Technical Documentation

SunGuard Functional Testing Procedure

Operational Verification

v01

Abstract:

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

All SunGuard 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.

NOTE: Due to the fabrication process of the SunGuard controller, an exact damaged component may not be evident. It may only be possible to determine if the unit is functioning properly. However, other factors may be apparent that will assist the technician in determining the cause of the failure.

NOTE: Due to the lack of terminals on the SunGuard controller, voltage and resistance measurements will be taken on exposed SunGuard leads and on the exposed solar and battery wire connection junctions with the SunGuard leads. Be sure to safely insulate and any wire splices or other connections after testing.

1.0 Tools and Equipment Required

- 12 battery bank
- Solar panel/array, or power supply input greater than battery voltage - see Section 6B(1) for specific recommendations.
- Small DC load (<2A). Loads are connected to battery terminals
- Multi-meter
- Clamp-type DC ammeter

2.0 System Information

Record system specifications in the table below:

System voltage	**12 Volt ONLY**
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 wiring connections and casing 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 SunGuard

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

A) Measure the resistance between both negative (-) leads. Resistance should be < 0.5 ohms.

B) Measure the resistance between battery (+) and negative (-) leads on SunGuard. Confirm no short-circuit (zero ohm reading).

C) Measure the resistance between solar (+) and negative (-) leads on SunGuard. Confirm no short-circuit (zero ohm reading).

D) Measure the resistance between battery (+) and solar (+) leads on SunGuard. 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, and with battery voltage above 6 Volts, connect a 12V battery bank to the SunGuard battery (+) and negative (-) leads.

C) Measure DC voltage across the SunGuard battery (+) and negative (-) leads, and record in 5(C) of Appendix. 5(A) and 5(C) readings recorded in Appendix should match.

D) Measure DC voltage across the SunGuard solar (+) and negative (-) leads, and record in 5(D) of Appendix. Measure the voltage at the Solar (PV) leads. This voltage should be less than -1.5 VDC (negative due to the diode drop across the input FETs). If battery voltage is measured, the input FETs are damaged and the unit will not properly regulate battery voltage.

6.0 Charging Verification

A) If field-testing with a solar array, measure the array open-circuit (Voc) voltage, and record the reading under 6(A) of Appendix. This voltage must greater than battery voltage in 5(A)(C), and a maximum of 30 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, and observing correct polarity, connect the solar array to the SunGuard solar (+) and negative (-) leads. CLOSE the solar breaker or INSERT the fuse. **GO TO (C)**

B(1) Adjust a regulated power supply to 20 Volts, then turn OFF the power supply. Observing correct polarity, connect the power supply leads to the SunGuard solar (+) and negative (-) leads. Turn ON

the power supply. **GO TO (C)**

C) Measure DC voltage across the SunGuard battery (+) and negative (-) leads and record in 6(C) of Appendix.

D) Measure DC voltage across the SunGuard solar (+) and negative (-) leads and record in 6(D) of Appendix. If the battery is not fully charged, the voltage across the solar leads should be the same as the voltage across the battery leads in 6(C)

E) If the batteries are charged, there will be a voltage difference between the solar (+) and battery (+). If your multi-meter has a frequency measurement setting, a 300Hz AC signal should also be measured between the solar (+) and battery (+). The duty cycle of this signal provides a rough indication of the battery state-of-charge. A lower duty-cycle indicates a higher state of charge.

F) Using clamp-type DC ammeter, measure battery cable current, and record in 6(G) of Appendix.

7.0 Power-down

A) Disconnect solar array from SunGuard

B) Disconnect battery from SunGuard

C) Disconnect load from battery

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(C) SunGuard battery leads voltage:

5(D) SunGuard solar leads voltage:

6(A) Solar array open-circuit voltage:

6(C) SunGuard battery leads voltage:

6(D) SunGuard solar leads voltage:

6(F) Clamp-type DC battery charging current: