

Frequently Asked Questions

Why does my solar panel not output the rated power?

Solar Panels are rated at Standard Test Conditions or STC, which is not a real world operating condition. STC is a panel cell temperature of 25°C / 77°F and full sunlight. Solar panels heat up from sunlight and as they do the power drops about 0.45% per °C. Typical temperature rise in full sun is about 40°C / 72°F or a power loss of about 18% from the STC Rating. So, a “245 Watt Panel” will actually produce about 82% of that or 200.9 Watts in Full Sun on a typical Summer Day at 25°C / 77°F.

What does the NOCT Solar Panel Rating mean?

NOCT stands for Nominal Operating Cell Temperature and is 45°C / 113°F with 80% Sunlight intensity. This is usually about 75% of the STC Rating and would be a typical operating condition. The Same “245 Watt” Panel mentioned above has a NOCT rating of 185 watts. Not all panels have this rating but it is more of a real world condition.

How can I tell if my battery is fully charged?

When the Output Voltage reaches 14.4 volts and the current drops to a low value without system load then the battery is Full. The LCD Display will indicate “Bat” “Ful” and the voltage. The Power Stage will shutdown. When the Battery drops below 13.5 volts the Charger will resume operation automatically.

What is MPPT and how does it work?

MPPT is an acronym for Maximum Power Point Tracking. Our Solar Charger has this feature and will even extract power out of a partially shaded panel where other charge controllers will not. The Charge Controller is constantly seeking this optimum operating point and maintains >99% of Maximum Power down to below 1 Watt Output. It does this by monitoring the Panel Voltage, Battery Voltage, and output current to determine where the optimum operating point is and adjusts this about 2000 times every second.

What is the difference between PWM and Our Charge Controller?

PWM stands for “Pulse Width Modulation”. A PWM controller is only a ON/OFF switch that uses a relay or transistor to switch the solar panel directly to the battery on and off without power conversion of any kind. This wastes a lot of power because you are never operating at the maximum power point. The main difference is Our Charge Controller is a True DC Power Converter which transfers more than 98% of the Solar Panel’s power to the system battery and doing this at the optimum power point at all times.

Our Charge Controller is the most efficient on the market and will give every last watt of power the solar panel can produce. Most other Charge Controllers use Heat Sinks that take wasted power and warm the air - We do NOT need them because less than 4 watts are lost at 200 watts output.

Can Solar work on Cloudy days or in Northern Latitudes / Colder Climates?

YES... Solar Panels still produce power when cloudy. The amount depends on the conditions but varies from about 5% to 40% of full sun output. Solar Panels **LOVE** cold weather and produce **MORE** power when cold. A cold winter day can approach the STC rating on a panel if there is some wind and / or the air temperature is well below freezing. The shorter winter days are partially offset by the colder temperatures. A large battery bank also helps out on cloudy days to augment the system power needs.

What angle is best for my panels?

North of the Equator Solar panels should face due **South** if possible and be tilted at the mid point between the sun angle on December 21 and June 21. As a guide take your latitude in degrees and add 3. For Example Detroit Michigan is 42° North so the panel tilt would be optimal at 45°. People in the **Southern Hemisphere** would face their panels **North**. This gives the best year around power production. The tilt angle can be adjusted up for more Summer Power or down for more winter power at the sacrifice of the other.

What Size Solar Panel can I use with the Charge Controller?

The Charge Controller will work with panels as small as 10 watts and as large as 255 Watts. The number of cells must be between 36 and 80. The open circuit voltage must be between 20 and 50 volts. Smaller Panels can be connected in series / parallel to make an array as long as it meets the above voltage and power requirements. Panels in series **MUST** have the same current rating (matched type and size). The Optimal range is 50-250 watts and 60-72 cells. For example 2 panels rated at 100 watts and 36 cells each can be connected in series to form an equivalent 200 watt 72 cell panel.

How many Charge Controller Outputs can be connected in Parallel?

There is no limit to how many can be connected to a system. Each one should go through a 20 amp Circuit Breaker or Fuse to the main DC System Buss and Battery Bank. Systems of many thousands of watts can easily be built by adding panels and charge controllers. Only parallel the output—do NOT parallel inputs as each controller should have ONE panel or array of up to 255 Watts connected.

What types of Batteries can I use?

Any standard Deep Cycle 12 volt Battery can be used however for best performance a 4 cell Lithium Iron Phosphate Battery will give far superior performance. When using the Lithium cells it is **STRONGLY** Recommended to use some form of cell balancing and over discharge protection. Most DC-AC inverters shut down at 10.5 volts which is highly desirable. The Full Charge Voltage for Lithium Iron Phosphate is 14.4 volts and is the same for the Deep Cycle Batteries. **DO NOT USE A CAR BATTERY**—cycle life will be very short. Also of importance is depth of discharge when using Deep Cycle Batteries do not discharge over 50% otherwise the life will be much shorter. Lithium Iron Phosphate does not have this limitation and gives a far superior cycle life.

Another important consideration is charge efficiency... Deep Cycle Batteries only return about **65%** of the energy used to charge them because the remainder is lost in heat and out-gassing. **Lithium Iron Phosphate is >99%** energy return. We have 4 year old Lithium Iron Phosphate Batteries in service at our Solar Research Facility that still deliver 100% of their rated capacity after more than 1200 charge and discharge cycles.

How many Amp Hours should my Batteries have?

The answer depends on your usage...how much power you need and for how long determines the number. For an off-grid application you should have at least 3 days worth of battery capacity to support the average power load... this allows for 3 consecutive cloudy days and still have power. As a rough guide for every 100 watt-hours of load you should have 30 amp hours of battery with Deep Cycle and 10 amp hours with Lithium Iron Phosphate cells. The difference is because you should not discharge Deep Cycle more than 30% so you need 3x the battery capacity for longest cycle life. Lithium Iron Phosphate does not have this limitation.

How many Solar Panels do I need?

The answer depends on power needs and how much average sunlight you get per day. Typically you want your batteries to fully re-charge with as little as 4 hours of sunlight and at the same time support your **AVERAGE** power load. So using a 60 amp hour battery and 4 hour charge time you need 15 amps of charge current or 1 charger board hooked to a 250 watt panel as a minimum. If you get a lot less of sun you need to use more panels and boards to compensate for the cloudy days. When doing an off grid system its better to size the solar array for the **MINIMUM** sunlight to meet electrical needs so you never run short of power. This would occur during the winter solstice or shortest day of the year.

If your load is intermittent you can get by with a lot less solar power—such as something used once a week for a few hours. If the Load is continuous like an **OFF-GRID** building then the Solar Panel requirement should be at least 2x the average load to allow batteries to fully charge up from 0% in a 4 hour period. Cloudy climates should be closer to 10x the average load to ensure you don't run out of power. Better to have extra than not

What happens if I connect too much solar to the Board?

The answer somewhat depends on if its too much voltage or too much power— Too much Voltage can damage the unit. Over 50 volts but less than 60 the board will display “O.L.”.

Above 60 volts will cause PERMANENT DAMAGE and is not covered under warranty.

Hooking up too much power (Over 255 Watts STC Rating) can cause either the current limit to activate above 16.25 amps or an over-temperature “**Hot**” shutdown. This will not damage the charge controller but you will not be getting the full available power of your panel at that point.

So its important to stay within the Charge Controller specification limits.

What Happens if I hook up the Solar Panel reverse Polarity?

The Protection will activate and the board will sit in power down mode (OFF) until the fault is corrected **as long as the voltage is less than 60 volts. Above that permanent damage will occur and that is not covered under warranty.**

What Happens if I hook up the Battery reverse Polarity?

The Protection will activate and the board will sit in power down mode (OFF) until the fault is corrected **as long as the voltage is less than 30 volts. Above that permanent damage will occur and that is not covered under warranty.**

Is the Board Protected from Water or liquid Spills?

No—and that is not covered under warranty. Keep it dry.

Can the Charge Controller be used Outdoors?

Yes as long as it is in a suitable enclosure and protected from Rain, Snow, and Direct Sunlight. Use an air tight and water tight metal enclosure for best results. In Coastal areas where Salty Humidity is present this is important to keep corrosion from happening. Operating temperature is -40C to 40C (-40F to 104F).

The LCD display may not operate well below freezing and will change more slowly—this is not a malfunction but a limitation of LCD displays. Best to install close to the system batteries to minimize wire power losses.

What Happens if the Air Temperature is OVER 104F (40C)?

The Thermal Protection may activate if the average Board Temperature reaches 160F / 170F and limit the Power Output. “Hot” will display on the LCD. This will not damage the unit however you no longer will get the full output of your panel. It is therefore important to allow natural convection cooling when using the board with large panels. Best to use the charge controller indoors in a temperature controlled environment so this never happens. The board is designed for open air panel mounting.

How long can my wires be?

Keep in mind that long wires loose power especially at higher currents. Use #12 wire for BOTH input and output. For Best Performance keep them as short as possible— less than 50 feet on the Panel side and less than 5 Feet on the battery side. Power loss can be calculated as follows: $(\text{Current in Amps})^2 * \text{Resistance in ohms}$. #12 wire is about 3 milliohms per foot at room temperature (both sides added) so a 5 foot cable at 16 amps will have losses of about 3.84 watts ($16 * 16 * .015 = 3.84$).

If there are any additional questions you think should be added please let us know at www.diySolarForu.com and fill out the “contact us” section.