

# SunSaver Duo

## Field Test Document

Version 1.0  
June 2007



Morningstar Corporation  
1098 Washington Crossing RD  
Washington Crossing, PA 18977  
Technical questions: [support@morningstarcorp.com](mailto:support@morningstarcorp.com)  
General questions: [info@morningstarcorp.com](mailto:info@morningstarcorp.com)

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## Quick Check

Verify correct SunSaver Duo operation by following these few short steps. Disconnect both batteries and the solar panel(s) from the SunSaver Duo before proceeding.

### Tools and components required:

- A solar panel (in full sun)
- One (1) healthy 12V battery, terminal voltage 11 volts or more
- A multi-meter to measure voltage

## Step 1

### Connect:

- 12V battery to the Battery #1 Input on the SunSaver Duo

### Measure:

- Voltage across Solar input terminals
- Voltage across Battery #2 terminals

### Expected Results:

- Status LED should flash 3 times on start-up and then remain off (w/ heartbeat)
- Voltage across Solar input terminals should be less than 0.1 Volts
- Voltage across Battery #2 terminals should be less than 0.3 Volts

If the voltage across the Solar or Battery #2 terminals exceeds the limit, the SunSaver Duo may have one or more damaged power transistors. Contact your authorized Morningstar dealer for service.

## Step 2

### Connect:

- 12V battery to the Battery #1 Input on the SunSaver Duo
- Solar panel to the Solar input on the SunSaver Duo

### Measure:

- Voltage across Battery #1 terminals
- Voltage across Solar input terminals
- Voltage across Battery #2 terminals

### Expected Results:

- Battery #1 Voltage = Solar input Voltage (if Status LED solid green)
- Voltage across Battery #2 terminals should be less than 0.3 Volts

If the battery has reached full charge, Battery #1 voltage will be at 14.1V or 14.4V \*\* (Absorption voltage), the Status LED will flash green, and the solar input voltage may be greater than Battery #1 voltage.

If the voltage across the Battery #2 terminals exceeds the limit, the SunSaver Duo may have one or more damaged power transistors. Contact your authorized Morningstar dealer for service.

\*\* Temperature compensation will skew the Absorption voltage value. In warm temperatures, the Absorption voltage will decrease. In cold temperatures, the Absorption voltage will increase.

## Step 3

### Connect:

- 12V battery to the Battery #2 Input on the SunSaver Duo
- Solar panel to the Solar input on the SunSaver Duo

### Measure:

- Voltage across Battery #1 terminals
- Voltage across Solar input terminals
- Voltage across Battery #2 terminals

### Expected Results:

- Battery #2 Voltage = Solar input Voltage (if Status LED solid green)
- Voltage across Battery #1 terminals should be less than 0.3 Volts

If the battery has reached full charge, Battery #2 voltage will be at 14.1V or 14.4V \*\* (Absorption voltage), the Status LED will flash green, and the solar input voltage may be greater than Battery #1 voltage.

If the voltage across the Battery #1 terminals exceeds the limit, the SunSaver Duo may have one or more damaged power transistors. Contact your authorized Morningstar dealer for service.

\*\* Temperature compensation will skew the Absorption voltage value. In warm temperatures, the Absorption voltage will decrease. In cold temperatures, the Absorption voltage will increase.

## FAQ

**Q:** The SunSaver Duo seems to be working but my battery does not recharge (or recharges very slowly). Why?

**A:** The recharge time depends on several factors:

1. **Amount of current produced by the solar panel(s) –vs- the amount of power drained from the battery daily** - If more power is drained from the battery by system loads than can be replaced by the solar panel, the battery will be at a constant state of discharge.
2. **Size of the battery bank** – If the capacity of the battery bank is large compared to the amount of current produced by the solar panel(s), charging time will be slow. Your solar system designer/installer should properly “size” the PV system.
3. **Health and age of the battery bank**- If the battery is old or has been abused, it may not accept or hold a charge.

**Q:** Why is the SunSaver Duo under-charging or over-charging my battery?

**A:** If the SunSaver Duo Status LED is not indicating a red error condition, the most likely reason is temperature compensation. If a Remote Temperature Sensor or the internal temperature sensor is being used for temperature compensation (see manual), then the regulation voltage will be higher in cooler ambient temperatures and lower in warmer ambient temperatures. The SunKeeper adjusts the regulation voltage to compensate for changes in battery chemistry which varies with temperature. Also, double-check the system wiring. Be sure that the Solar + and Battery + lines are not inadvertently wired together.

Other charging sources in the system such as the vehicle alternator or shore power charger may be responsible for over-charging the battery.

**Q:** Should I use a Remote Temperature Sensor?

**A:** The Remote Temperature Sensor allows precise temperature measurement at the battery so that the SunKeeper can more accurately adjust regulation voltage with temperature. If the battery is stored in significantly different ambient temperature than the SunKeeper, the Remote Temperature Sensor may be required.

**Q:** Will I damage the SunSaver Duo if I disconnect one or both batteries during operation?

**A:** No. Batteries can be connected or removed at anytime during operation without risk of damage. Be careful with live circuits and always fuse battery power cables. The SunSaver Duo will detect connected and missing batteries. If only one battery is connected, 100% of the charge current will be used to charge the battery.

**Q:** Does the connection order of the batteries and solar input matter?

**A:** No. The connection order provided in the manual is only a suggestion. The SunSaver Duo will not be damaged if the connection order is not followed.

**Q:** Can I disable temperature compensation?

**A:** Yes. There are two (2) ways to fix the SunSaver Duo to 25C regulation. The easiest way is to insert a through-hole 10K resistor across the Remote Temperature Sensor terminals. The

other option is to program custom setpoints with a temperature compensation coefficient of 0. Refer to the *SunSaver Duo Modbus Document* for more information.

**Q:** Can I repair the SunSaver Duo myself?

**A:** No. In most cases the SunSaver Duo cannot be repaired. The circuits are encapsulated in epoxy for maximum environmental protection. The epoxy prevents easy access to circuit components. Attempting repair may void the factory warranty. Contact your authorized Morningstar dealer for repair and warranty service.

# Error Codes

## **E01 – Reverse Polarity, Solar Input**

The Solar panel is connected backwards to the SunSaver Duo Solar input connection. Disconnecting the solar panel should clear the error immediately. Reconnect with correct polarity. Use red wire for Solar positive (+) and black wire for Solar negative(-). If the reverse connection mistake is at the solar panel j-box, correct the mistake in the J-box so that the red wire is positive and black is negative.

## **E02 – Reverse Polarity, Battery #1**

A battery is connected backwards to the SunSaver Duo Battery #1 connection. Disconnecting the battery should clear the error immediately. Reconnect with correct polarity. Use red wire for Battery positive (+) and black wire for Battery negative (-). If the reverse connection mistake is at the battery posts, correct the mistake at the posts so that the red wire is positive and black is negative.

## **E03 – Reverse Polarity, Battery #2**

A battery is connected backwards to the SunSaver Duo Battery #2 connection. Disconnecting the battery should clear the error immediately. Reconnect with correct polarity. Use red wire for Battery positive (+) and black wire for Battery negative (-). If the reverse connection mistake is at the battery posts, correct the mistake at the posts so that the red wire is positive and black is negative.

## **E04 – Local Temperature Sensor Damaged**

The sensor on the SunSaver Duo that measures ambient temperature has been damaged. A shorted or open sensor sets this error. Charging stops until this error is cleared. Inspect the "Temp. Sensor" for debris or breaks. The SunSaver Duo may have to be returned to your authorized Morningstar dealer for service.

## **E05 – Remote Temperature Sensor Damaged or Removed**

An optional Remote Temperature Sensor (RTS) connected to the SunSaver Duo is either open or shorted. In most cases, the RTS connection simply has come loose. Check the screw terminal connections. If the error persists, check the RTS cable for pinches or breaks.

## **E06 – Over-current Protection**

Solar input current exceeds the 25A rating. Reduce the size of the solar panel array. Also check wiring. A battery wired to the Solar input connection can cause this error.

## **E07 – High Temperature Protection**

The internal heatsink temperature sensor has detected a temperature that exceeds the safe operating limit. This error will clear when the SunSaver Duo cools off. If this error occurs frequently, consider reducing the solar input current and/or moving the SunSaver duo to a cooler location with better air flow.

## **E08 – High Voltage Disconnect**

Battery #1 or Battery #2 voltage has exceeded the 15.5 V HVD threshold. The SunSaver Duo will not charge a battery above 15.0 V (max. regulation voltage). In most situations, another charging source such as a vehicle alternator or dock shore power is charging a battery too high. This will not damage the SunSaver Duo and the error will automatically clear when the charging source stops and the battery voltage returns below 14.0 V. If there are no other charging sources in the system, the SunSaver Duo itself may be damaged. Follow the test instructions to check correct operation.

# Error Troubleshooting Diagram

