

# SURESINE-300

300 Watt Pure Sine Wave Inverter

## *Installation and Operation Manual*



<b>Model</b>	<b>DC Input</b>	<b>AC Output</b>
SI-300-115V	12 Vdc	115 V @ 60 Hz
SI-300-220V	12 Vdc	220 V @ 50 Hz



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# 1.0 Safety Notes

## IMPORTANT SAFETY INSTRUCTIONS SAVE THESE INSTRUCTIONS

This manual contains important safety, installation and operating instructions for the Morningstar SureSine-300 Inverter.

The SureSine produces voltages and currents capable of causing severe injury or death. Extreme caution must be taken when installing and using the SureSine.

The following symbols are used throughout this manual to indicate potentially dangerous conditions or important safety instructions.



**WARNING:** Indicates a potentially dangerous condition.



**CAUTION:** Indicates a critical procedure for safe and proper operation of the SureSine. Use extreme caution when performing this task.

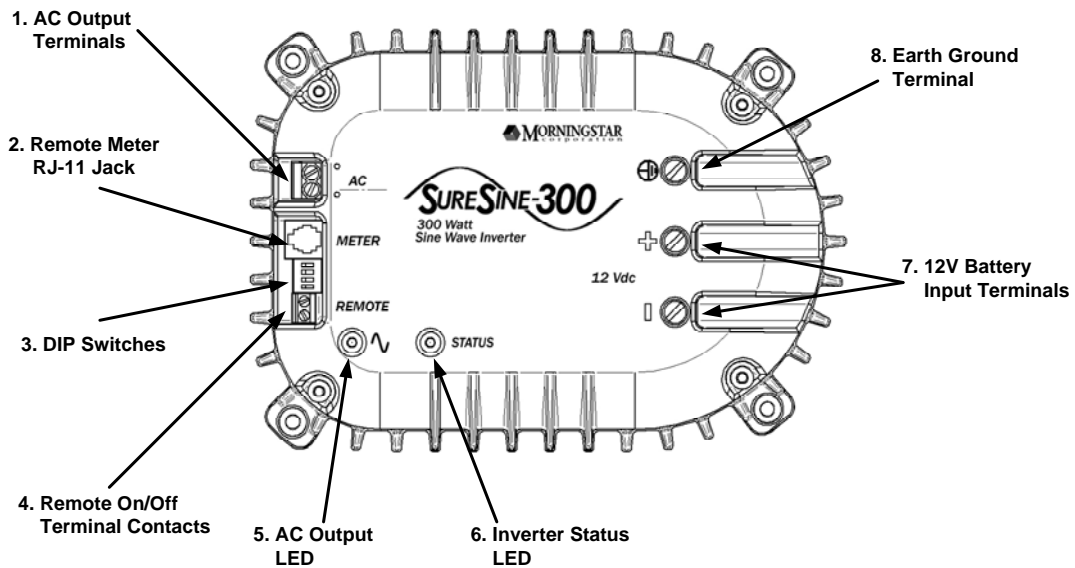


**NOTE:** Indicates a procedure or function that is important to the safe and proper operation of the SureSine Inverter.

### General Safety Information

- Read all of the instructions and cautions in the manual before starting the installation.
- Ensure that battery power has been disconnected **BEFORE** installing, servicing, or removing the SureSine Inverter.
- Do not allow water to enter the SureSine.

## 2.0 Overview



**Figure 1**

**1. AC Output Terminals** – Wiring location for AC output

**2. Remote Meter Jack** – Communication port for Morningstar Remote Meter or PC Communications\*\*.

**3. DIP Switches** – Four switches to adjust operating parameters

**4. Remote On/Off Contacts** – Connection points for remote On/Off switch or jumper wire

**5. AC Output LED** – Displays operating status of AC output

**6. Inverter Status LED** – Displays operating status of the SureSine

**7. 12V Battery Input Terminals** – Wiring location for 12V lead-acid battery input

**8. Earth Ground** – Wiring location for earth grounding or chassis grounding

\*\* Adapter required, not included. See Morningstar website for more details.

## 3.0 Installation

### Required Tools:

- Wire cutters / strippers
- Drill and 1/8" (3 mm) drill bit
- Philips and Flat-head screw drivers

### Required Parts (not included):

- 3A AC in-line fuse
- 100A DC in-line fuse
- Toggle switch (if remote switch is used)

## STEP 1 - Mounting



**CAUTION - To prevent fire, do not mount in zero-clearance compartment. Overheating may result.**

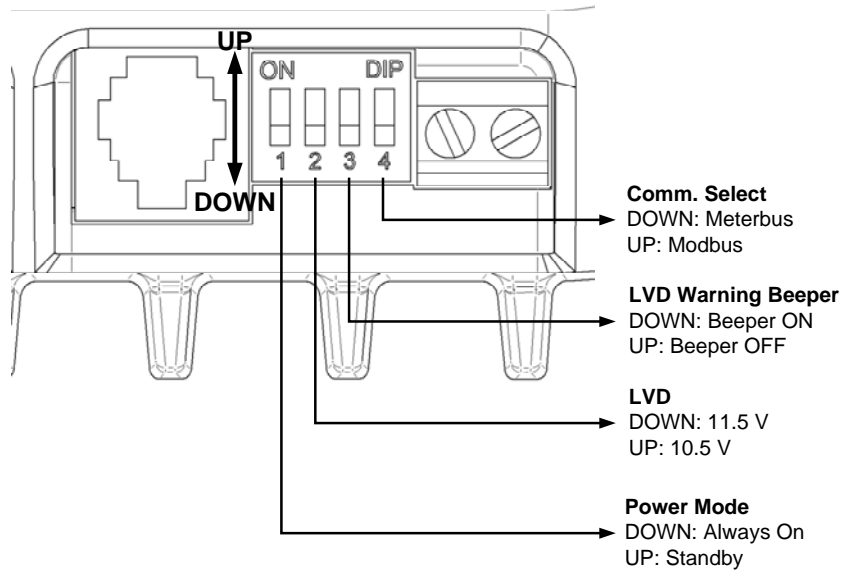
Locate the SureSine on a surface that is protected from direct sun, high temperatures, corrosive fumes, and water. SureSine may be mounted horizontally on a flat surface (like a table) or vertically (on a wall). Do not install in a confined area where battery gasses can accumulate.

Place the SureSine on the surface where it will be mounted and determine where the wires will enter/exit. Be sure there is sufficient bending room for the wires and other auxiliary connections. Verify that the mounting screws will not penetrate wires or other objects located on the opposite side of the surface. With a pencil or pen, mark the mounting hole locations

With a drill and 1/8" (3 mm) bit, drill pilot holes for each of the four mounting screw locations marked on the mounting surface.

Place the SureSine onto the surface and align the mounting feet holes with the four pilot holes. Use the included #10 screws to secure the SureSine to the surface.

## STEP 2 – Setup



**Figure 2 DIP Switch Functions**

### DIP Switch 1 - Power Mode

Select the desired power mode. In the *Always ON* mode, the inverter provides continuous AC output. *Standby* mode is an energy saving mode. When an AC load greater than 8W is detected, the AC Output is automatically turned on. When the total load falls below 8 Watts, the AC Output is automatically turned off to conserve energy. Loads are detected in one (1) second or less.

Down Position: Always ON (factory default)

Up Position: Standby Mode

### DIP Switch 2 – Low Voltage Disconnect

Select the *Low Voltage Disconnect* (LVD) and *Reconnect* (LVR) setpoints.

Down Position: LVD = 11.5V, LVR = 12.6V (factory default)

Up Position: LVD = 10.5V, LVR = 11.6V

### DIP Switch 3 – LVD Warning Beeper

Enable or disable the LVD audible *Warning Beeper*.

Down Position: Beeper Warning ON

Up Position: Beeper Warning OFF

### DIP Switch 4 – Communications Select

Specify the desired RJ-11 communication protocol. Select *Meterbus* for Morningstar remote meters and other Morningstar products. Select *Modbus* protocol for PC communications. An adapter is required (not included)

Down Position: Morningstar Meterbus (factory default)

Up Position: Modbus Protocol

## STEP 3 - AC Wiring

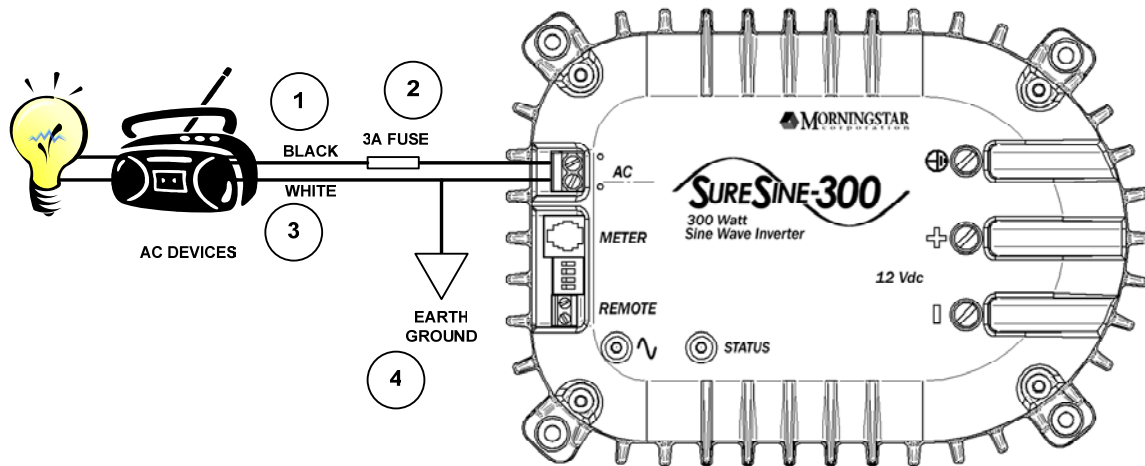


Figure 3 AC Wiring Diagram



**WARNING:** Complete all AC wiring **BEFORE** connecting a battery to the DC input to avoid contact with AC voltage.



**WARNING:** Risk of electric shock. Use only approved GFCI receptacle models listed on page 16 of this manual. Other types may fail to operate properly when connected to this unit.



**WARNING:** If installing in a recreational vehicle, a ground-fault interrupter receptacle must be installed to protect all branch circuits.



**CAUTION:** AC loads should not exceed 300W continuous (600W surge). Exceeding these ratings could damage the inverter. Observe AC output voltage and frequency markings on the SureSine. Be sure AC loads are compatible to avoid damage to loads and/or inverter.



**NOTE:** The AC output is isolated, therefore AC line and neutral are interchangeable. Use UL Listed 12AWG (4 mm<sup>2</sup>) black wire for *AC Line* and UL Listed 12AWG (4 mm<sup>2</sup>) white wire for *AC Neutral*. The earth grounded leg defines *AC Neutral*.

AC power cables are not supplied. Use the appropriate wire color for each AC connection as shown in figure 3.

1. Wire a UL Listed 12AWG (4 mm<sup>2</sup>) black AC Line wire to AC loads or distribution panel as shown in figure 3.
2. Insert a 3A in-line fuse in the AC Line wire as shown in figure 3.
3. Connect the AC Neutral wire to the AC device(s) or terminate at a distribution panel using UL Listed 12 AWG (4 mm<sup>2</sup>) white wire.
4. Wire the white AC Line wire to earth ground with UL Listed 12 AWG green wire. Check local code for appropriate earth grounding requirements.

## STEP 4 - Remote On/Off Switch

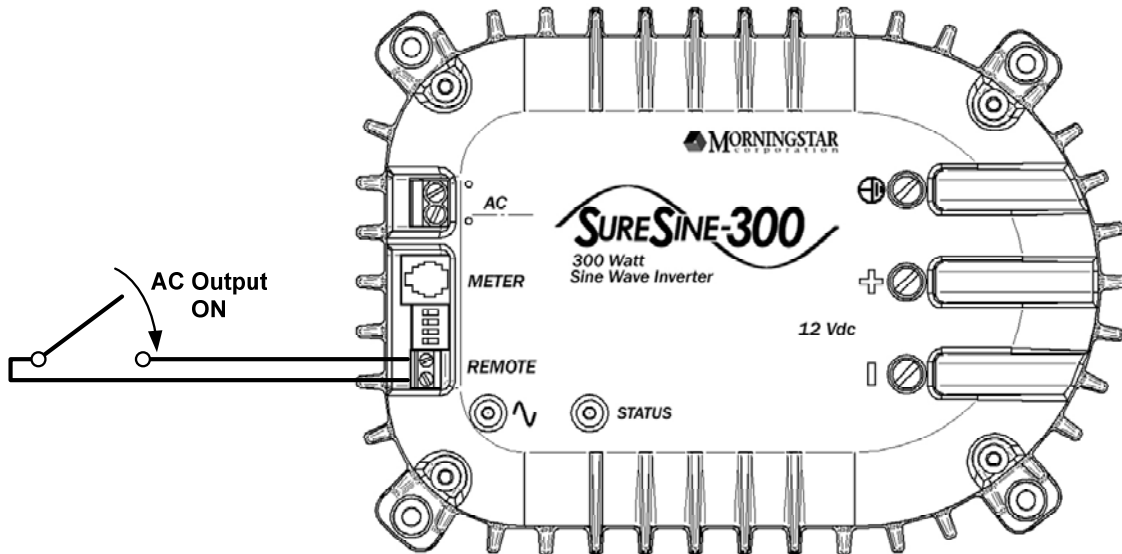


Figure 4 Remote On/Off Wiring Diagram



**NOTE:** If a Remote On/Off switch is not desired, install a jumper across the Remote On/Off terminals to fix AC output on (or in standby mode). A jumper is taped to the SureSine Lid for convenience.



**CAUTION:** All low voltage conductors must be rated to 300V minimum

A remote switch can be installed to switch the SureSine AC output on/off from a remote location allowing the SureSine to be installed in an inaccessible location or enclosure. A single-pole, single-throw switch (SPST) is required (not included).

1. Using a small gauge wire (max. 1.0 mm<sup>2</sup> or 16 AWG, 300V min.), wire one terminal of the Remote On/Off terminal block to one end of a SPST switch.
2. From the other contact on the switch, wire another small gauge wire to the remaining open terminal on the Remote On/Off terminal block.



## STEP 5 - DC Wiring



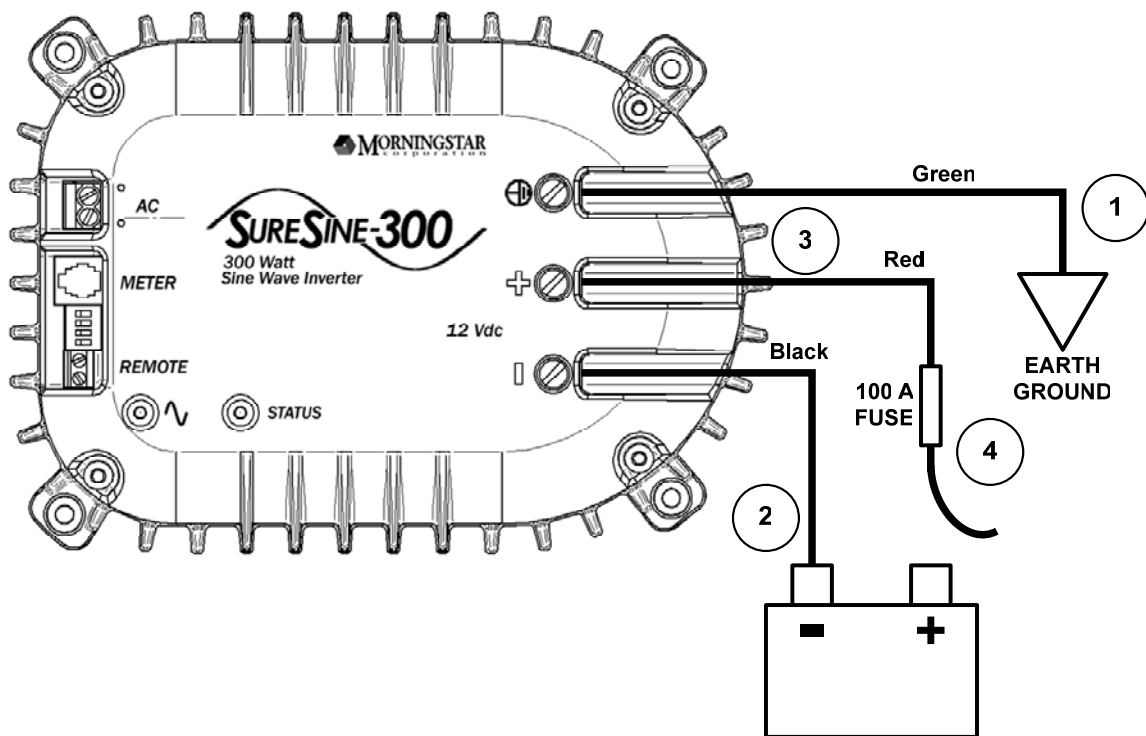
**CAUTION: DO NOT CONNECT THE BATTERY TO THE SURESINE ON THIS STEP!**



**CAUTION: Use nominal 12Vdc input only. Exceeding the 15.5V maximum input voltage may damage the inverter.**



**CAUTION: Use UL Listed wire only. The Earth Ground conductor (green) must be larger gauge than DC wiring.**



**Figure 5 DC Wiring Diagram**

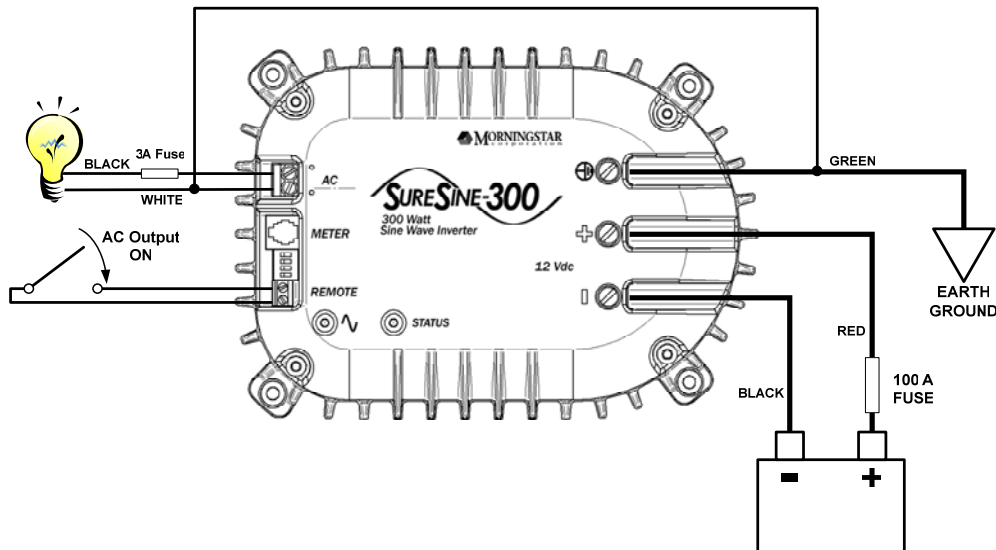
DC power cables are not supplied. Use UL Listed wire only; rated for the voltage, current, and wire length needed for the system. Minimum wire gauges have been recommended. Use the appropriate wire color for each DC connection as shown in figure 5.

For safety, wire in the following order:

1. Wire Earth Ground as shown in Figure 5 using UL Listed 4 AWG (25 mm<sup>2</sup>) or larger green wire. The Earth Ground conductor must be larger than the battery power conductors.
2. Wire 12V battery negative to the negative DC input terminal using UL Listed 6 AWG (6 mm<sup>2</sup>) or larger black wire.

3. Connect the 12V battery positive cable (red) to the DC input positive terminal on the SureSine using UL Listed 6 AWG (6 mm<sup>2</sup>) or larger red wire.
4. Wire an in-line fuse in the positive battery cable (red) no further than 12" (305 mm) from the Battery positive post. Do not connect the battery positive cable to the battery at this time.

## STEP 6 - Check Wiring and Power Up



**Figure 6 Complete System Wiring Diagram**

1. Review steps 2 through 5. Double-check all wiring and connections.
2. Verify that the battery is wired with correct polarity to the SureSine.
3. Connect the Battery + cable (red) to the positive battery post.



**WARNING:** Connecting the battery to the SureSine will cause a spark at the point of connection. There is a RISK OF EXPLOSION in hazardous areas or locations where explosive gases have accumulated.

4. The SureSine *STATUS LED* should turn on Solid Green indicating successful start-up and no faults.
5. If the jumper is installed or the *Remote On/Off* contacts are closed, the *AC Output LED* will turn on Solid Green after a few seconds delay. If jumper is removed or the contacts are open, the *AC Output LED* will remain off.



**Note:** In Standby Mode, the *AC Output LED* will turn on for a few seconds after start-up. If no AC load exists, the SureSine will transition to Standby Mode and the *AC Output LED* will blink Green.

## 4.0 Operation

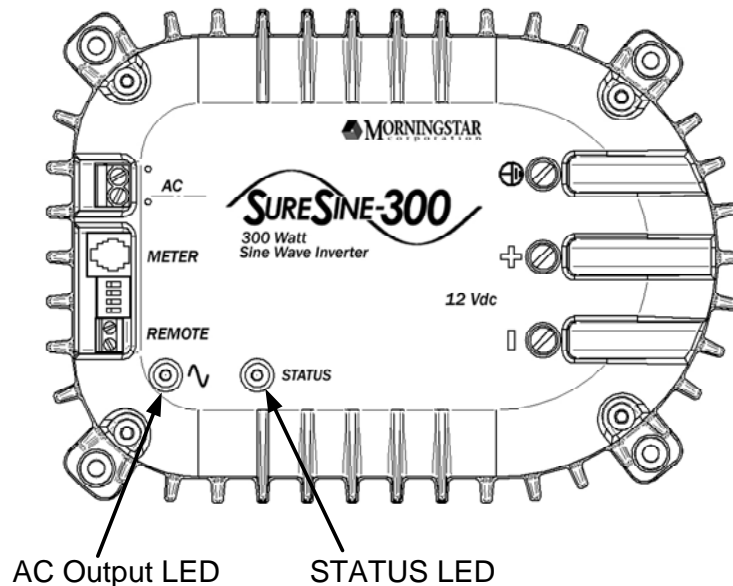
### 4.1 On/Off/Standby Modes

**On** – AC output always on unless the battery is too low or a fault exists

**Off** – AC output off

**Standby** – The AC output will remain off until an AC load greater than 8 Watts is detected. When the AC load falls below 8 Watts, the AC output is turned off.

### 4.2 LED Indications



**Figure 7 LED Identification**

AC Output LED	STATUS LED	Operation or State
OFF	OFF	No power or Battery below 9.5V
OFF	GREEN	AC Output OFF
GREEN	GREEN	AC Output ON
GREEN (BLINK)	GREEN	AC Standby Mode
RED (BLINK)	GREEN	Low Voltage Disconnect (LVD) Warning
RED	GREEN	LVD
RED	RED	Inverter or System Fault *
OFF	RED	Inverter or System Fault *

\* Refer to section 5.0 *Protections* for more information concerning faults

## 5.0 Protections

**5.1 Low Voltage Disconnect (LVD)** – The SureSine will disconnect AC Output when the battery discharges below the LVD setpoint (after a four minute delay). AC Output will resume when the battery has recharged to Low Voltage Reconnect (LVR) setpoint. The LVD/LVR thresholds are adjustable using DIP switch 2. See the *Installation, Step 2* section for details.

Audible LVD Warnings:

The SureSine will beep four (4) times when the battery discharges to the LVD Warning threshold voltage. The SureSine will beep twice when Low Voltage Disconnect occurs. The LVD Warning occurs 0.3V above the selected LVD threshold.

**5.2 High Voltage Disconnect (HVD)** – The SureSine will shut down and disconnect AC Output if battery voltage exceeds 15.5V. Automatic reconnection when battery voltage decreases to 14.5V.

**5.3 High Temperature Disconnect (HTD)** – If the SureSine heatsink temperature rises above 95°C, an HTD fault will occur and the SureSine will disconnect the AC Output. Normal operation will automatically resume when the heatsink cools to 80°C.

**5.4 Over-current Protection** – Full electronic protection against AC overloads. Fully automatic reconnect after 10 seconds.

**5.5 Short Circuit** – Full protection against short circuits on AC Output. Three (3) automatic retries every 10 seconds. If a short circuit still persists after three (3) retries, the fault must be manually cleared in one of the following ways:

1. Turn the remote switch off, then on (or disconnect/reconnect jumper)
2. Disconnect, then reconnect battery power.

**5.6 Reverse Polarity** – Protected by fuses against reverse battery connection. Fuses must be replaced to resume normal operation. (see section 6.3 for fuse replacement instructions)

## 6.0 Maintenance

### 6.1 General Care

- The SureSine should be mounted in a location out of direct sunlight with plenty of airflow for proper cooling.
- The exterior surfaces can be cleaned with a damp cloth as needed.
- Do not apply power if the SureSine case is cracked or damaged.

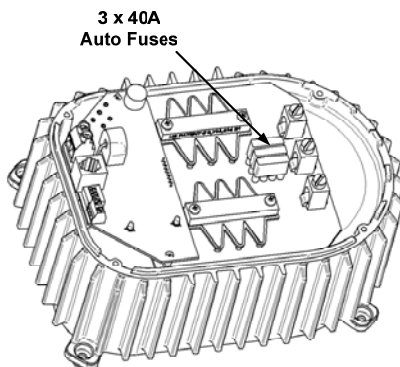
### 6.2 Annual Inspection

1. Tighten all terminals to avoid resistive connections.
2. Check all system fuses.
3. Inspect for broken wires, frayed wire insulation, and corroded conductors.
4. Inspect for dirt, insects, nests. Clean if necessary.
5. Check that the LED indicators match the system and inverter conditions at that time (see section 4.0 – LED Indications for details).
6. Open and close the *Remote ON/OFF* contacts. Verify that the AC Output properly switches on and off.

### 6.3 Fuse Replacement

If the SureSine does not function properly, there is a possibility of a blown fuse caused by DC reverse polarity or over-current. To check the fuses:

1. Disconnect the *Battery+* connection from the battery.
2. Disconnect all wire connections to the SureSine
3. Using a Philips screwdriver, remove the four screws that secure the plastic lid and carefully remove the lid.
4. See diagram below for fuse location. Inspect each of the three (3) fuses. Blown fuses will have a damaged filament.
5. Replace fuses as needed. **Replacement fuses should be 40A rated quick-blow automotive type fuses only.**
6. Replace lid and secure with the four screws.
7. Reconnect wire connections per the installation instructions in Section 3.0



**CAUTION: Replace lid before reconnecting power. DO NOT OPERATE INVERTER WITHOUT LID. Serious injury may result!**

**Figure 8 Fuse Location**

## **7.0 Warranty**

The SureSine-300 is warranted to be free from defects in material and workmanship for a period of TWO (2) years from the date of shipment to the original end user. Morningstar will, at its option, repair or replace any such defective products.

### **CLAIM PROCEDURE**

Before requesting warranty service, check the Operator's Manual to be certain that there is a fault with the SureSine. Return the defective product to your authorized Morningstar distributor with shipping charges prepaid. Provide proof of date and place of purchase. To obtain service under this warranty, the returned products must include the model, serial number and detailed reason for the failure. This information is critical to a rapid disposition of your warranty claim. Morningstar will pay the return shipping charges if the repairs are covered by the warranty.

### **WARRANTY EXCLUSIONS AND LIMITATIONS**

This warranty does not apply under the following conditions:

- Damage by accident, negligence, abuse or improper use.
- Unauthorized product modification or attempted repair
- Damage occurring during shipment

THE WARRANTY AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE AND IN LIEU OF ALL OTHERS, EXPRESS OR IMPLIED. MORNINGSTAR SPECIFICALLY DISCLAIMS ANY AND ALL IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. No Morningstar distributor, agent or employee is authorized to make any modification or extension to this warranty.

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## 8.0 Technical Specifications

	SI-300-220V	SI-300-115V
<b>Electrical</b>		
AC Output Voltage (RMS)	220V +/- 10%	115V +/- 10%
Nominal Power Rating	300 Watts @ 25°C	300 Watts @ 25°C
Peak Power Rating	600 Watts @ 25°C (15 min)	
DC Input Voltage	10.0V – 15.5V	
Self Consumption (AC Output OFF)	25 mA	
Self Consumption (AC Output ON)	450 mA	
AC Output Frequency	50 Hz +/- 0.1%	60 Hz +/- 0.1%
Peak Efficiency	91%	92%
Total Harmonic Distortion (THD)	< 4 %	
Waveform	Pure sine wave	
<b>Environmental</b>		
Operating Temperature Range	-40°C to +45°C	
Storage Temperature	-40°C to +85°C	
Humidity	100% Non-condensing	
Enclosure	Type 1 (Indoor Only)	
<b>Setpoints</b>		
Low Voltage Disconnect	11.5 V / 10.5 V	
Low Voltage Reconnect	12.6 V / 11.6 V	
LVD Warning Threshold (buzzer)	11.8 V / 10.8V	
LVD Delay Period	4 minutes	
Instant LVD	10 V	
High Voltage Disconnect	15.5 V	
High Voltage Reconnect	14.5 V	
Standby On Threshold	~ 8 Watts	~ 10 Watts
Standby Off Threshold	~ 8 Watts	~ 10 Watts
High Temperature Disconnect	95°C (heatsink)	
High Temperature Reconnect	80°C (heatsink)	
<b>Data Communications</b>		
RJ-11 Connection	Morningstar Meterbus / Modbus 16-bit RTU **	
<b>Mechanical</b>		
Dimensions	213 x 152 x 105 mm / 8.4 x 6.0 x 4.1 in	
Weight	4.5 Kg / 10.0 lbs	
Enclosure Rating	IP20	
AC Terminals:		
Wire Size	up to 4 mm <sup>2</sup> / up to 12 AWG	
Torque	0.80 Nm / 7.0 in-lb	
DC Terminals:		
Wire Size	2.5 to 35 mm <sup>2</sup> / 14 to 2 AWG	
Torque	5.65 Nm / 50 in-lb	
Remote On/Off Terminals:		
Wire Size	0.25 to 1.0 mm <sup>2</sup> / 24 to 16 AWG	
Torque	0.40 Nm / 3.5 in-lb	



MS-ZMAN-SI-EN-A (Oct 06)

## Approved GFCI Receptacles

<b>Manufacturer</b>	<b>Model</b>
Cooper - Eagle	XGF15
Cooper - Eagle	XGF20
Leviton	8598
Leviton	8599
Leviton	8898
Leviton	8899

For product and purchase inquiries contact:

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