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MODULE CONTROLLER

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Version	Date	Remarks	Author
1.0	May 2022		B.Sc. B. Pieters
1.1	Dec 2022	Cerbo connection drawing	B.Sc. B. Pieters
2.0	May 2023	Hardware version 7	B.Sc. B. Pieters

SAFETY INSTRUCTIONS

Please read the documentation supplied with this product first, so that you are familiar with the safety signs and directions before using the product.

WARNING: DANGER OF ELECTRICAL SHOCK
The product is used in combination with a battery. Even if the equipment is switched off, a dangerous electrical voltage can occur at the input and/or output terminals. Always switch the power off and disconnect the battery before performing maintenance.
The product contains no internal user-serviceable parts. Do not put the product into operation unless the cover is fitted. All maintenance and installation should be performed by qualified personnel.
Never use the product at sites where gas or dust explosions could occur.

Use the Tesla module in suitable housing. Do not use the Tesla module inside a house. Make sure the environment can withstand the fire which can be caused by the Tesla module. Use a fire barrier between the Tesla battery module and spaces where people are present. Place the Tesla module in a separate partition. Place the Tesla battery module in a dry environment. Place the Tesla battery module in an ambient temperature between 0°C and 35°C. Never connect Tesla modules in Parallel when their voltage is not equal!!!

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge. Children should be supervised to ensure that they do not play with the appliance.

Installation
Read the installation instructions before commencing installation activities. For electrical work, follow the local national wiring standard, regulation and installation instructions.
Ensure that the connection cables are provided with fuses and circuit breakers. Never replace a protective device by a component of a different type.
Ensure that the equipment is used under the correct operating conditions. Never operate it in a wet or dusty environment.
Install the product in a heatproof environment. Ensure therefore that there are no chemicals, plastic parts, curtains or other textiles, etc. in the immediate vicinity of the equipment.

Transport and storage
On storage or transport of the product, ensure that the mains supply, and battery leads are disconnected.
No liability can be accepted for damage in transit if the equipment is not transported in its original packaging.
Store the product in a dry environment; the storage temperature should range from –20°C to 60°C.

Location
Choose a dry location protected from direct sunlight. Humidity below 90% noncondensing. Environment temperature below 40 °C/104 °F.

Keep in mind the orientation of the Color display. The preferred installation is hanging on a wall.

Keep a short distance to the battery as battery current is high and you wish to avoid cable losses.

For your battery you wish to select a location keeping following in mind:

- Avoid direct sunlight.
- Avoid exposure to water.
- Avoid low ambient temperature, below 10 °C/ 50 °F.
- Avoid high ambient temperature, above 35 °C/ 95 °F.
- Avoid mechanical impact by any object.
- Protect against electrical shock, you must be unable to touch the poles.
- Do not place inside residential area.
- Protect from open fire.
- Do not stack.

DESCRIPTION

This module controller is designed for use with a maximum of 26 Tesla battery modules or 8 BMW I3 batteries, or 10 Mitsubishi outlander batteries. This module controller is not designed for feeding drivetrains from vehicles.

Following functionality is incorporated:
- Input voltage 18-53 VDC
- Cell balancing
- Current measurement
- SOC calculation

Contactor 400 Amp with safety features:
- High temperature switch-off
- Low temperature switch-off
- High cell voltage switch-off
- Low cell voltage switch-off

External interface:
- Charge enable (pot free contact)
- Heat enable (12V output)
- Cool enable (12V output)
- Victron CAN bus communication for GX family
- DC output for Victron color control

1. INSTALLATION

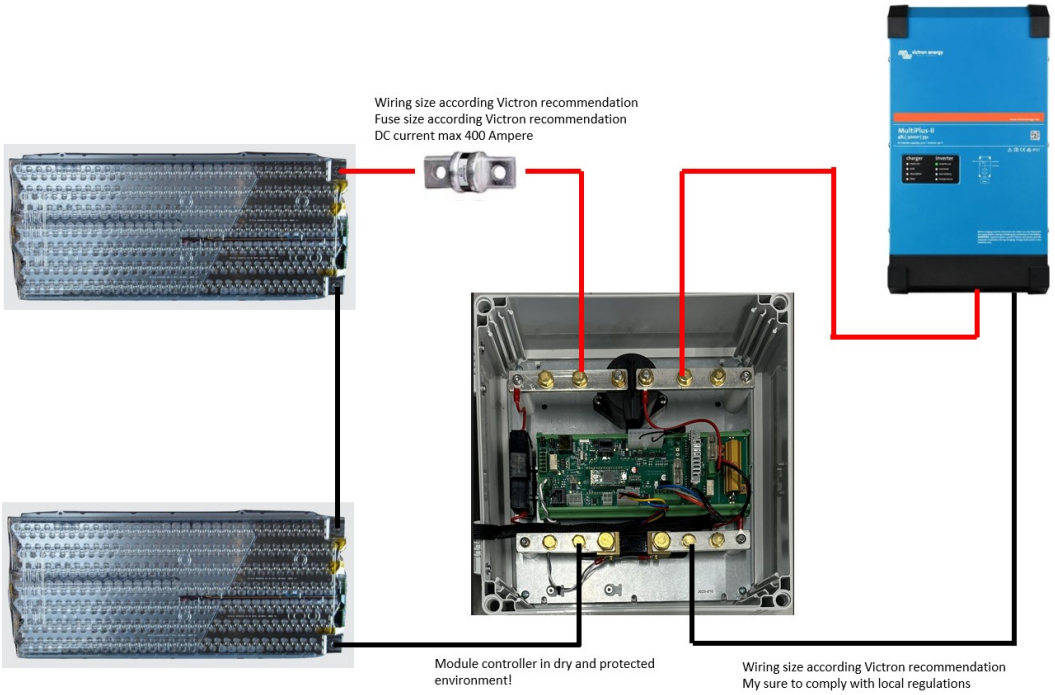
1.1 Power connections

Three power connections are needed.
+ Battery (18-53VDC)
- Battery
+ Consumption

Make sure to fit a fuse between the Tesla battery and the battery module controller. A Tesla battery has a short circuit capacity up to 3500 Amp. Match fuse accordingly. Find an explanation about fuse selection criteria:

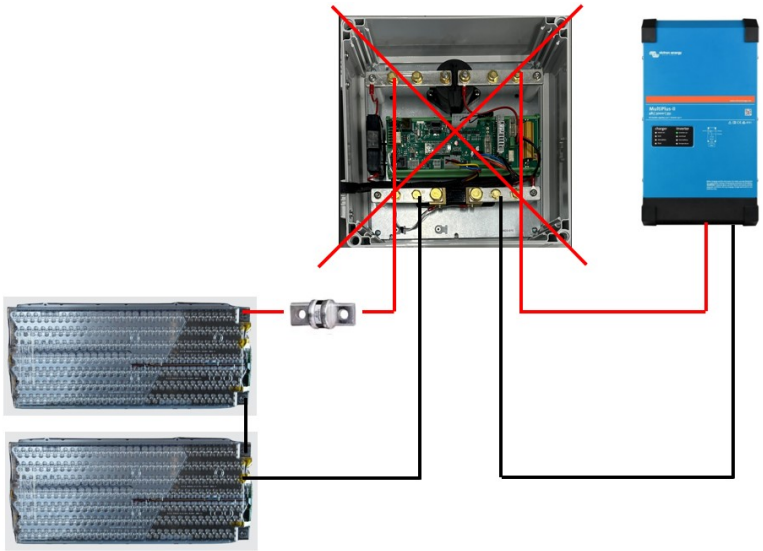
Choose a dry location to avoid exposure to sunlight. Mount the wall mounting lugs to the four corners of the BPath Module Controller.

Use highly flexible power cables (Class 5 or Class 6). The Positive cables enter the module controller via the top side.
Negative cables shall enter the module controller from the bottom side.



The + Battery cables enter via the left top side.
The – Battery cables enter via the left bottom side.
The + consumption/charger cables enter via the right top side.
The – consumption/charger cables enter via the right bottom side.

DO NOT ROUTE POSITIVE POWER CABLE FROM THE BOTTOM SIDE ACROSS THE CIRCUIT BOARD TO THE CONNECTION RAILS.
DO NOT ROUTE NEGATIVE POWER CABLE FROM THE TOP SIDE ACROSS THE CIRCUIT BOARD TO THE CONNECTION RAILS.



1.2 Battery communication connection

The module controller communicates with:

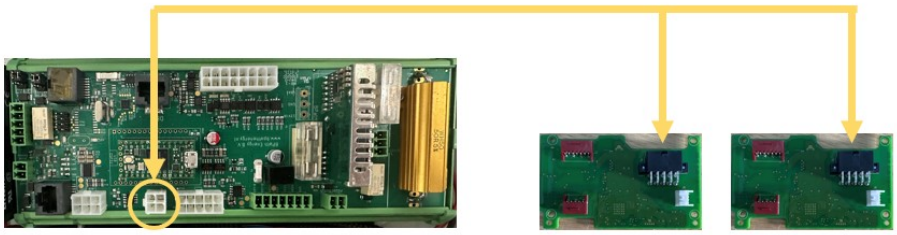
- Tesla model S/X batteries
- BMW I3 batteries
- Mitsubishi oultlander PHEV batteries

1.2.1 Tesla Module communication connection

The Module controller communicates with the Tesla battery modules. The Tesla modules are equipped with a battery monitoring board.

The BMS and BMB's are connected by a cable. Order/buy the appropriate cable together with the Module Controller. Follow QR link below:

The cable must have the same number of connectors as the number of Tesla modules connected. Leaving one connector unattached will not allow communication between BMB and BMS.



1.2.2 Mitsubishi Outlander PHEV

Preferably you send your connectors to the BPath Energy workshop to make the suitable communication cable for your application.
Contact BPath Energy to find your most suitable option.

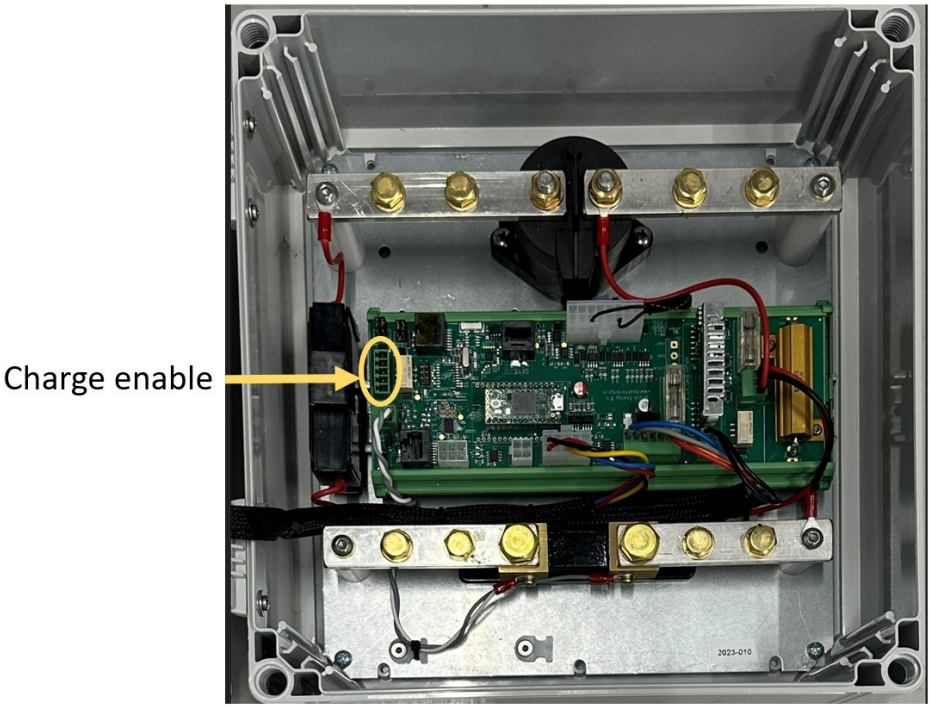
1.2.3 BMW I3

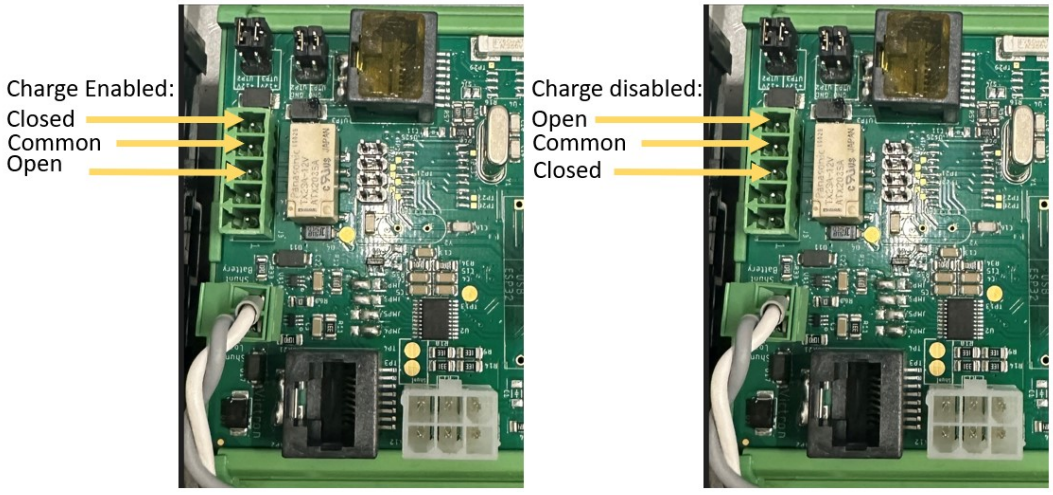
Preferably you send your connectors to the BPath Energy workshop to make the suitable communication cable for your application.
Contact BPath Energy to find your most suitable option.

1.3 Auxiliary contacts

1.3.1 Battery charger charge enabled.

This connection is used to enable/disable a battery charger.
A potential free relay is provided for this purpose.



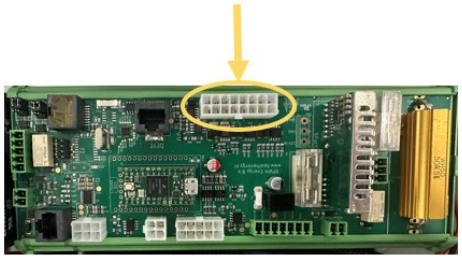


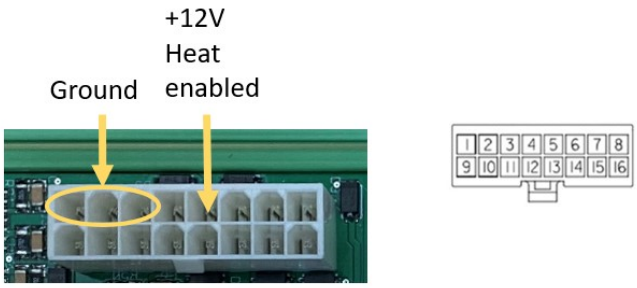
Contact ratings:

Maximum switching voltage: 250 VAC.
Maximum switching current: 1.5 Amp.
Maximum carrying current: 1.5 Amp.

1.3.2 Heat enabled.

Heat enable is a 12VDC (0.5 Amp) output used for switching an external relay.
Power for relay is provided on the connector below:



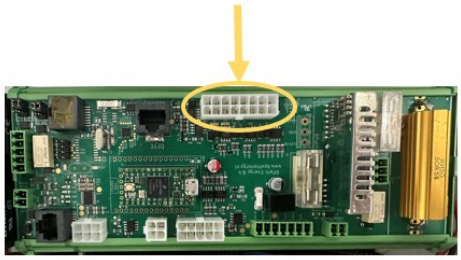


Use Molex minifit crimp. Pins 1,2 and 3 are ground, you may choose which one to use.
Pin 5 is heat enable.

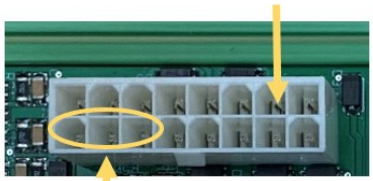
To switch a heater, use a finder relay as shown below, or equal (4C.01.9.012.0050):

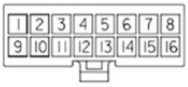
1.3.3 Cool enabled

Cool enable is a 12VDC (0.5 Amp) output used for switching an external relay.
Power for relay is provided on the connector below:



Ground
Cool
enable





+12V

Use Molex minifit crimp. Pins 9,10 and 11 are +12V, you may choose which one to use. Pin 7 is switched ground for cool enable.

To switch a cooling system, use a finder relay as shown below, or equal (4C.01.9.012.0050):

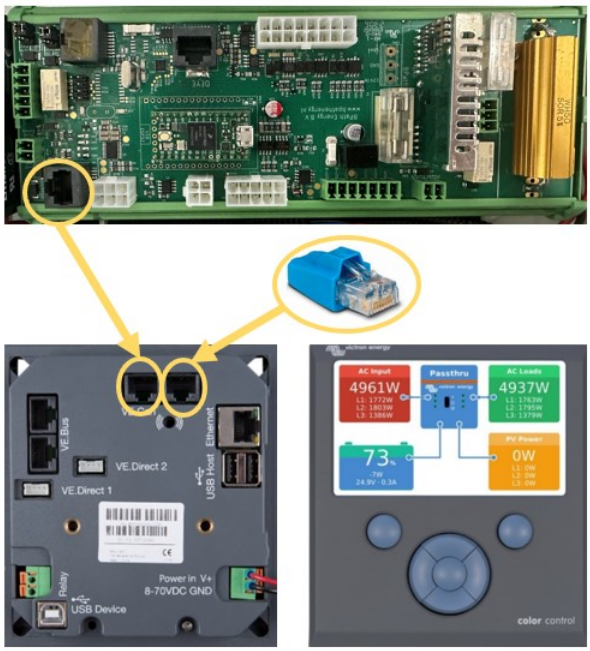
1.4 Victron communication

The battery module controller has support for Victron GX products:

Cerbo GX	CCGX	Venus GX	Octo GX	CANvu GX	Maxi GX	MultiPlus-II GX and EasySolar-II GX
						

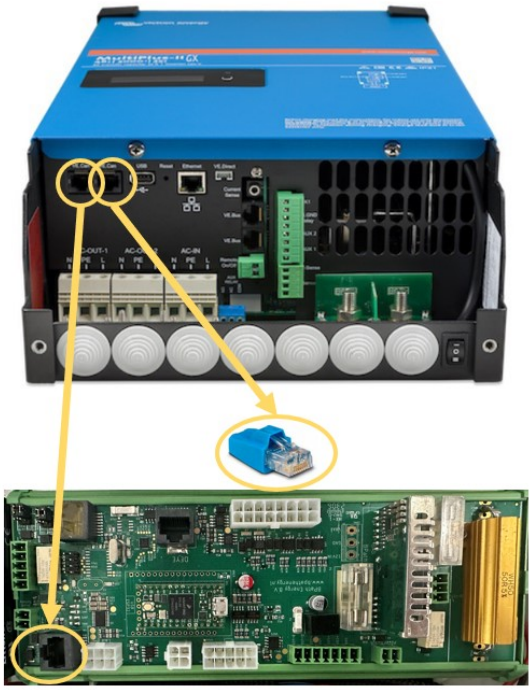
Connect the Victron VE can port with the UTP port on the BMS. Chapter 3 describes how to setup Victron charger controls (DVCC)

Canbus connection with Color control GX:



Canbus connenction with Cerbo GX

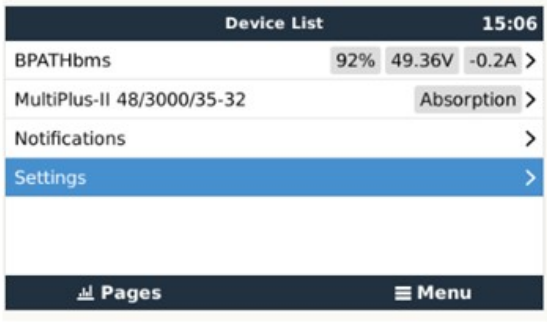
Canbus connection with Multiplus II GX

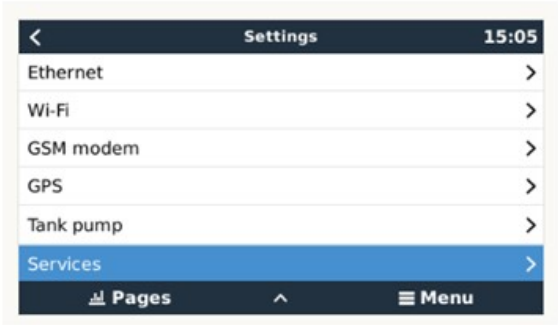


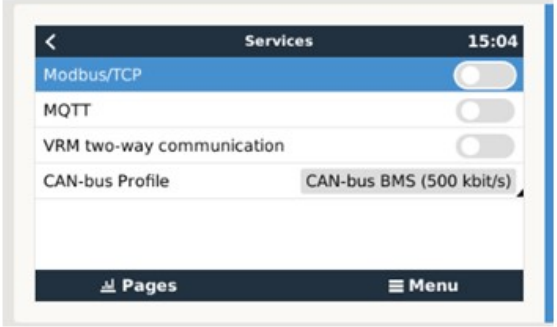
2. VICTRON SETUP

2.1 CAN-bus speed

Select the CAN-bus Profile as shown below.
Settings, Services and choose CAN-bus BMS (500 kbits/s).







After applying setting below the BMS appears in the device list

1. connecting the UTP cable according to chapter 1.4
2. and selection of the CAN bus profile BPATH BMS
3. and selection of the Victron in the BMS touch screen.

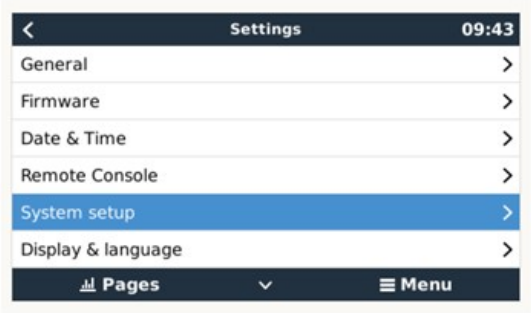
Battery Voltage, battery current, battery temperature, SOC and BMS alarms will be available on the Victron devices.

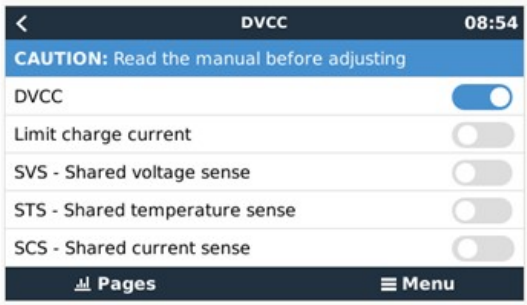
2.2 Victron charge control from BMS.

The battery management system can control several Victron chargers. The allowed charge current and charge voltage will be set by the BMS. Victron will follow these commands when setup according to this manual. Discharge current is not controlled.

It is allowed to use more than one charger/MPPT. There are restrictions regarding types of Victron chargers/MPPT's to work successfully together. Check the optimal DVCC configuration with you Victron dealer. Or check via QR link below:

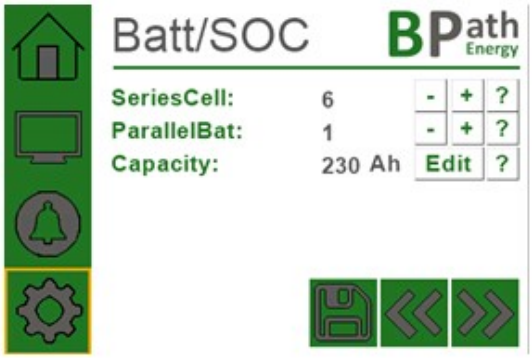
To enable this function instructions described in chapters 1.4 & 2 must be followed. Furthermore, apply settings as shown below:
Go to settings and system setup and switch on DVCC.



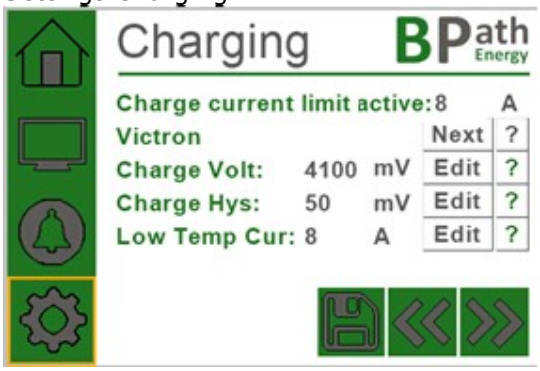


Check your configuration after this setup.

Example, how to test:
Check Manual Display & Settings BMS.
Settings Batt/SOC



Settings Charging



Charge battery to full. The charger should have an end voltage of: (4100/1000) *6= 24,6V.

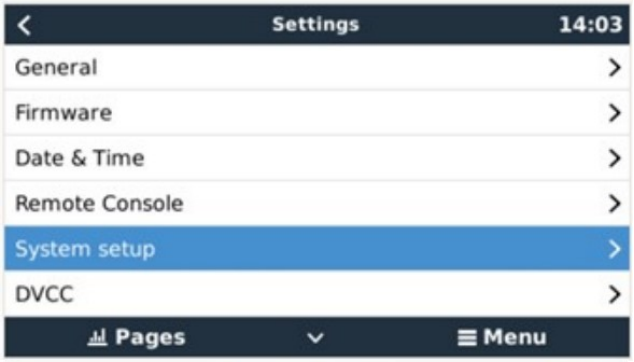
If the charger differs from this voltage your setup was not successful.

You can also choose to test the current limit setting.

2.3 Victron SOC presentation from BPath BMS

SOC will not automatically be presented on the victron display.

Follow instruction below to display SOC.



Now SOC is displayed:

3. RGB ON/OFF SWITCH

3.1 ON/OFF

Once installation is checked and completed you can start the BPath module controller by pressing the on/off button for two seconds.

When the controller is on you can switch it off by pressing the on/off button shortly. You will see shutdown and a counter reducing from 5 to zero. When zero is reached the contactor is opened en BPath module controller is switched off.
The BPath Module controller has no power consumption once it has switched off.

3.2 RGB

The led ring has colors to give information to the user.

3.2.1 SOC

The LED ring is green when the battery is fully charged. While draining the battery the color will change to orange at approximately 50% SOC (half full). Below 30% the color is red.

Note that several settings must be applied before the SOC calculation is correct.