

SUNGUARD

SOLAR BATTERY CHARGE CONTROLLER

OPERATOR'S MANUAL



1098 Washington Crossing Road
Washington Crossing, PA 18977 USA
Website: www.morningstarcorp.com

1.0 SPECIFICATION SUMMARY

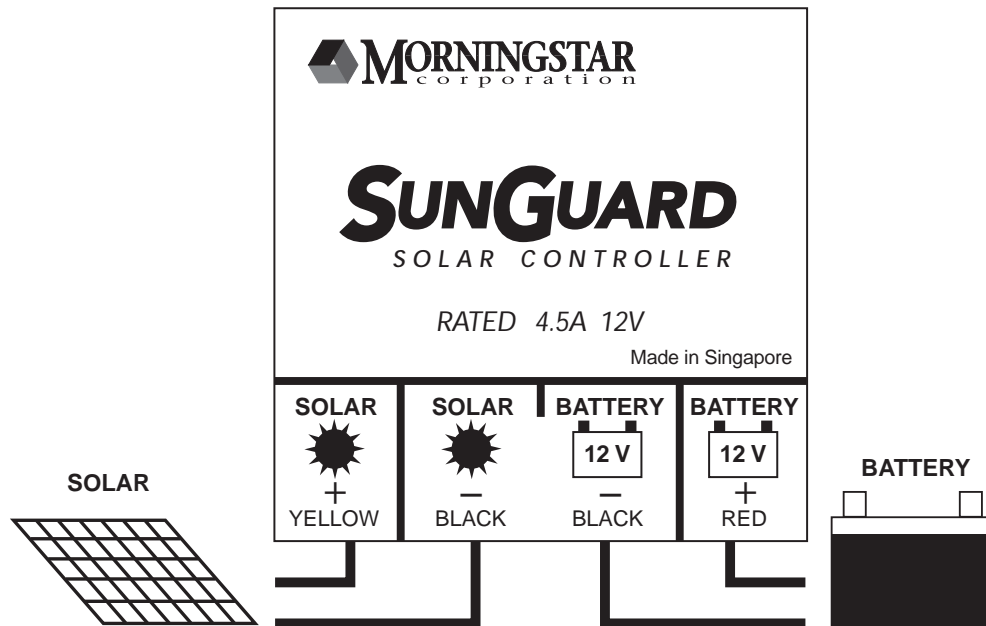
System Volts	12 V	PWM Setpoint	14.1 V
Max. Solar Volts	30 V	Accuracy	+/-60 mV
Rated Solar Input	4.5 A	Min. Operating Volts	6 V
Max. Input (5 min.)	5.5 A	Self-consumption	6 mA
Max. Solar Short Circuit Rating	5.5	A	
PWM Temp Compensation	-28	mV/°C	
Reverse Current Leakage	<10	uA	
Ambient Temperature Range	-40 to +60	°C	
Relative Humidity	100%		

2.0 SAFETY INSTRUCTIONS

- Follow these instructions carefully during installation.
- **WARNING** - Be very careful when working with batteries. Lead acid batteries can generate explosive gases, and short circuits can draw thousands of amps from the battery. Read all instructions provided with the battery.
- Do not exceed the voltage or current ratings of the controller. Use only with a 12 volt battery.
- **Do not SHORT CIRCUIT** the solar array while connected to the controller. This will **DAMAGE** the controller.
- The negative system conductor should be properly grounded for most effective lightning protection.

3.0 OPERATION AND FUNCTIONS

- 100% SOLID STATE: All power switching is done with MOSFETs. No mechanical relays are used.
- The SunGuard wires are rated for outdoor use, size 16 AWG, with Hypalon insulation.
- BATTERY CHARGE REGULATION: SunGuard uses an advanced series PWM charge control for constant voltage charging. A true 0 to 100% PWM duty cycle is very fast and stable for highly efficient charging.
- TEMPERATURE COMPENSATION: A sensor measures ambient temperature and corrects the constant voltage setpoint by $-28 \text{ mV per } ^\circ\text{C}$ with a 25°C reference. This works best if the SunGuard and battery are in a similar thermal environment.
- The SunGuard prevents the battery from discharging through the solar array at night. There is no need to install a blocking diode for this purpose.



4.0 INSTALLATION

1. SunGuard can be mounted in any position. It is best to mount to a vertical surface and allow space for air flow through the controller.
2. First connect the Battery **BLACK** wire (negative) to the battery. Use either black wire since they are connected together inside the controller.
3. Connect the **RED** Battery positive wire to the battery.
4. Connect the Solar array using the other **BLACK** wire and the **YELLOW** Solar positive wire. Be very careful not to short circuit the solar array, or the controller will be damaged.
5. SunGuard prevents reverse current leakage at night, so a blocking diode is not required in the system.
6. A negative earth ground at the battery is recommended for most effective lightning protection.
7. SunGuard can be mounted outdoors. Do not expose to ambient temperatures above 60°C. Make sure that water will drain from inside the case.

5.0 INSPECTION AND MAINTENANCE

At least once per year, inspect the controller to ensure best performance.

- Confirm that the solar array is not exceeding the SunGuard rating.
- Inspect the wire connections.
- Inspect for dirt, insects and corrosion. Clean as required.
- Check that the air flow through the SunGuard is not blocked.
- Confirm that water is not collecting inside the case.

6.0 TROUBLESHOOTING

The SunGuard can be tested with a power supply used in place of either the solar array or the battery. Observe the following cautions:

- Current limit the power supply to 2 amps.
- Set the power supply to 15 volts DC.
- Connect only one power supply to the controller.

IF THE BATTERY IS NOT CHARGING:

If the SunGuard is regulating (in PWM), then the controller is charging and operating correctly. If the battery voltage is low (under 12.5V - this test will not work if the SunGuard is regulating in PWM), then measure the solar voltage and battery voltage close to the SunGuard. If the voltages are within a few tenths of volts, the array is charging the battery. If the solar voltage is close to 20 volts and the battery voltage is low, the controller is not charging the battery and may be damaged.

IF THE BATTERY VOLTAGE IS TOO HIGH:

First account for the temperature compensation (for example: 0°C = 14.8 charging volts). Next, disconnect the solar array and measure the voltage at the SunGuard solar yellow and black leads. If battery voltage is measured at the solar leads, the controller may be damaged.

NOTE: For more detailed testing instructions, contact the Morningstar website.