

What Solar Panel Size Do I Need To Charge a 48V Battery?

12V and 24V solar panel systems used to be the most commonly used, but 48V batteries have since surpassed these. If you want to buy a 48V battery, you have to use the right solar panel sizes and voltage to get the best charging time.

Three 350 watt solar panels connected in a series can charge a 48V 100ah battery in a day. For cold areas, the panel VOC should be between 67 to 72 volts, and for hot conditions it should be from 80 to 82 volts. An MPPT charge controller works best for 48V systems.

How To Match Solar Panel Voltage And Battery Voltage

If you have a 48V battery (for example, 48v 100Ah), what voltage must your solar panel be? How do you match these panels, batteries and charge controllers when they have different voltages? It can be confusing, but here we will simplify everything.

The VOC (voltage open circuit) of your solar panel must be 1.4 to 1.8 times greater than the battery nominal voltage. The VMPP (maximum power voltage) of the solar panel or array has to be 1.3 times more than the battery nominal voltage.

- 12V systems: the VOC should be 16.8 to 21.6. For hot areas the voltage ideally is 20 to 21.5V, and if it is cold, 18V.
- 24V systems: the VOC can be from 33.6 to 43.2, with 40 to 41V for hot locations and 36V for colder areas.
- 48V systems: 67 to 86 VOC with 72V for cold and 80-82V for hot areas

These are general guidelines only. Some variances in the voltage will not hurt the system if properly installed. However, you should try to keep the VOC as close to these as possible. You can find the VOC, VMPP and other specs on your solar panel manual or user guide.

Solar Panel Specifications Guide

The following are some common solar panel terminologies and their meanings:

VOC (Voltage Open Circuit): This is the maximum amount of voltage the solar panel can generate. The VOC in the specs is what the panel will produce when not connected to any load (an open circuit).

IMPP (Current): This is the maximum current the solar panel can supply. ISC (Short Circuit Voltage). The maximum amount of current the solar panel can produce when solar wiring is shorted (short circuit).

VMPP (Voltage Maximum Power Point / Maximum Power Voltage): This refers to the volts produced by the solar panel when it is connected to a load. A load can be an appliance, device or battery connected to the panel, which leads to a current draw (IMPP).

To find the right solar panel size for a battery, multiply the VOC by 1.4 or 1.8, and you have the ideal solar panel voltage for the battery.

In our case:

$$48V \times 1.4 = 67.2 \text{ or } 48V \times 1.8 = 86.4$$

Do the same for 12V and 24V systems to match the solar panels and batteries.

Do not use a solar panel if the VOC is too high. If you have a 24V battery, go with 33.6 up to 43.2V. If the VOC is 50 or higher, that power will be wasted unless you have an MPPT charge controller that will adjust the voltage to match the battery. If you are looking for an MPPT controller, we recommend the [EPEVER Solar Controller](#) as it is one of the most reliable and cost effective available.

The information provided above is meant to give you an idea of how to match solar panels and batteries. Always refer to your product or manufacturer documentation for specific information about what voltages to use. While these guidelines should work, you should always look to the instructions in case your system has specific requirements.

How To Increase Solar Panel Voltage

Regardless of battery type, the solar panel voltage must always be greater than the battery. With a 48V battery, your solar panel voltage must be higher than 48 volts to produce a charge.

By connecting solar panels in a series, you can increase its voltage. Take 3 x 350W 24V solar panels connected in series and you will get 72 volts, the ideal number for a 48V system ($24V \times 3 = 72V$). To configure the panels in a series, connect the positive terminal of the panel to the negative terminal of the next panel. Repeat with the other terminals. Connecting solar panels in a series is not going to add up the amps. They will remain the same. In this case it does not matter because your goal is to increase the voltage to match a 48V battery.

You can only do a series connection with an MPPT charge controller however. With a PWM controller you can only connect the panels in parallel, which increase the amps but not the voltage. And we will show there are other reasons why MPPT controllers are preferable to PWM for 48V systems.

PWM Vs. MPPT Charge Controllers For 12V/24V/48V Systems

PWM and MPPT charge controllers have the same function, protect the battery from overloading, overcharging and otherwise keep it running the way it is supposed to.

A 20A MPPT charge controller can handle a 48V system up to 1000 watts. Most 48V charge controllers have a VOC capacity of 150V, good enough for 3 solar panels. There are also 250V MPPT charge controllers that allow you to connect up to 5 solar panels.

To find out what charge controller size you need, use this formula:

$$\text{Watts} / \text{volts} = \text{amps}$$

3 x 350W solar panels = 1050 watts. If you have a 48V battery that would be:

$$1050 \text{ watts} / 48V = 21.8A$$

You need a 20A or 30A charge controller.

A PWM charge controller is ideal only for small solar panels or an array consisting of two panels. For larger systems or high voltage batteries, get an MPPT charge controller for the most efficient performance results.

The biggest difference is a PWM pulls down the solar panel voltage to match the battery. If you have a low voltage battery and a high voltage PV module, the controller reduces the panel VMP to match the battery. The end result is low system performance and wasted power.

An MPPT charge controller adjusts the voltage so the solar panel runs at maximum voltage. A solar system running on an MPPT controller will produce more amps for the battery than a similar system on a PWM controller. If you have a small system, a PWM is fine. Otherwise, invest in an MPPT.

How Long Does It Take To Charge A 48V Battery?

The answer depends on how much power the solar panels have, how much sunlight is available, battery capacity and how fast you want to have the battery charged.

A 100ah 48V battery holds 4800 watts, so you need solar panels that can produce at least that amount. **3 x 350W solar panels can charge the battery in 5 hours.** Assuming each panel produces 350 watts an hour, that is 5250 watts total in a day.

Solar panels rarely produce peak output except in ideal weather. But even so three 350W panels should be able to provide 4800 watts. With an MPPT charge controller the system voltage is optimized for the best output.

What if you do not have 350W solar panels? You can still charge the battery but it might take longer with a smaller system. A 100-watt solar panel can provide 500 watts on a clear, sunny day, but even then it would take 10 days. And it is unlikely the panel can give supply 100 watts an hour during the entire period.

With 48V batteries you should not settle for anything less than a 300-watt solar panel. Either 3 x 350W or 4 x 300W solar array will do. You can also try 400W solar panels, though they are more expensive and heavier. But if weight and cost are not issues, 400-watt PV modules will do great for 48V systems.

Battery Capacity And Charge Time

The figures above are for fully charging a battery. If you are using a lead acid battery (FLA, gel, AGM), it is probably 50% filled. At least it should be because lead acid batteries should never be fully drained. Doing so shortens their life cycle.

The 50% depth discharge is one of the most limiting aspects of FLA batteries. But with a 48V system you have plenty of usable watts. If you recharge the battery at it is halfway empty, the charging time is reduced by half, assuming ideal weather.

Using the same example given above, your 48V battery now requires 2400 watts to be fully charged. The same 3 x 350W solar array can charge it in 3 hours or so. A couple of 300W solar panels can also recharge the battery in 5 hours or less.

All these figures assume the weather is favorable and that the solar system is properly set up. Of course the weather is rarely ever perfect, so expect the solar panels to produce less than their rated output.

The larger your solar array the faster the charge will be under favorable conditions. However you also have to make sure you have the right inverter size for your appliances

and other devices you want to carry. Check also if the inverter is designed to work with 48V systems.

Conclusion

A 48V battery requires a good-sized solar system to work. You have to make sure the panels not only provide enough power, but it must also have the right voltage. Lastly, be certain you are using a charge controller that works for this type of battery.