MNLR3648M (Mobile Version)
Little Rosie Inverter/Charger

Owner's Manual

MidNite Solar, Inc

Disclaimer of Liability

The use of this manual and the conditions or methods of installation, operation, use, and maintenance of the Little Rosie inverter/charger fall beyond the control of MidNite Solar. Consequently, the company assumes no responsibility and expressly disclaims any liability for loss, damage, or expense—whether direct, indirect, consequential, or incidental—that may arise from or be connected with such installation, operation, use, or maintenance.

Restrictions on Use

The Little Rosie inverter/charger is intended for use in life support devices or systems only with the express written approval of MidNite Solar. If this inverter fails, it could reasonably lead to the failure of the life support device or system, potentially affecting the safety and effectiveness of that equipment. In such cases, the health of the user or other individuals may be endangered.

Copyright Notice

Document Information

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Continuous Improvements and Product Updates

Please note that due to ongoing improvements and product updates, the images depicted in this manual may not precisely match the unit you have purchased.

Color Diagrams

While this physical copy presents the manual in black and white for easy printing and reference, a downloadable version with many diagrams in color is available for a more comprehensive user experience. You can find the digital version on our website at: www.MidNiteSolar.com

Safety Information

For safety and to reduce the risk of electrical shock, fire, or other hazards, this manual uses specific symbols. The following symbols provide visual cues to highlight critical safety instructions, potential dangers, and additional information as needed:

WARNING: This symbol indicates a critical alert. Failure to take the recommended action could result in physical harm. Be sure to heed any accompanying warnings.

CAUTION: This symbol indicates a risk of equipment damage. Follow the recommended actions to avoid breakage.

Info: This symbol offers additional information that can help you understand important points better. While it's not a warning, this information is valuable for a full understanding.

IMPORTANT PRODUCT SAFETY INSTRUCTIONS

This manual contains important safety instructions for installing and operating the Little Rosie. Before installation or use, read all instructions and safety information in this manual. Familiarize yourself with the following information to ensure safe operation:

- Electrical Work Compliance: All electrical work must adhere to local, state, and federal electrical codes. Follow these regulations to minimize risks associated with electrical shock or fire.
- Indoor Installation Only: This product is designed for indoor or compartmentalized installation. Avoid exposure to rain, snow, moisture, or any liquids that could compromise safety.
- Insulated Tools: When performing maintenance or installation, use insulated tools. This precaution reduces the risk of electrical shock or accidental short circuits.
- Remove Jewelry: Prior to working on the inverter, remove all jewelry (such as rings, watches, bracelets). This prevents accidental contact with live components.
- Disconnect Energy Source: Always disconnect batteries or the energy source before installing or maintaining the inverter. Remember that live power may exist at multiple points due to the inverter's dual use of batteries and AC. Even if the inverter is turned off, AC power can still flow through it.
- Verify Wiring: The conductor insulation must be approved for the specific voltage, operation, temperature, and location of use. Ensure wire connections are secure to prevent hazards.
- AC and DC Disconnects: This inverter does not include integral AC or DC disconnects. As part of the system installation, ensure that both AC and DC disconnects are provided.

- Battery Overcurrent Protection: The inverter lacks overcurrent protection from the battery. It is crucial to incorporate overcurrent protection for the battery cables during installation.
- AC Output Wiring Overcurrent Protection: Similarly, the inverter does not offer built-in overcurrent protection for AC output wiring. As part of the installation process, provide overcurrent protection specifically for the AC output wiring.

Remember to follow these safety instructions diligently to maintain a secure environment and prevent accidents. Safety first!

IMPORTANT BATTERY SAFETY INSTRUCTIONS

- Eye Protection: When working with batteries, wear safety glasses to protect your eyes.
- Remove Jewelry: Prior to battery installation or maintenance, remove all jewelry (such as rings, watches, bracelets). This minimizes the risk of accidental contact with live components.
- Lifting Techniques: Use proper lifting techniques when dealing with batteries. Proper lifting reduces strain and prevents injuries.
- Battery Selection: Avoid old or untested batteries. Check each battery's label for information on age, type, and date code. Ensure all batteries are identical.
- Temperature Sensitivity: Some batteries are sensitive to temperature changes. Install batteries in a stable environment to maintain their performance.
- Ventilation: For safety, install batteries in a well-ventilated area. Some batteries can produce explosive gases. In compartment or enclosure installations, always vent batteries to the outside.
- Air Space: Provide at least one inch (2.5 cm) of air space between batteries. Optimum cooling helps prevent overheating.
- Verify Polarity and Voltage: Always verify proper polarity and voltage before connecting batteries to the inverter.
- Avoid Short-Circuits: Do not short-circuit the batteries. Short circuits can lead to fire or explosion.
- Accidental Exposure: In case of battery acid exposure, wash thoroughly with soap and water. For eye exposure, flood eyes with running water for at least 15 minutes and seek immediate medical attention.
- This inverter is intended to recharge batteries. The battery that is connected to this product is only suitable if it complies with the given battery standard for that battery type and is provided with a battery management system that will monitor and control the electrical and thermal health of the battery during charging. When installing this inverter/charger, the battery is to be verified as in compliance with the applicable battery standard.

SAVE ALL INSTRUCTIONS

Safety Information

Informations de sécurité

Pour des raisons de sécurité et afin de réduire les risques de choc électrique, d'incendie ou d'autres dangers, ce manuel utilise des symboles spécifiques. Les symboles suivants servent de repères visuels pour mettre en évidence les instructions de sécurité essentielles, les dangers potentiels et les informations supplémentaires, le cas échéant:

AVERTISSEMENT: Ce symbole constitue une alerte critique. Ignorer l'action spécifiée pourrait entraîner des blessures physiques. Soyez attentif à toutes les mises en garde associées à ce symbole.

ATTENTION: Lorsque vous rencontrez ce symbole, faites preuve de prudence. Ne pas suivre l'action spécifiée peut entraîner des dommages à l'équipement. Prenez les précautions nécessaires pour éviter les conséquences indésirables.

Info: Ce symbole fournit des informations supplémentaires qui complètent ou mettent en évidence des points importants. Bien qu'il ne signale pas un danger immédiat, il est essentiel d'assimiler ces informations pour une compréhension globale.

INSTRUCTIONS IMPORTANTES DE SÉCURITÉ DU PRODUIT

Ce manuel contient des instructions de sécurité essentielles pour l'installation et l'utilisation du Little Rosie. Avant l'installation ou l'utilisation, lisez attentivement toutes les instructions et informations de sécurité contenues dans ce manuel. Familiarisez-vous avec les éléments suivants pour garantir un fonctionnement sûr:

- Conformité aux travaux électriques: Tous les travaux électriques doivent respecter les codes électriques locaux, étatiques et fédéraux. Suivez ces réglementations pour minimiser les risques liés aux chocs électriques ou aux incendies.
- Installation en intérieur uniquement: Ce produit est conçu pour une installation en intérieur ou dans un compartiment. Évitez toute exposition à la pluie, à la neige, à l'humidité ou à tout liquide pouvant compromettre la sécurité.
- Outils isolés: Lors de la maintenance ou de l'installation, utilisez des outils isolés. Cette précaution réduit le risque de choc électrique ou de courts-circuits accidentels.
- Retrait des bijoux: Avant de travailler sur l'onduleur, retirez tous les bijoux (comme les bagues, montres, bracelets). Cela évite tout contact accidentel avec les composants sous tension.
- Déconnexion de la source d'énergie: Déconnectez toujours les batteries ou la source d'énergie avant d'installer ou de maintenir l'onduleur. Rappelez-vous que le courant peut être présent à plusieurs points en raison de l'utilisation double de l'onduleur (batteries et courant alternatif). Même si l'onduleur est éteint, le courant alternatif peut toujours circuler.
- Vérification du câblage: L'isolation des conducteurs doit être approuvée pour la tension spécifique, le fonctionnement, la température et l'emplacement d'utilisation. Assurez-vous que les connexions sont sécurisées pour éviter les risques.
- Déconnexions AC et DC: Cet onduleur ne comprend pas de déconnexions AC ou DC intégrées. Dans le cadre de l'installation du système, assurez-vous que les deux types de déconnexions sont fournis.

- Protection contre les surintensités de la batterie: L'onduleur ne dispose pas d'une protection intégrée contre les surintensités de la batterie. Pour remédier à cela, il est crucial d'incorporer une protection contre les surintensités pour les câbles de la batterie lors de l'installation.
- Protection contre les surintensités du câblage de sortie AC: De même, l'onduleur ne propose pas de protection intégrée contre les surintensités pour le câblage de sortie AC. Dans le cadre du processus d'installation, assurez-vous de fournir une protection spécifique pour le câblage de sortie AC.

N'oubliez pas de suivre ces instructions de sécurité avec diligence pour maintenir un environnement sécurisé et prévenir les accidents. La sécurité avant tout !

INSTRUCTIONS IMPORTANTES DE SÉCURITÉ DES BATTERIES

- Protection des Yeux: Lorsque vous travaillez avec des batteries, portez des lunettes de sécurité pour protéger vos yeux.
- Retirez les Bijoux: Avant l'installation ou la maintenance de la batterie, retirez tous les bijoux (comme les bagues, montres, bracelets). Cela réduit le risque de contact accidentel avec des composants sous tension.
- Techniques de Levage: Utilisez des techniques de levage appropriées lors de la manipulation des batteries. Un levage correct réduit la tension et prévient les blessures.
- Sélection des Batteries: Évitez les batteries anciennes ou non testées. Vérifiez l'étiquette de chaque batterie pour connaître son âge, son type et son code de date. Assurez-vous que toutes les batteries sont identiques.
- Sensibilité à la Température: Certaines batteries sont sensibles aux variations de température. Installez les batteries dans un environnement stable pour maintenir leurs performances.
- Ventilation: Pour des raisons de sécurité, installez les batteries dans un endroit bien ventilé. Certaines batteries peuvent produire des gaz explosifs. Dans les installations en compartiment ou enceinte, ventilez toujours les batteries vers l'extérieur.
- Espace d'Air: Laissez au moins un pouce (2,5 cm) d'espace d'air entre les batteries. Un refroidissement optimal aide à prévenir la surchauffe.
- Vérification de la Polarité et de la Tension: Vérifiez toujours la polarité et la tension correctes avant de connecter les batteries à l'onduleur.
- Évitez les Courts-Circuits: Ne court-circuitez pas les batteries. Les courts-circuits peuvent entraîner un incendie ou une explosion.
- Exposition Accidentelle: En cas d'exposition à l'acide de la batterie, lavez abondamment à l'eau et au savon. En cas d'exposition aux yeux, rincez les yeux avec de l'eau courante pendant au moins 15 minutes et consultez immédiatement un médecin.
- Cet onduleur est destiné à recharger les batteries. La batterie connectée à ce produit n'est adaptée que si elle est conforme à la norme de batterie donnée pour ce type de batterie et est équipée d'un système de gestion de batterie qui surveillera et contrôlera la santé électrique et thermique de la batterie pendant la charge. Lors de l'installation de cet onduleur/chargeur, la batterie doit être vérifiée comme étant conforme à la norme de batterie applicable.

CONSERVEZ TOUTES LES INSTRUCTIONS

Table of Contents

Table of Contents (cont.)

List of Figures

List of Tables

1.0 Introduction

The MNLR3648M (hereafter, it may also be referred to as "Little Rosie" or "LR") is a true sine wave inverter and charger specifically designed for use in mobile applications such as RVs, trucks, and on boats. This inverter combines power with user-friendly simplicity. Take a moment to explore the features and benefits of the Little Rosie inverter/charger.

Features:

The Little Rosie inverter/charger is equipped with the following:

- Continuous 3600-watt, true sine-wave output power in a compact design—making it ideal for installations where space is limited.
- Multi-stage 60-amp battery charger with PFC (Power Factor Corrected) charging.
- Utilizes CAN communication protocol.
- Internal 30-amp AC transfer switch; allowing the incoming AC power to continue powering the loads even if the inverter is off.
- Field-serviceable for qualified personnel.
- Automatic battery temperature compensation to provide optimum charging even during extreme temperature changes—requires optional Battery Temperature Sensor to be used.
- Numerous protection features such as over-charge, over-current and short-circuit detection, high-temperature shutdown, and high and low battery voltage turn-off protection.
- Automatic Charger Back-off which reduces the power consumption of the battery charger to prioritize the incoming AC to power the loads and help prevent the AC input circuit breaker from tripping.
- AC Input Support which pulls power from the battery to continue powering loads that exceed the current capacity of the incoming AC source.

Regulatory Compliance

The MNLR3648M is listed to UL458 (Power Converters/Inverters and Power Converter/Inverter Systems for Land Vehicles and Marine Crafts) and UL1741 (Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources) for use in the US; and is also certified to CSA C22.2 No. 107.1-01 (General Use Power Supplies) for use in Canada. The Little Rosie has been tested and certified to these product safety standards by a Nationally Recognized Testing Laboratory (NRTL). NRTL's are qualified organizations that meet Occupational Safety and Health Administration (OSHA) regulations to perform independent safety testing and product certification.

1.1 How the Little Rosie Works

The Little Rosie inverter/charger takes direct current (DC) from your batteries and turns it into alternating current (AC). It also takes alternating current (when connected to a generator or to utility power) and transforms it into direct current to charge your batteries. There are two modes of operation:

- **Inverter Mode:** When the Little Rosie is properly connected to batteries and turned on, the direct current (DC) from the batteries is transformed into alternating current (AC). This AC is similar to the voltage provided by a utility for your home, and is used to power the electrical appliances (i.e., AC loads) connected to the inverter's output.
- **Standby (Charger/Transfer) Mode:** When an external source of AC power (e.g., utility power or generator) is connected and qualified on the Little Rosie's AC input, it operates in Standby mode. In Standby mode, the unit operates as a battery charger to convert the incoming AC power into DC power to recharge the batteries; and at the same time, automatically closes an internal AC transfer relay to pass the incoming AC power directly to the inverter's output to continue powering the connected electrical appliances. In this mode, the Little Rosie monitors the AC input and is "standing-by" to switch to Inverter mode if it detects a power failure.

1.2 Run Time and Powering Loads

The Little Rosie inverter/charger can power a wide range of household appliances (also known as "inverter loads" or "loads"). As with any appliance using batteries for power, there is a certain length of time that it can run—this is called "run time". Actual run time depends on several variables including the size and the type of appliance, the type of batteries installed in your application, as well as the battery's capacity and age. Other factors such as the battery's state of charge and temperature can also affect the length of time your appliances can run.

Depending on their size, some larger electrical appliances can be used for short durations. However, loads that are used for longer periods such as stoves or water heaters can quickly drain your batteries and are not recommended for inverter applications.

All electrical appliances are rated by the amount of power they consume. The rating is normally printed on the product's nameplate label, usually located on its chassis near the AC power cord. Even though it is difficult to calculate exactly how long an inverter will run a particular appliance, the best advice is trial and error. Your Little Rosie inverter has a built-in safeguard that will cause it to automatically turn off when the batteries get low - to protect your batteries from being over-discharged.

1.3 Little Rosie Features

This section covers the many features available on the Little Rosie inverter.

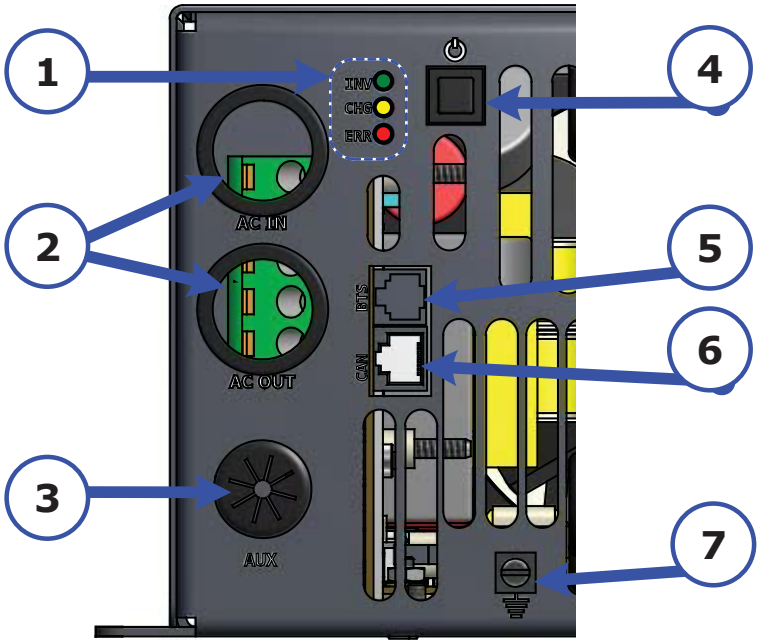


Figure 1-1, Front Side (Left-Hand) Features

1. **LED Status Indicators** – three LED status indicators (INV, CHG, and ERR) for monitoring inverter and charger operation; and any errors that may occur. See Section 4.1.2.
2. **AC Input/Output Connections** – two 3/4” openings provided to allow the AC input and output field wiring. See Section 2.4.
3. **AUX Wire Connections** – a 1/2” knockout to allow the wire connections to the Auxillary terminals.
4. **INV ON/OFF Switch** – a momentary pushbutton switch that alternately turns the inverter on or off. See Section 4.1.1.
5. **Battery Temperature Sensor Connection Port** – a RJ11 port that accepts MidNite’s Battery Temperature Sensor (MNBTS). See Section 2.6.1.
6. **CAN/Remote Connection Port** – a RJ45 port that accepts optional CAN capable accessories; or for connecting a MidNite Remote control. See Section 2.6.2.
7. **DC Equipment Ground Terminal** – this connection is used to tie the exposed chassis of the inverter to the vehicle’s DC grounding system. See Section 2.3.3.

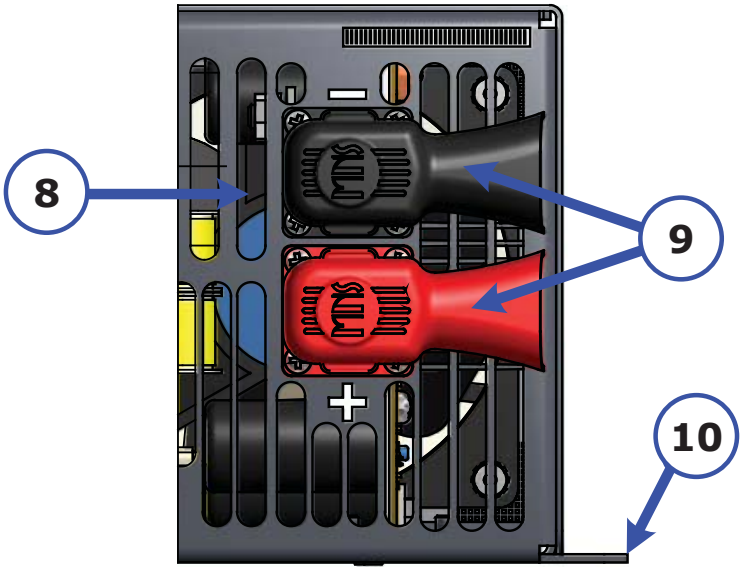


Figure 1-2, Front Side (Right-Hand) Features

8 **Exhaust Vents** – ventilation openings that allow heated air to be removed by the internal fan.

9 **Battery Connection Terminals** – provides the Negative (black) and Positive (red) connection point for the battery cables from the battery bank;. See Section 2.3.4.

10 **Mounting Flange** – used to secure the inverter to a shelf or wall. See Figure 2-2.

11 **Intake Air Opening** – opening that allows the internal cooling fan to pull in air to help keep the inverter cool for peak performance.

Figure 1-3, Rear Side Features

12 **Model/Serial Number and Warnings Label** – provides model/serial number, specifications, information and safety warnings on the Little Rosie. For specs see Section 6.0.

13 **Access Cover** – removing this cover provides access to the internal components listed below. See Figure 1-4.

- **A** DIP switch - used to enable/disable CAN Bus features, and change the remote switch function. See Section 3.3.
- **B** AC Terminal Block - for connecting the AC input/output wires. See Section 2.4.2.
- **C** Auxillary terminals - to connect externally controlled equipment and options. See Section 2.5.

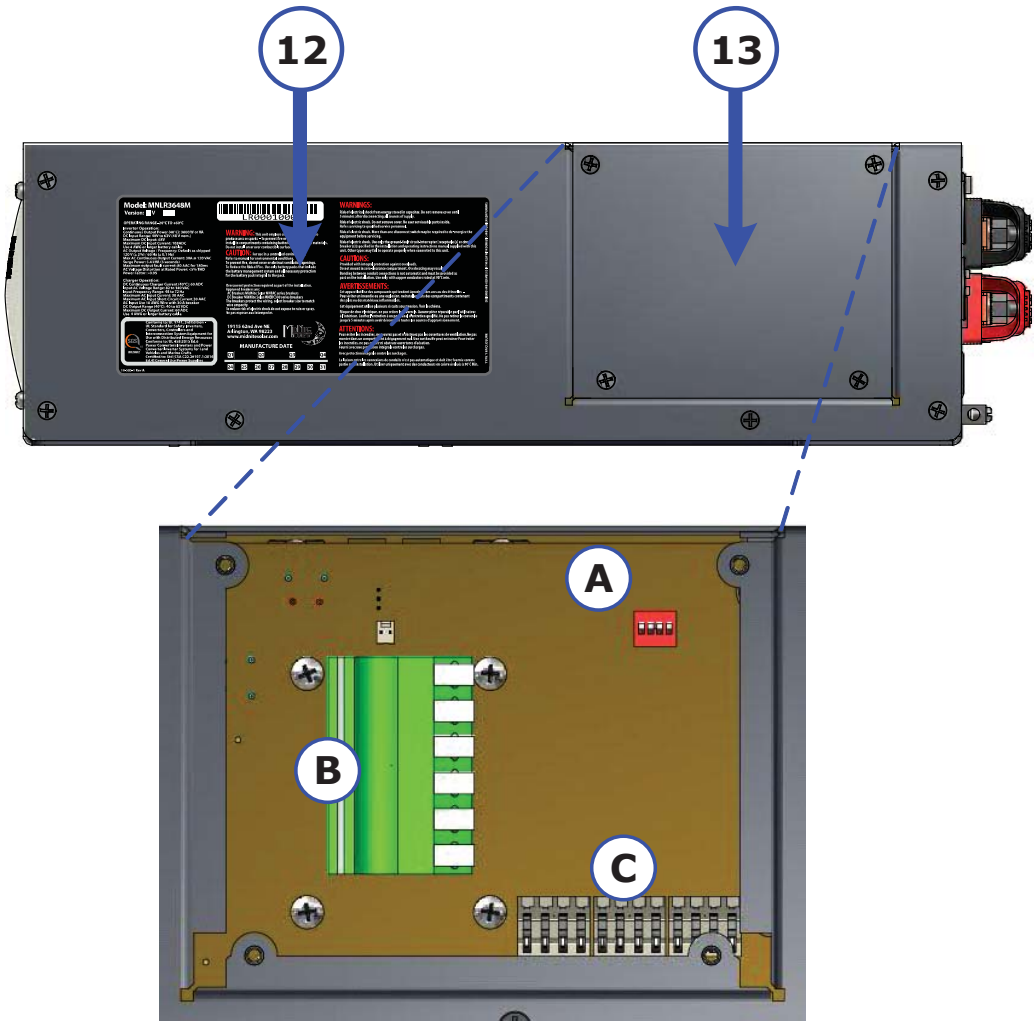


Figure 1-4, Left Side Features

2.0 Installation

2.1 Pre-Installation

Before installing the inverter, carefully review the entire Installation section. Following these guidelines will help ensure a safe and effective installation.

WARNING: Installations should be performed by qualified personnel, such as a licensed or certified electrician. The installer is responsible to identify which safety codes apply and ensure compliance with all applicable installation requirements. These requirements may vary depending on the specific location and purpose of the installation.

Info: Ensure the safety information on pages ii-v is reviewed before proceeding with the installation.

Before you begin the installation, review the following key points:

System Diagram Review

A basic diagram shown in Figure 2-1 serves as a reference for planning and designing your installation. The diagram shown is a RV system, but Marine and Truck installations are similar. This diagram does not override or restrict any national or local electrical requirements. Compliance with regulations remains the responsibility of the installer and installation inspector.

Unpacking and Inspection

When you receive your Little Rosie inverter, follow these steps:

Carefully remove it from the shipping container.

Inspect all contents to ensure everything is present and undamaged.

Verify the following items:

- Little Rosie Inverter/Charger
- Little Rosie Owner's Manual

If any items are missing or damaged, contact your authorized dealer or MidNite.

Ownership Documentation

Save your proof-of-purchase as a record of ownership.

This documentation will be necessary if the unit requires in-warranty service.

Record the model (MNLR3648M) and serial number of the unit in the front of the manual for future reference.

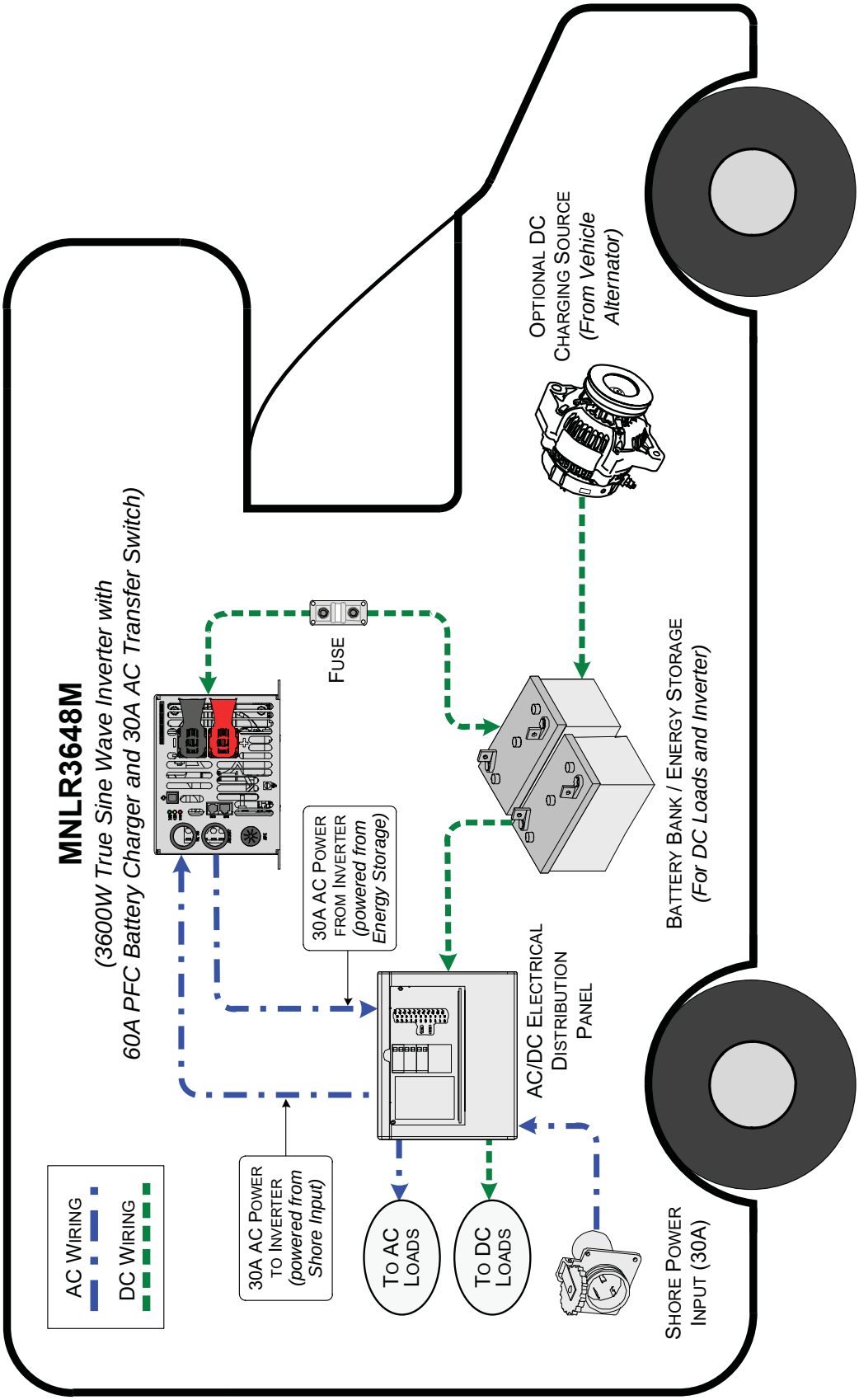


Figure 2-1, Little Rosie Basic RV Installation Diagram

2.2 Locating and Mounting the Inverter

WARNINGS:

- Do not mount the inverter near any flammable or combustible fluid or components.
- Provide adequate clearance/ventilation to the inverter.

The inverter should only be installed in a location that meets the following requirements:

Clean and Dry –

- The inverter is rated for indoor use only.
- Avoid installing it in areas where dust, fumes, insects, or rodents can enter or block the ventilation openings.
- Ensure it is free from the risk of condensation, water, or any other liquid that can enter or fall on the inverter.
- The inverter uses stainless steel or zinc-coated fasteners, plated copper busbars, and conformal-coated circuit boards–all within an aluminum power-coated enclosure to help withstand corrosive environments. However, using the inverter in this type of environmental condition may impact its lifespan, and inverter failure under these circumstances is not covered under warranty.

Cool – The inverter should be protected from direct exposure to the sun or any equipment or area that is extremely hot. If possible, maintain an ambient air temperature between -4°F and 140°F (-20°C to 60°C).

Ventilated – To prevent over-temperature error conditions and ensure continuous output power:

- Do not cover or block the inverter’s ventilation openings,
- Provide sufficient space for heated air inside the inverter to escape.
- Provide at least 3 inches (7.5 cm) of airspace clearance at the intake and exhaust vents to provide adequate ventilation.
- If installed in an compartment/enclosure, consider adding a fresh air intake opening to allow cool air to flow in and heated air to exit away from the inverter and enclosure.

CAUTION: Do not mount this inverter in a zero clearance compartment, nor cover or obstruct the ventilation openings—overheating may result.

Installation

Safe – Maintain a minimum distance of 2 feet (60 cm) between the inverter and any flammable/combustible materials (such as paper, cloth, or plastic) that could be ignited by heat, sparks, or flames.

WARNING: The Little Rosie should not be installed in any location that requires ignition-protected equipment. Additionally, avoid installing the inverter in areas containing highly flammable liquids like gasoline or propane.

Close to the Battery Bank –

- Like any inverter, position it near the batteries to minimize DC wire length.
- Avoid installing it in the same compartment as the batteries that can vent, or where it's exposed to battery gases.
- Battery gases are corrosive and can damage the inverter. Accumulated gases may even ignite and cause an explosion.

CAUTION: This inverter is intended to recharge batteries. The battery that is connected to this product is only suitable if it complies with the given battery standard for that battery type and is provided with a battery management system that will monitor and control the electrical and thermal health of the battery during charging. When installing this inverter/charger, the battery is to be verified as in compliance with the applicable battery standard.

Accessibility –

- Do not block access to the inverter's accessory ports.
- Allow sufficient room to access the DC wiring connections for periodic checks and tightening, to access the ON/OFF switch, and view the LED status indicators (INV, CHG, and ERR) to monitor inverter and charger operation - and any errors that may occur.

Mounting –

- Regulatory requirements dictate how the Little Rosie can be mounted. Refer to Figure 2-2 to determine how you can mount your Little Rosie inverter.

CAUTION: DO NOT mount the MNLR3648M with the DC terminals facing downward.

- The mounting surface must be non-combustible and capable of supporting at least twice the inverter's weight.
- Use the base of the inverter's chassis as a template to mark the mounting screw locations.
- Consider placing flexible washers or bushings between the mounting surface and the inverter's flanges to reduce vibration.

Once the inverter has been properly mounted, you can begin to wire the DC connections.

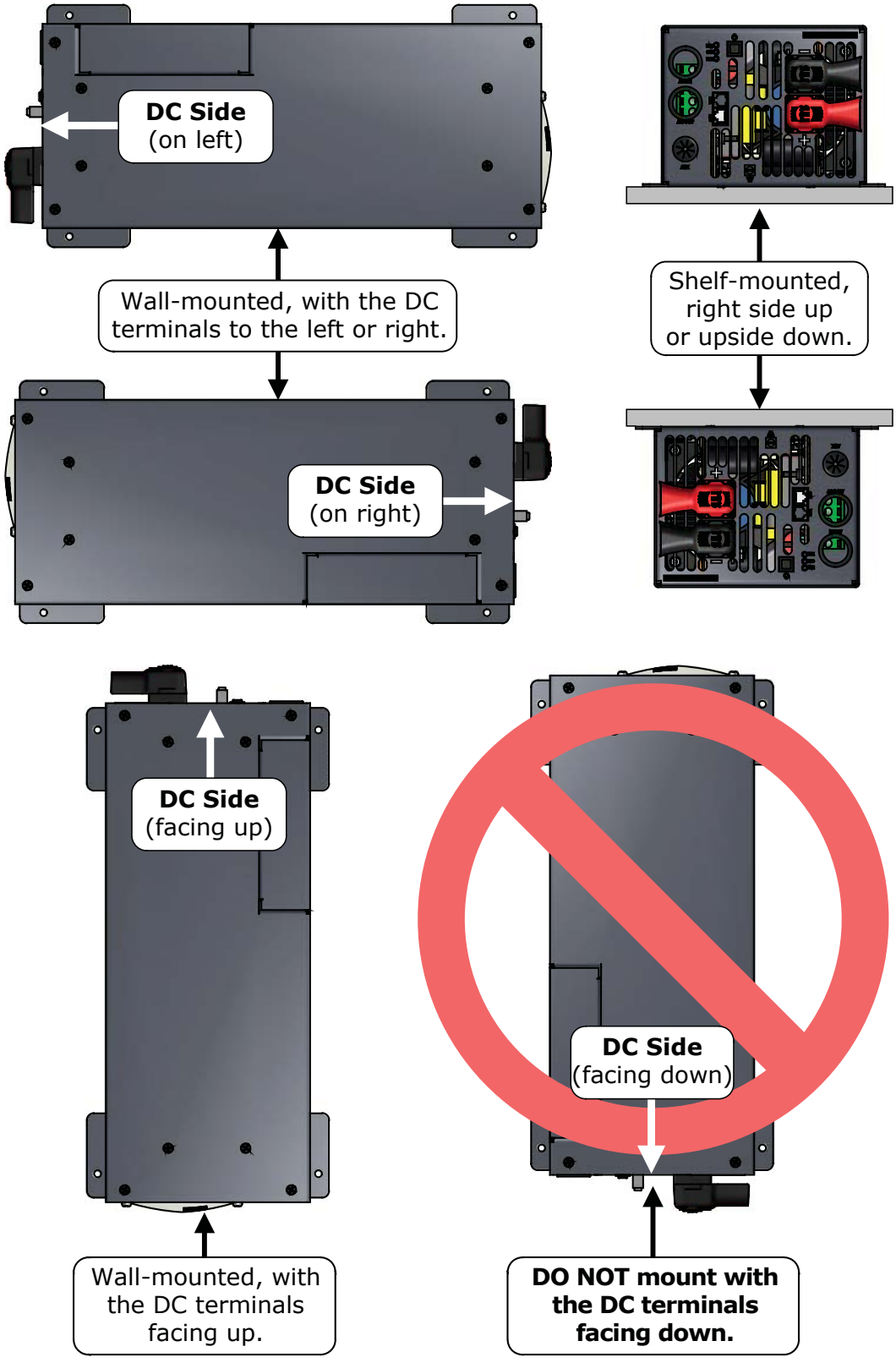


Figure 2-2, Approved Mounting Orientations (MNLR3648M)

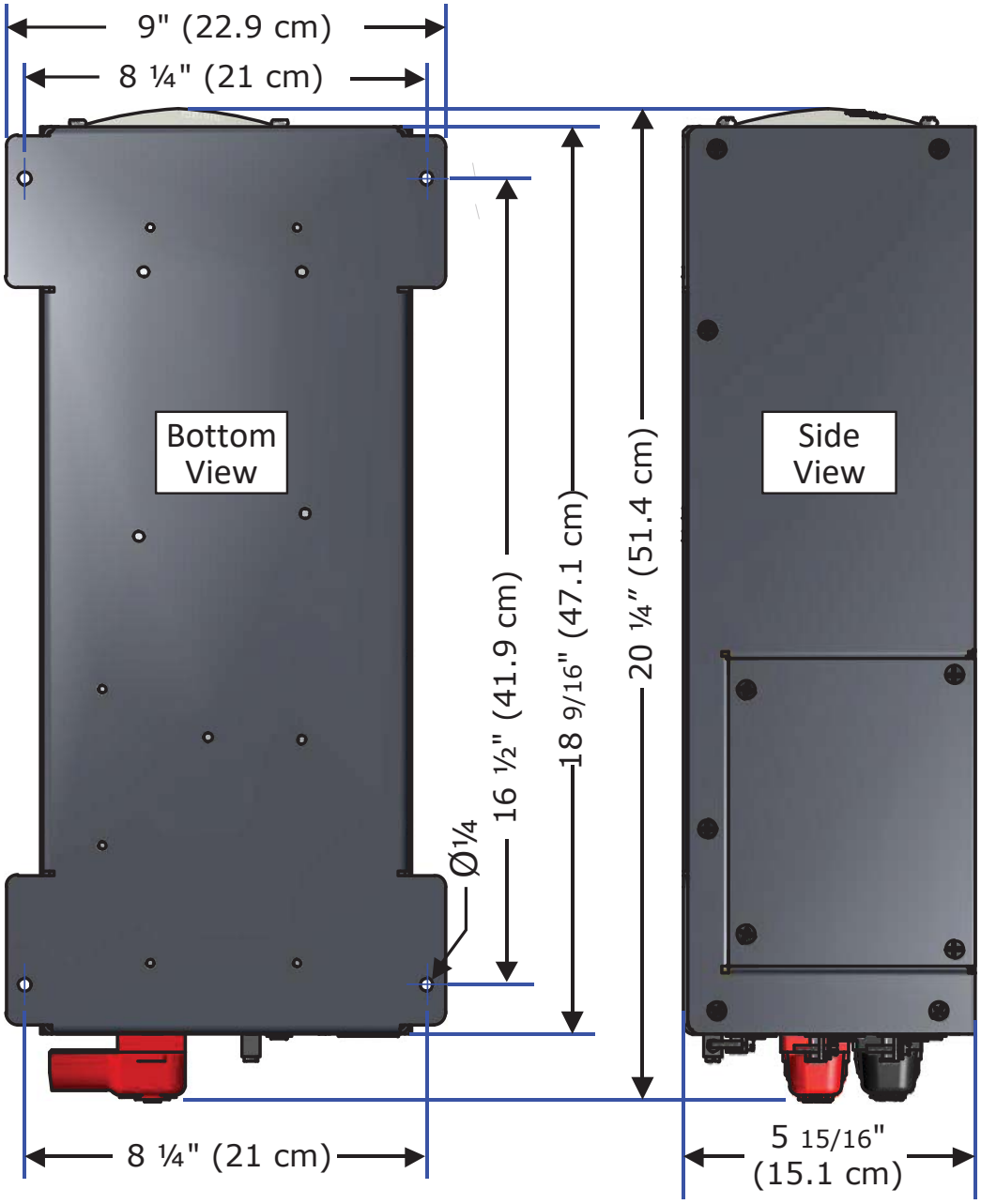


Figure 2-3, Little Rosie Inverter Dimensions

2.3 DC Wiring

This section provides details about the Little Rosie's required DC (Direct Current) wire sizes for optimal performance, the recommended disconnect/overcurrent protection, and how to make the necessary DC connections between the inverter and the battery bank.

WARNING: While DC voltage is often considered "low voltage," it can still pose significant hazards, especially in the case of battery system short circuits.

CAUTION: The inverter is NOT reverse polarity protected—Connecting the negative and positive battery voltage to the inverter incorrectly can result in damage. Use a voltmeter to verify the correct polarity BEFORE connecting the DC wires.

CAUTION: DO NOT connect the battery cables to the inverter until all wiring is complete and the correct DC voltage and polarity have been verified.

CAUTION: DO NOT use the chassis (in an RV or truck) as a substitute for the battery negative connection to the inverter. The inverter requires a reliable return path directly to the battery. Ensure a cable is connected directly from the inverter negative terminal to the battery negative connection.

When connecting the DC wires to the Little Rosie, refer to Figure 2-4. Additionally, for optimal performance, consider the following:

Tie Positive and Negative Cables Together - Use wire ties/straps or electrical tape to secure the DC positive and negative cables connected to the inverter from the battery bank, and tie them approximately every 6 inches (15.3 cm). This practice improves surge capability, reduces inductance effects, enhances the inverter waveform, and minimizes wear on the inverter's filter capacitors.

Battery Bank Voltage Range - The battery bank voltage must be between 40 to 63 volts for the inverter to operate correctly. If the voltage exceeds 68 volts, the inverter may be damaged.

Minimize Connections - Minimize all connections from the battery bank to the inverter. Exceptions include the DC fuse and DC disconnect in the positive line; and a DC shunt in the negative line. Additional connection points contribute to voltage drops and may loosen during use.

Color Code DC Cables/Wires - To help avoid polarity problems, color code the DC cables/wires to the battery bank: RED for positive (+), WHITE (or BLACK) for negative (–), GREEN (or bare copper) for DC ground.

2.3.1 DC Wire Sizing

Ensuring proper DC wire sizing is crucial for the inverter's performance, efficiency and safety of the system.

Selecting the Right Wire Size - To achieve maximum efficiency and minimize fire hazards, choose the correct DC wire size. Refer to Table 2-1 to determine the minimum wire size needed. If the distance between the inverter and the battery bank exceeds 10 feet (3.0m), consult the lower part of the table for longer distances.

Importance of Proper Sizing - Undersized cables can cause the output peak voltage from the inverter to be lower, reduce the ability to handle heavy loads during surges, increase the risk of overheating, and cause the battery bank to be under-charged.

Info: Keep wire runs as short as possible to prevent low voltage shutdowns.

Table 2-1, Recommended DC Wire/Overcurrent Device

		Little Rosie
Maximum Continuous Current[1]		108 amps
DC Grounding Electrode Wire Size[2]		#6 AWG (13.3 mm²)
Minimum DC Wire Size[3] [75°C rating in free air]		#4 AWG (21.2 mm²) [125 amps]
DC Fuse Size[4]		125 amps with time delay
Increased size for longer distance	**1 to 10 ft (0.3 to 3.0 m) =**	#4 AWG (21.2 mm²)
	10 to 15 ft (3.0 to 4.6 m) =	#2 AWG (33.6 mm²)

Note[1]: *Maximum Continuous Current is determined by the inverter's continuous power rating at the lowest input voltage, and account for any inefficiency.*

Note[2]: *Per the NEC, the DC grounding electrode conductor can be a #6 AWG (13.3 mm²) conductor if that is the only connection to the grounding electrode and that grounding electrode is a pipe, rod, or plate electrode.*

Note[3]: *Wire size is based on the requirements needed to increase efficiency and reduce stress to the inverter.*

Note[4]: *This fuse is matched with the 'Minimum DC Wire Size' to ensure the current rating of the fuse does not exceed the ampacity of the wire. If a larger fuse is used, ensure the ampacity of the DC wire is sized correctly.*

2.3.2 DC Overcurrent Protection

In mobile DC electrical systems, such as those found in RVs, trucks, and marine vessels, an overcurrent protection device is required. Its primary function is to protect the DC wiring from excessive current flow, which can occur due to overload or short circuits. In a mobile installation, the DC overcurrent protection device is normally a fuse.

Choosing the right fuse type and size is crucial. Batteries can deliver a massive surge of current (thousands of amps) during a short circuit. The fuse you choose must be a DC-rated fuse that has an interrupt current rating (known as Amps Interrupting Current or AIC) that can withstand the short-circuit current without explosion or damage. A Class-T type fuse or its equivalent is highly recommended, especially when paired with an inverter. A Class-T fuse is specifically rated for DC electrical systems, can handle extremely high short-circuit currents (up to 200,000 amps) and has a built-in delay time that allows for momentary current surges from the inverter without blowing the fuse unnecessarily.

Info: If the combined short-circuit current of all batteries in the bank is 2,700 amps or less, an ANL fuse type may suffice. When in doubt, it's advisable to use a Class-T fuse.

The fuse size should match the size of the DC cables being used; it must open before the cable reaches its maximum current carrying capability, thereby preventing a fire hazard. Refer to Table 2-1 for the recommended fuse size coordinated with your DC wire size for the inverter.

Note: Electrical systems in mobile installations typically do not use a DC disconnect; however, an overcurrent protection device is still required. These installations also do not normally use conduit; to address this, the fuse should be placed in the ungrounded conductor (positive line) within 18 inches of the battery. This allows the fuse to effectively safeguard the entire DC wiring system.

2.3.3 DC Grounding

Proper grounding is crucial to ensure a safe inverter operation. The metallic enclosures of all electrical components should be connected together to maintain the same voltage potential and minimize the risk of electric shock. Typically, the inverter chassis and negative battery cable are connected to a single point in the system's ground bond using a dedicated safety-grounding conductor. This conductor needs to be sized according to National Electrical Code (NEC) specifications for your application, but must be at least #6 AWG copper wire. Importantly, if installing in a vehicle, its metal frame shouldn't be used as a substitute for the negative connection or DC ground. The inverter requires a reliable dedicated path for negative and ground current to return directly to the battery.

The Little Rosie provides a DC equipment ground terminal for this purpose; see Figure 1-1, Item 7. This connector accepts copper or aluminum conductors from 4 - 14 AWG.

2.3.4 DC Cable Connections

When connecting the DC cable to the battery or the inverter, ensure there is a secure and direct connection - this is critical for optimal performance and safety.

The battery cable lug should be positioned directly against the battery post. DO NOT place any washers or other hardware between the lug and post—they can create high resistance. This resistance can lead to two problems: reduced performance from your inverter and potentially melted cable and terminal connections.

When connecting battery cables to the Little Rosie, stack the hardware in the correct order per Figure 2-4 and tighten the connections from 10 to 12 ft-lbs (13.6 to 16.3 Nm).

CAUTION: Do not put anything between the DC cable ring lug and the battery terminal post or the inverter's DC terminal. If antioxidant grease/spray is used, apply it after all connections have been made and properly tightened.

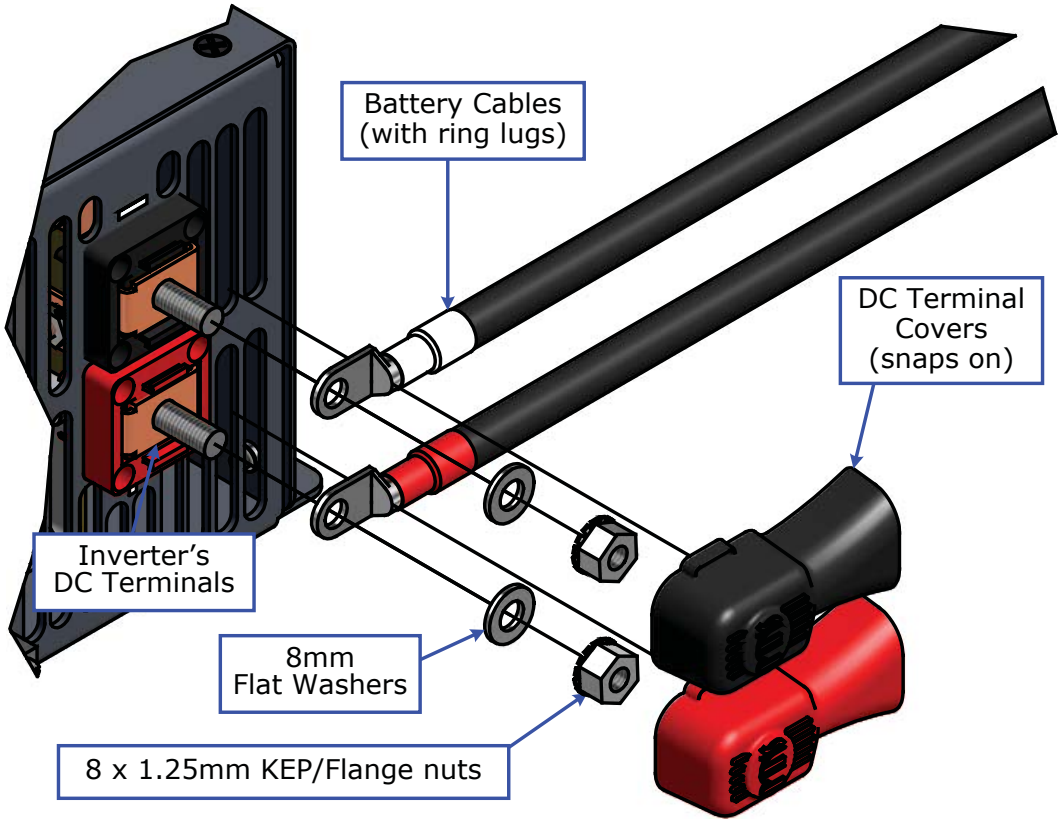


Figure 2-4, DC Cable to Inverter's DC Terminals

2.3.5 Battery Bank Wiring

WARNING: Making a direct connection between the positive and negative terminals of a battery bank can cause a dangerous electrical short circuit. To prevent this hazard, always ensure cable ends are properly insulated and cannot accidentally touch during installation or wiring.

CAUTION: Certain batteries generate explosive gases during operation. To ensure safety, always install these batteries in a well-ventilated area. If placing them within a compartment or enclosure, ensure proper ventilation to the outside environment.

Info: DO NOT connect the DC wires from the battery bank to the inverter until: 1) all DC wiring complete, 2) the correct DC overcurrent protection has been installed, and 3) the correct DC voltage and polarity have been verified.

Info: Using different types or unmatched batteries can lead to uneven charging/discharging, reducing overall system efficiency and potentially shortening lifespan. Avoid using old or untested batteries altogether, as they may not deliver the required power and could be a safety risk.

Depending upon the type of batteries you use in the installation, the batteries may need to be wired in series, parallel, or series-parallel to provide 48 VDC (see Appendix B – Battery Information, for guidance on wiring batteries together). We recommend that the interconnecting DC wires must be sized and rated the same as those that are used between the battery bank and the inverter.

Place the batteries as close as practical to the inverter, preferably in an insulated and ventilated enclosure. Allow adequate space above the batteries to access the terminals and vent caps (if applicable).

Allow ≥1” (2.5cm) of space between the batteries to provide good air flow. If the batteries vent gas while charging, DO NOT mount them directly under the inverter, or in the same compartment.

2.3.6 Inverter to Battery Bank Wiring

CAUTION: The inverter is NOT reverse polarity protected. If this happens, the inverter will be damaged and will not be covered under warranty. Before connecting the DC wires from the batteries to the inverter, verify the correct battery voltage and polarity using a voltmeter. If the positive terminal of the battery is connected to the negative terminal of the inverter and vice versa, severe damage will result. As a precaution, color code the cables with colored tape or heat shrink tubing—RED for positive (+) and BLACK (or WHITE) for negative (–) to avoid polarity confusion.

2.3.6.1 Wiring the Battery Bank to the Little Rosie

Before you begin, ensure ALL power sources are completely shut off. This includes disconnecting and de-energizing:

- DC power sources: Disconnect and isolate batteries.
- AC power sources: Turn off and lock out breakers for utility/ shore power or AC generators.

Never work on electrical systems while they are energized. Use the following information to safely connect the Little Rosie inverter to your battery bank.

DC Equipment Ground Wire

1. Route an appropriately sized DC grounding wire from the inverter's DC equipment ground terminal (Figure 1-1, Item 7) to the DC system's ground. Recommended tightening torque for a #6 AWG ground wire is 45 in-lbf (5.1 N-m).

DC Negative Wire

2. Route an appropriately sized DC negative wire from the negative terminal of the battery bank to the inverter's negative terminal (Figure 1-2, Item 9, black cover).

Info: If installing a battery SOC (State of Charge) monitor such as MidNite's WZBJr, install a DC shunt in-line with the negative battery cable.

DC Positive Wire

3. Mount the fuse assembly as near as practical to the batteries, but do not connect it yet (i.e., no power to inverter).

WARNING: DO NOT connect the fuse to connect battery power to the inverter at this time. This will occur in the **Functional Test** after the installation is complete.

CAUTION: If you connect live battery cables to the inverter DC terminals, a brief spark or arc may occur. This is normal and due to the inverter's internal capacitors being charged.

4. Route and connect an appropriately sized DC positive wire from the inverter's positive DC terminal to the positive terminal (Figure 1-2, Item 9, red cover) of the battery bank thru the DC fuse block assembly.
5. Recheck all DC wire connections (on the batteries, inverter, and DC fuse terminals) to ensure they are connected correctly. Once the DC connections are completely wired and tested, you can coat the terminals with an approved anti-oxidizing spray.
6. Attach the red and black terminal covers over the inverter's DC connectors, and then secure them in place.
7. If the batteries are in an enclosure, perform a final check of the connections to the battery terminals, then close and secure the battery enclosure.

2.4 AC Wiring

This section provides information on how to make the AC connections to the Little Rosie using the correct AC wire size and the corresponding overcurrent protection.

2.4.1 Pre-AC Wiring Requirements

WARNINGS

- To reduce the risk of fire, do not connect this inverter to an AC load center (Circuit breaker panel) that has multi-wire branch circuits connected.
- Ground Fault Circuit Interrupters (GFCIs) shall be installed in the recreational vehicle wiring system to protect all branch circuits.
- Risk of electrical shock. The following GFCI circuit breaker has been tested; other types may fail to operate properly when connected to the Little Rosie: Eaton CHFN120A1CS.

CAUTION: Before installing any AC wiring, review the safety information at the beginning of this manual and the following:

- The AC wires must be copper and be approved for the application (i.e., RV or marine wiring).
- DO NOT connect the inverter's output to an AC power source. This could cause severe damage to the inverter and is not covered under warranty.
- The wire sizes recommended in this manual are based on the ampacities given in Table 310.15 of the National Electrical Code. ANSI/NFPA 70, for 75°C (167°F) copper wire based on an ambient temperature of 30°C (86°F).

2.4.2 AC Terminal Block Connections

The Little Rosie has a six-pole AC wiring terminal block for connecting both incoming and outgoing AC wires. This terminal block (refer to Figure 2-6) allows you to wire your main electrical panel (service/distribution panel) directly to the inverter's input, and to wire a dedicated sub-panel between the inverter's output and your appliances (AC loads). To access and view the AC terminal block, simply remove the four Phillips screws holding the AC wiring access cover plate (see Figure 1-4, Item 13).

This terminal block uses a lever to open and close a stainless steel spring clamp to either release or secure the wire in place (see Figure 2-5). Each terminal is rated to accept either a solid or stranded copper wire sized between #16 to #6 AWG (1.3 to 13.3 mm²).

Info: The inverter's AC NEUTRAL IN and AC NEUTRAL OUT terminals are electrically isolated from each other while inverting. This is related to the neutral-ground bonding requirement and helps to prevent ground-loops (see Section 4.8 for more information).

Connecting the AC Wires

- Strip 0.5 inch (12-13 mm) of insulation off the end of the conductor.
- Flip the lever UP on the terminal block and insert the stripped wire.
- Flip the lever DOWN to clamp the wire, and verify that the wire is being held snugly.

IMPORTANT: Ensure the lever is pressed DOWN fully as shown in Figure 2-5.

- Repeat for all the wires being installed.

IMPORTANT: Make sure each terminal is clamped onto the wire, not the insulation.

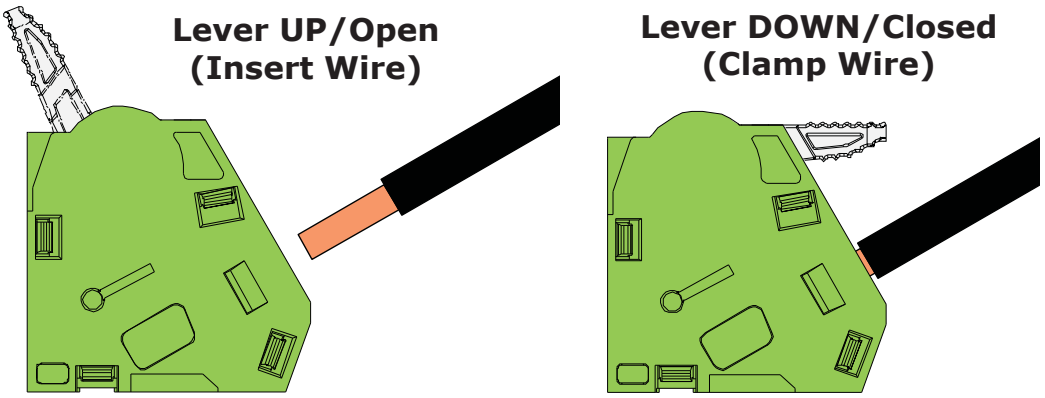


Figure 2-5, AC Terminal Block Lever (UP and DOWN)

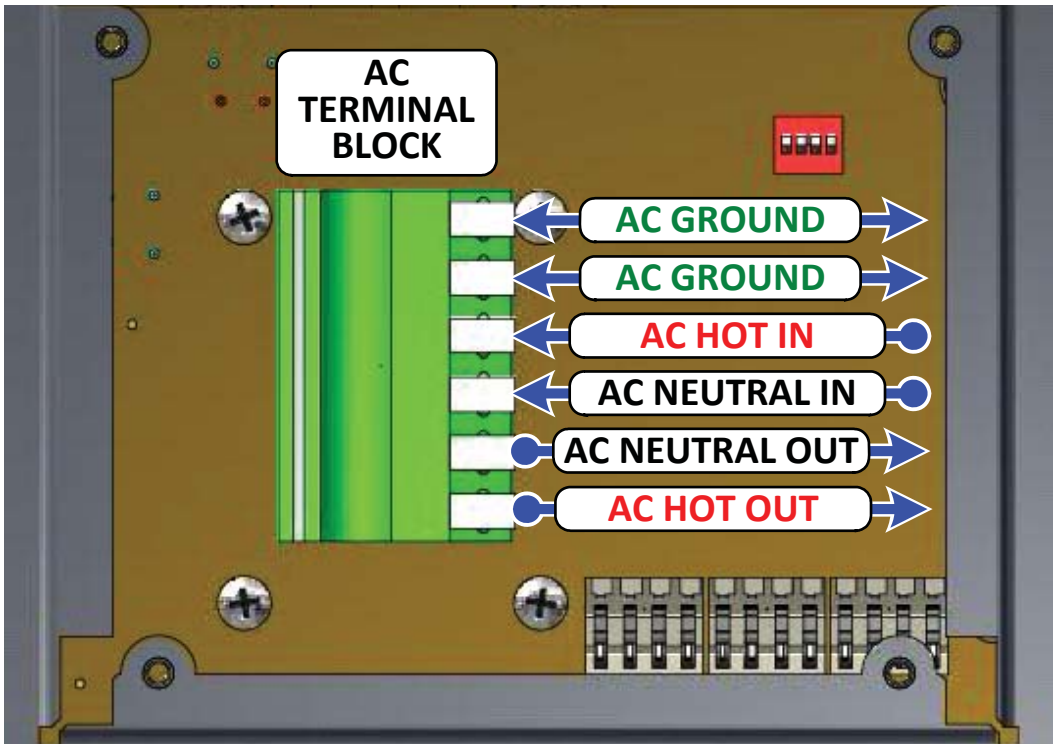


Figure 2-6, AC Terminal Block

2.4.3 AC Wire Size and Overcurrent Protection

Ensure your AC input and output wires are sized according to local electrical codes to handle the inverter's maximum current. Additionally, the AC wiring needs an overcurrent protection device (not included in the inverter) to safeguard against short circuits and overloads. A separate disconnect switch may be required to isolate the AC circuits for maintenance or emergencies. The overcurrent protection device must be properly sized for the wire gauge and the appliances it protects.

2.4.3.1 AC Input Wire Sizing

The pass-thu capability of the relay in the Little Rosie is limited to 30 amps. To protect this relay, install a 30-amp continuous duty rated breaker at the AC input, which corresponds to a minimum wire size of #10 AWG (5.3 mm²). If you are using other circuit breakers/wire sizes, consult your appropriate electrical codes for sizing requirements.

CAUTION: The inverter's internal AC transfer relay contacts are rated for 30 amps per leg, the pass-thru current must be no greater than 30 amps per leg or relay damage may occur.

2.4.3.2 AC Output Wire Sizing

This inverter when connected to an AC source for charging also has an automatically enabled AC load support feature. This means the inverter's AC output current can be greater than the current supplied by the AC source to the inverter's input. The output of the inverter can supply up to 55 amps AC, this requires a minimum cable size of #8 AWG (8.4 mm²) on the inverter's output.

CAUTION: If the inverter's output circuit is not wired for at least 55 amps, then an appropriately sized over-current protection device (i.e., fuse/circuit-breaker) must be installed on the inverter output circuit to prevent damage.

2.4.3.3 AC Ground Terminals

Inverter power systems must always be connected to a grounded wiring system. Proper grounding reduces the risk of electric shock and minimizes radio frequency interference. The main objective of a grounding system is to ensure that fault currents are safely directed to the ground in the event of an electrical malfunction.

The AC terminal block in the little Rosie provides two AC ground terminals (as shown in Figure 2-6). One terminal to connect the incoming ground from the main AC panel, and the other terminal to connect the equipment powered by the inverter (i.e., sub-panel).

Info: There is a safety requirement to only have one neutral-to-ground connection in the electrical system. See Section 4.8 for more information.

2.4.4 AC Conductor Wiring

The following steps are basic guidelines for installing and connecting the AC wiring to and from the Little Rosie inverter.

WARNING: Before making any AC connections, make sure the inverter is disconnected from the battery and there is no other source of live power connected to the inverter.

Note: Verify strain reliefs or grommets are in place to prevent damage to the wiring where it passes through walls/ bulkheads or other openings.

Wiring the Inverter AC Input

1. Remove the four Phillips screws on the AC access cover (Figure 1-4, Item 13) to access the internal AC terminal block.
2. Route the incoming wires (hot, neutral, and ground) from the AC electrical main panel through one of the openings on the inverter (Figure 1-1, Item 2).
3. Connect the incoming hot wire (BLACK) from the main panel's dedicated breaker to the inverter's AC HOT IN terminal.
4. Connect the incoming neutral (WHITE) from the main panel's neutral busbar to the inverter's AC NEUTRAL IN terminal.
5. Connect the incoming ground (GREEN) wire from the main panel's ground busbar

Wiring the Inverter AC Output

6. Route the outgoing wires (hot, neutral, and ground) through the unused grommet opening (or strain relief clamp) on the inverter (Figure 1-1, Item 2) to the AC electrical sub-panel.
7. Connect the outgoing hot (BLACK) wire from the inverter's AC HOT OUT terminal to the sub-panel main breaker.
8. Connect the outgoing neutral (WHITE) from the AC NEUTRAL OUT terminal to the sub-panel's neutral busbar.
9. Connect the outgoing ground (GREEN) wire to the sub-panel's ground busbar.
10. If strain relief clamps are used, tighten them securely on the wires - always leave a little extra slack in the wiring.

AC Wiring Inspection

11. In a mobile installation, use wire ties or other non-conductive fasteners to prevent chafing or damage from movement and vibration.
12. After verifying all AC connections are correct and all inverter AC terminal levers are fully clamped down. Replace the AC wiring access cover and the covers on the main electrical/distribution panel.

2.5 Auxillary (AUX) Terminal Block

The Little Rosie provides a 12-pole terminal block that serves as a connection point for auxiliary equipment. Each terminal on this block utilizes a spring cage tension clamp to secure the wire. This eliminates the need for traditional screws.

Wires are inserted after pulling up the eccentric lever on each terminal. Once the wire is in place, push the lever down and pull on the wire to ensure it is secure.

Each terminal is rated for 12 amps and accepts both solid and stranded wire, accommodating sizes from 28 to 16 AWG. (0.2 mm² to 1.5 mm²).

Figure 2-7, Little Rosie's Auxillary Terminals Block

Info: The MNGP2 (MidNite Graphics/Programming 2) remote is required to set up and program the Aux 1 and 2 functions.

2.5.1 Connecting to the AUX Terminal Block

The AUX terminal block provides different functions depending on which pole(s) are used. See Figure 2-8 below and the related information to help determine how to connect and enable each function.

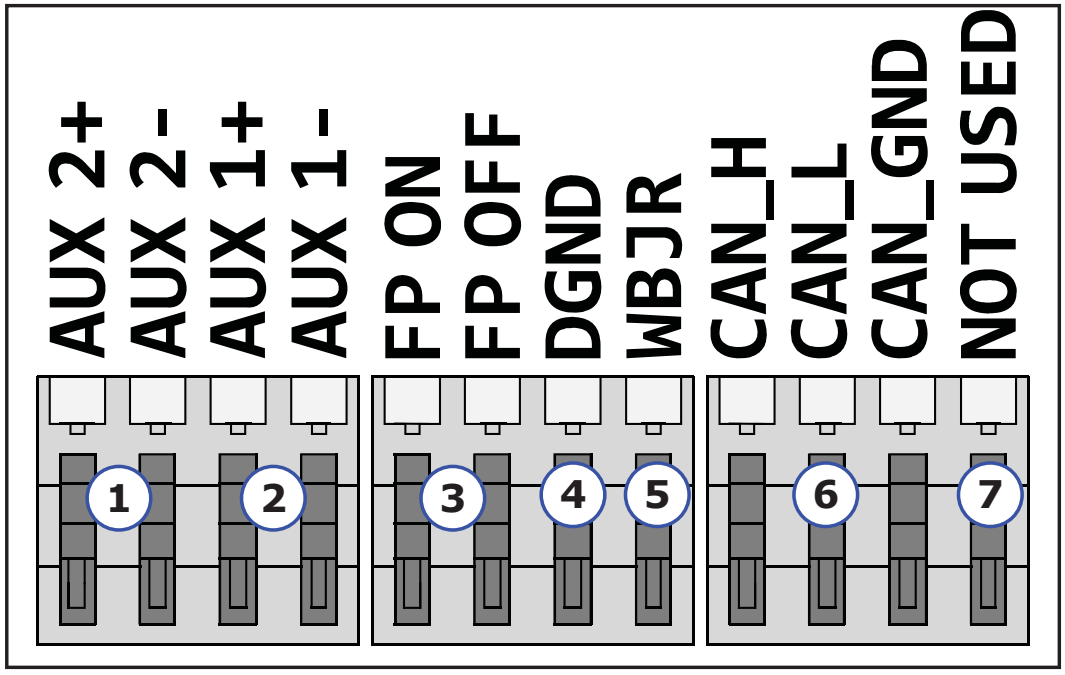


Figure 2-8, Auxillary Terminal Block Functions

1 2	**AUX Terminals** – The Little Rosie offers two terminal pairs [(AUX 1+/AUX 1-) and (AUX 2+/AUX2-)] that can be configured to be inputs or outputs. They can be used as a DCV trigger source for accessories such as a battery vent fan, diversion loads, or lights. These AUX circuits are polarity sensitive and output 12 VDC nominal at a maximum of 300mA; this requires an external relay between the accessory and a power source. The AUX circuit will trigger this external relay on/off. Their are many different AUX modes to choose from based on how you want to turn the accessory on or off. Some AUX modes allow a start-delay and off-delay timer–if desired–to hold the start function for a period of time, or to prevent the inverse function from occurring for a defined period of time. *Note: To set and enable the Aux Modes, you must use a MNGP2 Remote. See Section 3.2 for more information.* *Note: A re-settable Positive Temperature Co-efficient (PTC) fuse protects the internal components to the AUX terminals from over-current or a short circuit.*
3	**Front Panel (FP) Terminals** – The FP ON and FP OFF terminals allow users to connect an external switch to remotely turn the inverter on and off from a different location. Note: By default, the external switch must be a momentary, non-latching switch. It can be changed to a maintain switch by changing the #4 DIP switch setting. See Section 3.3. *Note: The FP terminals are marked 'FP ON' and 'FP OFF', but they are not polarity sensitive; either of these terminals can be wired to either of the external switch terminals.*
4	**DGND Terminal** – The terminal is not used for any function at this time.
5	**WBJR Terminal** – This terminal allows a Whiz Bang Jr (WBJr) to be connected. The Whiz Bang Jr is a current-sensing device that mounts to the side of a standard 500A/50mV shunt to measure the current into (and out of) the battery bank. This current flow can be used in calculating an accurate State of Charge (SOC) percentage and to monitor for Ending Amps, which is a targeted setpoint to terminate the Absorb charge cycle.
6	**CAN Terminals -** The CAN_L, CAN_H and CAN_GND terminals can be used to communicate with CANBUS compliant devices.
7	**Not Used -** This terminal is not used, nor connected to any circuit or feature.

2.6 Communications Ports

The Little Rosie provides two communication connection ports. The upper RJ11 port (See Figure 1-1, Item 5) is used to connect the BTS; and the lower RJ45 ports (See Figure 1-1, Item 6) is used to connect CAN capable devices, or for connecting the MNGP2 remote control.

2.6.1 Battery Temperature Sensor (BTS) Port

The optional MidNite Battery Temperature Sensor (Part Number: MNBTS) provides the Little Rosie with precise battery temperature information to automatically adjust the battery charger's absorb, and float voltage set-points. This allows the batteries to be correctly charged under extreme temperature changes. If the MNBTS is not installed or shorted, the charger will default to a neutral temperature of 25C and will not temp-comp the charging voltages. With certain battery types (e.g., Lead-Acid based), if the temperature sensor is NOT installed, and the batteries are subjected to large temperature changes, the battery life may be shortened.

In addition to temp-adjusting the charging voltages, the Little Rosie can be programmed to stop charging based on either a high or low battery temp setpoint.

Connecting the BTS:

1. Connect the phone jack of the MNBTS into the BTS port.
2. Pick a battery in the middle of your battery bank. About halfway up the side of the selected battery case, clean that area, remove the protective tape, and affix the MNBTS sensor to the battery wall. Consult battery manufacturer for optimal placement.

2.6.2 CAN/REMOTE Port

The RJ45 CAN port connector is provided to allow CANBUS-enabled devices to communicate with the Little Rosie.

This port is also used to connect a MNGP2 (MidNite remote control), which can be used to setup and monitor the Little Rosie. For information on the MNGP2 setup features, see Section 3.0.

Info: The conductors in the RJ45 CAN port are in parallel with the CAN terminals on the Auxillary Terminals Block as described in Section 2.5.

2.7 Functional Test

After all electrical connections to the inverter, batteries, AC source, and loads have been completed, follow these steps to test the installation and the inverter's operation.

1. Check the battery voltage and polarity before connecting the batteries to the inverter. Use a multimeter to verify 45 to 55 VDC at the batteries' positive and negative terminals.
2. Apply battery power to the inverter. The inverter remains off, but the LED status indicators go through a start-up test and the fan turns on to indicate that DC power has been connected and is ready to be turned on.
3. Prior to turning on the inverter, ensure all connected loads are switched off or disconnected from the AC outlets.
4. Press and release the inverter's ON/OFF power switch—located on the front of the inverter—to turn the inverter on.

   Verify inverter's INV LED status indicator is ON.
5. Check the output voltage of the inverter by connecting a multimeter to the outlets powered by the inverter. Verify the voltage is 120 VAC ±2.5 VAC.
6. Turn on or connect a load and verify it comes on. Continue to keep the load connected and turned on.
7. Press and release the inverter's ON/OFF power switch to turn the inverter off. The INV LED status indicator and the connected load should go off.
8. Apply AC power to the inverter's AC input. After the AC input power is qualified (approximately 10 seconds), the incoming AC power transfers through the inverter to the AC output and the connected load is powered. Verify the inverter's CHG LED illuminates and the connected load comes on.
9. Even though the connected load is on, the inverter is currently disabled/off. Press the ON/OFF power switch on the inverter to enable/turn-on the inverter.

   Verify inverter's INV LED status indicator is blinking.
10. Disconnect the incoming AC power to the inverter. Verify the connected load remains on—but now is powered by the inverter.

If the inverter passes all the steps, the inverter is ready for use.

If the inverter fails any steps, refer to Section 5.0, Troubleshooting.

3.0 Setup

When the Little Rosie is not connected to a remote, it uses the factory default settings that are adequate for most installations. If they are not appropriate for your application, you may need the MNGP2 remote.

3.1 Factory Default Setup Settings - Little Rosie

Figure 3-1 shows the Little Rosie's factory default settings under the Setup Menu. These settings–as shown on the MNGP2 remote–determine the Little Rosie's operating parameters. Review each menu item and the descriptions from the following sections to determine if any setting requires adjustment to meet your requirements.

Info: The default settings shown below are without a remote connected. If a remote is connected, the remote settings are saved in the inverter—even if the remote is disconnected—until all power to the inverter is removed.

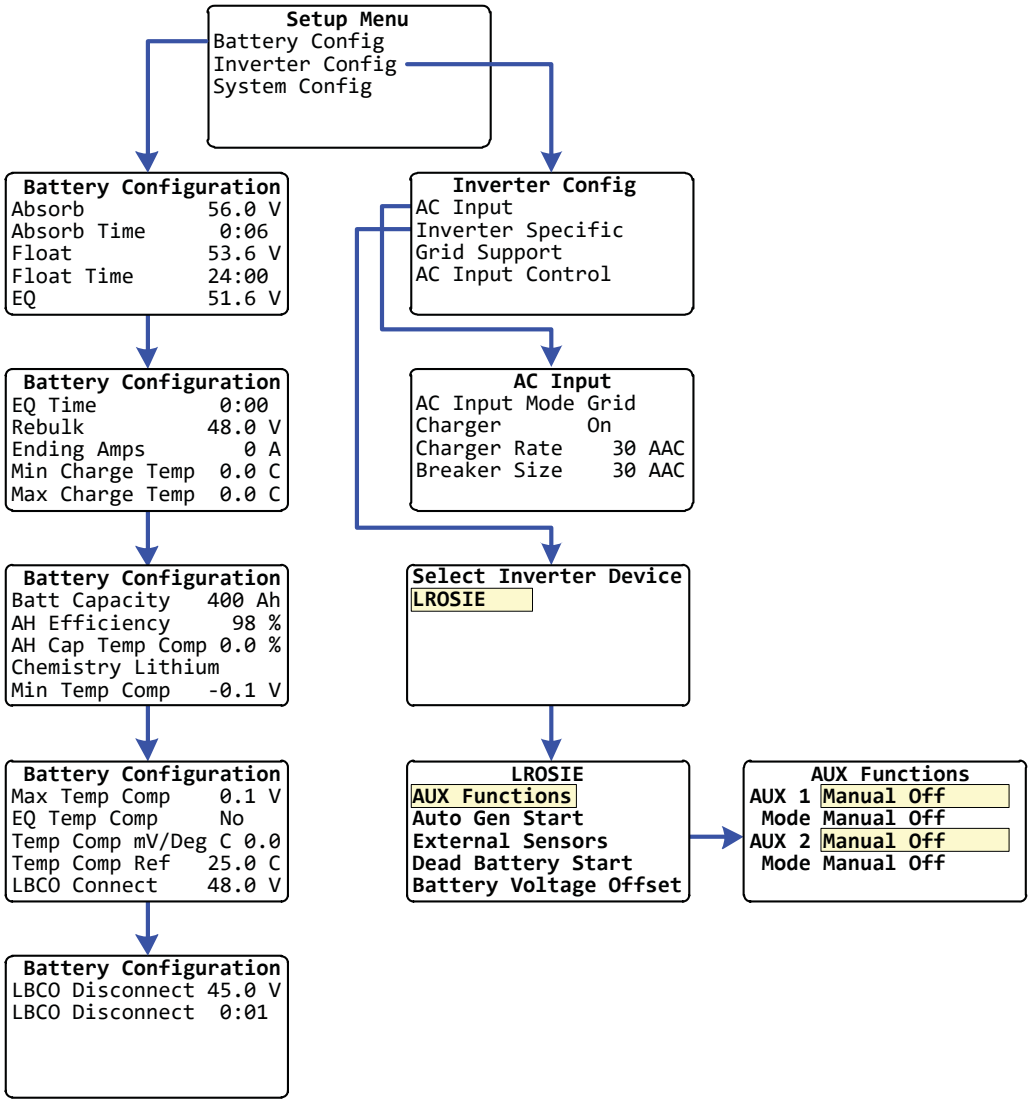


Figure 3-1, Little Rosie's Default Settings

3.1.1 Setup Menu/Battery Configuration

The following settings in the MNGP2 remote are available for the Little Rosie. If the default settings are not appropriate for your application, you can use the MNGP2 to adjust your setting.

• Absorb – Sets the Absorb charge cycle voltage. This comes from the battery manufacturer. Sometimes called "Bulk," "Constant Voltage," or "Boost" charge voltage. Default = 56.0 V.

• Absorb Time – Amount of time the Little Rosie stays in the Absorb charging cycle. Lithium batteries usually have a short or no Absorb time. Flooded and sealed usually use this formula: (Batt Bank 20hr Ah rating / Charging Amps) x 0.42 = Absorb Time. Default = 6 minutes.

• Float – Sets the Float voltage. Float is like a trickle charger and occurs after the Absorb cycle. Default = 53.6 V.

• Float Time – Amount of time Little Rosie stays in Float. Default = 24 Hours (Always in Float).

• EQ – Sets the Equalization (EQ) battery maintenance cycle voltage. Default = 51.6 V.

• EQ Time – Amount of time in EQ. Best to EQ in one-hour cycles, let batteries rest, measure the specific gravity of every cell. EQ until the cells are at or less than 0.025 S.G. apart. Default = 0 minutes.

• Rebulk – Battery voltage setpoint, below Float, that once reached causes the Rosie to start a new charge cycle...Bulk » Absorb » Float. Default = 48.0V.

• Ending Amps – Amp setpoint at which the batteries are fully charged. Commonly 1 – 3% of the bank's 20-hr Ah rating. The Little Rosie will go to Float when the Absorb Timer counts down to 0 or when Ending Amps is reached, whichever occurs first. Using Ending Amps is a better way to charge the battery bank properly and fully. Default = 0 A.

• Min/Max Charge Temp – Sets the temperature window (min to max) that the charger is allowed to charge. Whenever the temperature is outside this window, charging is disabled. Default = Min (0.0 C) / Max (0.0 C).

Note: The temperature is determined by the Battery Temperature Sensor.

• Battery Capacity - Enter the bank's 20-hr, Ah rating. If the bank consists of parallel strings, multiple the 20-hr rating of one battery by the number of parallel strings. Default = 400Ah.

• Amp Hour Efficiency – Set to Auto and will consider the selected Batt Chemistry type; or manually program a specific %. Most Flooded start at 80%; Sealed/Gel at 95%; Lithium at 94%. Default = 98%.

• Chemistry - Loads up typical, default charging voltages for the selected chemistry. Default = Lithium.

• Min/Max Temp Comp – Sets min and max voltage that the Little Rosie will not exceed when temperature compensating the batteries. When the batteries are cold, T-comp raises the charge (i.e., Absorb) voltage setpoint. The Max Temp Comp setting comes into play here. Conversely, when the batteries are warmer than the reference temp, the Little Rosie will lower the set charge voltages. Default = Min (-0.1 V) / Max (0.1 V).

• EQ Temp Comp – Turns ON or OFF T-comp during the EQ cycle. Be mindful of an elevated battery bank voltage in the winter when equalizing. The high DC input voltage to the Little Rosie is 63 VDC. However, it will not shutdown until 65 VDC (HBCO), which allows the EQ voltage to be temp comp. Default = No (EQ Temp Comp is ON).

• Temp Comp mV/Deg C – This is called the Temp Coefficient Factor. Commonly at -5mV. Check with your battery manufacturer. Set to 0mV for Lithium batteries; Lithium does not want T-comp from the Little Rosie – the BMS handles T-comp. Default = 0.0.

• Temp Comp Ref – Commonly 25C but check with the battery manufacturer. This is the neutral or reference temp at which the Little Rose T-comps around. If batteries are colder than the Ref Temp, then the Rosie will elevate the charge voltage. If warmer, then it will lower the charge voltage. Default = 25.0 C.

• LBCO Connect – Battery voltage setpoint for the Little Rosie to invert. Default = 48.0 V.

• LBCO Disconnect – Low battery voltage at which the Little Rosie stops inverting. Default = 45.0 V.

• LBCO Disconnect (Time) – Minutes to count-down once LBCO DISC is reached before the Little Rosie stops inverting. Default = 1 minute.

3.1.2 Setup Menu/Inverter Configuration

AC Input

- AC Input Mode – Grid or Generator. Default = Grid.
- Charger – On / Off. Allows charging from the AC input source. Default = On.
- Charger Rate – Max charging amps to the battery bank. Default = 30AAC.
- Breaker Size – Specify the amp size of the circuit breaker on the AC input. Default = 30AAC.

Note: The Little Rosie will not allow charging amps to exceed the max ampacity of the Breaker Size setting.

Inverter Specific (LROSIE)

- AUX Functions – Select desired AUX modes for AUX 1 and/or AUX 2. Default = Manual Off (AUX 1 and AUX 2).

Note: See Section 3.2 for AUX settings that can be set using the MNGP2 remote.

3.2 Auxiliary Modes

The Little Rosie offers two auxiliary ports/terminals (AUX1 & AUX2) which can be configured to become inputs or outputs. These AUX terminals can be used as a DC trigger voltage source for accessories such as battery vent fan, diversion loads, lights.

Notes:

- An internal, re-settable Positive Temperature Co-efficient (PTC) fuse protects the AUX internal components from over-current or a short circuit.
- When using the AUX ports, it is recommended that you have a external relay in line between the accessory and a power source to protect the Little Rosie. The AUX circuit will trigger this relay on/off. The AUX circuit outputs 12 VDC nominal at a maximum of 300mA. If you use a device that will pull more current, doing so can harm the Little Rosie.
- The Aux mode selected determines whether the ports provide an output or require an input. Most of the AUX ports provide an output, the exception is when the mode is set to 'Charger Enable", which requires an input. When the mode sets the port as an output, the output voltage is nominal +12 VDC (12 to 14.5 VDC), or 0 VDC. When the Aux mode sets the port as an input, it reads the state (i.e. Low or High) of a device connected and takes an action from there. Low input = 0 to 2.5 VDC, High input = 2.5 to 14.5 VDC.
- As shown in Table 3-1, the Little Rosie has many different AUX modes to choose from based on how you want your accessory turned on or off. Certain AUX modes allow a start-delay and off-delay timer if it is desired to hold the start function for a period of time, or to prevent the inverse function from occurring for a defined period of time.
- Notes for Table 3-1 and Table 3-2:
  1. Normal Output:

     AUX port is 'ON' = output is 12 VDC when the condition is active.

     AUX port is 'OFF' = output is 0 VDC when the condition is inactive.
  2. Inverted Output:

     AUX port is 'ON' = output is 0 VDC when the condition is active.

     AUX port is 'OFF' = output is 12 VDC when the condition is inactive.
  3. Input Only:

     'LOW' input = 0 to 2.5 VDC.

     'HIGH' input = >2.5 to 14.5 VDC.
- Most of the AUX modes have an inverse output mode, which reverses the ON and OFF output state when the aux mode condition becomes active.

3.2.1 Auxiliary Modes - Descriptions

- **Auto Gen Start -** The Auto Gen settings are used to automatically start and stop a 2-wire generator based on battery voltage, time of day, and battery state of charge. It can also prevent the generator from starting during designated Quiet Time periods; and regularly schedule the generator to run/exercise to maintain the starting battery and ensure reliable engine performance.

CAUTION: To ensure the Automatic Generator Start (AGS) aux system functions correctly, the connected generator must have a 2-wire electric start and an automatic choke. For reliable and safe operation, it's essential to use generator models specifically designed for unattended use. These models should feature remote operation capabilities and include protective mechanisms that automatically shut down the generator in cases of low oil pressure, high temperatures, starter lockout, and over-crank conditions.

Auto Gen Start/Stop Settings:

Start Voltage – Battery voltage at which generator starts.

Start on Voltage - Select No or Yes to enable the gen to start based on battery voltage.

Stop Voltage – Battery voltage at which generator turns off.

Stop on Voltage - Select No or Yes to enable the gen to stop based on battery voltage.

Start Time - Time of day to start the generator each day.

Start on Time - Select No or Yes to enable the generator to start based on time of day.

Stop Time - Time of day to start the generator each day.

Stop on Time - Select No or Yes to enable the generator to stop based on time of day.

Start SOC% - Battery State-Of-Charge percentage that starts the generator.

Start on SOC% - Select No or Yes to enable the gen to start based on SOC%.

Stop SOC% - Battery State-Of-Charge percentage that stops the generator.

Stop on SOC% - Select No or Yes to enable the generator to stop based on SOC%.

Stop on Float - Select No or Yes to enable the generator to stop when the Little Rosie enters the Float charge stage.

Max Run Time – Maximum time period the generator will stay on regardless of other settings.

Quiet Start – A day/night time setting that begins the quiet time period, which ensures the generator is prevented from starting.

Quiet Stop – A day/night time setting that ends the quiet time period to allow normal generator operations.

Exercise Int – When not disabled, sets the maximum number of days (Exercise Interval) the generator is allowed to sit without running. If the generator has not run in this number of days, the exercise parameters will start the generator.

- ◇ Exercise Start – Sets the time of day the generator exercise begins.
- ◇ Exercise Time – Set the minutes the generator will run.

Info: Once the Generator Exercise feature is enabled (by setting how many days to wait before exercising the generator under *Exercise Int*), the generator will start and begin exercising only after two conditions are met. First, the generator must not have run for a set number of days (i.e., *Exercise Int*). Second, the generator's exercise time of day setting (i.e., *Exercise Time)* must occur.

WarmUp Period – This setting sets the amount of time to allow the generator to turn on and run (i.e. warm-up) before the Little Rosie connects and places a load on the generator.

CoolDown Period – At end of generator use, the cooldown period allows the generator to continue to run unloaded after it disconnects from the Little Rosie and prior to stopping.

- **SOC% -** Allows you to turn on/off devices (i.e. dump loads, generator) based on the battery's State-Of-Charge.

  Normal Output:
  - ◇ SOC% ON: When SOC% is greater than or equal to the SOC ON% (On %) threshold for **Delay Time**.
  - ◇ SOC% OFF: When SOC% is less than the SOC OFF% (Off %) threshold for **Hold Time**.

  Inverted Output:
  - ◇ SOC% OFF: When SOC% is greater than or equal to the SOC ON% (On %) threshold for **Delay Time**.
  - ◇ SOC% ON: When SOC% is less than the SOC OFF% (Off %) threshold for **Hold Time**.
- **Vent Fan -** Allows you to run a vent fan for a battery-bank based on battery voltage.

  Normal Output:
  - ◇ Vent Fan ON: When battery voltage is greater than or equal to the On Voltage (On V) threshold for **90 seconds**.
  - ◇ Vent Fan OFF: When battery voltage falls 1V below the On Voltage (On V) threshold for **90 seconds**.

  Inverted Output:
  - ◇ Vent Fan OFF: When battery voltage is greater than or equal to the On Voltage (On V) threshold for **90 seconds**.
  - ◇ Vent Fan ON: When battery voltage falls 1V below the On Voltage (On V) threshold for **90 seconds**.

- **Float -** Allows you to turn on/off devices (i.e. generator) when the Little Rosie goes into the float charge stage.

  Normal Output:
  - ◇ Float ON: When the Little Rosie transitions to the Float state, it will turn the aux output ON after the **Delay Time**.
  - ◇ Float OFF: When the Little Rosie is no longer in the Float state, it will turn the aux output OFF after the **Hold Time**.

  Inverted Output:
  - ◇ Float OFF: When the Little Rosie transitions to the Float state, it will turn the aux output OFF after the **Delay Time**.
  - ◇ Float ON: When the LR is no longer in the Float state, it will turn the aux output ON after the **Hold Time**.
- **Waste Not -** Allows you to send surplus power—from an external charge source (i.e., PV, Hydro, wind)—once the batteries are satisfied, to a diversion load.

  Normal Output:
  - ◇ Waste Not ON: When the Little Rosie is in a regulated charge state (float, absorb, eq) for the **Delay Time** and above the On Offset (On O) threshold.
  - ◇ Waste Not OFF: When the Little Rosie is in a regulated charge state for the **Hold Time** and below the Off Offset (Off O) threshold.

  Inverted Output:
  - ◇ Waste Not OFF: When the Little Rosie is in a regulated charge state (float, absorb, eq) for the **Delay Time** and above the On Offset (On O) threshold.
  - ◇ Waste Not ON: When the Little Rosie is in a regulated charge state for the **Hold Time** and below the Off Offset (Off O) threshold.

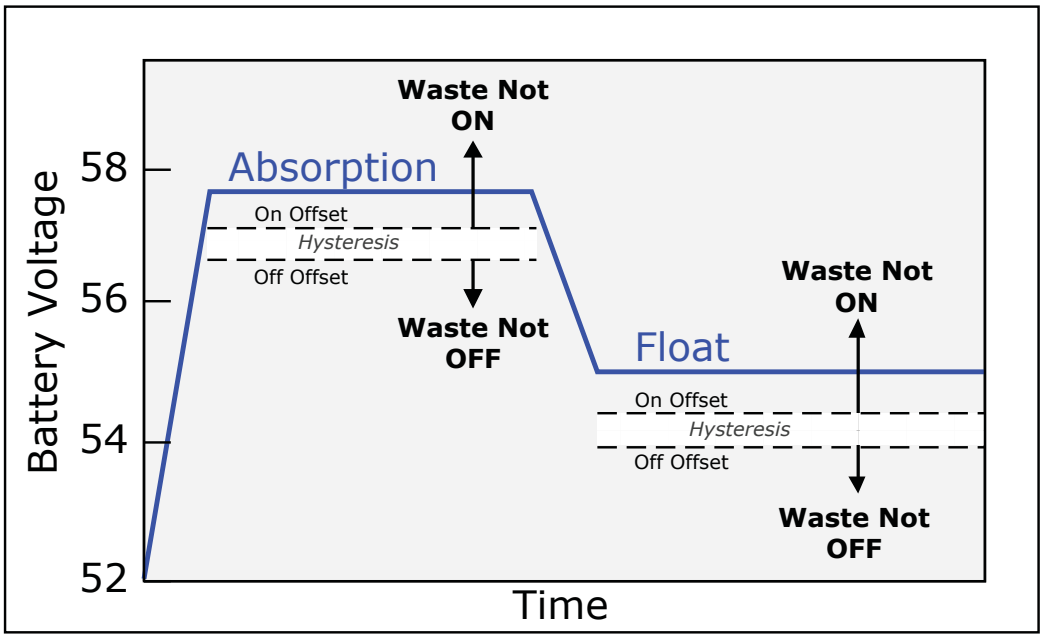


Figure 3-2, Aux - Waste Not Operation (Normal Output)

- **Battery Voltage -** Allows you to turn on/off devices based on the Little Rosie's battery voltage.

  Normal Output:
  - ◇ Battery Voltage ON: When battery voltage is greater than or equal to the On Voltage (On V) threshold value for the **Delay Time**.
  - ◇ Battery Voltage OFF: When battery voltage is below the Off Voltage (Off V) threshold value for the **Hold Time**.

  Inverted Output:
  - ◇ Battery Voltage OFF: When battery voltage is greater than or equal to the On Voltage (On V) threshold value for the **Delay Time**.
  - ◇ Battery Voltage ON: When battery voltage is below the Off Voltage (Off V) threshold value for the **Hold Time**.

- **Battery Temp -** Allows you to turn on/off devices based on the temperature of the BTS (Battery Temperature Sensor).

  Normal Output:
  - ◇ Battery Temp OFF: When battery temp is greater than or equal to the On Temp (On T) threshold value for the **Delay Time**.
  - ◇ Battery Temp ON: When battery temp is below the Off Temp (Off T) threshold value for the **Hold Time**.

  Inverted Output:
  - ◇ Battery Temp OFF: When battery temp is greater than or equal to the On Temp (On T) threshold value for the **Delay Time**.
  - ◇ Battery Temp ON: When battery temp is below the Off Temp (Off T) threshold value for the **Hold Time**.

- **FET Temp -** Allows you to turn on/off devices based on the Internal temperature of the Little Rosie.

  Normal Output:
  - ◇ FET Temp ON: When battery temp is greater than or equal to the On Temp (On T) threshold value for the **Delay Time**.
  - ◇ FET Temp OFF: When battery temp is below the Off Temp (Off T) threshold value for the **Hold Time**.

  Inverted Output:
  - ◇ FET Temp OFF: When battery temp is greater than or equal to the On Temp (On T) threshold value for the **Delay Time**.
  - ◇ FET Temp ON: When battery temp is below the Off Temp (Off T) threshold value for the **Hold Time**.

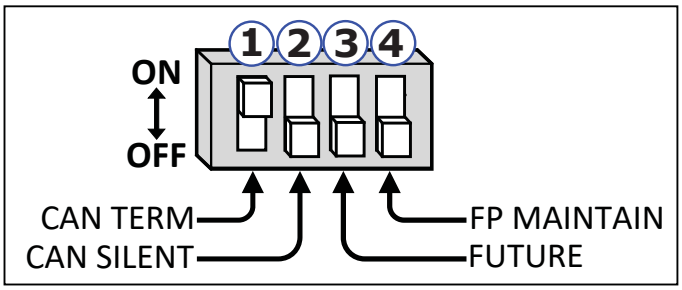
- **Toggle Test -** Allows you test the Aux terminals. When enabled, continuously turns the Aux output on for 3 seconds, then off for 3 seconds.
- **Charger Enabled (Input Only) -** Allows you to externally turn the charger operation of the Little Rosie either on or off.
  - ◇ ON: Charger functionality is enabled when the input voltage on the aux terminal is low (0 to 2.5 VDC).
  - ◇ OFF: Charger functionality is disabled when the input voltage on the aux terminal is high (>2.5 to 12 VDC).

Table 3-1, Auxiliary Modes Summarized

Mode	Output	Port When Active?	Port When Inactive?
Auto Gen Start	Normal only	ON: When start conditions met.	OFF: Waiting for start conditions.
SOC %	Normal	ON: ≥On %, for Delay Time.	OFF: <Off %, for Hold Time.
SOC %	Inverted	OFF: ≥On % for Delay Time.	ON: <Off % for Hold Time.
Vent Fan	Normal	ON: Batt V ≥On V, for 90 seconds.	OFF: Batt V <1V On V for 90 seconds.
Vent Fan	Inverted	OFF: Batt V ≥On V for 90 seconds.	ON: Batt V <1V On V, for 90 seconds.
Float	Normal	ON: In Float, ON after Delay Time	OFF: Not in Float, OFF after Hold Time.
Float	Inverted	OFF: In Float OFF after Delay Time	ON: Not in Float, ON after Hold Time.
Waste Not	Normal	ON: Regulated Charge and Batt V ≥On O for Delay Time.	OFF: Regulated Charge and Batt V <Off O for Hold Time.
Waste Not	Inverted	OFF: Regulated Charge and Batt V ≥On O for Delay Time.	ON: Regulated Charge and Batt V <Off O for Hold Time.
Battery Voltage	Normal	ON: Batt V ≥On V for Delay Time.	OFF: Batt V <Off V for Hold Time.
Battery Voltage	Inverted	OFF: Batt V ≥On V for Delay Time.	ON: Batt V <Off V for Hold Time.
Battery Temp	Normal	ON: Batt T ≥On T for Delay Time.	OFF: Batt T <Off T for Hold Time.
Battery Temp	Inverted	OFF: Batt T ≥On T for Delay Time.	ON: Batt T <Off T for Hold Time.
FET Temp	Normal	ON: FET T ≥On T for Delay Time.	OFF: FET T <On T for Hold Time.
FET Temp	Inverted	OFF: FET T ≥On T for Delay Time.	ON: FET T <On T for Hold Time.
Toggle Test	Normal only	Continually toggles Aux ON for 3 seconds, then OFF for 3 seconds.	
Charger Enabled	Input Only	LOW = Charger enabled	HIGH = Charger disabled

3.3 DIP Switch Settings

The Little Rosie has a DIP (Dual In-line Package) switch that includes 4 individual slide switches that can be set to the ON or OFF position (see Figure 3-3). This section provides information on each switch setting.



Factory Default Settings:

1. CAN TERM = ON
2. CAN SILENT = OFF
3. FUTURE = OFF
4. FP MAINTAIN = OFF

Figure 3-3, 4-Position DIP Switch

1	**CAN TERM** – When this switch is set to ON, a terminator resistor is inserted in the circuit to allow the Little Rosie to be used as the terminator at one end of the network bus. *Note: A change to this DIP switch setting becomes effective when initiated, and does not require power to the Little Rosie to be cycled off and on.*

Info: There should only be one terminator at each end of the CAN network. The CAN TERM should be set to OFF if there is an external terminator already connected at each end of the network bus.

2	**CAN SILENT** – This switch when set to ON, turns off the CAN Bus streaming traffic from the Little Rosie. This provides less conflicts/errors when third-party software is communicating with the Little Rosie. *Note: A change to this DIP switch setting only becomes effective after power to the Little Rosie is cycled off and on.* *Note: If using a MNGP2 remote, the CAN SILENT switch must be set to OFF; or you will not be able to receive any status/faults to the MNGP2 remote.*
3	**FUTURE -** This switch is not used for any function at this time, but may be used in the future.
4	**FP MAINTAIN -** This switch changes the functionally of the FP (Front Panel) terminals. When set ON, a momentary (non-latching) switch is required, and the external switch will work in addition to the front panel power switch. When set OFF, a maintain (only ON or OFF) switch is required. Refer to Section 2.5.1

Info: When the FP MAINTAIN switch is set to OFF, the front panel switch no longer works normally–or as expected.

4.0 Operation

This section discusses how the Little Rosie operates and information on how to identify the current inverter or charging status.

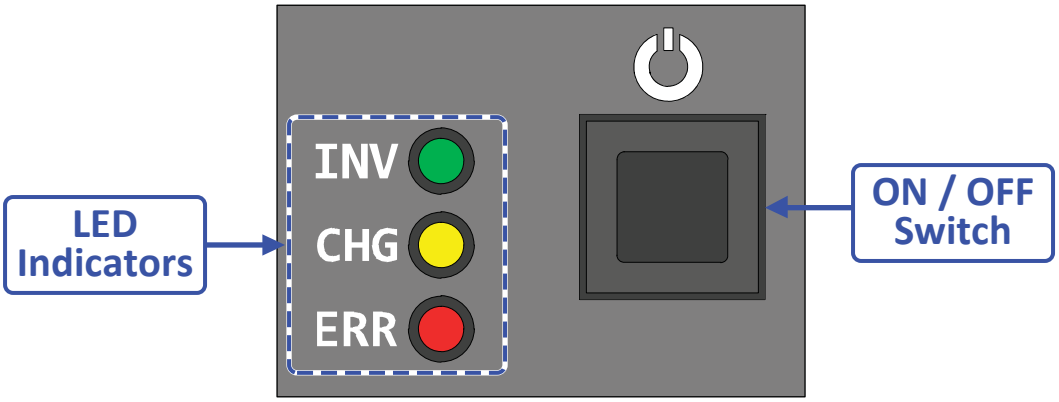


Figure 4-1, LED Indicators and ON/OFF Switch

4.1 Front Panel Features

The ON/OFF switch and LED (Light Emitting Diode) indicators are located on the front panel to enable the Little Rosie and monitor its operational status.

4.1.1 ON/OFF Switch

The momentary pushbutton is used to turn the inverter mode on and off. When the inverter is connected to the batteries, and ready to operate, the ON/OFF pushbutton switch must be pressed to start the unit. Once the inverter has been turned on, pressing the ON/OFF switch alternately turns inverter mode off and on.

WARNING: When an external AC power is passing through the inverter and is present on the output, pressing the ON/OFF switch will not remove this AC power on the inverter's output.

However, if you press this button while in Standby mode (e.g., connected to an external AC power and charging), you will disable inverter mode. This means the inverter loads will no longer be powered if the external AC input source is disconnected. To keep the inverter mode enabled to ensure loads continue to be powered after the AC input is disconnected, verify the INV LED is on and blinks on every four seconds (see Inverter Standby).

Info: The ON/OFF switch does not turn the battery charger function on or off.

4.1.2 LED Indicators

Watch the LED indicators for at least 10 seconds to determine (or verify) the inverter's operational condition—using the information in this section.

Info: Whenever the LED indicator blinks on, there is a four-second pause between each blink-on sequence. Example: "blink-on x2" means the LED is normally off, blinks on twice, and then turns off for 4 seconds—this blink on, turn-off sequence continues indefinitely while in this status.

4.1.2.1 INV (Inverter) LED Indicator

The INV (Inverter) indicator is a green LED that provides information on the operational mode of the inverter.

- INV off **(Inverter Off):** The inverter is not actively using power from the battery to provide power to the inverter's output.

Note: If the INV LED is off, but the CHG LED is on, this means an external AC power source is passing thru the Little Rosie to power the loads on the output; and the inverter function is disabled (i.e., the inverter will not come on to power the AC loads if this external AC power is removed). However, if you want the inverter to automatically come on and continue powering the AC loads when the external AC power is removed. Then press the ON/OFF power switch to enable the inverter function and put the inverter into the Inverter Standby mode (ensure INV LED blink-on x1).

Info: If the INV LED does not come on after pressing the ON/OFF switch, ensure the ERR LED is not on—preventing the inverter from coming on. Refer to Table 5-1, Troubleshooting Guide, to help diagnose/clear the error.

- INV on and not blinking **(Inverter On):** Energy from the battery is being used to provide power to the AC output terminals.
- INV blinking on/off each second, without any 4-second pause **(Search Mode):** The Little Rosie is in the Power Save Search mode, ready to supply full power to the AC output terminals—when a load greater than the Power Save Search setting is connected to the AC output.

  Info: The factory default setting for the Little Rosie has the Power Save Search feature turned off (DISABLE). It can be turned on (ENABLE) and adjusted using MidNite's MNGP2 remote.

- INV blink-on x1 **(Inverter Standby):** The Little Rosie is connected to an external AC source (utility or generator power) and is not actively inverting, but the inverter function is enabled and ready to start inverting—if the external AC source is disconnected.

4.1.2.2 CHG (Charge) LED Indicator

The yellow CHG (Charge) LED provides information on the inverter's charger status while in the Standby mode.

Info: Whenever AC power (utility or generator) is present at the inverter's AC input and is within the AC input limits (voltage and frequency), it connects and passes through the inverter—whether the inverter is turned on or off.

- CHG off (**Charger Off):** Either there is no external AC source connected, or the unit was placed in Charger Standby (from a connected remote or from the CAN network).
- CHG blinks on/off each second, without any 4-second pause **(AC Present):** AC Power has been detected on the AC input terminals.

  Note: If the CHG constantly blinks without connecting and charging, the AC input may be out-of-range. Ensure the AC power present at the inverter's AC input terminals is within the AC input limits (voltage and frequency).

  Note: The factory default settings for the AC input are:
  AC Voltage: 106 - 132 VAC / AC Frequency: 56 - 64 Hz
- CHG on and not blinking **(Bulk Charge).** The Bulk Charge stage delivers maximum current to the batteries. The charger remains in bulk until the absorb target voltage[1] is achieved.
- CHG blink-on x1 **(Absorb Charge):** The Absorb Charge stage is a constant voltage stage and begins after reaching the bulk voltage. In Absorb, the current will taper down in order to maintain the battery at the absorb target voltage[1].
- CHG blink-on x2 **(Float Charge):** The Float Charge stage occurs at the end of the absorb charging time—this charge stage reduces the charge voltage to maintain the batteries at the float target voltage[1].
- CHG blink-on x3 **(EQ Charge):** The charger is in the Equalize Charge stage, regulating the current to maintain the battery at the equalize target voltage[1].
- CHG blink-on x4 **(Charger Back-off):** In Charger Back-off, the charging current to the battery is reduced.

  Note: Charger Back-off occurs if the internal temperature is very hot (charge current is reduced to maintain temperature).

Note[1]: *Target Voltage – The temperature compensated voltage regulation set-point. The battery will be regulated to the voltage setting determined by the active charge stage (i.e., Absorb, Float, or Equalize) and any voltage increase or decrease based on the temperature around the BTS - if the BTS is enabled (by battery type) and installed. If the BTS is not installed, the Target Voltage is the same as the charge stage voltage setting.*

4.1.2.3 ERR (Error) LED Indicator

Under normal operating conditions, the red ERR (Error) LED indicator will be off. However, if a error condition occurs, this indicator serves as an important indicator for diagnosing issues - it will blink in a specific pattern to indicate the error that has shut down the inverter.

If the ERR LED comes on, count the number of times it blinks—before turning off for four seconds—to determine the particular reason for the shutdown. Once you have identified and cleared the error, the inverter can be turned on.

Info: Refer to Table 5-1, Troubleshooting Guide, to help diagnose and clear any of the error conditions.

- ERR off **(No Error):** This is the expected state when the inverter is operating normally. No error conditions are present.
- ERR on and not blinking **(Low Battery Voltage):** Indicates that the battery voltage has fallen below the LBCO setting (Default setting = 45 VDC, for more than one minute). Solution: Charge your batteries to raise the voltage. The error will automatically clear when the battery exceeds the LBCI setting (Default setting = 48 VDC).
- ERR blink-on x1 **(High Battery Voltage):** Battery voltage is at or above the HBCO setting (≥66 VDC for 3 seconds). Solution: Turn off the external charging source to lower the battery voltage. The error will automatically clear when the battery falls below the HBCI setting (≤65.0 VDC).
- ERR blink-on x2 **(Over-Temperature):** The inverter's internal temperature is above acceptable limits. This may be caused by excessive loads or inadequate ventilation. Solution: Allow the unit to cool down, and once it cools down sufficiently, restart the inverter by momentarily pressing the ON/OFF button.
- ERR blink-on x3 **(AC Overcurrent):** The inverter has turned off due to connected loads exceeding its output capacity, or a short in the output wiring. Solution: Reduce AC loads or fix the wiring issue. Restart the inverter by momentarily pressing the ON/OFF button.
- ERR blink-on x4 **(Internal Error):** The inverter has turned off because an internal problem has been detected. To clear this error, the inverter needs to be reset by disconnecting all DC power to the inverter for at least 15 seconds, and then reconnect. After resetting the inverter, momentarily press the inverter's ON/OFF switch and verify that the error has cleared. If the internal error remains, seek service at an authorized repair facility.

4.2 Operating Modes

The Little Rosie inverter/charger has two normal operating routines. Inverter mode, which powers the loads using the batteries; and Standby mode, which transfers the incoming AC power (i.e., shorepower or a generator) to power the loads and recharge the batteries. This inverter also includes an extensive protection circuitry that shuts down the inverter under certain error conditions.

4.2.1 Inverter Mode

When the inverter is properly connected to batteries and turned on, the direct current (DC) from the batteries is transformed into true sine wave alternating current (AC). The AC power from the Little Rosie is similar to what is provided by your utility and is used to power electrical appliances (i.e., AC loads) connected to the inverter's output.

- **Inverter OFF** – When the inverter is off, no power is used from the batteries to power the AC loads and the INV status LED will be off. Even though the inverter is off, if AC power from an external source (shorepower or generator) is connected and qualified on the inverter's AC input, this AC input power will pass through the inverter to power the AC loads. However, if this AC power is lost, the AC loads will no longer be powered because the inverter is off/disabled.
- **Searching** – The Power Save Search feature is provided to conserve battery power when AC power is not required. When this feature is enabled, the inverter sends pulses on the AC output looking for an AC load (i.e., electrical appliance). Whenever any AC load greater than the Power Save Search setting is turned on, the inverter recognizes the need for power and automatically starts inverting. When all loads are turned off, the inverter automatically goes back into Search mode to minimize energy consumption from the battery bank. When the inverter is "searching", the inverter's green INV LED blink-on x2.

  Info: The factory default setting for the Power Save Search feature is DISABLE. It can be turned on (ENABLE) and adjusted using MidNite's MNGP2 remote.

- **Inverting** – When the Little Rosie is first powered up, it defaults to the OFF mode. The inverter's momentary ON/OFF power switch must be pressed to turn the inverter on. Subsequently pressing this switch alternately turns the inverter off and on. The green INV LED will come on and stay on to indicate it is inverting. The amount of time the inverter can be inverting and providing AC power is directly related to the amount of AC loads that are connected, and the capacity of the battery bank.

4.2.2 Standby (Transfer/Charger) Mode

When an external source of AC power (i.e., shorepower or generator) is connected and qualified on the inverter's AC input, it operates in Standby mode. In Standby mode, an internal AC transfer relay automatically closes to pass the incoming AC power directly to the inverter's output to continue powering the connected electrical appliances. The unit is also monitoring the AC input and "standing-by" to switch to Inverter mode if the unit detects a power failure (or low AC voltage). While in the Standby mode, the unit can operate:

a) as a Battery Charger, which converts the incoming AC power into DC power to charge the battery bank; or

b) in AC Load Support, when the incoming AC source is not large enough to power the inverter loads, additional current from the battery is provided to help power the inverter loads.

4.2.2.1 Multi-Stage Battery Charger

The Little Rosie is equipped with an active Power Factor Corrected (PFC) multi-stage battery charger. The PFC feature maximizes the real power available from the AC power source (shorepower or generator), which translates into less power wasted and a greater charging capability than most chargers available today.

The charger can use up to four different charging stages to help monitor and keep the batteries healthy. The four stages include an automatic 3-stage charging process (Bulk, Absorb, and Float), and a manual Equalization (EQ) charge stage. The automatic 3-stage charge process provides complete recharging and monitoring of the batteries without damage due to overcharging. The Equalization stage is used to stir up stratified electrolyte and reverse any battery plate sulfation that might have occurred on lead-acid battery types.

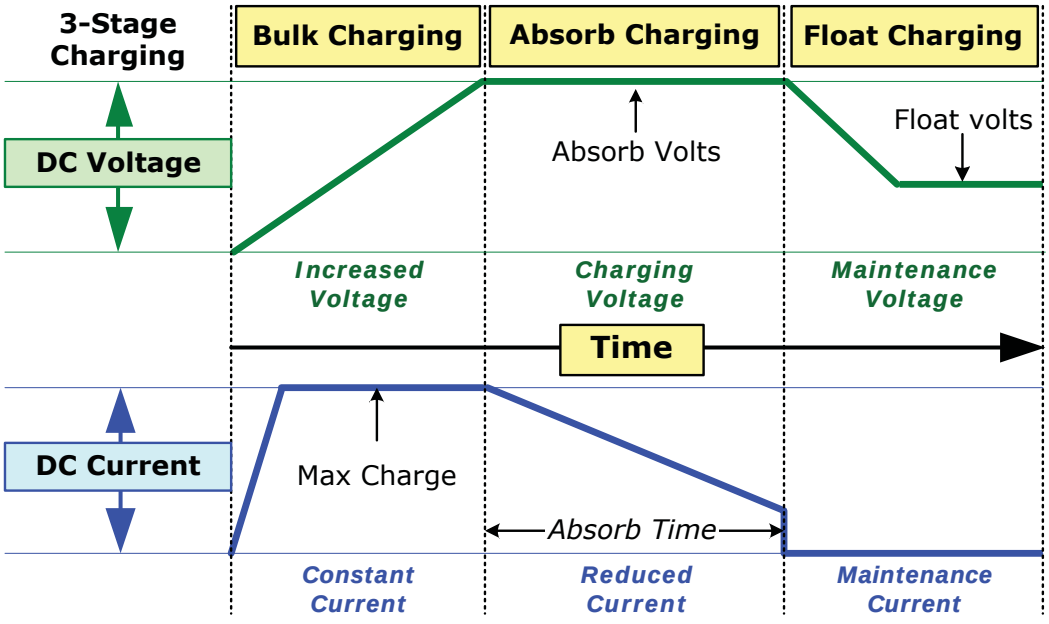


Figure 4-2, Automatic 3-Stage Charging Graph

The automatic 3-stage charging process includes:

Bulk Charging: This is the initial stage of charging. While bulk charging, the charger supplies the battery with constant current. The charger remains in bulk charge until the absorption charge voltage is achieved. The absorb charging voltage is defaulted to 56 VDC*.

Absorb Charging: This is the second charging stage and begins after the bulk voltage has been reached. Absorb charging provides the batteries with a constant voltage and reduces the DC charging current in order to maintain the absorb voltage setting. The absorb charging time is defaulted to 6 minutes.

Float Charging: The third charging stage occurs at the end of the absorb charging time. While float charging (also known as a maintenance charge), the batteries are kept fully charged and ready if needed by the inverter. This stage reduces battery gassing, minimizes watering requirements (flooded battery), and ensures the batteries are maintained at optimum capacity. In this stage, the charge voltage is reduced to the float charge voltage—to maintain batteries indefinitely. The float charging voltage is defaulted to 53.6 VDC*.

EQ Charging: Equalization, or EQ Charging is a maintenance cycle, manually performed as needed to equalize the internal resistance of the battery cells. During the EQ cycle, the Little Rosie applies an elevated charge voltage to the battery bank, which is needed to remove sulfates from the battery's lead plates.

The objective of EQ is to bring all the cells to a near-same level of internal resistance, so that all the cells will take the same charging and discharging voltages during normal operation.

For the cells to "see" the same voltage amongst the cells promotes battery health and longevity. Confirm with your battery manufacturer if your batteries need to be EQ or not.

Note: The MNGP2 remote control is required to start an EQ charge

Info: If the battery voltage falls to the re-bulk voltage (48.4 VDC) or lower, the unit will begin another bulk charge.

Info: While charging—if the internal temperature starts to become too hot—the unit may go into **Charger Back-off** protection. This feature reduces the charge current in an attempt to maintain the temperature instead of shutting down.

***** *Voltage settings based on the Battery Temperature Sensor (BTS) being disconnected, or at a temperature of 77°F (25°C). Depending on the battery chemistry selected, if the BTS is installed, these voltage settings increase if the temperature around the BTS is <77°F (25°C), and decrease if the temperature around the BTS is >77°F (25°C).*

Note: If some of your operating parameters need to be changed, the MNGP2 remote control can be used to allow changes to those settings.

4.2.2.2 AC Load Support

While in the Standby Mode, the Little Rosie operates in parallel with the incoming AC source (utility or generator power) to power the AC loads. When connected to the incoming AC source, the current from the AC source and used by the AC loads is continually monitored. If the current needed to power the inverter loads increases enough, the Little Rosie reduces the charge current to the batteries to allow more current to power the AC loads (i.e., Charger Back-off). If the inverter loads require even more current than the incoming AC source can provide on its own (based on the Breaker Size setting, default = 30-amps), then the AC Load Support feature automatically engages.

The AC Load Support feature enables the Little Rosie to pull additional current—that is needed for the loads—from the inverter batteries to keep the incoming AC current from exceeding the Breaker Size setting. Once the incoming AC source can adequately handle the load, this additional current—provided by the batteries—is reduced.

Info: In AC Load Support, even though the yellow LED indicator may indicate charging, the Little Rosie may not be putting current into the battery. If using a MNGP2 remote, the Amps meter indicates the load support process by displaying negative current flowing from the batteries to the loads.

4.3 Current Flow

The following figures show the current flow in the Little Rosie during the different modes:

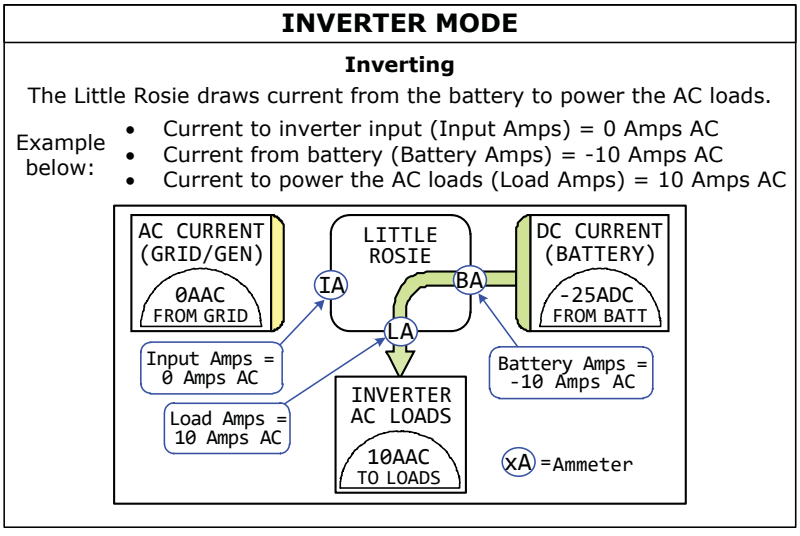


Figure 4-3, Current Flow - Inverter Mode

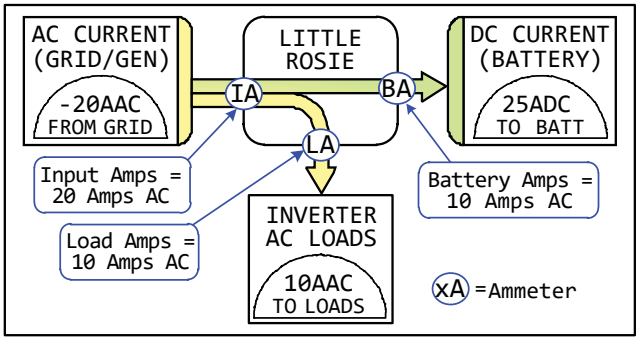
STANDBY MODE

Battery Charging

The Little Rosie uses current from the grid/gen to power the AC loads and simultaneously charge the battery.

Example below:

- Current to inverter input (Input Amps) = 20 Amps AC
- Current to charge battery (Battery Amps) = 10 Amps AC
- Current to power the AC loads (Load Amps) = 10 Amps AC

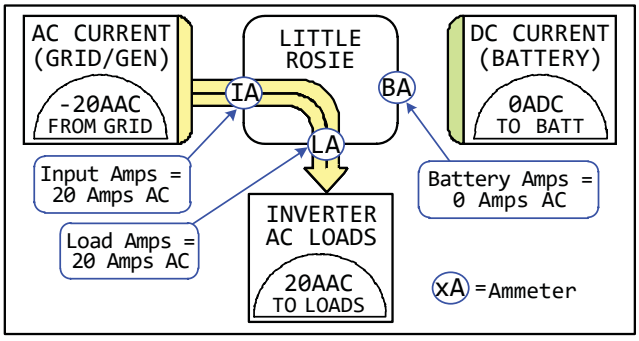


Charger Back-off

The Little Rosie reduces the battery charging current to provide enough current from the grid/gen to power the AC loads.

Example below:

- Current to inverter input (Input Amps) = 20 Amps AC
- Current to charge battery (Battery Amps) = 0 Amps AC
- Current to power the AC loads (Load Amps) = 20 Amps AC



AC Support Mode

The Little Rosie uses the full current from the grid/gen and additional current from the battery to power the AC loads.

Example below:

- Current to inverter input (Input Amps) = 20 Amps AC
- Current from battery (Battery Amps) = -10 Amps AC
- Current to power the AC loads (Load Amps) = 30 Amps AC

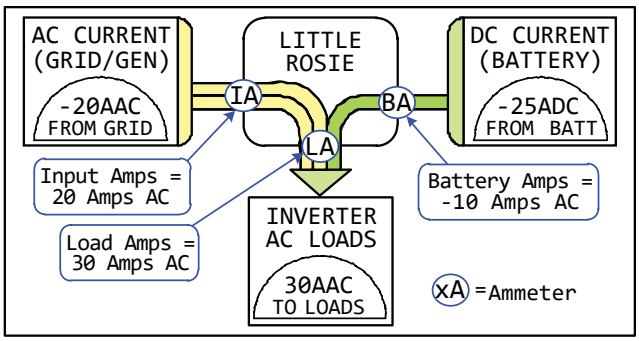


Figure 4-4, Current Flow - Standby Mode

4.4 Over-Charge Protection

The Little Rosie has protection mechanisms to prevent overcharging and extend the lifespan of your battery system.

When an AC source is connected to the AC input of the Little Rosie, the system begins monitoring the incoming AC voltage and frequency. Once the AC is deemed acceptable, the AC transfer relay closes, allowing the inverter to decide which charge stage to enter. If the battery voltage is low (≤51.2 VDC, default setting for lead-acid chemistry setting), the charger initiates the bulk charging stage. If the DC voltage is high (>51.2 VDC, default setting for lead-acid chemistry), the charger skips the bulk charging stage and directly enters the float charging stage.

Additionally, if the incoming AC power is lost and returns within 2 minutes, the charge mode resumes from the stage it was in prior to losing AC input. This happens regardless of the battery voltage. If the incoming AC power remains lost for more than 2 minutes, the system reevaluates the situation. It then decides which charge stage to enter based on the battery voltage, following the same rules mentioned earlier.

Info: Since lithium battery systems have built in overcharge protection, when the Battery Chemistry setting is set to Lithium (factory default), the Little Rosie will always enter the bulk charge stage when connected to an AC power source.

4.5 Protection Circuitry Operation

The inverter is protected against error conditions, and in normal usage it will be rare to see any. If a condition occurs that is outside the inverter's normal operating parameters, then it will shut down and attempt to protect itself, the battery bank, and your AC loads. Refer also to Table 5-1, Troubleshooting Guide to help diagnose and clear any of the error conditions below.

- **Low Battery** – The inverter shuts down whenever the battery voltage falls to the Low Battery Cut Out (**LBCO**) level for over one minute to protect the batteries from being over-discharged. Once the inverter has reached the LBCO level and turned off, it will automatically restart if the battery voltage rises to the Low Battery Cut In (**LBCI**) level.

  The INV LED turns off when a low battery error condition occurs. Refer to Table 4-1 to determine the LBCO and LBCI levels.

- **High Battery** – In the event the battery voltage approaches the High Battery Cut Out (**HBCO**) level, the inverter will automatically shut down to prevent the inverter from supplying unregulated AC output voltage. The INV LED turns off when a high battery error condition occurs. The inverter will automatically restart when the battery falls to the High Battery Cut In (**HBCI**) level. Refer to Table 4-1 to determine the HBCO and HBCI levels for your inverter.

  Info: High battery voltage may be caused by excessive or unregulated voltage from solar panels or other external charging sources.

- **Overload** – During Inverter and Standby operation modes, the inverter monitors the DC and AC current levels. In the event of a short-circuit or an overload condition for more than a few seconds, the inverter will shut down. To start operating after this error, the inverter would need to be restarted (turned back on) after the inverter's AC loads are reduced/removed.
- **Over-temperature –** If internal power components begin to exceed their safe operating temperature level, the inverter will shut down to protect itself from damage. The inverter will automatically restart after the units cools down.
- **Internal Error** – The inverter continually monitors several internal components and the processor communications. If a condition occurs that doesn't allow proper internal operation, the inverter will shut down to protect itself and the connected loads. The inverter will need to be reset to resume operating.

Table 4-1, Inverter Battery Turn On/Off Levels

Inverter Battery Turn On/Off Levels	Inverter Model
	Little Rosie
HBCO	≥66.0 VDC (after 3 seconds)
HBCI	≤65.0 VDC
LBCI	48.0 VDC
LBCO (one minute delay)	45.0 VDC

4.6 Battery Temperature Sensor Operation

The optional plug-in Battery Temperature Sensor (BTS) is used to determine the temperature around the batteries. This information allows the multi-stage battery charger to automatically adjust the battery charge voltages for optimum charging performance and longer life for certain battery chemistries (i.e., lead-acid based).

When the BTS is installed, if the temperature around the BTS is below 77°F (25°C) the absorb and float charge voltages increase. If the temperature around the BTS is higher than 77°F (25°C), the absorb and float charge voltages decrease.

If the temperature sensor is NOT installed, the charge voltages are not compensated and the battery maintains the charge it had at a temperature of 77°F (25°C). Without a BTS, the life of a lead-acid based battery may be reduced if it is subjected to large temperature changes.

4.7 Inverter Fan Operation

The inverter contains a variable speed cooling fan that is automatically controlled. The speed of this fan is determined either by the internal temperature of the inverter or by the loads on the inverter. The inverter's fan will come on full speed if the inverter reaches its maximum temperature, or the inverter is running at 100% of its rated load.

Info: Whenever the inverter is first connected to the battery, the fan comes on for one second during the power-up test.

Info: The inverter's fans do not come on based on temperature sensed by the optional Battery Temperature Sensor.

4.8 Neutral to Safety Ground Bonding

The recommended standards for safely wiring mobile installations stipulate that the neutral and safety ground must be connected only at the AC source, whether it's an inverter, utility power, or a generator. This connection is crucial for ensuring that a circuit breaker will activate in the event of a hot-wire-to-ground fault. Additionally, these standards require that the AC neutral be bonded to safety ground in one, and only one, place at any time. The single bond is established in order to make the electrical panel's neutral line safe, by connecting it to ground. When using an inverter with other AC sources (such as shorepower or a generator), it's crucial to prevent multiple connections between neutral and ground. Specifically, you want to avoid the inverter connecting the neutral-to-ground while another AC source is actively powering the inverter loads.

To address this, the mobile version of the Little Rosie features automatic neutral-to-ground switching, specifically designed for use in multiple-source applications. This inverter utilizes an internal relay that automatically connects the AC neutral output terminal to the ground of the vehicle while operating in inverter mode (as shown in Figure 4-5a). However, when an external AC source (such as utility power or a generator) is connected, an additional neutral-to-ground connection is introduced into the system. In standby mode, the internal relay automatically opens the neutral-to-ground connection (as depicted in Figure 4-5b). This design ensures that two neutral-to-ground connections do not occur simultaneously, thereby, preventing electrical shock hazards between the vehicle's neutral and the external AC source's neutral.

WARNING: If multiple bonds are established, currents can circulate between neutral and ground, resulting in "ground-loop" currents. These ground-loops can trip ground fault circuit interrupters (GFCIs), create electric shock hazards, and lead to other undesirable effects.

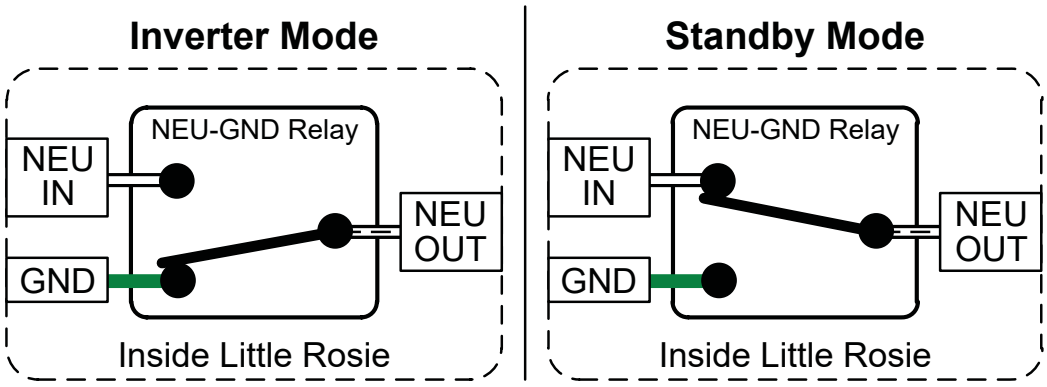


Figure 4-5, Neutral-to-Ground Connection

5.0 Troubleshooting

The following guide is provided to help determine and resolve errors or non-operational conditions with the Little Rosie.

Table 5-1, Troubleshooting Guide

Symptom	Possible Cause	Recommended Solution
Low Battery Voltage *(ERR indicator is on and not blinking)*	Battery voltage level has dropped below the Low Battery Cut Out (LBCO) set-point for more than one minute (45.0 VDC = LBCO default setting).	Battery voltage too low. Check fuses/ circuit-breakers and cable connections. Check battery voltage at inverter's terminals. Batteries may need to be charged—error condition clears when battery voltage exceeds 48.0 VDC.
High Battery Voltage *(ERR indicator blinks on 1 time every 4 secs)*	Battery voltage is above 66.0 VDC for more than 3 seconds. Inverter resets automatically and resumes operation when the battery voltage drops to 65.0 VDC or lower.	Generally, this condition only occurs when an external charging source (alternator, solar panels, etc.) is used to charge the battery bank. Reduce/turn off any other charger to the inverter batteries to allow the voltage level to drop.
Over-temperature *(ERR indicator blinks on 2 times every 4 secs)*	Temperature inside the inverter has risen above acceptable limits—loads too great for inverter to continuously operate or inadequate ventilation around inverter.	Reduce number of operating electrical loads.
		Check that the openings on the inverter are not blocked. Check ventilation around the inverter; ensure cool air is available to pass through the inverter.
		Once unit has cooled, turn inverter back on.
AC Overload *(ERR indicator blinks on 3 times every 4 secs)*	Inverter has turned off because connected loads are larger than the inverter's output capacity—or the output wires are shorted.	Reduce AC loads connected to inverter. Ensure there is not a short in the wiring on the inverter output by removing all AC output wiring and restart the inverter.

Troubleshooting Guide, Cont.

Symptom	Possible Cause	Recommended Solution
Internal error *(ERR indicator blinks on 4 times every 4 secs)*	An internal error detected.	To clear, perform a power reset by removing all power to the inverter. If the error does not clear, the unit will need to be serviced.
Inverter's INV status indicator is off	Inverter is switched OFF, or no DC voltage (battery) connected to inverter.	Switch inverter ON. Connect a battery with correct voltage to inverter.
AC input won't connect (CHG LED on remote blinks every second)	Incoming AC not accepted if voltage or frequency are out of limits.	Check incoming AC voltage & frequency on inverter's input, ensure it is within the default settings (80-130 VAC and 55-65Hz).
Appliances turn off and on, or there is low AC output power	Loose AC output connections	Tighten AC output connections.
	Loose/corroded battery cables	Clean and tighten all cables.
	Low battery voltage or ampacity.	Recharge or replace batteries.
Low charging rate when connected to shore power.	Charge rate set too low.	Adjust *Charge Rate* settings (on remote)
	The AC input voltage is low.	Check AC input source or input wiring.
Low charging rate when using a generator.	Generator output is too low to power both load and charger.	Reduce the load, increase the generator's RPMs.
		Check Breaker settings (if remote connected).
While charging, the DC charge voltage is higher or lower than expected	If the Battery Temperature Sensor is installed, it will increase or decrease the DC voltage level depending on the temperature around the battery sensor.	This is normal; see Section 4.6 (Battery Temperature Sensor Operation) for more information.

6.0 Specifications

Table 6-1, MNLR3648M Specifications

MODEL:	MNLR3648M
Inverter Specifications	
Input battery voltage	40 to 63 VDC
AC output voltage	120 VAC ±2%
Output frequency and accuracy	60 Hz ±0.1 Hz
Total Harmonic Distortion	<5%
5 sec surge power	>5400W
30 sec surge power	5400W
5 min surge power	4500W
30 min surge power	3690W
Continuous power output @ 40ºC	3600VA
Max. continuous input current	108 ADC
Inverter efficiency (max)	95%
Transfer time (typical)	4 mSecs
AC pass-thru capability	30A
Power Draw: Inverter ON	<22W (with no remote)
Power Draw: Inverter OFF	<4W (with no remote)
Output AC waveform type	True Sine Wave
Charger Specifications	
Continuous output @ 40°C	60 ADC
Power factor	> 0.95
Input current @ rated output	30 AAC
Temperature compensation	Yes, with BTS Option
General Features and Capabilities	
Protection circuitry	Low/High Battery, Over-temp & Overload
Corrosion protection	PCB's conformal coated, powder coated chassis
AC Input / Output Terminals	6-port lever-operated terminal block
Internal Cooling	Yes, 0 to 69 cfm variable speed fan
Optional remote available	MNGP2
Mounting	Shelf or wall
UL listing	Listed to UL458 and UL1741, CSA C22.2 #107.1,
Environmental Specifications	
Operating temperature	-20°C to +60°C (-4°F to 140°F)
Non-operating temperature	-40°C to +70°C (-40°F to 158°F)
Operating humidity	0 to 95% RH non-condensing
Physical Specifications	
Unit Dimensions (LxWxH)	20.25"x 9"x 6" (51.4 cm x 22.9 cm x 15.1 cm)
Shipping Dimensions (LxWxH)	22"x10"x 8.5" (55.9 cm x 25.4 cm x 21.6 cm)
Unit Weight	15 lbs. (6.8 kg)
Shipping weight	16 lbs. (8.6 kg)

Specifications subject to change without notice

6.1 Temperature and Inverter Power Output

The following curve shows the Little Rosie's continuous output power at different ambient temperatures.

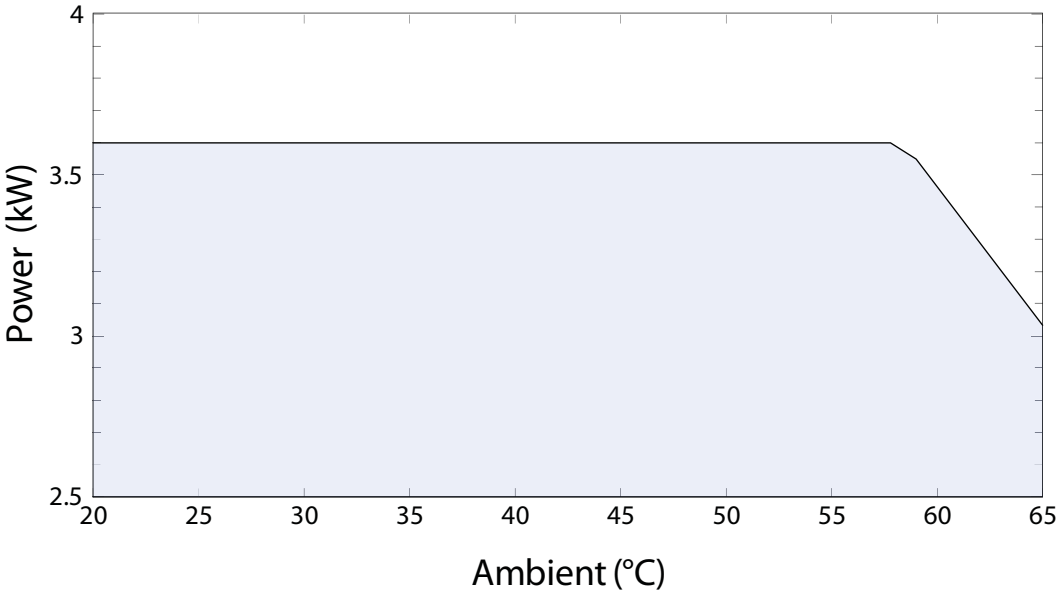


Figure 6-1, Inverter Power Output vs Temperature

6.2 Temperature and Charger Current Output

The following curve shows the Little Rosie's continuous charger current as the ambient temperature rises.

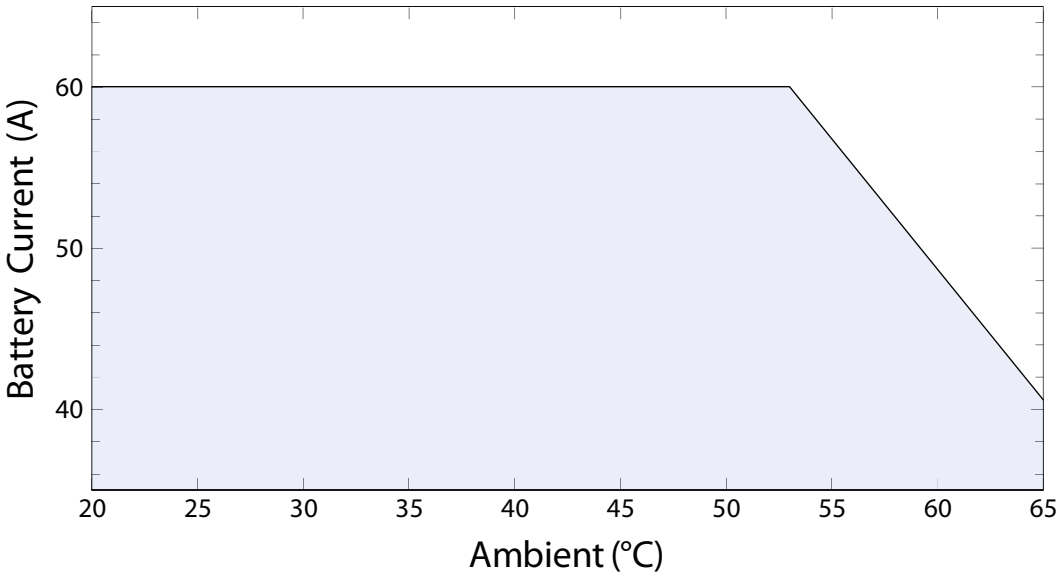


Figure 6-2, Charger Current Output vs Temperature

Appendix A – Optional Equipment & Accessories

The following components are available for use with the Little Rosie inverter/charger. Some of these items are required depending upon the intended use of the inverter.

MNWBJR (Whizbang Junior)

The Whiz Bang Jr is a current-sensing device that mounts to the side of a standard 500A/50mV shunt (MNSHUNT) to measure the current into (and out of) the battery bank. This current flow can be used in calculating an accurate State of Charge (SOC) percentage and to monitor for Ending Amps, which is a targeted setpoint to terminate the Absorb charge cycle.

To use the Whizbang Jr with the Little Rosie, you will need the MNGP2 remote control.

MNSHUNT (DC Shunt)

The 500A/50mV shunt from MidNite Solar serves as a current measurement device. It is commonly used in conjunction with the Whiz Bang Jr to determine the current flow into the battery bank from the Little Rosie during charging. Additionally, it helps measure the current flowing out of the battery bank when the Little Rosie is operating in inverter mode.

MNGP2 (Graphics and Programming Remote Control)

The MNGP2 graphics and programming remote allows communication, monitoring and programming of the Little Rosie. The rotary dial provides easy access to all menus and devices on the network as well as the selection of custom programming within the various sub-menus.

Surge Protection Devices

MidNite Solar's Surge Protector Devices (SPD) are Type 1 devices designed for both indoor and outdoor applications. There are four different models available, catering to both AC and DC systems and various voltage levels. These SPDs offer protection to service panels, load centers, or any location where direct connection to an electronic device requiring protection is necessary. Their primary function is to clamp surge voltage to a level that your system can sustain without causing damage to its components.

Appendix B – Battery Information

B-1 Battery Bank Sizing

The battery bank's size determines how long the inverter can power AC loads without recharging. A larger battery bank provides extended run time.

To size your battery bank:

- Consider the system's AC load requirements.
- Determine the required duration for running loads from the batteries.
- Avoid discharging the battery bank more than 50%.

B-2 Battery Types

Various battery types are available, including different sizes, amp-hour ratings, voltages, and chemistries.

For inverter applications:

- Choose deep cycle batteries (not starting batteries).
- Opt for batteries suited to your installation and cost.
- Use the same battery type for all batteries in the bank.
- Ideally, select batteries from the same lot and date (check the label).

B-3 Battery Wiring Configurations

When wiring the battery bank:

- Match the inverter's DC input voltage (e.g., 48 VDC).
- Consider additional run time.
- Explore these battery bank wiring configurations:

  Series Wiring: A series connection combines each battery in a string until the voltage matches the inverter's DC requirement. Despite using multiple batteries, the capacity remains the same. In the example (see top section of Figure B-1), four 12 VDC/100 AH batteries are combined into a single string, resulting in a 48 VDC/100 AH battery bank.

  Parallel Wiring: Batteries that are wired in parallel increases the total run time the batteries can operate the AC loads. A parallel connection combines overall battery capacity based on the number of batteries in the string. Despite using multiple batteries, the voltage remains the same.

  Series-Parallel Wiring: A series-parallel configuration increases both voltage (to match inverter's DC requirements) and capacity (to increase run time for operating loads), using smaller, lower-voltage batteries. In the example (bottom section of Figure B-1), four 12 VDC/100 AH batteries are combined into two strings, resulting in a 48 VDC/200 AH battery bank.

Appendix B – Battery Information

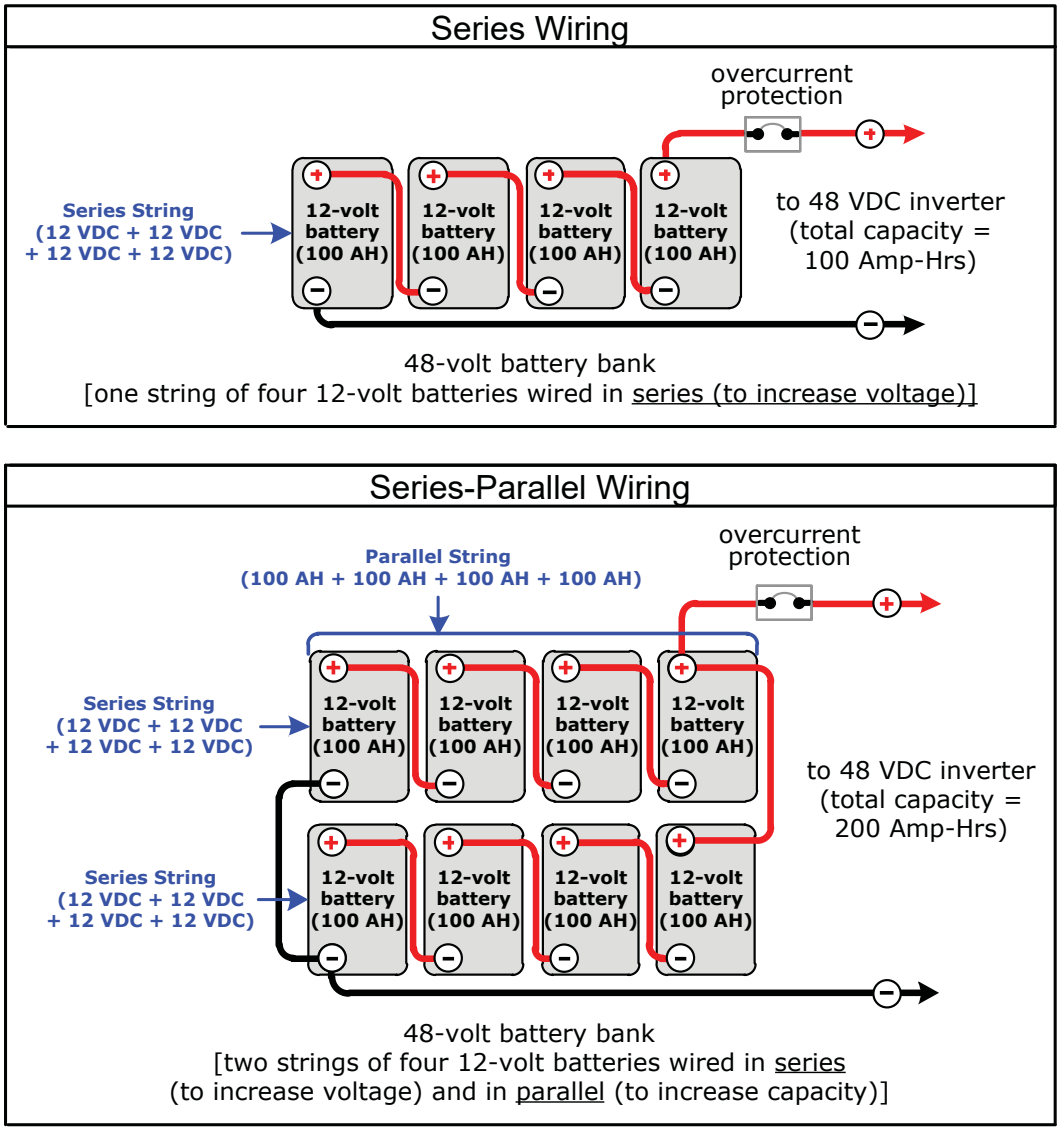


Figure B-1, Battery Bank Wiring Examples

Appendix C – Warranty/Service Information

C-1 Warranty Information

MidNite Solar Inc. warrants to the original customer that the MNLR3648M Inverter/Charger shall be free from defects in materials and workmanship. This warranty will be valid for a period of five (5) years.

MidNite Solar will not warranty third party inverter components used in MidNite's systems. Those components are warranted by the original manufacturer.

At its option, MidNite Solar will repair or replace at no charge any MidNite product that proves to be defective within such warranty period. This warranty shall not apply if the MidNite Solar product has been damaged by unreasonable use, accident, negligence, service, or modification by anyone other than MidNite Solar, or by any other causes unrelated to materials and workmanship. The original consumer purchaser must retain original purchase receipt for proof of purchase as a condition precedent to warranty coverage. To receive in-warranty service, the defective product must be received no later than two (2) weeks after the end of the warranty period. The product must be accompanied by proof of purchase and Return Material Authorization (RMA) number issued by MidNite Solar. For an RMA number contact MidNite Solar Inc., (360) 403-7207. Purchasers must prepay all delivery costs or shipping charges to return any defective MidNite Solar product under this warranty policy. Except for the warranty that the products are made in accordance with, the specifications therefore supplied or agreed to by the customer:

MIDNITE SOLAR MAKES NO WARRANTY EXPRESSED OR IMPLIED, AND ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WHICH EXCEEDS THE FOREGOING WARRANTY IS HEREBY DISCLAIMED BY MIDNITE SOLAR AND EXCLUDED FROM ANY AGREEMENT MADE BY ACCEPTANCE OF ANY ORDER PURSUANT TO THIS QUOTATION. MIDNITE SOLAR WILL NOT BE LIABLE FOR ANY CONSEQUENTIAL DAMAGES, LOSS OR EXPENSE ARISING IN CONNECTION WITH THE USE OF OR THE INABILITY TO USE ITS GOODS FOR ANY PURPOSE WHATSOEVER. MIDNITE SOLAR'S MAXIMUM LIABILITY SHALL NOT IN ANY CASE EXCEED THE CONTRACT PRICE FOR THE GOODS CLAIMED TO BE DEFECTIVE OR UNSUITABLE.

Products will be considered accepted by customer unless written notice to the contrary is given to MidNite Solar within ten (10) days of such delivery to customer. MidNite Solar is not responsible for loss or damage to products owned by customer and located on MidNite Solar's premises caused by fire or other casualties beyond MidNite Solar's control. This warranty is in lieu of all other warranties expressed or implied.

A RETURN MATERIAL AUTHORIZATION (RMA) NUMBER IS REQUIRED BEFORE RETURNING ANY PRODUCT

C-2 How to Receive Repair Service

If your product requires warranty service or repair, contact MidNite Solar at:

Technical/General Support

- Phone: 360.403.7207 Ext. 102, or
- Email: support@midnitesolar.com

If returning your product directly to MidNite for repair, you must:

1. Return the unit in the original, or equivalent, shipping container
2. Receive a Return Materials Authorization (RMA) number from the factory prior to the return of the product to MidNite for repair.
3. Place RMA numbers clearly on the shipping container or on the packing slip.

When sending your product for service, please ensure it is properly packaged. **Damage due to inadequate packaging is not covered under warranty.** We recommend sending the product by traceable and insured service.

MNLR3648M Owner's Manual

by:

MidNite Solar

Web: www.MidNiteSolar.com