

Installation Manual

Please take your time to read the following instructions.
We've included both general as well as brand specific info.

Your charge controller works with existing chargers

The majority of charge controller will work in parallel with other types of chargers and you can keep the old mains charger and generator/alternator.

Choose the charge controller

Find the controller Size

The controller will be marked with either a max PV watt or a max current rating. Often for example 10A which equals about 120W of solar panels (12V battery) (240W 24V batt)

Choose the type of controller: simple or MPPT

A simple controller might be a cost-effective solution. They are often called PWM controller. A MPPT controller may be more costly but will render more energy from any type of solar panel. In real life one should count on between a variable 0-30% increase in production.

So how to choose? As a guideline, IF space is hard to find then the need to optimize available solar panels is higher. Then a MPPT will be the right choice.

Choose the between MPPT controllers

Don't waste just good enough sunshine

Choose a MPPT controller that will start to charge *immediately* when the PV voltage surpass the battery voltage. When its cloudy or a low standing sun the voltage on the panels will not be as high as in perfect sunshine. But since most of us live in a climate in which clouds prevail its unnecessary to spoil good solar energy.

Most controllers required the voltage on the solar panel (PV) side to be much higher than the battery side BEFORE any charging take place. Solving this by requiring a serial installation introduces other problems, more about that later in this paper.

As a reference SUNBEAMsystem MoonRay MPPT will start charging when PV side is 0.1-1V above Battery side.

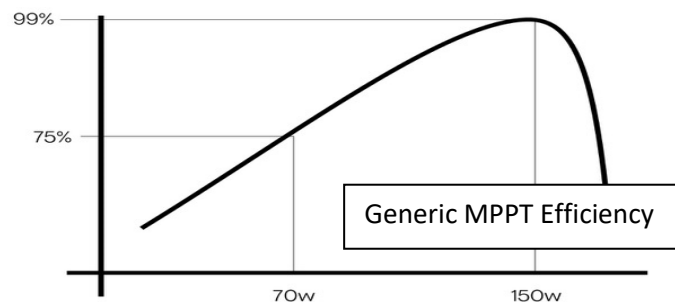
Notation on other brands specifications might be Batt+4V for example. Which in this example would mean a starting point when PV is 4V higher than Battery side.

Efficiency with any solar panel in any weather

Efficiency with any solar panel in any weather. If aiming for an all-round MPPT optimization check the efficiency curve of your potential controller. IF only very efficient at a specific amount of solar panel Watt. Are your panel(s) (sum) close to this? What does the efficiency curve look like when less solar light lowers the watt output? For the best all-round output choose a controller with a flat all-the-way high efficiency curve in the region of your solar panel's watt rating and below.

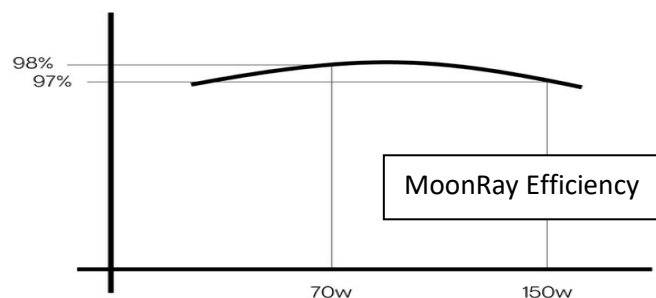
Below graph shows a typical high but very narrow efficiency in a common MPPT controller.

In this example, using a 70W panel would mean the controller may never pass 75% efficiency. Likewise, when using a 150W panel, which would seem like the perfect match. We might very often end up at 70W in non-perfect conditions such as cloudy, hazy, partial shadow, bad angle or low standing sun. This means we end up at 75% efficiency AGAIN even though we choose the seemingly correct solar panel – controller match.



Below and example of an all-round MPPT controller efficiency. Not reaching that very peak of 99% efficiency but instead working at a very high efficiency no matter what solar panel, what weather or sun angle we experience.

The Moonray controller efficiency curve look a lot like the below. This is one of the "secrets" why it is such a good choice for typical yacht or RV solar panel installations.



Type of batteries

Most controllers are meant for Sealed Lead Acid batteries. If you have Gel, AGM or lithium choose a configurable controller. If you have Lithium batteries always check with producer first! Except for SUNBEAMsystem SMART LITHIUM batteries which will work with an SLA setting, or even better AGM settings. The MoonRay MPPT charge controller is universally configurable for any battery type.

Controllers for 24 -48 Volt battery systems

Further info on FAQ www.sunbeamsystem.com Traditionally for a 24v or 48v battery system it would be required to connect solar panels in series. However, this will result in a lower performance on a yacht or RV. On top of this the installation ends up being dependent on healthy and correctly installed diodes, the result is an increased risk for solar panel wear and tear and ultimately damage. Hence, we do recommend using a "boost" controller like the Genasun Boost which allows a parallel solar panel installation.

Multiple Solar Panel Arrays

If a high expected consumption must be met with many large solar panel arrays', then one should follow some simple advices. In an environment with different main directions or reoccurring shading conditions (like a yacht) one could benefit from having several arrays with one MPPT controller each. For example, one starboard and one port array.

The MoonRay controller is prepared to be able to stack in large numbers controlling a lot of individual parts of a big array.

Installation

Fitting of the solar panel

Our Flush-model should be fitted on a firm and even surface. Fill any depression or crack deeper than 1.5mm before fitting. For bonding we recommend either double side tape or Sikaflex 291. Both types of bonding needs much less tape and glue than one would first think. Do not use a less flexible glue than Sikaflex. Apply Sikaflex in a big cross on the backside not less and not more. Alternatively, one could also use screws for panels equipped with eyelets; but make sure the screws are positioned in the center off the eyelet and do not tighten them fully to **allow for expansion** of the panel due to heat.

NEVER pierce or cut the solar panel!

Do not use a solar panel outside the intended usage. Tough Fold are made for mobile use while the majority of our models are made for being fixed on a solid and even surface. Carbon panels have a reinforced inside enabling the use on canvas.

Negligence of using the correct model for the intended purpose may increase the risk of permanent damage.

No model is built for being abused by heavy wind and repetitive motions. Always plan installation to avoid such risks and remove any temporary panels before heavy weather arrive.

Does the angle matter? – No not that much

If you live in the northern hemisphere you might find yourself in the situation where the sun is 45 degrees over the horizon. If you then instantly compare a solar panel lying flat on the ground with a solar panel directed towards the sun you will notice more than 30 % drop in production. However, if you would measure on the two panels mentioned above over an entire day you would only get a 11% drop in the total production for the panel lying flat on the ground compared with the panel angled 45 degrees towards south. This is because of the sun's movement over the day.

This is GREAT NEWS for all of us planning to put solar panels on moving boats and vehicles. Because fitting of a solar panel on a hard roof /deck is almost always the most practical and safest solution.

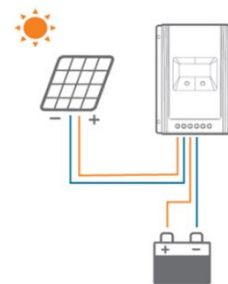
Connect the solar panel and controller.

In moist environments like a yacht or RV one should always use pre-tinned cables for the best performance over time.

A controller with autosensing will recognize the battery system voltage.

Between the controller and battery, a zero-voltage drop is preferable. Hence it is important to place the controller close to the batteries or main cables.

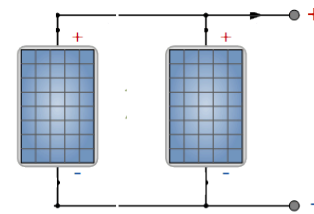
When using long extension cables between panel and controller, ensure they have sufficient cross area.



Multiple Solar Panels

Parallel Connection

Any SUNBEAMsystem panels can be put in parallel with other SUNBEAMsystem panels without extra considerations. For the best result use models with similar V_{mp} (found on the back).



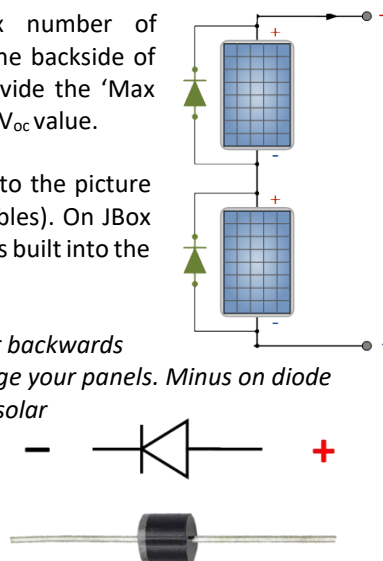
As wattage and cable length increases, the cross area of the main cables running from the solar panels to the controllers needs to be increasingly bigger to avoid losses in the cables.

Serial Connection

The recommended max number of panels can be found on the backside of the solar panel: simply divide the 'Max Sys. Voltage' by the panel V_{oc} value.

By-pass diodes according to the picture are needed (max 0.5m cables). On JBox models the by-pass diode is built into the box.

NOTE: Incorrect, broken or backwards installed diodes can damage your panels. Minus on diode should connect to plus on solar panel and vice versa



Serial connection

Pros:

Higher voltage on the solar panel side and cable backbone.

Cons:

- 1) Introducing a single point of failure (the diode). A faulty diode might result in damaged panels.
- 2) A small power loss in the by-pass diode not experienced on the diode-less Flush models.
- 3) Less production in most shading conditions.

We advise against a serial connection!

Instead choose a controller made for Parallel (or single) solar panels. For 24-48v battery system we recommend the Genasun Boost series.