground Fault Circuit Interrupters (GFCIs)

A GFCI is a device that de-energizes a circuit when a ground fault current exceeds a specified value, which is lower than the current required to trip 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 RICH SOLAR NOVA GFCI Kit option is available to use with the RICH SOLAR NOVA Inverter unit.

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 150°F (-40℃ and 65℃)—the cooler, the better.

Ventilated. Allow at least 5inches of clearance at the fan end for air flow, 1inch on each side, and 2inches 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)

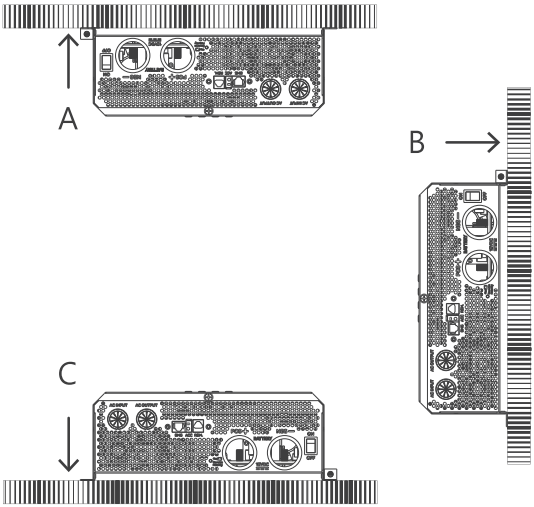


Figure 6 Approved Mounting Orientations

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

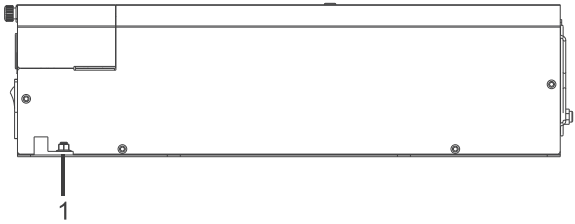
WARNING

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's chassis to the ground.



1	DC grounding lug

Figure 7 DC Panel Connections

Grounding Locations

You must connect the equipment 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) of force. Apply an anti-corrosion compound to the copper wire prior to connecting to the DC ground lug.

For recommended equipment ground cable size, see below.

Table 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 more than one AWG size smaller 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

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, 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 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 wiring, at an ambient temperature of 86°F. Other codes and regulations may be applicable to your installation.

Table 8 Required AC wire size vs. required breaker rating

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

The AC input terminal is located inside the unit through the front panel's 1/2" trade-size hole and is labeled properly as **AC IN** or **AC INPUT**. The unit comes with spring clamp-type terminals where individual wires can be attached securely.

NOTICE

EQUIPMENT DAMAGE
Make sure the wires are connected properly. The AC wiring terminal blocks are split into input and output sections.
Failure to follow these instructions can result in equipment damage.

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 (Earth)

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. Damage caused by a reverse polarity connection is not covered by your warranty.
Failure to follow these instructions can result in equipment damage.

NOTICE

EQUIPMENT DAMAGE

Install the supplied AC knockout plugs over the knockout holes when not used for wiring, to prevent objects and other materials from entering the unit.

Failure to follow these instructions can result in equipment damage.

AC Input Connections

To make a permanent connection to existing AC wiring:

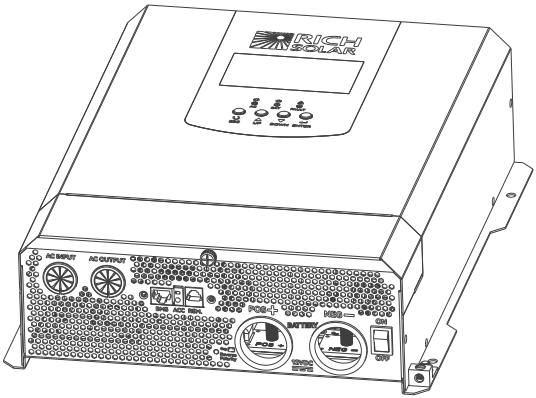
1. Ensure AC and DC power sources are turned off.
2. Install the required circuit breaker in the AC distribution panel supplying AC power to the unit.
3. Remove the wiring compartment cover by loosening the captive nut panel screw [1] and lifting the cover up and out. Maximum torque for wiring cover screw is 0.7 N·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	Wiring cover 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. Remove the wire cover and install a 1/2" strain relief clamp.
6. Route the wires through the strain relief clamp (not shown in the figure).

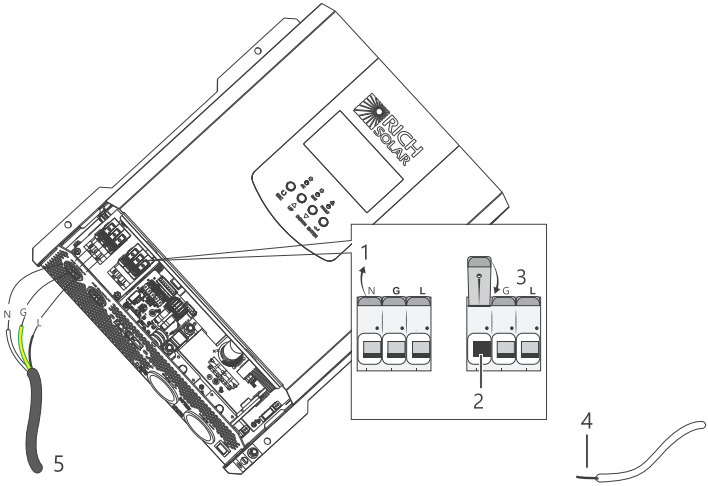


Figure 9 Routing the wires

1	Step 8a
2	Step 8b
3	Step 8c
4	10mm
5	to circuit breaker
NOTE: AC input hole-install a strain relief clamp (not shown).	

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

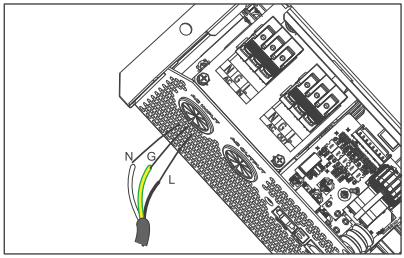
8. Connect each AC wire into its corresponding terminal on the no-tool cage clamp terminal block.

a. Lift the terminal lever (as shown in the previous figure).

b. Insert the wire fully into the open slot.

c. Lower the terminal lever to secure the wire in the slot.

9. Make sure that each AC wire is matched and connected to the Neutral (**N**), Ground (**G**), and Line (**L**) connections.



10. Tighten the strain relief clamp to secure the wires.
11. Replace the wiring compartment cover onto the unit (using a #2 Phillips torque screwdriver-see WARNING), if you are not connecting other wires such as for the AC Output. Otherwise, keep the AC compartment open and proceed to the next step.

WARNING

ELECTRICAL SHOCK HAZARD
Use a torque screwdriver to tighten the wiring cover screw to 5in-lb 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.

12. 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.
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 another source, and potentially hazardous or damaging conditions may occur. These conditions can occur even if the inverter is off.
Failure to follow these instructions can result in equipment damage.

Do not connect the unit to an AC branch circuit that has high-power consumption loads.
The unit will not operate electric heaters, air conditioners, stoves, and other electrical appliances that consume more than its rated watts.
A manufacturer- tested and approved GFCI must be connected to its 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. See Ground Fault Circuit Interrupters (GFCIs) on page 24.

AC Output Connections

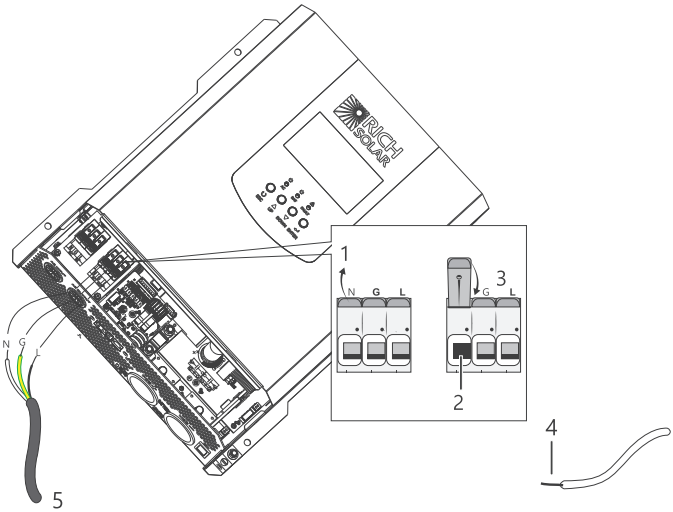


Figure 10 Routing the wires

1	Step 7a
2	Step 7b
3	Step 7c
4	10mm
5	to circuit breaker
NOTE: AC output hole-install a strain relief clamp (not shown).	

To make a permanent connection to existing AC wiring:

1. Ensure AC and DC power sources are turned off, if not already done from AC Output Connections on page 33.
2. Install the required circuit breaker in the inverter distribution panel receiving AC power.
3. Remove the wiring compartment cover, if not already done from AC Output Connections on page 33.

WARNING

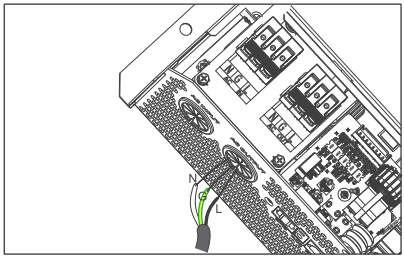
ELECTRIC SHOCK AND FIRE HAZARDS

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. Remove the wire cover and 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 (and installing the GFCI).

⚠ WARNING

ELECTRIC SHOCK AND FIRE HAZARDS

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

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

11. Connect the other end of the wires to a circuit breaker in the Inverter distribution panel.

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 copper wire rated 167°F minimum. Make sure all DC connections are tight to a torque of 3-4Nm of force.

Loose connections will overheat.

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

Follow the procedure given below to connect the battery leads to the terminals on the DC end. The cables should be as short as possible and large enough to handle the required current, in accordance with the electrical codes or regulations applicable to your installation. Table 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's ability to operate the loads.

Figure 11 shows the DC end for your reference. The reverse polarity LED will light up when the DC cables were reversed during installation. Reversing the connections may void the warranty.

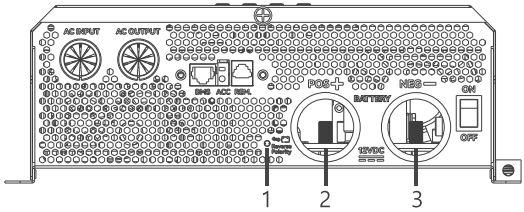


Figure 11 DC End

1	reverse polarity LED
2	positive (+)
3	negative (-)

To make the DC connections:

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

WARNING

ELECTRIC SHOCK 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.

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 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 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 cable. The amount stripped off will depend on the terminals chosen.

7. Attach the cable ring lug that will join the cable to the inverter DC terminal. Cover the lug stem with heat shrink insulation (see Step 6: Connecting the DC Cables) to ensure that the lug does not touch the enclosure.

8. Install a fuse and fuse holder in the cable that will be used for the positive side of the DC circuit. The fuse must:

a. be as close to the battery positive terminal as possible

b. be rated for DC circuits

c. have an Ampere Interrupting Capacity (AIC) that exceeds the short-circuit current available from the battery (that is, Class T fuse)

9. To prevent sparking when making the connection, ensure the disconnect/battery selector switch is off.

10. Route the positive cable through the left side strain relief clamp, and attach the cable lug on the positive cable to the positive DC terminal on the inverter.

11. Fasten the DC terminal nut (set aside earlier) to the terminal bolt. Tighten the nut to a torque of 3-4Nm of force.

Do not overtighten. Make the connection snug enough so the cable lug does not move around on the DC terminal. Center it through the DC knockout hole and do not let it touch the edge. See Step 6: Connecting the DC Cables on page 34.

⚠ 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 4Nm of force.

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

NOTICE

REVERSE POLARITY

• Check cable polarity at both the battery and the 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.

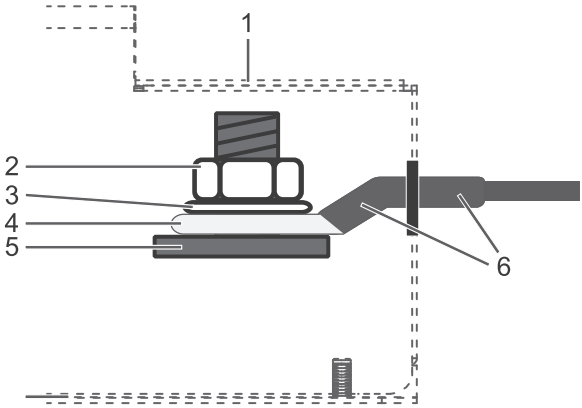


Figure 12 DC Cable Connections

1	Enclosure outline (DC compartment side view)
2	DC terminal nut (Torque: 2.94-3.92 N·m)
3	DC nut lock washer
4	Cable ring lug
5	DC terminal
6	DC cable with heat shrink insulation covering the lug stem
NOTE: The DC cable lug stem must be fully insulated with the heat shrink.	

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

⚠ WARNING

FIRE HAZARD

Do not complete the next step if flammable fumes are present.

Explosion or fire may result if the disconnect/battery selector switch is not in the off position.

Thoroughly ventilate the battery compartment before making this connection.

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

13. Route the negative cable through the right side strain relief clamp and connect the cable from the negative post of the battery to the negative DC terminal of the inverter.

14. Fasten the DC terminal nut (set aside earlier) to the terminal bolt. Tighten the nut to a torque of 3-4Nm of force.

Do not overtighten. Make the connection snug enough so the cable lug does not move around on the DC terminal. Center it through the DC knockout hole and do not let it touch the edge.

15. Replace the wiring compartment cover by tightening the captive nut panel screw. See the following electrical shock hazard warning.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

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

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

DC 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 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) of force. Apply an anti-corrosion compound to the copper wire prior to connecting to the DC ground lug.

Recreational Vehicle

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

Marine

Use copper wire that is bare or has insulation rated minimum 221°F, and connect it between the chassis ground lug and the boat's DC grounding bus or engine negative bus. For the RICH SOLAR NOVA 3K12 120VAC 12VDC, 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.

Connecting to ACC Signal

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 13.

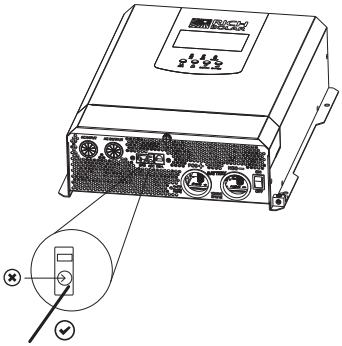


Figure 13 Ignition signal (ACC) input terminal

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 51.

Table 10 Ignition Control Features

Ignition On (ON)	This setting allows the inverter to operate (Battery Mode) automatically when an ignition control wire is connected to the ACC input and a valid ignition signal is constantly detected. The inverter works in tandem with the vehicle's ignition circuit.
Off (OFF)	To completely disable the ignition control features do the following: Set Ignition Control to Off (OFF) using the Select buttons on the display panel.

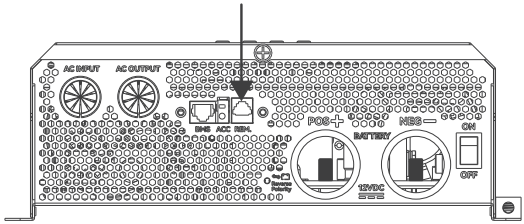
Step 7: Connecting to Port(s) on the RICH SOLAR NOVA

Connecting to the Remote Port

The RICH SOLAR NOVA can accommodate the inverter remote panel with cable (sold separately; comes with 25ft-cable)

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's Power button to the Standby mode (up position). This allows the remote panel to control the inverter's power status.

Step 8: Testing Your Installation

WARNING

ELECTRIC SHOCK HAZARD
Pressing the Power button to turn the 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 closed 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 on. The green status indicator LED for Battery Mode (Inverter Mode) is illuminated. See Status LED Indicators on page 46.
3. Plug a test load, such as a lamp within the power rating of the inverter 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.

Marine Installation

Figure 14 illustrates a typical marine installation with the following components:

1	Equipment ground - Engine negative bus/DC ground bus
2	RICH SOLAR NOVA Inverter
3	DC fuse/disconnect/DC circuit breaker
4	12V deep-cycle battery bank 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)

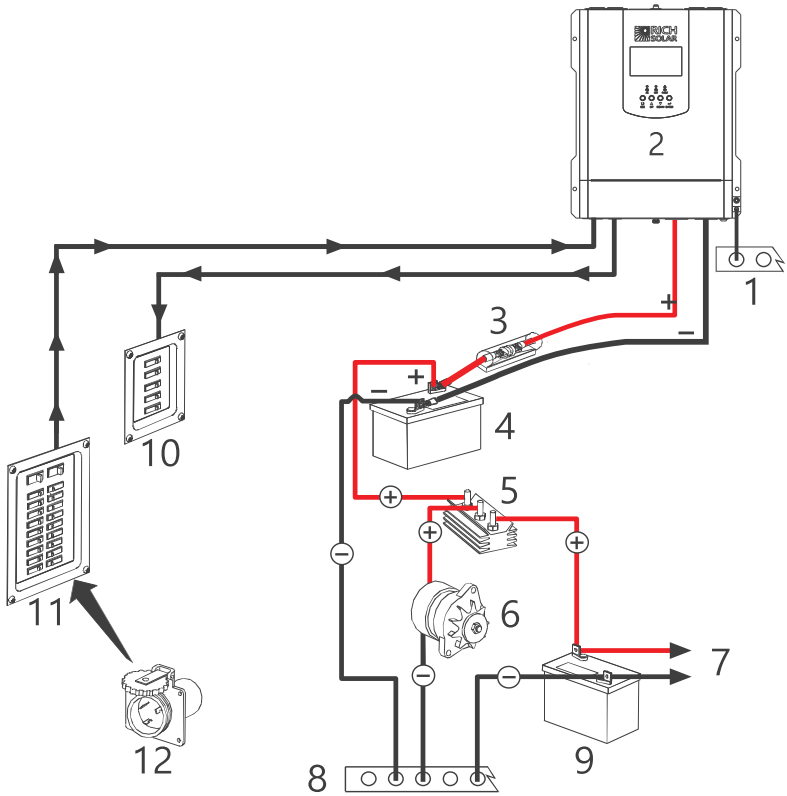


Figure 14 Typical Marine installation

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.

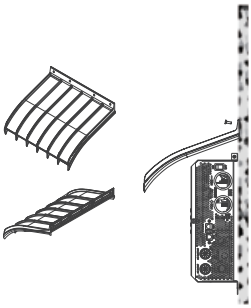


Figure 15 Drip shields

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 16.
3. Fasten the screws through the holes in the drip shield into the wall. See Figure 15.

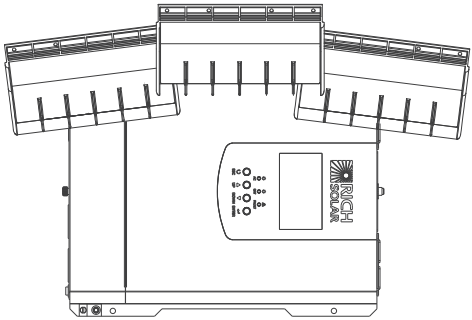


Figure 16 Typical Drip Shield Placement on a RICH SOLAR NOVA

Operation

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

5.1 RICH SOLAR NOVA Display Panel

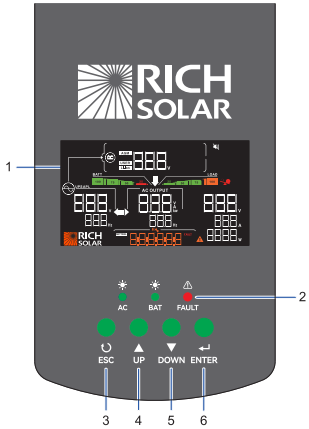


Figure 17 Display Panel

1	LCD screen
2	Status LED indicators
3	ESC see “Function Buttons” on the facing page
4	UP see “Function Buttons” on the facing page
5	DOWN see “Function Buttons” on the facing page
6	ENTER 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
AC BAT FAULT	Solid green. Indicates Grid Mode in which shore power is available and passing through to the loads.
AC BAT FAULT	Solid green. Indicates Battery Mode (Inverter Mode) in which the inverter is running and supplying power to the loads from the battery.
AC BAT FAULT	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 64.
AC BAT FAULT	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 64.

Function Buttons

Button	Definition
ESC	Return to default screen or exit setting mode.
UP	To go to previous selection.
DOWN	To go to next selection.
ENTER	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.

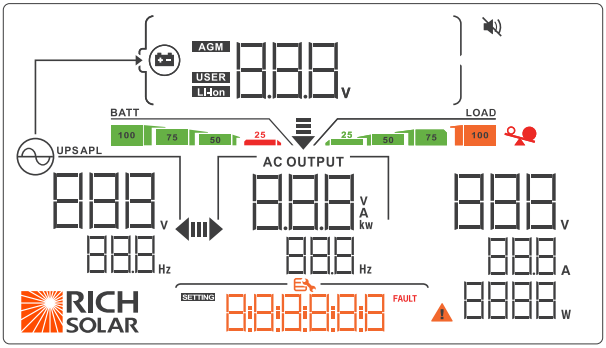
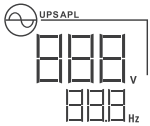
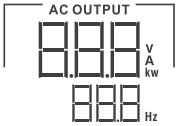
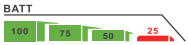
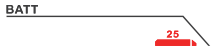
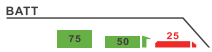


Figure 18 Parts of the LCD Screen

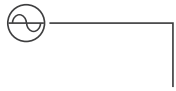
LCD Screen Icons

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 batter capacity. Battery type: Li-ion ($LiFePO_4$) /USER

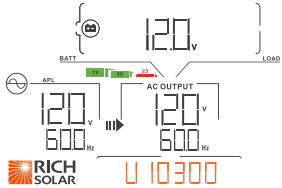
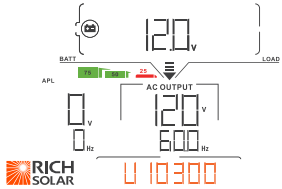
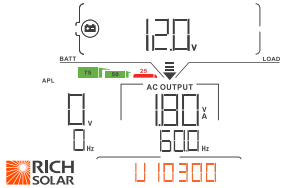
Battery type	Battery voltage V/cell	LCD Display
Li-ion ($LiFePO_4$) /USER	<12.8	
	12.8~13.1	
	13.1~13.3	
	>13.3	

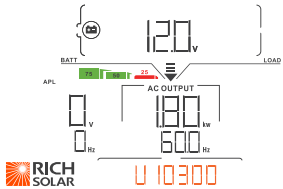
Icon	Definition	
Battery type: AGM		
Load Percentage	Battery voltage V/cell	LCD Display
Load>50%	<10.8	BATT 25
	10.8~11.2	BATT 50 25
	11.2~11.5	BATT 75 50 25
	>11.5	BATT 100 75 50 25
50%>Load >20%	<11.4	BATT 25
	11.4~11.8	BATT 50 25
	11.8~12.1	BATT 75 50 25
	>12.1	BATT 100 75 50 25
Load<20%	<11.8	BATT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

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

LCD Display

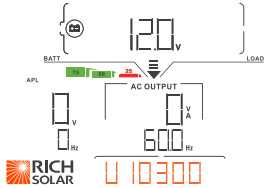
The LCD display information will be switched in turn by pressing the ▲ or ▼ button. The selectable information is switched as the following table in order.

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 

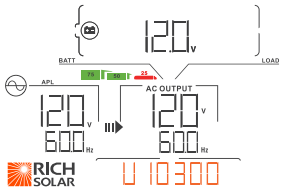
5.2 Viewing Information During Battery Mode

The unit will provide output power from battery.

Information	LCD Screen
Power from battery only	

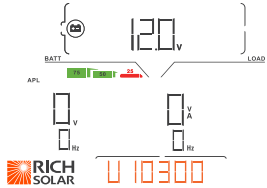
5.3 Viewing Information During Grid Mode

The unit will provide output power from the mains.

Information	LCD Screen
Power from mains only	

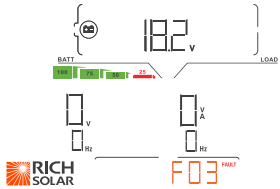
5.4 Viewing Information During Standby Mode

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 APL	If selected, transfer requirements <20ms	
		UPS 03 UPS	If selected, transfer requirements <10ms	
04	Battery type	Li-ion (default) 04 Li b	AGM 04 AGn	
		USER 04 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 Lrd	Restart enable (default) 05 LrE	
06	Auto restart when over-temperature occurs	Restart disable 06 trd	Restart enable (default) 06 trE	
07	Output frequency	50Hz 07 50	60Hz (default) 07 60	
08	Output Voltage	108VAC 08 108	110VAC 08 110	120VAC (default) 08 120
13	Buzzer alarm	Alarm On 13 bon	Alarm Off (default) 13 boF	
14	Backlight of LCD	Backlight On (default) 14 Lon	Backlight off 14 LoF	

Code	Content	Icon	
15	Low DC Cut-off Voltage for USER battery	11.9V (default) 15 CUT 11.9 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) 16 FCV 13.1 range if from 12.0V to 16.0V/Off. Increment of each click is 0.1V	
21	Load Search Mode	Normal (default) 21 non	Enable 21 PEN

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
58	Output voltage is too low.	F58

5.8 Warning Indicator

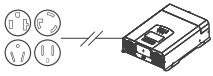
Code	Warning Event	Audible Alarm	Icon
01	Fan is locked when inverter is on.	Beep three times every second	01
02	Over-temperature.	None	02
04	Low battery.	Beep once every second	04
07	Overload.	Beep once every 0.5 second	07 LOAD 25 50 75 100

5.9 Operating in Battery Mode

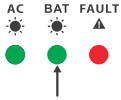
The RICH SOLAR NOVA is in Battery Mode (also called Inverter Mode) when all the following conditions exist:

- 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.

	BATT.MODE

Turning Inverter Operation ON and OFF

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

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

a. See LCD Settings 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 power save mode, the inverter can automatically go to load sense mode by sending short pulses to further reduce the battery discharge. Power save mode ends when a load greater than 25W is connected.

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 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 on.

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

Turning the Audible Alarm ON or OFF

The RICH SOLAR NOVA's audible alarm can be muted. But the error code continues to be displayed until the eror is cleared. See LCD Settings in Configuration Mode on page 51.

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 56.

Audible alarm for warning: See Waming Indicator on page 54.

Audible alarm for error: The unit beeps once every one second.

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 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 90 volts AC.

The transfer time can be set to two settings. For details, see LCD Settings in Configuration Mode on page 51.

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 the UPS to be set to transfer mode (APL) 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.

5.11 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:

- 1200 watts NOVA 1K12
- 2000 watts NOVA 2K12
- 3000 watts NOVA 3K12

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

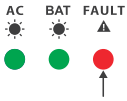
Input Voltage

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

Table 11 Input battery voltage range

Operating Condition	Battery Voltage	Comment
Full Operating Range	LBCO-18.0 volts (12VDC models)	Assuming the battery is fully charged, the inverter will operate until battery voltage drops below LBCO[c] voltage.
Low Voltage Recovery	>LBCO Recovery	Inverter is able to recover and continue to operate.

c. To set LBCO, see LCD Settings in Configuration Mode on page 51.

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 error code E01. After LBCO Shutdown delay timer runs out, the unit shuts down inverter output. The buzzer stops beeping, and the LCD screen shows error code E01.
Instant Low Voltage Shutdown	<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 (12VDC models)	The display shows error code E02 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 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 error code 07.

Overload Shutdown

When the RICH SOLAR NOVA AC load increases to near NOVA 2K12 120VAC 12VDC and NOVA 3K12 120VAC 12VDC, 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'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 02. If the over-temperature condition persists, the display will show error code F02. The status LED turns solid RED and the inverter 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 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 59.

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 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 52 to change the alarm settings.
The error codes are listed in Table 12. The text in the **Error Code** column appears on the LCD screen of the display panel.

Table 12 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.
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.

Table 13 Warning codes displayed on the LCD screen

Warning Code	Condition	Mode	Action
01	Fan is locked when inverter is on	Battery Mode (inverting)	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.
02	Over-temperature	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.
04	Low battery	Battery Mode (inverting)	Check battery status and recharge if necessary. Check for proper DC cable sizing. Check for loose connections and tighten if necessary.
07	AC output overload shutdown	Battery Mode (inverting)	Reduce the loads connected to the AC outlet of the unit.

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 DAMAGE

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

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

Table 14 Troubleshooting reference

Problem	Possible Cause	Solution
Alarm does not sound when an error is encountered.	Alarm is turned OFF.	See RICH SOLAR NOVA Unit on page 52 and follow instructions to turn the alarm buzzer on again.
No output voltage. The status LED is red.	AC shore power is not available or out of operating range and the inverter has shut down with the LCD screen showing one of the following error codes:	
	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 F05)	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's ventilation openings are not blocked.
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.

Problem	Possible Cause	Solution
No output voltage is shown on the LCD screen but the green status LED for Battery Mode is illuminated.	Battery voltage is too low (depending on setting, see RICH SOLAR NOVA Unit on page 52) 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 is OFF.	Check AC shore power. Turn the inverter ON.
	AC shore power is not available and the inverter is OFF due to a shutdown for more than 30 seconds.	Check AC shore power and battery voltage. Turn the inverter ON and look at the LCD screen for any error code. See "Problem" on the previous page.
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 your loads, read this section.

Resistive Loads

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

Motor Loads

Induction motors (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 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 long 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 for power.

Specifications

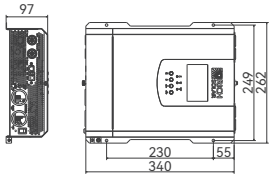
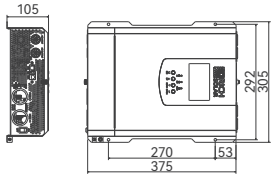
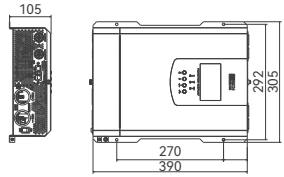
This section summarizes the hardware and electrical specifications of the RICH SOLAR NOVA Inverter.
NOTE: Specifications are subject to change without prior notice.

8.1 Physical Specifications

Table 15 Physical specifications

	NOVA 1K12	NOVA 2K12	NOVA 3K12
L×W×H	13.4"×10.3"×3.8" (340mm×262mm×97mm)	14.8"×12.0"×4.1" (375mm×305mm×105mm)	15.4"×12.0"×4.1" (390mm×305mm×105mm)
	NOTE: Width include flanges	**NOTE:** Width include flanges	**NOTE:** Width include flanges
Net Weight	11.46lbs (5.2kg)	15.9lbs (7.2kg)	17.64lbs (8kg)

Table 16 Product dimensions

		
NOVA 1K12	NOVA 2K12	NOVA 3K12

8.2 Environmental Specifications

Table 17 Environmental specifications

		NOVA 1K12	NOVA 2K12	NOVA 3K12
Ambient Temperature	Operating Temperature Range[a]	-40-150°F (-40-65℃), with output derated above 122°F (50℃)		
	Storage Temperature Range	-40-150°F (-40-65℃)		
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 18 System specifications

		NOVA 1K12	NOVA 2K12	NOVA 3K12
Transfer relay rating (A[a])		30A	30A	30A
Transfer time (milliseconds[b])	Shore to inverter	<20 milliseconds	<20 milliseconds	<20 milliseconds
	Inverter to shore	<20 milliseconds with a 20- second delay	<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	<90V and >140V
	Inverter to shore	<140V and >90V	<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	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.

b. To change the AC transfer time (mode), see RICH SOLAR NOVA unit on page 52.

Table 19 DC input for inverting

	NOVA 1K12	NOVA 2K12	NOVA 3K12
Operating voltage range	LBCO voltage[a]–18.0VDC	LBCO voltage[b]–18.0VDC	LBCO voltage[c]–18.0VDC
Nominal voltage	12.0VDC	12.0VDC (12VDC models)	12.0VDC (12VDC models)
Nominal current at full load	100ADC	192ADC (12VDC models)	288ADC (12VDC models)

a. To set LBCO, see LCD Settings in Configuration Mode on page 53.

b. To set LBCO, see LCD Settings in Configuration Mode on page 53.

c. To set LBCO, see LCD Settings in Configuration Mode on page 53.

Table 20 AC output for inverting

	NOVA 1K12	NOVA 2K12	NOVA 3K12
Output voltage options	120,110,108VAC	120,110,108VAC	120,110,108VAC
Continuous power (W[d])	1200W@50℃	2000W@50℃	3000W@50℃
Continuous current	8.4A	16.7A	25A
Surge power (5 sec)	2400W	4000W	6000W
Frequency[e]	60 (or 50) Hz	60 (or 50) Hz	60 (or 50) Hz
Wave shape	True Sine Wave	True Sine Wave	True Sine Wave
Peak efficiency	91%	91% (12VDC models)	91%
Full load efficiency	>87%	>87.5% (12VDC models)	>85%

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

e. To set the AC Frequency, see RICH SOLAR NOVA unit on page 52.

1-800-831-9889

support@richsolar.com

www.richsolar.com

1900 Mountain Ave, Norco, CA 92860