How to set up an PowerSpout TRG/PLT100C with a FM60/80 regulator

Safety

These instructions are interim until the new 2014 technical manual is written.

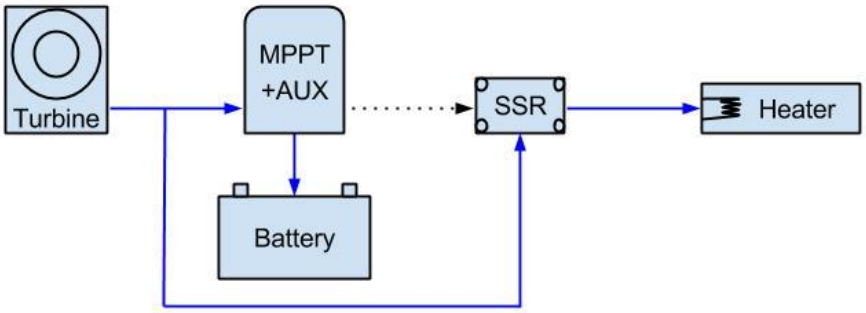
The above notes are intended to guide qualified technicians in the setup of diversion loads when PowerSpout PLT/TRG100C turbines are connected to F60/80 MPPT regulators.

Please ensure you abide by all the safety warnings in the 2014 Installation Manual that you must read in conjunction with this document.

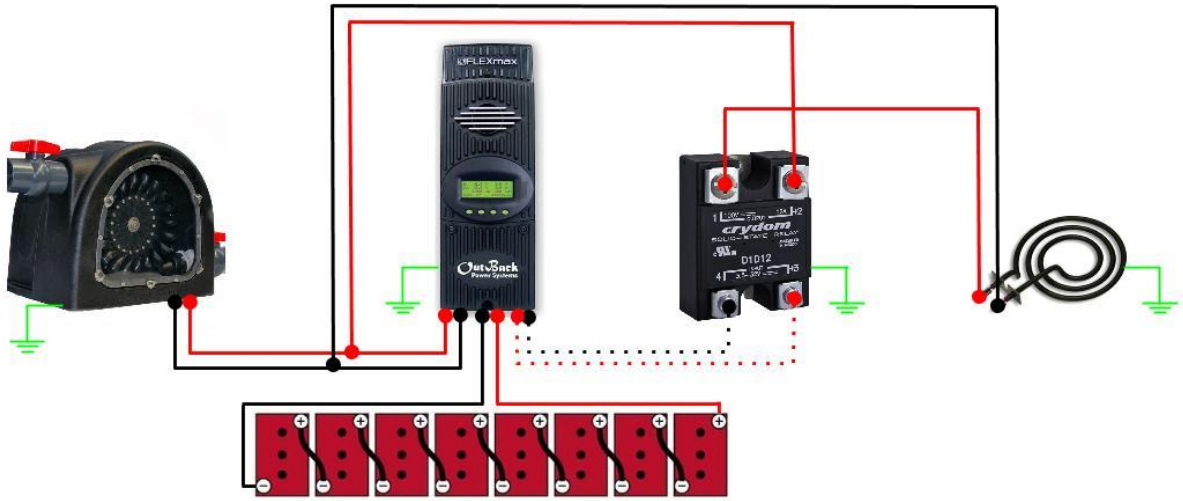
Fuses/breakers are not shown for clarity. This information in already covered in the new 2014 Installation Manual (2014 IM) section 8.

Refer to 2014 IM section 2.10.

Energy Flow diagram for a TRG/PLT100C using PV trigger AUX relay



Wiring diagram for a PLT100C using PV trigger AUX relay



Fuses/breakers are not shown for clarity. This information in already covered in the new 2014 Installation Manual (2014 IM) section 8

The positive and negative wire connections between the incoming hydro wires and the SSR/element can be made at the FM60/80 breaker position.

SSR's supplied with your order

If you ordered an SSR with your turbine it will look like the picture opposite.

It is fitted in a PVC protective enclosure mounted on a large heat sink.

PV trigger set up

The PV-Trigger settings will activate the AUX 12 VDC output relay, when the threshold voltage set point is exceeded. When the threshold voltage decreases below the voltage set point, the output will remain active for the duration of the hold time set by the user.

You must use the "PV-Trigger" setting to run your turbine. It is necessary to connect the load element (e.g. air or water heater) on the "input side" of the MPPT shown in the wiring diagram above.

As the input and output of an MPPT regulator are not directly coupled, you will get nuisance tripping of the 120 VDC Klampit (that is inside the PLT100C turbine) if you do not wire the AUX relay as shown above.

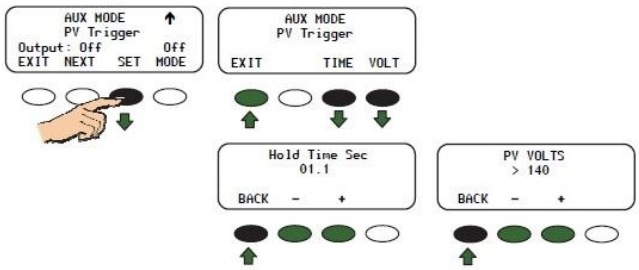
It is recommended that you put a warning on the MPPT breakers "Do not turn off these breakers with the turbine in operation". If the MPPT regulator is disconnected, the turbine speeds up and Klampit activates at 120 VDC shorting the turbine operation. This will not damage any equipment but the turbine will cease generation and this can be confusing for clients.

The turbine must be restarted in order to reset the Klampit. If no Klampit is installed in the turbine, the MPPT regulator will be destroyed.

Klampit operation checks

Prior to hooking up to your MPPT regulator you must check operation of the Klampit.
To do this attach a DC voltmeter to the turbine output lead. Turn the turbine on slowly, the volts should increase steadily until 120 VDC is reached, at this point the voltage should drop to almost zero volts and stay there. Turn off the turbine. Repeat and check that the Klampit has released the short circuit, if you have a voltage then all is good.

PV-Trigger test settings



Mode: Auto

Aux Polarity: Active High (↑)

Time: 0.01sec

Volt: 90-100V – some user adjustment needed for best results

(image from FM60/80 manual – example only, instructions do not follow this image)

It is important that a good quality fast switching SSR is used (so that we can effectively PWM the element at high speed) that has a very low on resistance. Low cost SSR's on Ebay are very cheap but have high on resistance and cannot be switched at 0.01s intervals. Do not buy these SSR's they will fail.

The PV-Trigger time must be as fast as possible to get the best result.

Suitable SSR (solid state relay)

The Crydom D1D40 and D2D40 are excellent SSR's that can switch up to 40 amps continuously (when mounted on a large heat sink).

For a pdf click here http://www.crydom.com/en/products/catalog/1_dc.pdf

- On state resistance = 0.05 ohm
- Maximum Surge current = 106 amp
- Maximum Load current = 40 amp
- Maximum turn on time = 100 us
- Maximum turn off time = 1 ms

240V - 3000W water elements using AUX "PV trigger" relay settings

This is best illustrated by way of an example. Let us assume you have a PLT100C turbine that is rated for 700W at 90-100 VDC and you intend to use a FM60/80 150 VDC MPPT regulator. We want to use a 240V 3000W water element as they are common globally both as stove and water heater elements.

The table shows the Wattage of this element in 10 volt increments from 10-240 VDC.

Voltage	Watts
240	3000
Volt step	Watts
10	5
20	21
30	47
40	83
50	130
60	188
70	255
80	333
90	422
100	521
110	630
120	750
130	880
140	1021
150	1172
160	1333
170	1505
180	1688
190	1880
200	2083
210	2297
220	2521
230	2755
240	3000

As a PLT100C turbine will develop maximum power at about 90-100 VDC we can set the PV trigger to operate at say 95-100 VDC. Once the batteries no longer require all the 700W being generated the MPPT regulator will allow the incoming voltage to increase, this will turn on the water element and at 95 vdc about 470W will go to hot water heating.

Once the batteries are fully charged we might see the incoming voltage rise to 100 VDC and 521W will be diverted to the water heater.

If the incoming voltage is less than 94 vdc, all the available 700W will be going

to the batteries. The trigger point can be adjusted until a good result is achieved.

A PLT100C turbine has a nominal MPPV of 100 VDC but this can be + 5 /-15 vdc, so some experimentation may be required on site to get it working really well.

If you notice that the Klampit activates at night (your generation Watts will drop to zero) when home loads are at a minimum, then it is likely that you need to fit a larger diversion relay to stop this nuisance tripping of the Klampit.

Note that a Crydom D1D40 relay has a maximum voltage of 100 vdc. So do not set the PV trigger above 100 vdc. Crydom also make a D2D40 which can switch at up to 200 vdc. These are more costly but may be more suitable for clients who want to divert more power in the 100+ VDC range. Stay at least 10 VDC away from the 120 VDC Klampit limit or you may get nuisance tripping.

The important point in selecting a diversion resistor is to chose a resistor that will draw less power than you are able to generate. Then you will have sufficient power for your MPPT regulator to complete the bulk, float an EQ charging. If you have a battery SOC monitor fitted it will still be accurate.

If you switch on a load resistor which is larger than your generation Watts (in the example above a 120V 1500W resistor – see table below), then your MPPT regulator will never be able to complete the bulk, float and EQ charging. Your battery monitor will never report that your batteries are fully charged.

If you switch on a load resistor which is much smaller than your generation Watts (in the example above a 240V 1500W resistor – see table below), then your MPPT regulator will complete the bulk, float and EQ charging, but your incoming voltage will steadily rise and activate the protective Klampit at 120 VDC. You do not want this to happen so fit a larger resistor or generate less power with smaller jets.

240 V Element ratings

Voltage 240	Watts 1000
Volt step	Watts
10	2
20	7
30	16
40	28
50	43
60	63
70	85
80	111
90	141
100	174
110	210
120	250
130	293
140	340
150	391
160	444
170	502
180	563
190	627
200	694
210	766
220	840
230	918
240	1000

Voltage 240	Watts 1500
Volt step	Watts
10	3
20	10
30	23
40	42
50	65
60	94
70	128
80	167
90	211
100	260
110	315
120	375
130	440
140	510
150	586
160	667
170	753
180	844
190	940
200	1042
210	1148
220	1260
230	1378
240	1500

Voltage 240	Watts 2000
Volt step	Watts
10	3
20	14
30	31
40	56
50	87
60	125
70	170
80	222
90	281
100	347
110	420
120	500
130	587
140	681
150	781
160	889
170	1003
180	1125
190	1253
200	1389
210	1531
220	1681
230	1837
240	2000

Voltage 240	Watts 2500
Volt step	Watts
10	4
20	17
30	39
40	69
50	109
60	156
70	213
80	278
90	352
100	434
110	525
120	625
130	734
140	851
150	977
160	1111
170	1254
180	1406
190	1567
200	1736
210	1914
220	2101
230	2296
240	2500

Voltage 240	Watts 3000
Volt step	Watts
10	5
20	21
30	47
40	83
50	130
60	188
70	255
80	333
90	422
100	521
110	630
120	750
130	880
140	1021
150	1172
160	1333
170	1505
180	1688
190	1880
200	2083
210	2297
220	2521
230	2755
240	3000

120 V Element ratings

Voltage 120	Watts 1000
Volt step	Watts
10	7
20	28
30	63
40	111
50	174
60	250
70	340
80	444
90	563
100	694
110	840
120	1000

Voltage 120	Watts 1500
Volt step	Watts
10	10
20	42
30	94
40	167
50	260
60	375
70	510
80	667
90	844
100	1042
110	1260
120	1500

Voltage 120	Watts 2000
Volt step	Watts
10	14
20	56
30	125
40	222
50	347
60	500
70	681
80	889
90	1125
100	1389
110	1681
120	2000

Queries

If you have queries about the above instructions you can email michael@ecoinnovation.co.nz for help.