

MANUAL DISPLAY
&
SETTINGS BMS

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1. Preface

This manual describes the BMS information and settings via the touch display.

1.1. Icons



Next page. An additional page with related information is available. Press this button to go to that page.



Previous page. Press this button to go back to the previous page



Save button. Press to save changes. Yellow when changes are made and not saved.



Help button. Help text is available.



Decrease/increase value by 1.

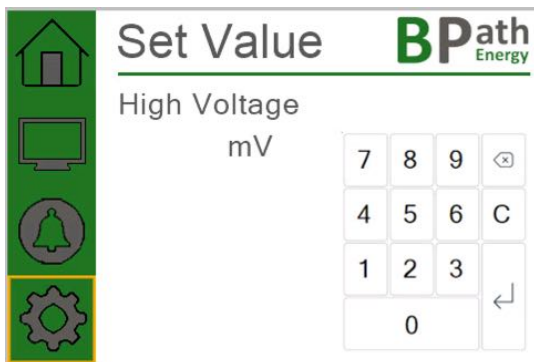


Provide next available option



Go to numeric keyboard to enter a new value.

Numeric keyboard

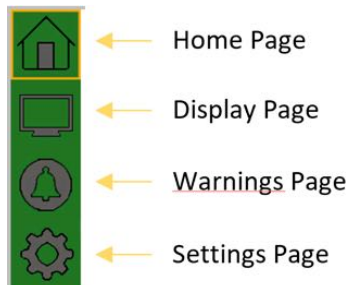


Type value and press enter.

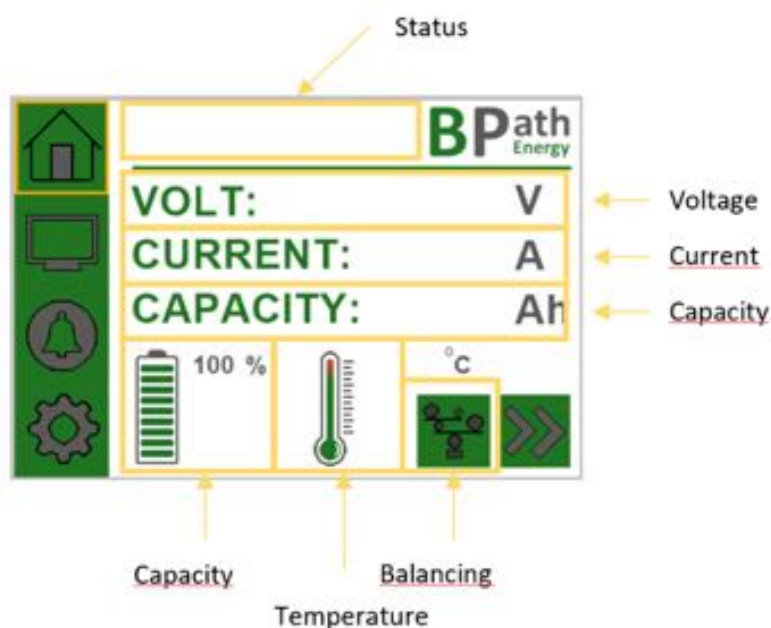
Use C or backspace as needed.

2. Pages

The left column displays four icons. Touch the icon to enter the related page. Function is described in upcoming paragraphs.



2.1 Home page



Status

Provides information about the software state.

Boot: Software is loading, information from batteries is retrieved.

Pre-charge: In this phase of start-up the capacitors of the connected inverter or MPPT's are pre-charged to avoid damaging the main contactor. Check chapter 2.4.6 parameter "Pre-charge timer"

Healthy: This is the normal status. Achieved when no errors occur and contactor is successfully closed.

Information

- Volt:** displays pack voltage. Check chapter 2.4.1. parameter "SeriesCells" for correct information.
- Current:** displays current when a Canbus sensor is installed and selected. Check sensor, chapter 2.4.1
- Capacity:** displays State Of Charge. See chapter 2.4.1 parameters "ParallelBat" & "Capacity". Calculation method can be "voltage based" when no current sensor is used. When a current sensor is used settings "chargedVolt", "tail current" and "Charged time" are relevant for current capacity information.

Icons



Balancing symbol shows when cell balancing is active. See chapter 2.4.1 parameters "BalanceVolt" & "BalanceHys" relevant for Balancing settings.

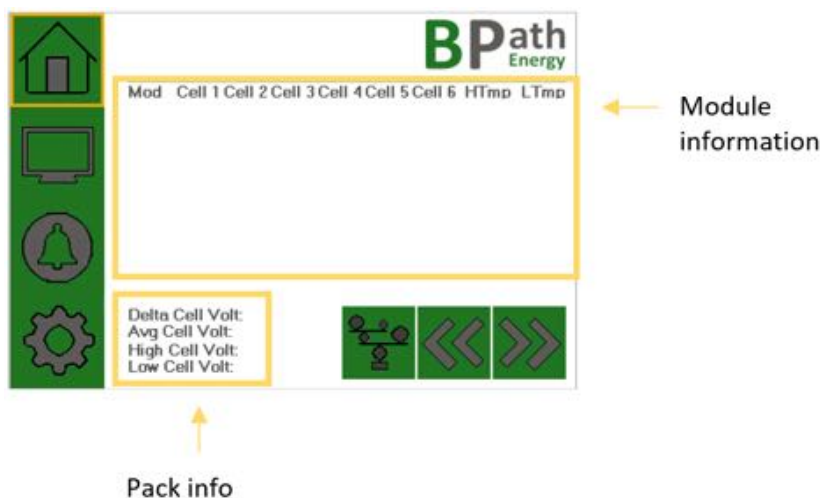


Capacity symbol illustrates the State Of Charge. See chapter 2.4.1 parameters "ParallelBat" & "Capacity". Calculation method can be "voltage based" when no current sensor is used. When a current sensor is used settings "chargedVolt", "tail current" and "Charged time" are relevant for current capacity information.



Displays average temperature measured on all sensors.

When pressed the detailed page is displayed.



Module information

One horizontal line displays information retrieved from a Tesla battery module. The next horizontal line displays information retrieved from the next Tesla battery module. Up to 13 modules are displayed on this page. When more modules are connected press next page button for their information.

Mod: Modules Voltage
 Cell 1: Voltage cell 1
 Cell 2: Voltage cell 2
 Cell x: Voltage cell x
 HTmp: The highest temperature measured on the Tesla module.
 LTmp: The lowest temperature measured on the Tesla module.

Pack info

Information related to all connected Tesla modules.

Delta Cell Volt: Difference between highest Cell and lowest Cell voltage.
 Avg Cell Volt: Average from all cells.
 High Cell Volt: Highest Cell voltage in the pack.
 Low Cell Volt: Lowest Cell voltage in the pack.

2.2 Display page

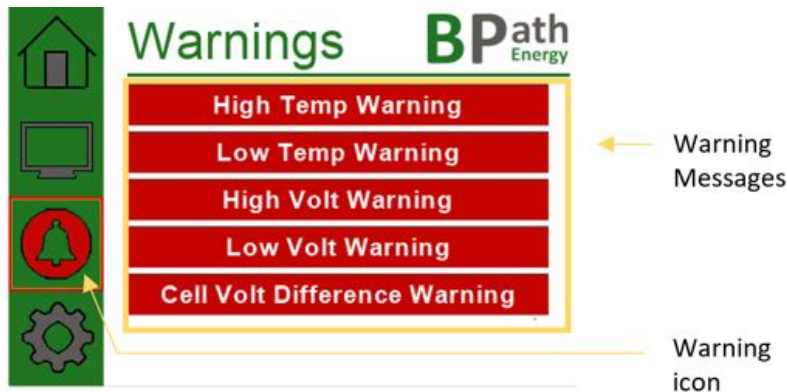
This page allows to change display related settings.



Brightness slider: Move red square from right to left to change the display brightness.
 Sleep timer: Press symbol and type a value between 1 and 60 minutes to set time between last touch event and display off.
 Display off: Press symbol to switch display off. Touch the blank display to switch it on.

2.3 Warning page

This page indicated warnings.



Warning messages

High Temp Warning: Message occurs when temperature approaches contactor trip level. Check chapter 2.4.5. parameter "High Temp" and chapter 2.4.2 parameter "Tmp Warn Offset".

Low Temp Warning: Message occurs when temperature approaches contactor trip level. Check chapter 2.4.5 parameter "Low Temp" and chapter 2.4.2 parameter "Tmp Warn Offset".

High Volt Warning: Message occurs when high cell voltage limit is approached. Check chapter 2.4.5. parameter "High Volt" and chapter 2.4.2. "Volt warning offset".

Low Volt Warning: Message occurs when low cell voltage limit is approached. Check chapter 2.4.5. parameter "Low Volt" and chapter 2.4.2. "Volt warning offset".

Cell Volt Difference Warning: Message occurs when a limit difference between highest cell voltage and lowest cell voltage is exceeded. Check chapter 2.4.2 "Cell Volt Diff".

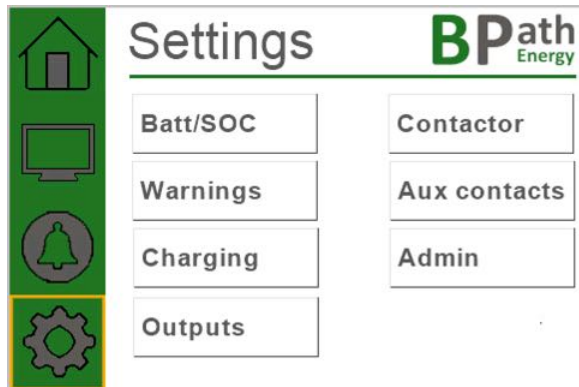
Reset warnings:

When the warning cause is eliminated the message is removed when the warning message is touched.

Warning icon:

The warning icon is coloured red when a message is present.

2.4 Settings page



2.4.1 Batt/SOC



The first parameters on the first page are related. They need correct settings for calculation Voltage and Capacity.

SeriesCell: When one 6S Tesla module is used the correct setting is 6. When two 6S Tesla modules are series connected the correct setting is 12.

ParallelBat: When one Tesla module is used the correct setting is 1. When two Tesla modules are parallel connected the correct setting is 2.

Capacity: Enter the capacity of one Tesla module.

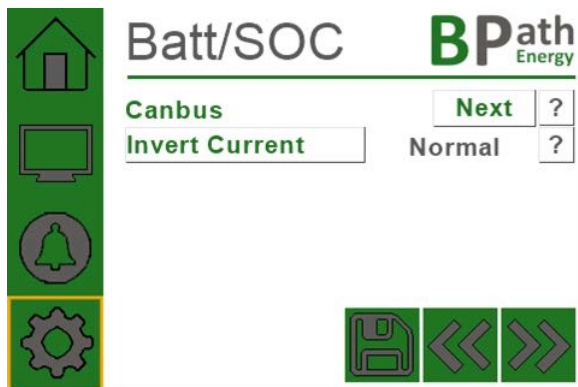
Do not series connect Tesla modules from coming from different vehicles. Make sure the voltage of each module is identical when the are used in any combination series of parallel.



Touch next page to enter the sensor selection page.

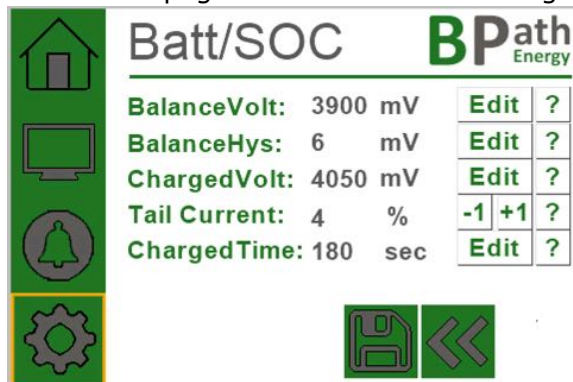
Canbus sensor available:

Page shown below is present when a canbus current sensor is selected. A LEM cab 300 sensor is supported. It is available via website: www.bpathenergy.com.



Press "invert current" when direction is not correct. Current drawn from the battery is negative. Charge current is positive.
The text will change between "Normal" and "inverted".

Touch next page for more related settings:



Parameters BalanceVolt and BalanceHys are related to start/stop cell balancing. The cell voltage must be above the BalanceVolt setting to start cell balancing and the difference between highest and lowest cell voltage must be more than BalanceHys parameter.

Parameters ChargedVolt, Tail Current and Charged Time are available when a current sensor is present. These three parameters reset the State of Charge when the battery is considered fully charged.

ChargedVolt: The voltage must be above this voltage level to consider the battery fully charged. The charged voltage parameter should be slightly below the charge voltage.

Example:

Charge voltage is 49,2 VDC.

Two Tesla modules are series connected (12 seriescells).

Calculate charge cell voltage $49,2/12 = 4,1 \text{ V} = 4100 \text{ mV}$.

Set Charged volt 30 mV below this value = 4070 mV.

Tail Current: Once the charge current has dropped to less than the set tail current (expressed as percentage of the battery capacity). The battery is considered as fully charged.

Example:
Capacity is 200 Ah
Tail current is 4%

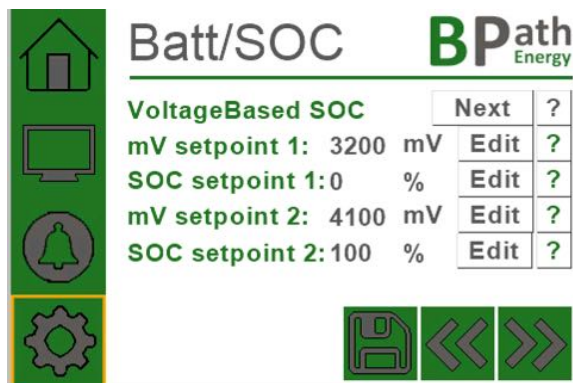
Reset SOC when current drops below 4% of 200 Ah = 8 Ampere.

Charged Time: This is the time charged parameters "ChargedVolt" & "Tail current" must be met in order to consider the battery to be fully charged.

Charge battery to full will reset SOC to 100% and provide correct SOC.

No Canbus sensor available:

Press "Next" when no sensor is available.

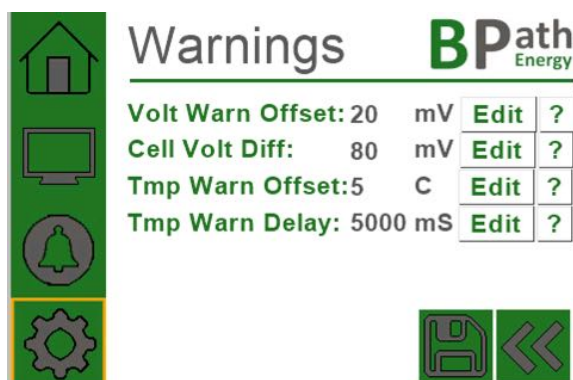


Battery capacity will be estimated based on voltage. This estimation is not 100% accurate but quite good. As the cell voltage is relatively linear to the state of charge.

Note: Cell voltage is used. Multiply with seriescell to determine pack voltage.

mV setpoint 1: Voltage empty.
SOC setpoint 1: SOC displayed as empty.
mV setpoint 2: Voltage charged.
SOC setpoint 2: SOC Displayed as charged.

2.4.2 Warnings



Volt Warn Offset: This entry allows to set an offset from HighVolt and LowVolt (chapter 2.4.5) to generate a warning.

Example:
HighVolt = 4250 mV
Seriescells = 12
LowVolt = 3200 mV
Volt Warn Offset is = 20 mV

High Volt Warning

Highvolt warning = $4250 - 20 = 4230 \text{ mV} \times 12 = 50.760/1000 = 50.76 \text{ Volt}$

Low Volt Warning

Lowvolt warning = $3200 + 20 = 3220 \text{ mV} \times 12 = 38.640/1000 = 38.64 \text{ Volt}$

Cell Volt Difference: This entry allows to set a warning when the difference between lowest and highest cell voltage exceeds this setting.

Tmp Warn Offset: This entry allows to set an offset from "High Temp" and "Low Temp" (chapter 2.4.5) to trigger a warning.

Tmp Warn Delay: This temperature warning delay time must be met to trigger the temperature warning.

Example:
HighTemp = 60°C
LowTemp = -10°C
Tmp Warn Offset = 5C
Tmp Warn Delay = 5000 mS

High Temp Warning

High temp warning = $60 - 5 = 55^\circ\text{C}$, Temp higher 55°C during 5 seconds.

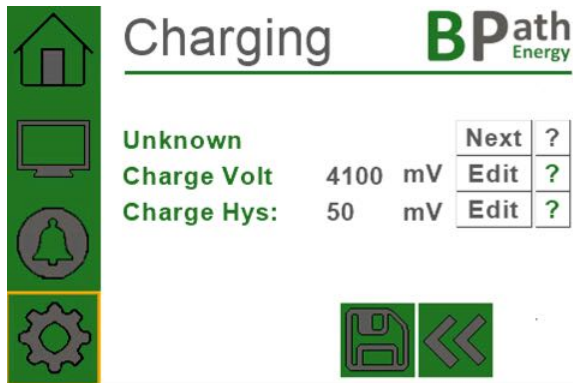
Low Volt Warning

Low temp warning = $-10 + 5 = -5^\circ\text{C}$, Temperature below during 5 seconds

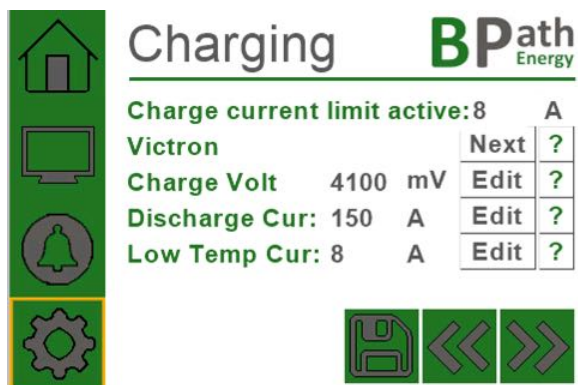
2.4.3 Charging

This entry allows to set communication with a Victron charger. Any other charger can be used without communication.

When no communication between charger and BMS is provided select "Unknown".



However, it is preferred to choose a Victron charger with communication via GX device With DVCC enabled. This allows the BMS to control the charger. The BMS settings will limit the charger according settings described below.



Charge Volt: The voltage limit sent to the charger is "Charge Volt" x "SeriesCell".

Example

Charge Volt = 4092 mV

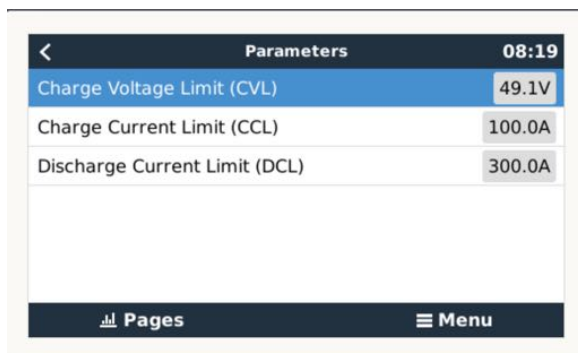
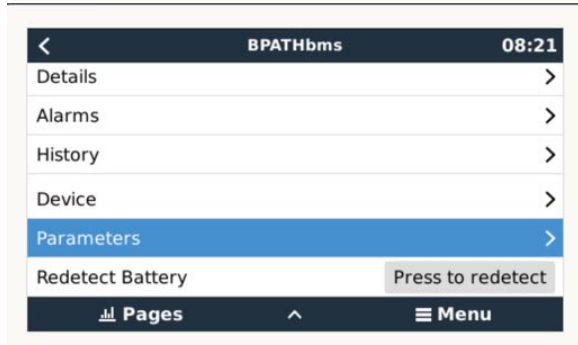
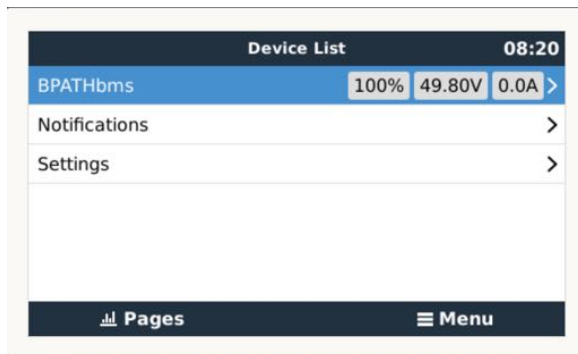
Seriescell = 12

Charge voltage is $(4092/1000) \times 12 = 49.1V$.

With Victron communication you will find this parameter.

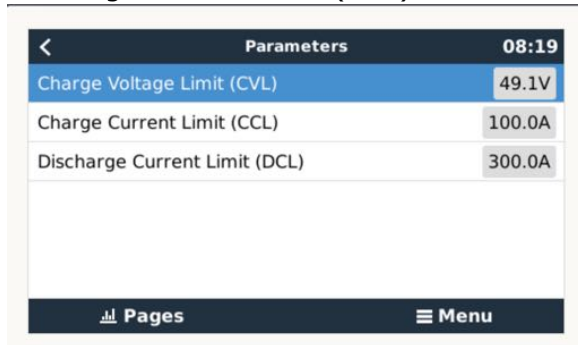
Select BPath bms => Parameters

Charge current limit (CLV) is the received setting.



Discharge Cur: This is the maximum allowed current drawn from the battery thus used by the inverter. The inverter will stop inverting when the load demand exceeds this allowance.

Discharge Current Limit (DCL) is the value Victron receives from BPath BMS.



Temperature related charging:

Below zero degrees Celsius 0 Amp is commanded to the charger.

Between zero degrees Celsius and "Low Temp" setpoint, the "Low Temp Cur" is commanded to the charger.

Example

Low Temp = 5°C

Low Temp Current = 10 A

Lowest measured temperature is 3°C.

The 10 A commanded is to the charger.

Victron DVCC networks see this value as allowed pack current. So when more chargers or MPPT's are used Victron will limit the combined charge current to 8 Ampere. Make sure to check compatibility in your configuration and execute a test!

Between "Low Temp" setpoint and "Med Temp" setpoint the "Med Temp Cur" setpoint is send to the charger.

Example

Low Temp = 5°C

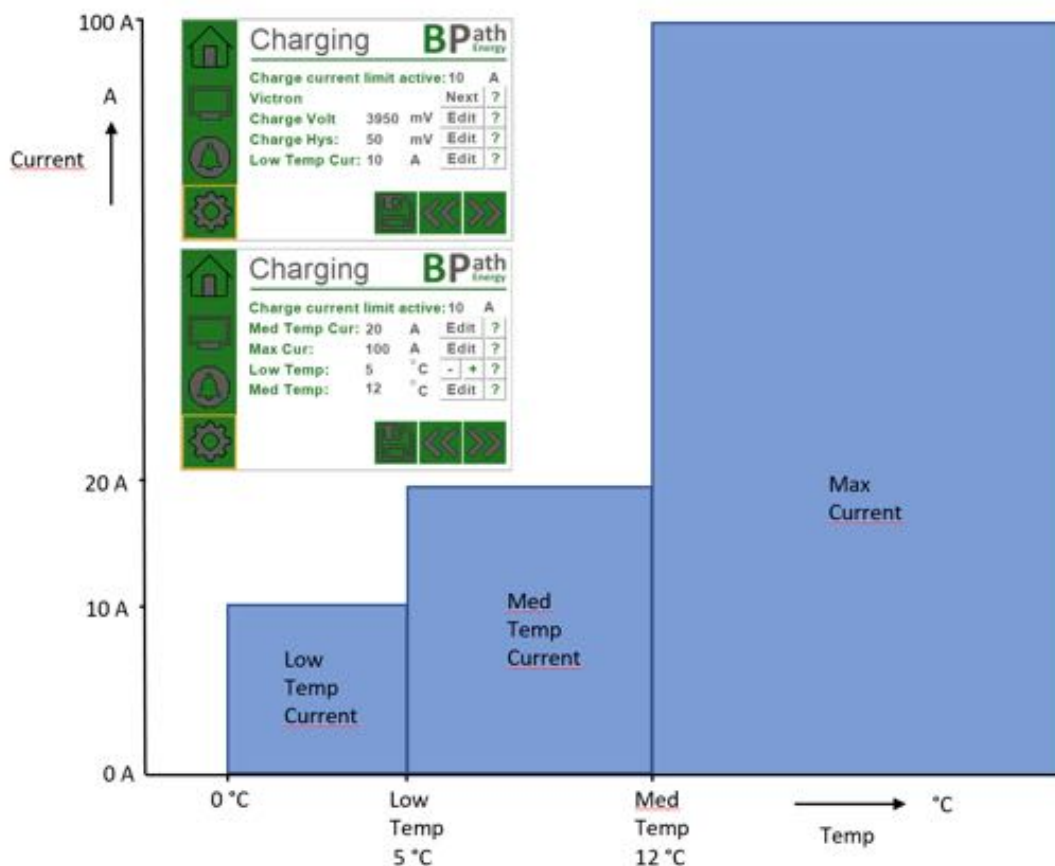
Med Temp = 12°C

Med Temp Cur = 20 Amp

Lowest measured temp is 8°C.

The 20 A is commanded to the charger.

Above the "Med Temp" Setpoint, the "Max Cur" setpoint is send to the charger.

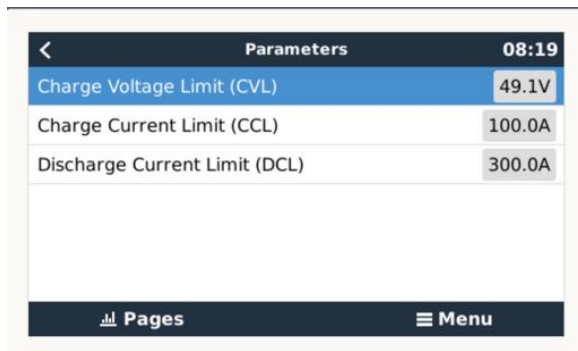


Above 40°C the Max Cur value is derated. At 60°C the current sent to the charger is 0 Amp.

Example:
Max Cur is 50 Amp.

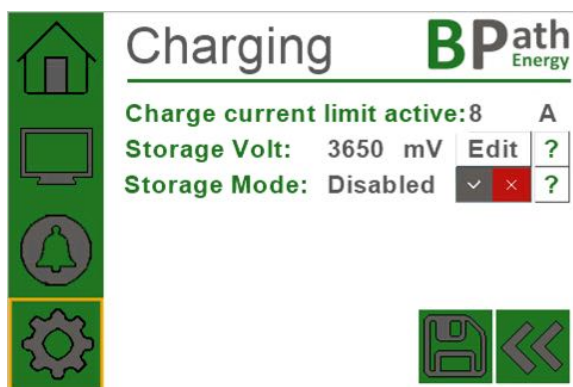
@40°C => current commanded to charger is 50 Amp.
@45°C => current commanded to charger is 37.5 Amp.
@50°C => current commanded to charger is 25 Amp.
@55°C => current commanded to charger is 12.5 Amp.
@60°C => current commanded to charger is 0 Amp.

Charge current limit (CVL) is the value Victron receives from the BPath BMS.

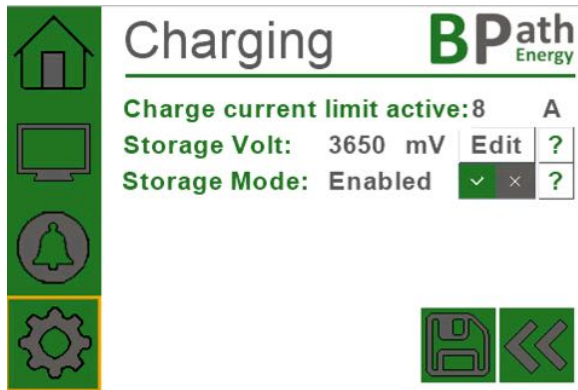


For more information on how to setup communication between Victron and BPath BMS see "Installation manual Module controller" chapter 3 "Victron".

Storage: Applying a reduced voltage when the battery is not in use for longer periods will extend the life time of the battery.



Enable storage mode by pressing this icon.



The Victron charger will not discharge the battery to the lower setting received from the BMS. User needs to discharge the battery manually.

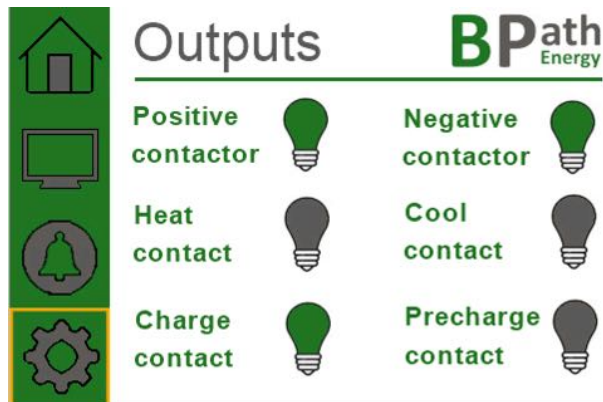
Example:
Storage Volt: 3650
Seriescell: 12

Charge voltage will be $(3650/1000) \times 12 = 43,8 \text{ V}$.

Recommended Storage volt setting is 3650 mV.

2.4.4 Outputs

This page displays BMS outputs

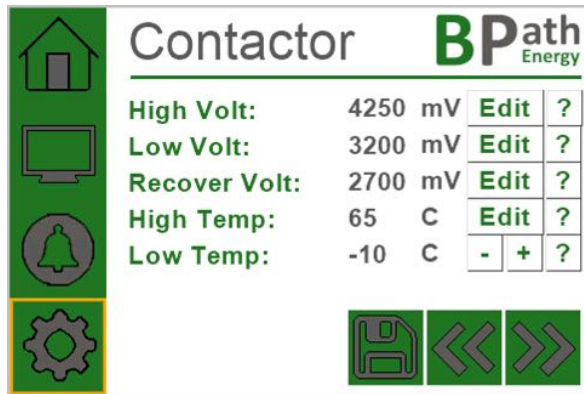


Green "lamps" are on and grey "lamps" are off.

Example: Heat is disabled, cool is disabled, charger is enabled.

2.4.5 Contactor

These settings apply to the main contactor(s). Used to connect/disconnect the batteries to all devices.



High Volt: This command allows entry if the highest allowable cell Voltage. If any cell in any module reaches this voltage the contactor is opened, resulting in disconnecting all devices from the battery.

This value should be higher than the charged voltage divided by seriescell.

Example:

Charge Volt = 4100 mV

SeriesCell = 12

High Volt = 4250 mV

The charger limits at $(4100/1000) \times 12 = 49.2V$

Contactor will open at $(4250/1000) \times 12 = 51V$

Low Volt: This command allows entry of lowest cell voltage. If any cell in any module falls below this voltage the contactor is opened, resulting in disconnecting all devices from the battery.

When the battery was discharged beyond the Low Volt setting the contactor will open to avoid further discharge and damaging the battery. Screen below will appear.



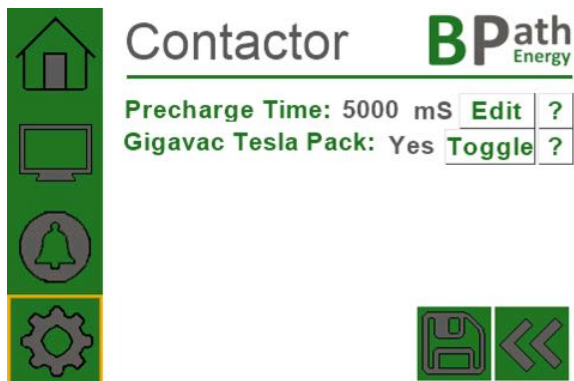
Touch button "Enable recovery mode?" to allow the contactor to close. Charge immediately.

Recover Volt: This command allows entry of bear minimum cell voltage to recover from accidental deep discharge which has led to contactor disengage. Push on/off switch 10-15 seconds to enter recovery mode. Or use "Enable recovery mode?" button on the touch screen.

Charge immediately.

High Temp: If any temperature of any module exceeds this setting the contactor will trip resulting in disconnecting all devices from the battery.

Low Temp: This entry allows you to set a minimum temperature. If any temperature of any module falls below this setting the contactor will trip resulting in disconnecting all devices from the battery.



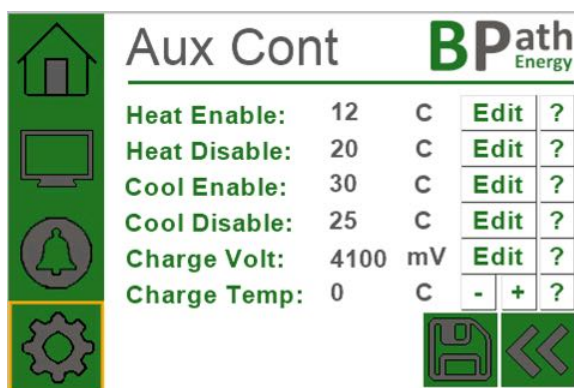
Precharge Time: This is the time used for pre-charging. The batteries are connected via a resistor to the load. Inverters and MPPT charge controllers use capacitors. The current spike can reach 10.000 to 12.000 Amperes, but only lasts less than a millisecond before tapering to quite manageable currents. But this is sufficient to arc weld the contacts of the main contactor.

Extend pre-charge time when large inverters or MPPT's are used.

Gigavac from Tesla Pack: Set to "yes" when a Gigavac contactor from a Tesla pack is used. Otherwise use a contactor 12VDC apply setting to "No".

Note: When set to "No" while using a Tesla contactor this will result in breaking the Tesla Gigavac contactor.

2.4.6 Aux contacts



Heat Enable: This entry allows to activate a heater, if one is connected. When the average temperature drops below this setting the output will switch high.

Heat disable: This entry allows to switch off the heater, if one is connected. When the average temperature rises above this setting the output will switch low.

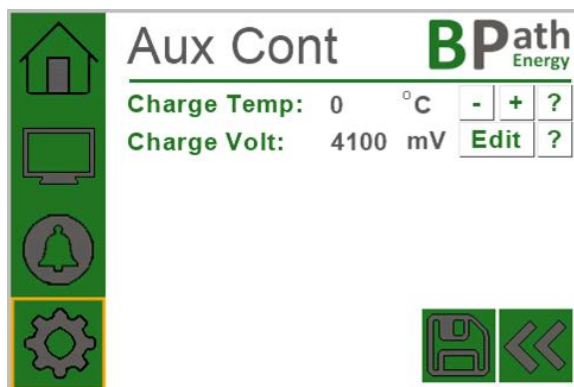
Cool Enable: This entry allows to activate cooling, if any is connected. When the average temperature rises above this setting the output will switch high.

Cool Disable: This entry allows to disable cooling, if any is connected. When the average temperature falls below this setting the output will switch low.

Charge Volt: This entry allows to enable/disable a charger via the charge enable contact.

When set to 4000 mV, with 12 seriescells the contact wil open above 48V.

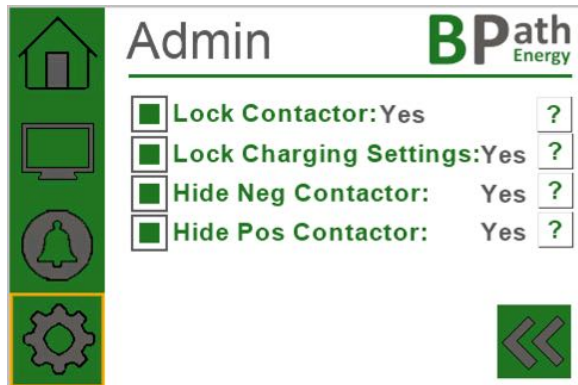
Charge Temp: This entry allows to set a minimum charge temperature. The charge enable/disable contact will be set to disable when temperature drops below this setting. Charging will be enabled 1°C above this setting.



2.4.7 Admin

The admin menu allows to "lock" settings which can harm your installation when accidentally altered. The admin access requires a login code. The login code is fixed to 9789.





Lock Contactor: Allows to lock the contactor setting (see paragraph 2.4.5). Incorrect contactor setting can damage the contactor.

Lock Charging Settings: Allows to lock the charging settings (see paragraph 2.4.3). Locked settings appear in grey colour.

Hide Neg Contactor: Hides Negative contactor icon from the "outputs page". When a negative contactor is not in use. (see paragraph 2.4.4).

Hide Pos Contactor: Hides Positive contactor icon from the "outputs page". When a positive contactor is not in use. (see paragraph 2.4.4).