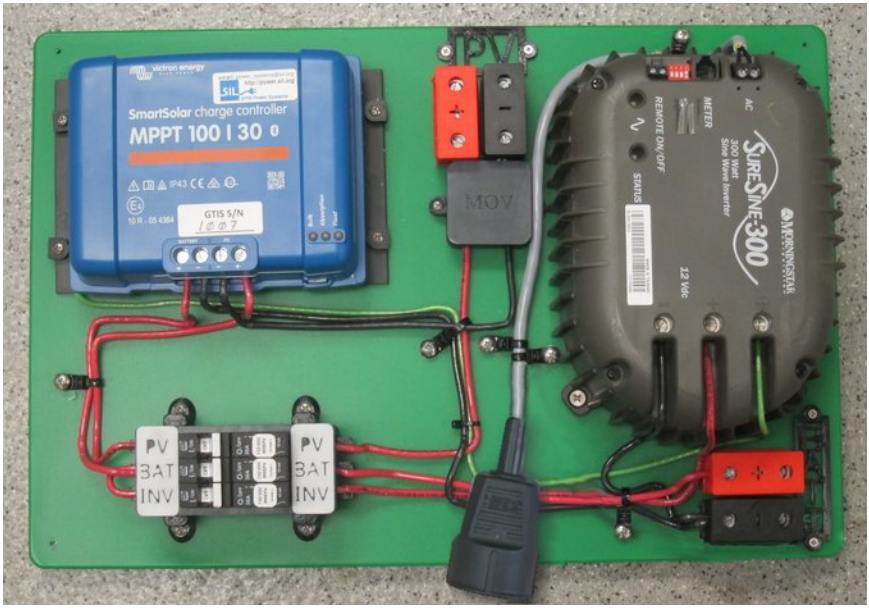
Starlink Power Hub

User's Manual

GTIS Power Systems
power_systems@sil.org

Contact power_systems@sil.org for help selecting batteries or solar panels, or for troubleshooting.

Introduction



The Starlink Power Hub is the heart of a Solar Power System. You need to add 100W or more of Solar Panels and a 12V battery bank of 100Ah or more using AGM or LiFePO4 (LFP) batteries.

Recommended configuration:

Solar panels rated 340W or more

12V AGM/Gel batteries rated 200Ah-400Ah
or
12V LFP Batteries rated 100Ah - 200Ah

This recommended configuration can provide over 500 watt-hours per day of energy in all sorts of weather conditions. That is enough to power a Starlink terminal plus a laptop computer for about 8 hours per day, rain or shine.

Wiring

The Red and Black screw terminals labeled “PV” are for the solar panels. Use 12 or 10AWG wire for the solar panels. Red is for the positive Wire and Black for the negative. The cables to the battery should be at least 10AWG or larger, and are connected to the screw terminals labeled “BAT.”

WARNING: There is no reverse polarity protection on the battery input. If you get it wrong you will ruin the Blue Charge Controller! Use a multi-meter if you have one to check the polarity before turning on the breakers.

Configuring the Battery Type

Your Power Hub was preconfigured by GTIS Power Systems for the type of batteries you requested. There is a selector switch on the lower right corner of the charge controller which can be used to change the battery type. Turn the selector with a small screwdriver. Position “2” is for AGM or Gel type batteries. Position “7” is for LFP batteries. (LiFePO4 and LFP are different abbreviations for the same battery type) LFP batteries will last *much* longer than AGM or Gel, especially in hot climates.

*Note that if you use the **VicronConnect** app on your phone or PC to configure your charge controller, the app settings will override the manual selector switch settings.*

Monitoring with the VictronConnect app

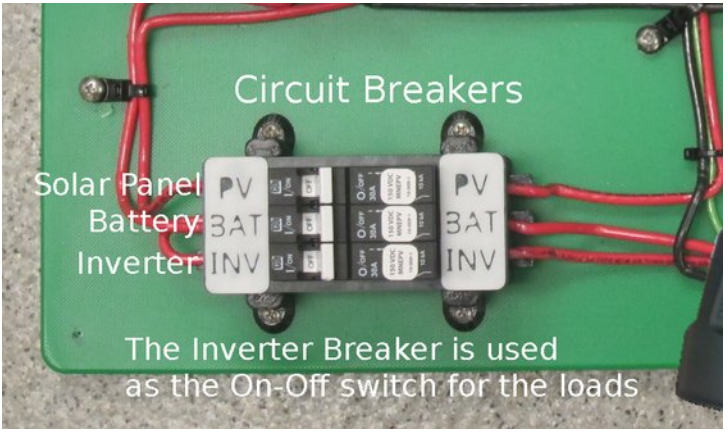
Victron supplies a free app that runs on android or apple phones, as well as a downloadable version for MacOS or Windows. Search your Phone or tablet’s app store for “VictronConnect.” You need to pair over Bluetooth with the SmartSolar charge controller, and then you can view real-time and historical data on the battery and solar panels. The controller remembers about a month’s worth of data.

You also can **change** the charge controller settings with the VictronConnect app.

Therefore it is important that you connect at least once with the VictronConnect app in order to change the Bluetooth security code! The code is set to the default of 000000. Connect and change it. (And write it down someplace!)

Using the Starlink Power Hub

After connecting the batteries and solar panels, the PV and BAT breakers should be flipped to the “On” position and left there. The bottom breaker, labeled “INV” is used as the On-Off switch for the inverter. The inverter wastes about 8W of power even if nothing is plugged into it, so turning it off when not in use will save energy.



Use the VictronConnect app to monitor the state of charge of your batteries. AGM and Gel batteries need to be fully charged at least once a week, preferably every day, to have a long battery lifetime. Consider adding more Solar panels if your batteries are constantly at a low state of charge. (LFP batteries do not need to be fully charged regularly like lead-acid.)

Precautions

Temperature

WARNING: Do Not charge LFP batteries if their temperature is below **0C**, the batteries could be damaged! Discharge is OK as low as **-10C**. If you are in a location where the temperature gets below freezing, consider installing heaters for the batteries.

Cooler temperatures will improve the lifetime of the batteries and electronics. Whenever possible, avoid mounting the Power Hub or batteries in direct sunlight. Do what you can to keep them cool.

Shock and Spark hazard

The recommended solar panel configuration creates high enough voltages at the PV input wires to be dangerous. See Appendix B for a procedure to hook up solar panels and avoid getting shocked or damaging the connectors with arcs.

Storage

If you will be away and not using the system for many weeks (e.g. on furlough) the best course of action depends on the battery type.

In either case, turn off the inverter switch so the inverter will not be discharging the batteries.

With LFP batteries, leave them partially charged at between 50% and 80% charge level (~13.2V-13.4V) and disconnect both the PV and BAT breakers. (all 3 breakers Off) They can sit uncharged for a year safely.

With AGM or Gel batteries leave the PV and BAT breakers in the “On” position and let the system keep them fully charged while you are gone. This is better for all lead-acid type batteries.

Appendix A

Absolute Maximum Ratings

- Solar panel array short circuit current (Isc) – 30A

  (For multiple panels connected in parallel, add the Isc ratings. But, when connected in series, currents do NOT add, instead, the Voltage adds.)
- Solar panel input – 100 Volts (warning: Actual panel voltage can exceed their Voc panel rating by 10% or more in cold climates. power_systems@sil.org can help you do a calculation if you're close.)
- Continuous AC output – 300 watts
- Peak AC output – 600 watts for 15 min. @ 25C, less if it's hotter.

Appendix B

Solar Panel configuration

Caution! Solar panels are especially **dangerous when 2 or more are connected in series** or if your skin is **wet**. The MC4 connectors that come on most panels will protect you from accidentally touching the wires, but if you have bare wire ends exposed, use extreme caution. It's safest to cover the panels so light can't hit them when your are connecting them up.

Panel array choices

The system will self-limit and never take more than about 390W of power from the solar panels even if more is available. In most locations you need panels rated about 480W to provide 390W of actual power at noontime. Add more panels and some power will be "thrown away" by the charge controller around noon on sunny days, but that's not necessarily bad.

Solar panels are relatively cheap compared to the batteries. You can oversize your panel array > 480W to get more power during mornings, afternoons, and during poor weather conditions, allowing you to run with smaller batteries and save money. You can choose to oversize your panel array to 1000W or more which will be a big help on cloudy or hazy days when you really need more power. Remember energy comes from the solar panels, not the batteries.

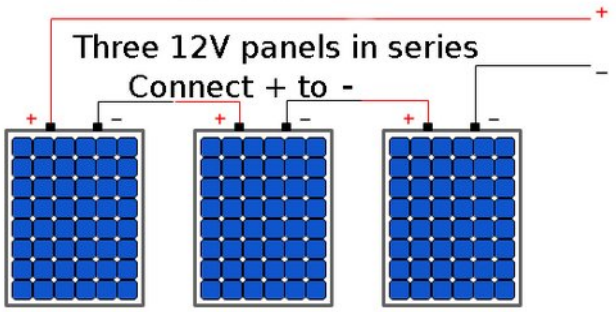
The Victron charge controller can withstand up to 100V from the panels, but on cold mornings panels can exceed their Voc rating by about 10%, so use 90V as your limit. Connect your solar panels in series when possible. 12V panels can be connected 3 in series, and the large 72 cell panels can be connected 2 in series if their Voc is under 45V. If in doubt, email us with the details on your panels at power_systems@sil.org We will want a photo of the sticker on the back of the panel with the ratings and/or manufacturer's name and model #

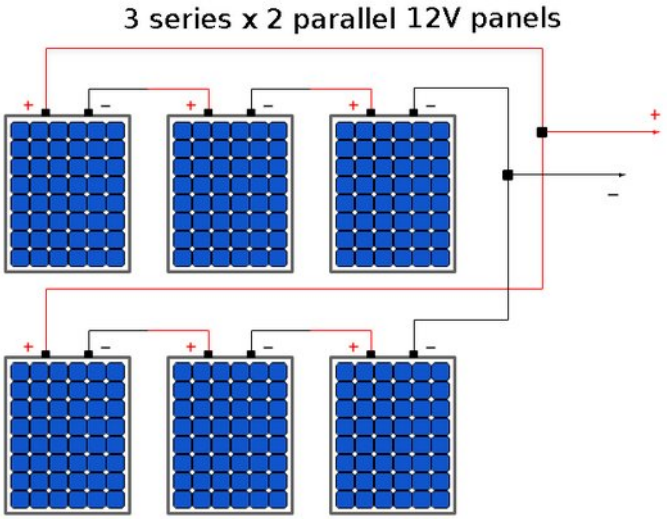
The Isc rating of your solar panel array should not exceed 30A. This is very easy to stay under if you have your panels in a series arrangement since only the voltage adds when in series.

Recommended Panel arrays

Using 12V Solar Panels rated 100W – 200W

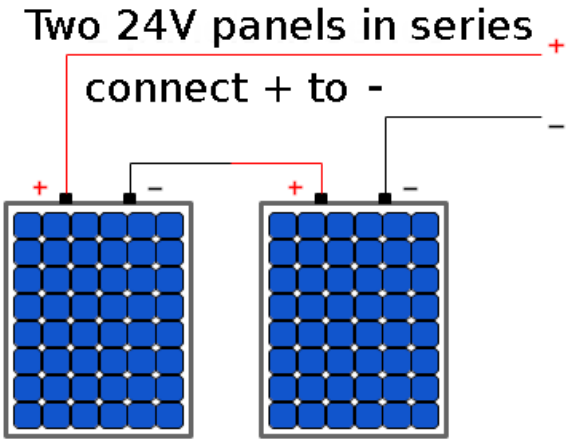
12V panels have a Voc rating of about 21V-24V and usually are less than 200W each. Use identical panels. Put 2 or 3 in series. For more panels put 4, 6 or 9 in a series-parallel array.

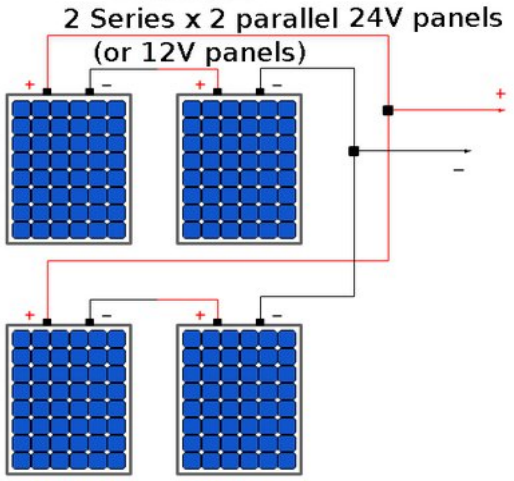




Using 24V Solar Panels rated 230W – 410W

Large panels, usually over 300W are much cheaper per watt. These 60 or 72 cells panels have an Open Circuit Voltage (Voc) of 40V – 45V. Unless you're in an especially cold location or the Voc rating is over 45V, two panels can be placed in series. If you want plenty of power during overcast weather you can even do a 2 series x 2 parallel array.





Procedure for Hooking up solar panels

The solar panels need to be connected to the Red and Black screw terminals on the top of the board, labeled “PV.” While installing, it’s best to cover the solar panels, but if you can’t, follow these steps in order to minimize the risk of getting shocked or damaging the connectors with sparks:

1. Verify the MC4 connectors at the solar panels are NOT connected to the extension wires leading indoors to the charge controller.
2. Verify the PV and Batt breakers on the Power hub are in the Off position.
3. Connect the bare ends of the extension wires to the Red (+) and Black (-) screw terminals on the Power Hub board.
4. At the solar panel array, plug the solar panel MC4 connectors together and to the extension cable. Then uncover the panels if they were covered.
5. Finally, turn on the **Bat** Breaker, then the **PV** breaker.