How to Size a Solar Charge Controllers

Choosing a well made charge controller is integral to the long life and efficiency of your entire solar power system. By optimizing the power coming in from your solar panels, you will get that much closer to offsetting your use of traditional on grid power sources and by protecting your battery supply you protect yourself from any unwanted and unneeded replacement costs. Your solar charge controller is an item well worth investing in and researching as your customize your solar panel electric system. Make sure you choose an option that is scalable and appropriate for your power load and make sure that you have sufficient battery storage space for the solar panels you have chosen to install. We will advise you on everything from optimizing your current power load to how best to install your solar panels and on choosing the right solar charge controller!

Solar charge controllers are rated and sized by the solar panel array current and system voltage. Most common are 12, 24, and 48-volt controllers. Amperage ratings normally run from 1 amp to 60 amps, voltages from 6-60 volts.

For example, if one module in your 12-volt system produces 7.45 amps and two modules are utilized, your system will produce 14.9 amps of current at 12 volts. Because of light reflection and the edge of cloud effect, sporadically increased current levels are not uncommon. For this reason we increase the controller amperage by a minimum of 25% bringing our minimum controller amperage to 18.6. Looking through the products we find a 20-amp controller, as close a match as possible. There is no problem going with a 30-amp or larger controller, other than the additional cost. If you think the system may increase in size, additional amperage capacity at this time should be considered.

MPPT Charge Controllers

Outback Power's MX60, an MPPT Charge Controller

Traditionally, you would assume that the nominal voltage of your battery and your solar panel array would be the same and that you would also choose that voltage for your charge controller. However, in recent years, a more efficient charging technology called Maximum Power Point Tracking (MPPT) has become available on some models of charge controllers. What of interesting features of this technology is that it usually allows you to have a solar panel array with a much higher voltage than your battery bank's voltage. The MPPT charge controller will automatically and efficiently convert the higher voltage down to the lower voltage.

MPPT Charge Controllers Save You Money on Wiring Costs

A big advantage to having a higher voltage solar panel array is that you can use smaller gauge wiring to the charge controller. And since a solar panel array can sometimes be over a 100 feet away from the charge controller, keeping the cost of the wiring down to a minimum is usually an important financial goal for the whole project. When you double the voltage (e.g. from 12 to 24 volts), you will decrease the current going through the wires by half which means you use a quarter as much copper (or cable with half of the diameter). See our wire sizing seminar for more information.

Example of Sizing an MPPT Charge Contoller

So, for instance, you could have a 1000 watt solar panel array that operates at 48 volts DC and your battery bank is 24 volts DC. MPPT charge controller are rated by the output amperage that they can handle, not the input current from the solar panel array. To determine the output current that the charge controller will have to handle we use the very basic formula for power (watts), which is:

Power = Volts x Amps

Here we know the power is 1000 watts, the battery bank is 24 volts, so:

1000 watts = 24 volts x Amps

which gives us:

Amps = 1000 watts/ 24 volts

Amps = 41.7A

We still want to boost this value by 25% to take into account special conditions that could occur causing the solar panel array to produce more power than it is normally rated for (e.g. due to sunlight's reflection off of snow, water, extraordinarily bright conditions, etc). So, 41.7A increased by 25% is 52.1A. In this case we'd probably choose a 60 Amp MPPT Charge Controller, like Outback Power's MX60.

Another Benefit of MPPT Charge Controllers

Because MPPT charge controllers can handle a different (but higher) input voltage from the solar panel array than the battery bank's voltage, you can also use these charge controllers with solar panels that have odd voltages that don't match any typical system voltage (i.e. 12, 24 or 48V). For instance, you could have a solar panel that has a nominal voltage of 57 volts and charge and battery bank that's 24 volts efficiently with an MPPT charge controller.

Be aware that MPPT charge controllers have an upper voltage limit that they can handle from the solar panel array. It's important that you make sure than there is no condition that the solar panel array voltage will go above this limit or you will like burn out the controller. You want to make sure that the open circuit voltage of the solar panel array does not go above this limit. You also want to give yourself a little bit of a margin for an error to take in account the possibility that a solar panel array's voltage will actually increase the colder it gets. If you give yourself a 10% margin of error you should be fine.

Here's an example:

We'll use four 12 volt Evergreen 102 Watt solar panels all run in series for a nominal voltage of 48 volts and our battery bank is at 12 volts. We'd like to use BZ Product's MPPT500 charge controller. If we look at the panel's specification page we see that each panel has an open circuit voltage of 21.3V. That means the array has four times that (because there are 4 panels in series). So the array open circuit voltage is 21.3V x 4 = 85.2V. We'll boost this up by 10% for safety and we get 93.7V. Now we'll look at the MPPT500's specifications and we see that it can take a maximum of 100 volts. So we're ok!