



Technical Specification

Model Specification	SL 1024	SL 2024	SL 3024
Continuous Power	1000 Watts	2000 Watts	3000 Watts
Efficiency	90% max.	90% max.	90% max.
Output Waveform	Sine wave		
DC Power at Rated Power	60 amps	120 amps	180 amps
DC Power at Short Circuit	180 amps	360 amps	540 amps
Nominal Input Voltage	24 Vdc	24 Vdc	24 Vdc
DC Input Voltage Range	20.0~30 Vdc		
Auto Low Battery Protection (Heavy/Light Load)	20.0 Vdc		
DC mode output Voltage Regulation	+/- 10%		
Power Factor Allowed	0.8 to 1		
Frequency Regulation	+/-1 Hz		
Standard Output Voltage	120 / 220 / 230 Vac		
Loading Sensing (Power Saving)	Selectable 0, 2%, 4%, 6%	Selectable 0, 2%, 4%, 6%	Selectable 0, 2%, 4%, 6%
Transfer Time	1 Cycle	1 Cycle	1 Cycle
Forced Air Cooling	Variable Speed	Variable Speed	Variable Speed
Automatic Transfer Relay	30A	40A	40A
Adjustable Charge current	3 ~ 35 amps	7 ~40 amps	7 ~ 45 amps
Number of Charge Profiles	2	2	2
Resistive Load	100%	100%	100%
Inductive Load	YES	YES	YES
Motor Load	YES	YES	YES
Rectifier Load	YES	YES	YES
Wall Mounting	YES	YES	YES
Shipping Weight (kg)	22.5	24.5	25
Dimensions (WxDxH)	18.4 x 54.6 x 21.6	18.4 x 54.6 x 21.6	18.4 x 54.6 x 21.6

● Technical Specifications subject to change without notification.

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1. Introduction

1.1 Introduction of Inverter

The SL series inverter not only is an inverter but also contains a powerful smart charger. Actually, it contains three modules in a single unit: inverter, charger and switch.

The SL series inverter is a heavy-duty, continuous working module generating a sinusoidal wave from a 12V/24V - battery bank, which can supply energy to various loads such as resistive load (heater), inductive load (air conditioners, refrigerator), motors (vacuum cleaners), and rectifier load (computer). All SL series are designed to work in heavy load condition. De-rating is not necessary. It provides a rapid and complete charging process.

The smart charger can be set with different charging profiles and battery capacities to match in various battery types and sizes. The switch module automatically diverts the energy transfer path between inverter and utility source. When the utility source is lower than the transfer level, the path switches to the inverter. Otherwise the load is conducted to the utility source. The transfer time is 1/4~1/2 of the total cycle time. The high power charger (80A) can charge a 12V/1000 AH battery bank in 14 hours. For example, a single unit of Inverter SL 2012 with a 1000 AH battery bank can supply a 2000W workload for over 6 hours after a charge of 14 hours.

SL series is an extremely good choice for utility back up power. However, it also can be used as a UPS for computers.

An inverter, charger and switching box can be replaced with a single SL series unit.

1.2 Important Safety Instructions

1.2.1 General Precautions

1. Before using the SL inverter, please read all instructions and cautionary marks on (1) the inverter, (2) the batteries, and (3) all appropriate sections of this instruction manual.
2. Do not expose SL INVERTER to rain, snow, or liquids of any type. The SL INVERTER is designed for indoor mounting only. Protect the inverter from splashing if used in vehicle applications.
3. Do not disassemble the SL INVERTER; take it to a qualified service center when service or maintenance is required. Incorrect re-assembly may result in risk of electric shock or fire.
4. To reduce risk of electric shock, disconnect all wiring before making any attempt to maintain or

clean. Simply turning off the INVERTER will not reduce this risk.

5. **WARNING: WORKING IN THE VICINITY OF A LEAD ACID BATTERY IS DANGEROUS. BATTERIES GENERATE EXPLOSIVE GASES DURING NORMAL OPERATION.** Provide ventilation to outdoors from the battery compartment. The battery enclosure should be designed to prevent accumulation and concentration of hydrogen "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.
6. **NEVER charge a frozen battery.**
7. **No terminals or lugs are required for hook-up of the AC wiring. AC wiring must be no less than 10 AWG(5.3mm²) gauge copper wire and rated for 75Amp or higher and should be no less than 20 AWG(67.4mm²) gauge.** Crimped and sealed copper ring terminal lugs with a 5/16 inch hole should be used to connect the battery cables to the DC terminals of the INVERTER. Soldered cable lugs are also acceptable .See section on battery cable sizing for more details for your application.
8. Torque all AC wiring connections to 15-20 inch-pounds. Torque all DC cable connections to 10-12 foot-pounds .Be extra cautious when working with metal tools on or around batteries. The potential of dropping a tool causing the batteries or other electrical parts resulting in sparks could cause an explosion. Tools required for AC wiring connections: wire strippers, 1/2"(13mm²) open-end wrench or socket, Phillips screw driver #2, slotted screw driver 1/4"(6 mm²) blade.
9. The INVERTER must be used with a battery supply of nominal voltage that matches the last two digits of the model number; e.g., 12 volts with SL1012, SL1512, SL 2012 or 24 volts with a SL1024, SL 1524, SL 2024 and SL 3024.
- 10.**GROUNDING INSTRUCTIONS.** This battery 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

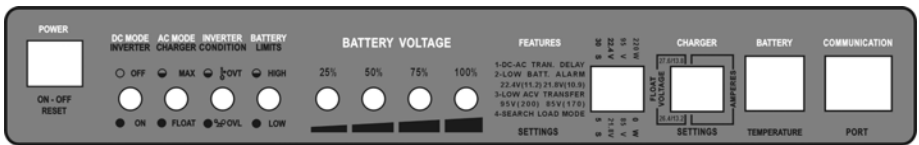
1. Someone should be within voice range when you work near batteries in case of an emergency.
2. Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.
3. Wear complete eye and clothing protection. Avoid touching eyes while working near batteries. Wash your hands when done.
4. If battery acid contacts skin or clothing, immediately wash with soap. If acid enters eyes immediately, flood eyes with cool, running water for at least 15 minutes. Immediately seek medical attention.
5. Never smoke or allow a spark or flame in the vicinity of a battery or generator.

6. Be extra cautious when working with metal tools on and around batteries. The potential of dropping a tool causing the batteries or other electrical parts resulting in sparks could cause an explosion.
7. Remove personal metal items such as rings, bracelets, necklaces, and watches when working with a battery. A battery can produce a short -circuit current, which is high enough to weld a ring or the like to metal causing severe burns.
8. If a remote or automatic generator starter system is used to disable the automatic starting circuit and/or disconnect the generator from its starting battery while servicing to prevent accidental starting during servicing.

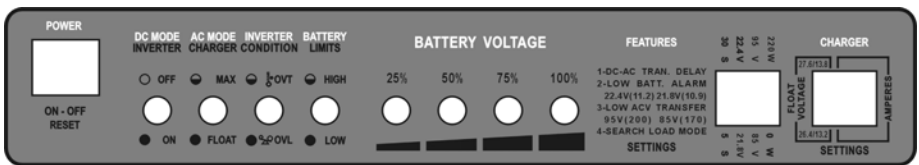
1.3 Indicator and Setting

1.3.1 Map of Controls and LED Indicators

Shown below are the control panel and indicator lights on the front of the SL INVERTER series. These controls can provide information in either inverter or battery charging mode of the operation. All models of the SL INVERTER series operate identically.



Large size



Small size

LED and Alarm Indicator for 12V system

	LED 1	LED 2	LED 3	LED 4	LED 5	LED 6	LED 7	LED 8	Alarm
AC Normal	Off	On/Blink	Off	Off	10.8V~11.5V	11.5 ~ 12.5v	12.5 ~ 13.5v	> 13.5V	Off
DC Model	On	Off	Off	Off	10.2 ~ 11.5v	11.5 ~ 12.5v	12.5 ~ 13.0V	> 13.0V	2 beeps @ 10 sec
Battery Low (DC Mode)	On	Off	Off	On	10.2 ~ 11.5v	11.5 ~ 12.5v	12.5 ~ 13.0V	> 13.0V	1 beeps @ 0.5 sec
Battery High (DC Mode)	On	Off	Off	blink	10.2 ~ 11.5v	11.5 ~ 12.5v	12.5 ~ 13.0V	> 13.0V	1 beep @ 0.5sec
Overload (DC Mode)110%	On	Off	On	Off	10.2 ~ 11.5v	11.5 ~ 12.5v	12.5 ~ 13.0V	> 13.0V	1beeps @ 0.5 sec
Overload (DC Mode)130%	On	Off	On	Off	10.2 ~ 11.5v	11.5 ~ 12.5v	12.5 ~ 13.0V	> 13.0V	Constant on
Overload (DC Mode)150%	On	Off	On	Off	10.2 ~ 11.5v	11.5 ~ 12.5v	12.5 ~ 13.0V	> 13.0V	Shutdown
Bypass Output (Power Off)	Off	Off	Off	Off	10.8 ~ 11.5v	11.5 ~ 12.5v	12.5 ~ 13.5v	> 13.5V	Off

LED and Alarm Indicator for 24V system

	LED 1	LED 2	LED 3	LED 4	LED 5	LED 6	LED 7	LED 8	Alarm
AC Normal	Off	On/Blink	Off	Off	21.6V~23.0V	23.0 ~25.0v	25.0 ~ 27.0v	> 27.0V	Off
DC Model	On	Off	Off	Off	20.4 ~ 23.0v	23.0 ~ 25.0v	25.0 ~ 26.0V	> 26.0V	2 beeps @ 10 sec
Battery Low (DC Mode)	On	Off	Off	On	20.4 ~ 23.0v	23.0 ~ 25.0v	25.0 ~ 26.0V	> 26.0V	1 beeps @ 0.5 sec
Battery High (DC Mode)	On	Off	Off	blink	20.4 ~ 23.0v	23.0 ~ 25.0v	25.0 ~ 26.0V	> 26.0V	1 beep @ 0.5sec
Overload (DC Mode)110%	On	Off	On	Off	20.4 ~ 23.0v	23.0 ~ 25.0v	25.0 ~ 26.0V	> 26.0V	1beeps @ 0.5 sec
Overload (DC Mode)130%	On	Off	On	Off	20.4 ~ 23.0v	23.0 ~ 25.0v	25.0 ~ 26.0V	> 26.0V	Constant on
Overload (DC Mode)150%	On	Off	On	Off	20.4 ~ 23.0v	23.0 ~ 25.0v	25.0 ~ 26.0V	> 26.0V	Shutdown
Bypass Output (Power Off)	Off	Off	Off	Off	21.6V~23.0V	23.0 ~25.0v	25.0 ~ 27.0v	> 27.0V	Off

1.3.1.1 Power Switch

The Power ON/OFF button is located in the left of the panel. Once the SL INVERTER has been properly installed and the batteries are connected, please press the button to power the SL INVERTER. This will alternately turn the SL INVERTER on and off. When the button is depressed, the buzzer will beep to announce that the button is being pushed down. Depressing the switch will toggle the working stage between on and off.

Note: When connected to batteries, the SL INVERTER will begin the process without AC source input. The SL INVERTER can be activated by depressing the on/off button.

Power On: Press the button for about 3 seconds until the buzzer beeps, and the INVERTER MODEL light turns on to announce that the activation is finished.

Power Off: Push the button for 3 seconds. The buzzer will beep to announce that the shut down process is completed.

1.3.1.2 DC Mode Inverter (LED 1)

The red LED indicates the system is working in inverter mode. When the utility power is unavailable, the SL INVERTER will transfer the energy sourcing from the DC side (battery bank). The red LED will be on during this period and off when the utility power is restored.

Note: The LED1 will blink in search mode.

1.3.1.3 AC Mode Charger (LED 2)

The LED is blink during the charging process and it is on when battery charge fully.

1.3.1.4 Inverter Condition (LED 3)

When the SL INVERTER 's temperature is higher than the default setting , the LED will be lit on RED and the SL INVERTER will shut down automatically for safe operation. Depress the POWER on/off button to restart the SL INVERTER after the temperature returns to normal.

When the load is higher than the default setting (110%), the red LED will light up. And the buzzer beeps continuously till the load is decreased. Please refer to the following chart for the overload protection.

Load Capacity (DC Mode)	LED1	LED 3	Buzzer	INVERTER State
110%	On	On	1beeps/0.5sec	The INVERTER will be shut down after 60 seconds.
130%	On	On	Constant on	The INVERTER will be shut down after 30 seconds.
>150%		On	Shutdown	The INVERTER will be shut down after 2 seconds.

Caution: Repeating connection of an AC source directly to the AC output may cause damage to the SL INVERTER.

1.3.1.5 Battery Limits (LED 4)

Battery High: In AC mode, the red LED 4 will light up. In DC mode, the SL inverter will be shut down automatically.

Battery Low: The red LED 4 will light up, and the buzzer will be on.

1.3.1.6 Battery Voltage (LED 5~8)

The LED 5~8 shows the battery capacity. Please refer to the details as below.

Battery Voltage & LED	LED 5	LED 6	LED 7	LED 8
25%	On	X	X	X
50%	On	On	X	X
75%	On	On	On	X
100%	On	On	On	On

1.3.1.7 Voltage Setting (Switch 1-3)

Switch	ON	OFF
DC to AC Transfer Delay(Switch 1)	30sec	5sec
Low Battery Setting (Switch 2) – 12V	11.2V	10.9V
Low Battery Setting (Switch 2) – 24V	22.4V	21.8V
AC Transfer Voltage (Switch 3) – 120V	95V	85V
AC Transfer Voltage (Switch 3) – 220V	180V	160V
AC Transfer Voltage (Switch 3) – 230V	190V	170V

Note1: The switches must be set before the system is turned on.

Note2: The switch 2 is for setting the low battery warning point.

Note3: The Switch 3 is for setting AC transfer voltage .

High-level voltage point: When the AC input voltage is higher than default setting, the SL INVERTER will switch to INVERTER MODE. If the AC input voltage decreases to below default setting, the INVERTER will automatically switch to AC MODE. Please see the details below.

Nominal Voltage	High Voltage Transfer Point (AC to DC Mode)	Return Voltage Point (DC to AC Mode)
120V	135V	133V
220V	252V	242V
230V	264V	254V

Low-level voltage point: There are two choices for setting lower AC voltage of the switch 3 button. For example, when the AC voltage is lower than 85V and switch 3 is in position of off, the SL INVERTER will switch to INVERTER MODE, where it remains until the voltage returns to 90V, then the SL INVERTER, after the delay time selected with switch 1, transfers back to AC MODE automatically.

Nominal Voltage		Load Voltage Transfer Point (AC to DC)	Return Voltage Point (DC to AC)
120V	On	95	100
	Off	85	90
220V	On	180	190
	Off	160	170
230V	On	190	200
	Off	170	180

1.3.1.8 Search Mode Setting (Switch4)

The Search Mode only activates when the unit is operating in the inverter mode (from batteries) to prevent unnecessary battery discharge when electrical power is not required. If the inverter is supporting loads that must constantly be powered, please turn off switch 4 to disable search mode.

With search mode enabled, the inverter pulses the AC output looking for an applied load. With no load ($< 150W$) detected, the inverter goes into the search mode to minimize energy consumption. When a load ($> 220W$) is applied, the load current is sensed, bringing the inverter into full power operation.

Switch 4	Search Mode
ON	Enable
OFF	Disable

1.3.1.9 Battery Floating Voltage(Switch 5)

Switch 5	Floating Voltage (12V Battery)	Floating Voltage (24V Battery)
ON	13.8V	27.6V
OFF	13.2V	26.4V

Note: Inverter will detect the battery voltage before charging on AC mode. If the battery voltage is lower than 12V/24V (Its mean the battery capacity is empty, need to fully charge), Inverter will charge the battery to saturation voltage 14.5V/29V and continue for one hour then drop to floating voltage 13.8V /27.6(SW1 On)/ 13.2V/26.4V (SW1 Off) .If the battery voltage is up to 12V/24V, Inverter will charge to floating voltage directly

1.3.1.10 Battery Charging Rate Setting (Switch 6 & 7 & 8)

These are the control on the maximum charging rate in amps. The charge rate in amps has 8 stages. It can be adjusted by setting the switch 6 & 7 & 8. (See the following chart). Amax is limited by the size of the battery bank.

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
	100%	80%	60%	50%	40%	30%	20%	10%

Note1. The charging rate depended on the battery bank size.

Note2: The charging current is different for each model as below chart.

Model	SL1012	SL1024	SL1512	SL1524	SL2012	SL2024	SL3024
Maximum Charging Current	40Amps	20Amps	50Amps	25Amps	80Amps	40Amps	60Amps

Note3: Please based on the battery specification for the battery bank installation

Caution: Excessively high charging rate can overheat a battery. If a small battery capacity is used to set the battery charge rate to the minimum setting.

1.3.1.11 Battery temperature port (only for large size)

This port is used for monitoring the battery temperature.

Note: At present, this series inverter has not this feature.

1.3.1.12 Communication Port (only for large size)

This port is used for turning on or turn off the inverter by remote control.

Note: At present, this series inverter has not this feature.

2. Installation and Operation

2.1 Installation

2.1.1 Environment

INVERTER is a sophisticated electronic device and should be treated accordingly. When selecting the operating environment for the inverter, do not think of it in the same terms as other equipment that works with it; e.g., Batteries, diesel generators, motor generators, washing machines, etc. It is a highly complex microprocessor controlled device. Generally speaking, it is a cousin to stereo equipment, television sets, and computers. The use of conformed 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 a condensing environment (one in which humidity and/or temperature change causes water to form on components) all the ingredients for electrolysis is present - water, electricity, and metals. In a condensing environment the life expectancy of the inverter cannot be determined and the warranty is voided.

Caution: It is in your best interest to install the INVERTER 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. (The INVERTER may be located in a compartment with sealed electronic equipment - and everything else. Batteries also generate hydrogen and oxygen. If accumulated, this combination could be ignited by an arc resulting from connection of the battery cables or by switching a relay.

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

2.1.2 System Grounding

Even system designers and electricians often misunderstand system grounding. The subject is more easily discussed if it is divided into three separate subjects. The grounding requirements vary in country and application. Consult local codes and the NEC for specific requirements.

2.1.3 Equipment or Chassis Grounds

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.

2.1.4 Ground Electrodes / Ground Rods

There are two purposes of the grounding electrode. It 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 'induced electromagnetic energy' or lightning to be dissipated. The size of the conductor to 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 (2meters) long driven in to 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.

It is often desirable to use multiple ground rods in a larger system or systems. The most common example is providing a direct path from the solar array to earth near the location of the solar array. Most electrical codes want to see the multiple ground rods connected by a separate wire with its own set of clamps. If this is done, it is a good idea to make the connection with a bar located outside of the conduit, if used, in a trench. The run of buried wire may be a better grounding electrode than the ground rods!

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

2.1.5 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 connection is why we call one of the wires "neutral" in the North American type of electrical systems. 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

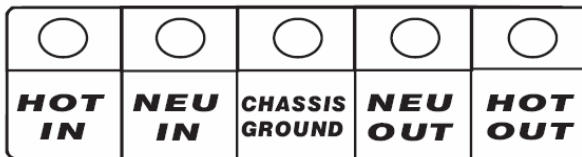
protection to stop the flow of current, protecting the system. The point of connection between the grounding system and the current carrying conductor is often called a "bond." It is usually located in the over current protection devices' enclosure. Although the point of connection can be done at the inverter, codes do not generally allow it since 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. After the power has passed through the kilowatt hour meter of the utility.

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.

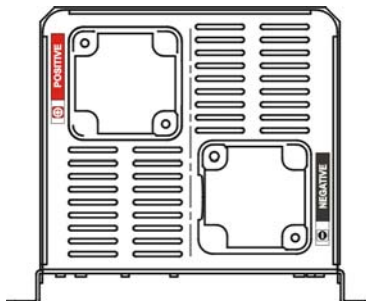
Bonding must be done at only one point in an electrical system. Our systems inherently have two separate electric systems- a DC system and a AC system. This means that two bonding points will occur in all inverter applications. The bonding point will also be connected to the chassis ground conductors. It is common to have two separate conductors connect the ground electrode and the two bonding points. Each conductor should use a separate clamp.

2.2 Installation Diagrams

2.2.1 Terminal Block (AC Side)



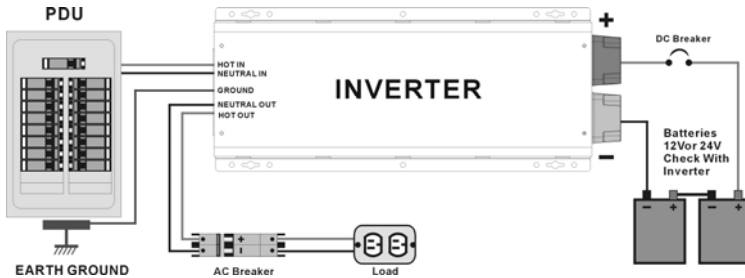
2.2.2 Terminal (DC Side)



2.2.3 Wire Gage

	AC INPUT			AC OUTPUT			DC Input
	120V	220V	230V	120V	220V	230V	
INVERTER 1012	10AWG	10AWG	10AWG	10 AWG	10 AWG	10 AWG	30 mm ²
INVERTER 1024	10 AWG	10AWG	10AWG	10 AWG	10 AWG	10 AWG	25 mm ²
INVERTER 1512	10 AWG	10 AWG	10 AWG	10 AWG	10 AWG	10 AWG	40 mm ²
INVERTER 1524	10 AWG	10 AWG	10 AWG	10 AWG	10 AWG	10 AWG	30 mm ²
INVERTER 2012	10 AWG	10 AWG	10 AWG	10 AWG	10 AWG	10 AWG	60 mm ²
INVERTER 2024	10AWG	10 AWG	10 AWG	10 AWG	10 AWG	10AWG	40 mm ²
INVERTER 3024	10 AWG	10AWG	10AWG	10 AWG	10 AWG	10 AWG	50 mm ²

2.2.4 Simple Installation Diagram



2.3 Installation Steps

- **Step 1**

Wire the unit from the battery to the utility power source, and then to the AC load. Confirm all wiring is correct and terminal is tight.

- **Step 2**

Check all the voltage rating is correct. Turn on the circuit breaker.

- **Step 3**

Press the on/off button. The system will start working after a few seconds. If the utility power fails the unit will work in Inverter mode. If not, the system will switch to charging mode and deliver energy to load and battery.

3. The Battery Charger

3.1 Theory of Operation

Inverter to Charger Transition

The internal battery charger and automatic transfer relay allow the unit to operate as either a battery charger or inverter, but not at the same time. An external source of AC power (e.g., shore power or generator) must be supplied to the INVERTER's AC input in order to allow it to operate as a battery charger. When the unit is operating as a charger, AC loads are powered by the external source (i.e., generator or public power).

3.2 Transfer Switching Speed

The transfer time is 1/4~1/2cycle.

4. Battery

4.1 Battery Size

Batteries are the INVERTER's fuel tank. The larger the batteries the longer the INVERTER can operate before recharging is necessary. An undersized battery bank results in reduced battery life and disappointing system performance.

Batteries should not be regularly discharged to the limit of 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-applications, battery size should provide between 3 and 5 days of storage before needing to be recharged. The power contribution from other charging sources is not included in this calculation to duplicate the conditions present during a cloudy or windless period. This is often referred to as the "number of days of autonomy." If the system is a hybrid system with daily generator runs periods then the battery size may be smaller. During cloudy periods the generator would be expected to run longer. Utilities back up applications often have very small batteries. The minimum recommended battery capacity is 200 amp-hours@12vdc and 100 amp-hours@24vdc.

4.1.1 Estimating Batteries 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 charging cycles. When the required amp hours are known, the expected amp hour usage ensures to be twice as this amount. 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 is determined and then added together.

You can compute your battery requirements using the nameplate rating of your appliances. The critical formula is **WATTS=VOLTS X AMPS**. Divide the wattage of your load by the battery voltage to determine the amperage the load will draw from the batteries.

If the AC current is known, then the battery amperage will be as follows:

AC Current x AC Voltage / Battery Voltage = DC amps.

Multiplying the amperage by the number of hours that the load will operate, and you have a reasonable estimate of amp hours.

Motors are normally marked with their running current rather than their starting current. Starting current may be three to six times running current. Manufacturer's literature may provide more accurate information than the motor nameplate. For larger motors, increasing the battery size indicates that the high demand for start-ups should be required.

Following this procedure for each item, you want to use with the INVERTER. Add the resulting amp hour requirements for each load to arrive at a total requirement. The minimum properly sized battery bank will be approximately double this amount. This will allow the battery to be cycled only 50% on a regular basis.

4.2 Monthly Maintenance

Checking the level of the electrolyte of each battery cell at a minimum interval once a month after the batteries has been charged, not before. It should be about 1/ 2" above the top of the plates, but 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 "spring" water and regular tap water may have high mineral levels that can only poison the battery chemistry and reduce battery life.

Check the battery interconnections for tightness and corrosion. If any corrosion is found to disconnect the cables, clean them with a mild solution of baking soda and water. **DO NOT ALLOW THE SOLUTION TO ENTER THE BATTERY.** Rinse the top of the battery with clean water when finished. (Replace the caps first.)

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 terminal and the cable lugs , the connection should be metal to metal. Apply the protective material after the bolts have been tightened

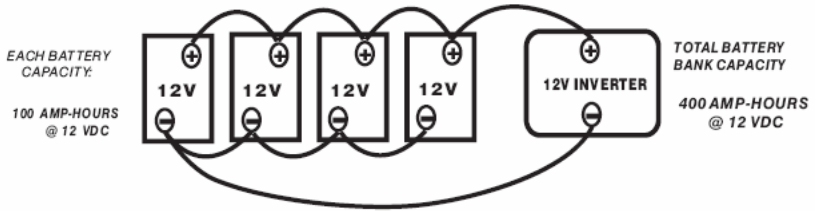
4.3 Battery Hook-up Configurations

Battery banks of substantial size can be configured by connecting several smaller batteries. There are three ways to do this. Batteries can be connected in parallel, series, or series -parallel.

4.3.1 Parallel Connection

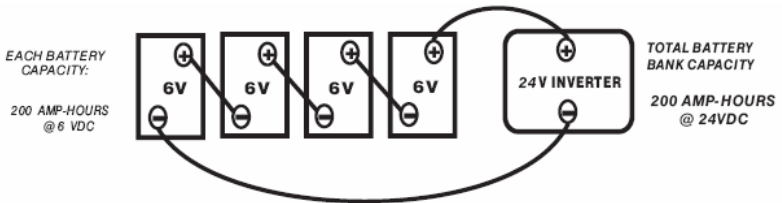
Batteries are connected in parallel when all of the positive terminals of a group of batteries are connected, and then all of the negative terminals of a group of batteries are connected. In a parallel

configuration the battery bank has the same voltage as a single battery and a amp/hour rating equal to the sum of the individual batteries. This usually is done only with 12 voltage battery -inverter systems.



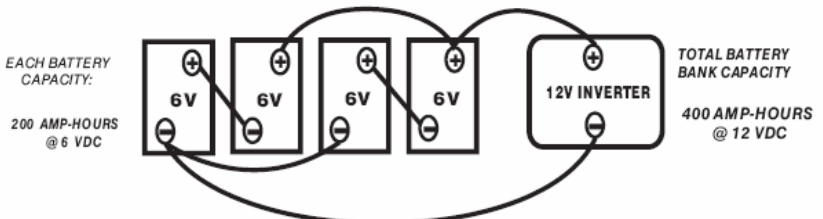
4.3.2 Series Connection

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.



4.3.3 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.



4.4 Battery Installation

Caution: Batteries can produce extremely high currents in short-circuit. Be very careful working around them. Read the important safety instructions at the beginning of this manual and the battery supplier's precautions before installing the INVERTER and batteries.

4.4.1 Battery Location

Batteries should be located in an accessible location with nothing restricting access to the battery caps and terminals. At least two feet of clearance above is recommended. They must be located as close as possible to the INVERTER but cannot limit access to the INVERTER and the INVERTER's disconnect. With the SL series inverter the batteries are best located at the left end as this is which 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 cabling should be no longer than required. For 12 VDC systems do not exceed 5 feet (one way) if 4/0 AWG cables are used. For 24 VDC systems do not exceed 10 feet (one way) if 4/0 AWG cables are used.

4.4.2 Battery Enclosure

To prevent access from untrained personal, batteries should be protected within a ventilated, locked enclosure or room. The enclosed 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 should also be provided at a low point in the enclosure to allow air to enter in order to promote 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 of 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.

4.4.3 Battery Cabling

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. Generally, the cables should not be smaller than the main battery cables to the inverter. If the main cables are 4/0 AWG the battery interconnects should be 4/0 AWG.

It is usually preferable to connect the batteries firstly 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 often called "cross-tying". 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.

5. Technical Specification

Model Specification	SL 1012	SL 1512	SL 2012	SL 1024	SL 1524	SL 2024	SL 3024
Continuous Power	1000 Watts	1500 Watts	2000 Watts	1000 Watts	1500 Watts	2000 Watts	3000 Watts
Efficiency	85% max.			87% max.			
Output Waveform	Sine wave						
DC Power at Rated Power	120 amps	180 amps	240 amps	60 amps	90 amps	120 amps	180 amps
DC Power at Short Circuit	360 amps	540 amps	720 amps	180 amps	270 amps	360 amps	540 amps
Nominal Input Voltage	12 Vdc			24 Vdc			
DC Input Voltage Range	10.0 ~ 15 Vdc			20.0 ~ 30 Vdc			
Low Battery Protection (Heavy/Light Load)	10.0/11.0 Vdc			20.0/22.0 Vdc			
DC mode output Voltage Regulation	+/- 10%						
Power Factor Allowed	0.8 to 1						
Frequency Regulation	+/-1 Hz						
Standard Output Voltage	120 / 220 / 230 Vac						
Loading Sensing (Power Saving)	150W ~ 220W						
Transfer Time	12 ms Max.						
Forced Air Cooling	Variable Speed						
Automatic Transfer Relay	15A		30A	15A		30A	
Adjustable Charge current	4 ~ 40 A	5 ~ 50 A	8 ~ 80 A	2 ~ 20 A	2.5 ~ 25 A	4 ~ 40 A	6 ~ 60 A
Number of Charge Profiles	2						
Resistive Load	100%						

Model Specification	SL 1012	SL 1512	SL 2012	SL 1024	SL 1524	SL 2024	SL 3024
Inductive Load	YES						
Motor Load	YES						
Rectifier Load	YES						
Wall Mounting	YES						
Shipping Weight (kg)	16.12	18.45	23.21	15.79	18.56	20.21	25
Dimensions (WxDxH) mm	540 x325 x310		650x320x295	540 x325 x310			650x320x295

* Technical Specifications subject to change without notification.

6. Troubleshooting

1. A small size battery being charged with a higher charging rate could cause an over voltage shut down or begin charging an already charged battery. Both could cause an over voltage shut down. Please reduce the charge rate or discharge the battery before recharging.
2. If system does not turn on properly turn off the Breaker in the front of the DC side, disconnect the system from battery for 30 seconds, and then repeat the turn on steps. If the system still does not function please contact your dealer.

7. Service and Support

If you have any questions or problems with the UPS, call your **Local Distributor** to 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 for all warranted units.