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Victron BMV
(FTI06009)

Hardware Installation Manual

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NOTICE

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References

VICTRON website:
http://www.victronenergy.com/index.php

VICTRON Energy support and downloads:
http://www.victronenergy.nl/battery-monitors/bmv-600%20and%20bmv-602/

Introduction

The Installation manual provides instructions for installing and monitoring the battery monitor as used within FT NavVision®. The chapters and sections are organized in chronological order in which the specific components must be installed and monitored (where applicable).

NOTE
This section provides only a summary of the most important safety requirements and notes, which will be mentioned in the individual sections. To protect your health and prevent damage to the devices, it is essential to read and carefully follow the safety instructions.

About the installation manual

The installation manual contains the following chapters:

- Chapter "Safety instructions" presents warning, caution and note information, which the user should pay attention to.

- Chapter "System configuration" gives an overview of the battery monitor.

- Chapter "Receiving, unpacking and checking" contains instructions on how to receive, unpack or check the battery monitor.

- Chapter "Installation and mounting" contains instructions on how to install and/or mount the battery monitor.

- Chapter "Technical specifications" contains an overview of the main features and technical data.

Abbreviations list

ABS   Acrylonitrile butadiene styrene
Ah   Ampere hours
BMV   Battery Monitor Victron
UTP   Unshielded Twisted Pair
VE Net   Victron Energy Network

Revision history

Revisions issued since publication.

Issue	Date	Revision	Reason
1.0	August 24, 2010		First release

Safety instructions

The indications NOTE, CAUTION and WARNING have the following significance:

NOTE:
An operating procedure, practice or condition etc., which it is essential to emphasize.

CAUTION

An operating procedure, practise or condition etc., which, if not strictly observed, may damage or destroy equipment.

WARNING

An operating procedure, practise or condition etc., which, if not carefully observed may result in personal injury or loss of life.

1. Receiving, unpacking and checking

1.1 Procedure

NOTE:
Notify your sales representative if any of the items mentioned below are missing or damaged.

1. Remove the transport casing

2. Visually inspect the respective parts

3. Check that all items are included in accordance with the delivery documents.

4. Check for transport damages.
   In case of transport damage appropriate action must be taken against the latest carrier and the nearest certified dealer or representative should be informed.

5. Store the part in the original transport package in a dry and dust free place, if the unit is not to be installed immediately. Observe the environmental requirements stated in the specifications

2. Installation and mounting

2.1 Overview

The VICTRON BMV 600/602 battery monitor is a device that monitors your battery status. It constantly measures the battery voltage and battery current. It uses this information to calculate the actual state of charge of your battery.

The BMV is also equipped with a potential free contact. This can be used to automatically start and stop a generator, or signal alarm conditions.

Figure 2-1: Overview (VICTRON BMV 600)

Figure 2-2: Overview (VICTRON BMV 602)

2.2 Safety precautions

CAUTION

- **Working in the vicinity of a lead acid battery is dangerous**
- **Batteries can generate explosive gases during operation. Never smoke or allow a spark or flame in the vicinity of a battery**
- **Provide sufficient ventilation around the battery**
- **Wear eye and clothing protection. Avoid touching eyes while working near batteries**
- **Wash your hands when done**
- **If battery acid contacts skin or clothing, wash them immediately with soap and water. If acid enters an eye, immediately flood the eye with running cold water for at least 15 minutes and get medical attention immediately**
- **Be careful when using metal tools in the vicinity of batteries**
- **Dropping a metal tool onto a battery might cause a short circuit and possibly an explosion**
- **Remove personal metal items such as rings, bracelets, necklaces, and watches when working with a battery. A battery can produce a short circuit current high enough to melt objects such as rings, causing severe burns.**

2.3 Interconnection diagram (BMV 600)

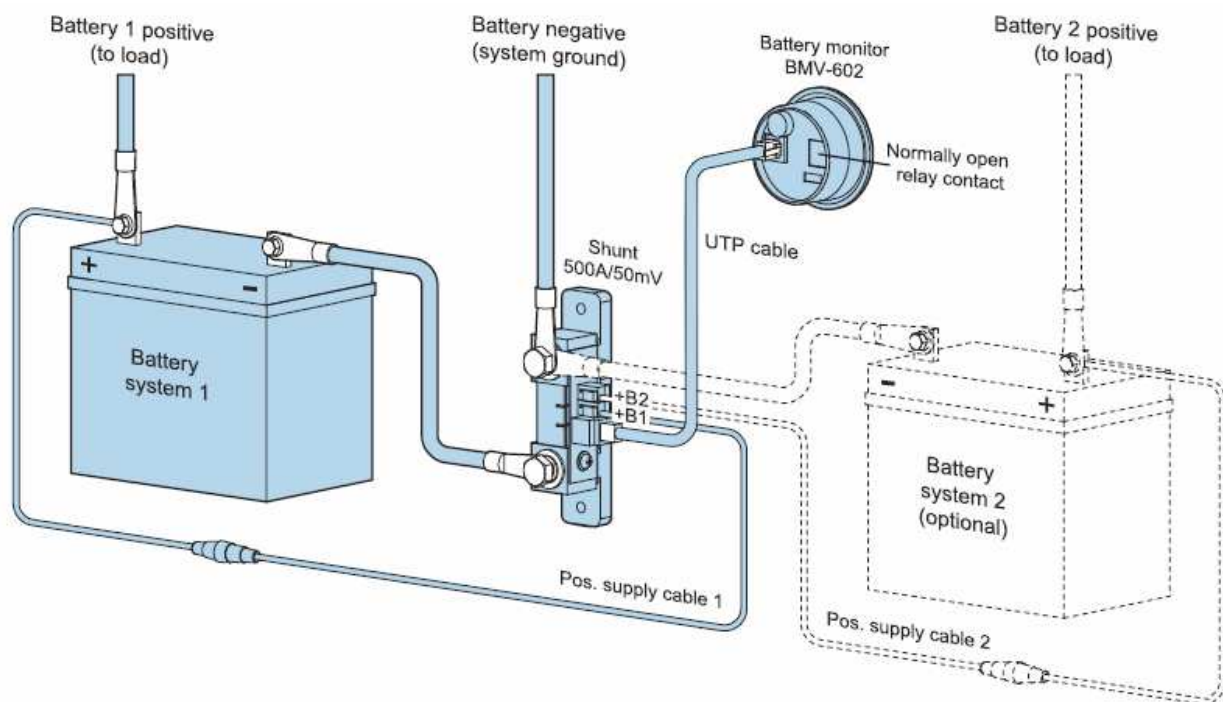*NOTE:*
Connect the negative pole of the battery last!
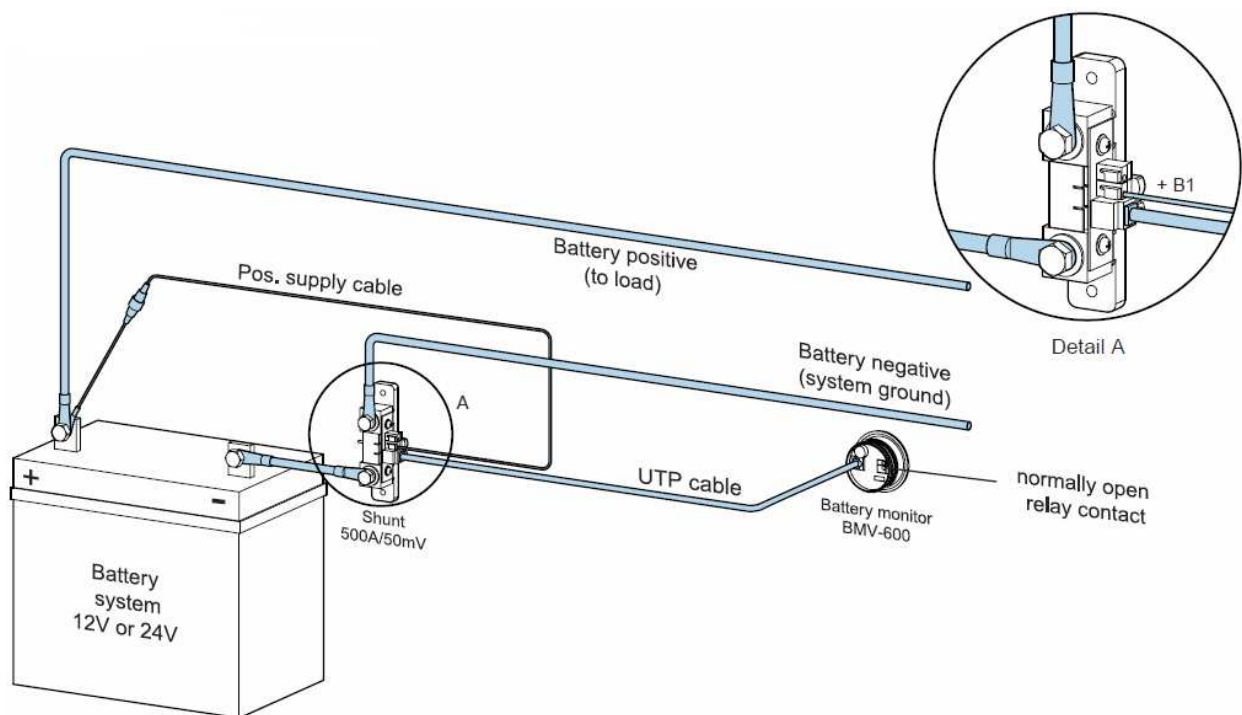
Figure 2-3: Wiring diagram (BMV 600)
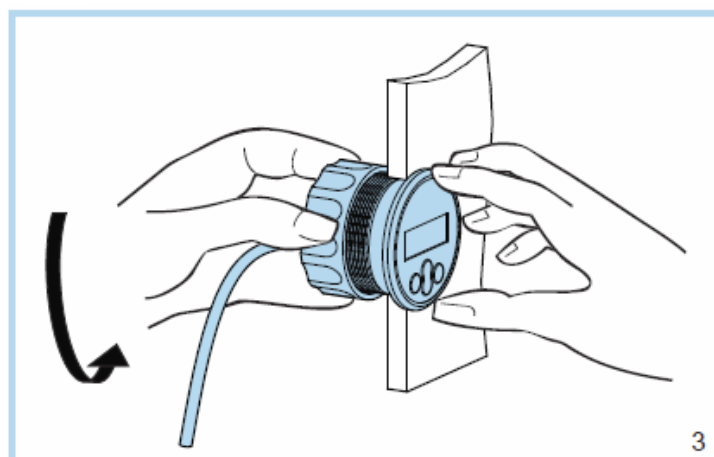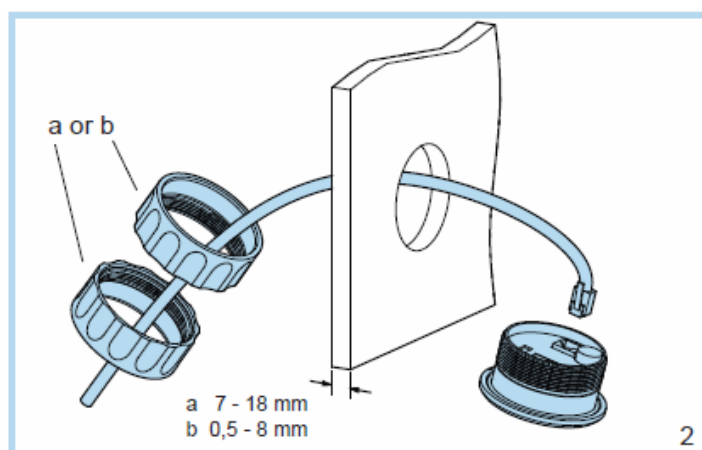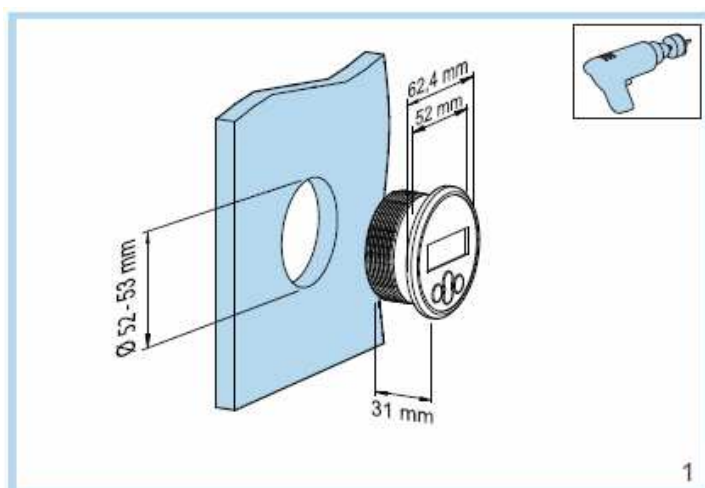
2.4 Interconnection diagram (BMV 602)

NOTE:
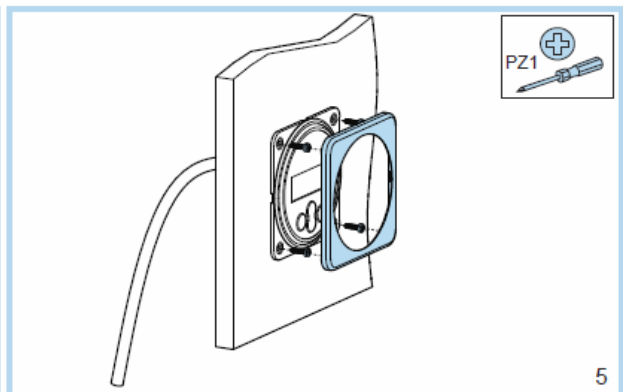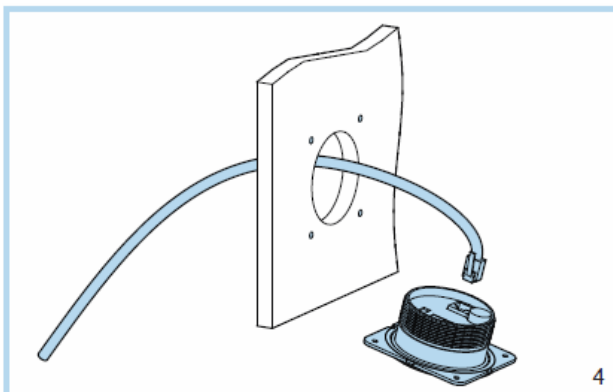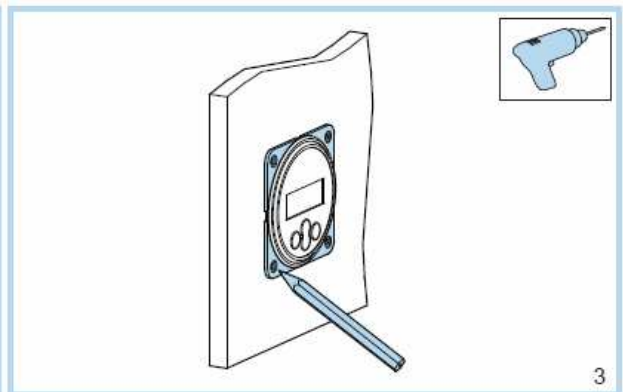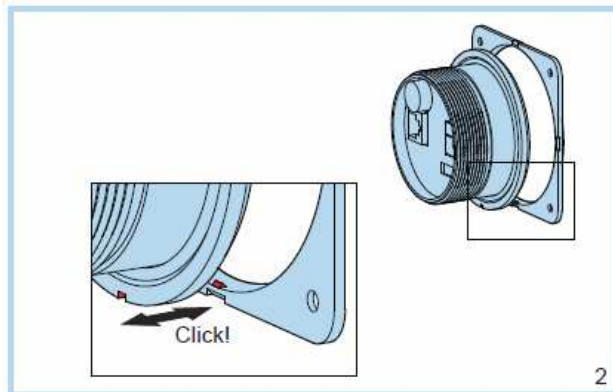*Connect the negative pole of the battery last!*

Figure 2-4: Interconnection diagram (BMV 602)

2.5 Installation procedure – Method A

2.6 Installation procedure – Method B

2.6.1 How does the BMV work?

The capacity of a battery is rated in Amp hours (Ah). For example, a battery that can deliver a current of 5 A for a period of 20 hours is rated at 100 Ah (5 * 20 = 100).
The BMV continuously measures the net current flow into or out of the battery. This way it can calculate the amount of energy removed from or added to the battery.
But since battery age, discharge current and temperature all influence the battery's capacity; you cannot rely simply on an Ah reading. When the same 100 Ah battery is discharged completely in two hours, it may only give you 56 Ah (because of the higher rate of discharge). As you can see the battery's capacity is almost halved. This phenomenon is called Peukert efficiency. Also, when the temperature of the battery is low, its capacity is decreased even more. This is why simple Ah counters or Voltmeters give you far from an accurate state-of-charge indication.

The BMV can display both the Ah removed (not compensated) and the actual state-of-charge (compensated by Peukert efficiency and charge efficiency).
Reading the state-of-charge is the best way to read your battery.
This parameter is given in percentages, where 100.0% represents a fully charged battery and 0.0% a completely flat battery. You can compare this with a fuel-gauge in a car.
The BMV also makes an estimation of how long the battery can support the present load (time-to-go readout).
This is actually the time left until the battery needs to be charged again. If the battery load is fluctuating heavily it is best not to rely on this reading too much since it is a momentary readout and must be used as a guideline only. We always encourage the use of the state-of-charge readout for accurate battery monitoring.

2.6.2 PC-Link

The BMV features a serial communications interface for connecting to a PC, or other suitable equipment, to provide remote monitoring capabilities.

2.6.3 Synchronizing the BMV

For a reliable readout of the state of charge of your battery, the battery monitor has to be synchronized regularly with the battery and charger. This is accomplished by fully charging the battery.
When the charger is operating in the "float" stage, the charger considers the battery full. At this moment the BMV must also determine that the battery is full. Now the Amp hour count can be reset to zero and the state-of-charge reading can be set to 100.0%.

By precisely adjusting the charged-parameters in the BMV, the battery monitor can automatically synchronize with the charger when the "float" stage is reached. The range of the charged parameters is wide enough to adjust the BMV to most battery charging methods. When the voltage supply to the BMV has been interrupted, the battery monitor must be resynchronized before it can operate correctly.

NOTE:
Please note that regularly (at least once per month) fully charging your battery not only keeps it in sync with the BMV, but also prevents substantial capacity loss of your battery which limits its lifetime.

2.6.4 Using the menus

There are four buttons that control the BMV. The functions of the buttons vary depending on which mode the BMV is in. When power is applied, the BMV starts in normal mode.

Button	Function	
	Normal mode	**Setup mode**
Setup	Hold for 2 seconds to switch to setup mode	• When not editing, hold this button for 2 seconds to switch to normal mode • When editing, press this button to confirm the change • When a parameter is out of range the nearest valid value will be saved instead. The display blinks 5 times and the nearest valid value is displayed.
Select	Switch between the monitoring and historical menus	• When not editing, press this button to begin editing the current parameter • When editing, this button will advance the cursor to the next editable digit.
+	Move up one item	• When not editing, this button moves up to the previous menu item • When editing, this button will increment the value of the selected digit.
-	Move down one item	• When not editing, this button moves down to the next menu item • When editing, this button will decrement the value of the selected digit.

2.6.5 Setup parameter detail

Name	Description	Min.	Default	Max.	Resolution	Units
Cb	Battery capacity	20	200	9999	1	Ah
Vc	Charged voltage	0.0	13.2	90.0	0.1	V
It	Tail current	0.5	4.0	10.0	0.1	%
Tcd	Charged detection time	1	3	50	1	min.
CEF	Charge efficiency factor	50	90	99	1	%
PC	Peukert exponent	1.00	1.25	1.50	0.01	
Ith	Current threshold	0.00	0.01	2.00	0.01	A
Tdt	Average time to go	0	3	12	1	min.
DF	Discharge floor (SOC relay)	0.0	50.0	99.0	0.1	%
ClS	Clear SOC relay	0.0	90.0	99.0	0.1	%
RME	Relay minimum enable time	0	0	500	1	min.
RDD	Relay disable delay	0	0	500	1	min.
Al	Alarm low voltage (buzzer)	0.0	0.0	95.0	0.1	V
Alc	Clear low voltage alarm	0.0	0.0	95.0	0.1	V
Ah	Alarm high voltage (buzzer)	0.0	0.0	95.0	0.1	V
Ahc	Clear high voltage alarm	0.0	0.0	95.0	0.1	V
AS	Alarm low SOC (buzzer)	0.0	0.0	95.0	0.1	%
ASc	Clear low SOC alarm	0.0	0.0	95.0	0.1	%
Rl	Relay low voltage	0.0	0.0	95.0	0.1	V
Rlc	Clear relay low voltage	0.0	0.0	95.0	0.1	V
Rh	Relay high voltage	0.0	0.0	95.0	0.1	V

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Name	Description	Min.	Default	Max.	Res.[1]	Units
AlS	Alarm low starter battery voltage (buzzer)	0.0	0.0	95.0	0.1	V
AlcS	Clear alarm low starter battery voltage	0.0	0.0	95.0	0.1	V
AhS	Alarm high starter battery voltage (buzzer)	0.0	0.0	95.0	0.1	V
AhcS	Clear high starter battery voltage	0.0	0.0	95.0	0.1	V
RlS	Relay low starter battery voltage	0.0	0.0	95.0	0.1	V
RlcS	Clear relay low starter battery voltage	0.0	0.0	95.0	0.1	V
RhS	Relay high starter battery voltage	0.0	0.0	95.0	0.1	V
RhcS	Clear relay high starter battery voltage	0.0	0.0	95.0	0.1	V
ShA	Maximum rated shunt current	1	500	999	1	A
ShV	The shunt output voltage at the maximum rated current	0.001	0.05	0.1	0.001	V

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[1] Res. = Resolution

2.6.6 Setup parameter overview

Cb	**Battery capacity Ah** The battery capacity for a 20 h discharge rate at 20℃.
Vc	**Charged voltage** The battery voltage must be above this voltage level to consider the battery as fully charged. Make sure the voltage-charged-parameter is always slightly below the voltage at which the charger finishes charging the battery (usually 0.1 V or 0.2 V below the "float" stage voltage of the charger).
It	**Tail current** When the charge current value is below this percentage of the battery capacity (Cb), the battery can be considered as fully charged. Make sure this is always greater than the minimum current at which the charger maintains the battery, or stops charging.
Tcd	**Charged detection time** This is the time the charged-parameters (It and Vc) must be met, in order for the battery to be considered fully charged.
CEF	**Charge Efficiency Factor** When a battery is being charged, energy is lost. The CEF compensates for the lost energy, where 100 % is no loss.
PC	**Peukert exponent** When unknown it is recommended to keep this value at 1.25. A value of 1.00 disables the Peukert compensation. Contact your battery manufacturer for the correct Peukert exponent for your battery.
Ith	**Current threshold** When the current measured falls below this value it will be considered as zero Amps. With this function it is possible to cancel out very small currents that can negatively affect long term state-of-charge readout in noisy environments. For example if an actual long term current is +0.05 A and due to injected noise or small offsets the battery monitor measures -0.05 A, in the long term the BMV can incorrectly indicate that the battery needs recharging. When in this case Ith is set to 0.1, the BMV calculates with 0.0 A so that errors are eliminated. A value of 0.0 A disables this function.
Tdt	**Average time-to-go** Specifies the time window (in minutes) that the moving averaging filter works with. Selecting the right time depends on your installation. A value of 0 disables the filter and gives you instantaneous (real-time) readout; however the displayed values may fluctuate heavily. Selecting the highest time (12 minutes) ensures that long term load fluctuations are included in the time-to-go calculations. Calculation is also linked to this value. It is recommended to keep this value at around 50.0 %.
CIS	**Clear SOC relay** When the state-of-charge percentage has risen above this value, the alarm relay will be de-activated. This value needs to be greater than or equal to DF.
RME	**Relay minimum enable time** Specifies the minimum amount of time that the alarm relay should be enabled once an alarm condition has occurred.
RDD	**Relay disable delay**

	Specifies how long you have to wait before disabling the relay; after the alarm condition has cleared.
Al	**Alarm low voltage (buzzer)** When the battery voltage falls below this value for more than 10 seconds a bell icon appears on the display, the backlight flashes, and the buzzer will sound. The buzzer and backlight-flashing can be turned off by pressing any key; the bell-icon will remain on the display.
Alc	**Clear low voltage alarm** When the battery voltage rises above this value, the alarm is turned off. This value needs to be greater than or equal to Al.
Ah	**Alarm high voltage (buzzer)** When the battery voltage rises above this value for more than 10 seconds a bell icon appears on the display, the backlight flashes, and the buzzer will sound. The buzzer and backlight-flashing can be turned off by pressing any key; the bell-icon will remain on the display.
Ahc	**Clear high voltage alarm** When the battery voltage falls below this value, the alarm is turned off. This value needs to be less than or equal to Ah.
AS	**Alarm low SOC (buzzer)** When the state-of-charge falls below this value for more than 10 seconds a bell icon appears on the display, the backlight flashes, and the buzzer will sound. The buzzer and backlight-flashing can be turned off by pressing any key; the bell-icon will remain on the display.
ASc	**Clear low SOC alarm** When the state-of-charge rises above this value, the alarm is turned off. This value needs to be greater than or equal to AS.
Rl	**Relay low voltage** When the battery voltage falls below this value for more than 10 seconds the alarm relay will be activated.
Rlc	**Clear relay low voltage** When the battery voltage rises above this value, the alarm relay will be de-activated. This value needs to be greater than or equal to Rl.
Rh	**Relay high voltage** When the battery voltage rises above this value for more than 10 seconds the alarm relay will be activated.
Rhc	**Clear relay high voltage** When the battery voltage falls below this value, the alarm relay will be de-activated. This value needs to be less than or equal to Rh.
BLI	**Intensity backlight** The intensity of the backlight, ranging from 0 (always off) to 9 (maximum intensity).
D V	**Battery voltage display** Determines if the battery voltage is available in the monitoring menu.
D I	**Current display** Determines if the current is available in the monitoring menu.
D CE	**Consumed energy display** Determines if the consumed energy is available in the monitoring menu.

D SOC	**State-of-charge display**
	Determines if the state of charge is available in the monitoring menu.
D TTG	**Time-to-go display**
	Determines if the time to go is available in the monitoring menu.
ZERO	**Zero current calibration**
	If the BMV reads a non-zero current even when there is no load and the battery is not charging, this option can be used to calibrate the zero reading.
	Ensure that there really is no current flowing into or out of the battery, then hold the select button for 5 seconds.
SYNC	**Manual synchronization**
	This option can be used to manually synchronize the BMV. When the battery is fully charged, hold the select button for 5 seconds.
	NOTE
	If the BMV fails to automatically synchronize, check the wiring, and ensure that Cb, Vc, It, and Tcd are set correctly.
R DEF	**Reset to factory defaults**
	Reset all settings to the factory defaults by holding the select button for 5 seconds.
Cl HIS	**Clear historic data**
	Clear all historical data by holding the select button for 5 seconds.
LOCK	**Setup lock**
	When on, all settings (except this one) are locked and cannot be altered.
SW	Firmware version (cannot be altered).

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AIS	**Alarm low starter battery voltage (buzzer)**
	When the starter battery voltage falls below this value for more than 10 seconds a bell icon appears on the display, the backlight flashes, and the buzzer will sound. The buzzer and backlight-flashing can be turned off by pressing any key; the bell-icon will remain on the display.
AlcS	**Clear low starter battery voltage alarm**
	When the starter battery voltage rises above this value, the alarm is turned off. This value needs to be greater than or equal to AIS.
AhS	**Alarm high starter battery voltage (buzzer)**
	When the starter battery voltage rises above this value for more than 10 seconds a bell icon appears on the display, the backlight flashes, and the buzzer will sound. The buzzer and backlight-flashing can be turned off by pressing any key; the bell-icon will remain on the display.
AhcS	**Clear high starter battery voltage alarm**
	When the starter battery voltage falls below this value, the alarm is turned off. This value needs to be less than or equal to AhS.
RIS	**Relay low starter battery voltage**
	When the starter battery voltage falls below this value for more than 10 seconds the alarm relay will be activated.
RlcS	**Clear relay low starter battery voltage**
	When the starter battery voltage rises above this value, the alarm relay will be de-

	activated. This value needs to be greater than or equal to RlS.	
RhS	**Relay high starter battery voltage** When the starter battery voltage rises above this value for more than 10 seconds the alarm relay will be activated.	
RhcS	**Clear relay high starter battery voltage** When the starter battery voltage falls below this value, the alarm relay will be de-activated. This value needs to be less than or equal to RhS.	
D VS	**Starter battery voltage display** Determines if the starter battery voltage is available in the monitoring menu.	
ShA	**Maximum rated shunt current** If using a shunt other than the one supplied with the BMV, set this to the rated current of the shunt.	
ShV	**The shunt output voltage at the maximum rated current** If using a shunt other than the one supplied with the BMV, set this to the rated voltage of the shunt.	

3. Technical specifications

Description	Detail
Supply voltage range	9.5 ... 95 VDC
Supply current (no alarm condition)	@Vin = 24 VDC without back lighting 3 mA @Vin = 12 VDC without back lighting 4 mA
Input voltage range auxiliary battery	9.5 ... 95 VDC 20 ... 9999Ah
Input current range (with supplied shunt)	-500 ... +500 A
Operating temperature range	0 ... 50℃
Readout resolution: Voltage (0 ... 135 V) Current (0 ... 10 A) Current (10 ... 500 A) Amp hours (0 ... 200 Ah) Amp hours (200 ... 9999 Ah) State-of-charge (0 ... 100%) Time-to-go (0 ... 1 hrs) Time-to-go (100 ... 240 hrs)	 Voltage dependent ± 0.1 A ± 1 A ± 0.1 Ah ± 1 Ah ± 0.1 % ± 1 minute ± 1 h
Voltage measurement accuracy	± 0.3 %
Current measurement accuracy	± 0.5 %
Potential free contact Mode Rating	 Normally open 60 V/1 A max.
Dimensions: Front panel Body diameter Overall depth	 69 x 69 mm 52 mm 31 mm
Net weight: BMV Shunt	 70 g 315 g
Material: Body Sticker	 ABS Polyester

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