

True Sine Wave Inverter Extreme Series

SL5-3024 / SL5-3548

SL5-3224 / SL5-4048



User's Manual

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Purpose

The purpose of this Installation and Operation Manual is to provide explanations and procedures for installing, operating, maintaining, and troubleshooting EXTREME series of Inverter/charger.

Scope

The Manual provides safety guidelines, detailed planning and setup information, procedures for installing the inverter, as well as information for operating and troubleshooting the unit. It does not provide details or suggestions on specific brands of batteries – consult individual battery manufacturers for this information.

Audience

This manual is intended for anyone who needs to install and operate the EXTREME inverter/charger. Installers should be certified electricians or technicians.

Conventions Used



WARNING

Warnings identify conditions or practices that could result in personal injury or loss of life.

Les avertissements identifient les conditions ou les pratiques qui pourraient avoir comme conséquence le dommage corporel ou les pertes humaines.



CAUTION

Cautions identify conditions or practices that could result in damage to the unit or other equipment.

Les attentions identifient les conditions ou les pratiques qui pourraient avoir comme conséquence les dommages à l'unité ou à tout autre équipement.



IMPORTANT

These notes describe things that are important to know, but not as serious as a caution or warning.

Ces notes décrivent les choses il est importante savoir que, mais pas aussi sérieux qu'une attention ou un avertissement.

Abbreviations and Acronyms

AC	Alternating Current	PV	Photovoltaic
ASNET	Network Interface	PVGFI	PV Ground Fault Interrupter
COM	COMmunications Port	RE	Renewable Energy
DC	Direct Current	RMA	Return Material Authorization
LED	Light Emitting Diode	EXTREME Inverter	EXTREME series Inverter/charger

IMPORTANT SAFETY INSTRUCTIONS

INSTRUCTIONS DE SÉCURITÉS IMPORTANTES

SAVE THESE INSTRUCTIONS

CONSERVER CES INSTRUCTIONS

General Precautions

1. Before using the EXTREME 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 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. Do not disassemble the 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.



WARNING

5. **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.

ATTENTION:

Une batterie peut présenter un risque de choc électrique, de brûlure par transfert d'énergie, d'incendie ou d'explosion des gaz dégagés. Suivre les précautions qui s'imposent.

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 90°C or higher.** 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 (see Table 4.1).
8. Torque all AC wiring connections to 30 in-lbs (3.4 N-m). Torque all DC cable connections to 5 ft-lbs (6.78 N-m). 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"(13mm) open-end wrench or socket, Phillips screw driver #2, slotted screw driver 3/16"(4.6 mm) 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., 24 volts with a SL5-3024/SL5-3224, and 48 volts with a SL5-3548/SL5-4048.
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.

11. 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. Introduction

1.1 Introduction to the Inverter

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

The EXTREME series inverter is a heavy-duty, continuous working module generating a sinusoidal wave from a 24V, or 48V 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 EXTREME series are designed to work in heavy load condition. De-rating is not necessary. It provides a rapid and complete charging process.

The EXTREME series are True Sine wave Inverters, not to be confused with Modified Sine wave models on the market. Unlike the modified sine wave counterpart, a true sine wave inverter provides a pure signal which will not interfere with some of the sensitive electronic equipment currently on the market. The EXTREME series inverters provide a (100/200 or 110/220 or 115/230 or 120/240) Volt AC Split-Phase or (100 or 110 or 115 or 120 or 200 or 220 or 230 or 240) Volt AC Single-Phase input and output. No external transformers are required for step up, step down or balancing, thus saving added costs, installation time, and several points of efficiency. ut line can supply up to 75% of the total load. The input can accept the line or 240 volt AC generators. The transfer relay is internal.

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 1/2~1 of the total cycle time. The high power charger (100A) can charge a 24V/1000 AH battery bank in 10 hours. For example, a single unit of Inverter SL5-3224 with a 1000 AH battery bank can supply a 3200W workload for over 6 hours after a charge of 10 hours.

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

1.2 Indicators and Settings

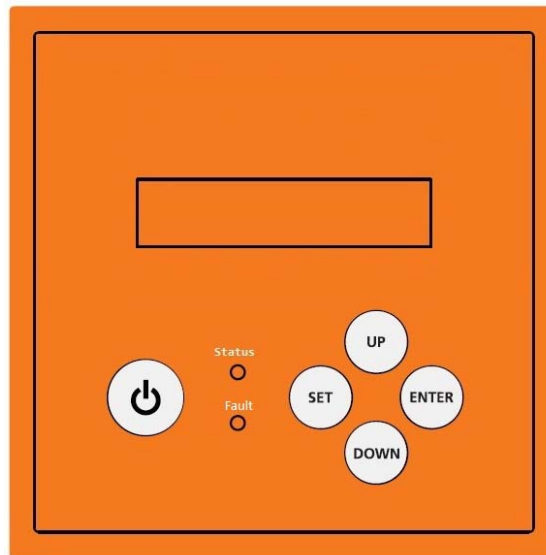







Figure 1.0: EXTREME Control Panel

-  – Power On/Off
When without AC input: INVERTING/STANDBY switching
When with AC input: CHARGING/STANDBY switching (STANDBY mode : AC by-pass output and no charge)
-  – Into the setting mode / Enter key
-  – Increase / Change the settings item
-  – decrease / change the settings item
-  – Return to previous page

2. The Battery Charger

2.1 Theory of Operation

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. line 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).

The Battery Charger utilizes a five stage charger algorithm (Bulk, Absorb, Float, Equalize and Standby). Figure 2.0 is a chart which illustrates the operation of this unit.

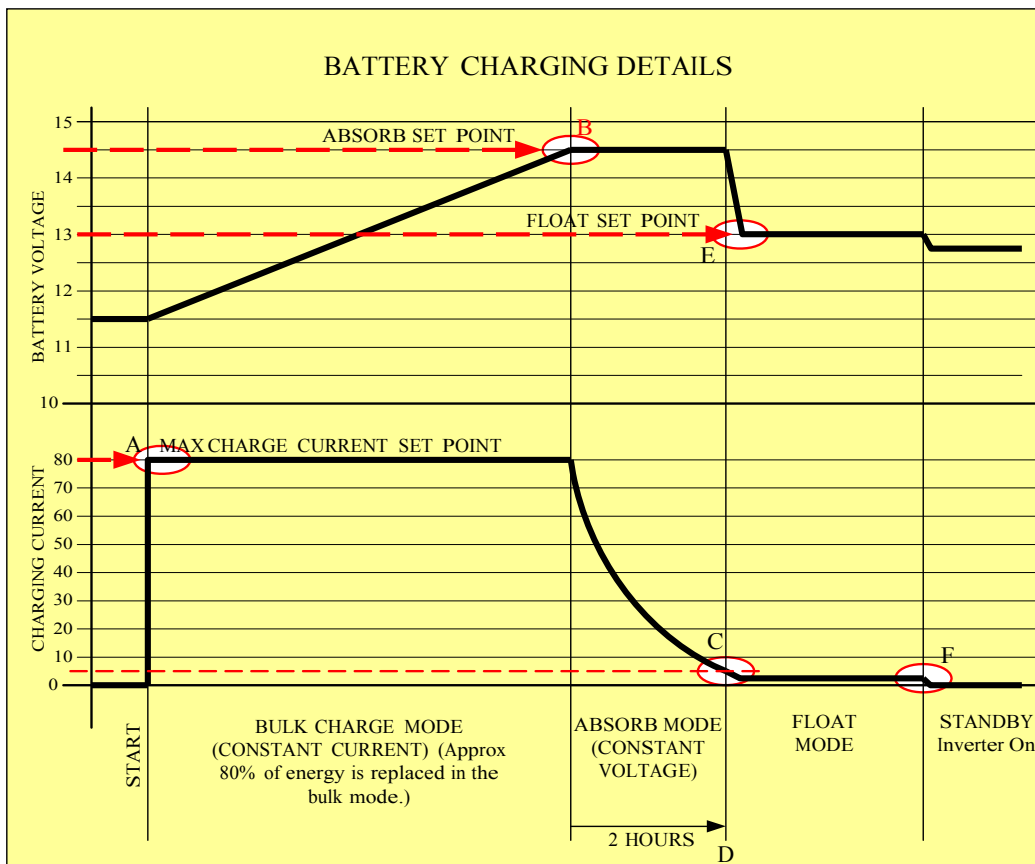


Figure 2.0: Battery Charger operation

2.2 Transfer Relay

2.2.1 Current Rating

40 Amps per leg

2.2.2 Transfer Speed

The transfer time is 1/2~1cycle (16ms Typical).

3.0 Installation

3.1 Installation Steps

3.1.1 Selecting appropriate Location

The 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. It should be treated similarly to other electronic devices (e.g. entertainment equipment, computers, etc.) The use of conformal coated circuit boards, plated copper bus bars, powder coated metal components, and stainless steel fasteners allows the unit to function in hostile environments, but high humidity/varying temperature (condensing) environment should be avoided. 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.

ATTENTION

Il est dans votre meilleur intérêt d'installer l'inverseur dans un endroit protégé sec à partir des sources de température et d'humidité. L'exposition à l'eau de mer est particulièrement destructive et potentiellement dangereuse.

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 other sealed electronic equipment. Batteries 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.

3.1.2 Inverter Mounting (Vertical)



The EXTREME Series inverter may be mounted vertically or horizontally. The vertical configuration is preferable.

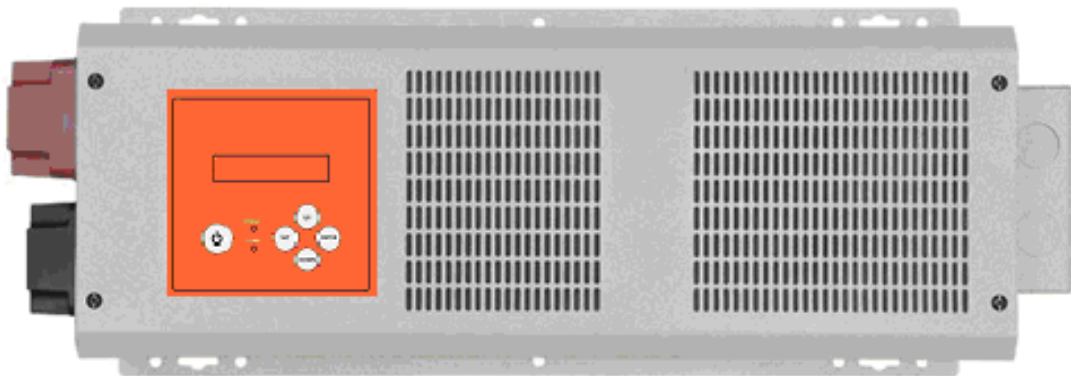
The next section shows dimensions which will aid in mounting the unit. Be sure to mount on a strong stable surface (some suggestions follow). The next section details horizontal mounting of the EXTREME series Inverter.

Please Note, the EXTREME Series inverter is shipped with the Display/Keypad mounted for the vertical mounting configuration. To position it for horizontal mounting, please follow the steps below:

- Remove the four (4) Display/Keypad mounting screws
- Carefully rotate the Display/Keypad 90 degrees
- Re-install the mounting screws using care not to over tighten.

Horizontal mounting is necessary when using the EXTREME Series Inverter as a replacement for other inverters with a similar form factor.

3.1.3 Inverter Mounting (Horizontal)



It is recommended that the EXTREME Inverter be mounted on a $\frac{3}{4}$ " plywood sheet which is nailed or screwed into the wall studs. Ensure that the plywood spans across three wall studs for adequate support. Alternately, when mounting horizontal, two 2x4s may be placed 8" on center to mount the inverter. Again, be sure to span three studs for adequate support.

It is best to locate the Inverter approximately 4 – 5 feet from the floor.

4. Wiring

4.1 Battery Information

4.1.1 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.

Avoid discharging batteries to more than 50% of their capacity too often. 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-alone 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 **100 amp-hours@24vdc**, and **50 amp-hours@48vdc**.

4.1.2 Battery Bank Sizing

To determine the proper battery bank size, compute the number of amp hours that will be used during charging 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, determine the amp hour requirements of each load and total them.

You can compute your battery requirements using the nameplate rating of your appliances. The 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.

Multiply 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.

Follow this procedure for each individual load. Add the resulting amp hour requirements for each load to arrive at a total requirement. The minimum properly sized battery bank should be approximately double this amount. This will allow the battery to be cycled only 50% on a regular basis.

4.1.3 Monthly Maintenance

The level of the electrolyte of a flooded battery should be checked monthly. It should be about 1/2" above the top of the plates, but not completely full. Don't overfill the batteries or the electrolyte will seep out during charging. Refill the batteries with distilled water. Avoid "spring" water and regular tap water as they may have high mineral levels that can affect the battery chemistry and reduce life. Check the battery interconnections for tightness and corrosion. If corrosion is found, 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.)

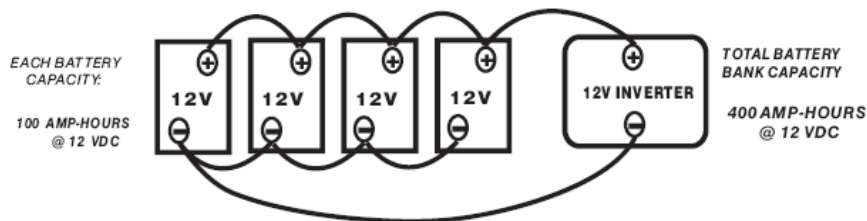
To reduce corrosion on the battery terminals, coat them with a thin layer of petroleum jelly or anti-corrosion grease available from automotive parts stores or battery suppliers. Do not apply any material between the terminal and the cable lugs, the connection should be metal to metal. Apply the protective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

4.1.4 Battery Hook-up Configurations

Battery banks of substantial size can be configured by connecting several smaller batteries. There are three ways: parallel, series, or series-parallel.

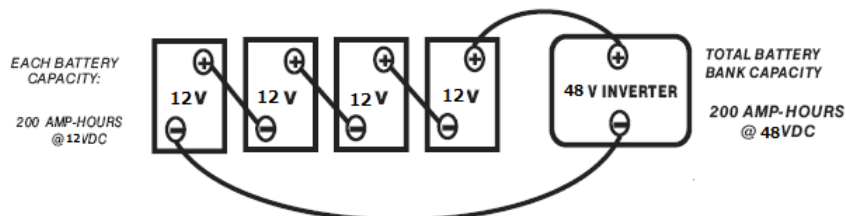
4.1.4.1 Parallel Connection

Batteries are connected in parallel when all of the positive terminals and 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 is done when the battery voltage matches the inverter voltage.



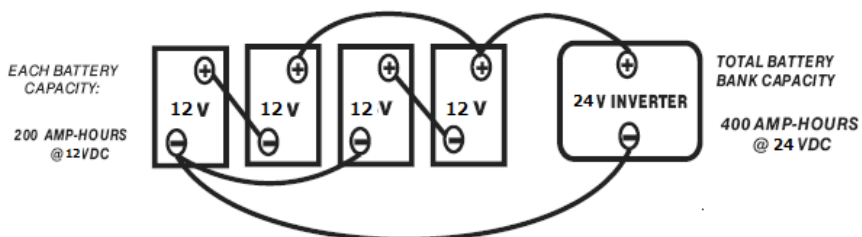
4.1.4.2 Series Connection

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 48 volt or higher battery-inverter systems.



4.1.4.3 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.



4.1.5 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.

ATTENTION

Les batteries peuvent produire les courants extrêmement élevés dans le court-circuit. Soyez fonctionnellement très soigneux autour de elles. Lisez les instructions de sûreté importantes au début de ce manuel et de la batterie supplier' ; précautions de s avant d'installer l'inverseur et les batteries.

4.1.5.1 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. Locate as close as possible to the Inverter, but do not limit access to the Inverter and the Inverter's disconnect. Do not locate the inverter in the same compartment with non-sealed batteries (sealed batteries are acceptable) as the gasses produced during charging are very corrosive and will shorten the life of the inverter.

Battery to inverter cabling should be no longer than required. For 24 VDC systems do not exceed 10 feet (one way) if 4/0 AWG cables are used. For 48 VDC systems do not exceed 20 feet (one way) if 4/0 AWG cables are used.

4.1.5.2 Battery Enclosure

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 from the battery during charging. An air intake should also be provided at a low point in the enclosure to allow air to enter to promote good ventilation. For most systems a one-inch diameter vent pipe from the top of the enclosure is adequate. 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 containing 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. If the batteries are located outdoors, 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.

4.1.5.3 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. E.g. If the main cables are 4/0 AWG the battery interconnects should be 4/0 AWG.

It is preferable 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 often called "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.

4.2 Grounding

4.2.1 System Grounding

System grounding is often the most misunderstood wiring concept. The subject is more easily discussed if it is divided into three separate subjects. The grounding requirements vary widely by locale and application. Consult local codes and the NEC (ANSI/NFPA 70) for specific requirements.

4.2.2 Equipment or Chassis Grounds

This is the simplest part of grounding. This involves connecting 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.

4.2.3 Ground Electrodes / Ground Rods

There are two purposes of the grounding electrode, also known as 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.

Well casings and water pipes may be used as grounding electrodes. Under no circumstance should a gas pipe or line be used. Consult local codes and the NEC (ANSI/NFPA 70) for more information.

4.2.4 Bonding the Grounding System to the Neutral and Negative Conductors

This is the most confusing part of grounding. The purpose 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 North American 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. 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 an 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.

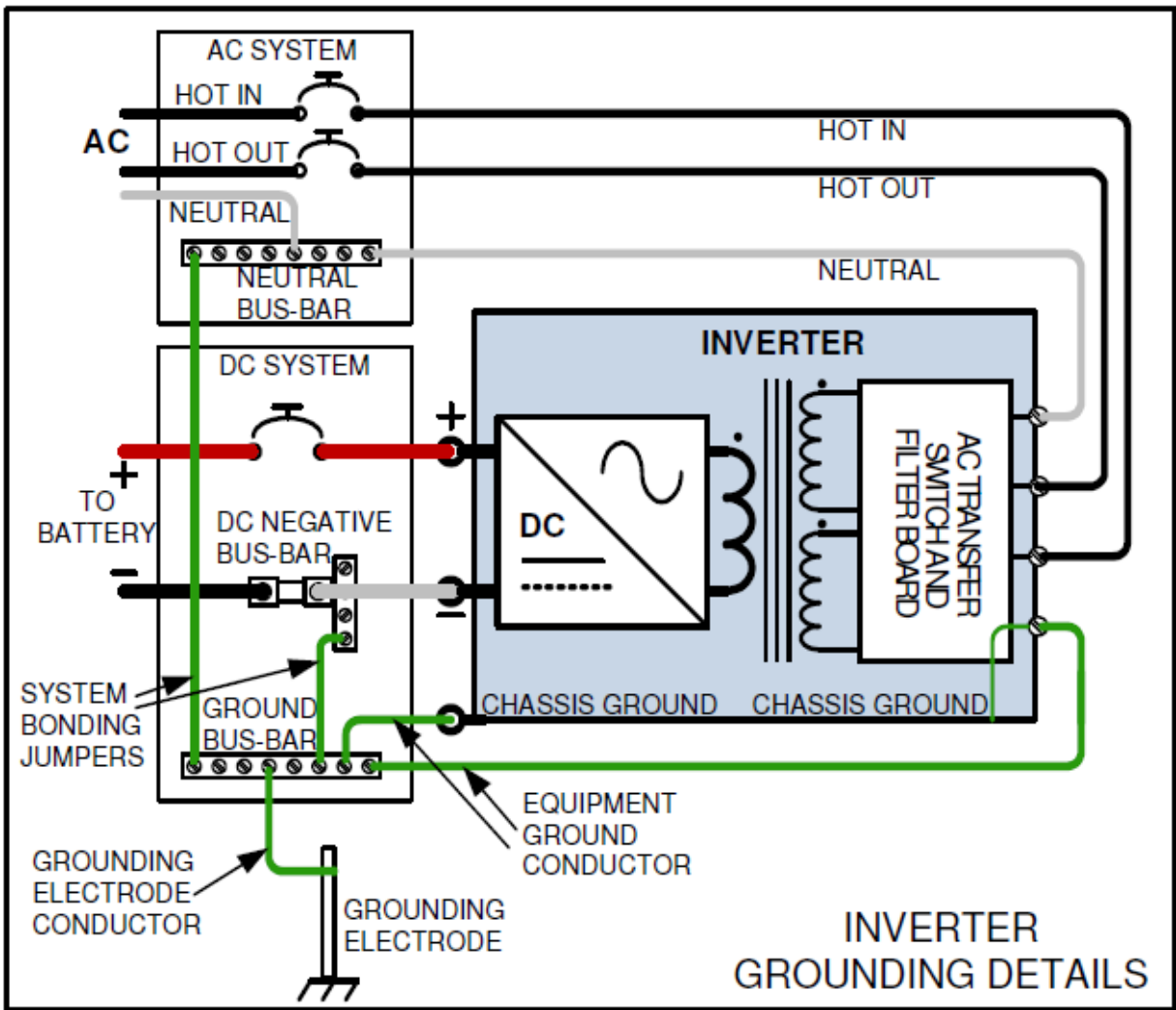


Figure 4.1: Recommended system grounding

4.3 AC and DC Wiring

MODEL	DC INPUT			AC INPUT WIRING		AC OUTPUT WIRING	
	Amps	AWG	mm2	120 VAC	240 VAC	120 VAC	240 VAC
SL5-3024 SL5-3224	160A	2/0 AWG	67	40A 8 AWG	40A 8 AWG	40A 8 AWG	40A 8 AWG
SL5-3548 SL5-4048	90A	1/0 AWG	50	40A 8 AWG	40A 8 AWG	40A 8 AWG	40A 8 AWG

Table 4.1 Input/Output Amp capacity and Minimum Recommended Wire Gag

4.3.1 DC Wiring

WARNING

Even though DC Voltage is low voltage, significant hazards may exist, particularly from short circuits of the battery system. A 250A rated circuit breaker must be used on the DC input.

AVERTISSEMENT

Quoique la tension CC Soit basse tension, les risques significatifs peuvent exister, en particulier des courts-circuits de l'installation de batterie.

CAUTION

The inverter is NOT reverse polarity protected. Use care not to connect the negative and positive battery voltage backward or damage to the inverter will result. Verify the correct voltage polarity before connecting the DC wires.

ATTENTION

L'inverseur n'est pas polarité renversée protégée. Prenez soin de ne pas relier le négatif et la tension positive de batterie vers l'arrière ou les dommages à l'inverseur résultera. Vérifiez la polarité correcte de tension avant de relier les fils de C.C.

IMPORTANT

DO NOT connect the battery cables to the inverter until all wiring is complete and the correct voltages and polarities are verified.

IMPORTANT

Ne reliez pas les câbles de batterie à l'inverseur jusqu'à ce que tout le câblage soit complet et les tensions et les polarités correctes sont vérifiées.

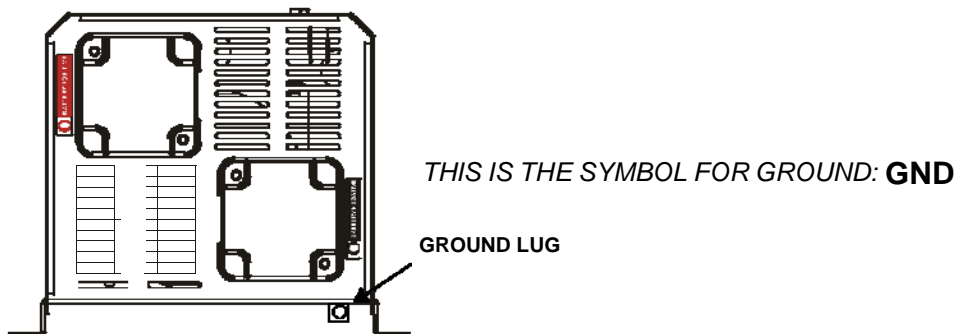


Figure 4.4: Terminals (DC Side) – Positive Top Left, Negative Bottom Right, Ground Lug Bottom Right

- When the inverter is installed in a Photovoltaic system, the NEC (ANSI/NFPA 70) requires that the DC wiring and circuit protection be sized to carry not less than 125% of the inverter's maximum current rating.
- Crimped and sealed copper ring terminal lugs with a 5/16" hole should be used to connect the DC wires to the DC terminals.
- To ensure the maximum performance from the inverter, all connections from the battery bank to the inverter should be minimized.
- All wiring to the battery terminals should be checked periodically (once a month) for proper tightness. The torque requirement is 5 ft-lb (6.78 N-m).
- Refer to Table 4.1 for proper wire sizing.

4.3.1.1 DC Cable Connections

When connecting the DC cable to the battery or inverter input terminals, the cable should be placed directly against the inverter or battery terminals. Incorrectly installed hardware can cause a high resistance connection which could result in poor inverter/charger performance and/or high heat which can melt the cable and terminal connections.

CAUTION

Use proper torque when tightening the inverter's DC terminal nuts. Assure that the cable lug is firmly seated against the body of the connector. It is advisable to use an anti-seize lubricant to prevent binding.

ATTENTION

Employez le couple approprié en serrant les écrous terminaux du C.C de l'inverseur. Assurez que le crochet de câble est fermement posé contre le corps du connecteur. Il est recommandé d'employer un lubrifiant anti-grippage pour empêcher lier.

4.3.1.2 Wiring the Battery Bank

WARNING

Lethal currents will be present if the positive and negative battery cables touch each other.

During the wiring process, ensure the cable ends are insulated or covered to avoid shorting to each other.

AVERTISSEMENT

Les courants mortels seront présent si les câbles positifs et négatifs de batterie se touchent.

Pendant le processus de câblage, assurez que les extrémités de câble sont isolées ou couvertes pour éviter de court-circuiter entre eux.

IMPORTANT

Do not connect the cables from the battery bank to the inverter until 1) all DC and AC wiring is complete, 2) the correct DC and AC current protection has been installed and 3) the correct DC voltage and polarity has been verified.

IMPORTANT

Ne reliez pas les câbles de la banque de batterie à l'inverseur jusque 1) à tout le C.C et le

câblage à C.A. est complet, 2) la protection courante correcte de C.C et à C.A. a été installée et 3) la tension CC et la polarité Correcte a été vérifiée.

Place the batteries as close as possible to the inverter, preferably in an insulated and ventilated enclosure. Allow adequate space above the batteries to access the terminals and vent caps (if flooded cells). Allow at least 1 inch of space between batteries too promote air flow. Avoid mounting the batteries directly under the inverter.

When wiring the batteries in either series or parallel (or combination) use a wire size appropriate to the charge/discharge current.

4.3.1.3 Battery Temperature Sensor Installation

Remove backing strip from adhesive on Battery Temperature Sensor, and attach to the side of one of the batteries in the bank (toward the center is preferable).

IMPORTANT

Do not attach to a battery terminal.

Plug the 4pin modular plug into the jack labeled Battery Temperature Sensor on the left side of the Inverter.

IMPORTANT

N'attachez pas à une borne de batterie. Branchez la prise 4pin modulaire au cric marqué sonde de température de batterie de l'aile gauche de l'inverseur.

4.3.1.4 Wiring the Inverter to the Battery Bank

IMPORTANT

The DC over current device (i.e. circuit breaker) must be wired in the positive DC cable line between the inverter's positive DC terminal and the battery positive terminal.

IMPORTANT

Le dispositif de surintensité de C.C (c.-à-d. disjoncteur) doit être câblé dans la ligne positive de câble de C.C entre la borne positive du C.C de l'inverseur et la borne positive de batterie.

IMPORTANT

The shunt must be wired in the negative DC cable line between the inverter's negative DC terminal and the battery negative terminal as close to the inverter as possible.

IMPORTANT

Le shunt doit être câblé dans la ligne négative de câble de C.C entre la borne négative du C.C de l'inverseur et la borne négative de batterie aussi étroitement à l'inverseur comme possible.

DC Negative Cable – Route the appropriately sized cable from the battery negative terminal to the shunt, and from the other side of the shunt to the inverter's negative DC terminal.

IMPORTANT

The side of the shunt that connects to the inverter should be considered the DC negative bus in order for the State of Charge (SOC) function to operate properly.

IMPORTANT

Le côté du shunt qui se relie à l'inverseur devrait être considéré l'autobus négatif de C.C afin de l'état de fonction de la charge (SOC) à fonctionner correctement.

DC Positive Cable - Route the appropriately sized cable from the battery cable terminal to the circuit breaker.

CAUTION

Observe the proper polarity (line side vs. load side) on DC circuit breakers.

ATTENTION

Observez la polarité appropriée (ligne côté contre le côté de charge) sur des disjoncteurs de C.C.

WARNING

Assure that the DC circuit breaker is off when connecting the positive battery cable to avoid activating the inverter prematurely.

AVERTISSEMENT

Assurez que le disjoncteur de C.C est outre de en reliant le câble positif de batterie pour éviter de déclencher l'inverseur prématurément.

Next route the appropriately sized cable from the other side of the circuit breaker to the positive DC terminal on the inverter.

4.3.2 AC Wiring

WARNING

Ensure that the DC input voltage to the inverter is not present prior to making AC connections to the inverter.

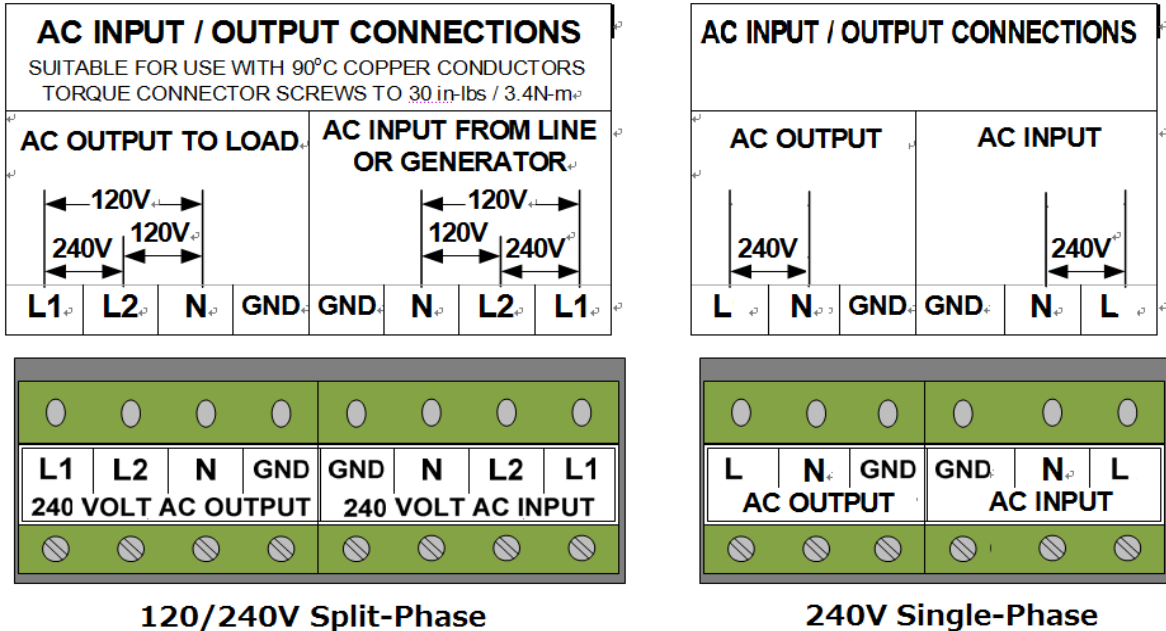


Figure 4.5: Terminal Block (AC Side)

- AC loads powered by the inverter must be installed in an electrical panel.
- Read all instructions and cautionary markings located in the beginning of this manual prior to installing the inverter and batteries.
- Always use 30 Amp rated circuit breakers.
- AC wiring must be no less than #10 AWG copper wire and approved for residential use per the NEC (ANSI/NFPA 70).
- DO NOT connect the inverter's output to an AC power source.
- Listed or labeled equipment must be installed and used in accordance with any instructions included in the listing or labeling.
- Assure that the AC output neutral is bonded to ground per NEC (ANSI/NFPA 70).

CAUTION

The inverter's internal AC transfer relay is rated at 40 Amps (each leg). The pass-thru current must be no greater than 40 Amps or damage to the relay may occur.

ATTENTION

Le relais interne de transfert à C.A. de l'inverseur est évalué à 40 ampères (chaque jambe). Passer-à-travers le courant ne doit être aucune r pe que 40 ampères ou dommages au relais peuvent se produire.

4.3.2.1 AC Wire Size and Over current Protection

AC input and output wiring must be sized per NEC (ANSI/NFPA 70) and local electrical safety code requirements to ensure the wires ability to safely handle the inverter's maximum load current. Over current protection devices are required to protect the inverter's input and output wiring. Since over current protection is not included in the inverter, it must be added at the time of installation.

4.3.2.2 AC Input and Output Wiring Connections

Refer to Table 4.1 for proper AC input and output wiring gauge. Connect the wires from the AC terminal block to the AC circuit breakers. Please observe the proper torque rating on the terminal block. To avoid confusion (and to conform to code), use white for neutral (N), and black and red for line (L1, L2) connections. Connect Green wires from the ground (GND) terminals to the earth ground bus bar.

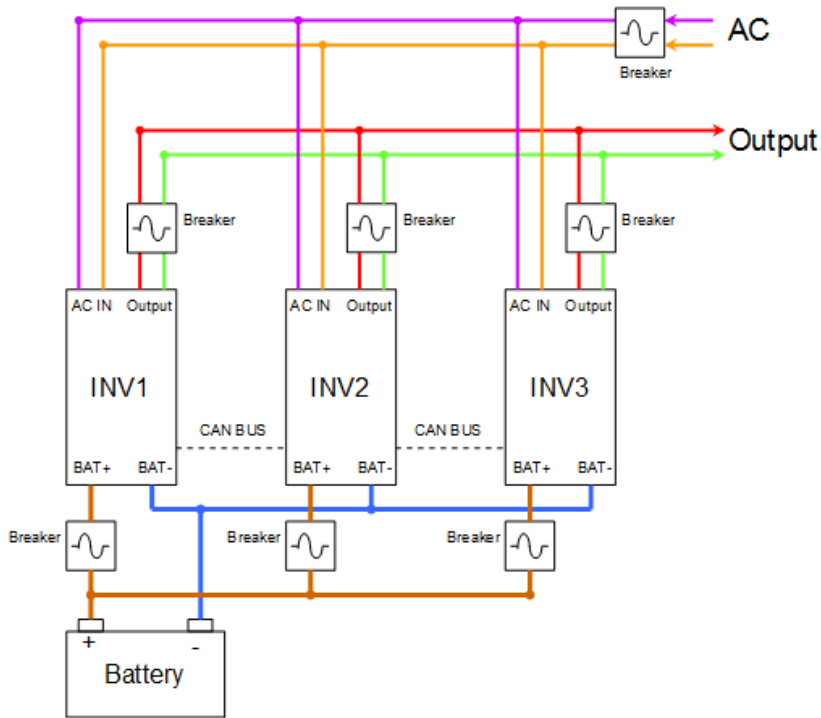
WARNING

Be sure to bond AC neutral to Ground.

4.4 EXTREME Inverter Stacking

Follow these directions when connecting multiple inverters in parallel for increased current output.

4.4.1 Connection diagram :



1. Use 250A breakers on the DC input and 40A breakers at AC output.
2. 4/0 AWG cable is recommended on the DC side and 10 AWG cable is recommended on the AC side. Beyond the AC combiner point, select a gauge which is appropriate for the total current.
3. Ensure that output L1/L2 connections are correct.
4. Use 6P4C 1.2m line for CAN BUS communication and terminator resistor 120Ω .
5. Be sure that each Inverter voltage and frequency setting is the same.

4.4.2 Parameter settings by LCD

1. Inverter Power on , In parameter setting screen to set the PARALLEL ENABLE (set to 1) and the first inverter ID set to 32, the second inverter ID set to 33.
2. The first and second Inverter communication connection : Inverter power off , the first Inverter ASNET interface connect to second Inverter ASNET interface .

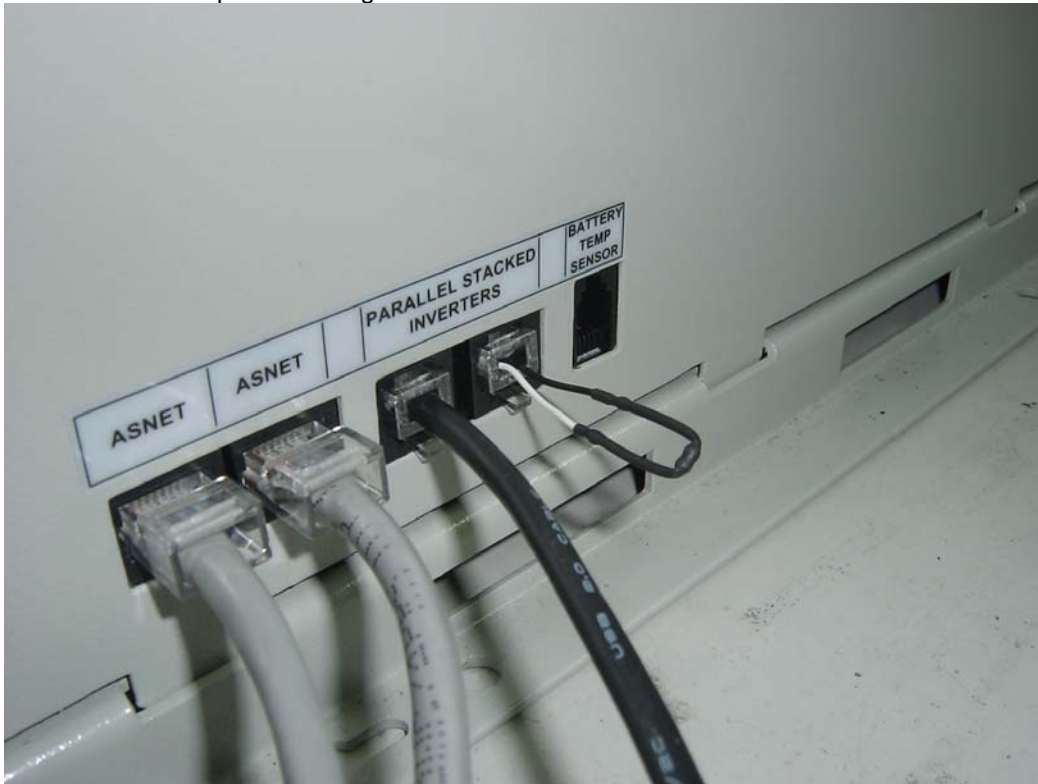


The first Inverter communication ASNET interface



The second Inverter communication ASNET interface and terminator resistor

3. The two sets Inverter of parallel wiring connected .



The first Inverter parallel interface and terminator resistor



The second Inverter parallel interface and terminator resistor

6. Power on two sets Inverter : Push "ON" button to enter the standby mode. If the CANbus connection is successful, you can be seen on one for the Master and other for the Slave.

4.4.3 Parallel Operation:

1. Auto Master setting:

When only one inverter is powered on in a parallel system, it would show 'CAN BUS NO RESPONSE' on LCD. When another inverter turns on, through normal CAN BUS operation, the first inverter powered will be the master. If both inverters power at the same time, then the inverter with the smaller ID will become the master. Because the system already has a master, even if a third inverter ID is smaller than the master, it only could be a slave.

When the master fails or is off-line, the slave inverter with the smallest ID will become the master.

2. Average output load:

A Slave will switch from standby to output automatically based on average load on a parallel system. When the total load is over 1760W, the inverter that is in standby mode with the smallest ID will change to output mode. When the average load is under 800W, the inverter that is in output mode with the biggest ID would change to standby mode.

5. Operation

5.1 Functional Test and Initial Setup

- **Step 1**

Confirm all wiring is correct and terminals are tight.

- **Step 2**

Check that the voltage and polarity is correct. Turn on the DC circuit breaker.

- **Step 3**

The unit will auto start in inverter mode within 6 seconds after power (battery) is applied.

- **Step 4**

Apply AC input (utility or generator). The unit should switch to charger mode.

CAUTION

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

ATTENTION

Excessivement - le taux de remplissage élevé peut surchauffer une batterie. Si une petite capacité de batterie est utilisée comme moyen de placer le taux de charge de batterie à l'arrangement minimum.

5.2 LCD Screen Descriptions

5.2.1 Startup Screen

SL5-4048 ID: 32 VER: 1.00	Boot Screen, show model No. / communication address / firmware version
---------------------------------	---

OUTPUT 240V 50Hz	Boot Screen, show voltage / frequency specifications
------------------------	--

5.2.2 Initial Status Screen

AUTO-START AFTER 5 SEC	Show countdown 5 seconds after the start output
---------------------------	---

5.2.3 Standby Mode Main Status Screen

STANDBY BAT 100 %	Standby Mode, Page1 : show the remaining battery capacity
STANDBY BAT 53.2V 0.0A	Standby Mode, Page2 : show the battery voltage and current
STANDBY AC 240.0V 0.0A	Standby Mode, Page3 : show the input voltage and current
STANDBY 0.0V 0.0A	Standby Mode, Page4 : show the output voltage and current
STANDBY 25.0C 25.0C	Standby Mode, Page5 : show heat-sink and transformer temperature

5.2.4 Inverter Mode Main Status Screen

INVERTING 253VA BAT 127min 100 %	Inverter Mode, Page1 : the upper right corner show the current output value of the load capacity, the second line show the remaining battery time and capacity
INVERTING 253VA BAT 53.2V 0.0A	Inverter Mode, Page2 : the upper right corner show the current output value of the load capacity, the second line show the battery voltage and current
INVERTING 253VA 240.0V 1.0A	Inverter Mode, Page3 : the upper right corner show the current output value of the load capacity, the second line show the output voltage and current
INVERTING 253VA L: 1.0A 253VA	Inverter Mode, Page4 : the upper right corner show the current output value of the load capacity, the second line show the L-line load current and load capacity
INVERTING 253VA N: 1.0A 253VA	Inverter Mode, Page5 : the upper right corner show the current output value of the load capacity, the second line show the N-line load current and load capacity

5.2.5 Charger Mode Main Status Screen

CHARGING 50.0Hz BAT 118min 20 %	Charge Mode, Page1 : the upper right corner show the current frequency value of input AC Mains, the second line show the remaining battery time and capacity
CHARGING 50.0Hz BAT 53.2V 0.0A	Charge Mode, Page2 : the upper right corner show the current frequency value of input AC Mains, the second line show the battery voltage and current
CHARGING 50.0Hz AC 240.0V 1.0A	Charge Mode, Page3 : the upper right corner show the current frequency value of input AC Mains, the second line show the output voltage and current

CHARGING	50.0Hz
L:	1.0A 253VA

Charge Mode, Page4 :
the upper right corner show the current frequency value of input AC Mains,
the second line show the L-line load current and load capacity

CHARGING	50.0Hz
N:	1.0A 253VA

Charge Mode, Page5 :
the upper right corner show the current frequency value of input AC Mains,
the second line show the N-line load current and load capacity

5.2.6 Error Messages

LCD Show	Explanation
OVER-LOAD	Output occurred over-load
TRANSFORMER OVER-TEMPERATURE	Transformer occurred over-temperature
HEAT-SINK OVER-TEMPERATURE	Heat-sink occurred over-temperature
OUTPUT ERROR	Output occurred low-voltage / Output occurred over-current
BATTERY LOW VOLTAGE	Battery occurred low-voltage
BATTERY OVER-VOLTAGE	Battery occurred over-voltage
AC OVER-CURRENT	AC Mains input occurred over-current

5.2.7 Setting Mode Main Status Screen

Press the Enter key to enter the selection of parameter group

PARAMETER GROUP
CHARGE CURVE

Setting mode, the first line shows the parameters of group selection page
The second line shows the current parameter group, then press “ENTER” key to enter the parameter group selection parameters

Press the Enter key to enter the parameter selection

CHARGE MODE
0

Parameter selection, the first row shows the parameter name
The second line shows the parameter values can change the parameters, press the UP / DOWN keys, then press “ENTER” key to enter the parameter setting or press the Back key to return

Password setting : Used to enter the parameter setting screen, you need to enter the 4 digit password, the password is correct and then you can change the parameters.

Revert to the normal display mode or three minutes keystrokes and then the password will be invalid.

KEY IN PASSWORD
0000

Password entry screen, enter the password “ ” can enter the parameter setting
Long press UP key or DOWN key to change the cursor position

Press the Enter key to enter the parameter selection

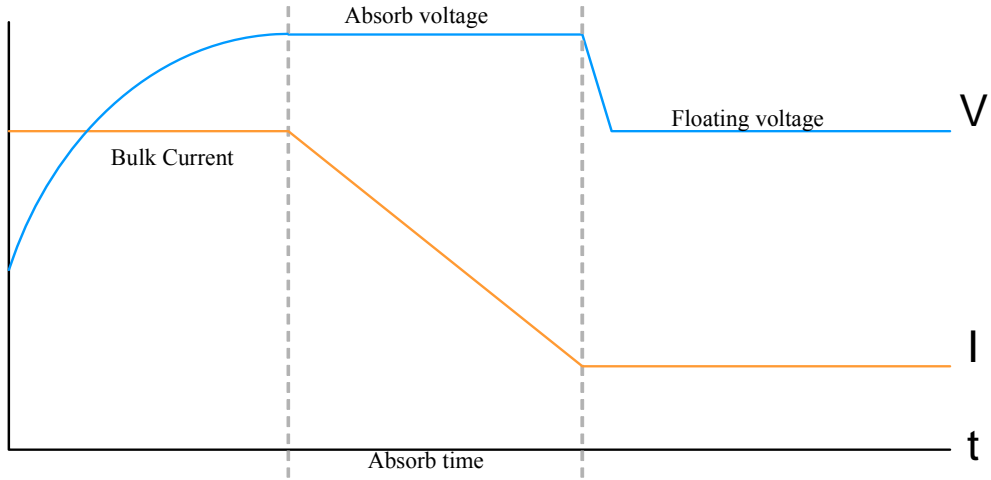
CHARGE MODE
0

Parameter setting, a short press UP / DOWN keys can change the parameters
Long press the UP key or DOWN key to change the cursor position, then press ENTER key to confirm, or press the Back key to return

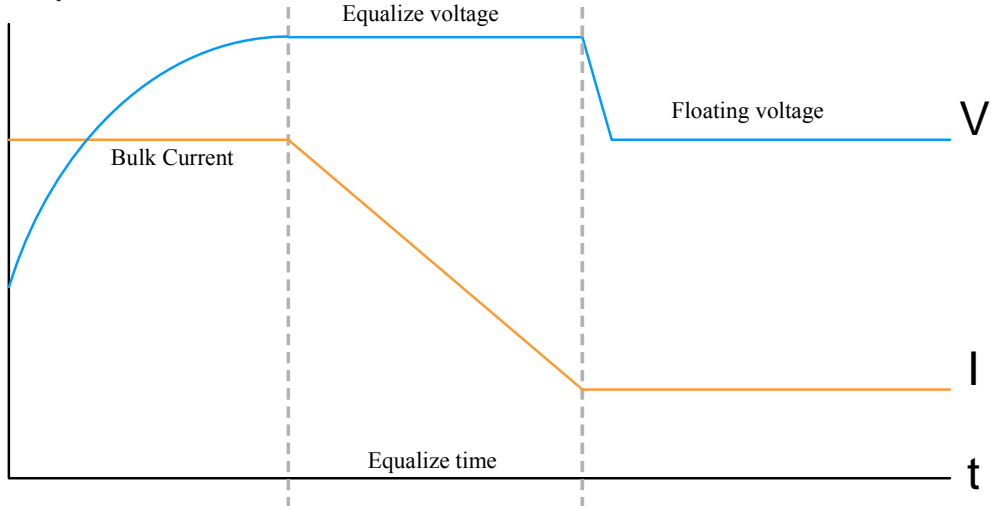
Example : Parameter Group for SL5-4048	Parameter Name	Parameter Description	Min.	Max.	(Unit)
CHARGE CURVE	CHARGE MODE	Charge mode selection	0	3	--
	BULK CURRENT	Bulk charge current	0	70	A
	ABSORB VOLTAGE	Absorb charge voltage	54.4	60.8	V
	ABSORB TIME	Absorb charge stage safety time	0	9999	min
	FLOATING VOLTAGE	Floating charge voltage	52.8	63.5	V
	EQUALIZE VOLTAGE	Equalize voltage	45.6	63.5	V
	EQUALIZE TIME	Equalize stage safety time	0	9999	min
	TEMP. COMPENSATE	Battery temperature compensation	1	8	mV
BATT PROTECTION	BATT OVER VOLT	Battery over voltage warning	57.2	80.0	V
	BATT LOW WARNING	Battery low voltage warning	42.0	54.0	V
	BATT UNDER VOLT	Battery under voltage cut off	40.0	50.0	V
	BATT OVER HEAT	Battery over temperature	30	70	C
POWER SAVING	SEARCH POWER	Minimum power into Search mode	0	200	VA
	SEARCH TIME	Search time	0	10	sec
COMMUNICATION	COMM. ID	Communication ID	1	247	
	PARALLEL ENABLE	Inverter parallel function enable	0	1	
	REMOTE CONTROL	Inverter remote control enable	0	1	
GRID PRIORITY	PRIORITY SELECT	Grid priority selection	0	3	
	DISCHARGE LOW V	Low voltage point of battery discharge function(LV)	38.0	55.0	V
	DISCHARGE HIGH V	High voltage point of battery discharge function(HV)	43.0	64.0	V
AC INPUT SETTING	STANADARD VOLT	⊙AC input standard voltage	0	3	
	STANDARD FREQ	AC input standard frequency	50.00	60.00	Hz
	HIGH VOLTAGE	AC input high voltage	10.0	40.0	V
	LOW VOLTAGE	AC input low voltage	10.0	80.0	V
	OVER LOAD TIME	Over Load Time	0	15000	ms
FAN CONTROL	CHANGE TIME	FAN speed change time	1000	20000	ms
	START POINT HS	Temp. start point by Heat Sink	30.0	60.0	C
	UP STEP HS	FAN speed up step by Heat Sink	1.0	10.0	C
	START POINT TR	Temp. start point by Transformer	40.0	80.0	C
	UP STEP TR	FAN speed up step by Transformer	2.0	20.0	C
	OVER HEAT HS	Heat Sink Over Heat point	50.0	95.0	C
	RECOVER POINT HS	Heat Sink Over Heat recover point	40.0	85.0	C
	OVER HEAT TR	Transformer Over Heat point	90.0	180.0	C

- STANADARD VOLT Setting : 0=240V, 1=230V, 2=220V, 3=200V for HV
0=120V, 1=115V, 2=110V, 3=100V for LV

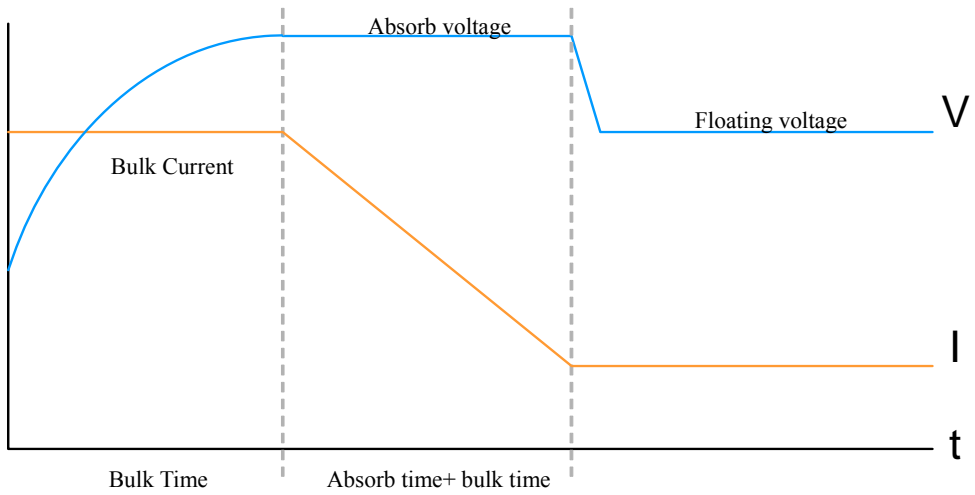
CHARGE MODE: Charge mode selection
 Set 0: Standard



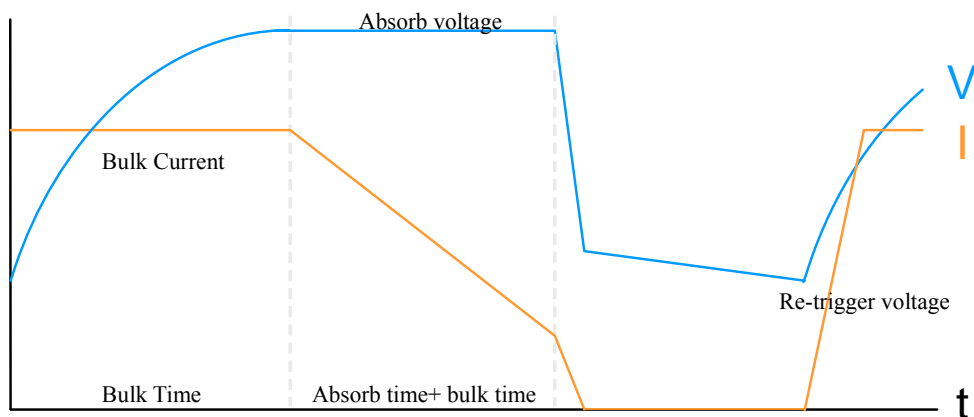
Set 1: Equalize



Set 2:



Set 3:



GRID PRIORITY : Priority Select

Set 0: Standard (AC Grid Priority)

Set 1: one time, when the unit is in charge mode, set 1 will let the inverter go to discharge mode until the battery voltage below the LV point, then the BAT DISCHARGE value will be clear to 0.

Set 2: Repeat mode 1, the inverter will discharge the battery until the battery voltage below the LV point, then go to charge mode until the battery voltage over the HV point, and repeat.

Set 3: Repeat mode 2, the inverter will discharge the battery until the battery voltage below the LV point, then go to charge mode until the battery charge in constant voltage stage and the charge current small than 5A, or in floating stage, and repeat.

6. Technical Specifications

Model	SL5-3024	SL5-3224	SL5-3548	SL5-4048
Continuous Power	3000 Watts	3200 Watts	3500 Watts	4000 Watts
Efficiency	92% max.		93% max.	
Output Waveform	Sine wave			
DC Power at Rated Power	180 amps	190 amps	105 amps	120 amps
DC Power at Short Circuit	540 amps	570 amps	315 amps	360 amps
Nominal Input Voltage	24 Vdc		48 Vdc	
DC Input Voltage Range	19 ~ 32 Vdc		38 ~ 64 Vdc	
Auto Low Battery Protection (Heavy/Light Load)	20 / 22 Vdc		40 / 44 Vdc	
DC mode output Voltage Regulation	±2%			
Power Factor Allowed	0.7 to 1			
T.H.D.	< 3% at full linear load			
Load Crest Factor Ratio	3 : 1			
Frequency Regulation	± 0.5 Hz			
Standard Input/Output Voltage for Single Phase Models	100 or 200Vac	100 or 110 or 115 or 120 or 220 or 230 or 240Vac	100 or 200Vac	100 or 110 or 115 or 120 or 220 or 230 or 240Vac
Standard Input/Output Voltage for Split Phase Models	100/200Vac	110/220Vac or 115/230Vac or 120/240Vac	100/200Vac	110/220Vac or 115/230Vac or 120/240Vac
Standard Output Frequency	50 or 60Hz +/- 1%			
Loading Sensing (Power Saving)	10W ~ 60W			
No load power consumption	< 29 Watts		< 35 Watts	
Search mode power consumption	< 5 Watts			
Transfer Time	16 ms typical			
Forced Air Cooling	Variable Speed			
Charge current(Max.)	65 A(Adjustable)	100 A(Adjustable)	45 A(Adjustable)	70 A(Adjustable)
Five Stage Battery Charger Output	Bulk, Absorb, Float, Equalize, Standby			
Battery Charging Power Factor Corrected	> 0.9			
Resistive Load	Yes			
Inductive Load	Yes			
Motor Load	Yes			
Rectifier Load	Yes			
Wall Mounting	Yes			
Data Communication	RS-485			
Weight (kg)	22.2			
Dimensions (mm) W x D x H	572 x 229 x 184			

Technical Specifications subject to change without notification

7. 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 the system does not turn on properly, turn off the Battery Breaker (DC input), disconnecting the system from the battery for 30 seconds, and then repeat the turn on steps. If the system still does not function please contact your Technical Support.

8. Service and Support

If you have any questions or problems with the EXTREME Series Inverter, ask for a technical support representative.

Please have the following information ready when you call Technical Support:

- 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 (if available) or repack in a secure shipping carton. 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 unit.