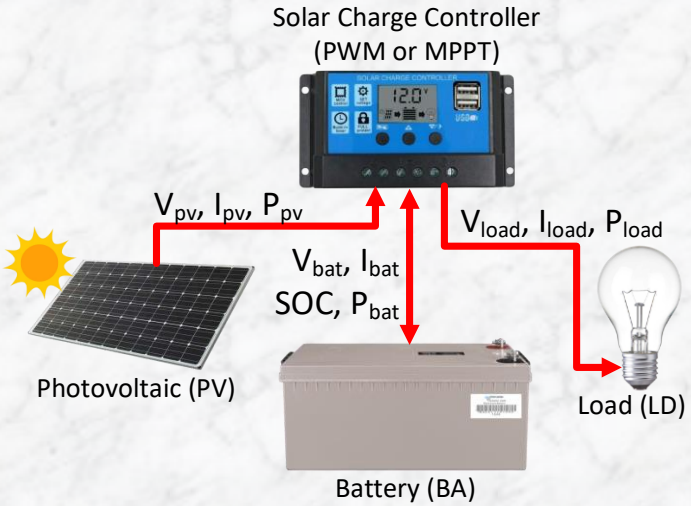
PWM vs MPPT Solar Charge Controller Simulator Educational kit



Drawback with Conventional Solar Educational Kit

- Requires sunlight. Unable to be used indoor or raining condition.
- Commonly use PWM since MPPT is expensive due to the additional power converter inside the charge controller. The cost and complexity becomes higher if both method is included.
- If use MPPT, the algorithm cannot be observe since its too fast (<1s).
- Change in battery cannot be observe since the PV and load used for education kit is small.
- Difficult to observe the battery full and depleted condition.
- Need multiple sensors and displays to observe all the important parameters of the system (commonly 6 sensors and 10 displays). These make the cost high.
- Safety issues since the battery can short-circuit and cause fire.
- The kit is heavy and takes a large space.

Advantages with PWM vs MPPT Solar Charge Controller Educational Kit

- No need for sunlight.
- Can operate in either PWM or MPPT.
- The MPPT is set to operate slower, good for education (around 20s).
- Change in battery is observable as the battery is set to a very small capacity.
- Easy to observe the battery full and depleted condition since battery changes quickly.
- No need for sensor as it is inside a simulation model. All the parameters are displayed in 1 display. These make the cost low and easy to observe.
- No safety issues at this is only simulator.
- The kit is light and small in size.

Disclaimer:

- In practice, MPPT needs to be fast and battery needs to be large. For learning purpose, this has to be changed to allow better observation.
- The method for fully charging and depleting batteries varies between manufacturers. This method is just one of several approaches used.
- The SOC is used instead of voltage (commonly used in charge controller) to determine the energy left in the battery

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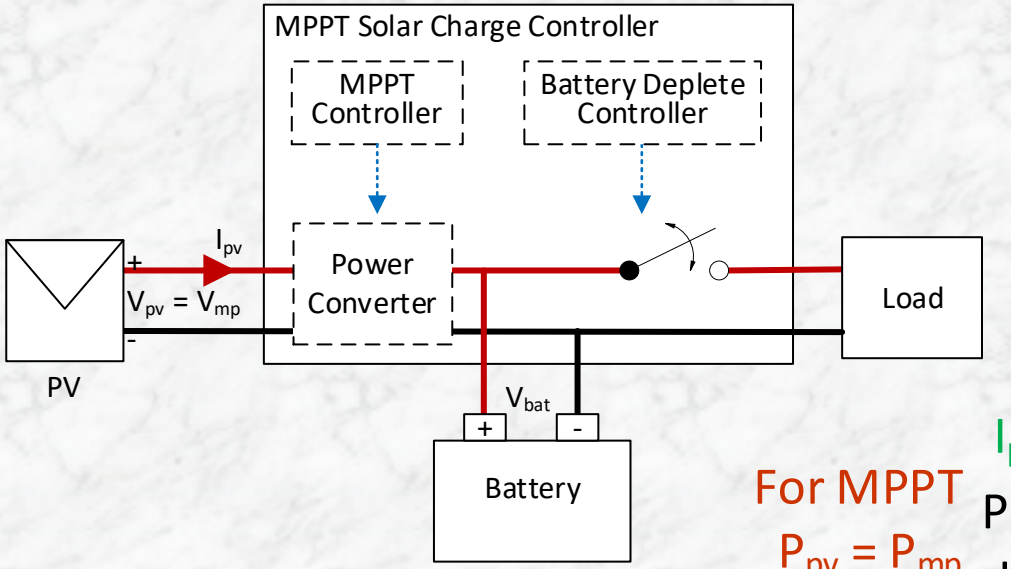
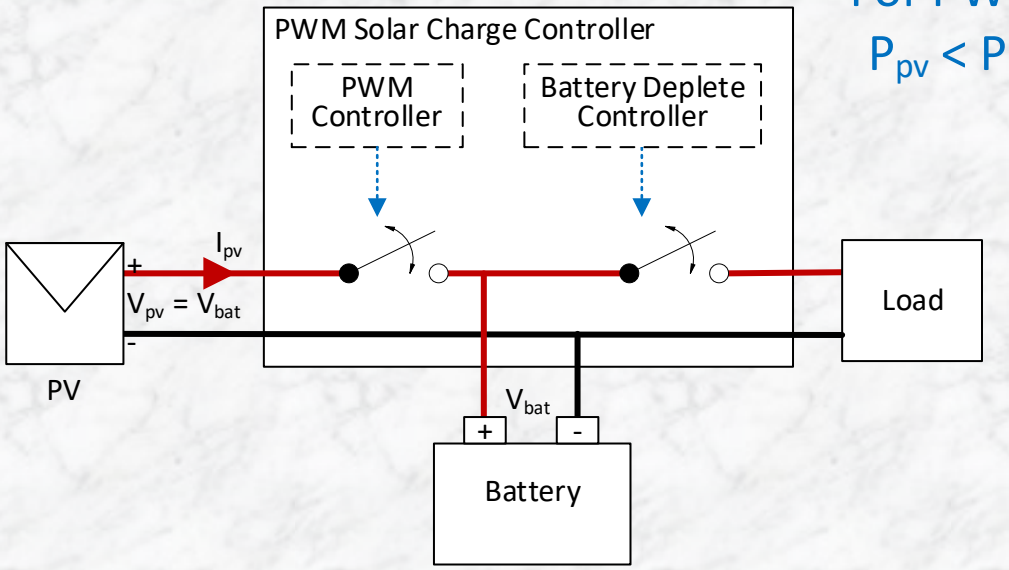


G = Irradiance	P_{pv} = PV Power
I_{mp} = Maximum Power Current	PV = Photovoltaic
I_{pv} = PV Current	PWM = Pulse Width Modulation
MP = Maximum Power	V_{bat} = Battery Voltage
MPPT = Maximum Power point Tracking	V_{mp} = Maximum Power Voltage
P_{mp} = Maximum Power	V_{pv} = PV Voltage

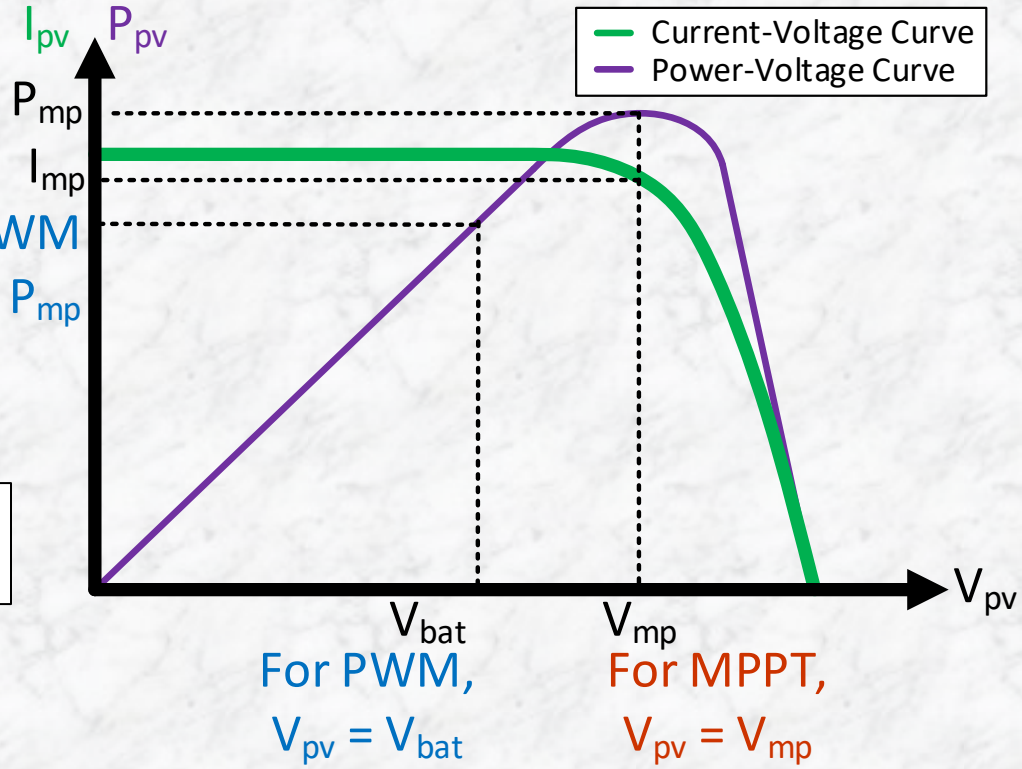


For MPPT

$P_{pv} = P_{mp}$

For PWM

$P_{pv} < P_{mp}$



For PWM,

$V_{pv} = V_{bat}$

For MPPT,

$V_{pv} = V_{mp}$