

GenStar MPPT™ Functional Testing Procedure

Operational Verification
v01



Abstract:

This document outlines the procedure for verifying correct operation of the GenStar MPPT controller.

All GenStar MPPT units are subject to calibration and functional testing at the factory before shipment. This procedure assumes the same.



CAUTION:

The following outlined procedures assume a basic working knowledge of electrical circuits. Exercise the necessary precautions when dealing with live electrical circuits present in solar energy systems.

1.0 Tools and Equipment Required

- 12, 24, or 48V battery bank
- Solar panel/array, or other power supply input greater than battery voltage - see Section 8B(1) for specific recommendations.
- Small DC load (<2A) - **DO NOT** connect motors, compressors, inverters, or pumps to load terminals.
- Multi-meter
- Clamp-type DC ammeter

2.0 System Information

Record system specifications in the table below:

System voltage (12, 24 or 48V)	
Array open-circuit voltage (Voc)	
System grounding (+) or (-)	
Solar module make and model	
# of modules (per controller)	
Total array wattage (per controller)	
Load current (or Wattage)	
Load description (application)	

3.0 Visual Inspection

Examine terminals and casings for any signs of water damage, excessive heat, burning, loose components or infestation - note details for technical support.

4.0 Pre-Startup Measurements – no connections to the GenStar

If any of the following measurements are out of tolerance, contact Morningstar Technical Support for assistance.

- A) Measure the resistance between both negative (-) terminals. Resistance should be < 0.5 ohms.
- B) Measure the resistance between battery (+) and negative (-) terminals on GenStar. Confirm no short-circuit (zero ohm reading).
- C) Measure the resistance between solar (+) and negative (-) terminals on GenStar. Confirm no short-circuit (zero ohm reading).
- D) Measure the resistance between load (+) and negative (-) terminals on GenStar. Confirm no short-circuit (zero ohm reading).
- E) Measure the resistance between load (+) and battery (+) terminals on GenStar. Confirm no short-circuit (zero ohm reading).
- F) Measure the resistance between load (+) and solar (+) terminals on GenStar. Confirm no short-circuit (zero ohm reading).
- G) Measure the resistance between battery (+) and solar (+) terminals on GenStar. Confirm no short-circuit (zero ohm reading).

5.0 Startup Measurements

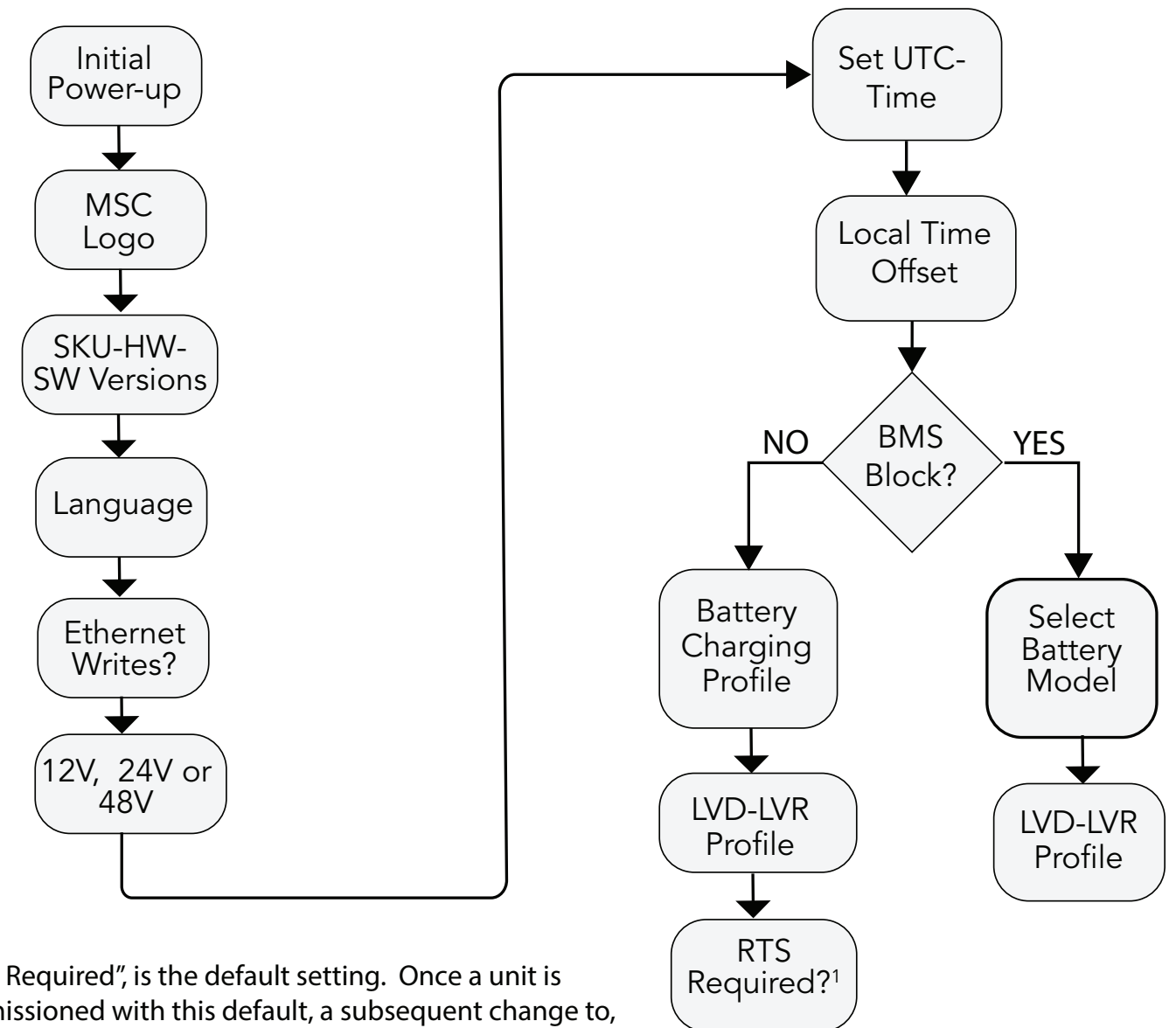
- A) Measure the DC voltage across the battery bank and record in 5(A) of Appendix
- B) Observing correct polarity, connect 12, 24 or 48V battery bank (or a 12, 24, or 48V regulated power supply) to the GenStar battery (+) and negative (-) terminals.
- C) Charge Status LED will illuminate solid green for approx. 3 seconds and then turn OFF. Next, the battery SOC LED will cycle green-yellow-red one time indicating proper boot up. The LEDs will then settle on any combination of G, G/Y, Y, Y/R, R depending on battery voltage. **NOTE: At least one of the Battery Status LEDs should be ON, and the green Charging Status LED should be OFF.** LCD display will turn ON, and briefly display model number, serial number, and hardware and firmware versions.
- D) Measure DC voltage across the GenStar battery (+) and negative (-) terminals, and record in 5(D) of Appendix. 5(A) and 5(D) readings should match.
- E) Measure DC voltage across the GenStar solar (+) and negative (-) terminals and record in 5(E) of Appendix. This reading should be less than 1 Volt. If the green Charging Status LED is ON, or battery voltage is measured at solar terminals, the input FETs are damaged and the unit will not

properly regulate battery voltage: FAILURE.

F) If the GenStar unit has not yet been commissioned, proceed to Section 6 - Commissioning. After commissioning, measure DC voltage across the GenStar load (+) and negative (-) terminals, and record in 5(F) of Appendix. This reading should be very close to the GenStar battery terminal voltage reading recorded in 5(D).

6.0 Commissioning

Use the meter display to complete the commissioning process as seen below. Then follow the display prompts to reboot the GenStar.



¹ "RTS Required", is the default setting. Once a unit is commissioned with this default, a subsequent change to, "RTS not required", necessitates that the unit be re-commissioned via a Factory Reset using the local meter - Installer Setup\Commands\Factory Reset.

7.0 Load Verification

NOTE: Load terminal use is optional

A) Re-check DC voltage across the GenStar load (+) and negative (-) terminals. This reading should match 5(F), and be approximately equal to battery voltage in 5(A)(D).

B) With the load breaker or fuse holder OPEN, and observing correct polarity, connect small 12V-2A test load(s) set to OFF. Use one 12V test load in series for each 12V of system voltage, e.g., use 2-12V test loads for a 24V system.

C) CLOSE the load breaker, or insert the fuse, and verify that the load(s) power ON. With the load(s) ON, measure the voltage at the GenStar load terminals; then measure the voltage at the GenStar battery terminals. Record these two readings in Appendix - 7(C). These readings should be very close to each other. If the load voltage is greater than 0.25V lower than the battery voltage, the LVD FETs are damaged: FAILURE.

D) Turn OFF the load(s), or OPEN the load circuit

8.0 Charging Verification

A) If field-testing with a solar array, measure the array open-circuit voltage, and record the reading in 8(A) of Appendix. This voltage must be greater than battery voltage in 5(A)(D), and a maximum of 200 Volts. This reading should match that of the system specification section.

Follow (B) Array OR B(1) Power Supply

B) With an OPEN solar breaker or fuse holder, and observing correct polarity, connect the solar array to the GenStar solar (+) and negative (-) terminals. CLOSE the solar breaker or INSERT the fuse. **GO TO (C)**

B(1) Depending on system voltage, adjust a regulated power supply to 20, 40 or 80 VDC - for 12, 24, or 48V nominal systems, respectively. Turn OFF the power supply and then, observing correct polarity, connect the power supply leads to the GenStar solar (+) and negative (-) terminals. Turn ON the power supply. **GO TO (C)**

C) If the battery is not charged, Charging Status LED should light solid green with heartbeat off every five seconds. At least one of the battery SOC LEDs should be ON, but any combination of flashing indicates a fault. See product manual Section 7 - Troubleshooting - for details.

D) Measure DC voltage across GenStar battery (+) and negative (-) terminals and record in 8(D) of Appendix. If the battery is not charged, the GenStar meter will indicate, "Bulk". If the battery has reached regulation voltage, the GenStar meter will indicate, "Absorption".

E) Measure DC voltage across GenStar solar (+) and negative (-) terminals and record in 8(E) of Appendix. Charging is indicated if this reading is V_{mp} , or ~70-80% of V_{oc} . Regulation is indicated if this reading is the array open-circuit voltage, AND Charging Status LED is blinking at 1Hz.

F) Using a clamp-type DC ammeter, measure battery cable current, and record in 8(F) of Appendix.

G) Check battery charging current seen in GenStar display, and record in 8(G) of Appendix. This value should match the 8(F) reading.

9.0 Power-down

A) Disconnect solar array from GenStar

B) Disconnect battery from GenStar

C) Disconnect load from GenStar

**IN CASE OF ANY FAILURE IN PERFORMANCE VERIFICATION, CONSULT
PRODUCT OPERATOR'S MANUAL, OR MORNINGSTAR TECHNICAL SUPPORT.**

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APPENDIX - TEST READINGS

5(A) Battery bank voltage:

5(D) GenStar battery terminal voltage:

5(E) GenStar solar terminal voltage:

5(F) GenStar load terminal voltage:

7(C) GenStar [loaded] load terminal voltage:

GenStar [loaded] battery terminal voltage:

8(A) Solar array open-circuit voltage:

8(D) GenStar battery voltage:

8(E) GenStar solar terminal voltage:

8(F) Measured battery charging current:

8(G) GenStar display battery charging current: