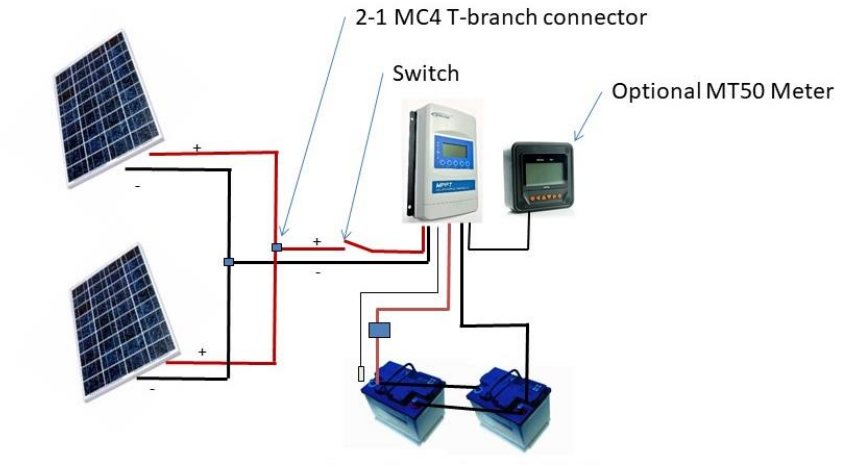
Troubleshooting Your Solar System



If your solar system is not producing the power it is designed to produce, there are four areas to evaluate to determine the probable cause of the lower than expected performance. The four areas are:

1. The solar panels
2. The solar system wiring (most common issue)
3. The solar controller
4. The batteries connected to the solar system

In this document, we will set forth the potential causes of underperformance in each area and suggest a methodology for trouble shooting that area. The tools you will need are a meter that will measure both voltage and amperage, a small screwdriver and perhaps wire cutters.

Reasons for solar system underperformance

1. The batteries need to be “hungry” and able to accept the power the solar panels are capable of producing. If you are connected to shore power or if your batteries are nearly full, the controller will back off so as to not overcharge the batteries. This will result in you seeing lower output from the panels.
2. The panels lose efficiency when heated by the sun. In full sun on an 86 degree day the panels are could reach 150 degrees or more. The panel cells decrease in performance by 10% for every 25 degrees over 75 degrees F. So the panel performance could be reduced by up to 30% because of their heat.

3. A common reason for solar panel underperformance is loose or corroded wires somewhere in the system. Possibly a blown fuse.
4. In summary, sun intensity, sun angle, temperature of the panel cells, state of charge of the batteries and condition of the system wiring are all factors related to panel performance.

Troubleshooting the solar panels and the wiring from the controller to the solar array.

In this operation, we will start at the controller and work our way up the wires to the individual solar panels to determine if there is a failure in the system. Do the following in full or nearly full sun.

1. Disconnect the PV solar wires entering the solar controller. Place a meter on the two wires and confirm positive and negative and measure the voltage and amperage (V and A). If the V and A are as expected, the reason for system underperformance is likely from the controller to the battery bank. If the V and A are below expectation, move up the system to where the panels are joined with a MC4 T-branch or bus bars. Check the V and A at this point. If it is below expectations, disconnect each panel in the array and test the V and A of each panel individually. If the panels are performing within 20% of spec, the problem is in the wires between the panels and the controller, probably corroded MC4 connections. If one or more panels measure below expected V and A, contact CMP for support. The panel may need to be repaired or replaced.
2. Reconnect the system step by step and verify performance and each point in the system.

Troubleshooting the battery bank connections

If the solar array is performing as expected at the controller, the next step is to test the wiring from the controller to the battery bank.

1. Disconnect the wires from the controller that are going to the battery bank. Put a meter on the wires to confirm the controller is getting power from the battery bank. If it is not receiving power, inspect the fuse in the positive line at the battery bank and inspect the terminal connections at the battery bank.
2. Notes:

a. Be sure the wires from the controller are of sufficient capacity to handle the power coming from the controller. #8 or #6 is often appropriate for this wire run.
b. Even if there is no power coming from the battery bank to the controller, the controller will often light up using power from the solar array. The controller is actually powered by the battery bank and if this connection is faulty, it will not allow full power from the solar panels.
c. The controller requires at least 10 volts from the battery bank to function. If the battery bank is below 10 volts (20 volts for a 24 volt system) the controller will not operate and no power will be generated by the solar array.

3. If the power to the controller is appropriate and solar panels are producing power, the problem may be with the controller.

Troubleshooting the solar controller. Try rebooting the controller

1. Disconnect all wires from the solar controller and let it set for 20 minutes.
2. Reconnect the wires from the battery bank first.
3. Reconnect the wires from the solar array second.
4. Give the controller 15-20 minutes to reset and find the maximum power point of the array.
5. If it is determined the controller is not functioning, contact CMP or the controller manufacturer.

Troubleshooting the battery bank

Older batteries lose their ability to accept and hold a charge. If they are full or not accepting a charge, there is no place for the solar energy to be stored so the controller will back off the solar power.

1. Check the water level in lead acid batteries.
2. Try connecting the solar controller to a different battery and see if the system produces power.
3. If the battery bank is having difficulty holding a charge, it is likely the battery bank is not accepting a charge.
4. Have the batteries tested for capacity and health.

5. If the batteries are LiFePO4 batteries, it is possible the batteries have gone into a sleep or protection state and will not accept a charge. Often these batteries can be awakened by applying a load or applying a charge with a “dumb” charger. This is a charger that does not require a battery voltage reading to initiate a charge. A trickle charger will often awaken the batteries.

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