

Guide to Power Inverters

What does a power inverter do, and what can I use one for?

A power inverter changes DC power from a battery into conventional AC power that you can use to operate all kinds of devices... electric lights, kitchen appliances, power tools, TVs, radios, computers, to name just a few. You just connect the inverter to a battery, and then plug your AC device into the inverter and you've got portable power whenever and wherever you need it.



The inverter draws its power from a 12 or 24 Volt battery (preferably deep-cycle), or several batteries wired in parallel (see page 4). The battery will need to be recharged as the inverter draws the power out of it. Running a car, lorry, a generator, solar panels or wind turbine can recharge the battery. Or you can use a battery charger plugged into an AC outlet to recharge the battery.

Using an Inverter for Emergency Home Back-up Power

The simple way to use an inverter for emergency power (such as during a power outage) is to use a car battery (with the vehicle running). An extension cord can then be used to run into the house, so you can plug in your electrical appliances.

What size inverter should I buy?

Short Answer: The size you choose depends on the watts (or amps) of what you want to run (find the power consumption by referring to the specification plate on the appliance or tool). We recommend you buy a larger model than you think you'll need (at least 20% to 50% more than your largest load).

Example: You want to power a computer with a 17" monitor, some lights, and a radio.

<i>Computer:</i>	<i>300 Watts</i>
<i>2 - 60 Watt lights:</i>	<i>120 Watts</i>
<i>Radio:</i>	<i>10 Watts</i>
<i>Total Needed:</i>	<i>430 Watts</i>

For this application, you would minimally need a 1000W inverter, and should give some thought to a larger one, as it is likely there will be a time when you wish you'd bought a bigger model... in this example, you might decide you'd like to run a fan, or let the kids watch TV.

Longer Answer: Determine Continuous Load and Starting (Peak) Load: You need to determine how much power your tool or appliance (or combination of them that you would use at the same time) requires to start up (starting load), and also the continued running requirements (continuous load).

What is meant by the terms "continuous-2000 Watts" and "peak surge-4000 Watts" is that some appliances or tools, such as ones with a motor, require an initial surge of power to start up ("starting load" or "peak load"). Once started, the tool or appliance requires less power to continue to operate ("continuous load").

Helpful formulas

To convert AMPS to WATTS:

Multiply: AMPS x 240 (AC voltage) = WATTS

This formula yields a close approximation of the continuous load of the appliance

To calculate approximate Start-up Load:

Multiply: WATTS x 2 = Starting Load

This formula yields a close approximation of the starting load of the appliance, though some may require an even greater starting load.

NOTE: Induction motors such as air conditioners, refrigerators, freezers and pumps may have a start up surge of 5 to 10 times the continuous rating.

Most often the start-up load of the appliance or power tool determines whether an inverter has the capability to power it. *For example:* If you have a freezer with a continuous load of 2 Amps, and a start up load of 6 Amps:

2 Amps x 240 volts = 480 Watts continuous

6 Amps x 240 volts = 1440 Watts starting load

You would need an inverter with peak-surge rating greater than 1440 Watts.

To convert AC Watts to DC Amps (for 12V system):

AC Watts divided by 12 x 1.1 = DC Amps

This is the size of the vehicle alternator you would need to keep up with a specific load; for example, to keep up with a continuous draw of 1000 Watts, you would need a 91 Amp alternator or a 100A/H battery to run the equipment for 1 hour.

Do I need Modified Sine Wave, or Pure Sine Wave?

Advantages of Pure Sine Wave inverters over Modified Sine Wave inverters:

1. Output voltage waveform is a pure sine wave with very low harmonic distortion and clean power like utility-supplied electricity.
2. Inductive loads like microwave ovens, water pumps, fridges and motors run faster, quieter and cooler.
3. Reduces audible and electrical noise in fans, fluorescent lights, audio amplifiers, TVs, game consoles and fax/answering machines.
4. Prevents computers crashing, strange print outs, glitches and noise in monitors.

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5. Reliably powers the following devices that will normally not work with modified sine wave inverters:

- Laser printers, photocopiers, magneto-optical hard drives
- Certain laptop computers (you should check with your manufacturer)
- Some fluorescent lights with electronic ballasts
- Power tools employing "solid state" power or variable speed control
- Some battery chargers for cordless tools
- Digital clocks with radios
- Sewing machines with speed/microprocessor control

Modified Sine Wave works well for most uses, and is the most common type of inverter on the market, as well as the most economical. Pure Sine Wave inverters (also called True Sine Wave) are more suited for sensitive electrical or electronic items such as laptop computers, stereos, laser printers, certain specialised applications such as digital clocks, and cooking devices multi-stage timers, and variable speed or rechargeable tools. If you wish to use those items with an inverter, then choose a Pure Sine Wave inverter. If you mostly want to run lights, TVs, microwave ovens, some tools, etc, a Modified Sine Wave inverter is fine for your needs.

One of the most common questions asked is: Will a TV work with a Modified Sine Wave inverter? LCD and LED TVs should work fine but some older CRT and plasma TVs will have interference such as lines or a hum. However, if you have any doubt about any appliance, tool or device, laptop computers, we recommend that you check with the manufacturer to be sure it is compatible with a Modified Sine Wave inverter. If it is not, choose one of our Pure Sine Inverters instead.

The difference between them is the Pure Sine Wave inverter produces a better and cleaner current allowing your appliance to run quietly and efficiently. As a result they are also more expensive due to the electronics used.

How do I hook up the Inverter? What size cable should I use, and is it included?

Many small inverters (300 Watts and under) come with a cigarette lighter adapter, and may be plugged into your vehicle's lighter socket (although you will not be able to draw more than 150 watts from the cigarette lighter socket).

Larger inverters (500 Watts and over) must be hard-wired directly to a battery. The cable size depends on the distance between battery and inverter, and will be specified in the inverters' manual.

When connecting the inverter to the battery use the thickest wire available, in the shortest length practical.

General recommendations:

<i>Inverter Size</i>	<i>< 1m</i>	<i>1m – 2m</i>	<i>2m – 3m</i>
<i>600 Watts</i>	<i>6 AWG</i>	<i>4 AWG</i>	<i>2 AWG</i>
<i>1000 Watts</i>	<i>4 AWG</i>	<i>2 AWG</i>	<i>1/0 AWG</i>
<i>1500 Watts</i>	<i>2 AWG</i>	<i>1 AWG</i>	<i>3/0 AWG</i>
<i>2500 Watts</i>	<i>1/0 AWG</i>	<i>3/0 AWG</i>	<i>350 AWG</i>

NOTE: These are general recommendations for inverters that utilise a single cable set (one positive and one negative cable) only and may not be correct for all inverters or applications. (Additionally, some inverters require two or more cable sets and therefore may require a different cable size than listed.)

Cable size recommendations may vary among inverter brands and models; check the Owner's Manual for the model you purchase before you buy the wire for it.

The maximum length generally recommended is 3m, and shorter is better. If you need more length, it is much better to put it on the AC side (as with an extension cord from inverter to appliance) than on the DC side.

What type of battery should I use (automotive or deep cycle)?

Small Inverters: Most leisure and marine batteries will provide an ample power supply for around 30 to 60 minutes even when the engine is off. Actual time may vary depending on the age and condition of the battery, and the power demand being placed on it by the equipment being operated by the inverter. If you use the inverter while the engine is off, depending on the condition of the battery you should start the engine every 30 minutes to an hour and let it run for 10 to 20 minutes to recharge the battery.

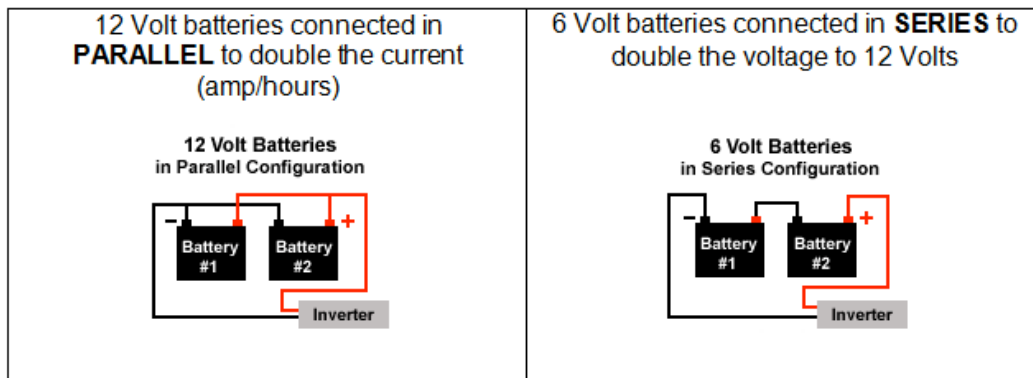
500 Watt and larger Inverters: We recommend you use deep cycle batteries, which will give you several hundred complete charge/discharge cycles. If you use the normal vehicle starting batteries they will wear out after about a dozen charge/discharge cycles. *If you do not have a deep cycle battery, we recommend that you run the engine of your vehicle when operating the power inverter.*

When operating the inverter with a deep cycle battery, start the engine every 30 to 60 minutes and let it run for 10 to 20 minutes to recharge the battery.

When the inverter will be operating appliances with high continuous load ratings for extended periods, it is not advisable to power the inverter with the same battery used to power your car. If the car battery is utilised for an extended period, it is possible that the battery voltage may be drained to the point where the battery has insufficient reserve power to start the vehicle. In these cases, it's a good idea to have an extra deep cycle battery for the inverter (installed close to the inverter), cabled to the starting battery. It is recommended to install a battery isolator between the batteries.

How do I connect two or more batteries?

It may be advisable to operate the inverter from a bank of 12 Volt batteries of the same type in a "parallel" configuration. Two such batteries will generate twice the amp/hours of a single battery; three batteries will generate three times the amp/hours, and so on. This will lengthen the time before your batteries will need to be recharged, giving you a longer time that you can run your appliances. You can also connect 6 Volt batteries together in "series" configuration to double the voltage to 12 volts. *NOTE: 6 Volt batteries must be connected in pairs.*



Operating a microwave with a power inverter

The power rating used with microwave ovens is the "cooking power" which refers to the power being "delivered" to the food being cooked. The actual operating power requirement rating is higher than the cooking power rating (for example, a microwave with an "advertised" rating of 600 watts usually corresponds to almost 1200 - 1500 Watts of power consumption). The actual power consumption is usually stated on the back of the microwave. If the operating power requirement cannot be found on the back of the microwave, check the owner's manual or contact the manufacturer. We recommend the use of a Pure Sine Wave inverter for this purpose for higher efficiency.

Operating a photographic strobe with a power inverter

A photographic strobe or flash generally requires a pure sine wave inverter capable of surging to at least 4 times the Watt/Sec rating of the strobe. For instance, a strobe rated at 300 Watts requires an inverter capable of surging to 1200 Watts or more.

Operating a laser printer with a power inverter

A laser printer generally requires a pure sine wave inverter capable of producing at least 3 times the continuous wattage rating of the printer. For instance, a laser printer rated at 500 Watts requires an inverter rated at 1500 Watts continuous or higher power.

An inkjet printer does not maintain the same requirements as a laser printer. Inkjet printers can be operated normally with a modified sine wave inverter rated to handle the printer wattage requirement.

TV and audio suggestions

Although most inverters are shielded and filtered to minimise signal interference, some interference with your television picture may be unavoidable, especially with weak signals.

Here are some suggestions that may improve reception:

1. First make sure that the television antenna produces a clear signal under normal operating conditions (i.e. at home plugged into a standard 240AC wall outlet). Also, insure that the antenna cable is properly shielded and of good quality.
2. Change positions of the inverter, antenna cables and television power cord.
3. Isolate the television, its power cord and antenna cables from the 12 Volt power source by running an extension cord from the inverter to the TV set. Ensure that any excess AC power cord is a distance away from the TV set.
4. Coil the television power cord and the input cables running from the 12 Volt power source to the inverter.

NOTE: Some inexpensive audio systems may discharge a slight "buzzing" sound when operated with an inverter. Deficient filters cause this in the audio system. The only solution to this problem is using a sound system with a higher quality power supply.

Appliance Cautions:

1. DO NOT plug small appliances into the inverter AC receptacles to directly recharge their nickel-cadmium batteries. Always use the charger provided with that appliance.

2. DO NOT plug in battery chargers for cordless power tools if the charger carries a warning that dangerous voltages are present at the battery terminals.
3. Not all fluorescent lamps operate properly with an inverter. If the bulb appears to be too bright, or fails to light, do not use the lamp with an inverter.
4. Some fans with synchronous motors may slightly increase in speed (RPM) when powered by an inverter. This is not harmful to the fan or to the inverter.
5. Certain chargers for small nickel-cadmium batteries can be damaged if plugged into an inverter. In particular, two types of appliances are susceptible to damage:
 - Small, battery-operated appliances such as flashlights, cordless razors and toothbrushes that can be plugged directly into an AC receptacle to charge.
 - Certain battery chargers for battery packs that are used in some cordless hand-tools. Chargers for these tools have a warning label stating that dangerous voltages are present at the battery terminals.DO NOT use an inverter with the above two types of equipment.

The majority of portable appliances do not have this problem. Most portable appliances use separate transformers or chargers that plug into AC receptacles to supply a low-voltage DC or AC output to the appliance. If the appliance label states that the charger or adapter produces a low-voltage DC or AC output (30 Volts or less), there should be no problem powering that charger or adapter.
6. *Safety Warning:* 240 Volts of electricity can be lethal. Improper use of a power inverter may result in property damage, personal injury, or loss of life. Please read and follow carefully the instructions in the manual provided with every inverter for important safety considerations and precautions.

General Safety Precautions and Installation Tips:

- Place the inverter on a reasonably flat surface, either horizontally or vertically.
- The inverter should not be installed in the engine compartment, due to possible water/oil/acid contamination, and excessive heat under the bonnet, as well as potential danger from petrol fumes and the spark that an inverter can occasionally produce. It's best to run battery cables to a dry, cool inverter mounting location.
- Keep the inverter dry. Do not expose it to rain or moisture. DO NOT operate the inverter if you, the inverter, the device being operated, or any other surfaces that may come in contact with any power source are wet. Water and many other liquids can conduct electricity, which may lead to serious injury or loss of life.
- Avoid placing the inverter on or near heating vents, radiators or other sources of heat. Do not place the inverter in direct sunlight. Ideal air temperature is between 10° and 30° C.
- In order to properly disperse heat generated while the inverter is in operation, keep it well ventilated. While in use, maintain several inches of clearance around the top and sides of the inverter.
- Do not use the inverter near flammable materials.
- Do not install inverters in unvented battery compartments.