



Testing Morningstar SunLight Controllers

Notes:

- Due to the nature of the SunLight controllers, it is possible only to determine whether the unit is functioning properly. It is not always apparent what component has failed or the cause for the failure. It is left up to the technician to determine the cause for the controllers failure based on evidence present at the site (i.e. burned leads, excessive loads, evidence of short circuits on load leads, more PV current than the controller is rated for etc.)
- It is difficult to completely verify the operation of the SunLight controller in less than 2 full days due to the nature of the controller. However the operation of the controller can be verified to a 95% confidence level with the test procedures outlined below.
- The procedures outlined below assume a basic knowledge of electric circuits and the necessary safety precautions to be used when working with live circuits present in solar energy systems.
- All voltages will be given for a 12V nominal system. For a 24V nominal system, all voltages should be double.

Recommended Tools:

- Digital Multi Meter (frequency and duty cycle measurements are helpful)
- Flat Bladed Screwdriver
- A lighting load (a type 1156 automotive brake lamp works well for 12V systems)
- A battery bank (of appropriate voltage for the controller)
- A solar array in full sun and/or a Power Supply (of appropriate voltage for the controller)
- Wire for connections to the SunLight.

Test Procedure:

- 1) Connect the battery and a load to the SunLight.
- 2) Set the load switch to any setting desired.
- 3) Verify the load works by pressing the test button.
- 4) Wait 5 minutes for the load to go off
- 5) Connect a power supply (set to 15V) or a PV panel placed in full sun to the Solar Input Terminals (Terminals #4 and #3). Be sure to observe correct polarity.

- 6) After a delay of 5-15minutes, the controller should be charging the battery. This can be verified by measuring the voltage drop between the PV+ terminal and the Battery+ terminal. If it is zero (Or less than .5Vdc) the controller is charging the battery in Bulk Charge mode. If you measure a DC voltage, switch your meter to AC voltage and see if an AC voltage is present. If an AC voltage is present, the SunLight is in the PWM mode and regulating the battery voltage. If your meter has frequency and duty cycle measurement capabilities, you can measure the PWM frequency (300Hz +/- 30Hz) and the duty cycle with the common (black) lead on the PV(+) and Voltage (red) lead on the Battery(+) terminal.
- 7) After you have verified the controller is charging the battery, disconnect the PV panel (or Power supply) from the controller terminal. After another wait of 5-15 minutes, your light should have turned on. If you are using a power supply, you must physically disconnect the wires from the Solar input terminals. The load switch should be in any position but the “Off” position (position 0). Do not press the test button – this will disrupt the test you are performing.
- 8) To verify the dawn shut off mode, reconnect the PV panel (or power supply) and wait the delay period for the light to shut off. The way the software is written, the controller will always shut the load off when dawn is detected whether the controller is in dusk to dawn mode or any other mode.

Some General Notes on SunLight Operation:

- There is a delay built into the micro-controller that waits from 5-15 minutes before changing from day to night (or night to day). This is so the controller will not get fooled by dark storm clouds passing in the summer time, bright lights on the array at night from passing cars or trucks etc. What this means is, when you start up the controller and connect the array, there will be some time before the controller begins to charge the battery.
- If the On/Off/On mode (3/1, 4/2 or 6/2) of operation has been selected the controller will not turn the load on before dawn on the first night of operation. The controller needs to measure the length of the first night before it can determine when to turn the load on for the Pre-Dawn lighting option.
- There is no feasible way to verify the correct timing of the SunLight. However the controller is designed to have a timing error of less than 1 minute per month.
- Any variation in load run times will occur in the Pre-Dawn and Dusk to Dawn lighting modes. This will be due to variations in conditions at dawn. Load run times will be the shortest on days with bright clear sunny dawns and will be longest during cloudy rainy/snowy periods.
- The delay between day to night and night to day transitions can be from 5 to 15 minutes in duration. It is necessary to wait the full 15 minutes to determine if the load will come on.
- If the load test button functions correctly but the controller does not detect the day/night transitions, carefully inspect your solar array wiring and installation. The cause is most likely on the solar side of the controller/PV system.
- The SunLight determines that a night to day transition has occurred when the PV array voltage is greater than 10Vdc.
- The SunLight determines that a day to night transition has occurred when the PV array voltage has dropped below 6Vdc.
- Leaves, dirt and snow on the PV array, extremely cloudy and rainy weather and PV arrays oriented west of south can all delay the SunLight's night to day transition. This is because the SunLight measures the open circuit voltage on the PV array to determine the night to day transition and any thing that blocks energy from reaching the PV Panels will lower the PV panel open circuit voltage.
- The Green Charging LED only indicates that energy is available to charge the battery, not that the SunLight is charging the battery.