

Comparing PWM & MPPT Charge Controllers

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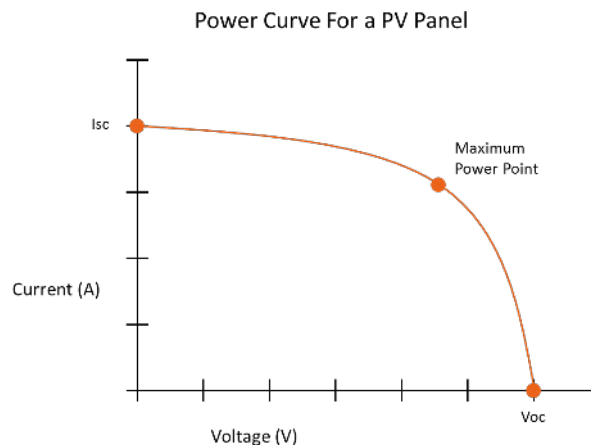
Differences between PWM & MPPT

PWM: Pulse-Width Modulation

MPPT: Maximum Power Point Tracking

PWM and MPPT are the two different types of charging methods solar charge controllers can use to charge batteries from a solar array/panel. Both technologies are widely used in the off-grid solar industry and are both great options for efficiently charging your battery. The decision to use PWM or MPPT regulation is not purely based on which power charging method is “better” than the other. Moreover, it involves determining which type of controller will work best in your system’s design.

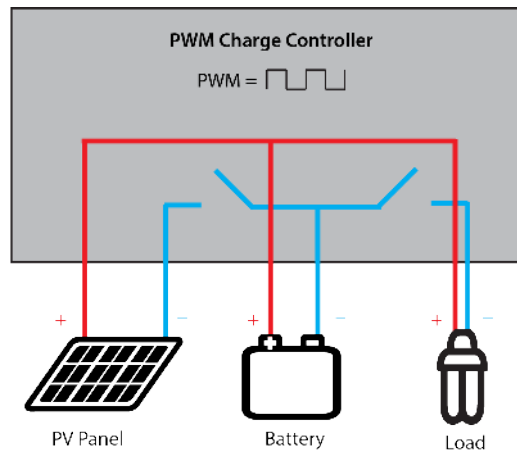
To understand the difference between PWM and MPPT charging, let’s first look at a typical power curve of a PV panel. The power curve is important because it states the expected power generation of the panel based on the combination voltage (“V”) and current (“I”) generated by the panel. The optimal ratio of current to voltage to produce the most power is known as the “Maximum Power Point” (MPPT). The MPPT will change dynamically throughout the day depending on irradiation conditions.



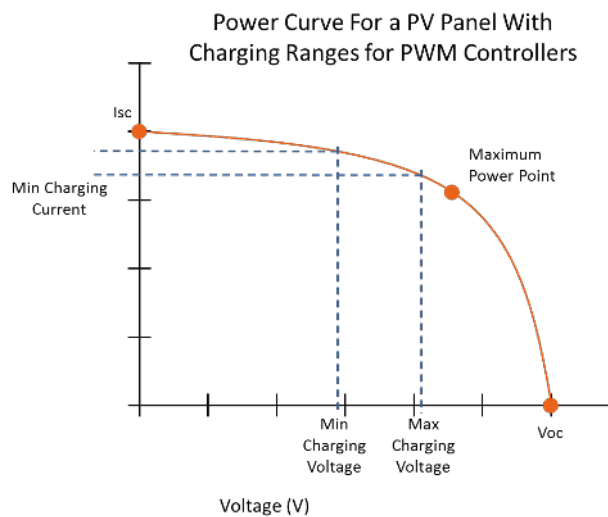
**Most often you can find the power curve for your PV panel on the product’s datasheet.*

PWM Charge Controllers

Pulse-Width Modulation (PWM) comes into play when the battery bank is full. During charging, the controller allows as much current as the PV panel/array can generate in order to reach the target voltage for the charge stage the controller is in. Once the battery approaches this target voltage, the charge controller quickly switches between connecting the battery bank to the panel array and disconnecting the battery bank, which regulates the battery voltage holding it constant. This quick switching is called PWM and it ensures your battery bank is efficiently charged while protecting it from being overcharged by the PV panel/array.

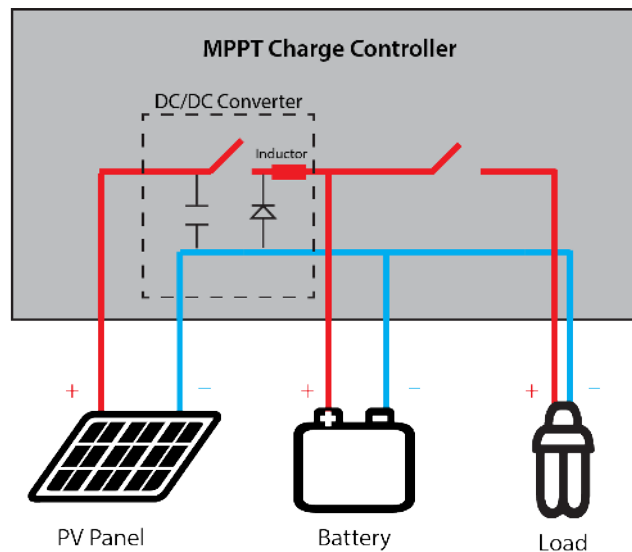


PWM controllers will operate close to the maximum power point but often slightly “above” it. An example operating range is shown below.

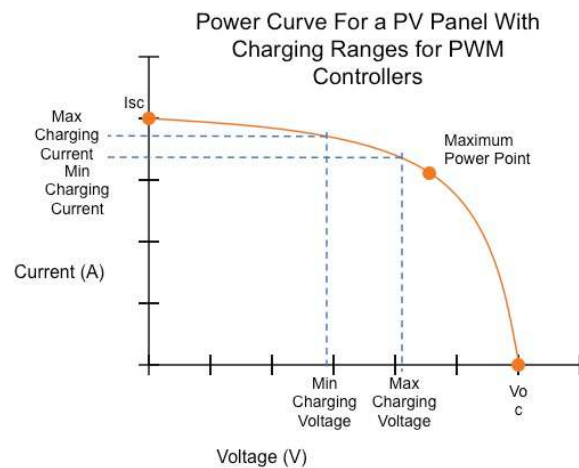


MPPT Charge Controllers

Maximum Power Point Tracking features an indirect connection between the PV array and the battery bank. The indirect connection includes a DC/DC voltage converter that can take excess PV voltage and convert it into extra current at a lower voltage without losing power.



MPPT controllers do this via an adaptive algorithm that follows the maximum power point of the PV array and then adjusts the incoming voltage to maintain the most efficient amount of power for the system.



Pros and Cons of Both Types of Controllers

	PWM	MPPT
Pros	1/3 – 1/2 the cost of a MPPT controller.	Highest charging efficiency (especially in cool climates).
	Longer expected lifespan due to fewer electronic components and less thermal stress.	Can be used with 60-cell panels.
	Smaller size	Possibility to oversize array to ensure sufficient charging in winter months.
Cons	PV arrays and battery banks must be sized more carefully and may require more design experience.	2-3 times more expensive than a comparable PWM controller.
	Cannot be used efficiently with 60-cell panels.	Shorter expected lifespan due to more electronic components and greater thermal stress.

How to choose the right controller for your system

On the next page you will find an infographic flow chart that will help you determine which type of charge controller is optimal for your specific project.

While there are many more variables to consider when determining which controller is the best fit for your system, the infographic on the next page aims to take some of the mystery out of the decision by addressing the most important factors that need to be considered when making your decision.

For further support, please feel free to contact our technical department at: tech.na@phocos.com.

PWM or MPPT?

A quick guide to choosing the right charge controller for your PV system

