

# **QuietPower 1800 (QP-1800) DC to AC Power Inverter**

**Model QP-1800 / PN 287A107 (System)**

**Owner's Manual  
Revised 15 OCT 01**

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# **1 Important Safety Instructions**

## **Item Identification**

The QuietPower Inverter System, PN 287A107, consists of four (4) items:

- QuietPower Inverter QP-1800 (PN 287A101) [Qty 1]
- QuietPower Inverter NATO SLAVE Cable (PN 287A106) [Qty 1]
- QuietPower Inverter Vibration Isolators (Neoprene, Cylindrical) with mounting hardware [Qty 4]
- QuietPower Inverter Operator's Manual [Qty 1]

## **General Safety Precautions**

1. Save these instructions. This Owner's Manual contains important safety and operating information for the QuietPower Inverter.
2. The QuietPower Inverter has a Ground Fault Circuit Interrupter (GFCI) and a Circuit Breaker for your safety. These features are critical to the safe operation of this system and must not be disabled.
3. Do not expose the QuietPower Inverter to rain, snow, spray, bilge or dust. To reduce risk of fire hazard, do not cover or obstruct the ventilation openings. Do not install the QuietPower Inverter in a zero-clearance compartment. Overheating may result.
4. Do not use attachments not recommended or sold by Iris Technology. Doing so may result in a risk of fire, electric shock, or injury to persons.
5. The QuietPower Inverter (PN 287A101) is designed to connect to a military vehicle 24 VDC power system through the supplied NATO SLAVE Cable (PN 287A106).
6. To avoid a risk of fire and electric shock, make sure that existing wiring is in good electrical condition. Do not operate the QuietPower Inverter with damaged wiring.
7. Do not operate the QuietPower Inverter if it has received a sharp blow, been dropped, or otherwise damaged in any way. If the QuietPower Inverter has been damaged, please refer to Section 8.0 of this manual: Warranty Service.
8. Do not disassemble the QuietPower Inverter; see the Service section of this manual for instructions on obtaining service for the QuietPower Inverter. Attempting to service the unit yourself may result in a risk of electrical shock or fire.
9. To reduce risk of electrical shock, disconnect the DC power from the QuietPower Inverter before attempting any maintenance or cleaning or working on any equipment and circuits connected to the QuietPower Inverter. Turning off controls will not reduce this risk.

## **Explosive Gas Precautions**

1. This equipment contains components which can produce arcs or sparks. To prevent fire or explosion do not install in compartments containing batteries or flammable materials or in locations which require ignition protected equipment. This includes any space containing gasoline-powered machinery, fuel tanks, or joints, fittings, or other connection between components of the fuel system.
2. Working in the vicinity of a lead-acid battery is dangerous. Batteries generate explosive gases during normal battery operation.

3. To reduce the risk of battery explosion, follow these instructions and those published by the battery manufacturer and the manufacturer of the equipment in which the battery is installed.

### **Precautions When Working With Batteries**

1. Someone should be within range of your voice or close enough to come to your aid when you work near a lead-acid battery.
2. Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.
3. Wear complete eye protection and clothing protection. Avoid touching eyes while working near batteries.
4. Clean battery terminals before making connections. Wear eye protection to keep corrosion from coming in contact with eyes.
5. If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters eye, immediately flood eye with running cold water for at least 20 minutes and get medical attention immediately.
6. NEVER smoke or allow a spark or flame in vicinity of battery or engine.
7. Do not drop a metal tool on the battery. The resulting spark or short-circuit on the battery or other electrical part may cause an explosion.
8. Remove personal metal items such as rings, bracelets, necklaces, and watches when working with a lead-acid battery. A lead-acid battery produces a short-circuit current high enough to weld a ring or the like to metal, causing a severe burn.

### **FCC INFORMATION**

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that the interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

### **Department of the Navy Product Evaluation**

This equipment has been tested by SPAWAR (Department of the Navy) for MARCORSYSCOM and is recommended for use in wheeled military vehicles. Contact Iris Technology for details about obtaining a copy of this evaluation (Restricted Distribution, FOUO).

## **2 Introduction**

Thank you for your purchase of this QuietPower Inverter. As a high quality, true sine wave output inverter, you can expect the QuietPower to deliver exceptional performance and give you years of dependable operation. The true sine wave AC output from the QuietPower Inverter ensures all AC loads operating from the unit perform efficiently and correctly. Since these loads were designed to operate from true sine wave voltage, you can expect these loads to operate the same as if operating from grid/utility supplied power. In some cases, the true sine wave output from the QuietPower Inverter is even superior to the power supplied by your utility company.

To get the most out of your QuietPower Inverter, please carefully read and follow the instructions in this guide. Pay special attention to the Important Safety Instructions in this guide and to the CAUTION and WARNING statements found throughout the guide and on the product. Please retain all packaging.

Should you have any questions before, during, or after installation, please call Iris Technology's Customer Service Department for help.

Customer Service Toll Free: (866)240-9540  
Customer Service Phone: (949)975-8410  
Customer Service Fax: (949)975-8498  
Customer Service Email: [support@iristechnology.org](mailto:support@iristechnology.org)

Please record the following information for use if you need to contact Iris Technology for servicing of the unit.

QuietPower Inverter Serial #: \_\_\_\_\_

Place of purchase: \_\_\_\_\_

Date of purchase: \_\_\_\_\_

Contract reference \_\_\_\_\_

### **2.1 QuietPower Inverter Key Features**

The QuietPower Inverter utilizes advanced high frequency switching technology in the power conversion process. The circuits are similar to those used in power supplies for computers and other electronic equipment. This technology offers several benefits:

- Light weight: for easy installation
- Totally silent: for quiet operation
- High surge capability: for 'hard-to-start' AC loads

See Section 10 Specifications, for complete product specifications.

#### **2.1.1. Inverter Function**

When connected properly and the power switch is turned to the 'I' position, the QuietPower Inverter draws power from a battery and delivers a true sine wave AC output voltage that is similar to the voltage supplied by your local utility. As long as the battery voltage is within the operating range of the unit, the QuietPower will continue to deliver AC power to the loads connected. High and low battery shutdowns will engage if the battery voltage falls out of the specified range of operation (20-32 VDC).

### 2.1.2 Control Panel

The Control Panel provides '0/1'(Off/On) control and displays operating information so you can monitor the status of the Inverter and your batteries.

This panel can be removed and re-attached in different orientations so the display information is directed at you in the most convenient fashion, for all recommended mounting configurations.

## **3 Installation**

This section contains instructions for installing the QuietPower Inverter. After securing the unit and making wiring connections, do not turn the unit on.

Proceed to the next section of the manual which provides operating instructions.

### **3.1 Requirements for Installation**

What You Need to Install the QuietPower Inverter

You need the following tools and hardware to properly install the QuietPower Inverter:

- Wrench for DC terminals ( $\frac{1}{2}$ " or 13 mm)
- Wrench for Vibration Isolators (optional use)
- DC cables (supplied as PN 287A106)

### **3.2 Locating the QuietPower Inverter**

The QuietPower Inverter utilizes complex electronic circuits and although design precautions have been made for protection of these circuits, they can be susceptible to damage from use in extreme environments. The QuietPower Inverter should only be installed in a location that meets the following requirements:

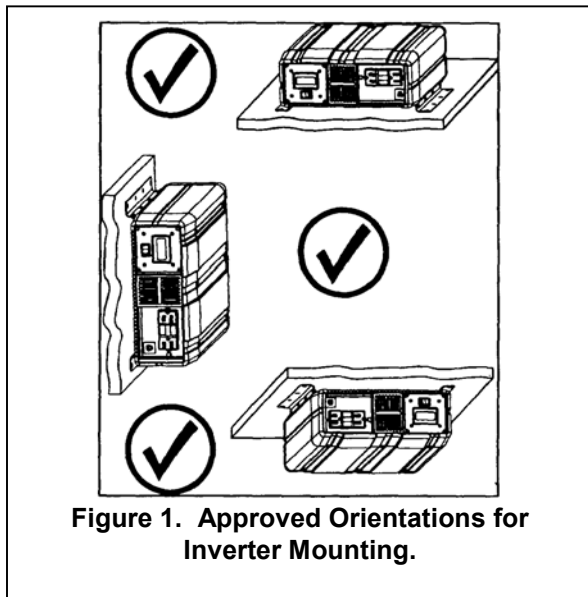
- Dry: do not allow water or other fluids to drip or splash on the QuietPower Inverter. Do not mount the QuietPower Inverter in an area subject to splashing or dripping water or bilge.
- Cool: normal ambient air temperature should be between 0°C (32°F) and 25°C (77°F) - the cooler the better within this range. Refer to the operating temperature information in the specifications section of this manual.
- Ventilated: allow at least 5 inches (13 cm) of clearance all around the unit. Ensure that the ventilation openings on the unit are not obstructed. If mounting in a compartment, ventilate with louvers or cut-outs.
- Safe: do not install the QuietPower Inverter in the same compartment as batteries or in any compartment capable of storing flammable liquids such as gasoline. Do not install the QuietPower Inverter in an engine compartment or other location where ignition protected equipment is required.
- Dust-free: do not install the QuietPower Inverter in a dusty environment where either dust, wood particles or other filings/shavings are present. These can be pulled into the unit when the cooling fan is operating.
- Close to AC junction box: avoid the use of extended wire lengths if possible.
- Close to battery/batteries: Avoid excessive cable lengths but do not install the QuietPower Inverter in the same compartment as batteries. Use the recommended wire lengths and sizes (see section 3.4.4). Also do not mount the QuietPower Inverter where it will be exposed to the gases produced by the battery. These gases are very corrosive and prolonged exposure will damage the QuietPower Inverter.
- Protected from battery acid: Never allow battery acid to drip on the QuietPower Inverter or its wiring when reading specific gravity or filling the battery.

### 3.3 Mounting the QuietPower Inverter

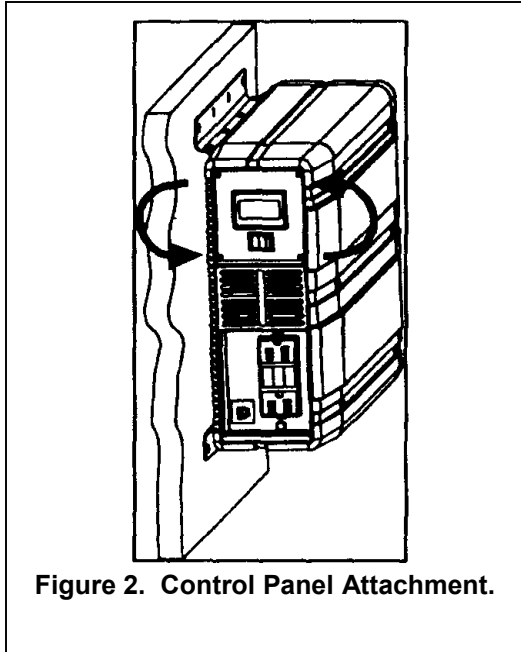
Before mounting the QuietPower Inverter, test the chosen location for adequate space around the unit to allow for connections and ventilation. Mounting hardware should be corrosion resistant and  $\frac{1}{4}$ " or 6 mm diameter screws. Your mounting system should be able to support three times the weight of the QuietPower Inverter, which weighs approximately 16 pounds (7.3Kg). The more clearance for ventilation around the unit, the better the performance. At a minimum, have 5" of free space on all sides of the inverter. For your convenience, four (4) Neoprene Cylindrical Sandwich Mount Vibration Isolators and attachment hardware are provided for shock mounting.

#### To mount the QuietPower Inverter

Mount the QuietPower Inverter on either a horizontal or vertical surface (such as a bulkhead) using the mounting holes provided. For secure, permanent mounting, use all eight mounting holes. Optionally, use four shock mounts provided. To meet regulatory requirements, the QuietPower Inverter must be mounted in one of the three orientations shown in Figure 1 below.



Remove and re-attach the front panel depending on the orientation of the base unit itself. For example, if the unit is mounted on a vertical surface, you may want to remove the panel and attach it so it is again readable horizontally. This can be done as depicted in Figure 2, below, by removing the 4 screws, taking the panel out of the housing, rotating the panel and reattaching the panel to the base unit. Be sure to re-install all four screws.



**Figure 2. Control Panel Attachment.**

### **3.4 Wiring the QuietPower Inverter**

Once your DC connections and ground wiring connection are complete, the unit is ready to deliver AC power via the front outlet.

#### **3.4.1 Making DC Wiring Connections**

The cables supplied with the QuietPower Inverter System are approximately 12 feet long and are fabricated from 2/0 AWG multi-strand flexible cables. They are terminated with a NATO SLAVE Plug at one end and two (2) lug terminals which connect to the Inverter.

Before making connections, route the positive and negative battery cables directly to the DC connection terminals on the QuietPower Inverter. Slide the plastic terminal connector covers (boots) over the positive and negative cables (the red boot slides on the positive cable and the black boot slides on the negative cable). Do not route the cables through a distribution panel, battery isolator, or other device that will add additional voltage drops.

#### **3.4.2 DC Grounding**

The QuietPower Inverter has a lug on the rear panel labeled Chassis Ground. This lug is used to connect the chassis of the QuietPower Inverter to your DC ground as is required by regulations for some installations.

## **4 QuietPower Inverter Operation**

This section details how the unit functions as an inverter, provides information on the control panel, and describes operating limits for inverter operation.

### **4.1. Principles of Operation**

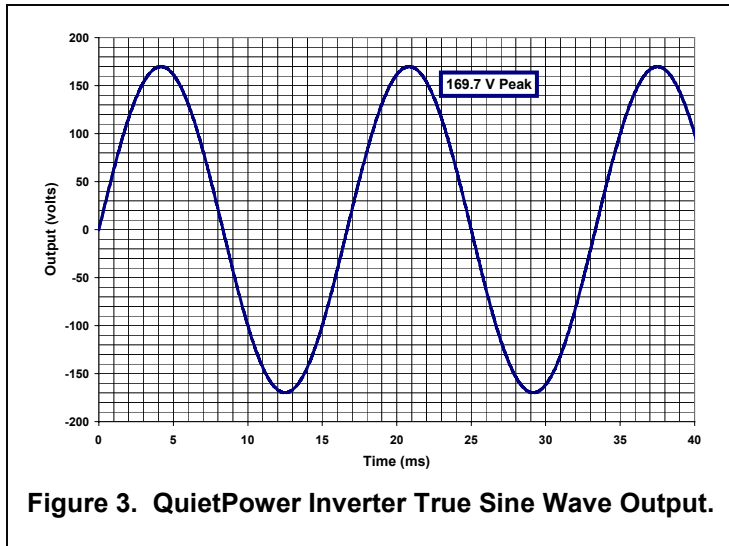
The QuietPower Inverter converts power from the batteries in two stages. The first stage is a DC-to-DC converter, used to raise the low voltage DC input to high voltage DC. The second stage is the actual inverter stage, taking the high voltage DC and converting it to a precise, true sine wave AC output.

The DC-to-DC converter stage uses modern high frequency power conversion technology that eliminates the bulky, low frequency (50/60 Hz) based transformers found in inverters using older technology. The inverter stage uses advanced power semiconductors that provide excellent overload capabilities.

### **4.2 Output Waveform**

The AC output waveform of the QuietPower Inverter is a “true sine wave” with typically 1% Total Harmonic Distortion (THD). Figure 3 illustrates the output waveform from the QuietPower Inverter. This waveform is nearly identical to your utility-supplied power and in some cases where utility power is poor, the QuietPower Inverter delivers cleaner, more precise AC power.





There are many advantages of true sine wave over other wave forms delivered by other inverters:

- AC powered equipment is designed to operate with true sine wave. Many loads will perform better when connected to the QuietPower Inverter.
- motor loads start easier
- reduced stress on surge protection circuitry within the equipment means potentially longer equipment life

Many advantages of true sine wave are also due to the absence of the sharp-rising edges of waveforms prevalent in either modified sine wave or square wave

inverters. Some of these advantages are:

- reduced interference in audio or electronic equipment, especially those that use less complex internal power supplies
- significantly reduced in-rush current into capacitive loads and reduced stress on the output devices of the inverter, potentially lengthening equipment life
- motor loads generally operate cooler and quieter without the extra harmonic distortion generated by a modified sine wave

### 4.3 Control Panel

Once the QuietPower Inverter is properly installed and connected to batteries, it is ready to begin delivering AC power to your loads. The control panel is the interface between you and the inverter. This section describes the features of this panel and is followed by other sections that contain inverter operating information.

1. **INVERTER O/I:** this switch turns the QuietPower Inverter ON ('I'). It is also used to enable or disable POWERSAVE mode during the power-up sequence.
2. **LIQUID CRYSTAL DISPLAY (LCD) DISPLAY:** displays input current from the battery and battery voltage numerically. A multi-segment bar graph displays actual output power in watts from the inverter when a load is being operated
3. **MULTI-POSITION MOUNT:** the control panel is designed so it can be removed and re-attached to the chassis in 90 degree increments depending on the mounting orientation of the inverter itself. The panel can also be removed entirely from the unit and mounted remotely, with the purchase of the optional QuietPower Interface Panel.
4. **FAULT CONDITION DISPLAY:** should a fault occur, the error will immediately be displayed. An audible alarm sounds and the back-lighting of the display will flash to draw attention to the fault condition (see Section 6.1)

To operate the QuietPower Inverter:

Turn the unit ON by moving the rocker switch on the control panel to 'I' position. The following information will be displayed (upon each power-up), identifying the type and configuration of your QuietPower:

- QuietPower model number (1800 watt)
- Input Voltage, Output Voltage and Frequency configuration
- POWERSAVE mode OFF (factory set default)

Following the display of this information, the control panel then defaults to the standard display information of input voltage, input current and output power. When a load is connected, the output power (watts) is displayed in bar-graph form.

Once the standard display screen is shown, the QuietPower Inverter is ready to deliver AC power to your loads. You can now plug in a load to the front outlet of the unit. The loads should operate from the inverter as they would from utility power. Section 4.5 explains the operating limits for the QuietPower Inverter.

#### 4.4 QuietPower POWERSAVE Mode

Your QuietPower Inverter has a function mode called POWERSAVE. This “sleep” mode shuts off much of the power control circuitry of the QuietPower Inverter as well as the display back-lighting, reducing the standby current draw considerably. With this mode enabled, the unit draws approximately 1.5 watts while powered up but with no load on the inverter. The QuietPower Inverter detects the presence of a load by sending out pulses approximately once every 2.5 seconds. Full output power is available with the detection of a load. The unit will remain in POWERSAVE mode if the load it detects is less than 10W for the QuietPower 1000 and less than 20W for the QuietPower 1800. This is a factory set search mode setting and cannot be changed.

You would want to enable POWERSAVE mode if the inverter is only being used periodically to power loads. This allows the inverter to draw less power from the batteries during non-use periods. If the inverter is being used frequently and your batteries are being recharged during inverter use (e.g. vehicle alternator), or soon after inverter use, you can leave POWERSAVE disabled.

Your QuietPower is factory default set to POWERSAVE OFF. To enable the POWERSAVE mode, follow these steps:

- 1) Turn the Control Panel switch to ‘0’ position
- 2) Switch the unit back to ‘1’ position. You will see the power-up information being displayed as described previously (model number and voltage/frequency configuration)
- 3) When the Control Panel displays “POWERSAVE OFF” turn the switch to ‘0’ position, wait for approximately 3 seconds, and then turn the switch back to ‘1’ position again. “POWERSAVE ON” will now be displayed during the start-up sequence and when the normal state display appears, a small pointer will be visible, indicating POWERSAVE mode is enabled. Follow the same procedure for disabling POWERSAVE mode.

#### 4.5 Inverter Operating Limits and Protection Features

Power Output: The QuietPower 1800 delivers 1800 watts continuously. The following table displays the continuous and peak current ratings as well as surge rating:

**Table 1. Operating Limitations.**

Model	Continuous AC Output Current Rating	Peak AC Output Current Rating	Surge Rating (max. watts delivered for 5 seconds)
QP-1800	15A	45A	2900W

The unit above will be able to operate all AC loads rated at or below these power ratings. Some high horsepower induction motors used in pumps and other motor-operated equipment require very high surge currents to start and the QuietPower Inverter battery combination may have difficulty starting these loads.

If you have problems with certain loads, ensure that battery connections are solid, your DC cables are appropriately sized, and that the battery is of sufficient capacity and fully charged.

Input Voltage: The QuietPower Inverter operates from an input voltage ranging from 20 to 32 VDC.

Peak performance for these inverters occurs when DC input voltage is in the range of 24 volts to 30 volts for 24V models. The QuietPower Inverter will indicate high and low DC voltage conditions as follows:

**Table 2. System Trip Voltages.**

Model	DC Input Over Voltage Alarm	DC Input Over Voltage Shut-down	DC Input Under Voltage Alarm	DC Input Under Voltage Shut-down
QP-1800	31.6 VDC	32.0 VDC	21.0 VDC	20.0 VDC

The over-voltage protection and shutdown protects the inverter against excessive input voltage, should the unit be connected to a higher voltage than it is designed for (up to 35 VDC - higher voltages may cause damage). Low input voltage shutdown protects your battery from being over-discharged. The QuietPower Inverter requires a manual reset to re-start after shutdown from either high or low input voltage. Turn the power switch to '0' and then back to 'I' to re-start the unit.

Output Overload Protection: A short circuit may be applied to the output continuously without damage to any internal components. The QuietPower Inverter will shutdown in less than five seconds when the output falls 10% below the nominal voltage as a result of current limiting.

Input Reverse Polarity Protection: the internal circuitry of the QuietPower Inverter is protected by an internal, 32V, fast-blow fuse. This fuse is only replaceable by qualified service personnel. In many reverse polarity conditions, this fuse will protect internal circuits, however, certain high voltage/current situations may cause internal damage.

## **5 Testing**

The following simple test procedure should ensure that the QuietPower Inverter is connected and installed properly.

To test the QuietPower Inverter:

1. Double check all wiring terminals on the inverter to observe correct polarity and secure connections.
2. Turn rocker switch to 'I' position.
3. Observe the power-up sequence on the display. The normal-state inverter display of input current and input voltage should come up.
4. Plug a test load (e.g. a light bulb) into the outlet of the QuietPower Inverter. The load should function normally. Observe the output power bar graph - it should increase with load demand,
5. Repeat Test 4 with the QuietPower in "Powersave" mode.
6. The QuietPower Inverter is now ready for operation

## 6 Troubleshooting Guide

This section describes potential installation and configuration problems and solutions, including fault conditions and indicators. More information is found in the Technical Addendum and on our web site.

### 6.1 Fault Conditions and Indicators

The following fault conditions are displayed on the control panel along with an alarm sound and blinking LCD back-light.

**Table 3. Fault Indicators.**

Control Panel Indication	Fault Condition	Solution
HIGH BATT SHUTDOWN	Battery voltage too high	Check for fault with battery charging system. Manually reset inverter by turning switch to '0' then to '1' again.
LOW BATT SHUTDOWN	Battery voltage too low	Charge battery. Manually reset inverter by turning switch to '0' then to '1' again.
OVERLOAD SHUTDOWN	Battery current too high, probable AC overload	Reduce load on the inverter.
OVERTEMP SHUTDOWN	System over-temperature	Improve ventilation and cooling and/or reduce load on the inverter.
SYSTEM SHUTDOWN PS_FAULT SHUTDOWN DC-DC SHUTDOWN	Overload or system hardware fault	Ensure all loads are disconnected. Try to reset the unit by switching to '0' and then to '1'. If unit still does not operate, Contact Iris Technology for service warranty replacement.

The table below provides some troubleshooting tips:

**Table 4. Troubleshooting Tips.**

Problem and symptoms	Possible Cause	Solution
No output voltage and control panel reading 20.4 VDC or lower	Low input voltage shutdown	Recharge battery, check connections and cable
No output voltage, no voltage indication.	Inverter switched to '0' No battery power to inverter Reverse DC polarity connection - internal fuse open	Turn Inverter power switch to '1' Check wiring to inverter.
No output voltage and control panel reading 32.0 VDC or higher	High input voltage shutdown	Make sure that the inverter is connected to correct battery voltage, check regulation of charging system.
Low battery warning on all the time, voltage indicator below 22.0 VDC	Poor DC wiring, poor battery condition	Use proper cable and make solid connections. Charge battery or use new battery.

## **7      Warranty**

Iris Technology manufactures its products from parts and components that are new or equivalent to new in accordance with industry-standard practices. Iris Technology warrants the QuietPower Inverter to be free from defects in workmanship or materials for 24 months from the date of purchase. Proof of purchase is required for warranty service. During the warranty period, Iris Technology will, at its option, repair or replace the defective product free of charge. This warranty will be considered void if the unit has suffered any physical damage or alteration, either internally or externally, and does not cover damage arising from improper use or from use in an unsuitable environment. This warranty will be considered void where the product has been misused, neglected, improperly installed, or repaired or modified by anyone other than Iris Technology, without prior authorization by Iris Technology.

Repair or replacement are your sole remedies and Iris Technology shall not be liable for damages, whether direct, incidental, special, or consequential, even though caused by negligence or fault.

Iris Technology owns all parts removed from repaired products. Iris Technology uses new and reconditioned parts made by various manufacturers in performing warranty repairs and building replacement products. If Iris Technology repairs or replaces a product, its warranty term is 90 days or the balance of the original warranty, whichever is longer.

This is Iris Technology's only warranty, and the Company makes no warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

## **8      Warranty Service**

If your QuietPower Inverter requires service, please return it Iris Technology directly:

Phone:           (949)975-8410  
Toll Free       (866)240-9540  
Fax:              (949)975-8435  
Email            [support@iristechnology.org](mailto:support@iristechnology.org)

Iris Technology Corporation  
17175 Von Karman Avenue, Suite 104  
Irvine, CA 92614-0904, USA

You must obtain a Return Authorization Number from Iris Technology before returning the QuietPower Inverter directly to Iris Technology. Do not return the QuietPower Inverter to Iris Technology without first obtaining a Return Authorization Number. When you contact Iris Technology to obtain service, be prepared to supply the serial number of your QuietPower Inverter.

If you are returning the unit from the USA, follow this procedure:

1. Obtain a Return Authorization Number from Iris Technology.
2. Package the unit safely, preferably using the original box and packing materials. Include the Return Authorization Number, a return address where the repaired unit can be shipped, a contact telephone number, and a brief description of the problem.
3. Ship the unit to Iris Technology, freight prepaid:

If you are returning the unit from outside the USA, please contact the place of purchase or the local Iris Technology dealer in your country.

## **9 Battery Information**

### **9.1 Battery Type**

This appendix explains some of the differences between the different lead-acid batteries to help you choose a battery which best suits your needs.

The lead-acid battery which is probably most common is the starting battery in your automobile. An automotive starting battery is designed to deliver a large amount of current for a short period of time (so it can start your engine). Only a small portion of the battery's capacity is used when starting the engine and it is quickly recharged by the running engine. It is not designed for repeated charge-discharge cycles where the battery is almost completely discharged and then recharged. Starting batteries used in this kind of deep discharge service will wear out rapidly.

Your QuietPower Inverter is designed to be used with DEEP CYCLE lead acid batteries. These batteries are designed for deep discharge service where they will be repeatedly charged and discharged. This type of battery is often labeled as a marine, recreational vehicle, or golf cart battery. Iris Technology recommends you use one or more of these batteries separated from the starting battery of your vehicle or boat with a battery isolator.

The many different types of deep cycle lead acid batteries can be grouped into four categories: flooded (or wet), sealed flooded ("maintenance free"), recombinant flooded (often "starved electrolyte"), and gel batteries. The table that follows summarizes these battery types, identifying features, advantages and disadvantages.

Note – for the following list:

- SUPERIOR™, PACER™ are registered trademarks of TROJAN BATTERY COMPANY
- SEAVOLT™, SEAGEL™ are registered trademarks of WEST MARINE PRODUCTS
- VOYAGER™ is a registered trademark of DELCO-REMY.
- GENESIS™ is a registered trademark of GATES ENERGY PRODUCTS (HAWKER ENERGY)
- EVOLYTE™, SUNLYTE™, STOWAWAY™, ACTIONPAC™ are registered trademarks of GNB INDUSTRIAL BATTERY COMPANY
- PREVAILER™ is a registered trademark of SONNENSCHNEIN
- DYNASTY™ is a registered trademark of JOHNSON CONTROLS, INC. BATTERY DIVISION

#### **FLOODED BATTERIES:**

TROJAN:	Golf Cart, SUPERIOR™, PACER™
WEST MARINE:	SEAVOLT™
MOTOMASTER:	Nautilus
IDENTIFYING FEATURES:	Vents which can be removed to fill the battery with water. Low price and higher maintenance.
ADVANTAGES:	More resistant to over-charging since they can be filled with water. Cheaper than other batteries.
DISADVANTAGES:	Must be filled with distilled water and usually require equalization. Maintenance required.

#### **SEALED FLOODED BATTERIES:**

DELCO:	VOYAGER™
IDENTIFYING FEATURES:	Vents which look like they are removable but are not. Sold as "Maintenance Free" at attractive prices.
ADVANTAGES:	Less maintenance required than Flooded. No need to fill with water. Less expensive.

DISADVANTAGES: Less resistant to over-charging because they consume water but cannot be refilled.

#### RECOMBINANT FLOODED (SEALED) BATTERIES:

HAWKER ENERGY: GENESIS™  
OPTIMA: Yellow Top  
GNB INDUSTRIAL: EVOLYTE™  
IDENTIFYING FEATURES: Vents are often concealed. Sold using the following phrases: Recombinant, Valve Regulated, Maintenance Free, Starved Electrolyte.  
ADVANTAGES: Require no maintenance. Non-spillable.  
DISADVANTAGES: Can be damaged by equalization. Generally more expensive.

#### GEL SEALED BATTERIES:

SONNENSCHNEIN: PREVAILER™  
WEST MARINE: SEAGEL™  
IDENTIFYING FEATURES: Sold as either "Gel" or "Gelled Electrolyte" batteries.  
ADVANTAGES: Require no maintenance. Often can be used on their side. Non-spillable. Low self-discharge. Less damage from being left discharged.  
DISADVANTAGES: Damaged by equalization. Generally more expensive.

## 9.2. Battery Size

Just as important as the type of battery selected for use with your QuietPower Inverter is the subject of battery size or capacity. Unfortunately, there are a number of different standards for rating battery energy storage capacity. Automotive starting batteries are normally rated by cranking amps. This is not a relevant rating for continuous use. Deep cycle batteries are rated either by reserve capacity in minutes or by amp-hours. Battery reserve capacity is a measure of how long a battery can deliver a certain amount of current - usually 25 amps. For example, a battery with a reserve capacity of 180 minutes can deliver 25 amps for 180 minutes before it is completely discharged. Amp-hour capacity is a measure of how many amps a battery can deliver for a specified length of time - usually 20 hours. For example, a typical marine or RV battery rated for 100 amp-hours can deliver 5 amps for 20 hours. (5 amps \* 20 hours = 100 amp-hours).

The batteries are a very important part of your system, so we recommend you purchase as much battery capacity as possible. A large battery will extend running time and ensure your QuietPower Inverter delivers full rated surge.

You can expect performance from the inverter to suffer with the use of a small, low amp-hour rated battery (e.g. 50 Ah). Even if your battery is in excellent shape and fully charged you will likely experience poor surge power performance and unsatisfactory operating time with anything but a small AC load. Iris Technology recommends a minimum battery size of 200 Ah for moderate loads (< 1000 W) and greater than 400 Ah for heavy loads.

To determine how large a battery or battery bank you require for equipment running from the inverter, simply add together the power requirements for all electrical devices that you will be running multiplied by their approximate running times in hours between battery recharges. Each device will be rated in either watts, volts and amps, or VA. For this calculation, all three of these ratings are equivalent (i.e. volts \* amps = watts = VA). The following example, based on battery recharging every three days, illustrates the calculation:

**Table 5. Sample Operating Time Calculation.**

<b>Load</b>	<b>Power Consumption</b>	<b>Operating time (cumulative usage between recharges)</b>	<b>Watt-hours (power consumption * operating time)</b>
TV & VCR	115 watts	3 hours (1 hour per day)	345
Coffee Maker	750 watts	1 hour (20 min per day)	750
Microwave Oven	800 watts	0.5 hour(10 min per day)	400
<b>TOTAL</b>			<b>1495</b>

Convert the watt-hours to amp-hours by dividing total watt-hours by 10: 30°C (86°F)

$$1495 \text{ watt hours} / 10 = 149.5 \text{ amp-hours}$$

A 150 amp-hour battery is required to supply enough power for the above loads, and become completely discharged. Ideally, you normally want to discharge your battery to only 50% capacity, so for the above loads, you would require 300 amp-hours of battery capacity.

When sizing your battery, be generous. More capacity is better since you will have more reserve capacity, and your battery won't be discharged as deeply. Battery life is directly dependent on how deeply the battery is discharged. The deeper the discharge, the shorter the battery life.

As your power requirements increase, to obtain sufficient battery capacity, you may need to use more than one battery. Two identical batteries can be connected positive to positive and negative to negative in a parallel system that doubles the capacity and maintains the voltage of a single battery. It is not recommended to connect batteries from different manufacturers or with different amp-hour ratings or with different battery electrolytes in parallel. Decreased battery life may result.

## **10. Performance Graphs and Specifications**

### **10.1. Power Derating Curve**

As with all inverters, the amount of continuous power that the QuietPower Inverters can deliver without overheating is limited by ambient (surrounding air) temperature. The nominal temperature for the power ratings specified for the QuietPower Inverters is 25°C (77°F). They will operate and deliver their continuous power ratings at higher temperatures, but the extent to which they can do this is limited by the ambient temperature as well as the input voltage from battery. The following "Power Derating Curve vs. Temperature" illustrates the relationship between power output and ambient temperature.

The rated power output of the QP-1800 inverter is 1800W up to 25°C ( 77°F). Operating the unit above this temperature will result in thermal shutdown or decreased performance. At input voltages less than 24V, the unit runs warmer which will cause thermal shutdowns at temperatures below these ambient temperature guidelines.

Operating the unit in conditions outside the power and temperature limits ("above" and "to-the-right" of the derating curves) will result in thermal shutdown and/or significantly decreased performance. In addition, operation in this range is outside of the ratings covered by the product's regulatory approvals.

These curves are published for information purposes only to let you know what may happen while operating in high ambient temperature conditions. Under normal battery voltage conditions and non-extreme temperatures, inverter operation will be within the derating curve.



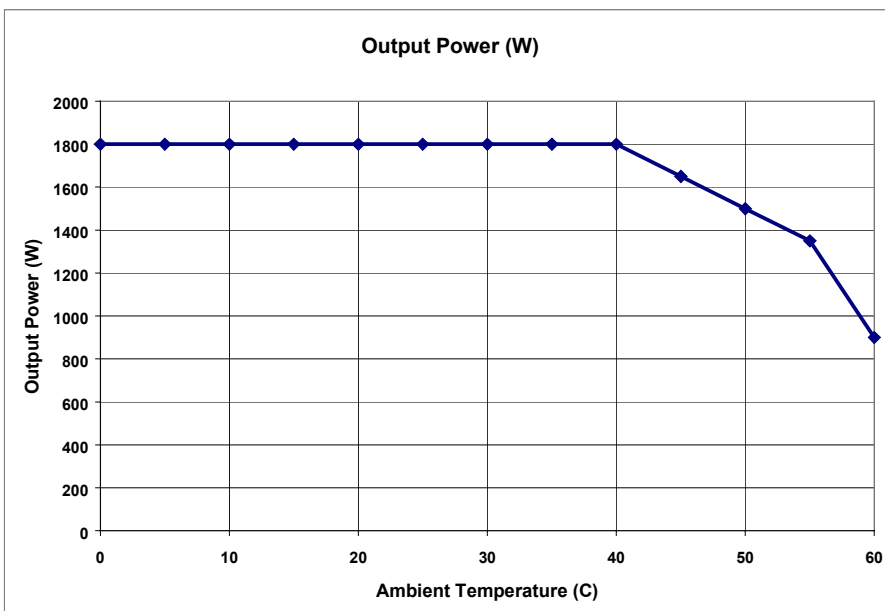


Figure 4. Output Power (W) Derating Curve.

## 10.2. Efficiency Curve

The efficiency rating of the QuietPower inverter indicates what percentage of DC power is converted to usable AC power at given power output levels. The higher the rating, the less power is lost in the way of heat from the inverting process. QuietPower Inverters have an extremely flat efficiency curve over much of their operating range so less battery power is wasted, whether operating at low power levels or higher power levels.

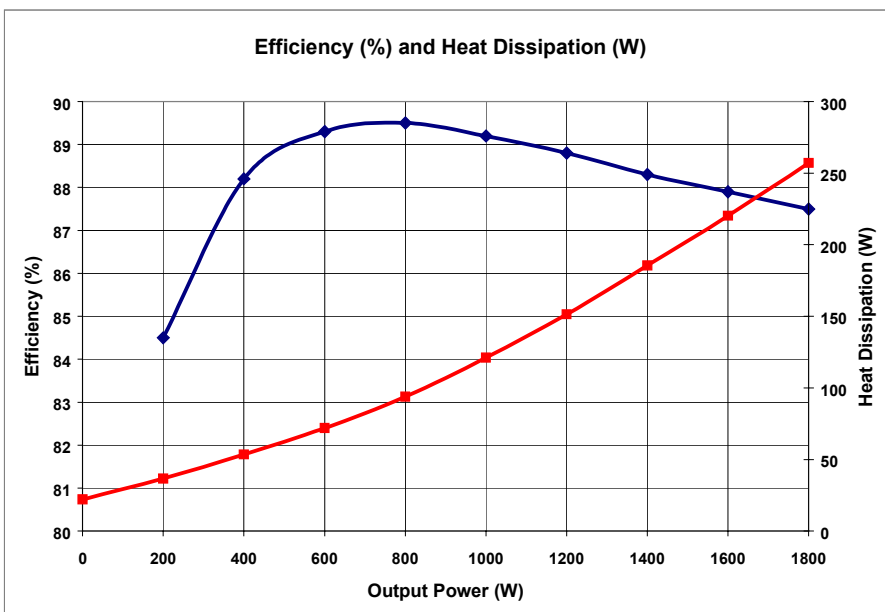


Figure 5. Efficiency (%) and Heat Dissipation (W).

## 11 System Components



**PN 287A107**  
**QuietPower 1800 Inverter System**

*Includes:*

**PN 287A101**  
**QuietPower 1800 Inverter**  
**1800 Watts (115 VAC, 60 Hz)**



**PN 287A106**  
**NATO SLAVE Cable**  
**2/0 AWG Flexible**



# QP-1800 QuietPower Inverter System



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<b>Product</b>	<b>QP-1800 System</b>
<b>Iris Part Number(s)</b>	System 287.A107 Inverter 287.A101 Cabling 287.A106
<b>Continuous Power</b>	1800 W
<b>Surge Power</b>	2900 W
<b>Peak Efficiency</b>	90 %
<b>No Load Current Draw</b>	< 0.92 A
<b>Output Frequency</b>	60 Hz $\pm$ 0.05 % crystal controlled
<b>Output Waveform</b>	True Sine Wave < 3 % THD
<b>Input Voltage Range</b>	20 - 32 VDC
<b>Output Voltage</b>	120 VAC RMS -10 / +4 %
<b>Input DC Connection</b>	Two 5/16" Posts for Ring Lugs
<b>Output AC Connection</b>	Dual Receptacles with GFCI
<b>Supplied Cabling</b>	2/0 AWG Flexible with NATO SLAVE Plug
<b>Weight</b>	Inverter 16.5 lbs (7500 g) Cabling 18.0 lbs (8200 g)
<b>Length x Width x Height</b>	15.4 x 11.0 x 4.5 in (390 x 280 x 115 mm)
<b>Operating Temperature</b>	0 / +60 °C (+32 / +140 °F)
<b>Storage Temperature</b>	-30 / +70 °C (-22 / +158 °F)
<b>Warranty</b>	12 Months

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## 11. Appendix A. Technical Addendum.

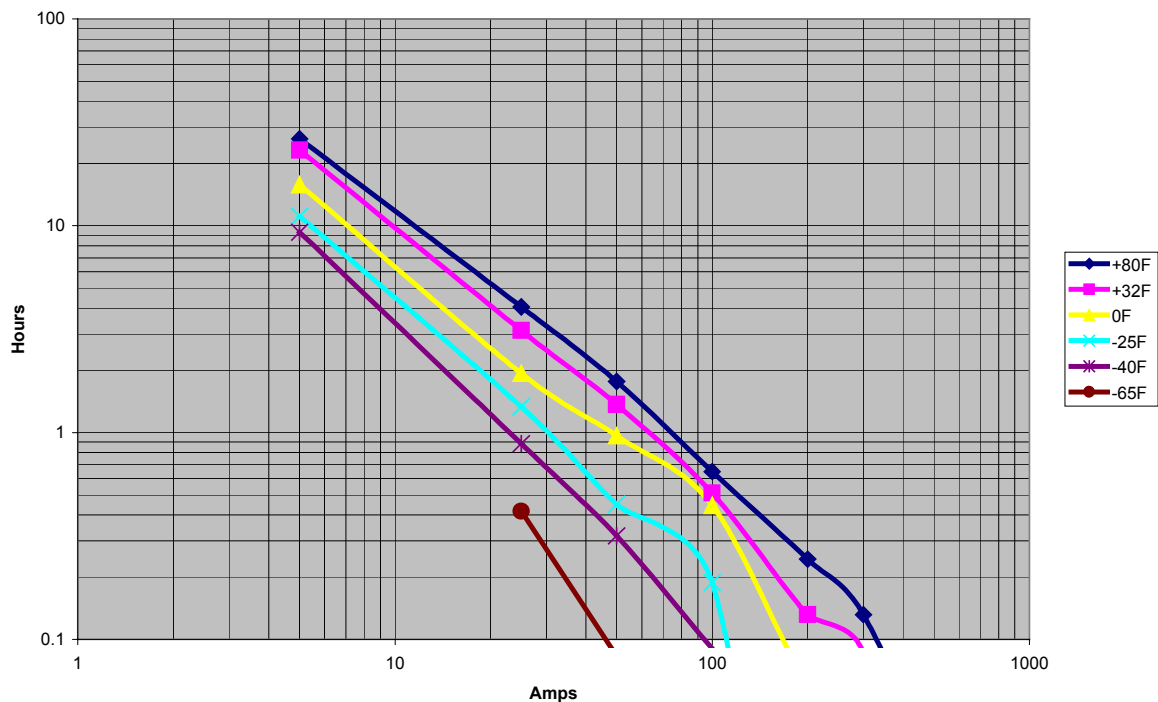
### Equipment Runtime

We have heard questions about a “short” operating runtime with this equipment. In field tests at Camp Pendleton, we measured and verified conversion efficiency of the QP-1800 to be approximately 90%, well within specifications. The QuietPower 1800 equipment, by its very design, can demand a large current drain from the vehicle electrical system (75 to 90 Amperes depending upon battery voltage and load). A high conversion efficiency means that it is not the cause for wasted energy.

We then inspected the HMMWV vehicle batteries and observed loose and corroded battery connections, measured batteries to be “weak” or “dead”, and have seen low outputs from vehicle alternators. It is not adequate to measure the voltage across the vehicle batteries in an unloaded condition. Lead acid batteries recover to relatively high voltages even if they are weak or damaged. It is important to measure the holding voltage across these batteries while loaded and typical battery testers do that.

To operate effectively, all connections within the vehicle electrical system must be clean and very secure. The battery health is critical, too. In speaking with Exide, the manufacturer of the 6TL and 6TMF batteries, the rated value is 100 Ampere-Hours (AH). That is to say that a 20 Ampere load should run for 5 hours ( $20 \text{ A} \times 5 \text{ H} = 100 \text{ AH}$ ). This is a temperature dependent parameter, too, and Runtime v Load data is provided below for varying temperatures.

Exide 6TL & 6TMF Runtime to Cutoff @ 10 VDC



### **Operation with Power Strips**

We see an occasional compatibility issue with power strips having integral surge suppressor components (MOVs). The QuietPower 1800 provides surge suppression at the output and no additional suppressors are typically needed. In fact, the use of additional surge suppressors is not recommended. We have evaluated alternate power strips with this equipment and have not seen this issue recur. A separate, but related issue, deals with the Ground Fault Circuit Interrupter (GFCI) discussed next.

### **Operation with Downstream EMC Components**

The QuietPower 1800 is delivered with a Ground Fault Circuit Interrupter (GFCI) type duplex outlet. Occasionally, when operated with certain types of electronics, the GFCI would trip for no apparent reason. The following discussion provided a basic understanding of the operational issues.

Ground Fault Circuit Interrupters (GFCIs) are important for minimizing shock hazards in outdoor and potentially wet areas. They are now generally required by the National Electronic Code (NEC) in these locations. However, what the GFCI detects to protect people - an imbalance in the currents between the Hot and Neutral wires caused, possibly, by someone touching a live conductor – may exist safely by design in three (3) wire grounded electronic equipment and consequently result in the false tripping of the GFCI. The reason is that there are usually small filter capacitors between all three wires (Hot, Neutral, and Ground) in the EMC line filters of many computer and military electronic systems. At power-on and often while operating there may be enough leakage current through the capacitors, between Hot and Ground especially, to falsely trip the GFCI. Even for ungrounded two (2) wire devices, the power-on surge into inductive or capacitive loads as presented by switching power supplies may falsely trip the GFCI. This is more likely to happen with multiple devices plugged into the same GFCI protected outlet especially if they are controlled by a common power switch.

Ground fault currents can properly result from deteriorating wiring; contact contamination due to moisture, oil or dust; insulation breakdown; or other conditions which are indicators that repairs need to be made.

We have verified the operation of the QuietPower 1800 for compatibility with the PAC-216/U adapter for SINCGARS, laptop and desktop computer systems (including monitors and laser printers), cellular telephone rechargers, fluorescent lamps, and Uninterruptable Power Supplies manufactured by APS. This system is also compatible with personal electronics (radios) and, importantly, most coffee makers.

### **Visit our Web Site for FAQs**

We appreciate your input very much. You, best, know how this equipment is used operationally and can provide invaluable feedback. Please visit our web site at [www.iris technology.org](http://www.iris technology.org) for updates to the Operator's Manual and Product Data Sheets. We will be establishing a Frequently Asked Questions (FAQs) section specific to our military inverter line. If you take a few moments to register online, we will notify you of any relevant data releases.

## Energy Flow

The only energy source put into your military vehicle enters in the form of diesel fuel

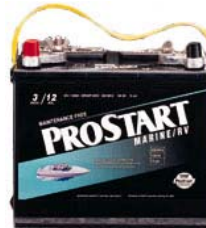


1) Some of this energy is converted by the engine to mechanical energy for motion

2) Some of this mechanical energy is converted by the alternator to electrical energy



3) A fraction of this electrical energy is *stored* in the batteries for future use (such as starting)



4) Some of this energy can be converted by the QuietPower from 24 VDC to 115 VAC (with ~90% efficiency)



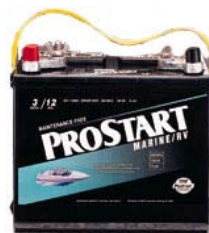
## Energy Storage



1) When the vehicle is running, the alternator provides most of the current demanded by the connected electrical systems

2) The excess current flows into the storage batteries to:

- a) deliver electrical power when the vehicle is not running
- b) supply surge currents exceeding the nominal output of the alternator



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