samlexpower®

SMH Series Power Inverter

SMH-5000F-12
SMH-5000T-12
SMH-5000X-12

Owner's Manual

Please read this manual BEFORE operating your device.

MANUAL | Index

SECTION 1
SAFETY INSTRUCTIONS
1.1 Important Safety Instructions 4

SECTION 2
DESCRIPTION, FEATURES & PRINCIPLE OF OPERATION....6
2.1 Descriptions 6
2.2 Features 6
2.3 Power Rating 6
2.4 Principle of Operation 7

SECTION 3
PRODUCT LAYOUT 10

SECTION 4
INSTALLATION 13
4.1 Safety And Environment For Installation 13
4.2 Typical Installation Diagram....14
4.3 DC Input Requirements....17
4.3.1 Battery Selection 17
4.3.2 Battery Configuration 18
4.3.3 Polarity and Grounding....19
4.3.4 DC Fuse Protection Requirements....20
4.3.5 DC Cable Sizing and Wiring Considerations....20
4.4 AC Output Connections, Protection, and Load Considerations 21
4.4.1 AC Output Configuration....21
4.4.2 AC Wiring and Circuit Protection Requirements 22
4.5 Electromagnetic Interference (EMI) Considerations 23
4.6 Buzzing or Humming Sound in Audio Equipment....24

MANUAL | Index

SECTION 5
OPERATIONS 25
5.1 Connecting Loads, Switching ON & Switching OFF 25
5.2 Universal Circuit Protection Operation 26
5.2.1 Automatic Protection Functions.....26
5.2.2 Low DC Input Voltage Protection 26
5.2.3 High DC Input Voltage Protection.....27
5.2.4 Over-Temperature Protection and Thermal Derating.....27
5.2.5 Short Circuit and Overload Protection 27
5.2.6 Soft Start Technology.....28

SECTION 6
PROTECTIONS MONITORING & TROUBLE-SHOOTING 29

SECTION 7
SPECIFICATIONS 30

SECTION 8
WARRANTY 31

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SECTION 1 | Safety Instructions

1.1 IMPORTANT SAFETY INSTRUCTIONS

THIS MANUAL CONTAINS IMPORTANT INFORMATION REGARDING SAFETY, OPERATION, MAINTENANCE AND STORAGE OF THIS PRODUCT. BEFORE USE, READ AND UNDERSTAND ALL CAUTIONS, WARNINGS, INSTRUCTIONS AND PRODUCT LABELS, PLUS YOUR VEHICLE'S BATTERY MANUFACTURER'S GUIDELINES. FAILURE TO DO SO COULD RESULT IN INJURY AND / OR PROPERTY DAMAGE.

THE FOLLOWING SYMBOLS WILL BE USED IN THIS MANUAL TO HIGHLIGHT SAFETY AND IMPORTANT INFORMATION:

WARNING!
Indicates possibility of physical harm to the user in case of non-compliance.

CAUTION!
Indicates possibility of damage to the equipment in case of non-compliance.

INFO
Indicates useful supplemental information.

WARNING!

To reduce the risk of fire, electric shock, explosion or injury

1. Do not connect in parallel with another AC source e.g. Utility AC Distribution Wiring / generator. This is NOT a Grid Tied Inverter!
2. Disconnect appliance plug from outlet strip or turn off the inverter before working on the appliance. Multiple Outlet Power Strips with switches and circuit breakers only interrupt power to the "Hot" receptacle terminals.
3. Precautions when working with batteries
   - Batteries contain very corrosive diluted Sulphuric Acid as electrolyte. Precautions should be taken to prevent contact with skin, eyes or clothing.
   - Batteries generate Hydrogen and Oxygen during charging resulting in evolution of explosive gas mixture. Care should be taken to ventilate the battery area and follow the battery manufacturer's recommendations.
   - Never smoke or allow a spark or flame near the batteries.
   - Use caution to reduce the risk of dropping a metal tool on the battery. It could spark or short circuit the battery or other electrical parts and could cause an explosion.
   - Remove metal items like rings, bracelets and watches when working with batteries and also use caution when working with metal tools. Batteries can produce a short circuit current high enough to melt / weld metals and thus, cause severe burn.
   - If you need to remove a battery, always remove the ground terminal from the battery first. Make sure that all the accessories are off so that you do not cause a spark.

SECTION 1 | Safety Instructions

4. Do not make any electrical connections or disconnections in areas designated as **IGNITION PROTECTED**. This includes 12 VDC Power Plug (Cigarette Plug) connections and terminal connections.
5. This is not a toy - keep away from children.
6. Do NOT insert object into the air vents.

CAUTION!

1. Observe correct polarity when connecting the DC input terminals of the inverter to the battery. Connect Positive of the battery to the Positive input connector of the inverter and the Negative of the battery to the Negative input terminal of the inverter. Reverse polarity connection will result in a blown fuse and may cause permanent damage to the inverter. Damage due to reverse polarity is not covered under warranty.
2. This inverter will not operate high wattage appliances that exceed the output power limit or the surge power limit.
3. Do not operate this inverter if it is wet.
4. Do not install in engine compartment—please install in a well-ventilated area.
5. This inverter is not tested for use with medical devices.

SECTION 2 | Description, Features & Principle of Operation

2.1 DESCRIPTION

The Samlex SMH-5000 Series is a high-power 12 VDC to 115 VAC modified sine wave inverter designed to deliver 5000 W continuous and 10,000 W surge output for demanding mobile, off-grid, and backup applications. It features high efficiency, soft-start technology for improved surge handling, smart variable-speed cooling, and a cool-surface chassis for safer operation. An integrated LCD display provides real-time input voltage, output level, and fault indications.

Built with heavy-duty DC terminals, optional remote control capability, and multiple AC output configurations (NEMA5-15R or hardwire terminals), the SMH-5000 Series includes comprehensive protections such as low/high input voltage shutdown, overload and short-circuit protection, and over-temperature auto-reset. ETL-listed to UL 458 / CSA C22.2 No. 107.1, it is engineered for reliable, high-power performance in vehicles, boats, off-grid systems, and mobile work environments.

The SMH-5000X-12 utilizes an electronic breaker system that provides ganged protection for all AC receptacle outputs. If an overload condition occurs on any single outlet, all AC outlets are simultaneously interrupted and automatically reset once the fault is removed. The SMH-5000F-12 incorporates individual fuse protection for each NEMA 5-15R AC receptacle, allowing a fault or overload on one outlet to be isolated without affecting the remaining outlets. The SMH-5000T-12 is designed for hardwire-only installations and does not include fused AC receptacle outputs; external branch-circuit protection must be provided as part of the installation. These variations allow the SMH-5000 Series to support a wide range of application and wiring requirements.

2.2 FEATURES

- Very high power to weight & size ratio—compact and light weight.
- High efficiency and very low no-load current draw.
- LCD display for showing input voltage, output level, and fault message.
- Heavy duty DC input terminals.
- Soft Start Technology for better surge performance.
- Smart variable speed cooling fan for better efficiency and lower noise.
- Cool Surface Technology for cooler and safer touch temperature.
- Universal Protection circuit for low or high DC input voltage, overload or short circuit, and over temperature.
- Low Interference Technology for controlled RF noise in TV pictures, audio and radio equipment.

2.3 POWER RATING

The continuous power rating of these models:

- SMH-5000X-12, SMH-5000T-12, SMH-5000F-12: 5000 Watts

SECTION 2 | Description, Features & Principle of Operation

2.4 PRINCIPLE OF OPERATION

Conversion of 12 VDC from the battery or other DC source to 115 VAC takes place in 2 stages. In the first stage, the 12 VDC is converted to high voltage DC (around 160 VDC) using high frequency switching and Pulse Width Modulation (PWM) technique. In the 2nd stage, the 160 V high voltage DC is converted to 115 V, 60 Hz Modified Sine Wave AC. (**Note:** 115 V is the RMS value of the Modified Sine Wave AC voltage. The peak value of the Modified Sine Wave AC voltage will be equal to the value of the above high voltage of around 160 V. See the Fig 2.1 below)

Modified Sine Waveform - Characteristics & Comparison with Pure Sine Waveform

Please refer to Fig 2.1 below which shows one cycle of Modified Sine Wave and Pure Sine Wave for comparison.

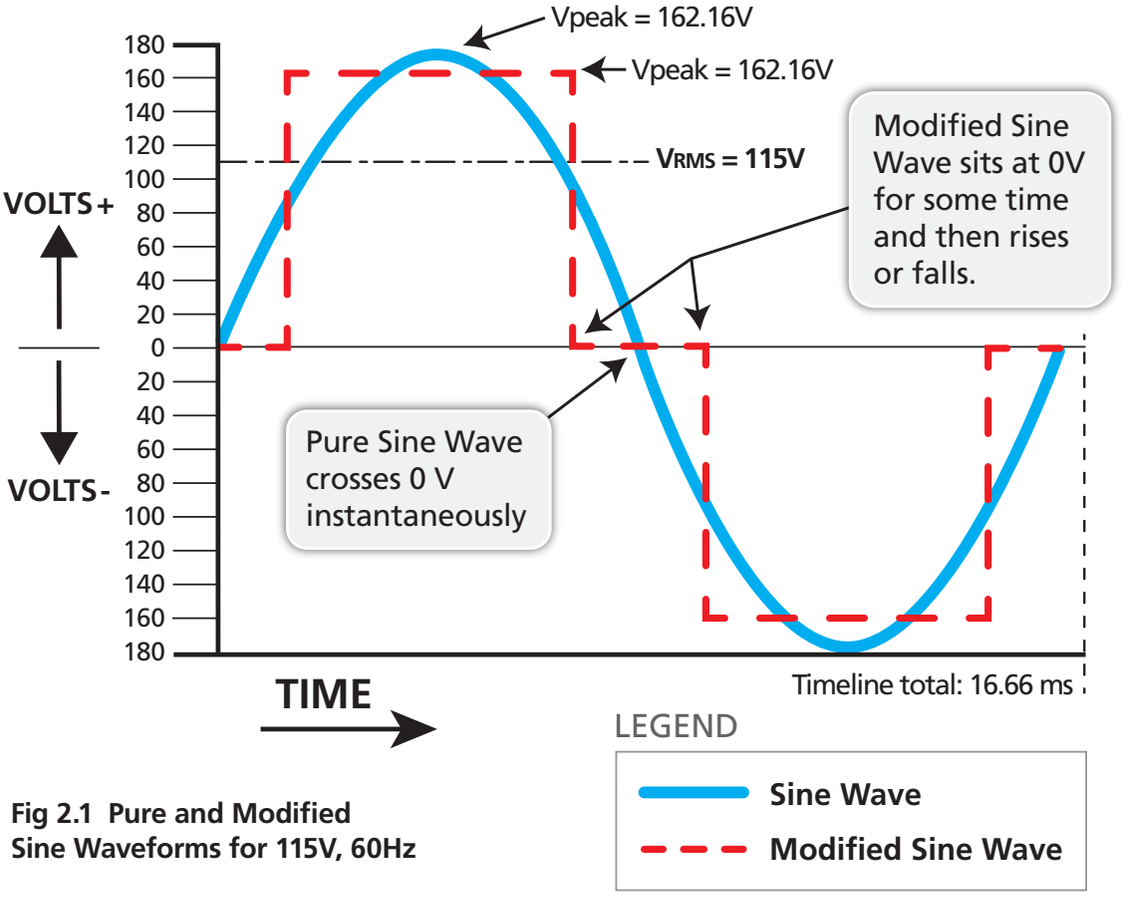


Fig 2.1 Pure and Modified Sine Waveforms for 115V, 60Hz

The voltage waveform consists of rectangular pulses that approximate sine wave pulses of a Pure Sine Wave. The voltage rises and falls abruptly at a particular phase angle and sits at 0 Volts for some time before changing its polarity. In a Pure Sine Wave, the voltage rises and falls smoothly with respect to phase angle and the voltage changes its polarity instantly when it crosses 0 Volts.

SECTION 2 | Description, Features & Principle of Operation

CAUTION!

Certain devices (few examples given below) may malfunction when powered from Modified Sine Wave. Check with the manufacturer of the device for suitability of powering with Modified Sine Wave:

- Devices utilizing zero voltage crossing for timing control: Some clocks used in consumer electronic items (will not keep accurate time).
- Devices using modulation of RF signals on AC lines during zero crossing e.g. X-10 System for Home Automation.
- Devices utilizing Triac based phase control for transformerless voltage step down e.g.:
  - Small battery chargers for hand tools, flashlights, night-lights, shavers etc.
  - Variable motor speed control in hand tools
  - Light dimmers
  - Temperature controllers e.g. Temperature Controlled Electric Blankets
- Devices using high capacitance-based voltage multipliers for generating high voltage (will create very high surge currents) e.g.:
  - Photographic Strobe Lights
  - Laser Printers
- Other potential issues with device powered by modified sine-wave inverter:
  - Device may run hotter than they would on a pure sine-wave inverter
  - Buzzing or humming sound may exhibit for device for sensitive components
  - Efficiency trade off due to reduced performance of device

Signs a Device May Not Be Suitable for a Modified Sine Wave Inverter:

When powered from a Modified Sine Wave inverter, some devices may exhibit abnormal behavior. If any of the following conditions are observed, discontinue use and switch to a pure sine-wave inverter:

- Inverter Protection Warnings or Shutdown - inverter overload, over-current, or short-circuit alarms activate even though the connected load is within rated power;
- Inverter shuts down immediately at startup of the device, or repeated fault/restart cycling when the device is turned on;
- Excessive Current Draw - DC cables, terminals, or inverter chassis become abnormally warm at modest load levels, or inverter reaches thermal limits well below rated output power; excessive heat in the load;
- Audible Noise or Vibration - Buzzing, humming, or whining from the connected device or inverter that was not present with other loads; increased mechanical vibration in motors or transformers;
- Abnormal or Unstable Device Operation - device fails to start, stalls, or runs intermittently; reduced performance (e.g., motor runs slower, microwave cooks poorly).
- Timing or Control Errors - clocks do not keep accurate time, dimmers, speed controls, or temperature controls respond improperly.
- Electrical Interference - radio frequency (RF) noise affecting nearby electronics; Interference with communication, automation, or monitoring systems; flickering lights or erratic behavior in other connected loads.
- Nuisance Tripping of Protection Devices - GFCI, AFCI, or internal device protection trips without a clear fault.

SECTION 2 | Description, Features & Principle of Operation

Measuring Modified Sine-Wave Voltage with a "True Rms" Voltmeter

As mentioned above, Modified Sine Wave voltage is a type of square wave that has an RMS (Root Mean Square) value of 115 VAC in this inverter. A general-purpose AC voltmeter is calibrated to accurately measure the RMS value of a Pure Sine Wave and NOT of a Modified Sine Wave. If this general-purpose voltmeter is used to measure Modified Sine Wave voltage, it will indicate a lower value (96 VAC to 104 VAC). For accurately measuring the voltage of a Modified Sine Wave, use a voltmeter which is designed to measure "True RMS Values" like Fluke 87, Fluke 8060A, Fluke 77 / 99, Beckman 4410 etc.

SECTION 3 | Layout

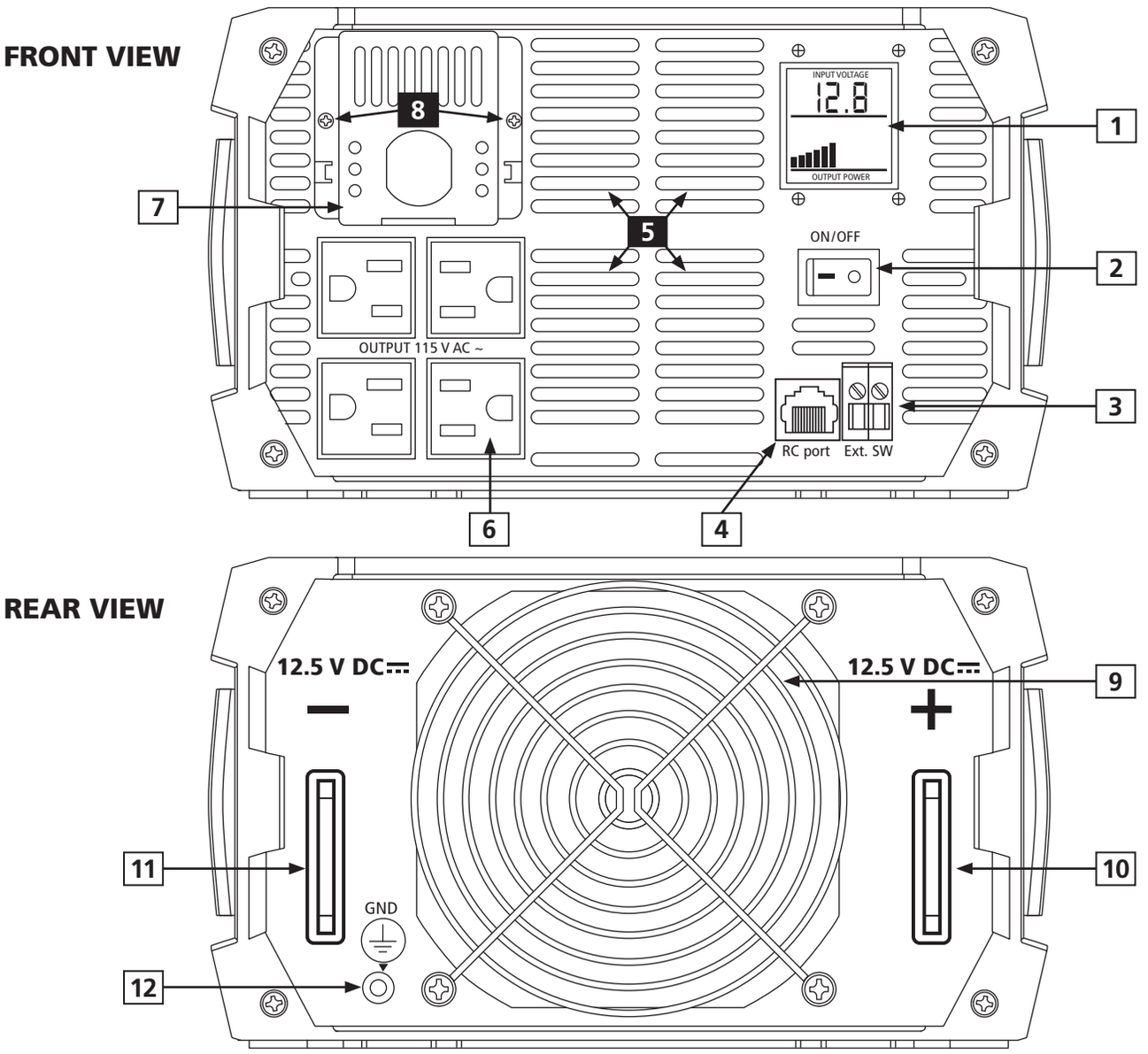


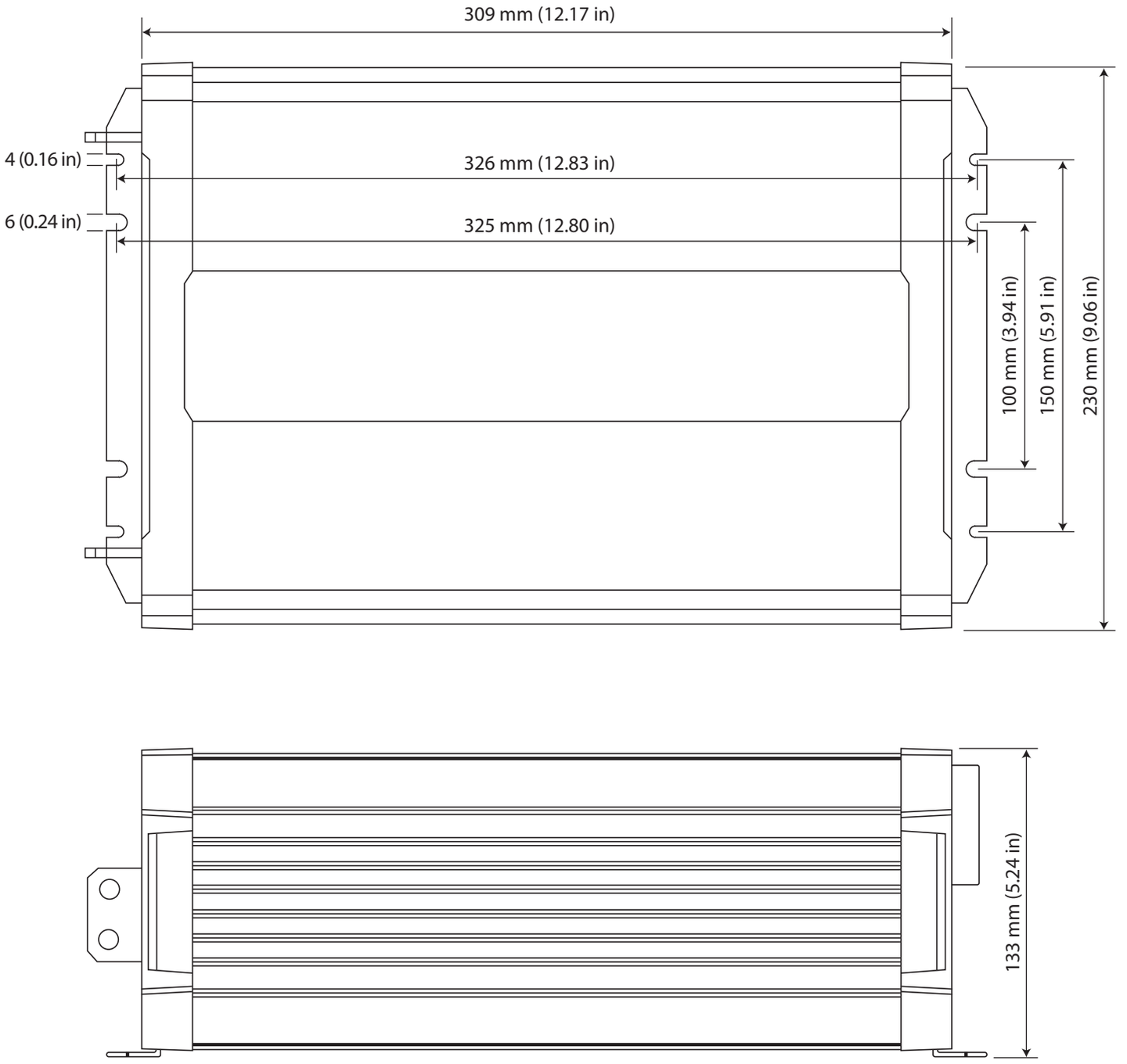
Figure 3.1 Front and Back View of the SMH-5000X-12 and SMH-5000F-12

LEGEND

1. Monochrome LCD Display
2. ON/OFF Switch
3. External ON/OFF port
4. Modular Jack for Remote Control SMH-RC (optional)
5. Cooling Air Intake Slots
6. AC OUTLETS: 4x NEMA5-15R receptacles
7. Hardwire Terminal Removable Cover
8. Screws (2x) for Terminal Cover
9. Opening for Fan Air Discharge
10. Positive Battery Input Terminal
11. Negative Battery Input Terminal
12. Inverter grounding connector

SECTION 3 | Layout

Fig 3.2 Top and Side View of the SMH-5000X-12, SMH-5000F-12 and SMH-5000T-12



SECTION 3 | Layout

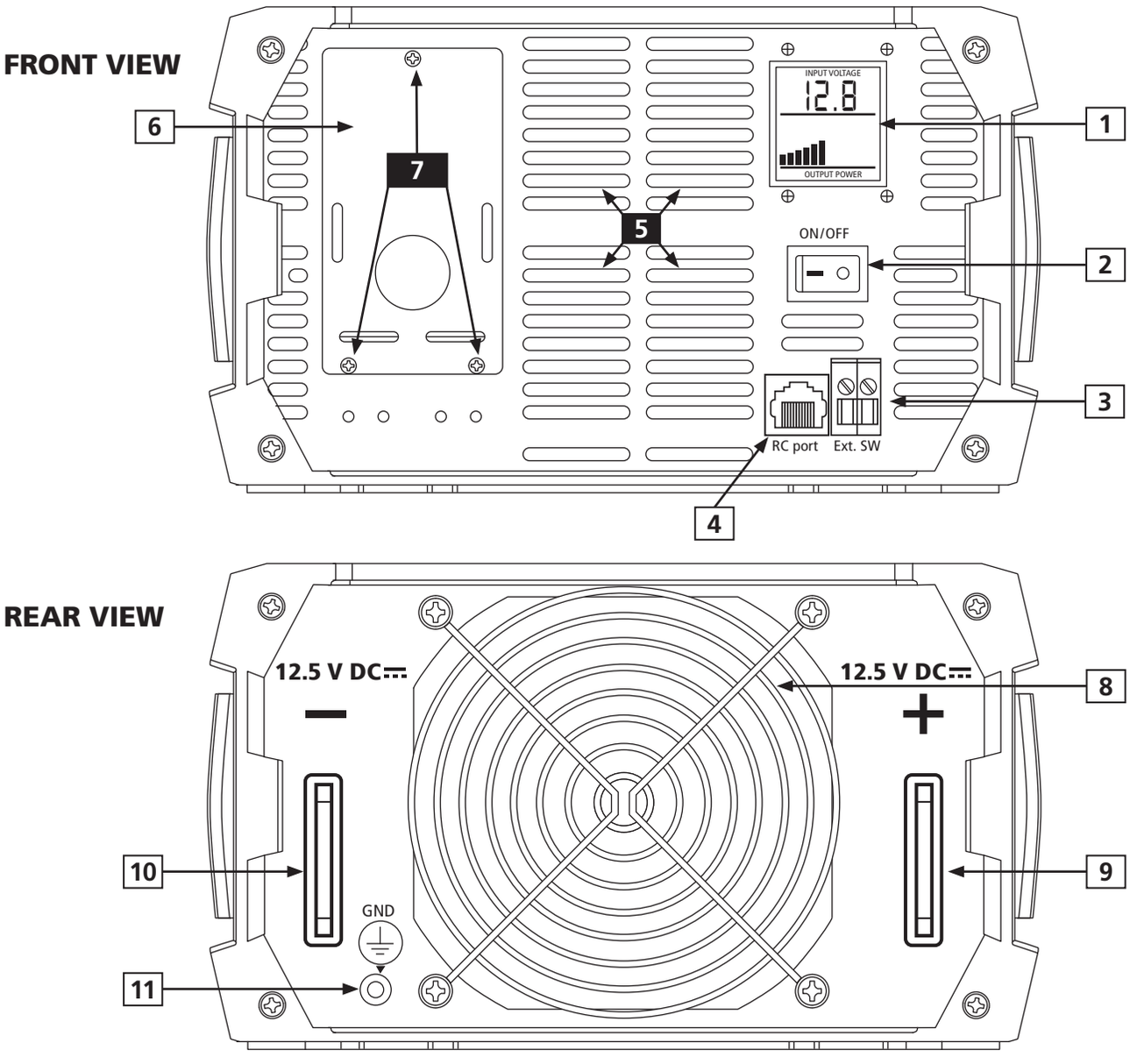


Fig 3.3 Front and Back View of SMH-5000T-12

LEGEND

1. LCD Display
2. ON/OFF Switch
3. External ON/OFF port
4. Modular Jack for Remote Control SMH-RC (optional)
5. Cooling Air Intake Slots
6. Hardwire terminal cover
7. Screws for open terminal cover
8. Opening for Fan Air Discharge
9. Positive Battery Input Terminal
10. Negative Battery Input Terminal
11. Inverter grounding connector

SECTION 4 | Installation

4.1 SAFETY AND ENVIRONMENT FOR INSTALLATION

Please read safety instructions in section 1 before commencing installation.

Installation Environment

For best operating results, the inverter should be placed on flat surface, such as the ground, car floor, or other solid surface. The power cord allows easy positioning of the inverter. The inverter should only be used in locations that meet the following criteria:

Dry - Do not allow water and/or other liquids to come into contact with the power inverter. In all marine applications, do not install the inverter below or near the waterline and keep the inverter away from moisture or water. If Flooded / Wet Cell Type of battery is being used, ensure that it is not installed very close to the battery to avoid contact with acid or acid vapors.

Cool - Ambient air temperature should be between -25 °C (-13 °F) to 40 °C (104 °F) at full load. Above 40 °C (104 °F) the unit will begin to derate the output power, but continue to operate until 50 °C (122 °F). Do not place the inverter on or near a heating vent or any piece of equipment, which generates heat above room temperature. Keep the inverter away from direct sunlight.

Ventilated - The unit is cooled by smart variable speed fan. The fan will automatically running at different speed to keep inverter get enough cooling and less fan noise. The fan sucks cool air in from the ventilation slots on the AC outlet side and discharges hot air out of the fan opening on the DC Input Terminal side. Keep the areas surrounding the inverter clear by at least 10 inch to ensure free air circulation around the unit. Ensure that the ventilation slots and fan opening on the sides are not blocked. Do not place items on or over the inverter during operation.

Mounting Orientation

Two flanges on the bottom with 4 mounting slots each are provided for mounting.
If the inverter is required to be mounted on a vertical surface like a wall, please ensure that the fan axis is horizontal as shown in Fig 4.4(a).

The DC input side has larger ventilation openings Fig 3.1(9) for fan airflow. Mounting with the fan side facing up or down as shown in Figs 4.4(b) or 4.3(c) is NOT permitted due to safety considerations . If mounted as in Fig 4.3(b), metallic or other conductive object(s) may accidentally fall inside the unit through the fan ventilation openings, and create hazardous condition resulting from short circuit of internal high voltage section(s). If mounted as in Fig 4.4(c), hot or molten material from damaged internal portion of the unit due to malfunction may fall on combustible material on the floor and may create fire hazard.

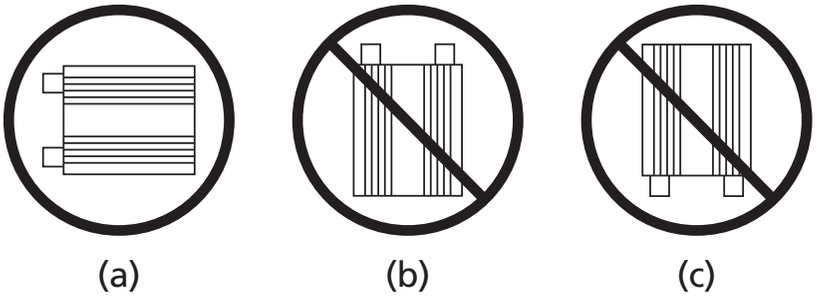


Fig 4.4
Mounting Orientation
on Wall

4.2 TYPICAL INSTALLATION DIAGRAM

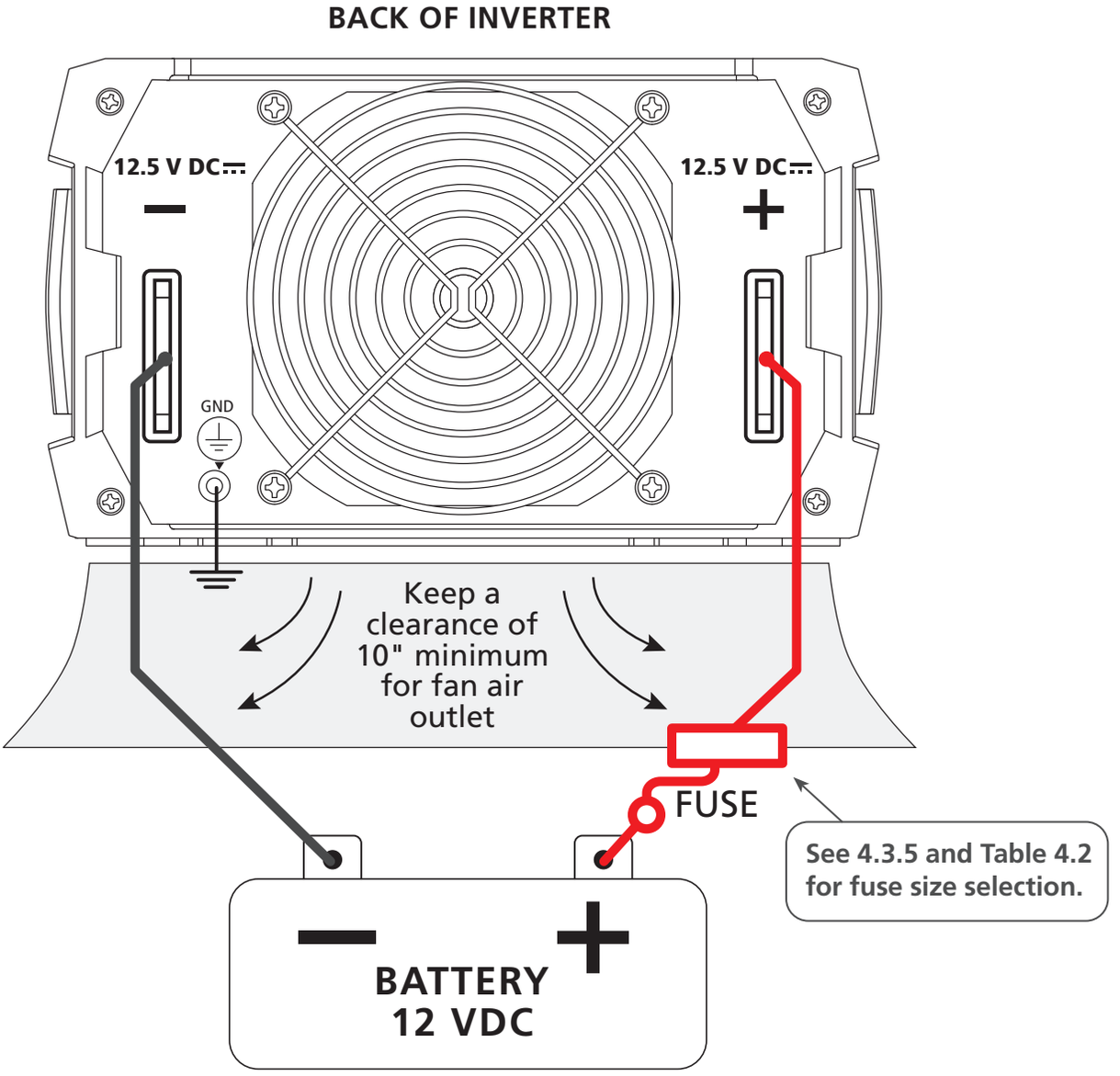


Fig 4.1 Input DC Connection of the SMH-5000X-12

WARNING
Consider use of proper wiring and fuse to prevent occurrence of hazardous conditions. Fuse should be installed within 7" from the battery terminal.

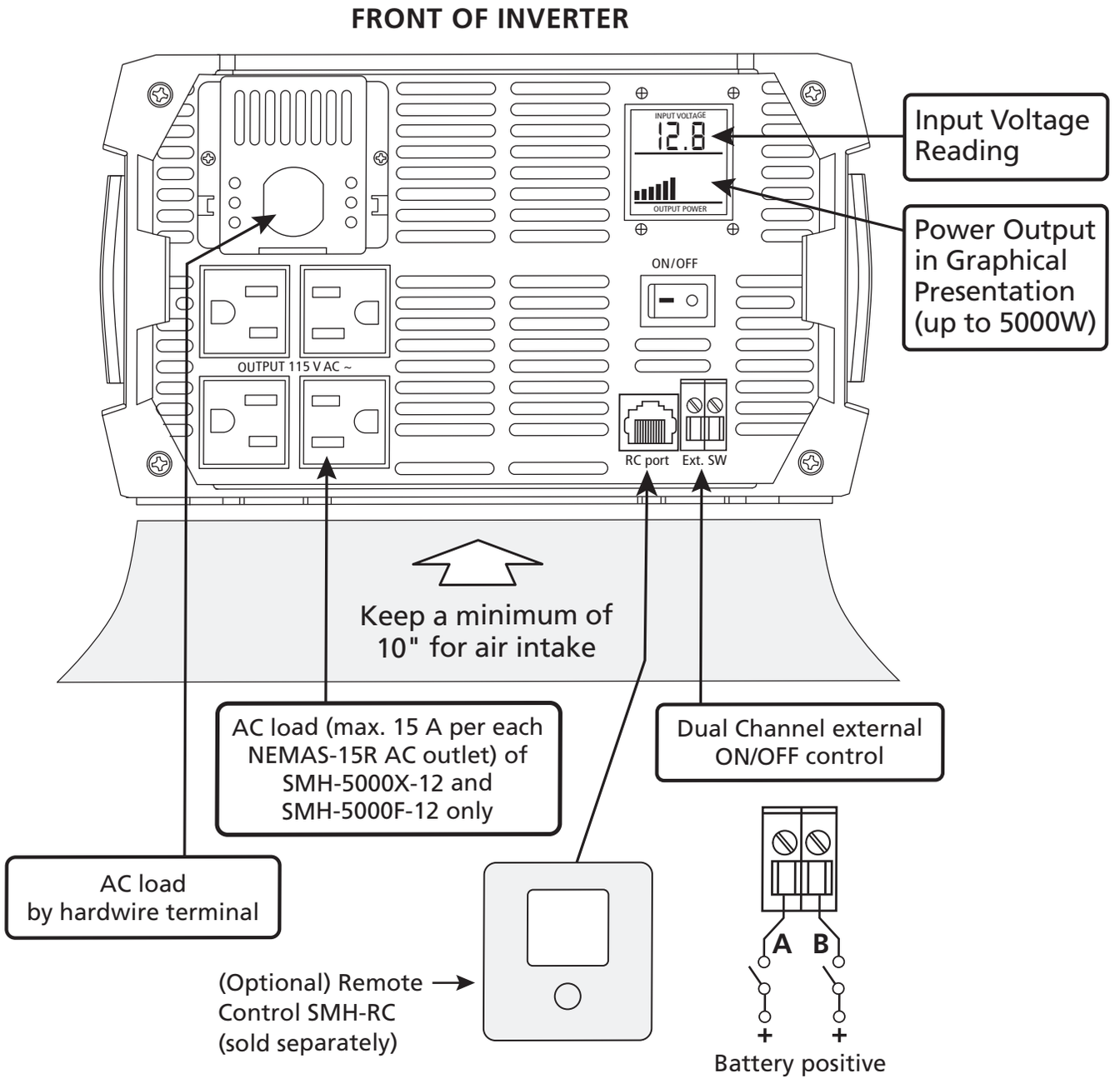


Figure 4.2 Front Connection and Display of SMH-5000X-12 and SMH-5000F-12

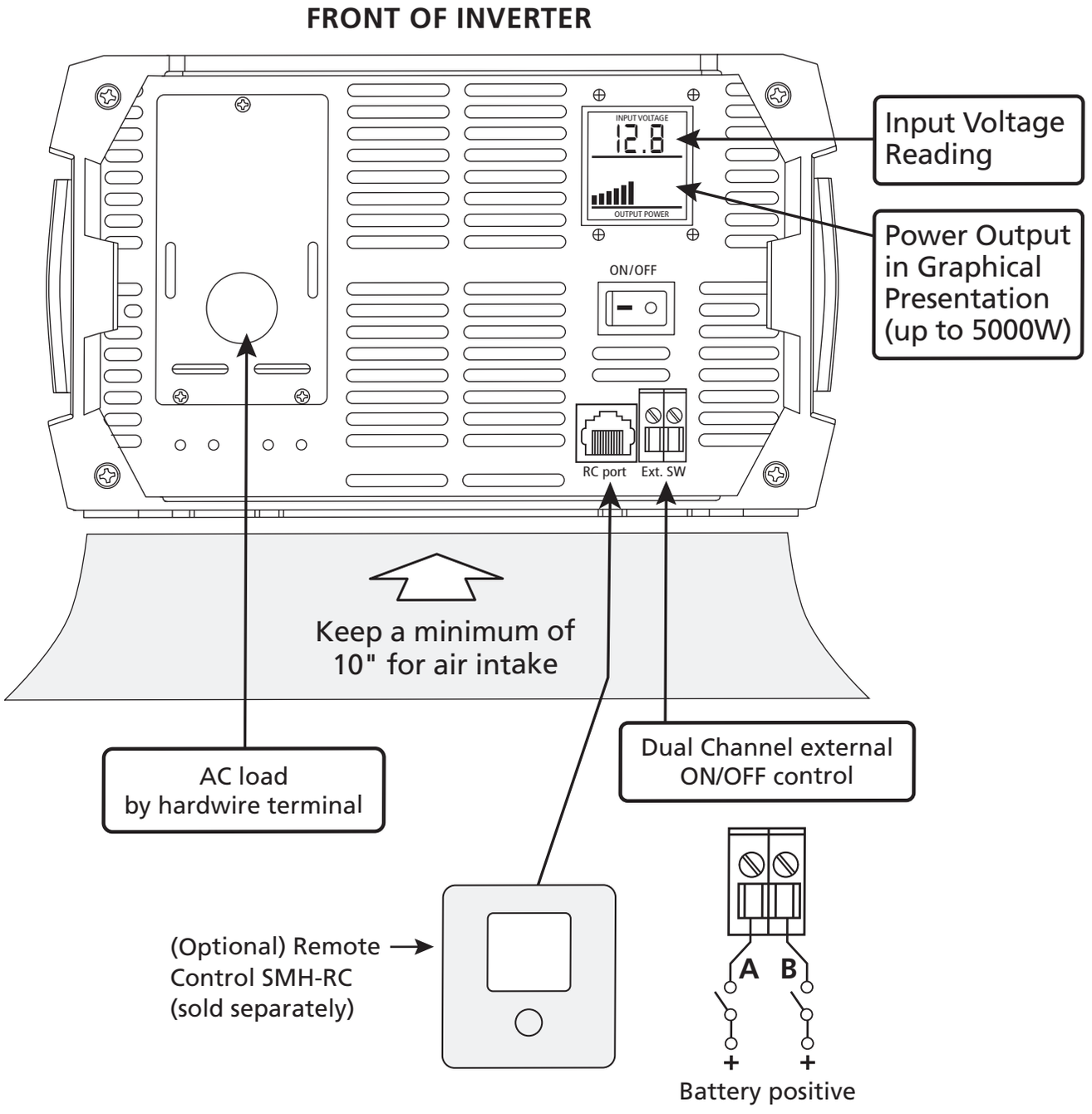


Fig 4.3 Front Connection and Display of the SMH-5000T-12

SECTION 4 | Installation

4.3 DC INPUT REQUIREMENTS

The SMH-5000 Series inverter requires a high-current 12 VDC power source capable of supplying both continuous and surge currents. At full rated output, the inverter may draw up to 500 A from the DC source.

A simplified guideline for estimating DC input current is:
DC Input Current (A) ≈ AC Load Power (W) ÷ 10

Table 4.1 DC Input Current

Model	Rated Input Current
SMH-5000F-12	500 A
SMH-5000T-12	500 A
SMH-5000X-12	500 A

4.3.1 BATTERY SELECTION

Because of the very high DC current demand, proper battery selection is critical for safe and reliable operation.

Recommended guidelines:

- Use high-capacity deep-cycle batteries in good condition
- AGM, Gel, or $LiFePO_4$ batteries may be used if supported by the system
- Battery capacity must be sufficient to support expected runtime and surge loads
- When additional capacity is required, connect batteries in parallel
    - System voltage remains 12 VDC
    - Total amp-hour (Ah) capacity is the sum of all connected batteries
    - All batteries in a parallel bank should be of the same type, age, and condition
    - Insufficient battery capacity may result in excessive voltage drop, premature low-voltage shutdown, or reduced inverter performance.

Sizing Inverter Battery Bank

The following basic rules are used to determine the size of the battery bank:

Active Power:

- Watts (W) = Volts (V) x Amps (A) x Power Factor

DC Current Draw:

- For a 12 V battery system DC Current (A) = AC Load (W) / 10

Energy Required:

- Battery Energy (Ah) = DC Current (A) x Runtime (Hr)

Required Battery Capacity:

- As rule of thumb, Ah capacity of battery at twice the energy required
- Battery Capacity (Ah) = 2 x Battery Energy (Ah)

An example of this calculation for a 12 V inverter is given below:

- The total continuous AC power to be delivered by a 12 V inverter = 5000 W
- Using the formula, the DC current to be delivered by the 12 V batteries = 5000 W ÷ 10 = **500 Amps**.
- Next, the energy required by the load in amp-hours (Ah) is determined:
- For example, if the load is to operate for 3 hours, then as per the formula above, the energy to be delivered by the 12 V batteries = 500 Amp × 3 hours = 1500 Amp hours (Ah)
- Finally, as per rule of thumb, the ah capacity of the batteries should be twice the energy required by the load in Ah = 1500 Ah x 2 = 3000 Ah

4.3.2 BATTERY CONFIGURATION

Battery in Series Connection

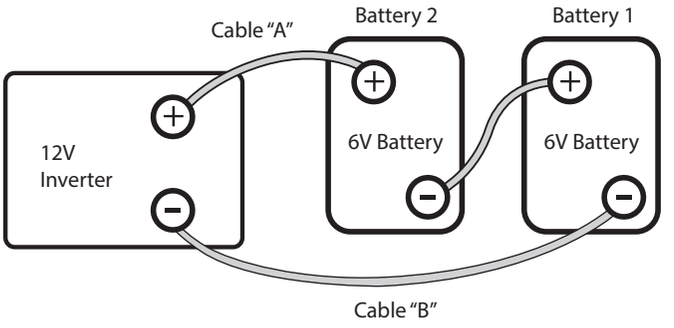


Fig. 4.5 Series Connection

When two or more batteries are connected in series, their voltages add up but their Ah capacity remains the same. Fig. 4.5 above shows 2 pieces of 6V, 200 Ah batteries connected in series to form a battery bank of 12V with a capacity of 200 Ah. The Positive terminal of Battery 2 becomes the Positive terminal of the 12V bank. The Negative terminal of Battery 2 is connected to the Positive terminal of Battery 1. The Negative terminal of Battery 1 becomes the Negative terminal of the 12V battery bank.

Battery in Parallel Connection

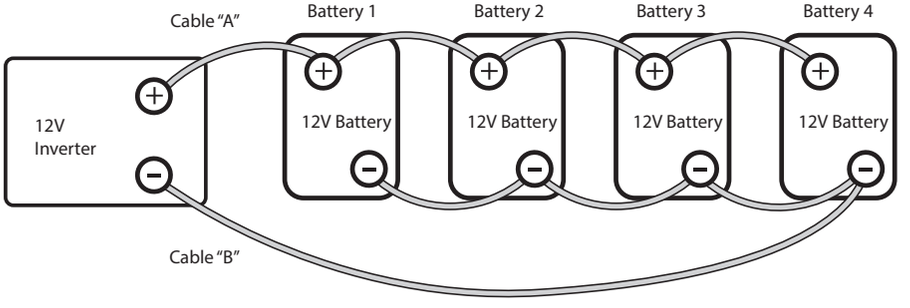


Fig. 4.6 Parallel Connection

When two or more batteries are connected in parallel, their voltage remains the same but their Ah capacities add up. Fig. 4.6 above shows 4 pieces of 12V, 100 AH batteries connected in parallel to form a battery bank of

12V with a capacity of 400 Ah. The four Positive terminals of Batteries 1 to 4 are paralleled (connected together) and this common Positive connection becomes the Positive terminal of the 12V bank. Similarly, the four Negative terminals of Batteries 1 to 4 are paralleled (connected together) and this common Negative connection becomes the Negative terminal of the 12V battery bank.

Battery in Series – Parallel Connection

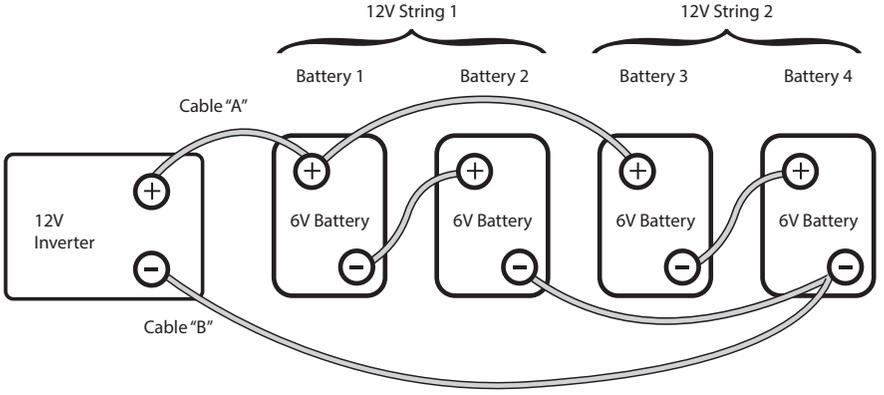


Fig. 4.7 Series-Parallel Connection

Figure 4.7 above shows a series – parallel connection consisting of four 6V, 200 Ah batteries to form a 12V, 400 Ah battery bank. Two 6V, 200 Ah batteries, batteries 1 and 2 are connected in series to form a 12V, 200 Ah battery (String 1). Similarly, two 6V, 200 Ah batteries, batteries 3 and 4 are connected in series to form a 12V, 200 Ah battery (String 2). These two 12V, 200 Ah strings 1 and 2 are connected in parallel to form a 12V, 400 Ah bank.

To ensure balanced current flow, the inverter positive and negative connections should be taken from opposite ends of a parallel battery bank. This wiring method helps prevent uneven loading, reduces stress on individual batteries, and improves overall battery life.

4.3.3 POLARITY AND GROUNDING

Always observe correct polarity when connecting the DC input cables:

- Battery Positive (+) → Inverter Positive (+)
- Battery Negative (–) → Inverter Negative (–)

Reverse polarity will blow internal DC fuses and may cause permanent damage. Damage caused by reverse polarity is not covered under warranty. The inverter chassis is internally bonded to the AC output grounding terminals. In vehicle and marine installations, the battery negative terminal is typically bonded to the chassis.

WARNING! This inverter must not be used in positive-ground electrical systems. Reverse polarity will cause permanent damage of the inverter.

4.3.4 DC FUSE PROTECTION REQUIREMENTS

A properly rated DC fuse must be installed to protect the wiring and battery system from hazardous short-circuit currents.

Fuse installation requirements:

- Install the fuse in series with the positive (+) battery cable
- Locate the fuse within 7 inches (18 cm) of the battery's positive terminal

Fuse selection must satisfy:

- Fuse rating ≥ inverter's maximum DC input current
- Fuse rating ≤ cable ampacity
- High interruption rating suitable for large battery banks

Recommended fuse types:

- Class-T fuse (preferred for high-power inverters)
- MRBF fuse (compact option for marine and RV systems)

Proper fusing prevents cable overheating, fire hazards, and battery damage in the event of a short circuit.

4.3.5 DC CABLE SIZING AND WIRING CONSIDERATIONS

Because the SMH-5000 Series inverter can draw up to 500 A, proper DC cabling is essential for safety, efficiency, and performance.

Apply recommendation in this section for short, heavy-gauge copper cables capable of safely carrying the required current. Cable resistance increases with length and decreases with conductor size; therefore, long or undersized cables can result in:

- Excessive heating
- Voltage drop
- Reduced inverter performance
- Premature low-voltage shutdown
- Damage to cable insulation

To ensure safe operation:

- Cable ampacity must meet or exceed the inverter's maximum continuous current
- Conductors should be sized according to NEC guidelines
- Total voltage drop between the battery and inverter should be kept as low as possible (ideally < 3%)

Use high-quality copper conductors with properly crimped lugs, and keep cable runs as short and straight as practical. At high current levels, even small resistance results in significant heat and power loss. Proper cable sizing minimizes thermal stress, voltage drop, and unnecessary inverter shutdowns.

The DC cable size recommendations in Table 4.2 are based on the following assumptions:

- **Cable Type:** Flexible copper battery cable or equivalent high-strand cable, rated 90–105 °C insulation temperature.

- **System Voltage:** 12 VDC nominal inverter input.
- **Cable Length:** Lengths shown are one-way distances; total circuit length is twice the stated value.
- **Voltage Drop Criterion:** Cable sizes are selected to limit voltage drop to approximately 3% or less at the upper limit of each current range.
- **Duty Cycle:** High-current, continuous-duty inverter operation.
- **Ambient Conditions:** Normal installation environments without excessive heat, bundling, or conduit fill.
- **Termination:** Properly crimped copper lugs with secure, low-resistance connections.

These recommendations are intended to minimize voltage drop, heating, and premature inverter shutdown while supporting reliable high-current operation.

Actual installations may require larger conductors if the cables are longer, ambient temperature is elevated, cables are bundled, or installation conditions differ. Always ensure conductor ampacity and overcurrent protection comply with applicable NEC requirements and local electrical codes. All final conductor and overcurrent protection sizing must be verified and installed by a qualified electrician and must comply with applicable NEC and local electrical codes.

Table 4.2 DC Cable and Fuse Size Recommendation

AC Output Power (Watts)	Rated continuous DC Current (Amp)	DC Cable Size Recommended[1]		Max Fuse Size[3]
		5 ft one-way	10 ft one-way	
0–1000	~100 A	8 AWG	4 AWG	150 A
1000–2000	~200 A	2 AWG	1/0 AWG	300 A
2000–3000	~300 A	1/0 AWG	4/0 AWG	400 A
3000–4000	~400 A	2/0 AWG	2 × 4/0 AWG[2]	500 A
4000–5000	~500 A	3/0 AWG	2 × 4/0 AWG[2]	600 A

Notes For Table 4.2:

1. Cable running distance between the unit and battery
2. Use parallel cabling supported at DC terminal
3. Type: Class-T or Marine Rated Battery Type (MRBT); Rating of fuse should not exceed ampacity of the cable selected

4.4 AC OUTPUT CONNECTIONS, PROTECTION, AND LOAD CONSIDERATIONS

See typical installation diagrams in Fig. 4.1, Fig. 4.2, and Fig. 4.3.

4.4.1 AC OUTPUT CONFIGURATION

The SMH-5000 Series provides 115 VAC, 60 Hz Modified Sine Wave output.

- **SMH-5000F-12**
  - Four NEMA 5-15R receptacles, each rated at 15 A maximum
  - Each NEMA 5-15R is protected by individual fuse without interrupting operation to remaining outlets during overload or fault
  - One AC hardware terminal block (no fuse)

- **SMH-5000X-12**
  - Four NEMA 5-15R receptacles, each rated at 15 A maximum
  - All NEMA 5-15R receptacles are protected by electronic breaker with ganged operation
  - One AC hardware terminal block (no fuse)
- **SMH-5000T-12**
  - AC hardwire terminal block only (no receptacles)

The AC output neutral and ground are internally bonded to the inverter chassis. The chassis ground terminal must be connected to the system grounding conductor.

CAUTION!

1. The AC output from this inverter should NOT be connected in parallel with another AC source like grid, generator, or another inverter - **SEVERE DAMAGE WILL OCCUR!**
2. Never connect the inverter AC output to a transfer switch or relay with another channel AC power source. Short periods of sparking or crossover may severely damage the inverter or the whole system.
3. If the AC output from this inverter is required to be fed to an AC Distribution Panel / Sub Panel for backup AC power, a suitable Transfer Switch design for SMH series should be used. The Transfer Switch will prevent parallel operation of AC output of this inverter with the other AC source.

4.4.2 AC WIRING AND CIRCUIT PROTECTION REQUIREMENTS

Similar consideration as the DC wiring should be given for wiring uses at the AC terminal block:

- Use copper conductors only
- Size conductors according to expected load and applicable NEC and local code requirements
- The hardwire terminal block can accommodate conductors up to 8 AWG
- For loads approaching the inverter's full 5000 W output, 8 AWG copper conductors are recommended
- Smaller conductor sizes may be used for lower loads, provided conductor ampacity and overcurrent protection requirements are met

Improper or undersized AC wiring may result in excessive heating, voltage drop, nuisance tripping, or fire hazards.

AC Circuit Protection

The AC hardwire terminal block does not include an internal circuit breaker. An external AC breaker must be installed to protect the wiring and connected loads.

Breaker selection must satisfy:

- Breaker rating ≤ conductor ampacity
- Breaker rating appropriate for the inverter's maximum AC output current
- Compliance with NEC continuous-load and branch-circuit requirements

SECTION 4 | Installation

Proper AC protection ensures safe operation during overloads, short circuits, and fault conditions.

Inverter Sizing for High-Surge Loads

Many appliances require substantially higher power during startup than during normal operation. Manufacturer ratings typically list only running power, not starting surge power.

Table 4.3 provides recommended Inverter Sizing Factors for common high-surge loads. Multiply the appliance's rated running wattage by the applicable factor to determine the required inverter continuous power rating.

Table 4.3 Inverter Sizing Factor

Type of Device or Appliance	**Inverter Sizing Factor** (See Note 1)
Air Conditioner / Refrigerator / Freezer (Compressor based)	5
Air Compressor	4
Sump Pump / Well Pump / Submersible Pump	3
Dishwasher / Clothes Washer	3
Microwave (where rated output power is the cooking power)	2
Furnace Fan	3
Industrial Motor	4
Portable Kerosene / Diesel Fuel Heater	3
Circular Saw / Bench Grinder	3
Incandescent / Halogen / Quartz Lamps	3
Laser Printer / Other Devices using Quartz Lamps for heating	4
Photographic Strobe / Flash Lights	4 (See Note 2)

Notes For Table 4.3

1. Multiply the Maximum Continuous Power Rating (Active power Rating in Watts) Of the appliance / device by the recommended sizing factor to arrive at the Maximum Continuous Running Power Rating of the Inverter.
2. For photographic strobe / flash unit, the Surge Power of the inverter should be > 4 times the Watt Sec rating of photographic strobe / flash unit.

4.5 ELECTROMAGNETIC INTERFERENCE (EMI) CONSIDERATIONS

This inverter uses high-frequency switching circuitry, which can generate conducted and radiated electromagnetic interference (EMI). While internal filtering limits EMI to acceptable levels, external installation factors can influence interference severity.

To minimize EMI:

- Ensure the inverter is properly grounded
- Keep DC battery cables as short as possible and routed together
- Locate the inverter away from sensitive audio, video, and radio equipment
- Use shielded cables for audio, video, and antenna connections where applicable
- Based on 5000 W rating, a 55 Amp breaker can be used: Max current load: 1.25 x 5000 W / 115 V

4.6 BUZZING OR HUMMING SOUND IN AUDIO EQUIPMENT

Some audio systems and inexpensive stereo devices may emit a buzzing or humming sound when powered from a Modified Sine Wave inverter. This occurs when the device's internal power supply does not adequately filter higher frequency harmonics present in the waveform.

This condition:

- Does not indicate a fault with the inverter
- Does not damage the audio equipment
- Is dependent on the quality of the device's internal power supply design

If objectionable noise occurs, the recommended solution is to use higher-quality audio equipment or a pure sine-wave inverter for sensitive audio applications.

SECTION 5 | Operations

5.1 CONNECTING LOADS, SWITCHING ON & SWITCHING OFF

Connecting Loads

1. Make sure that single load or the combined load requirement of your equipment does not exceed the inverter's output rating.
2. Switch OFF the inverter.
3. Switch OFF the load.
4. Plug the cord(s) from the load(s) into the AC receptacle(s) of the inverter
5. Switch ON the inverter. Wait for a few seconds.
6. The LCD showing battery voltage without fault warning that the inverter is operating normally.
7. Switch ON the load(s).

Switching ON

1. Switch OFF the load connected to the inverter. Avoid switching ON the inverter with load in ON condition.
2. Switch ON the inverter, wait for a few seconds and then switch ON the load.
3. When using high capacitive loads with inadequate inrush current limiting like cheaper quality of Compact Fluorescent Lamps (CFL) etc., wait for 10 seconds before switching ON such loads. If the inverter is switched ON with these types of loads in ON condition, the inverter may shut down or the loads may not switch ON. Sometimes, adding a small resistive load (like incandescent lamp) in parallel with such devices may prevent such shut down.

Switching OFF

1. Switch OFF the load connected to the inverter
2. Switch OFF the inverter.

External and Power Switch for ON/OFF control

Besides its Power ON/OFF switch, the inverters provide dual channel external control for switching ON or OFF of the inverters as shown in Fig 4.2 and Fig 4.3. When the Power Switch remains at OFF, the inverters can be switched ON or OFF by any of the External Switch A, External Switch B or the SMH-RC (via the RJ45 port). Note that the inverters will not switch OFF when one or more of the 3 control switches remain ON.

Remote Control Model SMH-RC (optional)

An optional wired Remote Control Model SMH-RC is available. It comes with RJ-45 cable. It can be used to Switch ON and switch OFF the inverter and also displays the operational status of the inverter using LCD. Plug the Remote Control Modular Plug into the Modular Jack. (Fig 3.1, #4). See typical installation diagram at Fig 4.1 & Fig 4.2. Refer to separate Owner's Manual provided with the Remote for further details of the remote's operation.

CAUTION!

NOTE: For switching ON and switching OFF the inverter using optional Remote Control SMH-RC, the main ON/OFF Switch on the inverter should be in OFF position. If the ON/OFF Switch on the inverter is left in ON position, the inverter cannot be switched OFF using Remote Control or external switch.

SECTION 5 | Operations

LCD Display

During operation, the inverter's monochrome LCD display provides real-time feedback on system status. The screen shows the input DC voltage in a clear digital readout to help monitor battery condition, while a bar-graph histogram visually represents the output power level, allowing the user to quickly assess loading and ensure the inverter is operating within its capacity.

5.2 UNIVERSAL CIRCUIT PROTECTION OPERATION

Most electrical tools, appliances and audio/video equipment have labels that indicate the power consumption in Amps or Watts. Ensure that the total load connected to the inverter is less than its rated output. (If a device consumption is rated in Amps AC, multiply the value by the AC Volts (115) to determine the approximate wattage). The inverter will shut down if the load exceeds its capacity.

The overload must be removed before the inverter will restart. Resistive loads are the easiest for the inverter to run. However, larger resistive loads, such as electric stoves or heaters, usually require more wattage than the inverter can deliver. Inductive loads, such as TV's and stereos, require more current to operate than do resistive loads of the same wattage rating. Induction motors, as well as some televisions, may require 2 to 6 times their wattage rating to start up. The most demanding in this category are those that start under load, such as compressors and pumps.

To restart the unit after a shutdown due to overloading, remove the cause of overload, turn the power switch OFF, wait for at least 3 minutes and then switch ON again.

5.2.1 AUTOMATIC PROTECTION FUNCTIONS

The inverter incorporates several automatic protection features to prevent damage to itself and connected loads. The sequence of operation for each protection mode is summarized below.

5.2.2 LOW DC INPUT VOLTAGE PROTECTION

The inverter monitors the DC input voltage continuously. When voltage drops due to battery discharge or cable voltage drop, the following sequence occurs:

1. **Low Voltage Alarm:**
   - Buzzer will activate when input voltage falls below 10.5 V ± 0.3 V.
   - AC output remains active, but the user should discontinue operation to avoid shutdown.

2. **Low Voltage Shutdown**
   - If voltage continues to fall and reaches 10.0 V ± 0.3 V the inverter will cut off its AC output. "Input Fault" will be displayed on the unit as well as the SMH-RC (if connected).

3. **Automatic Recovery:**
   - Alarm turns off when voltage rises above 10.8 V +- 0.3 V
   - The inverter automatically restarts when input voltage increases to 11.0 V +/- 0.3V or higher.

This condition does not damage the inverter but may damage batteries if repeatedly allowed to occur due to deep discharge.

5.2.3 HIGH DC INPUT VOLTAGE PROTECTION

If the DC input voltage rises above the inverter's safe operating range:

1. **High Voltage Shutdown:**
   - Shutdown occurs when input voltage exceeds 16.0 V ± 0.3 V
   - AC output is disabled
   - LCD displays "Input Fault"

2. **Automatic Recovery:**
   - The inverter will restore operation once voltage falls below approx. 15.5 V +/-0.3 V

High input voltage can damage internal components; therefore, operation above this range is prohibited.

5.2.4 OVER-TEMPERATURE PROTECTION AND THERMAL DERATING

The inverter is equipped with a temperature-controlled cooling system and automatic thermal protection. The internal cooling fan and temperature protection operate in the following sequence:

1. **Automatic Fan Operation:**
   - The fan turns on when internal temperature exceeds a preset threshold or when the inverter output exceeds ~3000 W.

2. **Thermal Derating:**
   - To prevent overheating, the inverter reduces its maximum AC output power linearly as temperature increases from 40 °C to its overheat threshold (~ 100 °C), output capability decreases from 5000 W to 3000 W.
   - This maintains safe internal temperatures under high load or elevated ambient conditions.

3. **Over-Temperature Shutdown:**
   - If internal temperature exceeds 100 °C, the inverter will cut off AC output while keeping the fan running

4. **Automatic Reset:**
   - The inverter will automatically restart when internal temperature drops by approximately 10 °C below the shutdown point.

5.2.5 SHORT CIRCUIT AND OVERLOAD PROTECTION

The SMH-5000 series incorporates both per-outlet protection and aggregate overload protection to prevent damage to the inverter and connected equipment.

Per-Outlet Overload Protection (SMH-5000F-12 Only)

- For the SMH-5000F-12, each NEMA 5-15R AC outlet is independently fuse-protected.
- An individual outlet will trip its fuse if the connected load exceeds ~15 A and the tripped outlet become unusable until the fuse has replaced.
- All other outlets will not be interrupted by the trip and remain operational .
- Until the fuse is reset, the inverter will be displaying "Output Fault".

Overload Protection (SMH-5000X-12 Only)

- For the SMH-5000X-12, an electronic breaker protects all NEMA 5-15R AC outlets during a trip to any of the outlet.
- An individual outlet will trip all outlets if any of the 4 outlets with load that exceeds ~15 A and all outlets will become unusable until the overload is removed (few seconds after)
- The inverter will automatically reset within seconds.
- If the overload remains connected, the outlet will repeatedly trip and thus, the inverter will reset until the excessive load is removed.
- This prevents damage to the inverter and wiring when a single device exceeds the outlet's rating.

Hardwire Protection (SMH-5000X-12/SMH-5000F-12/SMH-5000T-12)

- All models provide its hardwire connection for direct wiring rated at 5000 W
- Correct cable sizing and breaker are recommended to protect

Aggregate Output Overload and Short Circuit Protection (All Models)

- In addition to per-outlet protection, the inverter monitors total AC output power.
- The inverter enters overload protection if the combined load across all outlets and the hardwire terminal exceeds the inverter's continuous rating (5000 W).
- When an aggregate overload or short circuit is detected, the inverter will interrupt AC output.
- The unit will automatically attempt to reset within a few seconds.
- If the overload or short circuit condition is still present, the inverter will repeatedly cycle through protection resets until the total load is reduced below the rated limit.
- The buzzer will be activated during this fault as well as "Output Fault" will be displayed.

Clearing an Overload Condition

To successfully restore operation:

- Identify and remove the load(s) causing per-outlet or aggregate overload.
- Verify that the total connected load is within the inverter's 5000 W continuous rating.
- After overload is removed, the inverter will automatically resume normal operation.

5.2.6 SOFT START TECHNOLOGY

This feature offers the following advantages:

- When the inverter is switched ON, the voltage ramps up to 115 VAC in around 2 sec. If the load was already ON at the time of switching ON of the inverter, starting surge current demanded by certain reactive devices like motors etc. will be reduced and there will be less likelihood of the inverter shutting down due to overload.
- If the inverter is switched ON first and then a load with higher starting or inrush current like SMPS or motor is switched ON, the voltage will dip momentarily and will ramp up and reduce inrush / starting surge current in the load as above.
- Similar overload reduction will be initiated during any other momentary overload condition.

SECTION 6 | Protections Monitoring and Trouble-Shooting

PROTECTIONS AND MONITORING

Operating Condition/ Protection	Threshold/ Reason	LCD and inverter status	Buzzer	Remedy/Reset
Normal	-	Show input voltage and output power level.	OFF	-
Low DC Input Alarm	Below 10.5 V ± 0.3 V	Show input voltage and output power level.	ON	Check battery voltage and charge the battery.
No Output due to Low DC Input Voltage shutdown	Below 10.0 V ± 0.3 V	Show input voltage. No output power level Show "Input Fault".	ON	Reduce load to prevent battery drain soon.
No output due to High DC Input Voltage Shut Down	Above 16.0 V ± 0.3 V	Show input voltage. No output power level Show "Input Fault"	OFF	Check charger voltage. Disconnect the over voltage DC source.
No Output due to Overheating	Shutdown due to operation outside the temperature limits	Show input voltage. No output power level Show "Input Fault". Fan may continuously run.	OFF	Check fan operation. Check both vents are not blocked. Ensure unit is in a space that does not exceed temperature limits (measure at air intake of unit) and has good air ventilation. Unit will Auto-reset when it cools down.
Low output voltage due to Over Load	Output power is > Rating	Show input voltage. Show high power level.	OFF	Reduce load. Voltage recover after reduce load.
No output due to Over Load Shut Down	Output power is > Rating	Show input voltage. Discontinuous power level Show: "Output Fault"	OFF	Reduce load. Unit in continuous auto-reset.
No output due to Short Circuit Shut Down	Output power is > Surge Rating	Show input voltage. No output power level Show "Output Fault".	OFF	Turn off the inverter, check and remove the faulty load and then reset manually.
No output No power to the inverter	No DC Input Voltage due to Blown DC Input Fuse	LCD display off.	OFF	Check fuse in the 12 V battery input line.

SECTION 7 | Specifications

INVERTER PARAMETER	SMH-5000F-12	SMH-5000T-12	SMH-5000X-12
INPUT			
BATTERY SYSTEM VOLTAGE	12 VDC		
NOMINAL INPUT VOLTAGE	12.5 VDC		
INPUT VOLTAGE RANGE	Between 10.0 +/- 0.3 VDC and 16.0 +/- 0.3 VDC		
INPUT CURRENT AT CONTINUOUS POWER	500 A		
INPUT/IDLE CURRENT AT NO LOAD	<0.9 A		
OUTPUT			
OUTPUT VOLTAGE WAVE FORM	Modified Sine Wave		
OUTPUT VOLTAGE	115 VAC		
OUTPUT FREQUENCY	60 Hz ± 5%		
OUTPUT POWER, CONTINUOUS (RESISTIVE LOAD)	5000 W		
OUTPUT POWER, SURGE (<1 SEC., RESISTIVE LOAD)	10000 W		
PEAK EFFICIENCY	>90%		
PROTECTIONS			
LOW INPUT VOLTAGE ALARM	10.5 VDC ± 0.3 VDC (Auto-reset)		
LOW INPUT VOLTAGE SHUTDOWN	10.0 VDC ± 0.3 VDC (Auto-reset)		
HIGH INPUT VOLTAGE SHUTDOWN	16.0 VDC ± 0.3 VDC (Auto-reset)		
OUTPUT SHORT CIRCUIT AND OVERLOAD SHUT DOWN	Yes. Auto-reset.		
OVER TEMPERATURE SHUTDOWN	Auto-reset when cools down		
COOLING FAN	Smart controlled by temperature and loading		
DC INPUT FUSE	User to install externally		
CONNECTIONS			
DC INPUT CONNECTIONS	2x 8.5mm diameter hole per each terminal		
AC OUTPUT - NO. OF NEMA5-15R RECEPTACLES	4 (independent fused)	--	4
AC OUTPUT – HARDWIRE TERMINAL	YES		
REMOTE CONTROL PORT	YES		
EXTERNAL ON/OFF SWITCH PORT	YES		
GENERAL			
SAFETY COMPLIANCE	Intertek - ETL listed. Conforms to UL Standard UL 458, and certified to CSA std. C22.2 No. 107.1		
OPERATING TEMPERATURE RANGE	-25 °C to +50 °C (-13 °F to 122 °F); Output derated above 40 °C (104 °F)		
OPERATING HUMIDITY	< 80 %		
CHASSIS BONDING	Chassis bonded to AC socket/ terminal ground		
DIMENSIONS (W X D X H) MM DIMENSIONS (W X D X H) INCHES	230 x 345 x 134 mm 9.05" x 13.6" x 5.3" in		
Weight, KG / LBS	6.5 kg / 14.33 lbs		

NOTE: Specifications are subject to change without notice.

SECTION 8 | WARRANTY

2 YEAR LIMITED WARRANTY

The SMH-5000F-12, SMH-5000T-12 and SMH-5000X-12 inverters are manufactured by Samlex America Inc. (the "Warrantor") are warranted to be free from defects in workmanship and materials under normal use and service. The warranty period is 2 years for the United States and Canada, and is in effect from the date of purchase by the user (the "Purchaser").

Warranty outside of the United States and Canada is limited to 6 months. For a warranty claim, the Purchaser should contact the place of purchase to obtain a Return Authorization Number.

The defective part or unit should be returned at the Purchaser's expense to the authorized location. A written statement describing the nature of the defect, the date of purchase, the place of purchase, and the Purchaser's name, address and telephone number should also be included.

If upon the Warrantor's examination, the defect proves to be the result of defective material or workmanship, the equipment will be repaired or replaced at the Warrantor's discretion without charge, and returned to the Purchaser at the Warrantor's expense. (Contiguous US and Canada only)

No refund of the purchase price will be granted under any condition. The Purchaser's sole and exclusive remedy under this warranty is the repair or replacement of the defective unit as determined by the Warrantor. The Warrantor will not provide refunds or credits under this warranty. Replacement units may be new or refurbished at the Warrantor's discretion. Any attempt to remedy the defect by anyone other than the Warrantor shall render this warranty void. There shall be no warranty for defects or damages caused by improper installation or hook-up, abuse or misuse of the equipment including exposure to excessive heat, salt or fresh water spray, or water immersion.

No other express warranty is hereby given and there are no warranties which extend beyond those described herein. This warranty is expressly in lieu of any other expressed or implied warranties, including any implied warranty of merchantability, fitness for the ordinary purposes for which such goods are used, or fitness for a particular purpose, or any other obligations on the part of the Warrantor or its employees and representatives.

There shall be no responsibility or liability whatsoever on the part of the Warrantor or its employees and representatives for injury to any persons, or damage to person or persons, or damage to property, or loss of income or profit, or any other consequential or resulting damage which may be claimed to have been incurred through the use or sale of the equipment, including any possible failure of malfunction of the equipment, or part thereof. The Warrantor assumes no liability for incidental or consequential damages of any kind.

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