PROwatt™ 1500

DC to AC Power Inverter

12/24 V versions

OWNER'S MANUAL

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1 Introduction

Your new PROwatt 1500 inverter is a member of the most advanced line of dc to ac inverters available today. It will give you years of dependable service in your boat, RV, service vehicle or remote home.

To get the most out of your PROwatt 1500, it must be installed and used properly. Please read the installation and operating instructions in this manual carefully before installing and using your PROwatt 1500. Pay special attention to the **CAUTION** and **WARNING** statements in this manual and on the PROwatt 1500. **CAUTION** statements identify conditions or practices which could result in damage to your PROwatt 1500 or to other equipment. **WARNING** statements identify conditions or practices that could result in personal injury or loss of life.

2 How Your PROwatt 1500 Works

An inverter is an electronic device that converts low voltage DC (direct current) electricity from a battery or other power source to standard 115 volt AC (alternating current) household power. In designing the PROwatt 1500, Statpower has used power conversion technology previously employed in computer power supplies to give you an inverter that is smaller, lighter, and easier to use than inverters based on older technology.

2.1 Principle of Operation

The PROwatt 1500 converts power in two stages. The first stage is a DC-to-DC converter that raises the low voltage DC at the inverter input to 145 volts DC. The second stage is the actual inverter stage. It converts the high voltage DC into 115 volts, 60 Hz AC.

The DC-to-DC converter stage uses modern high frequency power conversion techniques that eliminate the bulky transformers found in inverters based on older technology. The inverter stage uses advanced power MOSFET transistors in a full bridge configuration. This gives you excellent overload capability and the ability to operate tough reactive loads like lamp ballasts and induction motors.

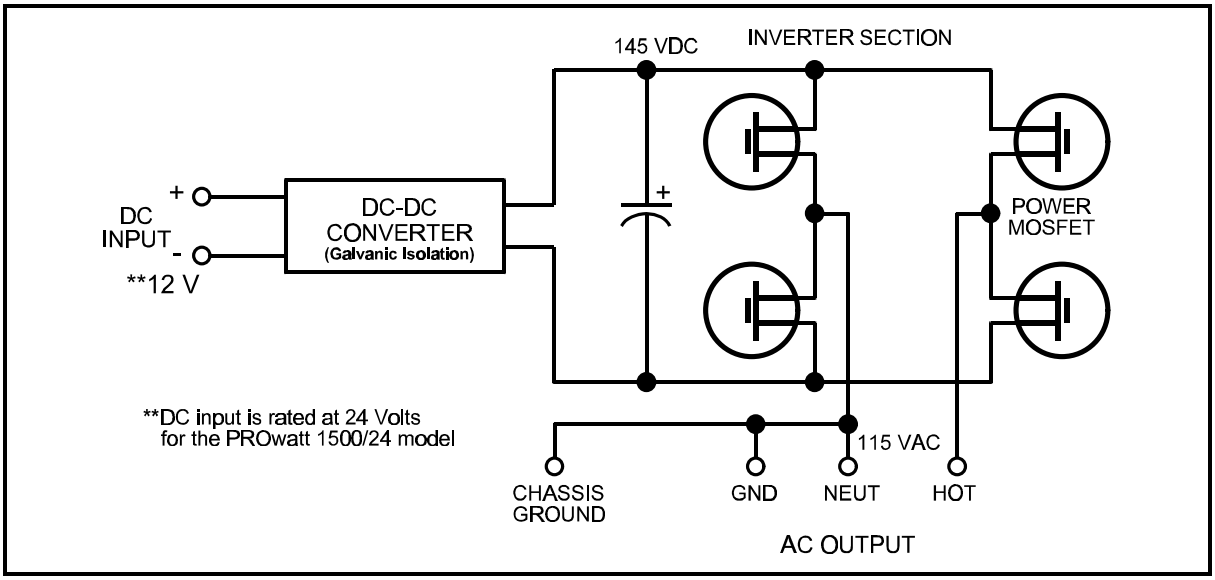
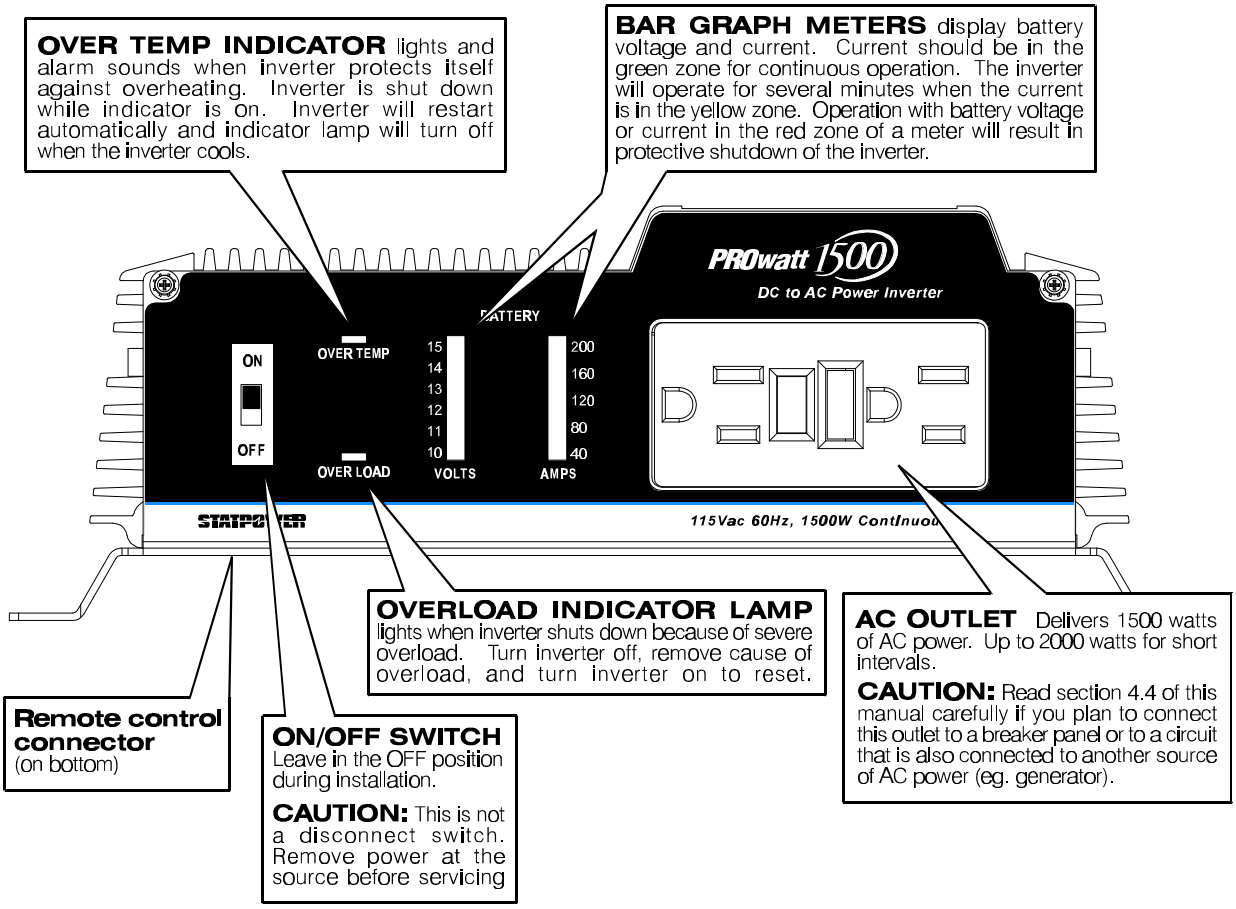


Figure 1. Principle of Operation



OVER TEMP INDICATOR lights and alarm sounds when inverter protects itself against overheating. Inverter is shut down while indicator is on. Inverter will restart automatically and indicator lamp will turn off when the inverter cools.

BAR GRAPH METERS display battery voltage and current. Current should be in the green zone for continuous operation. The inverter will operate for several minutes when the current is in the yellow zone. Operation with battery voltage or current in the red zone of a meter will result in protective shutdown of the inverter.

OVERLOAD INDICATOR LAMP lights when inverter shuts down because of severe overload. Turn inverter off, remove cause of overload, and turn inverter on to reset.

AC OUTLET Delivers 1500 watts of AC power. Up to 2000 watts for short intervals.

CAUTION: Read section 4.4 of this manual carefully if you plan to connect this outlet to a breaker panel or to a circuit that is also connected to another source of AC power (eg. generator).

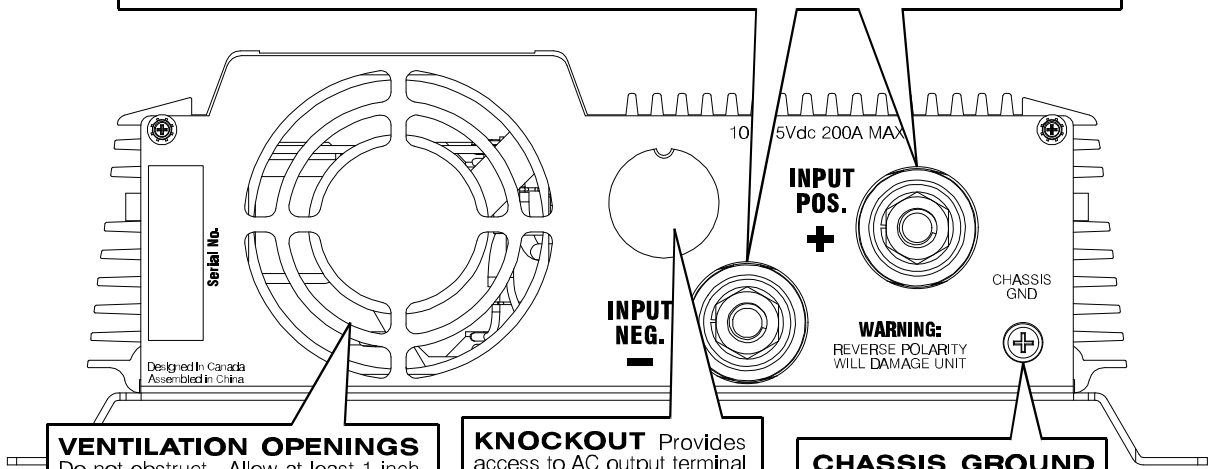
Remote control connector (on bottom)

ON/OFF SWITCH Leave in the OFF position during installation.

CAUTION: This is not a disconnect switch. Remove power at the source before servicing

BATTERY TERMINALS Connect to 12V battery or other 12 VDC power source able to deliver up to 200 amps (24V/100 amps for PW1500/24). Use #2 AWG (#4AWG for PW1500/24) insulated copper cable for connections. Red terminal is positive, black terminal is negative.

CAUTION: Reverse polarity connection will blow internal fuse and may damage inverter permanently



VENTILATION OPENINGS Do not obstruct. Allow at least 1 inch clearance for air flow.

KNOCKOUT Provides access to AC output terminal blocks. See section 4.4 of this manual.

CHASSIS GROUND Connect to earth ground or to vehicle chassis using #8 AWG wire.

WARNING: Operation of the inverter without a proper ground connection may result in an electrical safety hazard.

2.2 PROwatt 1500 Output Waveform

The AC output waveform of the PROwatt 1500 is called a "quasi-sine wave" or a "modified sine wave". It is a stepped waveform that is designed to have characteristics similar to the sine wave shape of utility power. A waveform of this type is suitable for most AC loads, including linear and switching power supplies used in electronic equipment, transformers, and motors. This waveform is much superior to the square wave produced by some other dc to ac inverters.

CAUTION! RECHARGEABLE APPLIANCES
Certain rechargers for small nickel cadmium batteries can be damaged if connected to the PROwatt. Two particular types of equipment are prone to this problem:

1) small battery operated appliances such as flashlights, razors, and night lights that can be plugged directly into an ac receptacle to recharge.

2) certain battery chargers for battery packs used in hand power tools. These chargers have a **WARNING** label stating that dangerous voltages are present at the battery terminals.

Do NOT use the PROwatt with the above equipment.

This problem does not occur with the vast majority of battery operated equipment. Most of this equipment uses a separate charger or transformer that is plugged into the ac receptacle and produces a low voltage output. If the label on the ac adapter or charger states that the adapter or charger produces a low voltage ac or dc output (less than 30 volts), the PROwatt will have no trouble powering this charger or adapter safely.

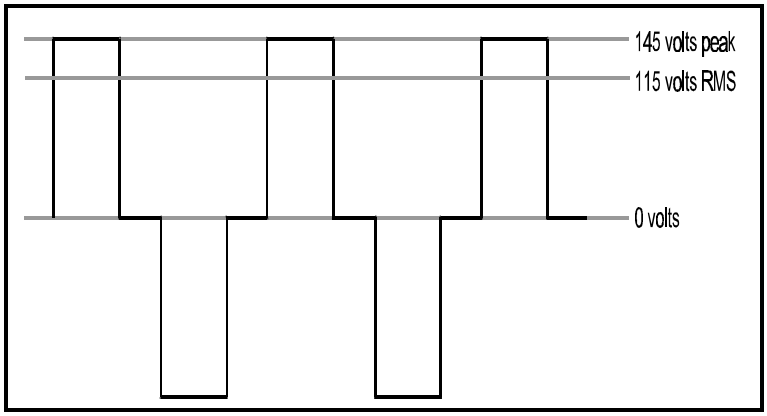


Figure 2. Modified Sine Wave

The modified sine wave produced by the PROwatt 1500 is designed to have an RMS (root mean square) voltage of 115 volts, 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 2 to 20 volts low when measuring the output of the PROwatt 1500. For accurate measurement of the output voltage of the PROwatt 1500, a **true RMS** reading voltmeter, such as a Fluke 87, Fluke 27, Tektronix DMM 249, or B&K Precision Model 391, must be used.

3 Quick Checkout

This section will give you the information you need to quickly hook-up your PROwatt 1500 and check its performance before going ahead with permanent installation. You will need the following:

a) a 12 volt DC power source (24 volt for PW1500/24)
b) two cables to connect the power source to the PROwatt 1500
c) a test load that can be plugged into the AC receptacle on the PROwatt 1500.

3.1 Power Source

The power source must provide between 11 and 15 volts (22 and 30 volts for PW1500/24) DC and must be able to supply sufficient current to operate the test load. As a rough guideline, divide the wattage of the test load by 10 (by 20 for PW1500/24) to obtain the current (in amperes) the power source must deliver.

Example: Test load is rated at 250 watts. Power source must be able to deliver 250 ÷ 10 = 25 amperes (or 12.5Amps for 24 volt model).

Battery

Use a fully-charged 12 volt (nominal) battery that can deliver the required current while maintaining its voltage above 11 volts (22 volts for 24 volt battery system). A fully-charged (12 volt) automobile battery is capable of delivering up to 50 amperes without an excessive voltage drop.

DC Power Supply

Use a well regulated DC power supply that has an output voltage between 11 volts and 14 volts (22-28 volts for PW1500/24) and can deliver the required current. If the supply is adjustable, make sure that the output voltage is adjusted to be between 11 volts and 14 volts (22-28 volts for PW1500/24). The inverter may shut down if the voltage is outside these limits and may be damaged if the voltage is above 16 volts (32 volts for PW1500/24). Also ensure that any current limit control is set so that the power supply can deliver the required current.

3.2 Cables

Your cables must be as short as possible and large enough to handle the required current. This is to minimize the voltage drop between the power source and the inverter when the inverter is drawing current from the power source. If the cables introduce an excessive voltage drop, the inverter may shut down when drawing higher currents because the voltage at the inverter drops below 10 volts (20 volts on PW1500/24).

We recommend #2 AWG (#4 AWG on PW1500/24) stranded copper cable that is no longer than 4 ft (1.2 m) if you want to test the PROwatt 1500 to its maximum ratings. For short term testing at reduced power levels, the guidelines below should be followed:

Test Load Power Consumption For Short Term Test	Minimum Cable Size PW1500/12 volt	Minimum Cable Size PW1500/24 volt
100 watts	#16 AWG copper	#18 AWG copper
250 watts	#12 AWG copper	#16 AWG copper
500 watts	#8 AWG copper	#12 AWG copper

Ideally, the cable should be no more than 4 ft (1.2 m) long.

Attach 5/16 inch ring terminals to the ends of the cables to be attached to the DC terminal studs on the PROwatt 1500. The ring terminals must be crimped with a proper crimping tool. Another option is to use Ilsco or equivalent box-lug terminals (available at electrical parts suppliers) sized for the wire gauge and a 5/16 inch stud. The bare cable end is inserted into the lug terminal and secured with a set-screw.
The other end of the cable, which is connected to the power source, must be terminated with a lug or other connector that allows a secure, low resistance connection to be made to the power source. For instance, if the power source is a battery, the cable must be terminated with a battery terminal that clamps to the post on the battery.

A solid, low resistance connection to the power source is essential for proper operation of the PROwatt 1500.

3.3 Test Loads

Use only equipment rated for 110-120 volt, 60 Hz AC operation that has a power consumption of 1500 watts or less. We recommend that you start with a relatively low power load, such as a 100 watt lamp, to verify your test set-up before trying high power loads.

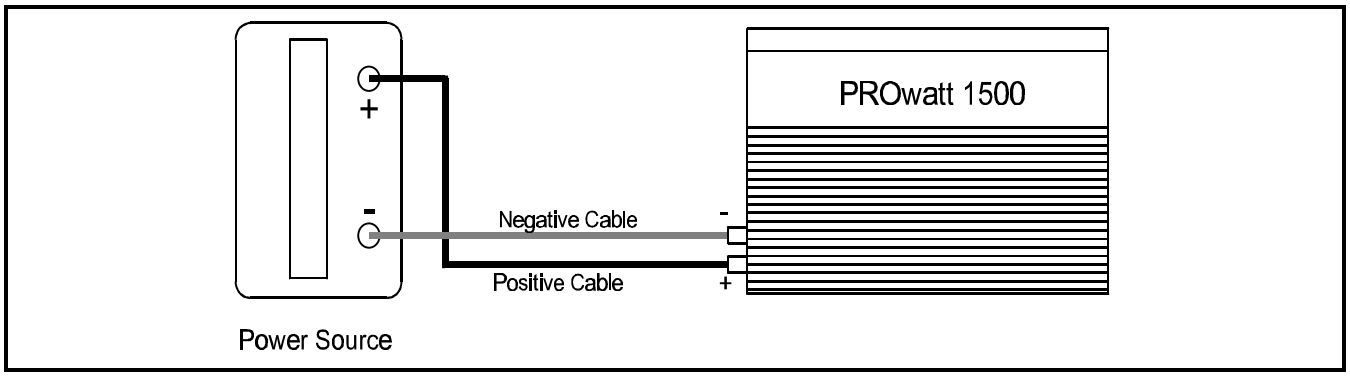


Figure 3. Connections to the PROwatt 1500

3.4 Connections

Follow the connection sequence described below.

STEP 1 Ensure that the ON/OFF switch on the PROwatt 1500 is in the OFF position. If the power source is a DC power supply, switch it off as well.

STEP 2 Connect the cables to the power input terminals on the rear panel of the PROwatt 1500. The red terminal is positive (+) and the black terminal is negative (-). Place the cable connector (ring terminal or box lug) on the stud and then install the supplied lock washer and nut. Tighten the nut with a wrench to a torque of 9 –10 ft-lbs (12 – 13 Nm).

STEP 3 Connect the cable from the negative (black) terminal of the PROwatt 1500 to the negative terminal of the power source. Make a secure connection.

CAUTION! Loosely tightened connectors result in excessive voltage drop and may cause overheated wires and melted insulation.

STEP 4 Before proceeding further, carefully check that the cable you have just connected connects the negative terminal of the PROwatt 1500 to the negative output terminal of the power source. Power connections to the PROwatt 1500 must be positive to positive and negative to negative.

CAUTION! Reverse polarity connection (positive to negative) will blow the fuses in the PROwatt 1500 and may permanently damage the PROwatt 1500. Damage caused by reverse polarity connection is not covered by your warranty.

STEP 5 Connect the cable from the positive (red) terminal of the PROwatt 1500 to the positive terminal of the power source. Make a secure connection.

WARNING! You may observe a spark when you make this connection since current may flow to charge capacitors in the PROwatt 1500. **Do not make this connection in the presence of flammable fumes. Explosion or fire may result.**

STEP 6 If you are using a DC power supply as the power source, switch it on. Set the ON/OFF switch on the PROwatt 1500 to the ON position. Check the meters and indicators on the front panel of the PROwatt 1500. The voltage bar graph should indicate 11 to 14 volts (22-28 volts for PW1500/24), depending on the voltage of the power source. If it does not, check your power source and the connections to the PROwatt 1500. The other indicators should be off.

STEP 7 Set the PROwatt 1500 ON/OFF switch to the OFF position. The indicator lights may blink and the internal alarm may sound momentarily. This is normal. Plug the test load into the AC receptacle on the front panel of the PROwatt 1500. Leave the test load switched off.

STEP 8 Set the PROwatt 1500 ON/OFF switch to the ON position and turn the test load on. The PROwatt 1500 should supply power to the load. If it does not, refer to the troubleshooting section of this manual. If you plan to measure the output voltage of the PROwatt 1500, refer to Section 2.2 of this manual.

4 Installation

4.1 Where to Install The PROwatt 1500 should be installed in a location that meets the following requirements:

a) **Dry** - do not allow water to drip or splash on the PROwatt 1500.

b) **Cool** - ambient air temperature should be between 0^{o} C and 40^{o} C (30^{o} F and 105^{o} F) - the cooler the better.

c) **Ventilated** - allow at least 1 inch (2.5cm) of clearance around the PROwatt 1500 for air flow. Ensure that ventilation openings on the rear and bottom of the unit are not obstructed.

d) **Safe** - do not install the PROwatt in the same compartment as batteries or in any compartment capable of storing flammable liquids such as gasoline.

e) **Close to Battery** - install as close to the battery as possible in order to minimize the length of cable required to connect the inverter to the battery. It is better and cheaper to run longer AC wires than longer DC cables.

CAUTION! To prevent fire, do not cover or obstruct ventilation openings. Do not install the PROwatt 1500 in a zero-clearance compartment. Overheating may result.

WARNING! This equipment contains components which tend to 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.

Mount the PROwatt on a flat surface using the mounting bracket on the bottom. Mounting hardware should be corrosion resistant and #10 or larger. The PROwatt may be mounted horizontally or vertically.

4.2 Battery

The battery you use strongly affects the performance you can expect from your PROwatt 1500. It is important to connect the PROwatt 1500 to the correct size and type of battery. The following information will help you select the appropriate batteries for your application.

Battery Type

The lead-acid battery which is probably most familiar 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. If it is used in this kind of deep discharge service, it will wear out very rapidly.

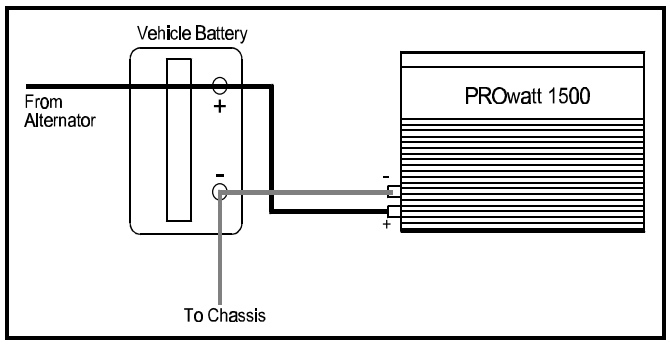


Figure 4. PROwatt 1500 Connected Directly to Engine Battery for Light-Duty Applications

Deep-cycle lead-acid batteries are designed for deep discharge service where they will be repeatedly discharged and recharged. They are marketed for use in recreational vehicles, boats, and electric golf carts so you may see them referred to as RV batteries, marine batteries, or golf cart batteries.

For most applications of the PROwatt 1500, Statpower recommends that you use one or more deep-cycle batteries that are separated from the starting battery in your vehicle by a battery isolator. A battery isolator is a solid-state electronic circuit that allows equipment to be operated from an auxiliary battery without danger of discharging the vehicle's starting battery. During vehicle operation, the battery isolator automatically directs the charge from the alternator to the battery requiring the charge. Battery isolators can be obtained at marine and RV dealers and most auto parts stores.

If your application involves relatively low power loads (i.e. average power consumption of 300 watts or less) and relatively short operating times before recharging (one hour or less), you may connect the PROwatt 1500 directly to the vehicle starting battery.

CAUTION! The PROwatt 1500/12 must be connected only to batteries with a nominal output voltage of 12 volts . The PROwatt 1500/12 will not operate from a 6 volt battery, and will be damaged if it is connected to a 24 volt battery. The PW1500/24 must be connected only to a 24 volt battery system. The PW1500/24 will not operate from a 6 or 12 volt battery.

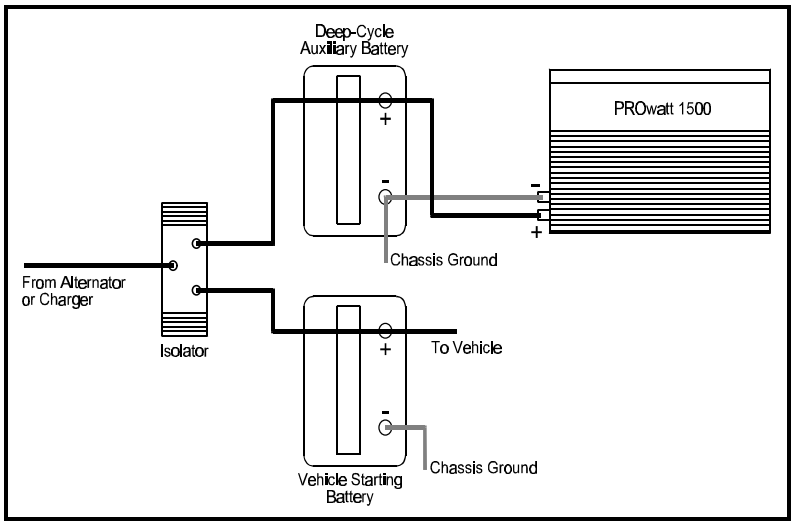


Figure 5. Recommended Battery Configuration for Medium-Duty Applications

Battery Sizing

Unfortunately, there are a number of different standards for rating battery energy storage capacity. 12 volt 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 *ampere-hour* capacity.

Battery reserve capacity is a measure of how long a battery can deliver a certain amount of current - usually 25 amperes. For instance, a battery with a reserve capacity of 180 minutes can deliver 25 amperes for 180 minutes before it is completely discharged.

Ampere-hour capacity is a measure of how many amperes a battery can deliver for a specified length of time - usually 20 hours. For example, a typical marine or RV battery rated for 100 ampere-hours can deliver 5 amperes for 20 hours (5 amperes x 20 hours = 100 amp-hrs).

Actual battery capacity decreases as discharge current increases. A battery rated at 100 ampere-hours, which can deliver 5 amperes for 20 hours, may deliver 20 amperes for only 4 hours, resulting in an actual capacity of 80 ampere-hours. For this reason, it is difficult to compare rated ampere-hour capacity with battery reserve capacity. For example a battery with a reserve capacity of 180 minutes has the following calculated ampere-hour capacity:

180 min.÷ 60 = 3 hr., 3 hr. x 25 amps = 75 amp-hrs

However its actual ampere-hour rating will be closer to 100 ampere-hours because it is rated at the discharge current required to get 20 hours of operation (about 5 amperes).

To determine the battery capacity you require, follow these steps:

STEP 1 For each piece of equipment you will be operating from the PROwatt 1500, determine how many watts it consumes. This can normally be found on a label on the product. If only the current draw is given, multiply the current draw by 115 to get the power consumption in watts.

STEP 2 For each piece of equipment you will be operating from the PROwatt 1500, estimate how many hours it will operate between battery charging cycles.

STEP 3 Calculate total watt-hours of energy consumption, total hours running time, and average power consumption as in the following example:

Equipment	Power Consumption	Operating Time	Watt - Hours (Power x Operating Time)
TV & VCR	115 watts	3 hours	345
Sewing Machine	150 watts	1 hour	150
Waterpik	90 watts	0.25 hour	22.5
Blender	300 watts	0.25 hour	75
Coffee Maker	750 watts	0.3 hour	225
Coffee Grinder	100 watts	0.l hour	10
Microwave Oven	1500 watts	0.5 hour	750
Totals		5.4 hours	1577.5 watt-hours

INVERTER OUTPUT POWER (WATTS)	TYPICAL LOAD	BATTERY SIZE					
		BCI GROUP SIZE:	20NF	24	27	8D	DUAL 8D's
		RESERVE CAPACITY	90 MINUTES	140 MINUTES	180 MINUTES	400 MINUTES	900 MINUTES
		AMP-HRS:	50	75	100	200	400
50	STEREO SYSTEM	OPERATING TIME:	9 HOURS	14 HOURS	20 HOURS	40 HOURS	80 HOURS
100	19" COLOR TV	OPERATING TIME:	4 HOURS	6 HOURS	10 HOURS	20 HOURS	40 HOURS
200	COMPUTER SYSTEM	OPERATING TIME:	2 HOURS	3 HOURS	4.5 HOURS	10 HOURS	20 HOURS
300	BLENDER	OPERATING TIME:	1.3 HOURS	2.2 HOURS	3 HOURS	6 HOURS	12 HOURS
400	POWER DRILL	OPERATING TIME:	1 HOUR	1.5 HOURS	2 HOURS	4.5 HOURS	10 HOURS
600	SMALL COFFEE MAKER	OPERATING TIME:	N.R.	N.R.	1 HOUR	2.5 HOURS	6 HOURS
800	SMALL MICROWAVE OVEN	OPERATING TIME:	N.R.	N.R.	N.R.	1.5 HOURS	4 HOURS
1000	TOASTER	OPERATING TIME:	N.R.	N.R.	N.R.	1 HOUR	3 HOURS
1500	FULL SIZE MICROWAVE	OPERATING TIME:	N.R.	N.R.	N.R.	0.5 HOURS	2 HOURS

N.R. - NOT RECOMMENDED

Figure 6. 12 Volt Battery Sizing Chart

Average Power Consumption = 1577.5 watt-hrs ÷ 5.4 hours = 292 watts
12 volt Ampere-Hours Consumed = Watt-hours ÷ 10 = 1577.5 ÷ 10 = 157.8 ampere-hours

or, for PW1500/24 volt system, Consumption = 1577.5 watt-hours = 292 watts
24 volt Ampere-Hours Consumed = Watt-hours ÷ 20 = 1577.5 ÷ 20 = 79 ampere-hours

Step 4 Using the chart above (figure 6), find the battery size that will give you the required operating time at the calculated average power consumption. For instance, from the example above, the required operating time is 5.4 hours and the average power consumption is 292 watts. From the chart, the smallest battery size that will give more than 5 hours of operation at a power level between 200 and 300 watts is the 200 amp-hr. battery, which offers between 6 and 10 hours of operating time.

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. Ideally, the number of ampere-hours consumed by your loads before recharging the battery should be no more than 50% of the battery's rated capacity.

Using Multiple Batteries

To obtain sufficient battery capacity you may need to use more than one battery. Two identical batteries can be connected + to + and - to - in a parallel system that doubles capacity and maintains the voltage of a single battery. Do not connect batteries from different manufacturers, or with different amp-hr ratings, in parallel. Decreased battery life may result.

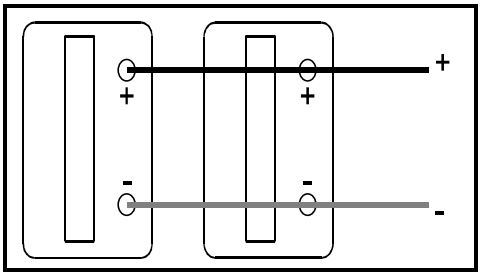


Figure 7. Parallel Connection of Two Batteries

If you are using different batteries, or need to use more than two batteries, we recommend that you set up two separate battery banks and use them alternately. Battery selector switches are available from marine and RV dealers that allow you to select between two banks of batteries, or use both in parallel, or disconnect both from the load.

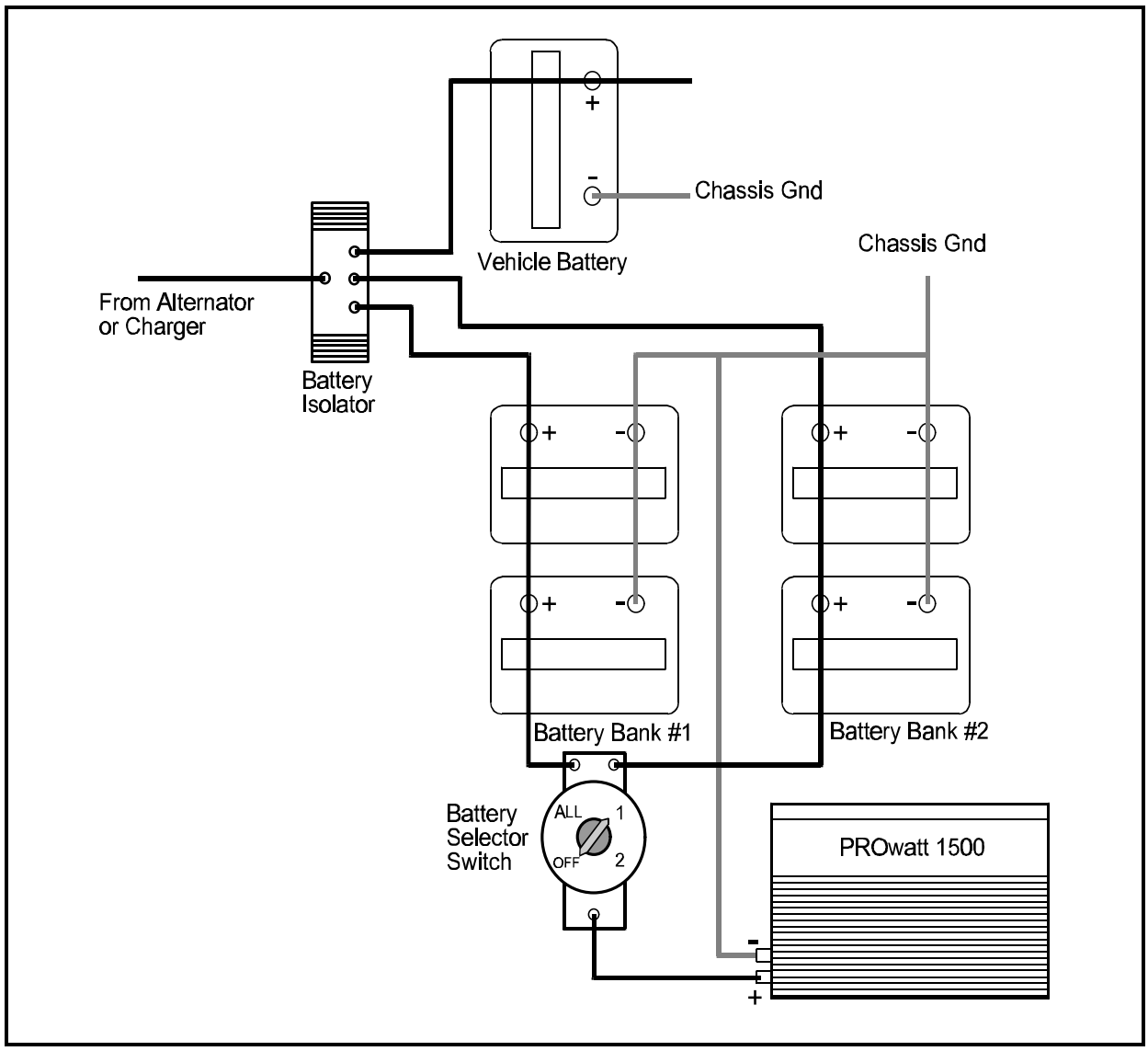


Figure 8. Recommended Battery Configuration for Heavy-Duty Applications

Note: PW1500/24 model inverter only: 24 Volt systems typically have 2 x 12 Volt batteries connected in series.

Battery Tips

1. Lead-acid batteries may emit hydrogen and oxygen gases, and sulfuric acid fumes when recharging. Vent the battery compartment to prevent accumulation of these gases, and do not install electronic or electrical equipment in the battery compartment. Do not smoke or carry an open flame when working around batteries.

2. The capacity of lead-acid batteries is temperature sensitive. Battery capacity is rated at 25° C (77 ° F). At -20°C (0 ° F) the ampere-hour capacity will be about half the rated capacity.

3. Do not leave batteries in a discharged state for more than a day or two. They will undergo a chemical process called sulfation, which can permanently damage the battery. Also, batteries will self-discharge over a period of 3 to 6 months, so they should be periodically recharged even if they are not being used.

4. If your batteries are not the "maintenance-free" type, check the electrolyte fluid level at least once a month. Use only distilled water to replenish the electrolyte fluid. Excessive fluid loss is a sign of overcharging.

5. Connections to battery posts must be made with permanent connectors that provide a reliable, low-resistance connection. Do not use "alligator" clips. Clean the connections regularly and prevent corrosion by using a protective spray coating or vaseline.

6. Battery state of charge can be measured with a hydrometer or, more easily, with a voltmeter. Use a digital voltmeter that can display tenths or hundredths of a volt when measuring 10 to 30 volts. Make your measurements after the (12 volt) battery has not been charged or discharged for several hours. For a deep-cycle battery at 25 ^{o} C (77 ^{o} F), the following table may be used:

Battery Voltage	State-of-Charge
12.7 - 12.9	100%
12.5 - 12.6	80%
12.3 - 12.4	60%
12.1 - 12.2	40 %
11.9 - 12.0	20%

Alternators and Charging Systems

A good charging system is important for the health of your batteries. Poor recharging methods can quickly damage your batteries. When possible, recharge your batteries when they are about 50% discharged. This will give you much longer battery cycle life than recharging when the batteries are almost completely discharged. The Statpower TRUEcharge family of battery chargers are designed to maximize your batteries' performance and useful life (see your Statpower dealer for more details).

The charging system should be capable of delivering a charging current equal to 25% of the ampere-hour capacity of your battery. For instance, if you have a 200 ampere-hour battery, the charging system should be able to deliver 50 amperes. The charging system must also be able to charge each 12 volt battery up to approximately 14.4 volts and then drop back to a "float" voltage of 13.5 to 14 volts (or shut off).

A typical engine alternator (12 Volt) may not be able to meet these requirements if large capacity batteries are used. Alternators are typically rated for the current they can deliver when they are cold. In actual use, alternators heat up and their output current capability drops by as much as 25%. Thus standard alternators with ratings of 40 amperes to 105 amperes will only deliver a maximum of 30 to 80 amperes in actual use and will deliver even less as battery voltage rises. Many alternators cannot produce more than 13.6 volts when they are hot. As a result, a standard alternator may not be able to charge a large battery quickly and completely.

One solution is to install an alternator controller that will bypass the voltage regulator and boost the alternator's output voltage during charging. This will increase the alternator's charging rate at higher battery voltages and ensure more rapid and complete charging. Alternator controllers are available from marine product dealers.

Another solution is to install a high-output alternator. Heavy-duty alternators rated from 100 amperes to 140 amperes are available from RV and marine dealers, and auto parts suppliers. These alternators are designed to directly replace standard alternators but produce the higher current and higher voltage required to charge multiple battery systems.

When recharging from AC power, use a good quality marine battery charger or RV converter, such as the Statpower TRUEcharge series, that meets the requirements specified above. Do not use chargers intended for occasional recharging of automotive starting batteries; these chargers are not intended for continuous use.

Your batteries may also be recharged from alternative energy sources such as solar panels, wind, or hydro systems. Make sure that you use the appropriate battery charge controller for your energy source.

Do not operate the PROwatt 1500 directly from a charging source such as an alternator or solar panel. The PROwatt must be connected to a battery or a well-regulated, high-current DC power supply to work properly.

4.3 Cables

Proper wire and wiring is very important to the proper operation of the PROwatt 1500. Because the PROwatt 1500 has a low voltage, high current input, low resistance wiring between the battery and the PROwatt 1500 is essential to deliver the maximum amount of usable energy to your load. Don't waste the investment you have made in batteries and a highly efficient inverter by using undersized wires.

Use only copper wire. Aluminum wire has about 1/3 more resistance than copper wire of the same size and it is more difficult to make good, low-resistance connections to aluminum wire.

We recommend #2 AWG copper cable (90º C. insulation rating) as the minimum size for connections between the battery and the PROwatt 1500 (#4 AWG for PW1500/24). Keep the cable length as short as possible, no longer than 4 ft (1.2 meters). This will keep the voltage drop between the battery and the PROwatt to a minimum. If the cables introduce an excessive voltage drop, the inverter may shut down when drawing higher currents because the voltage at the inverter drops below 10 volts (20 volts for PW1500/24). If you must use longer cables, then choose larger cable, such as #00 AWG (#2 AWG for PW1500/24).

Attach 5/16 inch ring terminals to the ends of the cables to be attached to the DC terminal studs on the PROwatt 1500. The ring terminals must be crimped with a proper crimping tool. Another option is to use Ilsco or equivalent box-lug terminals (available at electrical parts suppliers) sized for the wire gauge of the cable and for a 5/16 inch stud. The bare cable end is inserted into the box-lug terminal and secured with a set-screw.

NOTE: It may be necessary to slide the supplied rubber insulating boots on to the cables before attaching the terminals.

The other end of the cables, which are connected to the battery, battery switch, or a fuse block (see Section 4.4), must be terminated with lugs or other connectors that allow a secure, permanent, low resistance connection to be made. For instance, if the connection is directly to a battery, the cable must be terminated with a battery terminal that clamps to the post on the battery. **A solid, low resistance connection to the battery is essential for proper operation of the PROwatt 1500.**

4.4 Connections

<u>AC Wiring</u>

WARNING! If making a permanent AC connection to the PROwatt 1500, ensure that the following AC wiring steps are performed **before any DC wiring is done**. DC hook-up energizes internal components, regardless of the position of the ON/OFF switch. Working on AC connections in such a circumstance may result in electrical shock.

WARNING! Permanent AC connections to the terminal blocks shown in figures 9 & 9A **are not** GFCI protected.

WARNING! 115 Volt AC power is potentially lethal. Do not work on AC wiring while the wiring is connected to the PROwatt 1500 (even if it is switched off) unless the DC power source is physically disconnected from the

inverter. Also do not work on AC wiring if it is connected to another AC power source such as a generator or the utility line.

CAUTION! Electrical installations must meet local and national wiring codes, and should be done by a qualified electrician.

Do not attempt your own AC wiring unless you have the knowledge and experience to do a safe job. Your RV or boat dealer, or a licensed electrician can do the job for you if you do not wish to do your own wiring.

In many cases you can plug your AC loads directly into the AC receptacle on the front panel of the PROwatt 1500. In other installations you may wish to connect the output of the PROwatt 1500 to existing AC wiring. The PROwatt 1500 is equipped with internal terminals to allow permanent connection to existing AC wiring. To make a permanent connection, follow these steps:

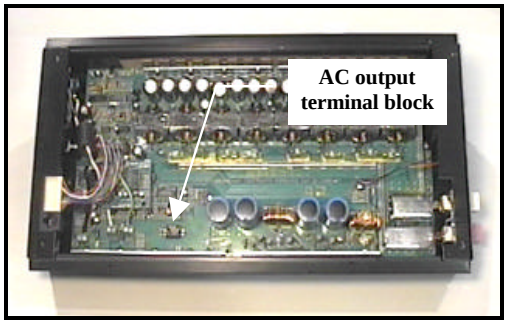


Figure 9. PROwatt 1500 AC output connections

a) Ensure there is no DC voltage supplied to the inverter

b) Remove the bottom plate from the PROwatt 1500 (four screws). This will expose the AC terminal blocks (see Figure 9).

c) Remove the knockout on the rear panel and feed your three conductor AC cable (14 AWG) through the hole. Use a standard strain relief connector (cable clamp) for electrical junction boxes (available at hardware stores and building supply stores) to hold the cable in the hole.

d) Connect the ground lead of your AC cable to the internal ground lug on the rear panel of the PROwatt 1500. Strip the hot and neutral leads of your AC cable 1/4 inch (6mm) and connect to the AC output terminal blocks on the PROwatt 1500 circuit board (labeled " AC NEUT" and "AC HOT", in Figure 9A). Check carefully that you have maintained correct polarity (see below) and that there are no loose strands of wire. Make certain that the ground lead, which may be a bare wire, is cut as short as possible and is not touching any component within the PROwatt.

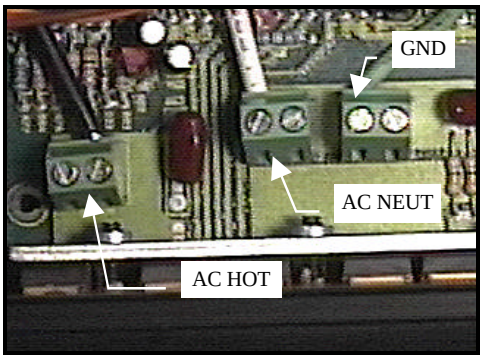


Figure 9A. AC Output Terminal Block

e) Replace the bottom panel.

CAUTION! When connecting the PROwatt 1500 to existing AC wiring, be sure to observe the following precautions.

1. Maintain correct wiring polarity. A modern 115 volt AC wiring system has three conductors - hot, neutral (or common), and ground. Wire insulation is color coded black for hot and white for neutral. The ground conductor may be a bare wire or it may be a green insulated wire. Screws on terminals are typically color coded brass for hot, silver for neutral, and green for ground.

The AC output of the PROwatt 1500 has hot, neutral, and ground conductors. Figure 9A shows the internal terminals for the hot, neutral, and ground conductors. When connecting to the AC wiring, connect the hot (black) wire to the hot terminal and the neutral (white) to the neutral terminal. Connect the ground wire to the internal ground lug in the PROwatt. Connect the other end of the ground wire to a grounding point on a junction box or breaker panel.

Improper connections, such as connecting a "hot" conductor to a neutral conductor, will cause the PROwatt 1500 to malfunction and may cause permanent damage to the inverter.

2. Do not connect the PROwatt 1500 and another AC source (such as a generator or utility power) to the AC wiring at the same time. The PROwatt 1500 will not operate if its output is connected to AC voltage from another source and potentially hazardous or damaging conditions may occur. These conditions can occur even if the PROwatt inverter is switched off.

When installing the PROwatt 1500 into an electrical system that also uses power from a generator or the utility line, you must include a means of switching between the PROwatt and the other power source that never allows both to be connected to the AC distribution system at the same time. This can be as simple as a plug that is plugged into the desired AC power source (see Figure 10).

Alternatively, you can employ a manual or automatic transfer switch. A transfer switch is a double pole, double throw (DPDT) switch that switches both the hot and neutral wires to the AC distribution system from one power source to the other. Manual and automatic transfer switches are available from marine and RV dealers. They are commonly used to switch between a generator and "shore" (utility) power. Make sure you purchase an approved switch with AC voltage and current ratings that exceed the output ratings of both the inverter and the other source.

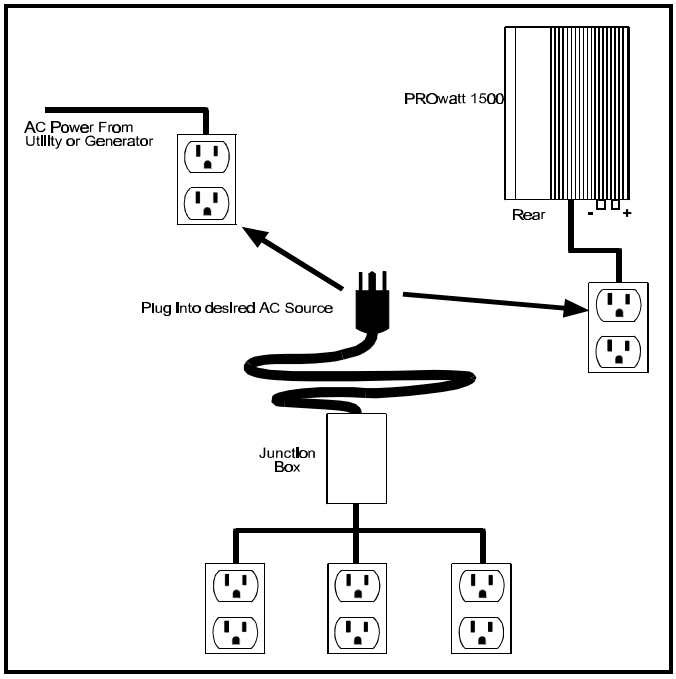


Figure 10. Simple Transfer Switching

3. Do not connect the PROwatt 1500 to an AC branch circuit that has high-power consumption loads. The PROwatt 1500 will not operate electric heaters, air conditioners, stoves, and other electrical appliances that consume more than 1500 watts.

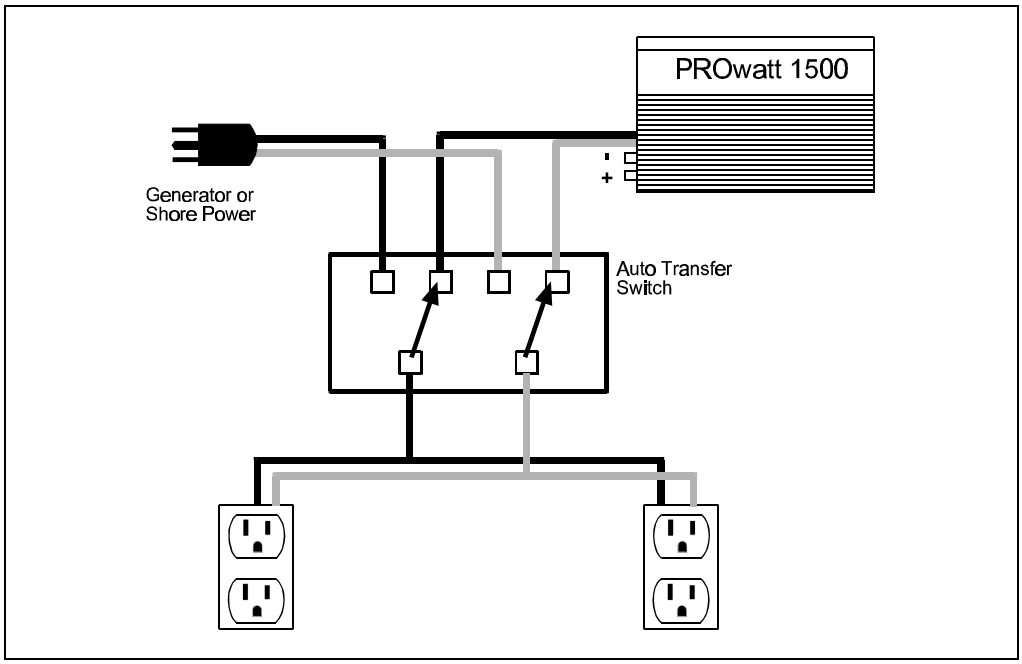


Figure 11. AC Wiring with Transfer Switch

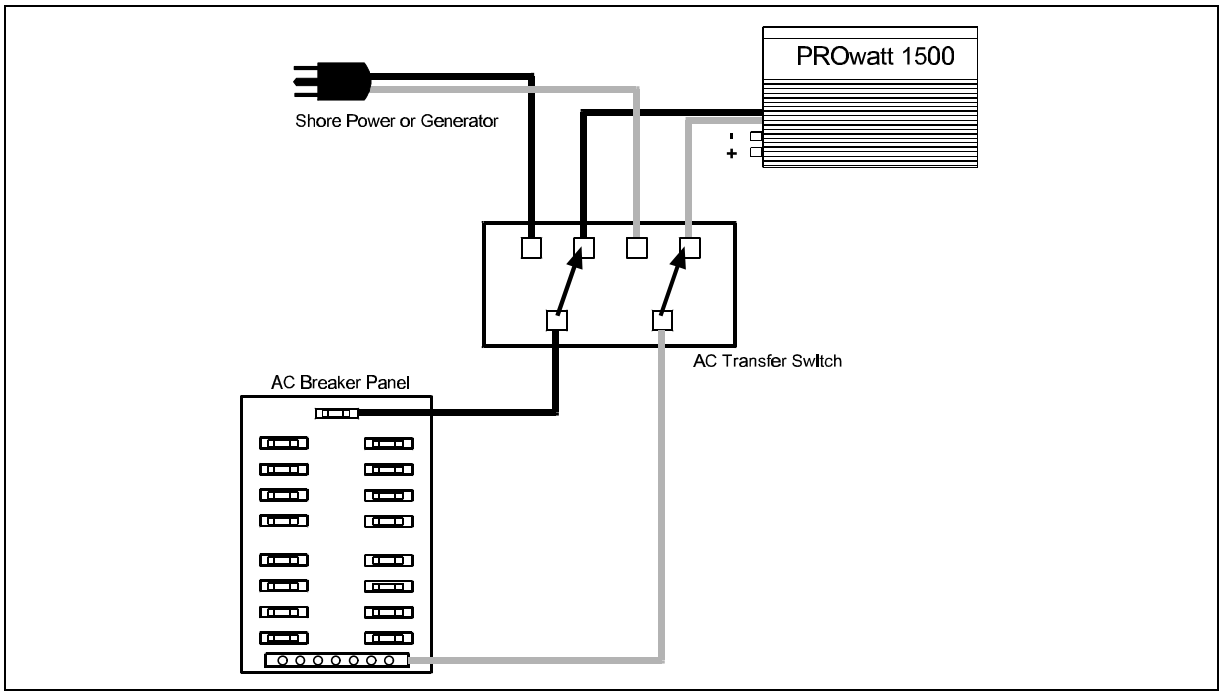


Figure 12. Wiring to AC Breaker Panel

Ground Wiring

The PROwatt 1500 has a screw terminal on the rear panel labeled Chassis Ground. This is to connect the chassis of the PROwatt 1500 to ground. The ground terminal in the AC outlet on the front panel of the PROwatt 1500 is connected to the chassis.

The chassis ground terminal must be connected to a grounding point, which will vary depending on where the PROwatt 1500 is installed. In a vehicle, connect the chassis ground to the chassis of the vehicle. In a boat, connect to the boat's grounding system. In a fixed location, connect the chassis ground lug to earth ground by connecting to a ground rod (a metal rod pounded into the earth) or other proper service entrance ground. Use a #8 AWG or larger copper wire (preferably with green/yellow insulation) to connect the chassis ground terminal to the grounding point. In some installations a larger wire size may be required. Refer to the local/national codes applicable for your type of installation.

The neutral (common) conductor of the PROwatt 1500 AC output circuit is connected to chassis ground. Therefore, when the chassis is connected to ground, the neutral conductor will also be grounded. This conforms to National Electrical Code requirements that separately derived AC sources (such as inverters and generators) have their neutral conductors tied to ground in the same way that the neutral conductor from the utility line is tied to ground at the AC breaker panel.

WARNING! Do not operate the PROwatt 1500 without connecting it to ground. Electrical shock hazard may result.

DC Wiring

CAUTION! We recommend a Main Fuse in the cable between the battery positive and the inverter to protect against dc wiring short circuits (external to the inverter). The fuse should be as close to the battery as possible. The specific fuse ampere rating should be sized to allow operation of all equipment connected to the cable and provide adequate protection for the cable. We recommend a Buss Fuse ANL-250 or equivalent if you are connecting the PROwatt 1500 with the recommended cable size.

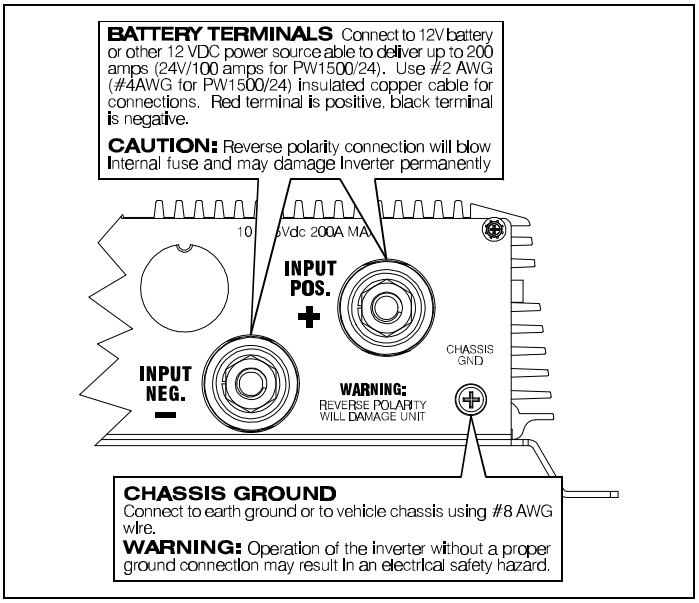


Figure 13. Rear Panel Connections to PROwatt 1500

STEP 1 Ensure that the ON/OFF switch on the PROwatt 1500 is in the OFF position. If you are using a battery selector switch, switch it off as well.

STEP 2 If you have not already done so, slide the plastic terminal connector covers (boots) over the positive and negative cables – red boot on the positive cable and black boot on the negative cable. Connect the cables to the power input terminals on the rear panel of the PROwatt 1500. The red terminal is positive (+) and the black terminal is negative (-). Place the cable connector (ring terminal or box lug) on the stud and then install the supplied lock washer and nut. Tighten the nut with a wrench to a torque of 9 – 10 ft-lbs (12 – 13 Nm). Slide the boots over the studs to cover the connection.

STEP 3 Connect the cable from the negative (black) terminal of the PROwatt 1500 to the negative terminal of the battery. Make a secure connection.

CAUTION! Loosely tightened connectors result in excessive voltage drop and may cause overheated wires and melted insulation

STEP 4 Before proceeding further, carefully check that the cable you have just connected connects the negative terminal of the PROwatt 1500 to the negative terminal of the battery. Power connections to the PROwatt 1500 must be positive to positive and negative to negative.

CAUTION! Reverse polarity connection (positive to negative) will blow a fuse in the PROwatt 1500 and may permanently damage the PROwatt 1500 . Damage caused by reverse polarity connection is not covered by your warranty.

STEP 5 Connect the cable from the positive (red) terminal of the PROwatt 1500 to the positive terminal of the battery Main Fuse, or to the battery selector switch, if you are using one. Make a secure connection.

You may observe a spark when you make this connection since current may flow to charge capacitors in the PROwatt 1500.

WARNING! Do not make this connection in the presence of flammable fumes. Explosion or fire may result. Thoroughly ventilate the battery compartment before making this connection.

STEP 6 If you are using a battery selector switch, switch it to select one of the batteries. Set the ON/OFF switch on the PROwatt 1500 to the ON position. Check the meters and indicators on the front panel of the PROwatt 1500. The voltage bar graph should indicate 12 to 13 volts (24-26V for PW1500/24), depending on the voltage of the battery. If it does not, check your battery and the connections to the PROwatt 1500. The other indicators should be off.

4.5 Remote Panel

The PROwatt remote switch allows your PROwatt inverter to be switched on/off from a convenient remote location while the inverter is mounted out of sight.

Installation Instructions:

1. Cut out the template, located on the back page of the manual (Figure 14), and position it on the wall where the switch is to be mounted.

2. Mark the location of the two holes, and the square area to be cut out. NOTE: Remote switch assembly requires 0.7”/18mm minimum clear panel depth.

3. Drill two holes, 7/64”/2.8mm diameter and remove the cut-out area.

4. Feed the phone jack connector and wire through the cut-out hole in the panel and route the wire to the inverter phone jack receptacle.

5. Position the remote switch assembly upright and secure to the panel using the two screws provided. Plug the phone jack into the inverter.

Operating Instructions:

1. Turn the Inverter Switch “ON”.

2. Press the Remote for “ON” (LED illuminated). Press the Remote for “OFF” (LED off).

3. Leave the inverter switch “ON” (Switching the inverter “OFF” will disable the remote switch).

5 Operation

To operate the PROwatt 1500, turn it on using the ON/OFF switch on the front panel. The PROwatt 1500 is now ready to deliver AC power to your loads. If you are operating several loads from the PROwatt 1500, turn them on separately after the PROwatt has been turned on. This will ensure that the PROwatt does not have to deliver the starting currents for all the loads at once.

5.1 Outlets, Controls and Indicators

AC Outlet

The AC outlet on the PROwatt 1500 is a Ground Fault Circuit Interrupter (GFCI) outlet. This device will protect you against hazardous electrical shock that could be caused by dampness, faulty mechanism, worn insulation, etc. You may still feel a shock, but the GFCI should cut it off quickly enough so a person in normal health should not have serious injury (infants and small children may still be affected).

Test Procedures:

Like any other safety device, the GFCI should periodically be checked to make sure it is operating properly. Just follow the simple instructions below:

1. Push TEST button and RESET button should pop out. This should result in power being OFF. Verify by plugging test lamp into the outlet. **CAUTION!** If TEST lamp remains lit when the RESET button pops out, or if RESET button does not pop out at all when test button is depressed, the inverter should be returned to your place of purchase for service.

2. If the GFCI tests okay, restore power by pushing the RESET button back in firmly and fully into place until it locks and remains depressed after pressure has been removed. If the GFCI fails to reset properly, do not use it - the inverter should be returned to your place of purchase for service. Test lamp should light again.

3. If the GFCI trips by itself at any time, reset it and perform test procedures 1 and 2.

WARNING! There are no user serviceable parts inside of the PROwatt 1500, and the GFCI tripping does NOT mean that there is no risk of personal injury if one attempts to service the inverter or perform AC wiring. Refer all servicing to qualified personnel.

ON/OFF Switch The ON/OFF switch turns the control circuit in the PROwatt 1500 on and off. It does not disconnect power from the PROwatt.

When the switch is in the OFF position, the PROwatt 1500 draws no current from the battery. When the switch is in the ON position but no power is being supplied to the load, the PROwatt 1500 (12 and 24 volt) draws less than 500 milliamperes from the battery. This is a low current draw. It would take more than a week to discharge a 100 ampere-hour battery at this current, so you don't have to worry about excessive drain on your battery if you leave the PROwatt 1500 switched on for a few days. Do switch the PROwatt off if you are not planning to recharge your battery within a week or so.

Remote Panel The PROwatt also has a jack located on the bottom of the unit which interfaces with the supplied remote panel. The remote panel allows you to mount your PROwatt out of sight and turn your PROwatt ON/OFF from a conveniently located panel. The remote panel has a button and indicator light showing the inverter is ON or OFF (see section 4.5 for installation and operating instructions).

Battery Voltage Indicator The battery voltage bar graph indicates the voltage at the input terminals of the PROwatt 1500. At low input currents, this voltage is very close to the battery voltage. At high input currents, this voltage will be lower than the battery voltage because of the voltage drop across the cable and connections.

Ideally, the voltage should remain in the green area of the bar graph. If the voltage goes into the red areas at the top and bottom of the graph, the PROwatt may shut down.

Battery Current Indicator The battery current bar graph indicates the current drawn from the battery by the PROwatt 1500. It will not indicate current drawn by other loads also connected to the battery.

For long term operation, the current should remain in the green area of the bar graph. Short term operation is possible with current in the yellow area. If the current rises to the red area, the PROwatt will reduce its output voltage to protect itself.

OVERTEMP Indicator The OVERTEMP indicator light and alarm sound indicates that the PROwatt 1500 has shut itself down because it has become overheated. The PROwatt may overheat because it has been operated at power levels above its 1500 watt continuous output rating, or because it has been installed in a location which does not allow it to dissipate heat properly. The PROwatt 1500 will restart automatically once it has cooled off.

OVERLOAD Indicator The OVERLOAD indicator indicates that the PROwatt 1500 has shut itself down because of: severe overload, an AC wiring fault, or another AC power source connected to the AC circuit Switch the ON/OFF switch to OFF, correct the fault condition, and then switch the ON/OFF switch back to ON. Do not turn the PROwatt 1500 back on unless the fault condition is corrected (load removed/unplugged, wiring fixed, etc.).

5.2 Operating Limits

Power Output

The PROwatt 1500 will deliver 1500 watts or 13 amperes continuously. It will deliver greater than 2000 watts or 17 amperes for about 10 to 15 minutes. The PROwatt must cool for 15 minutes before it can resume operation at 2000 watts. The wattage rating applies to resistive loads such as incandescent lights while the current rating applies to reactive loads such as motors.

The PROwatt 1500 will operate most AC loads within its power rating. Some induction motors used in freezers, pumps, and other motor operated equipment require very high surge currents to start. The PROwatt 1500 may not be able to start some of these motors even though their rated current draw is within the PROwatt's limits. The PROwatt 1500 will normally start single phase induction motors rated at 3/4 HP or less.

If a motor refuses to start, observe the battery voltage indicator while trying to start the motor. If the battery voltage indicator drops below 11 volts (22V for PW1500/24) while the PROwatt 1500 is attempting to start the motor, this may be why the motor won't start. Make sure that the battery connections are good and that the battery is fully charged. If the connections are good and the battery is charged, but the voltage still drops below 11 volts (22V for PW1500/24), you may need to use a larger battery.

Input Voltage

The PROwatt 1500 will operate from input voltage ranging from 10 volts to 15 volts (20-30V for PW1500/24). It operates best when the voltage is in the range from 12 volts to 14.5 volts (24-29V for PW1500/24). If the voltage drops below 10.7 volts (21.5V for PW1500/24), an audible low battery warning will sound and the voltage indicator will be in the lower red zone. The PROwatt 1500 will shut down if the input voltage drops below 10 volts

(20V for PW1500/24). This protects your battery from being over-discharged. The PROwatt will not restart unless the input voltage exceeds 11 volts (22V for PW1500/24).

The PROwatt 1500 will also shut down if the input voltage exceeds 15 volts (30 V for PW1500/24). This protects the inverter against excessive input voltage. The voltage indicator will be in the upper red zone. Although the PROwatt 1500 incorporates protection against overvoltage, it may still be damaged if the input voltage exceeds 16 volts (32V for PW1500/24).

6 Troubleshooting

6.1 Common Problems

Buzz in Audio Systems

Some inexpensive stereo systems and "boom boxes" will emit a buzzing noise from their loudspeakers when operated from the PROwatt 1500. This is because the power supply in the device does not adequately filter the modified sine wave produced by the PROwatt 1500. The only solution is to use a sound system that incorporates a higher quality power supply.

Television Interference

Operation of the PROwatt 1500 can interfere with television reception on some channels. If this situation occurs, the following steps may help to alleviate the problem:

1. Make sure that the chassis ground lug on the back of the PROwatt 1500 is solidly connected to the ground system of your vehicle, boat, or home.

2. Do not operate high power loads with the PROwatt 1500 while watching television.

3. Make sure that the antenna feeding your television provides an adequate ("snow free") signal and that you are using good quality cable between the antenna and the television.

4. Move the television as far away from the PROwatt 1500 as possible.

5. Keep the cables between the battery and the PROwatt 1500 as short as possible and twist them together with about 2 to 3 twists per foot. This minimizes radiated interference from the cables.

6.2 Troubleshooting Guide

Problem and Symptoms	Possible Cause	Solution
Low output voltage (96 VAC to 104 VAC)	Using average reading voltmeter	Use true RMS reading meter. See section 2.2 of manual
Low output voltage and current indicator in red zone.	Overload	Reduce load.
No output voltage and voltage indicator in lower red zone	Low input voltage connections and cable.	Recharge battery, check
No output voltage, no voltage indication.	Inverter switched off No power to inverter Internal fuse open Reverse DC polarity	Turn inverter on. Check wiring to inverter. Have qualified service technician check and replace. Have qualified service technician check and replace fuse, OBSERVE CORRECT POLARITY.
No output voltage, voltage indicator in upper red zone.	High input voltage.	Make sure that PROwatt is connected to 12V battery (24V for PW1500/24), check regulation of charging system.
Low battery alarm on all the time, voltage indicator below 11 V (22V for PW1500/24)	Poor DC wiring, poor battery condition	Use proper cable and make solid connections, Use new battery.
No output voltage, OVERTEMP indicator on, load in excess of 1500 watts/150 ampere input CURRENT (or 75A for PW1500/24).	Thermal shutdown	Allow PROwatt to cool off. Reduce load if continuous operation required.
No output voltage, OVERTEMP indicator on, load less than 1500 watts/150 ampere input current (or 75A for PW1500/24).	Thermal shutdown	Improve ventilation, make sure ventilation openings in PROwatt aren't obstructed, reduce ambient temperature.
No output voltage, OVERLOAD indicator on.	Short circuit or wiring error. Very high power load	Check AC wiring for short circuit, improper polarity (hot and neutral reversed), or another AC power source Remove load.

7 Maintenance

Very little maintenance is required to keep your PROwatt 1500 operating properly. You should clean the exterior of the unit periodically with a damp cloth to prevent accumulation of dust and dirt. At the same time, tighten the nuts on the DC input terminals.

8 Warranty

Limited Warranty
(USA and Canada only)

What Does This Warranty Cover? Statpower manufactures its products from parts and components that are new or equivalent to new, in accordance with industry standard practices. This warranty covers any defects in workmanship or materials.

How Long Does The Coverage Last? This warranty lasts for 12 months from the date of purchase. Implied warranties of merchantability and fitness for a particular purpose are limited to twelve months from date of purchase. Some jurisdictions do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

What Does This Warranty Not Cover? This warranty will not apply where the product has been misused, neglected, improperly installed, physically damaged or altered, either internally or externally, or damaged from improper use or use in an unsuitable environment. Statpower does not warrant uninterrupted operations of its products. Statpower shall not be liable for damages, whether direct, incidental, special, or consequential, or economic loss even though caused by the negligence or fault of Statpower. Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

What Will Statpower Do? Statpower will, at its option, repair or replace the defective product free of charge. Statpower will, at its own option, use new and/or reconditioned parts made by various manufacturers in performing warranty repair and building replacement products. If Statpower repairs or replaces a product, its warranty term is not extended. Statpower owns all parts removed from repaired products.

How Do You Get Service? In order to qualify for the warranty, dated proof of purchase must be provided and the product must not be disassembled or modified without prior authorization by Statpower. If your product requires warranty service, please return it to the place of purchase along with a copy of your dated proof of purchase. If you are unable to contact your merchant, or the merchant is unable to provide service, contact Statpower directly:

BY PHONE:	(604) 420-1585
BY FAX:	(604) 420-1591
BY EMAIL:	customerservice@statpower.com
BY MAIL:	Statpower Technologies Corporation 7725 Lougheed Highway Burnaby, BC V5A 4V8 CANADA

You must obtain a Return Authorization Number from Statpower before returning a product directly to Statpower. Do not return a product to Statpower without first obtaining a Return Authorization Number. When you contact Statpower to obtain service, be prepared to supply the serial number of your product and its date of purchase.

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

1. Obtain a Return Authorization Number from Statpower.

2. Package the unit safely, preferably using the original box and packing materials. Include the Return Authorization Number, a copy of your dated proof of purchase, a return address where the repaired unit can be shipped, a contact telephone numbers, and a brief description of the problem.

3. Ship the unit to the following address, freight prepaid:

   Statpower Technologies Corporation
   c/o International Parcel Service Warehouse
   #8 – 14th Street
   Blaine, WA 98230 USA

If you are returning a product from Canada, follow steps 1 & 2 above and ship the unit, freight prepaid, to the following address:

Statpower Technologies Corporation
7725 Lougheed Highway
Burnaby, BC V5A 4V8
CANADA

How Other Laws Apply? This warranty gives you specific legal rights, and you may also have other rights which vary from jurisdiction to jurisdiction.

For our Canadian Customers: When used herein "implied warranties of merchantability and fitness for a particular purpose" includes all warranties and conditions, express or implied, statutory or otherwise, including without limitation implied warranties and conditions of merchantability and fitness for a particular purpose.

9 Specifications

9.1 Electrical Performance

	PW1500/12	**PW1500/24**
Output Power		
30 minutes:	1800 watts	1800 watts
10 minutes:	2000 watts	2000 watts
Continuous:	1500 watts	1500 watts
Output voltage:	115 VAC RMS ± 5%	115 V AC RMS ± 5%
Output waveform:	Modified sine wave, phase corrected	Modified sine wave, phase corrected
Output frequency:	60 Hz ± 0.01%	60 Hz ± 0.01%
Input voltage:	10 to 15 VDC	20 to 30 VDC
Low battery alarm:	audible, 10.7 volts	audible, 21.5 volts
Low battery cutout:	10 volts	20 volts
Efficiency:	approx. 85-90%	approx. 85-90%
No-load current draw:	< 0.5 A	< 0.4 A

9.2 Dimensions

Height:	3"(8cm)	3"(8cm)
Width:	9"(24cm)	9"(24cm)
Length:	16"(41cm)	16"(41cm)
Weight:	8.25 lb.(3.8 kg)	8.25 lb.(3.8 kg)

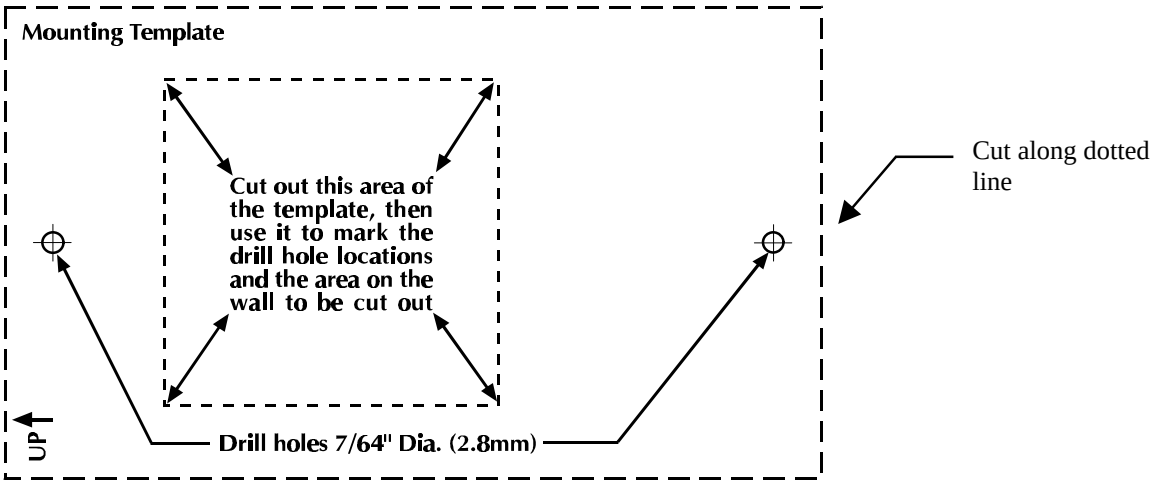


Figure 14. Remote Mounting Template

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Part No. 445-0077-01 Rev. 1