POWERTEK

INVERTER

USER MANUAL

SERIES L-UPS

SERIES SW-LUPS

SINE WAVE AND STEP WAVE

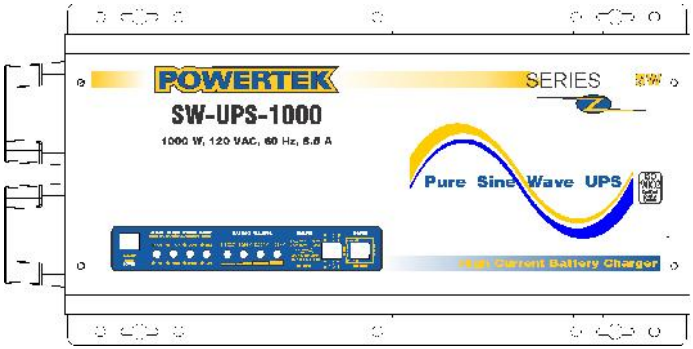
Digital Long Backup UPS

High Current Battery Charger

Jan. 2013.UMSIV-Ver.10

L-UPS-3600, L-UPS-4000 AND SW-UPS-3000

L-UPS-1000 , L-UPS-1500, L-UPS-2500, SW-UPS-1000, SW-UPS-1500, SW-UPS-2400 AND SW-UPS-3000



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1. Introduction

1.1 Introduction

These units are powerful inverter / charger systems made up of three modules: inverter, charger and transfer switch.

The **POWERTEK INVERTER Series L-UPS and SW** are a heavy-duty, continuous working System generating a modified sine wave from a 12V/24V - battery bank. It can supply energy to various loads including resistive loads (heater), inductive loads (air conditioners, refrigerator), motors (vacuum cleaners), and rectifier loads (computer).
For example, a single Powertek model L-UPS-3524 with a 880 AH battery bank can supply a 2000W workload for over 8 hours after a charge of 10 hours.
All Powertek models are designed to work under heavy load conditions.

The smart charger can be set with different charging profiles to match battery banks of different capacities. The high power charger can charge a 24V/800 AH battery bank in 10 hours.
The transfer switch module automatically diverts the energy transfer path between inverter and utility source. When the utility source is lower or higher than the transfer voltage levels, the path switches to the inverter. Otherwise the load is conducted to the utility source. The Powertek Inverter has an extremely fast transfer time, the time it takes to detect an abnormal input voltage plus the time to switch the load from the AC input source to the inverter's output.

The POWERTEK INVERTER is an extremely good choice for utility back up power and the rapid transfer time makes it possible to be used as a UPS for computers.

1.2 Important Safety Instructions

1.2.1 General Precautions

1. Before using the **INVERTER**, please read all instructions and warnings in this manual.
2. Do not expose the **INVERTER** to rain, snow, or liquids of any type. The **INVERTER** is designed for indoor mounting only. Protect the inverter from splashing if used in vehicle applications.
3. Take the **INVERTER** to a qualified service center when service or maintenance is required. Incorrect re-assembly may result in risk of electric shock or fire.
4. Reduce the risk of electric shock by disconnecting all wiring before making any attempt to maintain or clean the unit. Simply turning off the **INVERTER** will not reduce this risk.
5. Systems installed with photovoltaic cells or wind generators will produce power when exposed to light or wind. Be sure to disconnect these power sources before maintenance.
6. WORKING IN THE VICINITY OF A LEAD ACID BATTERY IS DANGEROUS. BATTERIES GENERATE EXPLOSIVE GASES DURING NORMAL OPERATION. The battery compartment should be well ventilated. The battery enclosure should be designed to prevent accumulation and concentration of hydrogen gas "pockets" at the top of the compartment. Vent the battery compartment from the highest point. A sloped lid can also be used to direct the flow through the vent opening location.
7. HYDROGEN ACCUMULATION MAY CAUSE BATTERIES TO EXPLODE.
8. **REVERSING BATTERY BANK POLARITY MAY CAUSE SERIOUS DAMAGES NOT COVERED BY THE WARRANTY.**
9. **CONNECTING AN AC SOURCE TO THE INVERTER AC OUTPUT MAY CAUSE DAMAGES NOT COVERED BY THE WARRANTY**
10. **NEVER** try to recharge a frozen battery.
11. Torque all AC wiring connections to 15-20 inch-pounds.
12. Torque all DC cable connections to 10-12 foot-pounds.
13. Be extremely cautious when working with metal tools around batteries. Dropping a tool could cause a short circuit or produce sparks that could cause an explosion.
14. The **INVERTER** must be used with a battery supply that matches the nominal DC :
15. **GROUNDING INSTRUCTIONS**. This inverter / charger should be connected to a grounded, permanent wiring system. For most installations, the negative battery conductor should be bonded to the grounding system at one, and only one, point in the system. All installations should comply with all national and local codes and ordinances.

1.2.2 Personal Precautions

1. Someone should be within voice range when you work near batteries in case of an emergency.
2. Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.
3. Wear complete eye and clothing protection. Avoid touching eyes while working near batteries. Wash your hands when done.
4. If battery acid contacts skin or clothing, immediately wash with soap. If acid enters eyes immediately flood eyes with cold running water for at least 15 minutes. Seek medical attention.
5. Never smoke or allow a spark or flame in the vicinity of a battery or generator.
6. Remove personal metal items such as rings, bracelets, necklaces, and watches when working with batteries. A battery can produce a short -circuit current, which is high enough to weld a ring to a battery terminal.

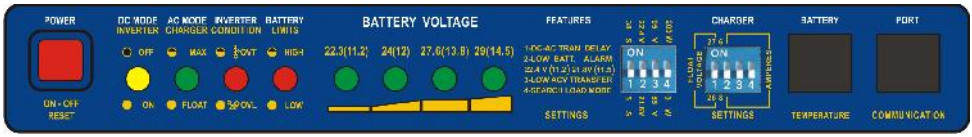
2. Front Panel / Inverter Operation

2.1 Indicator and Settings

2.1.1 Controls and LED Indicators

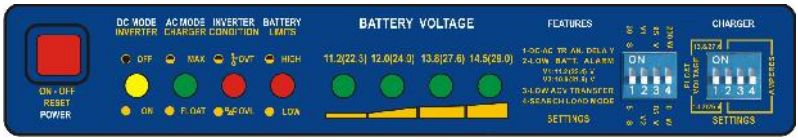
INVERTER SERIES L-UPS and **SERIES SW** operate identically.

L-UPS-3500, L-UPS-4000 AND SW 3000



LEDS: 1 2 3 4 5 6 7 8

L-UPS-1000, L-UPS-1500, L-UPS-2500, SW-UPS-1000, SW-UPS-1500, SW-UPS-2000, SW-UPS-2400



LEDS: 1 2 3 4 5 6 7 8

2.1.2 POWER ON-OFF - RESET Push Button

The Power ON/OFF-RESET push button is located on the left side of the panel.

Once the **INVERTER** has been properly installed and the batteries are connected, press the button to turn the **INVERTER ON**. This will alternately turn the **INVERTER** on and off. When the button is pressed, the buzzer will beep, release it when the buzzer stop beeping.

Note: When connected to batteries, the **INVERTER** can be activated by pressing the on/off button without AC input source.

Note: When the **INVERTER** is off, the device will be in Bypass Mode acting as a Voltage protector and recharging the batteries.

Note: When the **INVERTER** is shutdown by limited conditions (overload or low battery), the system can be reset by pressing twice the **POWER ON-OFF / RESET Button**.

Power On: Press the push button until the buzzer stops then release it. The INVERTER DC MODE light (LD1) or the AC MODE led (LD2) will turn on indicating Power On.

Power Off: Press the push button until the buzzer stops

Resetting the Unit: Repeat the Power Off or Power On procedure

2.1.3 Inverter DC Mode LED (LED 1)

The yellow LED indicates the system is working in DC Mode. When the utility power is unavailable or is out of range. The **INVERTER** will transfer the energy sourcing from AC to the DC source (battery bank) and the yellow led will turn on. It will turn off when the utility power is restored. The buzzer will beep every 10 sec during a minute.

This LED will blink when the Power search mode is set and the load is lower than 220W.

2.1.4 AC Mode / Battery Charger LED (LED 2)

The green LED turns on when operating in AC Mode indicating the different steps of the charger: Blinking during the **BULK** (limited current) and **ABSORBTION** steps and fully lit during the **FLOATATION** step.

2.1.5 Limited conditions: Over Temperature / Over Load LED (LED 3)

Over Temperature

When the PWM inverter's transformer temperature is higher than the default setting 120℃), the red LED will blink and the buzzer will beep twice every second and the **INVERTER** will shut down automatically for safe operation.

The inverter will restart automatically when the temperature returns to normal.

Over Load

When the load surpasses the nominal power in DC mode the red LED 3 will start to blink and the buzzer will beep every second. If the load is not decreased the inverter will shut off in one minute and the red led will lit.

If the load surpasses the Maximum power allowed (150 %), the inverter will stop immediately and LED 3 will be fully lit.

The inverter can be restarted or turned on with the Power ON/OFF / RESET button once the user has removed the overload condition.

If the AC input comes back on within the acceptable range the unit will transfer the load to the input source, the LED 3 will turn off. But if the overload condition persists, the AC Input breaker will trip and the Inverter will switch back to DC mode and the overload condition will return.

Please refer to the following chart for Overload indicator descriptions.

Load Capacity (DC Mode)	LED 3 Overload	Buzzer	INVERTER Status
<100%	Off	Off	INVERTER is operating in DC Mode
>100% < 150 %	On	Beeps every sec.	INVERTER will shut down in 1 minute
>Max Power	On	On	INVERTER will shut Off immediately

2.1.6 BATTERY High / Low LED (LED 4)

Battery High:

When batteries reach the high warning voltage of 30V/ 15V in AC mode, the red LED 4 will blink. The alarm will beep twice every second and the **INVERTER** will switch to DC mode. The red led will stay blinking to signalize the high battery condition.

If the batteries reach 30.5V/15.5 Volts in DC mode, the unit will shut off.

CALL INMEDIATELY THE AUTHORIZED SERVICING PERSONAL.

Battery Low:

In DC Mode when batteries reach low warning voltage, the led will light up and the buzzer will beep once every second until the battery reaches the low voltage cut off level, and the inverter shuts down. The inverter can be restarted in DC mode (from low battery condition) by pressing the Power ON-OFF RESET button.

During this condition the inverter will be waiting for the AC input to restart automatically. If the battery becomes too discharged (20V) the inverter will SHUT OFF automatically and user intervention will be necessary to turn the unit ON with the Power On switch.

In AC mode the led will be off while the unit recharges the battery.

2.1.7 Battery Voltage Meter LED (LED 5-8)

The LED 5~8 indicates the battery voltage level. Please refer to the details as below.

Battery Voltage	LED 5	LED 6	LED 7	LED 8
10.8V~11.5V / 21.6V~23.0V	On	X	X	X
11.5V~12.5V / 23.0V~25.0V	On	On	X	X
12.5V~14.0V / 25.0V~28.0V	On	On	On	X
14.0V~15.0V / 28.0V~30.0V	On	On	On	On

2.1.8 LED and Alarm Indicator for 24 and 12V systems

	LED1	LED2	LED3	LED4	LED 5	LED 6	LED 7	LED 8	BUZZER
	DC MODE	AC MODE	OVERTEMP	BATTERY	BATTERY METER				
CONDITION	(INVERTER)	CHARGER	OVERLOADED	LIMITS	22.3 (11,2)	24.0 (12.0)	26,8 (13.3)	29.0 (14.5)	WARNING
AC MODE					Lit if VBAT 21.6 ~ 23.0v 10.8 ~ 11.5v	Lit if VBAT 23.0 ~ 25.0v 11.5 ~ 12.5v	Lit if VBAT 25.0 ~ 28.0v 12.5 ~ 14v	Lit if VBAT 28.0 ~ 30.0v 14 ~ 15v	
BYPASS (Power Off)		ON OR BLINKING							
CURRENT MODE STEP		BLINKING							
ABSORPTION STEP		BLINKING							
FLOATATION STEP		ON							
CHARGER OVERTEMP			ON						
DC MODE					Lit if VBAT 21.6 ~ 23.0v 10.8 ~ 11.5v	Lit if VBAT 23.0 ~ 25.0v 11.5 ~ 12.5v	Lit if VBAT 25.0 ~ 28.0v 12.5 ~ 14v	Lit if VBAT 28.0 ~ 30.0v 14 ~ 15v	
INVERTER ON	ON								1Beep /10 sec. @ 1min.
NV. SEARCHING	BLINKING								
INV. OVERLOADED			ON						1Beep by Sec.@ 1min.
INV. OVERTEMP			BLINKING						2 Beeps by Sec.
BATTERY LOW WARNING				ON					2 Beeps by Sec.
BATTERY HIGH				BLINKING					2 Beeps by Sec.
INV.OFF LOW BAT				ON					

2.1.9 Features Settings

The following features can be set at the User's convenience

SWITCH	FEATURE	ON	OFF
SW1	DC-AC Transfer Delay	30 Sec.	5 Sec.
SW2	Low Battery Alarm @ 12V Devices	11.2V	11.0V
SW2	Low Battery Alarm @ 24V Devices	22.4V	21.8V
SW3	AC Transfer Voltage @ 120V Devices	95V	85V
SW4	Search Mode	(150-200) W	0 W

2.1.9.1 DC to AC Transfer Delay Setting (Switch 1)

The unit will transfer the load from DC to AC Mode when the input voltage stays in it limits for the delay time selected.

Switch 1	ON	OFF
Delay	30 Sec.	5 Sec

Note: The switch must be set before the system is turned on.

2.1.9.2 Low Battery Warning Setting (Switch 2)

Switch 2 sets the low battery alarm warning point. See the details below.

Switch 2 / Battery Voltage	12V	24V
On	11.2V	22.4V
Off	11.0V	21.8V

Note: The switch must be set before the system is turned on.

Note: Regardless of the Low Battery Warning Setting, the inverter will shut down when the battery reaches 20 V for the 24V model and 10V for the 12V. If after shutting down the inverter the battery voltage does not rise above 22 Volts (11Volts) the unit will shut off within 10 seconds.

2.1.9.3 AC Transfer Voltage Setting (Switch 3)

Low Voltage Transfer:

This switch selects the lower limit of the input voltage to transfer from AC to DC Mode. For example, when the voltage is lower than 85V, the **INVERTER** will switch to INVERTER MODE, where it remains until the voltage reaches 90V. Then the INVERTER, after the delay time selected with Switch 1, transfers back automatically from DC to AC MODE.

Switch 3 Low AC Voltage Transfer.	120V	220V	230V
Off	85/90V	160/165V	170/175V
On	95/100V	190/195V	200/205V

High Voltage Transfer:

When the AC input voltage is higher than the default setting, the **INVERTER** will switch to DC Mode. If the AC input voltage decreases below the return voltage point, the **INVERTER** will automatically switch to AC MODE. Please see the details below.

Nominal Voltage	Transfer (AC to DC)	Return (DC to AC)
120V	135	133
220V	264	254
230V	276	266

2.1.9.4 Search Load Mode Setting (Switch 4)

In DC Mode the Inverter can perform a Search load if Switch 4 is set to ON.
A minimum load of 220 W must be present in order to make the inverter start.

Switch 4 / Search load Mode	ON	OFF
	Search ON	Search OFF

Note: The switch must be set before the system is turned on.

2.1.10 Charger Settings

2.1.10.1 Battery Charging Profile / Floating Voltage Setting (Switch 5)

Switch 5 sets the different charge profiles to match the various battery types.

The **CHARGER** will FLOAT the battery at the selected voltage.

Set S1 OFF for AGM Battery and ON for FLOODED Battery

Switch 5 / Battery Voltage (FLOAT Stage)	12V	24V
On (FLOODED)	13.8V	27.6V
Off (AGM)	13.6V	27.2V

Note: The switch must be set before the system is turned on.

2.1.10.2 Battery Charging Rate Setting (Switch 6, 7, 8)

These three switches control the maximum charge rate in amps. The charge rate in amps has 8 stages. It can be adjusted by setting the switches 6, 7, and 8 (see the following chart). The maximum charge current is determined by the size of the battery bank.

Charge Rate	100%	80%	60%	50%	40%	30%	20%	10%
Switch 6	ON	ON	ON	ON	OFF	OFF	OFF	OFF
Switch 7	ON	ON	OFF	OFF	ON	ON	OFF	OFF
Switch 8	ON	OFF	ON	OFF	ON	OFF	ON	OFF

Caution: Excessively high charge rate can overheat a battery.

If a small battery capacity is being used, set the battery charge rate to the minimum setting.

Max Charge Rate . Models: SW-UPS and L-UPS

Model	1000@12	1500@12	1500	2000	2400/2500	3024	3624	4024
AmpsMax.	50	50	40	50	50	60	60	70

3. Battery

3.1 Battery Size

Batteries are the **Inverter** fuel tank. The larger the batteries the longer the **INVERTER** can operate. An undersized battery bank results in reduced battery life and short backup time.

Batteries should not be regularly discharged to more than 50% of their capacity. Under extreme conditions, such as a severe storm or a long utility outage, cycling to a discharge level of 80% is acceptable. Totally discharging a battery may result in permanent damage and reduced life.

For stand-by applications, the battery should provide between 3 and 5 days of backup before needing to be recharged. This is often referred to as the "number of days of autonomy."

Utility back up applications often have very small batteries. The minimum recommended battery capacity is **200 amp-hours@12vdc** and **100 amp-hours@24vdc**.

3.1.1 Estimating Battery Requirement

In order to determine the proper battery bank size, it is necessary to compute the number of amp hours that will be used during discharging cycles. Doubling the expected amp hour usage ensures that the batteries will not be overly discharged and extends battery life. To compute total amp hours usage, the amp hour requirements of each appliance that is to be used should be determined and totaled.

You can approximately compute your load by using the nameplate rating of your appliances.

This formula can be used to convert all nameplate values to watts. **Watts = Volts x Amps.** See following three examples

Case 1. Nameplate is in watts: no need to convert watts
Case 2. Nameplates is in amps : multiply by Volts (120V in USA)
Case 3. Nameplates in VA : consider the same value in Watts

Follow this procedure for each item you want to connect to the **INVERTER**.

Divide the total wattage of your load by the battery voltage to determine the amperage the load will draw from the batteries

Add the resulting amp hour requirements for each load to determine the total amps hours requirement.

For example, if the total load is 600Watts the current withdraw from the 24V battery bank will be approximately 600/24= 25Amps.

Multiplying the DC Amps by the number of hours that the load will be operating you will have a reasonable estimation of the amps hour.

In this example, if you want 4 hours of backup time multiply 25 amps x 4 hours = 100 amp / hour.

Now double the amp / hour calculated. This is the requirement for your battery bank.

In this example, it would be a 200 Amp / hour battery bank.

Doubling the amp/hour, will allow the battery to be cycled at 50% on a regular basis.

Motors are normally marked with their running current rather than their starting current. Starting currents may be three to six times running currents. Manufacturer's literature may provide more accurate information than the motor nameplate. For larger motors, the battery size must be increased due to the high demand of start-ups of the motors.

3.2 Battery Maintenance.

Check the level of the electrolyte of each battery cell at least once a month.

Always use extreme caution when handling batteries and electrolyte. Wear gloves, goggles and old clothes. "Battery acid" will burn skin and eyes and destroy cotton and wool clothing.

The quickest way to ruin lead-acid batteries is to discharge them deeply and leave them stand "dead" for an extended period of time. When they discharge, there is a chemical change in the positive plates of the battery. They change from lead oxide when charged to lead sulfate when discharged. If they remain in the lead sulfate state for a few days, some parts of the plate do not return to lead oxide when the battery is recharged. If the battery remains discharged longer, a greater amount of the positive plate will remain lead sulfate. The parts of the plates that become "sulfated" no longer store energy. Batteries that are deeply discharged, and then charged partially on a regular basis can fail in less than one year.

Check your batteries on a regular basis to be sure they are getting charged. Use a hydrometer to check the specific gravity of your lead acid batteries. If batteries are cycled very deeply and then recharged quickly, the specific gravity reading will be lower than it should because the electrolyte at the top of the battery may not have mixed with the "charged" electrolyte. Check the electrolyte level in wet-cell batteries at least four times a year and refill each cell with distilled water. Do not add water to discharged batteries. Electrolyte is absorbed when batteries are very discharged. If you add water at this time, and then recharge the battery, electrolyte will overflow, With proper care, lead-acid batteries will have a long service life and work very well in almost any power system.

Measuring Battery Condition

Connect a voltmeter and measure the voltage across the battery terminals with the battery at rest (no input, no output) for at least three hours. These readings are best taken in the early morning, at or before sunrise, or in late evening. Take the reading while all loads are off and no charging sources are producing power. (See: Battery State of charge)

The table will allow conversion of the voltage readings obtained to an estimate of state of charge. The table is good for batteries at 77ºF that has been at rest for 3 hours or more. If the batteries are at a lower temperature you can expect lower voltage readings. When your voltage reading is about equal to the battery "nominal voltage" **your battery is about 60% discharged.**

Keep the tops of your batteries clean and check that cables are tight. Do not tighten or remove cables while charging or discharging. Any spark around batteries can cause a dangerous hydrogen explosion inside and ruin one of the cells. When some cells show a variation of 0.05 specific gravity from each other an equalizing charge is recommended. This is a long steady overcharge, bringing the battery to a gassing or bubbling state. Consult recommendations of the battery manufacture for equalization charges. Do not equalize sealed or gel type batteries.

The batteries should be charged before checking the electrolyte level which should be about 1/ 2" above the top of the plates, NOT completely full. Most batteries have a plastic cup that the electrolyte should just touch when full. Don't overfill the batteries or the electrolyte will spill out of the batteries during charging. Refill the batteries with distilled water. Regular tap water may have high mineral levels that can contaminate the battery chemistry and reduce battery life.

Check the battery cable connections for tightness and corrosion. Torque all DC cable connections

to 10-12 foot-pounds. If any corrosion is found, disconnect the cables and carefully clean them with a mild solution of baking soda and water. DO NOT ALLOW THE SOLUTION TO ENTER THE BATTERY. Wash and replace the caps to the battery. Rinse the top of the battery with clean water when finished.

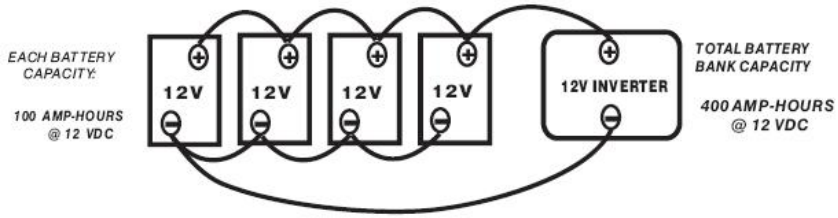
To reduce the amount of corrosion on the battery terminals, coat them with a thin layer of petroleum jelly or anti-corrosion grease available from automotive parts stores or battery suppliers. Do not apply any material between the battery terminal and the cable lugs, the connection should be metal to metal. Apply the protective material after the bolts have been tightened**.**

3.3 Battery Configurations

Battery banks of substantial size can be configured by connecting several smaller batteries. There are three ways to do this: parallel, series, or series -parallel. Torque all DC cable connections to 10-12 foot-pounds.

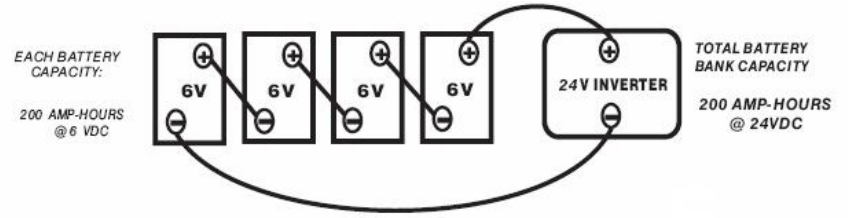
3.3.1 Parallel Connection

Batteries are connected in parallel when all of the positive terminals of a group of batteries are connected, and then all of the negative terminals of a group of batteries are connected. In a parallel configuration the battery bank has the same voltage as a single battery and an amp/hour rating equal to the sum of the individual batteries. This usually is done only with 12 voltage battery -inverter systems.



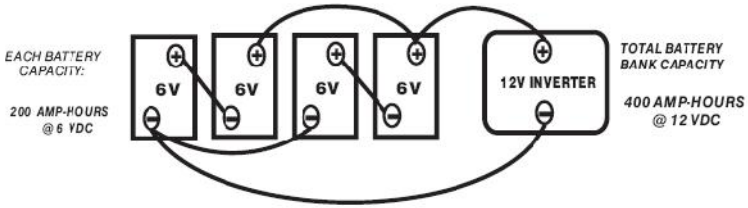
3.3.2 Series Connection

When batteries are connected with the positive terminal of one to the negative terminal of the next, they are connected in series. In a series configuration the battery bank has the same amp/hour rating as a single battery and an overall voltage equal to the sum of the individual batteries. This is common with 24 volt or higher battery-inverter systems.



3.3.3 Series-Parallel Connection

As the name implies, both of the above techniques are used in combination. The result is an increase in both the voltage and the capacity of the total battery bank. This is done very often to make a larger, higher voltage battery bank out of several smaller, lower voltage batteries. This is common with all battery-inverter system voltages.



3.4 Battery Installation

Caution: Batteries can produce extremely high currents during short-circuits. Be very careful while working with them. Read the important safety instructions at the beginning of this manual and the battery supplier precautions before installing the INVERTER and batteries.

3.4.1 Battery Location

Battery should be located in a place that allows the user easy access to battery caps and terminals. At least two feet of clearance above batteries is recommended (when using non-sealed batteries) to allow the user to check the electrolyte level in batteries. The batteries should be located as close as possible to the **INVERTER** but cannot limit access to the INVERTER and the Inverter AC/DC connections. The batteries are best located at the end of the Powertek INVERTER where the DC connections are located. Do not locate the inverter in the same compartment with non-sealed batteries (sealed batteries are acceptable). The gasses produced by these batteries during charging are very corrosive and will shorten the life of the inverter.

Battery to inverter wiring should be as short as possible to avoid excessive drop in voltage. See 4.2.1 for correct cable sizing.

3.4.2 Battery Enclosure

To prevent access from untrained personal, batteries should be protected within a ventilated, locked enclosure or room. The enclosure should be ventilated to the outdoors from the highest point to prevent accumulation of hydrogen gasses that are released in the battery charging process. An air intake vent should also be provided at a low point in the enclosure to allow for good ventilation. For most systems a one inch diameter vent pipe from the top of the enclosure is adequate to prevent accumulation of hydrogen. A sloped top can help direct the hydrogen to the vent location and prevent pockets of hydrogen from occurring. The enclosure should also be capable of holding at least one battery cell worth of electrolyte in the event a spill or leak occurs. The enclosure should be made of acid resistant material or have an acid resistant finish applied to resist the corrosion from spilled electrolyte and released fumes. If the batteries are located out doors the enclosure should be rainproof and have mesh screens over any openings to prevent insects and rodents from entering. Before placing the batteries in the enclosure cover the bottom with a layer of baking soda to neutralize any acid that might be spilled in the future.

3.4.3 Battery Cables

Heavy cables should be used to connect individual batteries to configure a larger battery bank**.** The actual size of the cable depends upon whether the batteries are connected in parallel or series. It is better to connect the batteries first in series and then in parallel when connecting smaller batteries. The best option is to connect the batteries both in series and parallel in a configuration known as "cross-trying'. This requires additional cables but reduces imbalances in the battery and can improve the overall performance. Consult your battery supplier for more information regarding the hook-up configuration required for your system.

4. Installation

4.1 Inverter Installation

Tools required for AC wiring connections are: wire strippers, 1/2"(13MM) open-end wrench or socket, Phillips screwdriver #2, slotted screw driver 1/4"(6MM) blade. Torque all AC wiring connections to 15-20 inch-pounds.

4.1.1 Environment

The Powertek INVERTER is a sophisticated electronic device and should be treated accordingly. When selecting the operating environment for the inverter, keep in mind that is a highly complex microprocessor controlled device and must be treated similar to other electronic devices such as televisions and computers. The use of coated circuit boards, plated copper bus bars, powder coated metal components, and stainless steel fasteners allows the unit to function in hostile environments, however, in an environment with high condensation (one in which humidity and/or temperature change causes water to form on components) all the ingredients for electrolysis are present - water, electricity, and metals and therefore the life expectancy of the inverter cannot be determined and the warranty is voided.

The **INVERTER** should be installed in a dry protected location away from sources of high temperature and moisture. Exposure to saltwater is particularly destructive and potentially hazardous.

Locate the **INVERTER** as close as possible to the batteries in order to keep the battery cables short. However, do not locate the inverter in the same compartment as non-sealed batteries.

Caution: Do not mount the inverter in a closed container. Unrestricted airflow is necessary in order for the inverter to operate at high power for sustained periods of time. Without ventilation, the protection circuitry will activate and reduce the maximum power available.

4.1.2 System Grounding

Grounding requirements vary by country and application. Consult local codes and the NEC for specific requirements.

4.1.2.1 Equipment or Chassis Ground

This is the simplest part of grounding. The idea is to connect the metallic chassis of the various enclosures to have them at the same voltage level. This reduces the potential for electric shock. It also provides a path for fault currents to flow resulting in blown fuses or tripped circuit breakers. The size of the connecting conductors should be coordinated with the size of the over current devices involved. Under some circumstances the conduit and enclosures themselves will provide the current paths.

4.1.2.2 Ground Electrodes / Ground Rods

There are two purposes of the grounding electrode, which is often called a ground rod. The first is to "bleed" off any electrical charge that may accumulate in the electrical system. The second is to provide a path for dissipating induced electromagnetic energy or lightning energy. The size of the conductor of the grounding electrode or grounding system is usually based on the size of the largest conductor in the system. Most systems use a 5/8' (16mm) copper plated rod 6 feet (2 mts) long driven into the earth as a grounding electrode. It is also common to use copper wire placed in the concrete foundation of the building as a grounding system. While either method may be acceptable, the local code will prevail. Connection to the ground electrode should be done with special clamps located above ground where they can be periodically inspected.

Multiple ground rods are recommended in larger systems. Most electrical codes require multiple ground rods connected by a separate wire with its own set of clamps.

Well casings and water pipes can be used as grounding electrodes. Under no circumstance should a gas pipe or line be used. Consult local codes and the NEC for more information.

4.1.3 Bonding the Grounding System to the Neutral and Negative Conductors

This is the most confusing part of grounding. The idea is to connect one of the current carrying conductors, usually the AC neutral and DC negative, to the grounding system.

This is why we call one of the wires "neutral" in the North American electrical systems. This way you can touch this wire and the grounding system and not receive a shock. When the other ungrounded conductor, the hot or positive, touches the grounding system, current will flow through it to the point of connection to the grounded conductor and back to the source. This will cause the over current protection to stop the flow of current, protecting the system. The point of connection between the grounding system and the current carrying conductor is often called a "bond." It is usually located on the enclosure of the current protection device. Although the

point of connection can be made on the inverter, codes do not generally allow it because the inverter is considered a "serviceable" item which may be removed from the system. In residential systems the point of connection is located at the service entrance panel.

In some countries the neutral is not bonded to the grounding system. This means you may not know when a fault has occurred since the over current device will not trip unless a "double" fault occurs. This type of system is used in some marine electrical codes.

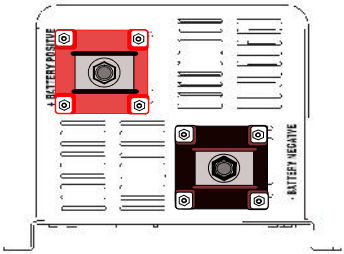
Bonding must be done at only one point in an electrical system. The Powertek has two separate power sources- a DC and an AC source. This means that two bonding points will occur in all inverter applications. The bonding point will also be connected to the chassis ground conductors. It is common to have two separate conductors for connecting the ground electrode and the two bonding points. Each conductor must use a separate clamp.

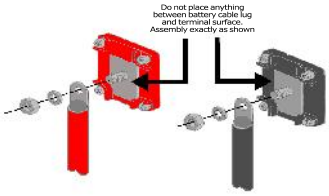
4.2 Installation Diagrams

4.2.1 DC Wire Size

POWERTEK DC terminal:

The picture at the left illustrates the proper method to connect battery cables to the





The following table indicates, according to distance, the proper wire size for each model

The voltage drop calculations are based on the wire length indicated on top of the table.(both positive and negative wires of the same length).

WIRE LENGTH < 5 FEET

MODEL	1524-1824	2524-3024	3624-4024	1512-1812	2512-3012
WIRE GAUGE	AWG 2	AWG 1/0	AWG 2/0	AWG 1/0	AWG 2/0
MAX VOLT DROP	0.207	0.217	0.229	0.260	0.340
NOM. VOLT DROP	0.138	0.145	0.153	0.174	0.229

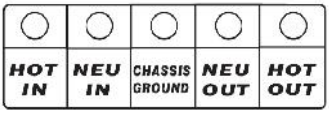
WIRE LENGTH < 10 FEET

MODEL	1524-1824	2524-3024	3624-4024	1512-1812	2512-3012
WIRE GAUGE	AWG 2/0	AWG 3/0	AWG 4/0	AWG 3/0	AWG 4/0
MAX VOLT DROP	0.206	0.273	0.288	0.330	0.430
NOM. VOLT DROP	0.137	0.182	0.192	0.218	0.288

WIRE LENGTH < 20 FEET

MODEL	1524-1824	2524-3024	3624-4024	1512-1812	2512-3012
WIRE GAUGE	AWG 2/0	AWG 3/0	AWG 4/0	AWG 3/0	AWG 4/0
MAX VOLT DROP	0.412	0.545	0.576	0.300	0.430
NOM. VOLT DROP	0.275	0.364	0.384	0.218	0.288

4.2.2 Terminal Block (AC Side)



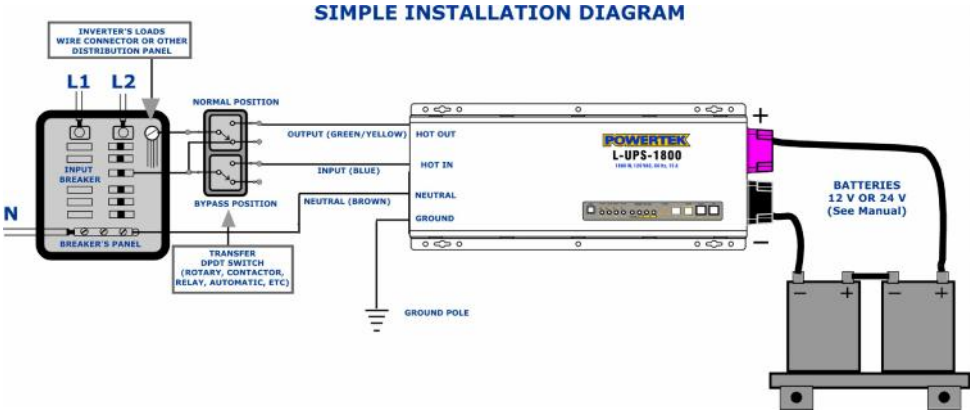
4.2.3 AC Wire Gauge Recommended

The following chart indicates recommended AC wire gauge for wire lengths up to 20 feet.

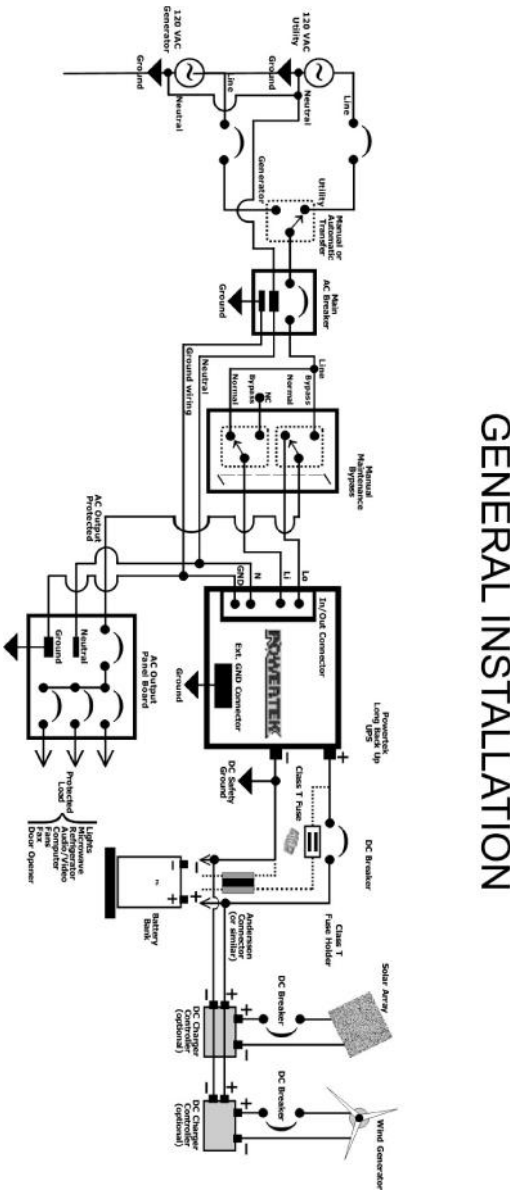
MODEL	120V	220V	230V	120V	220V	230V	INPUT BREAKER
INVERTER 1500-12V	**10 AWG**	12 AWG	12 AWG	12 AWG	16 AWG	16 AWG	20
INVERTER 1800-24V	**10 AWG**	10 AWG	10 AWG	12 AWG	16 AWG	16 AWG	20
INVERTER 2000-24V	**8 AWG**	10 AWG	10 AWG	10 AWG	14 AWG	14 AWG	25
INVERTER 2500-24V	**8 AWG**	10 AWG	10 AWG	10 AWG	14 AWG	14 AWG	30
INVERTER 3000-24V	**6 AWG**	8 AWG	8 AWG	8 AWG	14 AWG	14 AWG	40
INVERTER 3600-24V	**6 AWG**	8 AWG	8 AWG	8 AWG	12 AWG	12 AWG	50
NVERTER 4000-24V	**6 AWG**	6 AWG	6 AWG	8 AWG	10 AWG	10 AWG	50

Note. Input breaker recommended in table correspond to the 120V Models

4.2.4 Simple Installation Diagram



4.2.5 General Installation Diagram



4.3 Connection's Steps

After batteries have been installed and interconnected, follow these steps to complete the installation as in the Simple Installation Diagram.

4.3.1 Step 1 "Connect the inverter to the Batteries and Test the inverter in Battery Mode"

- Before connecting, confirm that wire gauge, battery voltage, and polarity are correct.
- Connect the unit to the battery.
- Confirm the tightness of the terminal.
- Turn the inverter ON and confirm the output voltage on the AC output terminals.
- Turn the inverter OFF.

4.3.2 Step 2 "Connect the inverter to an AC Source"

- Wire the Bypass switch and other connections to the Distribution Panel.
- Confirm that the input breaker is well dimensioned.
- Wire the inverter to the input power source. (Bypass Switch on the Diagram)
- Turn on the input breaker on the Main panel
- The battery LEDs on the inverter front panel should turn on and 30 seconds later (or 5 Sec. according to the setting) the output will be present at the output contacts on the AC Terminal Block.
- The charger will start 5 seconds later.
- At this moment, confirm the battery charge. The battery voltage should be about 27.6 (13.8) VDC when floating.

4.3.3 Step 3 "Turn the Inverter ON"

- Push the POWER ON /RESET Button until the alarm stops and release the button.
- LED 2 will turn ON.
- Switch OFF the Input breaker in the Distribution Panel and verify that the inverter LED 1 turns ON.
- Switch ON the input breaker and verify that 30 Sec (5 Sec.) later the output change to AC Mode and LED 1 turns OFF and LED 2 Turns ON

4.3.4 Step 4 “Connect the Load”

- Turn the inverter OFF
- Switch the Input breaker OFF
- Choose all of the loads to connect to the inverter
- Wire the loads to a connector or to a separate Breaker Panel.
- Place the BYPASS Switch in the Bypass position.
- Switch the Input breaker ON.
- Turn ON all of the loads.
- Measure the AC Amps in the input breaker wire.
- Confirm that the Inverter output current capability is at least 25% higher that the measured value above. (If not disconnect several loads up to reach this condition)
- Place the BYPASS Switch to the neutral position.
- Turn ON all the electrical devices on the site including air conditioners, washing machines, dryers and **all the 120V and 220V devices**.
- Confirm that the voltage between the load connector (Hot wire) and Neutral is ZERO VOLTS (0 V to 3V). If it is not ZERO VOLTS, verify the cause of voltage before proceeding.
- **Turns OFF all of the loads.**
- Switch the Input breaker OFF.
- Turn the Inverter ON with the POWER ON / RESET Push button
- Switch the BYPASS switch to NORMAL POSITION.
- Turns the inverters loads ON.
- Confirm that inverter output voltage is correct all of the loads are operating satisfactory.

4.3.5 Step 5 “Transfer the Load to the AC Input source”

- Switch the input breaker ON.
- In 30 seconds (5 Sec.) the unit will transfer the load to the AC input source and the charger will start charging the battery.
- Confirm everything is working properly
- Now you can consider the installation done.

5. Technical Specifications

5.1 SERIE L-UPS

SPECIFICATIONS	LUPS-1000	LUPS-1500	LUPS-2500	LUPS-3000	LUPS-3600	LUPS-4000
Nominal Power @ 25 °C	1000 W	1500 W	2500	3000 W	3600 W	4000 W
Maximum Power@ 1min.	1500 W	2250 W	3750 W	4000 W	5400 W	6000 W
Output Amps	8.5	12.5	21	25	30	33.5
Efficiency	85%					
Output Voltage Regulation	5%					
Power Factor Allowed	0.8 to 1					
Standard Output Voltage	120 / 220 / 230 Vac					
Frequency Regulation	Nom. Freq. +/- 1HZ					
Loading Sensing	Selectable : 0 W - 220W					
Output Waveform	Step Wave					
DC Input Amps at Rated Power	100	75	125	148	176	196
DC Input Amps at Short Circuit	200	150	320	430	540	600
Nominal DC Input Voltage	12 Vdc	24 Vdc				
DC Input Voltage Range	10.0~15 Vdc	20.0~30 Vdc				
Automatic Low Battery Protection	10.0 Vdc	20.0 Vdc				
Low Battery warning alarm	Vols	Selectable 21.6-22.4 Volts				
High Battery voltage detection	Yes, 15 V	Yes: 30 V				
Transfer Time	~10 mS					
Input Voltage Range	Adjustable low voltage cut off (85/95) – Fixed high voltage cut off 135 V					
Load Protection Breaker Amps	15		20	30	30	40
Forced Air Cooling	Variable Speed according temperature					
Automatic Transfer Relay	30A		30A			40A
Max. DC Amps Charger 100%	40	40	45	50	60	60
Adjustable Charge Rate	Yes: 10%, 20%, 30%, 40%, 50%, 60%, 80%, 100%					
Three Stage Charging	Yes: Bulk (29/ 14.5 V), Absortion (1h), Floatation (indefinite)					
Temperature compensate Charger	Yes:, for ciclic use from 0 to 50°Celsius					
Overcharged battery protection	Yes (15/30) Vmax					
Charger Protection Breaker Amps	15		25	30	30	40
Acoustic alarm	Yes					
LEDs Indicators	AC Mode, DC Mode, Low/ High battery, Overload/ Overtemp condition, Battery level meter					
Control switches	Master Power ON/ OFF and condition RESET (Overload, Low Battery)					
Heavy duty terminal Block	Yes					
Line frequency sinchronization	AC Mode 55-65 Hz, DC Mode 57-63 Hz					
Line Filter and surge suppressor	SURGE ARRESTER 270 Joules HN-HG-NG					
Resistive Load	Yes: Up to 100%					
Inductive Load	Yes: 0.8 Lag					
Motor Load	Yes					
Rectifier Load	Yes					
Operating temperatures	10 to 50 ºC					
Humidity	90 % Not condending					
Quality and Safety certifications	CE (120V 50-60 Hz), ETL pending (120V 60 Hz, ISO 9001, ANSIII/ IEEE C 62.41 Cat. B					
Shipping Weight (kg)	21	22	24	25	25.5	26
Dimensions (WxDxH) (cm)	56x23x19					
Shipping Dimensions (WxDxH) (cm)	66x33x30					

5.2 SERIE SW-UPS

SPECIFICATIONS	SW-UPS-1500	SW-UPS-2000	SW-UPS-2400	SW-UPS-3000
Nominal Power @ 25°C	1500 W	2000	2400	3000 W
Maximum Power@ 1min.	2250 W	3000 W	3600	4500 W
Output Amps	12.5	16.7	20	25
Efficiency	85%			
Output Voltage Regulation	5%			
Power Factor Allowed	0.8 to 1			
Standard Output Voltage	Options: 120 / 220 / 230 Vac			
Frequency Regulation	Nom. Freq. +/- 1HZ			
Loading Sensing	Selectable : 0 W - 220W			
Output Waveform	Pure Sine Wave (THD Less 3%)			
DC Input Amps at Rated Power	90	125	130	148
DC Input Amps at Short Circuit	250	320	350	430
Nominal DC Input Voltage	24 Vdc			
DC Input Voltage Range	20.0~30 Vdc			
Automatic Low Battery Protection	20.0 Vdc			
Low Battery warning alarm	Selectable 21.6 - 22.4 Volts			
High Battery voltage detection	Yes: 30 V			
Transfer Time	~10 mS			
Input Voltage Range	Adjustable low voltage cut off (85/95) – Fixed high voltage cut off 135 V			
Load Protection Breaker Amps	15	20	25	30
Forced Air Cooling	Variable Speed according temperature			
Automatic Transfer Relay	30A	30A		
Max. DC Amps Charger 100%	40	50	50	60
Adjustable Charge Rate	Yes: 10%, 20%, 30%, 40%, 50%, 60%, 80%, 100%			
Three Stage Charging	Yes: Bulk (29/ 14.5 V), Absortion (1h), Floatation (indefinite)			
Temperature compensate Charger	Yes:, for ciclic use from 0 to 50°Celsius			
Overcharged battery protection	Yes (15/ 30) Vmax			
Charger Protection Breaker Amps	15	25	26	30
Acoustic alarm	Yes			
LEDs Indicators	AC Mode, DC Mode, Low/ High battery, Overload/ Overtemp condition, Battery level meter			
Control switches	Master Power ON/ OFF and condition RESET (Overload, Low Battery)			
Heavy duty terminal Block	Yes			
Line frequency sinchronization	AC Mode 55-65 Hz, DC Mode 57-63 Hz			
Line Filter and surge suppressor	Yes, SURGE ARRESTER 270 Joules HN-HG-NG			
Resistive Load	Yes: Up to 100%			
Inductive Load	Yes: 0.8 Lag			
Motor Load	Yes			
Rectifier Load	Yes			
Operating temperatures	10 to 50 oC			
Humidity	90 % Not condending			
Quality and Safety certifications	CE (120V 50-60 Hz), ETL pending (120V 60 Hz, ISO 9001, ANSIII/ IEEE C62.41 Cat. B			
Shipping Weight (kg)	22	24	24	25
Dimensions (WxDxH) (cm)	56x23x19			
Shipping Dimensions (WxDxH) (cm)	66x33x30			

6. Service and Support

If you have any questions, contact our representative in the Dominican Republic, ACTEL SRL (Tel. 809 5651717) and ask for a technical representative.

Please have the following information ready when you call the **Local Distributor**:

- Model number
- Serial number
- Date of failure or problem
- Symptoms of failure or problem
- Customer returns address and contact information

If repair is required, you will be given a Returned Material Authorization (RMA) Number. This number must appear on the outside of the package and on the Bill of Lading (if applicable). Use the original packaging or request packaging from the Help Desk or distributor. Units damaged in shipment as a result of improper packaging are not covered under warranty. A replacement or repair unit will be shipped, freight prepaid by customer for all warranted units.

7. POWERTEK Warranty

The POWERTEK warranty is 3 years, covering any failure due to manufacturing and including spare parts costs during the first year.

The warranty does not cover damages caused by external factors such as: fire, flooding, electrical accidents, etc.

The warranty does not cover damages caused to devices connected to the unit nor indemnity & for opportunity cost due to devices out of service.

The warranty is honored in the authorized Service Department and does not cover transport and technical services done to evaluate or correct nor the dismounting or mounting of the device.

The unit must be installed by personnel properly trained. In case of damage, a Local Service Representative should be allowed to inspect the installation condition in order to determine the cause of damage.

Warranty will not cover damages caused by:

1. Reversing Battery polarity
2. Applying an AC source to the Unit's output
3. Grounding absence
4. High input voltage that damages the surge suppressor.

Warranty will be voided if:

1. The unit has been opened by unauthorized personal.
2. The unit is in abnormal conditions such as: excessive dirt, wet, visible corrosion or any other condition that indicates misuse.
3. The owner does not present the Warranty card properly filled out and the purchase invoice indicating name, date and serial number.

9. Troubleshooting

SYMPTOM	CAUSE	SOLUTION
No output in DC Mode	Inverter is turned off	Turn unit on
	Inverter is disable by low battery, high battery, Overload, or Overtemp	Remove the condition
No output in AC Mode	Load breaker is tripped	Reset the breaker
Unit stays in DC Mode when input voltage is present.	Input voltage is out of range	Correct input voltage or change input voltage cut off levels
	Charger breaker is tripped	Reset the breaker
	Input breaker at the distribution panel is tripped	Reset the breaker
Inverter backup time is very short during blackout	Electrolyte level of batteries is too low	Add distilled water to correct level
	Battery Electrolyte level is too high	Carefully remove excess electrolyte.
	Batteries are in poor condition	Replace batteries
Low Battery LED is always Lit		With a Voltage Meter check the battery voltage when the unit is in AC Mode. If battery voltage does not increase call Technical Service.
Led 8 (the fourth led on the inverter battery meter) never turns on	Damaged Batteries	Check battery temperature and water consumption. If abnormal, the batteries may be damaged. Call technical service or replace batteries
Charger breaker trips several seconds after unit transfers to AC Mode		Bypass the Unit and call Technical Service.
Input breaker in the Distribution panel trips often	Incorrect breaker size	Switch breaker to correct amp size
	Loose breaker contacts	Tighten breaker contacts
		With Dip Switch decrease to minimum the Amps rate setting and call Technical Service
Resetable Load breaker trips often	Overloading inverter	Decrease the load connected to inverter
The unit pass very often to DC Mode	Input voltage is out of range	Change input voltage settings or call an electrician to correct input voltage.
		If this occurs during starting of heavy loads such as: Motors, Air conditionings, freezers, etc. If so call Technical Service.
Unit does not turn on with Push button	Extremely low battery voltage	Recharge batteries with a external charger and then turn on the unit
Unit smells burnt but is working		Call Technical Service
Unit smells burnt and is not working		Call Technical Service
Unit does nothing and no LEDs are lit		Call Technical Service
Fan is always On	Environment temperature is above 40ºC	Ventilate the area
	Batteries overheated	Replace batteries

9. Technical Information Disclaimer

Any information in any written paper, catalog or User Manual of this products can be changed without previous notice.

The company makes not warranty as to the accuracy, sufficiency or suitability of any technical documentation. Furthermore, our company assumes no responsibility or liability for loss or damage, whether direct, indirect, consequential or incidental which may arise out of the use of such information. The use of the information will be at the user or distributor own risk.

Pictures or drawings showed in this manual may be slightly different to the product that you received.

10. Technical Note

CHARGING AGM BATTERIES: Switch S5 OFF

To maximize the life of your AGM Battery, it is important that it is properly charged.

Both, over and under charging will result in a shortened service life, as with all lead-acid batteries.

The POWERTEK Inverter has a quality charger and routinely makes sure that the charging current and voltage are maintained.

CHARGER GUIDELINES

Follow these instructions before charging your battery

The cable connection must be clean and adapted to the battery terminals to ensure a snug connection.

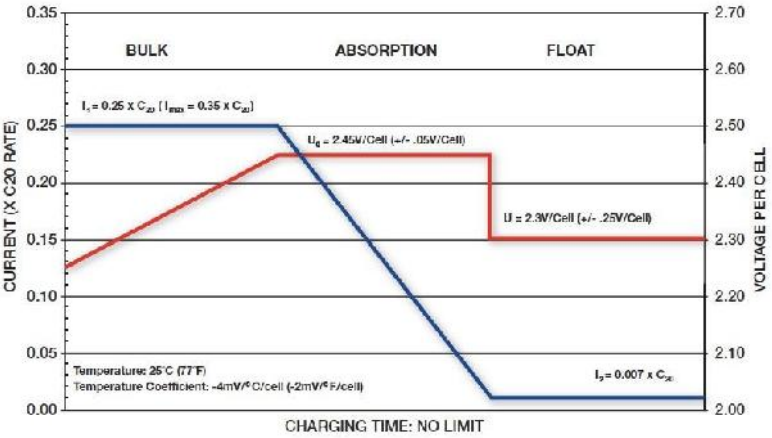
Allow a fully charge of the batteries after each discharge's cycle.

Charge in a ventilated area as gasses may be released through the pressure relief valve if the batteries are overcharged.

CHARGING CHARACTERISTICS

The charger has a setting for AGM, use this setting. (Switch S5 OFF)

VOLTAGE REGULATED CHARGER



SE'

The initial current is recommended to be set at I1=0.25 x C20 (IMAX=0.35xC20) in order to fully charge the batteries within reasonable amount of time. It can be lower, however, please be aware that charge time will increase so make sure the batteries have enough time to fully charge before being put back into service.
Use Switches S6, S7 and S8 to set the current.
If the battery has a low internal resistance you can increase the charging current to decrease the charging time.

BULK STAGE
The charger will deliver the initial current I until the stage voltage limit, Uo, is reached.

ABSORBTION STAGE
The charger should maintain the voltage Uo until the current tapers to I2 or after 2 hours.
FLOAT STAGE AND TERMINATION
The charger can maintain the charging current I2 indefinitely. This stage is ideal to maintain battery state of charge.
To maximize your battery life a voltage regulated charger with temperature compensation is strongly recommended if it is use in areas where the temperature may decrease to “0” deg. Celsius
Some models are provided with its temperature sensor.

CHARGER VOLTAGE REFERENCE

S5 OFF, Temperature compensation probe

		32°F (0°C)	50°F (10°C)	68°F (20°C)	77°F (25°C)	86°F (30°C)	104°F (40°C)
2V	Charge Voltage	2.55V	2.51V	2.47V	2.45V	2.43V	2.39V
	Float Voltage	2.38V	2.34V	2.30V	2.28V	2.26V	2.22V
12V	Charge Voltage	15.30V	15.06V	14.82V	14.70V	14.58V	14.34V
	Float Voltage	14.25V	14.01V	13.77V	13.65V	13.53V	13.29V
24V	Charge Voltage	30.60V	30.12V	29.64V	29.40V	29.16V	28.68V
	Float Voltage	28.50V	28.02V	27.54V	27.30V	27.06V	26.58V
48V	Charge Voltage	61.20V	60.24V	59.28V	58.80V	58.32V	57.36V
	Float Voltage	57.00V	56.04V	55.08V	54.60V	54.12V	53.16V

Battery State of Charge Voltage Table

Percent of Full Charge	DC System		
	12 VDC	24 VDC	48 VDC
100.00%	12.70	25.40	50.80
90.00%	12.60	25.20	50.40
80.00%	12.50	25.00	50.00
70.00%	12.30	24.60	49.20
60.00%	12.20	24.40	48.80
50.00%	12.10	24.20	48.40
40.00%	12.00	24.00	48.00
30.00%	11.80	23.60	47.20
20.00%	11.70	23.40	46.80
10.00%	11.60	23.20	46.40
0.00%	<11.60	<23.20	<46.40