SRNE 250V MPPT Charge Controllers for PowerSpout Turbines

Please read this document carefully in conjunction with the PowerSpout Installation manual.

Disclaimer
UNLESS SPECIFICALLY AGREED TO IN WRITING, ECOINNOVATION LIMITED:

(a) MAKES NO WARRANTY AS TO THE ACCURACY, SUFFICIENCY OR SUITABILITY OF ANY TECHNICAL OR OTHER INFORMATION PROVIDED IN ITS DOCUMENTATION.

(b) ASSUMES NO RESPONSIBILITY OR LIABILITY FOR LOSS OR DAMAGE, WHETHER DIRECT, INDIRECT, CONSEQUENTIAL OR INCIDENTAL, WHICH MIGHT ARISE OUT OF THE USE OF SUCH INFORMATION. THE USE OF ANY SUCH INFORMATION WILL BE ENTIRELY AT THE USER'S RISK.

Revisions history
1.1. New release by ML, BB and Edited by H.P.

Introduction

250v MPPT Power Conversion Equipment (PCE) have been widely used with PowerSpout hydro turbines (for over a decade) since the release of fully featured products such as the Midnight Classic 250V in hydro mode and the 250V Victron Smart Solar range. Both these 250v MPPTs have become the benchmark for PowerSpout hydro turbines charging 48v battery banks.

Why do we need a 250V MPPT controller?

To charge a 48V battery through an MPPT controller, you need a hydro turbine operating voltage about 10v higher than the maximum charge voltage of the battery. Battery voltage can reach 60V (for some 48v batteries), so we need 70V operating. Then there is the need to allow for errors in the hydro site data, and the voltage steps we can provide in our PMA options. As such, in practice **we need to target a turbine operating voltage of about 80V** for it to work well for all customers.

Our turbines unloaded and free spinning can produce an open circuit voltage (V_{OC}) up to 3 time higher, in other words as high as 240V. So, an approved solar PV MPPT charge controller rated for 240V or higher can be used to charge 12/24/36/48 volt battery bank via a PowerSpout hydro turbine.

(If you wish to charge a 12 or 24v battery, then common, lower cost 150V MPPTs can be used with a Powerspout turbine operating at 40-50V design output voltage.)

Almost all home-scale off-grid power systems use a 48v battery bank these days, so this is where our focus lies and why we are very interested in recent 250V MPPTs available at lower cost from China. Large leading brands (Midnite and Victron) 250V MPPTs retail from about $800-1,000US each. The SRNE equivalent retails for 35-50% of this price.

Who is the target market for lower cost 250v MPPT

Lower cost MPPTs are popular with clients on a budget who do not require extra features or such a long warranty cover. They do not need to view all the performance data online for example, if it costs less to buy.

There are some very affordable 5kW hybrid (solar MPPT combined with a 5kW inverter/charger) PCE that are increasingly common globally. You can read about how to use these with PowerSpout turbines here and here.

If you want to use both PV and hydro in such a system, then this 250v MPPT is a good way to do it at an affordable price. You might for example add our budget priced PLT Cube to your system in this manner.

SRNE 250V Model options

Model sizes available:

Model Number	Output Current rating Amps	Dimensions and weight
MC4860N25	60	264x188x121mm -3.7kg
MC48670N25	70	264x188x121mm -3.7kg
MC48685N25	85	314x259x121mm -5.7kg
MC486100N25	100	314x259x121mm -5.7kg

- Click here for the user manual
- Click here for the SRNE brochure
- Click here for the SRNE Modbus protocol manual (geeks only)

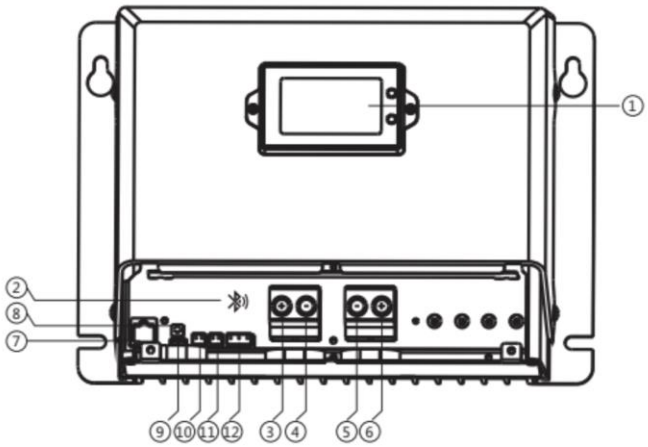
There are two physical size options, and it is likely that the 60-70A and the 85-100A options are physically the same, but that the output current rating is limited by software.

The MPPT is sold under several brands such as SRNE and PUYANG. Is it likely that PUYANG buy OEM from SRNE. If you are concerned about the quality of SRNE products, companies like Midnitesolar brand them as their DIY MPPT Series and DIY inverter series. Midnite would not sell them unless they were happy with the quality and performance.

For a single Powerspout hydro turbine application, the 60A version is more than adequate, as it can handle up to 3kW charge rate into a 48V battery.

(60A x 50V = 3,000W)

For continuous 24/7 hydro operation we suggest that they are not operated above 2/3 of their rating, nominally 2kW on a 48v battery (unless external fan cooling is implemented).



No.	Name	No.	Name
①	Liquid crystal display (LCD)	⑦	RS485 communication interface
②	Bluetooth 4.0BLE module	⑧	Key
③	Positive interface of battery	⑨	TTL communication interface
④	Negative interface of battery	⑩	Battery temperature sampling interface
⑤	Negative interface of solar panel	⑪	Battery voltage sampling interface
⑥	Positive interface of solar panel	⑫	Relay output interface

Our testing

We tested the MC4860N25 in our test room using output from a PMA driven by a VSD. We also performed a real hydro test on a 1.4kW Powerspout LH hydro turbine.

Parameter	Results
Can casing be opened or are they sealed	Unit is sealed, as the two coils are potted into the aluminium case lid. Cannot be serviced or repaired.
Remote meter supplied	Yes, and it is removable. Clear and stable display. One of the best we have seen
Blue tooth monitoring app suppled as standard	Yes – it works well. Password **(135790123) is not provided and difficult to locate online.** Bluetooth app has a clean and tidy layout, simple and easy menus to navigate. Includes graphs of historical data up to 2 years. Downside, it needs reconnecting regularly and you cannot easily tell if it is connected or not.
IEC 62109 compliant	**Yes click here to view this very recent certification. This is mandatory in some global markets**
CE certification	Yes
UL1741 certification	Yes
IEC62509 certification	Yes
Test on a real hydro turbine	On a PowerSpout LH hydro downward track test from 170 VOC it went to 80% VOC of 117 and then tracked after a further minute to 77V and 18.0A. External meter verified that metering to be accurate. Operation was stable and PCE tracked up or down fine. After watching the display for 20 minutes we did not observe a new Voc track – this is an issue with Victron MPPT's. It tested a little better than the Midnite 250v MPPT.
Voc test at >250V	PCE drops the load and VOC warning on the display. On reducing the voltage to <250v normal operation resumes.
Voltage rating of internal capacitors	250V, so a VOC high enough to rupture the capacitor back would kill the PCE as the caps cannot be replaced.
Load terminals	No
Battery temperature compensation	Yes
Voltage compensation wires	Yes
Programable relay	Yes – **but limited functionality so of little to no use**
Common negative design	Yes
Display	Yes, clear, accurate and stable
Manufacture warranty time	3-years. Click here for the SRNE warranty statement
Input short circuit current rating	70A (for all 250V models). This is a **high rating**. On the 60 A version tested **the short circuit rating is higher than the output rating.**
Operational input voltage range	Bat V + 2 to **180V**

Metal case protective earth lug	Yes

Possible applications with this 250V PCE

As previously mentioned, we usually need a 250V charge controller for a 48V battery charging. Other factors to consider in system design are:

- Avoiding overspeed of the turbine when the battery is full.
  (If unloaded speed exceeds 2,000 rpm then there must be some device to ensure the turbine is kept loaded. This corresponds to net heads above about 40m for PLT, 10m for TRG and 4m for LH turbines.) The turbine can be kept loaded using diversion of power from battery to dump loads or to useful water heating with a Morningstar TS45 or TS60 PWM or more directly using our PowerClamp regulator.
- Very long cable runs from the turbine can be costly at 80V, due to the weight of copper required. Using our PowerClamp regulator allows us to design for 150-180V operation without danger to the 250V MPPT, with much lighter wiring, and this also prevents turbine overspeed.

Turbine Option	Cable load voltage	Runaway RPM	PowerClamp or TS45/60 required?
PLT80, PLT Cube 80, TRG80, LH200	80V 100V	<2000 <2000	No – optional only. Useful if you wish to harness surplus power generated. **Drawing A**
PLT80, PLT Cube 80, TRG80, LH200	80V 100V	>2000 >2000	PowerClamp **or** Morningstar TS45 or TS60 PWM diversion regulator **Drawing B & C**
PLT150-180, PLT Cube 150-180, TRG150-180, LH300-LH350	150-180V 150-180V	N/A N/A	PowerClamp must be installed to provide over voltage protection **Drawing D**

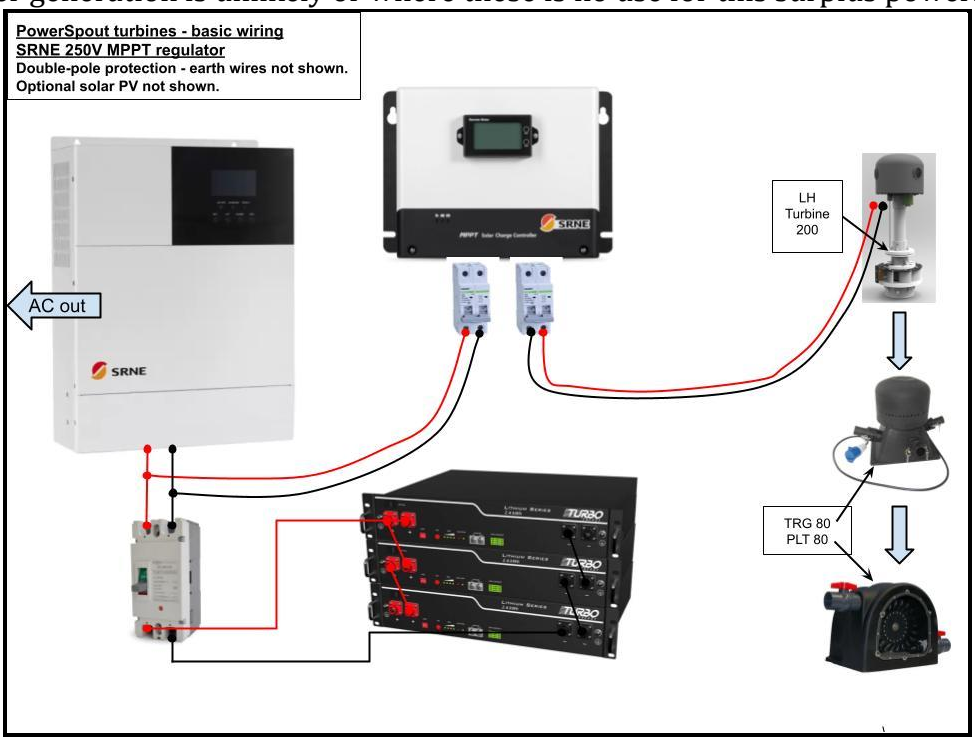
PowerClamp update

EcoInnovation will soon have on the market the PC2 (PowerClamp 2nd generation). In addition to heaters that load the turbine directly, this PC2 will have two **auxiliary relays** to control surplus power diversion via an AC or DC SSR. Clients who have good hydro sites with ample surplus will be able to automatically divert excess power to a useful purpose either at the battery voltage or on the AC side of the inverter. Examples include water heating or charging an electric car. The original heaters will protect the MPPT and prevent overspeed in the event that these useful applications are disconnected for any reason.

Refer to drawing D.

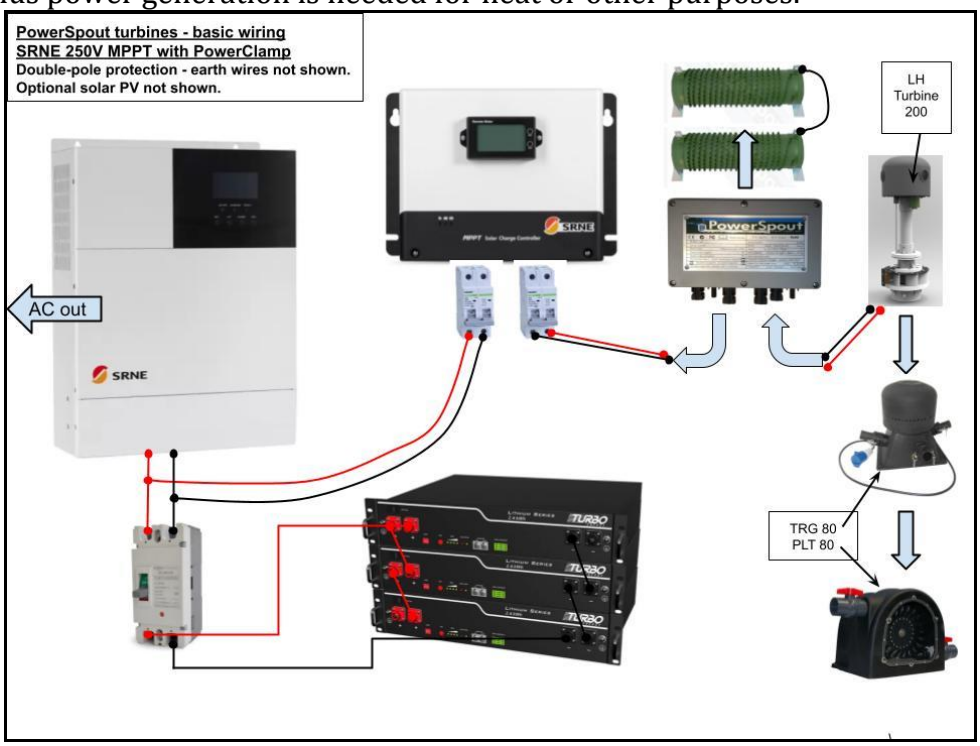
Drawing A

Simple installation for runaway rpm < 2000. Only to be used where surplus power generation is unlikely or where these is no use for this surplus power.



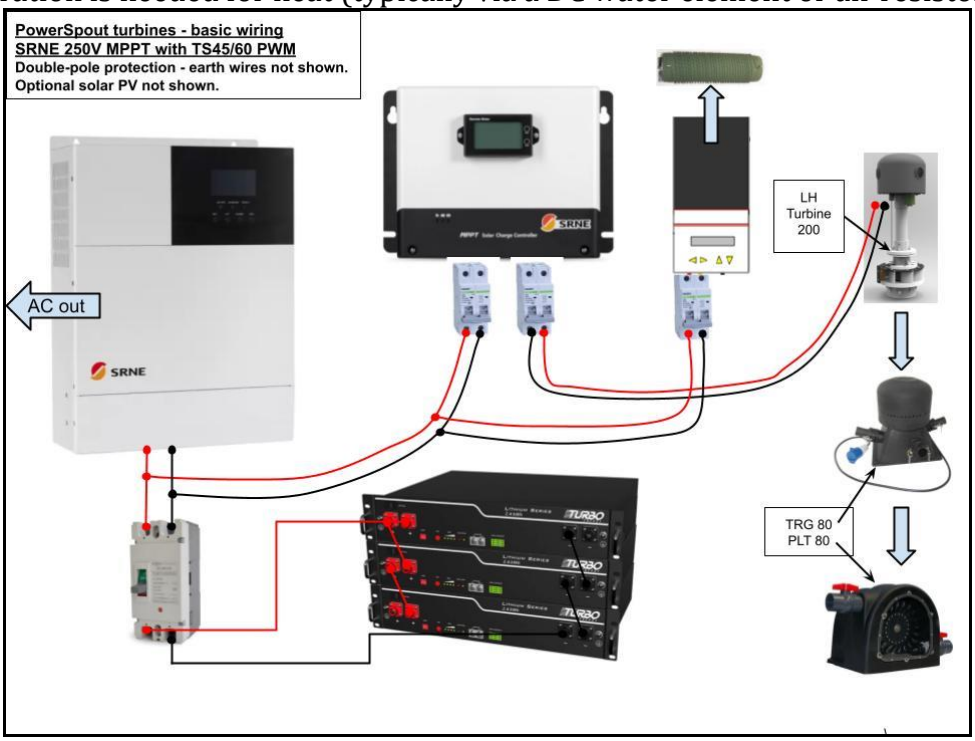
Drawing B

Installation with a PowerClamp for runaway rpm > 2000. Can be used where surplus power generation is needed for heat or other purposes.



Drawing C

Installation with a Morningstar TS45/60 for runaway rpm > 2000. This is a lower cost option than with a PowerClamp. Can be used where surplus power generation is needed for heat (typically via a DC water element or air resistor)



Drawing D

Installation with a PowerClamp for higher voltage cable applications regardless of turbine runaway rpm. Surplus power generation is also desirable for heat or other purposes.