

INVERTER POWER SWITCH TURNED ON

Trouble/Indication	Possible Cause	Suggested Remedy
No AC output — Fault LED lit	DC input is below 10.7 volts	Recharge or replace the battery.
	Excessive appliance load	Reset unit by turning OFF, then back ON.
	Inverter hot	Disconnect load from inverter. Operate inverter without load for a few minutes. Reconnect load.
No AC output — Power LED not lit	Bad connection or wiring	Tighten all DC connections.
Fault LED lights	Low battery voltage	Recharge battery. Remove load from inverter while recharging battery.
Motorized power tool will not operate	Excessive start-up load	If appliance does not start, appliance is drawing too much voltage and will not work with this inverter.
Motorized power tool does not operate at correct speed	Purely inductive load	Make the load not purely inductive (i.e., operate an incandescent lamp at the same time as power tool).
Television/radio interference	Snow in picture, "buzzing" sound	Keep inverter and antenna distant from each other. Use shielded antenna. Connect antenna to amplifier.

**SPECIFICATIONS**

- Output Connection: North American standard outlets
- Output Voltage: Approx. 115 volts AC, RMS 60 Hz
- Output Current: 3.5 amps max.
- Output Waveform: Modified Sine Wave
- Input Voltage: 12.5 volts DC
- Low Voltage Alarm and Shutdown: < 10.7 volts DC
- No Load Input Current: 0.3 amps max.
- Input Fuses: Internal
- Input Cables: Battery clip cables
- Additional Protection: Overload, overvoltage, overheating



**400 Watt  
Power Inverter**  
Vehicle Power System  
Converts DC Vehicle Power  
to 115 Volt AC Household Power



**USER'S MANUAL  
& WARRANTY INFORMATION**

**IMPORTANT SAFETY INFORMATION, SAVE THESE INSTRUCTIONS**

TO REDUCE THE RISK OF INJURY, USER MUST READ AND UNDERSTAND THIS INSTRUCTIONAL MANUAL. THIS MANUAL CONTAINS IMPORTANT INFORMATION REGARDING THE OPERATION AND WARRANTY OF THIS PRODUCT. PLEASE RETAIN FOR FUTURE REFERENCE.

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[www.vectormfg.com](http://www.vectormfg.com)

# IMPORTANT SAFETY INSTRUCTIONS

## WARNINGS

### TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK, EXPLOSION OR INJURY:

- **Disconnect inverter before attempting any maintenance or cleaning. Turning off controls will not reduce the risk of electric shock.**
- **NEVER connect to AC distribution wiring.**
- **Remove appliance plug from outlet strip or turn off inverter before working on the appliance. Multiple outlet power strips with switches and circuit breakers only interrupt power to the "hot" receptacle terminals. The "neutral" terminals remain powered with respect to the "ground" terminals.**
- **Do not open — there are no user-serviceable parts inside. Return to manufacturer or take to a qualified service technician when service or repair is required. Incorrect reassembly may result in a risk of electric shock or fire.**
- **DO NOT make any electrical connections or disconnections in areas designated as IGNITION PROTECTED. This inverter is NOT approved for ignition protected areas.**
- **Do not install in compartments containing batteries or flammable materials. This equipment employs components that tend to produce arcs or sparks.**
- **Use this unit in properly ventilated areas ONLY.**
- **Do not insert foreign objects into the outlets.**
- **Do not expose the unit to liquids, including water, rain or snow.**
- **Do not attempt to install or operate this unit while operating a motor vehicle.**
- **This is not a toy — keep away from children.**

### FOR USAGE ABOVE 80 WATTS:

- **Use battery clips ONLY.**
- **DO NOT use the DC accessory plug or the fuse will open.**

## CAUTIONS

- Always inspect battery supply connections and cables to ensure they are tight and that cable insulation is not damaged.
- Do not use with positive ground electrical systems. \* Reverse polarity connection will result in a blown fuse and may cause permanent damage to the inverter and will void warranty.  
*\*Most modern automobiles, RV's, trucks and boats are negative ground and can be used with this inverter.*
- Grounding the Neutral will cause the inverter to shut down. Do not operate this inverter if it is wet. Do not install in engine compartment — install in a well ventilated area.
- This inverter has not been tested for use with medical devices.

## BATTERY PRECAUTIONS

- Someone capable of being of assistance should be within the range of your voice or near enough to come to your aid when you work on or near a lead-acid battery.
- Have fresh soap and water nearby. If battery acid contacts skin or clothing, immediately wash with soap and water. If acid enters eye, flood the eye with cold running water for 10 minutes and immediately seek medical attention.
- NEVER smoke or allow a spark or flame in the vicinity of the battery.
- Remove personal metal items, such as rings, bracelets, necklaces and watches when working with a lead-acid battery. These conduct electricity. A lead-acid battery can produce a short circuit current high enough to cause a severe burn.

## APPLIANCE PRECAUTIONS

NEVER plug in battery chargers for cordless power tools if the charger carries a warning that dangerous voltages are present at the battery terminals.

NEVER plug small appliances directly into the inverter outlets to recharge nickel-cadmium batteries. Always use the charger provided with the appliance.

Certain chargers for small nickel-cadmium batteries can be damaged if plugged into the inverters. DO NOT use inverters with the following two types of equipment.

1. Small, battery-operated appliances such as flashlights, cordless razors and toothbrushes that can be plugged directly into an AC receptacle to recharge.

2. Battery chargers that have a warning label stating that dangerous voltages are present at the battery terminals.

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 DC or AC voltage output to the appliance. If the appliance label states that the charger or adapter produces a low DC or AC voltage output (30 volts or less), there should be no problem powering that charger or adapter.

Some fluorescent lamps may not operate properly with this type of inverter. If the bulb appears to be too bright, or fails to light, do not use the lamp with this inverter.

Some fans with synchronous motors may slightly increase in speed (RPM) when powered by the inverter. This is not harmful to the fan or to the inverter.

## Important Cable Information

Substantial power loss and reduced battery operating time result from inverters installed with cables that are not able to supply full power. Symptoms of low battery power can result from cables that are either excessively long or an insufficient gauge. Marine installations are also subjected to vibration and stresses that exceed those of other mobile installations. Therefore, 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.

**Read All Instructions Before Using This Power Inverter!**

**SAVE THESE INSTRUCTIONS**

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## TWO YEAR LIMITED WARRANTY PROGRAM

This limited warranty program is the only one that applies to this product, and it sets forth all the responsibilities of Vector Products, regarding this product. There is no other warranty, other than those described herein. Any implied warranty of merchantability or fitness for a particular purpose on this product is limited in duration to the duration of this warranty.

This Vector Products product is warranted, to the original purchaser only, to be free of defects in materials and workmanship for two years from the date of purchase without additional charge. The warranty does not extend to subsequent purchasers or users. Manufacturer will not be responsible for any amount of damage in excess of the retail purchase price of the product under any circumstances. Incidental and consequential damages are specifically excluded from coverage under this warranty.

This product is not intended for commercial use. This warranty does not apply to damage to units from misuse or incorrect installation/connection. Misuse includes wiring or connecting to improper polarity power sources.

**RETURN/REPAIR POLICY:** Defective products may be returned to manufacturer. Any defective product that is returned to manufacturer within 30 days of the date of purchase will be replaced free of charge. If such a product is returned more than 30 days but less than two years from the purchase date, manufacturer will repair the unit or, at its option, replace it, free of charge.

If the unit is repaired, new or reconditioned replacement parts may be used, at manufacturer's option. A unit may be replaced with a new or reconditioned unit of the same or comparable design. The repaired or replaced unit will then be warranted under the terms of the remainder of the warranty period. The customer is responsible for the shipping charges on all returned items. During the warranty period, manufacturer will be responsible for the return shipping charges to the customer in the United States.

**LIMITATIONS:** This warranty does not cover accessories, such as charging adapters, bulbs, fuses and batteries, damage or defects resulting from normal wear and tear (including chips, scratches, abrasions, discoloration or fading due to usage or exposure to sunlight), accidents, damage during shipping to our service facility, alterations, unauthorized use or repair, neglect, misuse, abuse, failure to follow instructions for care and maintenance, fire, flood and Acts of God.

If your problem is not covered by this warranty, call our Technical Support Department toll free at (800) 544-6986 for general repair information and charges if applicable.

**STATE LAW RIGHTS:** This warranty gives you specific legal rights. Some states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation of incidental or consequential damages, so the exclusions or limitations stated herein may not apply. This warranty gives the purchaser specific legal rights: other rights, which vary from state to state, may apply.

**TO REQUEST WARRANTY SERVICE FOR THIS PRODUCT:** Contact Technical Support by telephone, fax or mail (see below). We suggest that you keep the original packaging in case you need to ship the unit. When returning a product, include your name, address, phone number, dated sales receipt (or copy) and a description of the reason for return and product serial number. After repairing or replacing the unit, we will make every effort to return it to you within four weeks.

**WARRANTY ACTIVATION:** Please complete Warranty Activation Card and mail to Vector Products. Enter "VEC024B" as Model and "400 Watt Power Inverter Vehicle Power System" as Product Type. All Vector products must be registered within 30 days of purchase to activate this warranty. Mail the completed registration form, along with a copy of the original sales receipt, to:

BLACK & DECKER  
4409 W. Wanda,  
McAllen, TX 78503

• TOLL FREE: (800) 544-6986 • FAX: (956) 630-0492 •

WARRANTY IS NON-TRANSFERABLE.

RD092106

## INTRODUCTION

Your new **VEC024B 400 Watt Power Inverter Vehicle Power System** is one in a series of the most advanced DC to AC inverters available. With proper care and appropriate usage, it will give you years of dependable service in your car, truck, RV or boat.

The **VEC024B** supplies 400 watts of continuous power, in the form of a standard North American household outlet that is ready to deliver 115 volt AC power whenever and wherever you need it! The heavy-duty inverter has enough power to run most household or electronic appliances. It also comes equipped with battery clips to handle higher amperage/load applications, such as: power tools, stereo amplifiers, vacuums, etc. Added safety features include automatic shutdown and a low battery alarm to prevent damage to your battery.

This Vector Power Inverter is configured with the latest Soft Start Technology (SST). Before introduction of SST, high start-up currents from large inductive loads could shut down the inverter. SST improves inverter operation. Three major features incorporated in SST include: First, gradual voltage ramp-up during inverter start-up. This eliminates failed cold starts under load. Second, output that momentarily dips in voltage and quickly recovers to allow large motorized loads to start. This eliminates almost all shutdowns from momentary overloads. Last, the inverter needs to be turned off then turned on once the overload that caused the inverter shutdown is removed.

This power inverter also incorporates a new cooling technology that directly benefits our customers. The new design more efficiently cools the power transistors, and combined with SST, dramatically increases reliability and the life of the product.

## CONTROLS, INDICATORS AND CONNECTORS

Figure 1 details the front panel, featuring the unit's two 115 volt AC Outlets, ON/OFF Power Switch and two LED indicators. The green LED indicates power and proper operation of the inverter and the red LED indicates inverter shutdown from an overload or over-temperature fault. In addition to turning the unit ON and OFF, the ON/OFF Power Switch can be used to force reset of the inverter circuits.

Power is supplied through two standard North American outlets that can accommodate either two- or three-pin AC plugs.

Figure 1 Front Panel



Figure 2 shows the back panel of the inverter, where the DC Power Connections and high speed cooling fan are located.

Figure 2 Back Panel

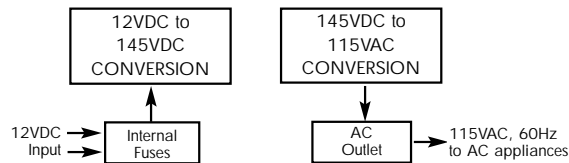


## HOW THIS INVERTER WORKS

The power inverter converts low voltage DC (direct current) from a battery or other power source to standard 115 volt AC (alternating current) household power.

### Principle of Operation

The inverter converts power in two stages. The first stage is a DC to DC conversion process that raises the low voltage DC at the inverter input to 145 volts DC. The second stage is the actual inverter stage that converts the high voltage DC current into 115 volts, 60 Hz AC current.



The DC-to-DC converter stage uses modern high frequency power conversion techniques that have replaced the bulky transformers found in less technologically-advanced models. The inverter stage uses advanced power MOSFET transistors in a full bridge configuration. This ensures excellent overload capacity.

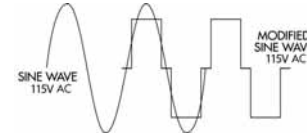
### The Power Inverter Output Waveform

The AC output waveform of the Power Inverter is known as “modified sine wave.” It is a waveform that has characteristics similar to the sine wave shape of utility power.

This type of waveform is suitable for most AC loads, including linear and switching power supplies used in electronic equipment, transformers, and motors.

The modified sine wave produced by the Power Inverter has an RMS (root mean square) voltage of 115 volts, 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 a Fluke 179, Fluke 79 III series, Beckman 4410, or Triplett 4200.

### Modified Sine Wave and Sine Wave Comparison



## PROTECTIVE FEATURES OF THE INVERTER

The Power Inverter monitors the following potentially hazardous conditions:

**Low Battery Voltage** — This condition is not harmful to the inverter, but could damage the power source. An alarm will sound and the Inverter automatically shuts down when input voltage drops below 10.7 volts. When the condition is corrected, the inverter will automatically restart.

**Over Voltage Protection** — The Power Inverter will automatically shutdown when the input voltage exceeds 15.0 volts DC.

**Overload Protection** — The unit will automatically shut down when the continuous draw exceeds the 400 watts. Reduce the load and manually reset using the inverter's ON/OFF Power Switch.

**Over Temperature Protection** — If the temperature inside the Power Inverter reaches 150°F, the unit will automatically shut down. Allow the unit to cool for at least 15 minutes before restarting after a heat-related shutdown. Unplug the unit while cooling.

If the Fault LED lights when the battery is fully charged, follow the steps outlined in the “Troubleshooting” section of this User's Manual. The Fault LED will light if there is an excessive voltage drop between the battery and the inverter.

**Note: Reverse polarity or short circuit condition may cause external or internal fuses to open and may cause irreversible damage to the Power Inverter. Take extra care to ensure a proper polarity hook-up.**

## INSTALLATION AND OPERATING INSTRUCTIONS

### Power Source Requirements

The power source must provide a nominal voltage of 12.5 volts DC and must be able to supply the necessary current to operate the load. The power source may be a battery or a well-regulated DC power supply. To obtain a rough estimate of the current (in amperes) the power source must deliver, simply divide the power consumption of the load (in watts AC) by 10.

Example: If a load is rated at 400 watts AC, the power source must be able to deliver: 400 divided by 10 = 40 amperes.

## ⚠ CAUTION

- **The Power Inverter must be connected only to batteries with a nominal output voltage of 12 volts. The unit will not operate from a 6 volt battery and will sustain permanent damage if connected to a 24 volt battery.**
- **Reverse polarity connection will result in a blown fuse and may cause permanent damage to the inverter.**

### Connection to a Power Source

The Power Inverter comes equipped with a DC accessory outlet plug and battery clip cables for connection to a power source.

#### Connecting to a Power Source Using the Accessory Outlet Plug

The DC accessory outlet plug is suitable for operating the inverter at power outputs up to 80 watts. The connectors on the DC Accessory Outlet Plug are clearly marked POSITIVE (+) and NEGATIVE (-). Attach them to the appropriate post on the back of the inverter and secure by screwing on the connector caps.

Connect the inverter to a power source by inserting the plug end of the DC Accessory Outlet Plug firmly into the DC accessory outlet of a vehicle or other functioning 12 volt DC power source.

## ⚠ CAUTIONS

- **When operating above 80 watts, do not use the 12 Volt DC Accessory Outlet Plug. Use the provided cables or direct hardwiring.**
- **Do not use with positive ground electrical systems.**

**Notes: Most vehicle accessory outlet circuits have fuses rated at 15 to 20 amps or less. To operate at full power, either use the battery clip cable (supplied) or directly wire to the power source with user-supplied wire and fuse. The majority of modern automobiles, RVs and trucks are negative ground.**

**Some vehicles require that the ignition be switched to the accessory position to power the accessory outlet.**

#### Connecting to a Power Source Using the Provided Cables

Use the provided cables and connect the Power Inverter directly to the 12 volt power source as follows:

1. Make sure the Power Inverter power is turned OFF and that no flammable fumes are present in the installation area.
2. Connect the RED cable to the RED post marked (+) on the back of the inverter. Connect the battery clip to the POSITIVE terminal of the battery.
3. Connect the BLACK cable to the BLACK post marked (-) on the back of the inverter. Connect the battery clip to the NEGATIVE terminal of the battery.
4. Make sure that all connections between battery clips and terminals are secure.

#### Direct Hardwiring to Power Source

Use #14 AWG wire if the inverter to power source connection is 4 feet or less. For longer cable lengths use #8 AWG wire. In either case, protect the positive (+) wire from shorts by installing a 50 amp fuse or circuit breaker close to the DC power source (battery) terminal.

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 (-) DC power source (battery) terminals.

3. Install a fuse holder or breaker close to the POSITIVE (+) terminal of the DC source (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 DC power source 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 DC power source (battery).
8. Test the inverter by turning it on and plugging in a 100 watt lamp or equipment.
9. If the inverter is not operating properly, then refer to the "Troubleshooting" section of this manual.

## ⚠ CAUTIONS

- **Loose connectors may cause overheated wires and melted insulation.**
- **Check to make sure you have not reversed the polarity. Damage due to reversed polarity is not covered by our warranty.**

### Connection To Load

The Power Inverter is equipped with a standard North American three-prong type outlet. Plug the cord from the equipment you wish to operate into the AC outlet. Make sure the load requirement of your equipment does not exceed 400 watts.

The Power Inverter is engineered to be connected directly to standard electrical and electronic equipment in the manner described above. 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 DC (battery) source.

## ⚠ CAUTION – Rechargeable Devices

**Certain rechargeable devices do not operate well from a modified sine wave inverter. They only operate properly from a standard household outlet which provides a pure sine wave. Therefore, Vector recommends that these types of devices be operated from a standard household outlet only, not from the inverter.**

**This problem does not occur with the majority of battery-operated devices. Most of these devices use a separate charger or transformer that is plugged into an AC outlet. This inverter is easily capable of operating most chargers and transformers.**

### Placement of the Inverter

For best operating results, the inverter should be placed on a flat surface, such as the ground, car floor or seat, or other solid surface. A power cord has been provided for easy positioning of the inverter. The inverter should only be operated in locations that meet the following criteria:

DRY – Do not allow water and/or other liquids to come into contact with the inverter.

**COOL** – Ambient air temperature should be between 30°F (-1°C) non-condensing and 105°F (40°C). Do not place the inverter on or near a heating vent or any piece of equipment that is generating heat above room temperature. Keep the inverter away from direct sunlight, if at all possible.

**VENTILATED** – Keep the area surrounding the inverter clear to ensure free air circulation around the unit. Do not place items on or over the inverter during operation. A fan is helpful if the inverter is operating at maximum power outputs for extended periods of time. The unit will restart after it cools.

**SAFE** – Do not use the inverter near flammable materials or in any locations that may accumulate flammable fumes or gases.

## 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 the power consumption of the item you wish to operate is rated at 400 watts or less. (If the power consumption is rated in amps AC, multiply by the AC volts (115) to determine the wattage).

The inverter has overload protection, so it is safe to try to operate equipment rated at 400 watts or less. The inverter will shut down if it is overloaded.

Resistive loads are the easiest for the inverter to operate. However, large resistive loads, such as electric stoves or heaters usually require more wattage than this inverter can deliver on a continuous basis. Inductive loads, such as TVs 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 two to six times their wattage rating to start up. The most demanding in this category are those that start under load, such as compressors and pumps.

Testing is the only definitive way to determine whether a specific load can be started and how long it can run.

## **⚠ CAUTION**

**This inverter will not operate high wattage appliances or equipment that produces heat, such as hair dryers, microwave items, or toasters.**

### ***Battery Operating Time***

With a typical vehicle battery, a minimum operating time of 2 to 3 hours can be expected. In most instances, 5 to 10 hours of operating time is achievable. However, Vector recommends that the operator start the vehicle every half hour to recharge the battery system. This will guard against any unexpected shut-down of the equipment and will ensure that there is always sufficient battery capacity to start the vehicle's engine. The inverter's Fault LED will light when DC voltage drops below 11.0 volts.

The inverter may be used whether or not the vehicle's engine is running. However, the inverter may not operate while the engine is starting since the battery voltage can drop substantially during cranking.

The inverter draws less than 0.8 ampere from the battery when it is not supplying power to a load and ON/OFF Switch is in ON position. In most instances, the inverter can be left connected to the battery when not in use since it draws so little current. However, if the vehicle is to remain unused for several days, disconnect the inverter from the battery.

## **CARE AND MAINTENANCE**

### **Storage**

1. Ideal storage temperature range is 50-68°F (10-20°C).
2. Store and use the inverter in a cool, dry place with adequate ventilation.
3. Avoid locations that are exposed to heating units, radiators, direct sunlight or excessive humidity or dampness.

### **Maintenance**

This unit contains no user-serviceable parts. It is recommended that the unit be returned to manufacturer for service (see the Warranty for repair/replacement policy and contact information).

### **Fuse Replacement**

This power inverter is equipped with multiple internal fuses. Normally, these fuses will not blow unless there is a serious problem inside the unit. Internal fuses are replaceable; however, only electronically knowledgeable people should attempt fuse replacement. If the unit is damaged during fuse replacement, the warranty may be voided. Vector recommends contacting Technical Support for guidance. Call toll free: (800) 544-6986.

## **TROUBLESHOOTING**

### **Common Audio/Visual Problems**

#### ***“Buzzing” sound in audio systems***

Some inexpensive stereo systems and “boom boxes” emit a buzzing sound from their speakers when operated from the Power Inverter. This occurs because the power supply in the electronic device does not adequately filter the modified sine wave produced by the inverter. The only solution to this problem is to use a higher quality sound system that incorporates a higher quality power amplified supply.

#### ***Television Interference***

The Inverter is shielded to minimize interference with TV signals. However, in some instances, interference may still be visible, particularly with weak TV signals. Try the following corrective measures:

- Position the inverter as far as possible from the television, the antenna and the antenna cables. Use an extension cable, if necessary.
- Adjust the orientation of the inverter, the antenna cables and the TV power cord to minimize interference.
- Make sure that the antenna feeding the television provides an adequate (“snow free”) signal and that high quality, shielded antenna cable is used.