

- CAR series** Modified Sine Wave Inverter
- P series** Pure Sine Wave Inverter

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User Manual

# DC TO AC POWER INVERTER



ISO9001: 2008 CE RoHS E8

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## 1. Introduction

Thanks for your purchasing our CAR and P series power inverter.

Our power inverters are compact and high efficient inverters, and it is the leader in the field of high frequency inverters.

Our power inverter converts low voltage, direct current (DC) to 110/220 volt modified sine wave (MSW) or pure sine wave (PSW) alternating current (AC).

By connecting the power inverter directly to the 12/24/48V battery, you can turn your vehicle into a mobile office, or have power to run entertainment electronics.

Read this guide before install and use the power inverter, and please reserve it for future reference.

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## 2. Important Safety Instructions

**Important:** Read and save this owner's guide for future reference.

This chapter contains important safety and installation instructions for our CAR and P series power inverters. Each time, before using the power inverter, read all instructions and cautionary marking on or provided with inverter and all appropriate sections of this guide.

### ! DANGER ELECTRICAL SHOCK HAZARD

- ◆ Do not expose the inverter to rain, snow, spray, or bilge water. This inverter is designed for indoor use only.
- ◆ Do not operate the inverter if it has received a sharp blow, been dropped, has cracks.
- ◆ Do not disassemble the inverter. Internal capacitors remain charged after all power is disconnected.
- ◆ Disconnect both AC and DC power from the inverter before attempting any maintenance or cleaning or working on any circuits connected to the inverter. See note below.
- ◆ Do not operate the inverter with damaged or substandard wiring.
- ◆ Make sure that all wiring is in good condition and is not undersized.

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

**Notes:** Turning off the inverter using the ON/OFF switch on the front panel will not reduce an electrical shock hazard.

### ! DANGER FIRE AND BURN HAZARD

- ◆ Do not cover or obstruct the air intake vent openings and /or install in a zero-clearance compartment.
- ◆ Do not use transformer less battery chargers in conjunction with the inverter due to overheating.

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

### ! DANGER EXPLOSION HAZARD

- ◆ Charge only properly rated (such as 12V) lead-acid (GEL, AGM, Flooded, or lead-calcium) rechargeable batteries because other battery types may explode and burst.
- ◆ Do not work in the vicinity of lead-acid batteries. Batteries generate explosive gases during normal operation.
- ◆ Do not install and /or operate in compartments containing flammable materials or in locations that require ignition-protected equipment.

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

### Notes:

1. Follow these instructions and those published by the battery manufacturer and the manufacturer of any equipment you intend to use in the vicinity of the battery. Review cautionary markings on these products and on the engine.
2. The inverter contains components which tend to produce arcs or sparks.
3. Locations include any space containing gasoline-powered machinery, fuel tanks, as well as joints, fittings, or other connections between components of the fuel system.

### CAUTION RISK OF DAMAGE TO THE INVERTER

- ◆ Never allow battery acid to drip on the inverter when reading gravity, or filling battery.
- ◆ Never place the inverter unit directly above batteries, gases from a battery will corrode and damage the inverter.
- ◆ Do not place a battery on top of the inverter.
- ◆ The inverter will not operate high Wattage appliances over the output power limit or surge power limit.
- ◆ This is not a toy - keep away from children.

Failure to follow these instructions can damage the unit and/or damage other equipment.

### 3. Protection Features

Our power inverters are equipped with numerous protection features to guarantee safe and trouble free operation:

<b>Low Battery Alarm</b>	Alerts you if the battery has become discharged to 10.5V or lower.
<b>Low Battery Voltage Shutdown</b>	Shuts the inverter down automatically if the battery voltage drops below 9.5 volts. This feature protects the battery from being completely discharged.
<b>High Battery Voltage Shutdown</b>	Shuts the inverter down automatically if the input voltage rises to 15.5 volts or more.
<b>Over Load Shutdown</b>	Shuts the inverter down automatically if the loads connected to the inverter exceed the inverter's operating limits.
<b>Over Thermal Shutdown</b>	Shuts the inverter down automatically if its internal temperature rises above an unacceptable level.
<b>Output Short Circuit Shutdown</b>	Shuts the inverter down automatically if a short circuit is detected in the circuitry connected to the inverter's output.
<b>Reverse Polarity Protection</b>	If wrong polarity connection, the internal fuse shall blow out.
<b>Earth Fault Protection</b>	The inverter complies with the standard current leakage allowance. When large current leakage to earth terminal occurs, the protection circuit activated and shut down the inverter, which prevent electric shock to human. Turn off the inverter, unplug the fault AC appliances and then turn ON is the only way to restart it.

**Notes:** All protection is automatically recovered. To protect the battery, if the unit needs to be restarted after lower voltage protection, the voltage of DC input factory setting: modified sine wave inverter is 11.8V; pure sine wave inverter is 12.6V.

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### 4. Location

The power inverter must only be installed in a location that is:

**Dry** The inverter must be installed in a dry location not subject to moisture especially rain, spray, or splashing bilge water.

**Cool** The inverter should not be exposed to metal fillings or any other form of contamination.

**Ventilated** The ambient air temperature should be between 0-40 °C (32-104 °F) for best performance.

**Safe** Ventilation openings on the inverter must not be obstructed. If the inverter is mounted in a tight fitting compartment, the compartment must be ventilated with cut-outs to prevent the inverter from overheating.

**Close to battery** The inverter is not ignition-protected equipment, so it cannot be installed in areas containing gasoline tanks or fittings which require ignition protected equipment. We recommend that it is safest not to install any kind of electrical equipment including the inverter in these areas.

**Protected from battery gases** The inverter should be installed as close as possible to the batteries, but not in the same compartment to prevent corrosion. Avoid excessive cable lengths and use the recommended wire sizes. We recommend that installing with battery cables sized to achieve less than 3% voltage drop on battery cables under full load. This will maximize the performance of the inverter.

### 5. Principle of Operation

There are two working stages in the power inverter:

**The first stage:** It is a DC to DC conversion process that raises the lower voltage DC at the inverter input to 300volts DC.

**The second stage:** It is a actual inverter stage that convert the high voltage DC into 110volts or 220volts AC (rms). The DC to DC convert stage uses modern high frequency power conversion techniques that have replaced the bulky transformers found in less technology-advanced models. The inverter stage uses advanced power MOSFET transistors in a full bridge configuration.

### 6. Inverter Materials List and Indication

#### ◆ Materials List

There are power inverter unit, user manual, DC cables and spare fuse inside of packing. Figure 1(6.1, 6.2, 6.3, 6.4, 6.5, 6.6)

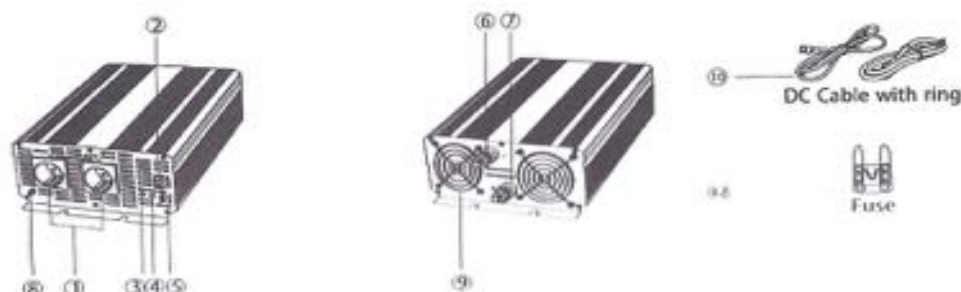
#### 6.1 Modified sine wave inverter 700W~900W



### 6.2 Modified sine wave inverter 1000W~1800W



### 6.3 Modified sine wave inverter 2000W~5000W



### 6.4 Pure sine wave inverter 300W~600W



### 6.5 Pure sine wave inverter 1000W



### 6.6 Pure sine wave inverter 1500W~2500W



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#### ◆ Indication:

① **AC outlets** are used to power loads

Please see the pictures as follows, the output AC outlets type optional.

Figure 2



② **ON/OFF Switch** turns the inverter on and off.

③ **Fault light (red)** indicates that the inverter has shutdown due to inverter overload, over temperature, short circuit, leakage or fault happen.

④ **Power light (green)** indicates the inverter is operating.

⑤ **USB port** it output DC5V 500mA or 800mA, connect the USB external appliance to USB port and switch it on. The USB output on the power inverter provides a supply of 5V DC power for USB external appliances (e.g. lights, fans, radios).

The USB output is permanently on when the power inverter is connected to a 12V input voltage.

⚠ **Warning:** The USB port on the power is not designed for transferring data.

◆ Do not connect memory sticks, MP3 player or similar data storage external appliances.

◆ Do not connect any data transfer cables to the USB port!

⑥ **Negative DC input terminal (-)** always connects to the negative terminal of the battery via a negative DC input cable (black battery cable).the negative DC input terminal is colored black.

⑦ **Positive DC input terminal (+)** always connects to the positive terminal of the battery via a positive DC input cable (red battery cable).the positive DC input terminal is colored red.

⚠ **Warning:** Do not reverse polarity connection, the wrong connection will result in a blown fuse and may cause permanent damage to the inverter.

⑧ **Chassis ground screw** grounding the earth by use wire.

⑨ **High - Speed Cooling fan** must not be obstructed for the proper operation of the inverter. When the inverter is mounted, then ventilation opening on the DC panel must not point up or down.

⑩ **DC cable with ring**, please you can connect the ring in red cable to red terminal on inverter and the ring in another side to battery. Do same way in black cable.

⑪ **DC cable with clip**, you can use it connect the battery and inverter by connecting the clips in cable to battery, and the ring in another side to inverter.

⚠ **Warning:** Symptoms of low battery power can result from cables that are either excessively long or an insufficient gauge. Substantial power loss and reduced battery operating time results from inverters installed with cables that are not able to supply full power.

**Notes:** The installer/operator should be especially aware of the requirements to maintain secure, tight, water-resistant electrical connections and to provide for strain relief for DC cables and appliance wiring. Cable insulation must be the appropriate type for the environment.

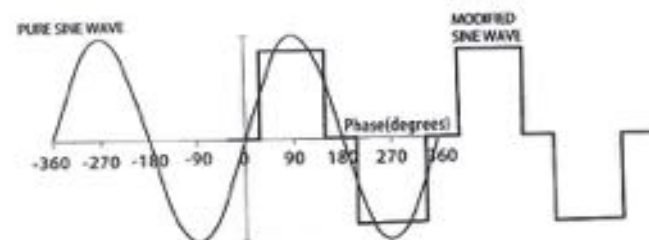
⑫ **Fuse**, there is internal fuse inside inverter, and we put some spare fuses inside packing.

**Notes:** The fuse for reverse polarity protection, the fuse shall blow out if wrong connection, after you replace it then the inverter working again. If after you replace the fuse, the inverter still not works properly, please contact technicians.

## 7. The Inverter's Output Waveform

The AC output waveform of the CAR series inverter is known as "modified sine wave", P series inverter output waveform is "pure sine wave".

Figure 3



Modified sine wave and pure sine wave comparison

The modified sine wave has an RMS (Root mean square) voltage of 110/220volts, which is the same as standard household power. Most AC voltmeters (both digital and analog) are sensitive to the average value of the waveform rather than the RMS value. They are calibrated for RMS voltage under the assumption that the waveform measured will be a pure sine wave. These meters will not read the RMS voltage of a modified sine wave correctly. They will read about 20 to 30 volts low when measuring the output of the inverter. For accurate measurement of the output voltage of this unit, use a true RMS reading voltmeter such as Fluke 87III, Fluke 8060A, Fluke 77/99 series or Beckman 4410.

## INTERFERENCE WITH SOME EQUIPMENT

### ◆ Buzz in Audio Equipment

Some inexpensive stereo systems may emit a buzzing noise from their loudspeakers when operated from the inverter. This occurs because the power supply in the audio system does not adequately filter the modified sine wave produced by the inverter.

The only solution is to use a sound system that has a high quality power supply.

### ◆ Television Reception

When the inverter is operating, it can interfere with television reception on some channels. If interference occurs, try the following:

1. Make sure that the chassis ground screw on the rear of the inverter is solidly connected to the ground system of your vehicle or home.
2. Make sure that the television antenna provides an adequate ( " snow-free " ) signal and that you are using good quality cable between the antenna and the television.
3. Keep the cables between the battery and the inverter as short as possible, and twist them together with two to three twists per foot.( this minimizes radiated interference from the cables.)
4. Move the television as far away from the inverter as possible.
5. Do not operate high power loads with the inverter which the television is on.

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## 8. Choose the Battery

### ◆ Battery Requirements

Battery type and battery size strongly affect the performance of the power inverter. Therefore, you need to identify the type of loads your inverter will be powering and how much you will be using them between charges. To determine the minimum battery size that you need to operate appliances, follow these steps:

1. Determine the wattage of each appliance and/or tool you will need to simultaneously operate from the inverter. To do this, read the labels on the requirement to be operated. Usually, power consumption is shown in watts. If it is shown in amps, multiply by 110V/220V to determine the

wattage.

2. Estimate the number of hours the equipment will be in use between battery recharges.

3. Determine the total watt-hours of energy use, the total running time and the average power consumption power (in watts) by 10 if 12V system, by 20. If 24V system, by 40 if 48V system.

To calculate the approximate power in amps a 24 volt battery bank has to supply you need to know the current, or amps required for powering the continuous AC load. A shortcut method is to divide the continuous AC load wattage by 20.

For example, the continuous AC load is 2000 watts, the current (amps) is:  $2000/20$  or 100amps at 24VDC.

Add to the load any DC appliances that may be powered by the battery bank.

**Notes:** Some appliances required high surge power to start, then consumer less power. And some appliances are not operating for long periods of time. For example, a typical home-use coffee maker draws 500watts during its brew time of 5minutes, but it maintains the temperature of the pot at about 100watts. Typical use of a microwave is only a few minutes, sometimes at lower power; some exceptions to brief operating times are lamps, TVs and computers.

**Important:** The power inverter must be connected only to batteries with a normal output voltage of 12 volts when you use a 12V inverter. The unit will not operate from a 6 volt battery, and will sustain permanent damage if connected to a 24 volt battery.

**Caution:** Loosen connectors may cause overheated wires and melted insulation. Check to make sure you have not reversed the polarity. Reverse polarity connection will result in a blown fuse and may cause permanent damage to the inverter.

### ◆ The Calculation of the Battery's Back Up Time

The battery's back up depends on the battery capacity (Ah) and your appliances power (Watt)

The method to calculate the backup time:

Battery capacity (Ah) \* Input voltage (Volt)/Loads power (Watt)

For example:

Battery capacity = 150Ah

Input voltage = 12Volt

Loading power = 600Watt

So:

$(150Ah * 12V) / 600Watt = 3$  Hours

**Note:** the time calculated by this way is a theory value; the actual using time may short than this value.

### ◆ Recharging Batteries

When possible, recharge your batteries when they about 50% discharged or earlier. This gives the batteries a much longer life cycle than recharging when they are more deeply discharged.

Our inverter has a battery low voltage shutdown around 10Vdc. With moderate to heavy loads,

this will protect against over-discharging the battery. if the inverter is running only light loads it is advisable to recharge before the inverter low voltage shutdown point is reached.

For more information on maintaining batteries, consult your battery's manufacturer.

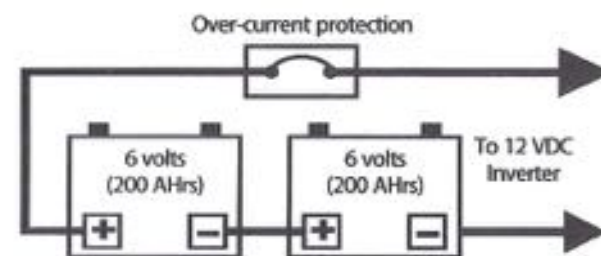
For information about our battery chargers, please contact us.

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### ◆ Batteries Wiring

#### 1. SERIES WIRING

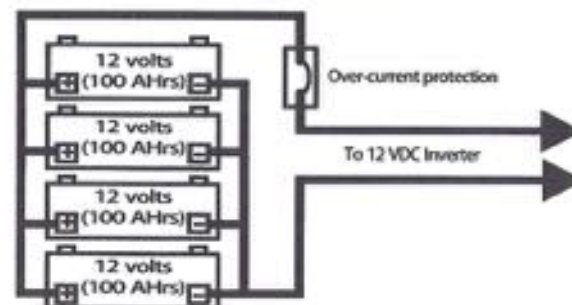
Wiring batteries in a series increases the total battery bank output voltage. A series connection combines each battery in a string until the voltage matches the inverter's DC requirement. Even though there are multiple batteries, the capacity remains the same. In the example below (Figure 4), two 6VDC/200Ah batteries are combined into a single string-resulting in a 12VDC /200Ah bank.



12 volt battery bank (total capacity = 200 Ahrs)  
Figure 4, Series Battery Wiring

#### 2. PARALLEL WIRING

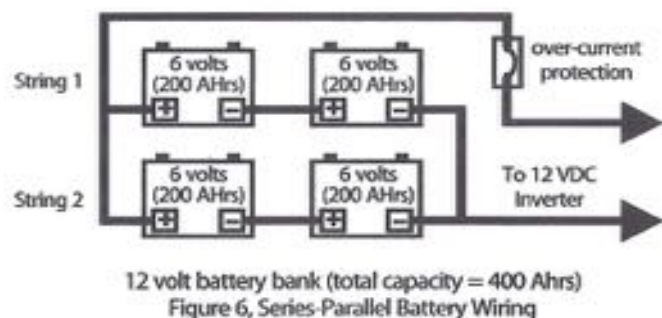
Wiring the batteries in parallel increases the total run time the batteries can operate the AC loads. A parallel connection combines overall battery capacity by the number of batteries in the string. Even though there are multiple batteries, the voltage remains the same. In the example below (Figure 5), four 12 VDC/100Ah batteries are combined into a single 12VDC/400AH battery bank.



12 volt battery bank (total capacity = 400 Ahrs)  
Figure 5, Parallel Battery Wiring

### 3. SERIES - PARALLEL WIRING

A series-parallel configuration increases both voltage (to match the inverter's DC requirements) and capacity (to increase run time for operating the loads) using smaller, lower voltage batteries. In the example below (Figure 6), four 6 VDC/200Ah batteries are combined into two strings resulting in a 12VDC/400Ah battery bank.



#### ◆ Best use of Battery Power

Make sure any appliances are energy efficient and turned off after use. Use Compact Florescent Lamps. Wherever possible, charge with solar panels or wind generators. Do not allow lead acid batteries to remain discharged for long periods of time, they lose capacity (amps hours).

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## 9. Mounting and Connecting the Inverter

#### ◆ Mounting the Inverter

**Warning:** Keeping ventilation when using batteries. Batteries may generate flammable gas during charging or discharging.

The inverter (1000W to 5000W models) has four slots in its mounting bracket that allow the unit to be fastened against a bulkhead, floor, wall or other flat surface. Ideally, the mounting surface should be cool to the touch.

It is more electrically efficient to use longer AC wiring than DC wiring, so install the inverter as close as possible to the 12 /24/48V DC power source (Battery).

The inverter can be operated in any position, however, if it is to be mounted on a wall, mount it horizontally (Figure 7) so that indicators, switches, outlets and terminal blocks located on the front panel are visible and accessible. If inverter is to be installed in a moving vehicle, we strongly recommends that the inverter be shock-mounted either on the floor (in a clear, safe area) or on a secure flat surface.

Figure7

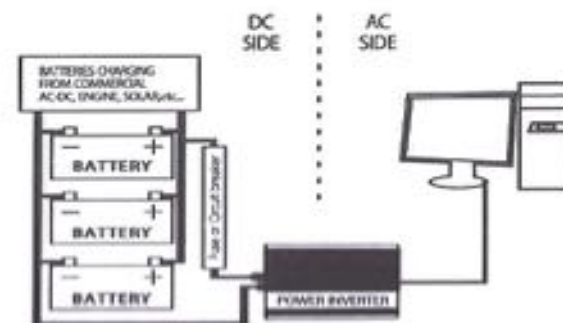


#### ◆ System Connection

When you connect the battery with inverter, please remember to connect the correct volts (e.g.12V inverter connect with 12volts batteries) .

The inverter will provide you 110/220VAC when powered by a 12/24/48VDC source. This manual does not describe all of the possible types of battery configurations, battery charging configurations and battery isolation configurations. The figure 8 as below show the typical connection.

Figure 8



**Note:** For safety concern, you can connect a DC-rated fuse or a DC-rated circuit breakers on the positive cable line in your power system, following these recommendations when you purchasing fuses or circuit breakers.

Select a fuse or circuit breaker with a proper rating (e.g.:1000W advice 150Adc, 1500W advice 200Adc)

Determine the short-circuit current rating of the battery and choose a battery fuses that withstand the short circuit current that may be generated by the battery.

#### ◆ Connection and Installation Steps

1. Check to be sure the inverter's power switch is turned off and that no flammable fumes are present.
2. Identify the positive (+) and negative (-) battery terminals.
3. Install a fuse holder or breaker close to the positive (+) terminal of the battery.
4. Connect a length of wire on one side of the fuse holder or circuit breaker. Connect the other



end of the wire to the positive (+) terminal of the inverter.

5. Connect a length of wire between the inverter's negative (-) terminal and the battery's negative (-) terminal.
6. Connect a short length of wire to the other terminal of the fuse holder or circuit breaker. Mark it "positive" or "+".
7. Connect the free end of the fuse or breaker wire to the positive terminal of the battery.
8. Insert a suitable fuse in the fuse holder.

9. Check to be sure that all connections between battery clips, terminals and fuses are secure and tight.

**Notes:** Sparking is normal for the first connection.

Make sure you have good secure connections- Do not over-tighten.

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## 10. Operating the AC Appliances

1. When you have confirmed that the AC appliances to be operated is turned off, plug an appliance cord into the AC outlet on the front panel of the inverter.
2. Turn ON the inverter.
3. Turn the appliance on.
4. Plug in additional appliances and turn them on.

**Notes:** 1. Plug the cord from the AC appliances you wish to operate into the AC receptacle. When turn ON the inverter. The Red and Green LED both lit for 3~5seconds then red LED not lit, green LED indicator lights to indicate that the inverter is functioning. Make sure the combined load requirement of your equipment does not exceed inverter's output rating.

2. Turn OFF the inverter. The over load LED may briefly "blink" and the audible alarm may also sound a short " chirp." This is normal. This same alarm may also sound when the inverter being connected to or disconnect from the battery.
3. When using an extension cord from the inverter to an appliance the extension cord should not be longer than 50 feet.
4. When you plan to operate more appliances, please make sure plug and switch ON the biggest one first and then smaller one.

**Caution:** The inverter is engineered to be connected directly to standard electrical and electronic equipments. Do not connect the power inverter to household or RV AC distribution wiring. Do not connect the power inverter to any AC load circuit in which the neutral conductor is connected to ground (earth) or to the negative of the battery source.

 **Warning:** Do not connect to AC distribution wiring.

## ◆ Operating Tips

### Rated versus actual current draw of equipment

Most electrical tools, appliances and audio/video equipment have labels that indicate the power consumption in amps or watts.

Be sure that the power consumption of the item you wish to operate is less than inverter's rating power.(if the power consumption is rated in amps, simply multiply by the AC volts(110V or 220V) to determine the wattage). The inverter will shutdown if it is overloaded. The overload must be removed before the inverter will restart.

Resistive loads are the easiest for the inverter to run. However, larger resistive loads, such as electric stoves or heaters, usually require more wattage than the inverter can deliver. Inductive loads, such as TV's and stereos, require more current to operate than do resistive loads of the same wattage rating. Induction motors, as well as some televisions, may require 2 to 6 times their wattage rating to start up. The most demanding in this category are those that start under load, such as compressors and pumps. To restart the unit after a shutdown due to overloading, remove the overload if necessary turn the power switch OFF then ON.

## 11. Fuse Replacement

The inverter protected by our integral electronic circuit and will automatically reset.

More than that, this inverter is equipment with a fuse that is located inside the inverter. If reverse polarity connection, the fuse burn. Please you need open the bottom to replace the fuse. There are some spare fuses inside of inverter's packing.

Please replace the fuse by same size as burn one. Normally after you replace the new fuse, the inverter recovers automatically. But sometimes there is a kind of special condition, even after you replace the new fuse, the inverter still not working properly, then please you need contact technician to find and fix the problems.

**Caution:** High voltage and high temperature inside!

## 12. Trouble Shooting

### No AC output; red LED lit, green LED not lit

Possible Cause	Suggested Solution
DC input below 10volts(battery low voltage)	Recharge or replace battery.
Inverter overheat→ thermal shutdown	Remove or reduce load, wait for inverter to cool.

### No AC output; red & green LED not lit

Possible Cause	Suggested Solution
Inverter fuses open	Open the inverter case, change the fuse. Or contact technical support.

### Non-continuous AC output; red LED lit on & off, green LED lit

Possible Cause	Suggested Solution
Inverter output power limited by overload/short circuit protection circuit	Reduce load or remove short circuit

### Reduce load or remove short circuit

Possible Cause	Suggested Solution
The voltmeter you used not a true RMS meter	Change to use a true "RMS" voltmeter when you measure the AC voltage output from modified sine wave inverter.

### No AC output (latch up); red & green LED lit

Possible Cause	Suggested Solution
Earth fault protection is activated by excessive current leakage from the load	Unplug the faulted load.

### The battery backup time shorter than expect

Possible Cause	Suggested Solution
The inverter you choose too small	Recharge or replace battery.
Battery poor quality or damaged	Remove or reduce load, wait for inverter to cool.
Battery empty or lower voltage	Recharge for the battery, or use good quality charger to charge the battery.

### No AC output; red LED lit, green LED not lit

Possible Cause	Suggested Solution
The current dissipation too much in DC cables	Use heavy cables and shorten the cables.

### Low battery alarm sounds abnormal

Possible Cause	Suggested Solution
Bad connection or wiring	Tighten all DC connections.

### Low battery alarm sounds

Possible Cause	Suggested Solution
Low battery voltage	Recharge or replace battery.

### Low battery alarm sounds

Possible Cause	Suggested Solution
Low battery voltage	if appliances does not start, then appliance is drawing excessive wattage and will not work with inverter.

### Low battery alarm sounds

Possible Cause	Suggested Solution
Appliance too close to inverter	Keep inverter and antenna distant from each other. Use shielded antenna cable. Connect antenna with amplifier.

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## 14. Maintaining the Inverter

Minimal maintenance is required to keep your inverter operating properly, periodically you should:

- ◆ Clean the exterior of the unit with a damp cloth to prevent the accumulation of dust and dirt.
- ◆ Ensure that DC cables are secure and fasteners are tight.
- ◆ Make sure the ventilation openings on the DC panel and bottom of the inverter are not clogged.

## 15. Disposal Instructions

**Home electronic equipment:** If you no longer wish to use this appliance, please take it to the applicable collection point or deliver it to a public recycling location for old electronic equipment. Electronic equipment shall under no circumstances be disposed of in the same manner as normal household waste (see the crossed-out garbage can symbol above).

**Further disposal instructions:** Hand over the appliance in a condition that will allow for safe recycling and disposal. Remove all batteries from the appliance in advance and prevent any liquid containers from being damaged. Electronic equipment may contain harmful substances. Improper use or malfunction caused by damage may adversely affect human health and harm the environment during recycling.

