

# StormPro 1400

1400W Sure Sine Wave™ Inverter

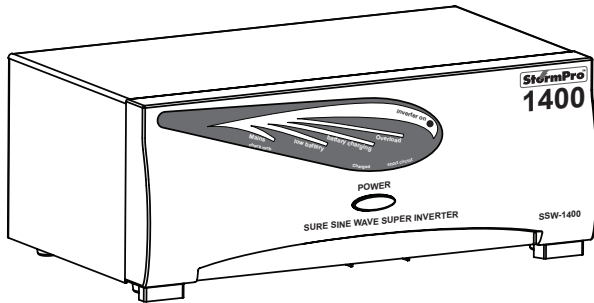
## OPERATION MANUAL

Dated: 5/20/08

Supersedes: None

Document No.: SP1400-OM

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### Introduction

This manual has been specially created to give you a thorough understanding of your inverter and its optimum use. **Do spare some time to read it carefully.** In case you should need help at any time, please feel free to contact or mail us at:

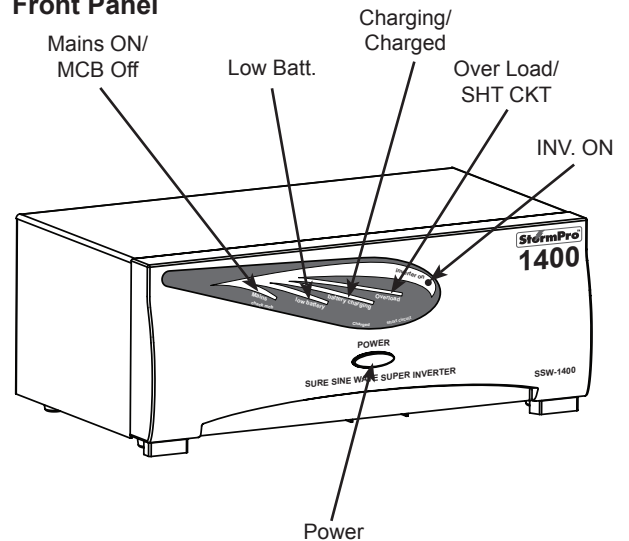
**residentialproducts@metropolitanind.com**

Any suggestions, comments or grievances are welcome.

### Knowing Your Inverter

In its most basic form, a Super Inverter transforms Direct Current (DC) to Alternating Current (AC). The battery pack with the inverter acts as a reserve to ensure continuous supply of power whenever mains supply from utility power is not available.

#### Front Panel



On the front panel of the inverter there is ON/OFF switch and LED display for indications.

LED Description	Color	Status	Meaning
Mains On/ MCB Off	Green	Continuously On	Presence of Mains Supply
Mains On/ MCB Off	Green	Flashing with Beep Sound	Mains Fuse Blown (MCB Tripped)
Super Inverter	Amber	Continuously On	Inverter Active
Battery Charging	Green	Blinking	Battery Charging
Battery Charging	Green	Continuous	Battery Charged
Low Battery	Red	Continuous	Battery Low
Over Load/ Short Circuit	Red	Continuously On with Beep	Short Circuit
Over Load/ Short Circuit	Red	Blinking with Beep	Overload

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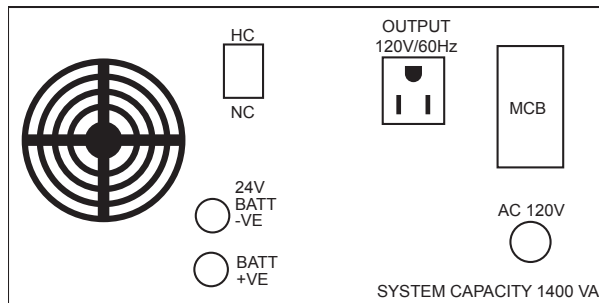
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The inverter has two battery wires coming out from the rear side, a MCB, battery fuse, a 6 AMP output socket and a power cord to connect with mains supply. Battery wires are red and black in color, the red color wire has to be connected to the POSITIVE TERMINAL of the battery and black one to the NEGATIVE TERMINAL.

### Back Panel



**Caution:** Do not reverse the battery connections, as it will blow the battery fuse. A power cord has been provided to connect the inverter to incoming AC mains.

### Important Safety Instructions

Before proceeding further kindly go through the safety instructions carefully.

#### General Precautions:

- Before using the inverter read all instructions and caution markings on the inverter, the batteries & all appropriate sections of this instruction manual.
- Do not expose the inverter to any type of chemicals. The inverter is designed for interior use only.
- Do not disassemble the inverter; take it to a qualified service center when service or repair is required. Opening by unqualified personnel can lead to electrical shock or fire hazard and void the warranty.
- To reduce risk of electric shock, disconnect all wiring before cleaning.
- Warning: Avoid exposing the inverter or batteries to any type of explosive gases (in the vicinity, as batteries generate explosive gases during normal operation). Provide proper ventilation. The battery enclosures should be designed to prevent

accumulation and concentration by hydrogen gas in “pockets” at the top of the compartment. Vent the battery compartment from the highest point. A sloped lid can also be used to direct the flow to the vent opening location. To reduce the risk of the battery explosion, follow all the instructions of the battery supplier or any equipment you intend to use in the vicinity of batteries.

- Use the correct insulated tools to make AC/DC wiring connections.
- Do not install this inverter on or near flammable materials (plywood, chemicals, gas online etc.)

#### CAUTION:

#### Personal Precautions:

- Someone should be within the range of your voice to come to your aid when you work near batteries.
- Have plenty of fresh water and soap nearby in the event that battery acid contact skin, clothing or eyes.
- Wear complete eye and clothing protection.
- Avoid touching eyes while working near batteries. Wash your hands when done.
- If battery acid comes in contact with skin or clothing, wash immediately with soap and water. If acid enters eyes immediately flood eyes with running cold water for at least 15 minutes and get medical attention immediately.
- Baking soda neutralizes battery electrolyte. Keep a supply in the battery area handy.
- NEVER smoke or allow spark or a flame in the vicinity of the battery.
- Be extra cautious when working with metal tools on and around batteries. It could short-circuit the batteries or other electrical parts, producing a spark that could cause an explosion.
- Remove personal metal items such as rings, bracelets, necklace, and watches when working with the battery. Battery can produce a short-circuit current high enough to cause severe burns.
- Never attempt to charge a frozen battery.
- Before touching the battery terminal makes sure that the inverter front switch is OFF and the unit is unplugged.

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- If it is necessary to remove any battery, always remove the grounded terminal from the battery first. Make sure all the power is off, so as not to cause arcing.
- Be sure that the area around the battery is well ventilated.
- Clean battery terminals. Be careful not to allow corrosion to come in contact with eyes.
- Study all battery manufacturer's specific precautions and recommended rates of charge.
- For wet batteries, add only distilled water in each cell until acid reaches level specified by battery manufacturer. This helps purge excessive gas from cells. Do not overfill.

Metropolitan Industries is not responsible for any kind of battery related problems.

### Concept of Charging

#### Five Stage ATM Pulse Charging

**Bulk:** Batteries are charged at maximum allowed continuous consent charging current at constant voltage for speedy charging of battery up to 13.6V

**Boost:** The charger checks the charging current when the battery voltage reaches 13.6 V for 12V batteries. The boost mode of the charger will be activated, which will boost the battery up to 20% more than its rated voltage (14.4V for 12V batteries) and charging current is reduced to 50% of bulk charging rate (i.e. 4 to 5AMP).

**Taper:** When the voltage level of battery is 20% more than its rated voltage, the taper mode of the charger will be activated, which will keep the charging current about 4 AMPS to achieve the specific gravity of electrolyte for a fully charged battery.

**Pulse (Reset):** To maintain the float level, the charger resets to zero current at 13.6V for sometime and starts again with pulse charging of <1AMP current at the same voltage. This keeps the battery in full charge condition even when not in use.

#### Special Notice:

- The inverter charger is for use with a nominal battery supply voltage of 12V DC.
- No AC or DC disconnects are provided as an integral parts of this inverter. Both AC and DC

disconnects must be provided as part of system installation.

- No over current protection for the battery supply is provided as an integral part of this inverter.
- No over current protection for the AC output wiring is provided as an integral part of this inverter.
- **Grounding Instructions:** This inverter must be connected to a grounded 115V outlet.

### Features

#### DSP based Sine Wave Output

DSP based circuit will increase the efficiency and accuracy of the inverter. This technology makes possible a high level of internal inverter management and generates a Sine Wave Output.

#### Auto Reset

Inverter has auto-reset function in case of Overload Short Circuit. It will reset itself automatically and will make 8 attempts for Overload and 4 attempts for Short Circuit. Otherwise it will shut off and you will have to reset the Super Inverter manually by turning ON/OFF switch on its front panel.

#### Protection Circuit

The inverter is protected from low battery voltage and over current conditions. When the inverter senses one of these situation, it will protect itself by disconnecting from the load, and will signal an error condition by displaying along with the buzzer.

#### State-of-the-art DSP based Technology

The technology used in the inverter is DSP based technology that uses **Auto Sense Intelligent Control** (ASIC). ASIC technology gives maximum power and backup time. DSP monitors the output level & battery voltage and also adjusts the amplitude & wave shape of the sine wave accordingly. The DSP also corrects the Power Factor while the battery is in charging mode.

#### Automatic Low Battery Cutout (LBCO)

The inverter protects your batteries from damage caused by over-discharging, by automatically shutting itself off when battery voltage falls to a preset level. This feature is called the low battery cutout. The inverter comes from the factory with the LBCO voltage set at 9.8 volts per battery.

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### Automatic High Battery Cutout

When battery voltage rises above 14.4 volts per battery, the charger stops its normal charging and comes to the trickle mode so as to take care of the self-discharging of the battery. The charger automatically resumes operation when battery voltage drops below 13.7 volts per battery.

### Over Current cutout

The inverter is protected from over current conditions. When the load being run demands more current than the inverter can handle, the inverter will shutdown automatically along with the LED display indication.

### Battery Type Optimization

The inverter is designed to prevent damage and extend the life of your batteries by regulating the charging voltage and duration. To do this, the inverter must be configured for the type of batteries in the system by the charge rate. Batteries can overheat if the charge rate is too high. With High and Low Charging Mode selection and ASIC technology the inverter protects your batteries by limiting the charging current, so that the regulation can adjust the charging current to the optimum level.

### Volts AC Dropout

The inverter monitors the voltage of the AC power passing through to the charge and AC loads. When AC voltage falls below the preset level, the inverter **automatically** transfers from AC to DC power (i.e. it comes to UPS mode). This dropout voltage is factory preset at 90-10 volts. So when the AC voltage drops to this level, the inverter automatically transfers from AC to DC power.

### Reduces Power Consumption of the Inverter

The circuitry design reduces power intake of the inverter when the battery is in trickle charge mode and also minimizes the evaporation of battery electrolyte.

## Getting Started

### MOUNTING

Mount the inverter securely to the battery box in a clean, dry and ventilated area.

### DC Cabling-

- Ensure that the ON/OFF switch on the front

panel of the inverter is in the OFF position before you begin the installation.

- Connect the POSITIVE TERMINAL of the battery to the POSITIVE WIRE (RED) of the inverter. It is advised not to use any other extra cable for batteries other than those supplied with the unit.
- Connect the NEGATIVE TERMINAL of the batteries to the NEGATIVE WIRE (BLACK) of the inverter.

### AC Cabling-

- Plug-in the power cord to a dedicated outlet on the wall.

### DC Over Current Protection

Fuses and disconnects must be sized to protect the wiring in the system. The fuse is required to blow before the wire reaches its maximum current carrying capacity.

### TEST

- Check to see that the inverter's ON/OFF switch in the front of the unit is in the Off position, then reconnect to the AC power source.
- Turn the inverter to the ON position and check inverter operations.

## INSTALLING YOUR INVERTER

### Environment

The inverter is a sophisticated device and must be treated accordingly. Keep the inverter in a non-condensing, well ventilated environment, ensuring that there is no significant amount of moisture or foreign material.

### OPERATION

Once the AC and DC wiring have been installed and connected, take a moment to re-examine all the connections and make sure they are secured and in the proper terminals.

Check to see that the inverter is turned off, and then connect battery (DC) power to it. Ensure that all wiring has been installed properly. Put ON/OFF switch to the ON position. The inverter should run a load without AC input (battery only). Place a load on the inverter and make sure it works.



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To charge your batteries connect AC power to the inverter by plugging in the inverter into the wall outlet. This shows that the charger is working properly. Any AC load powered by the inverter should also work at this point since a portion of the AC power is passed through the inverter to power the load. The delay before connecting is provided within acceptable frequency and voltage limits.

Disconnect the AC power. The inverter should transfer to UPS mode immediately. This will be indicated by a clicking sound as the internal transfer relay changes position. The inverter will begin to take power from the batteries and use it to power the load, and the load continues to operate uninterrupted. Make sure you plug the inverter back into the wall outlet.

*The above steps will complete a functional test of the inverter. If all areas pass, the inverter is ready for use. If all areas fail, figure out why before proceeding.*

### Terminology

Here is a description of terms which you may not be familiar with:

**Electrolyte:** Typically a mixture of water and sulfuric acid, it is commonly referred to as battery acid.

**Plates:** Originally made of lead, now fabricated from lead oxide. Plates connect to the battery terminals and provide a structure for the chemicals that create current. There are several plates in each cell; each insulated from the other by separators.

**Sulfating:** As the battery discharges, its plates get covered with lead sulfate. During recharging the lead surface leaves the plate and recombines with electrolyte. If the lead sulfate remains on the plates for an extended period of time (over two months), it hardens, and recharging will not remove it. This reduces the effective plate area and the battery's capacity.

**Stratification:** Over time a battery's electrolyte (liquid) tends to separate. The electrolyte at the top of the battery becomes watery while at the bottom it becomes more acidic. This effect is corrosive to the plates.

**Deep Discharging:** A deep discharge occurs when a battery is discharged to less than 20% of its capacity (80% depth of discharge).

### Batteries

There are two principal types of batteries; starting and deep cycle. There are several different types of battery constitutions including liquid lead acid, nickel iron, nickel cadmium, alkaline, and maintenance free. Batteries are sealed or vented.

#### Starting Batteries

Starting batteries are designed for high cranking power but not deep cycling. Do not use them with your inverter. They do not affect the inverter, but they will simply not last long in a deep cycle application. They use a lot of thin plates to maximize the surface area of the battery. This allows very high starting current but less run time when the battery is cycled.

#### Deep Cycle Batteries

Deep Cycle batteries are best suited for use with the inverter. They are designed to have the majority of their capacity used before recharge. Available in many sizes and types, be sure to use at least a 90AH battery.



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### Troubleshooting

Symptoms	Rectification
Main power is coming. Still inverter shows Main Fuse Blown on its display panel	Reduce/disconnect the load and replace the glass fuse (reset the MCB) located on back side of the inverter
Inverter mode but no power	<ul style="list-style-type: none"> <li>• Check display if low battery condition is present. Remove all loads and switch the power switch ON/OFF, Allow the battery to charge when the mains is resumed before running the UPS on battery again.</li> <li>• Check display if overload/short circuit condition is present.</li> <li>• Reduce load and switch the power switch ON/OFF</li> </ul>
Inverter does no operate and no message on display	Check the battery connections and the mains connections
Inverter trips frequently at UPS mode	Reduce the load and reset the inverter

Symptoms	Problems	Remedy
	Low Battery	Check conditions of batteries and recharge
	Loose or corroded battery connection	Check and clean all connections
	Loose AC output connection	Check all AC output connections
Inverter shut down after 20 seconds No display at all	Output of inverter is wired back to its own input	Check for proper AC input and output and output wiring
Low surge power	Weak batteries, battery cables too long	Refer to cable and battery recommendation in this manual
Unit overheats	Unit is hot	Reduce load and let the unit cool down

### Technical Specifications

Voltage Limits	
Mains A.C. Lower Voltage Limit	60 ± 5V
Mains A.C. Lower Recovery Voltage	65 ± 5V
Mains A.C. High Voltage Limit	170 ± 5V
Mains A.C. Higher Recovery Voltage	165 ± 5V
Output Voltage with Full Load	120V/110 ± 10V
Battery Lower Voltage Limit	10.5 ± 0.2V (For 12V System)
Output Frequency	
Main Output Frequency	Same as Input
Battery Charging	
Battery Charging Voltage Range	55 to 170V
Maximum Charging Current	9amp ± 1 amp (NC Mode) 13 ± 1 amp (HC Mode)
Trickle Charging Current Limit	1.5 ± 1 ano
Battery Charger Boost Voltage	14.4 ± 0.2V (Per Battery)
Battery Charger Float Voltage	13.6 ± 0.2V (Per Battery)
Overload	100 ± 3% (With Auto Reset Function)
Short Circuit Protection	> 300% Load (With Manual Reset Function)

## WARRANTY

1. Coverage and Term. Metropolitan Industries, Inc. (“**Metropolitan**”) warrants to the original purchaser (the “Buyer”) of each Metropolitan product (the “product”), that any part thereof which proves to be defective in material or workmanship within one (1) year from date of installation or 18 months from the date of manufacture, whichever comes first, will be replaced at no charge with a new or remanufactured part, F.O.B. factory. Buyer shall be responsible for all freight charges and all costs of field labor or other charges incurred in the removal and/or reinstallation of any product, part or component thereof.
2. Exclusions. **THE WARRANTY IS SUBJECT TO THE FOLLOWING CONDITIONS AND EXCLUSIONS:**
  - (a) The Warranty excludes products or workmanship which becomes defective as a result of: (i) earthquake, fire, storms, the elements or any other acts of God; (ii) normal wear and tear from use; (iii) accident, misuse, abuse or neglect ; (iv) modifications made by Buyer or any third party, other than **Metropolitan**; and (v) Buyer’s failure to properly install, maintain, service and/or operate the product under normal conditions and according to manufacturer’s instructions.
  - (b) **Metropolitan** shall not be responsible for, and the Warranty shall not cover, extended damage which occurs because of Buyer’s failure to notify **Metropolitan** promptly in writing of apparent defects.
  - (c) Any part or component designated as manufactured by anyone other than **Metropolitan** shall be covered only by the express warranty of the manufacturer thereof.
  - (d) The Warranty shall lapse upon Buyer’s failure to fully comply with the terms and conditions of its contract with **Metropolitan**, including Buyer’s failure to pay the purchase price for the product or any portion thereof. Buyer’s subsequent compliance with the terms and conditions of any such contract, will not cause the term of the Warranty to extend beyond the time period set forth above.
  - (e) No actions taken by **Metropolitan** to correct a defect in a product shall extend the Warranty beyond the period set forth above. **Metropolitan** shall not be obligated to remedy any defect, where otherwise required pursuant to the Warranty unless and until Buyer notifies **Metropolitan** in writing of the defect and then only if such notification is made prior to the expiration of the period set forth above.
3. Process of Claims and Repairs. **Metropolitan** agrees that if the product or any part or component thereof shall fail to conform to the terms of this Warranty, **Metropolitan** shall replace such nonconforming product, part or component at the original point of delivery and furnish instruction for its disposition. Any transportation charges involved in such disposition and all costs of field labor or other charges incurred in the removal and/or reinstallation of any product, part or component thereof shall be the responsibility of Buyer.
4. Limitation on Liability. Notwithstanding any provision to the contrary, **Metropolitan’s** entire liability under this Warranty shall not in the aggregate exceed, and Buyer’s exclusive and sole remedies are, to the extent permitted by law, shall be to secure replacement of the defective product. **UNDER NO CIRCUMSTANCES SHALL METROPOLITAN BE LIABLE UNDER THE WARRANTY FOR ANY INDIRECT, PUNITIVE, SPECIAL, EXEMPLARY, CONSEQUENTIAL OR INCIDENTAL DAMAGES (INCLUDING LOST PROFITS, REVENUE, USE OR ECONOMIC ADVANTAGE).**
5. Express Waiver of Any Other Warranties. **THE EXPRESS WARRANTY SET FORTH IN THIS WRITTEN WARRANTY IS THE ONLY WARRANTY MADE BY METROPOLITAN, OR ANY OTHER PARTY, IN CONNECTION WITH ANY PRODUCT PURCHASED FROM METROPOLITAN. NEITHER METROPOLITAN, NOR ANY OTHER PARTY, MAKES ANY OTHER EXPRESS OR IMPLIED WARRANTY WHICH IS NOT SET FORTH HEREIN, AND METROPOLITAN HEREBY DISCLAIMS AND BUYER HEREBY WAIVES ALL IMPLIED WARRANTIES, INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY AND THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.**
6. Not Transferable. The Warranty may not be transferred and shall be void on the sale or other transfer of the product.
7. Products and Warranty Subject to Change. **Metropolitan** reserves the right to make revisions to its products and their specifications, and to revise this Warranty and related information without notice.