2000 WATT
PURE SINE WAVE INVERTER

USER MANUAL

MODEL: RS-V2P12/RS-V2P24

THIS MANUAL CONTAINS IMPORTANT SAFETY AND OPERATING INSTRUCTIONS FOR PURE SINE WAVE INVERTERS. PLEASE READ THIS MANUAL AND FOLLOW THE INSTRUCTIONS EXACTLY.

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User Manual—Read before using this equipment

Thank you for purchasing the **RICH SOLAR** power inverter. This a compact and highly portable power inverter, the leader in the field of high-frequency inverter design.

From the 12V/24V DC outlet inyour vehicle orboat, or directly from a dedicated 12V/24V DCbattery, or the solar power bank, the inverterwill efficiently and reliably power a wide va-riety of household AC products, such as TVs,computers, and VCRs. It includes automaticsafety monitoring circuitry to protect theinverter and your battery from inad-vertent overload conditions.

Read this guide before installing or using the inverter and save it for future reference.

If you require technical support regarding this product, please call **1-800-831-9889** or email **support@richsolar.com.**

Safety Features

- Electronic overload protection with automatic shutdown.
- Built-in internal backup DC fuse provides added safety.
- Low battery voltage protection with automatic shutdown.
- Over-temperature protection with automatic shutdown.
- Output short-circuit protection.

Specifications

Model	RS-V2P12/RS-V2P24
Output Power	2000W
Input Voltage	12V DC/24V DC
Output Voltage	120V AC
Peak Surge	4000W
Efficiency	>88%
Frequency	60Hz
Total Harmonic Distortion (THD)	<3%
No Load Current Draw	<2.0A
Battery Low Alarm	10.5V±0.5V DC/20.5V±0.5V DC
Battery Low Shutdown	10.0V±0.5V DC/20.0V±0.5V DC
Overvoltage Shutdown	16.5V±0.5V DC/33.0V±1.0V DC
Cooling Fan	Thermally controlled
AC Output Sockets	3
USB Power Port	5V/2.1A
Power Output Control	AC On/Off Switch
Dimensions	410 x 244 x 102mm (16.1 x 9.6 x 4.0in)
Net Weight (Approx.)	4.6kg/10.1lb
Certification	ETL Listed to UL 458 and CSA 22.2 NO 107.1-01

Remote switch included, not sold separately.

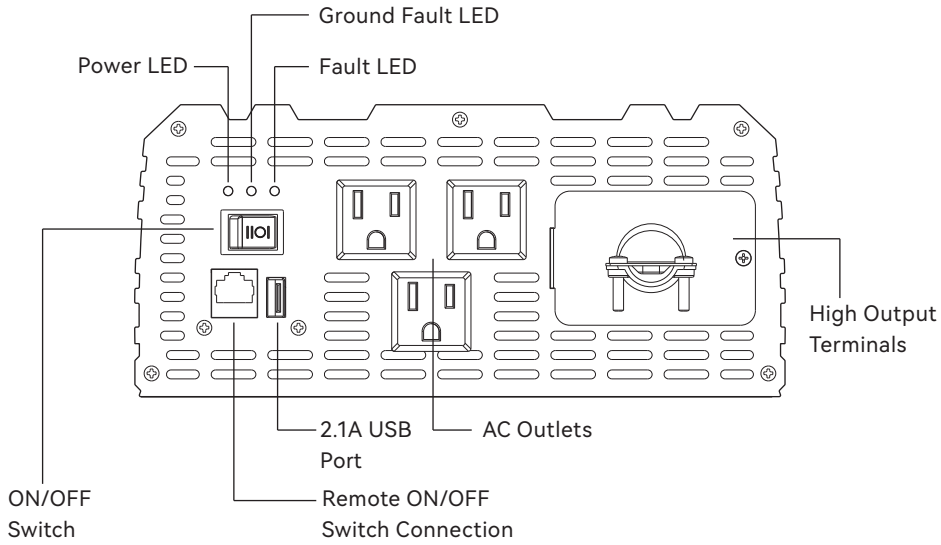
Warning

- **Inverter output can be lethal. Improper use of this inverter may result in property damage, personal injury or loss of life.**
- **Keep the inverter away from any direct heat source or combustible materials.**
- **Keep well ventilated—this device generates heat.**
- **Keep this inverter in a dry environment.**
- **Do not operate any equipment over the rated capacity.**
- **This inverter is designed to operate from a 12 or 24 volt DC power source only, depending on the model.**
- **Do not attempt to connect the inverter to any other power source, including any AC power source.**
- **Incorrect battery polarity will damage the inverter and void the warranty.**
- **Do not open the inverter;there are no user-serviceable parts inside.**

Disposal/Recycling of Inverter

Electronic products are known to contain materials that are toxic if improperly disposed of. Contact local authorities for disposal and recycling information.

Front Panel



- **ON/OFF Switch** – This switch controls the AC output of the inverter.
- **Power LED** (Green) – When this green LED is lit, the inverter is operating normally.
- **Ground Fault LED** (Yellow) – When the yellow LED is lit, the ground fault circuit has been interrupted. Shut down the inverter and restart.
- **Fault LED** (Red) – The red indicator turns on as the inverter shuts down due to overheating, overload, undervoltage, or overvoltage.

  - If the FAULT LED is lit, immediately turn off all AC appliances. Allow the inverter to cool before continuing. Make sure that the ventilation vents are not blocked.
  - If an inverter shutdown was preceded by a buzzing sound, there may be an excessive load in combination with a low voltage or cable problem.

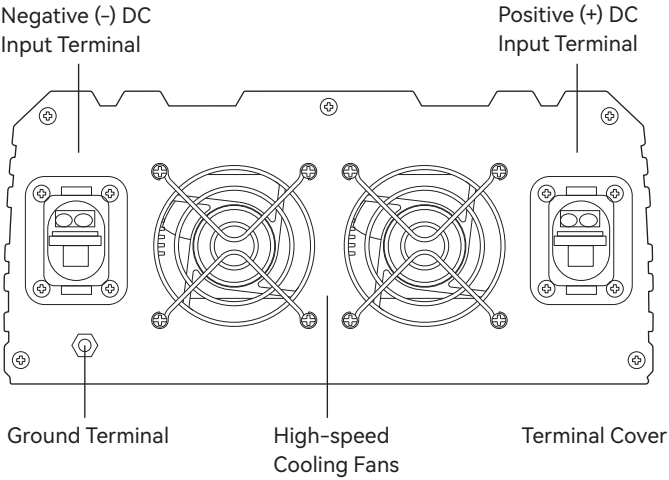
- **AC Outlets** – These outlets can supply up to 15 amps at 120V AC 60Hz, depending on capacity of the inverter.
- **High Output AC Terminals** – There are three insulated terminals on the front panel of the inverter. These terminals are for connecting 120 volt AC devices that require more than 15 amps to operate. Other uses are for connection to distributed wiring that has multiple AC outlets. Remove 2 screws on protective cover to access terminals. Any AC output wiring that is directly connected must comply with US National Electric Code (NEC) wiring gauge recommendations. Facing the front panel, the terminals are:

Left	Middle	Right
Neutral	Ground	Live

  - NEUTRAL and GROUND are bonded inside the inverter to comply with the National Electric Code (NEC) requirement that any AC source must have a neutral to ground connection.

- **USB Power Port**-This power port can supply 5 volts at 2.1A for charging or powering tablets, e-readers,smartphones,and other small electronic devices.
- **Audible Alarm** (internal to the inverter)-When the Audible Alarm makes a buzzing sound,the inverter senses a low battery condition. The user should reduce the AC load, charge the battery, and check the DC cable for excessivelosses.
- **Remote Switch Connection**

Rear Panel



- **Positive Terminal -** Positive (+) DC Input (Red)
- **Negative Terminal -** Negative (-) DC Input (Black)
- **Cooling Fans-** High-speed and load-controlled
- **Ground Terminal** - For attaching an insulated safety ground wire. This safety wire is for protecting personnel if there is an unlikely failure in either the cabling or enclosure insulation. Grounding the inverter enclosure ensures personnel safety in case of a DC cable problem. During installation, the Ground Terminal is connected either to a vehicle chassis or to the negative DC terminal of the battery. Do not directly connect this ground connection to the negative DC terminal of the inverter. Use an insulated 10 gauge wire to make the ground connection. If the inverter installation is located in fixed location, the safety wire can be connected to earth ground.

REMOTE ON/OFF CONTROL

Insert wired remote plug into Remote Switch Connection port. Set the ON/OFF switch to the "remote" position.

LOAD CONSIDERATIONS

The startup load of an appliance is a major factor of whether this inverter can power it. This initial load is only momentary. With many appliances, it is approximately twice the continuous load, but some appliance startup loads can be as high as eight times the continuous load.
The inverter will automatically shut down in the event of an output overload, so there is no danger of damaging either the inverter or the equipment. When the red LED indicator is lit, the inverter is signaling a fault.

Planning the Inverter System

Any large wattage inverter system requires planning before installation. There are several steps to the planning process, so the user must determine the following:

- Maximum inverter wattage required.
- Operating time (run time) needed between battery recharges.
- Battery bank capacity in amp-hours.
- Charger requirement to charge batteries within a practical time.
- Distance between battery bank and inverter.

DETERMINING MAXIMUM APPLIANCE WATTAGE

Do not exceed the maximum AC wattage load or the inverter will shut down.

Most electrical tools, appliances, and audio/video equipment have labels that list the unit's power requirements in watts. If the tool or device is rated in amps, multiply the amps by 120 (115V AC) to determine the watts. For example, an appliance rated at 0.5 amps will draw 60 watts.

WATTS = VOLTS x AMPS

Remember to consider the startup surge that motorized appliances will cause. Do not exceed the watt momentary surge rating of this inverter. This can cause immediate overload shut down and/or blow a fuse.

CONFIGURING THE BATTERY BANK

To determine the minimum battery ampere-hour rating that you will need to operate appliances from the inverter and any DC appliances powered by the battery bank, follow these steps. The following example applies to12V systems only-for 24V systems, the same principles apply, the actual calculation will vary depending on the inverter rated input voltage.

1. List the maximum continuous wattage that the inverter has to supply.
2. Estimate the number of hours the appliances will be in use between battery recharges.
   This will vary depending on appliances. For example, a typical home-use coffee maker draws 500 watts during its brew time of 5 minutes. It maintains the temperature of the pot, requiring 100 watts. Typical use of a microwave oven is only for a few minutes. Some longer operating time appliances are lamps, TVs, computers, and refrigerators/freezers.

Determine the total watt-hours of energy needed. This is done by multiplying average power consumption in watts by hours of run time. For example: 500 watts for 10 hours = 5,000 watt hours. To get an estimate of the maximum current (in amps) that a battery bank must be capable of delivering to the inverter, divide the load watts by ten. For example a 500 watt appliance load will need 50 amps at 12 volts DC. Using the 500 watts (or 50 amps) for 10 hours example as above, 50 amps is needed for 10 hours. This provides us with the basic amp-hours (AH) of battery that is required. Ten hours at 50 amps equals 500 amp-hours (AH). There are additional factors that determine actual run time. These include:

- AC appliance load and time in use (basic AH).
- Cable gauge and length (cable losses).
- Charge level of the batteries (between use, chargers must be able to fully charge the batteries).
- Temperature of the batteries (colder batteries provide fewer amps).
- Age and condition of the batteries (older batteries lose AH capacity).
- Ensure compliance by turning off unnecessary AC loads.
- Use of DC appliances and ensure compliance by turning off unnecessary DC loads.

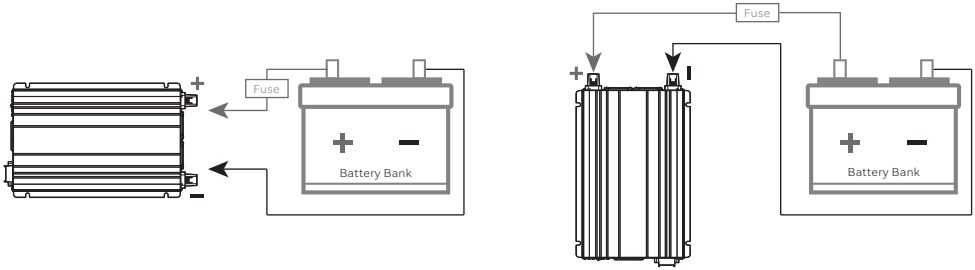
SETTING UP THE BATTERY BANK

Batteries used indoors or inside a vehicle or vessel should be deep-cycle, sealed lead-acid batteries.

NOTE: It is important to include battery protection fuses in any inverter installation. Battery fuses are added to the positive (+) battery cable as close as possible to the battery bank's positive terminal. The fuse amperage rating must be sized to allow simultaneous operation of all the AC appliances to be powered, plus 20 percent safety factor. Fuses are very important to protect equipment, batteries, and personnel. The fuses protect against battery explosion if the cables that connect to the inverter accidentally short.

BATTERY BANK DIAGRAM

The diagram below shows inverter connections to a battery bank with recommended fuse protection.



⚠ WARNING: Exploding Batteries!

Exploding batteries can spray molten lead, hot sulfuric acid, other metals and plastic fragments. Batteries that are charging or under high discharge rates produce explosive hydrogen gas into the surrounding area. Be safe, fuse the battery bank and make sure the batteries are properly ventilated.

CONNECTING THE INVERTER

Installation Procedure:

- Mount the inverter in a secure location. If the inverter is to be mounted on a wall, mount it horizontally. Make sure that the front and rear of the inverter have free air flow.
- Make sure the cables are the proper gauge and have the fuse holder as close to the battery bank's Positive (red) terminal.
- Install the fuse in the Positive (red) cable.
- Make sure the Power Switch located on the front panel of the inverter is in the Off position.
- Locate the ground lug terminal on the inverter. Connect an insulated 10 gauge copper wire to the terminal. The other end of the ground wire is connected to a "proper" grounding point. Use the shortest practical length of wire. Connect this wire to the chassis of your vehicle or to the grounding system in your boat. In a city, the ground wire can connect to a metal cold water pipe that goes underground. In remote locations, the ground wire can be connected to an "earth ground". This can be an attachment to a foot long copper clad metal rod driven into the ground. In the unlikely event of a short circuit, operating the inverter without proper grounding can result in electrical shock. Do not directly connect this ground wire to the Negative (black) DC Terminal of the inverter. As an alternative grounding connection, use the Negative (black) terminal of the battery.

  NOTE: Crimp-on ring terminals are required on all cable ends. The cable ends need to be stripped of insulation for1/2 inch before crimping on ring terminals. Select a crimp terminal size to fit the gauge cable and inverter and battery terminal connectors. After crimping make sure that the cable connectors are secure on the cables so there are no loose connections.
- Remove the terminal covers from the inverter. Slide the cable through the correct terminal cover.
- Connect the Negative (black) cable end to the inverter terminal and battery Negative Terminal. Make sure you have good, secure connections.
- Recheck and make sure the DC cable fuse is installed in the fuse holder.

  CAUTION: Making an initial connection between the positive cable end and the inverter's positive terminal may cause a spark. This is normal and is a result of capacitors in the inverter starting to charge. Because of the possibility of sparking, it is extremely important that both the inverter and the battery bank be positioned away from any source of flammable fumes or gases. Failure to heed this warning can result in fire or explosion. Do not make the positive terminal connection immediately after the batteries have been charging. Allow time for the battery gases to vent to outside air.
- Attach the positive cable to the Positive DC connector on the battery and then the inverter. Make sure the connections are tight and secure.
- Turn on the inverter from the Front Panel Power Switch "I".

- Make certain that the green Operating LED is lit and the FAULT LED indicator is not lit.
- Turn the inverter off by switching it to "O". The Fault LED may briefly "flash". This is normal. The audible alarm may also sound a short "chirp". This is also normal.
- When you have confirmed that the appliance to be operated is turned off,plug the appliance into one of the two AC outlets on the front panel of the inverter.
- Turn the inverter on.
- Turn the appliance on.The appliance should begin working.
- Observe the LED indicators and the digital display for normal operation.

NOTE: If an extension cord is used from the inverter to the appliance, limit the extension cord length to 100 feet or less. Make sure that the cord is safety approved and AWG 14 or larger to carry the appliance load. Remember that extension cords are for temporary use.

⚠ **WARNING:** There is danger of explosion. DO NOT connect or disconnect charger cables directly after battery discharge or recharge —— make sure that the battery bank area is well vented before attaching or removing cables.

OPERATING ISSUES: TELEVISION AND AUDIO EQUIPMENT SUGGESTIONS.

Although all inverters are shielded and filtered to minimize signal interference, some interference with your television picture may be unavoidable, especially with weak signals. However, here are some suggestions that may improve reception.

- Make sure that the television antenna produces a clear signal under normal operating conditions (i.e. plugged into a standard 110V/120V AC wall outlet). Also ensure that the antenna cable is of good quality and properly shielded.
- Sometimes vehicle alternators produce some electrical noise. There are filters available to mount on the alternator to reduce the noise.
- Change the positions of the inverter, antenna cables, and television power cord.
- Isolate the television, its power cord, and antenna cables from the power source by running an extension cord from the inverter to the television.

Troubleshooting

PROBLEM: Low or No Output Voltage-Fault LED Lit.

Reason	Solution
Poor contact with battery, inverter terminals.	Clean terminals thoroughly. Reinstall and tighten.

PROBLEM: Inverter Auto Shut Down-Fault LED Lit.

Reason	Solution
Battery voltage is below rated value.	Charge or replace battery.
Inverter is too hot (thermal shut down mode).	Allow inverter to cool. Check for adequate ventilation. Reduce the load on the inverter to the specified "True-rated" power max output.
Equipment being operated draws too much power.	Do not use the equipment with this inverter; use a higher wattage inverter.

PROBLEM: Continuous Buzzing Sound

Reason	Solution
Input voltage is below rated value.	Keep input voltage above rated value.
Poor or weak battery condition.	Recharge or replace battery.
Poor or loose cable connection.	Inspect terminals and tighten all connections.
Inadequate power being delivered to the inverter or excessive voltage drop.	Use a heavier gauge DC cable. Keep cable length as short as possible.

Important Safety Information

Incorrect installation or misuse of the inverter may result in danger to the user or hazardous conditions. We urge you to pay special attention to all CAUTION and WARNING statements. CAUTION statements identify conditions or practices that may result in damage to other equipment. WARNING statements identify conditions that may result in personal injury or loss of life.

⚠ WARNING! Shock hazard. Keep away from children.

- The inverter generates the same potentially lethal AC power as a normal household wall outlet. Treat it with the same respect that you would like AC outlet.
- Do not insert foreign objects into the inverter's AC outlet, fan or vent openings.
- Do not expose the inverter to water, rain, snow or spray.
- Do not under any circumstances, connect the inverter to utility power AC distribution wiring.

⚠ WARNING! Heated surface.

- The inverter's housing may become uncomfortably warm, reaching 140°F (60°C) under extended high-power operation. Ensure at least 2 inches (5 cm) of air space is maintained on all sides of the inverter. During operation, keep away from materials that may be affected by high temperatures.

⚠ WARNING! Explosion hazard.

- Do not use the inverter in the presence of flammable fumes or gases, such as in the bilge of a gasoline powered boat, or near propane tanks. Do not use the inverter in an enclosure containing automotive-type, lead-acid batteries. These batteries, unlike sealed batteries, vent explosive hydrogen gas, which can be ignited by sparks from electrical connections.
- When working on electrical equipment, always ensure someone is nearby to help you in an emergency.

⚠ CAUTION!

- Do not connect live AC power to the inverter's AC outlets. The inverter will be damaged even if it is switched OFF.
- Do not connect any AC load, which has its neutral conductor connected to ground, to the inverter.
- Do not expose the inverter to temperatures exceeding 104°F (40°C).

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