

# Smart BatteryProtect 12/24V

12/24V - 65A | 12/24V - 100A | 12/24V - 220A

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## 1. Introduction

The Smart BatteryProtect disconnects the battery from non-essential loads before it is completely discharged (which would damage the battery) or before it has insufficient power left to crank the engine.

It also provides an alternative to disable chargers without a remote on/off port to protect from over-voltage.

Compared to the BatteryProtect, the Smart BatteryProtect can be conveniently programmed via Bluetooth and our VictronConnect app or the PROG pin to GND pin method. All necessary parameters can be set in this way.

The Smart BatteryProtect is a uni-directional device. It can only deal with current in one direction, so either current to a load, or current from a charger, but not both currents at the same time. In addition to this, current can only flow from the IN terminal to the OUT terminal.

## 2. Features

The Smart BatteryProtect offers a wide range of different features. These include:

- Protection of the battery against excessive discharge and can be used as a system on/off switch.
- 12/24V auto ranging. The Smart BatteryProtect automatically detects system voltage one time only (can be re-triggered - see section [Programming table \[11\]](#)).
- Easy Bluetooth programming.
- A special setting for Lithium batteries. This feature allows external control from a BMS like the VE.Bus BMS or Lynx Smart BMS. If the load disconnect output of a BMS is connected to the Remote H input and the signal becomes free-floating, the load is immediately disconnected.
- Ultra-low current consumption of 1.4mA with Bluetooth on: This is important in case of Li-ion batteries, especially after low cell voltage shutdown.
- Over voltage protection: To prevent damage to sensitive loads due to over voltage. The load is disconnected whenever the DC voltage exceeds 16.3V (for a 12V system) respectively 32.6V (for a 24V system).
- Ignition proof: No relays but MOSFET switches, and therefore no sparks.
- Delayed alarm output: The alarm output is activated if the battery voltage drops below the preset disconnect level for more than 12 seconds. Starting the engine will therefore not activate the alarm.
- Delayed load disconnect and delayed reconnect. Responding quickly within this delay, for example by reducing the load or starting a generator or charger to charge the batteries, can prevent loads from being switched off.

For a full description of all features, please see the [datasheets](#).

## 3. Installation and wiring examples

### 3.1. Precautions and installation notes

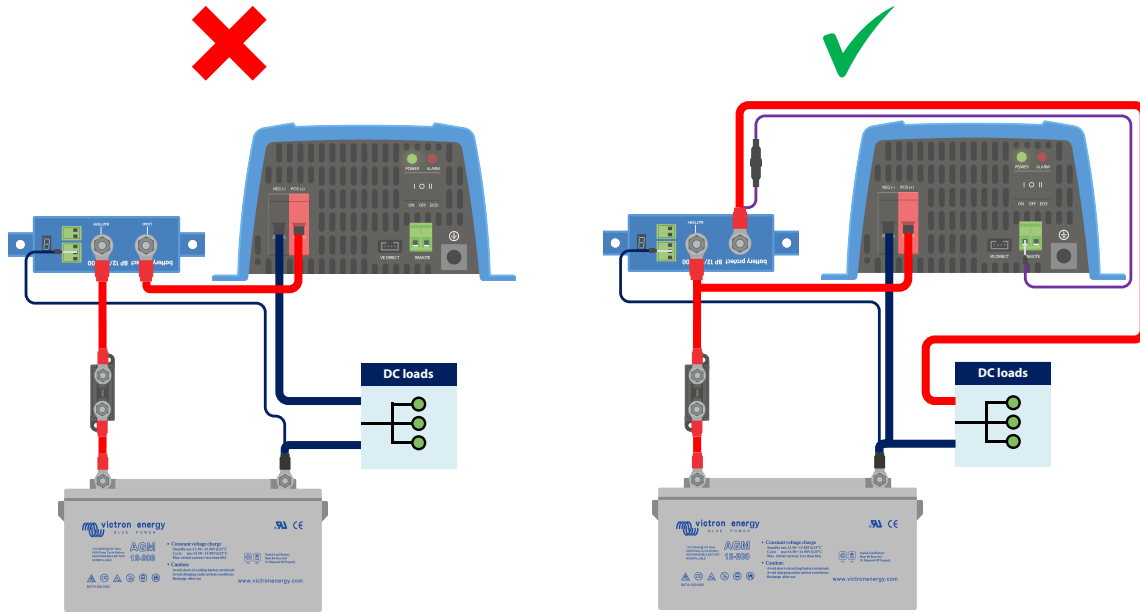
There are a few basic things to keep in mind when installing a Smart BatteryProtect:

1. The Smart BatteryProtect must be installed in a well-ventilated area and preferably close (max 50 cm) to the battery (but, due to possible corrosive gasses not above the battery!).
2. Choose the correct cable size and length to match the load. **Voltage drop over a long or undersized cable between the battery plus and the SBP may result in a short circuit alarm when starting-up the load, or unexpected shutdown.** You can also find more information on selecting the right cable size and its protection in our book [Wiring Unlimited](#).
3. A properly sized fuse must be inserted according to local regulations in the cable between the battery and the SBP.
4. Pay attention to the correct orientation. The SBP is designed to allow current to flow from IN (battery) to OUT (load) terminals only. Reverse currents from OUT to IN terminals are strictly forbidden and will damage the device. If you wish to use the SBP as a disconnection for a charge source, you must orient the unit in the system so that the current is flowing in the intended direction, IN to OUT.
5. The short circuit protection of the SBP will be activated if you try to directly connect loads with capacitors, for example inverters or inverterchargers, on their DC inputs. For that use case, please use the SBP to control the remote on/off control on the inverter, instead of disconnecting the higher power DC line. **See also the warning on the next page.**
6. Use a 1,5mm<sup>2</sup> wire (included) for the GND connection, which should be connected directly to the battery negative terminal (or the chassis of a vehicle). No other equipment should be connected to this wire.
7. The pin assignment of the connectors are printed either on the front or on the side of the housing.
8. The SBP automatically detects the system voltage once only during initial power up. The selected voltage (12 or 24 V) is stored, and further automatic detection is disabled. See "d" in the programming table for how to reset it when re-using the SBP in a different installation or use Bluetooth.
9. Do not connect the load output until the SBP has been fully programmed.
10. A remote on/off switch can be connected between Remote H and Remote L. Alternatively, terminal H can be switched high (to battery positive), or terminal L can be switched low (to battery negative).
11. A buzzer, LED or relay can be connected between the alarm output terminal and the battery positive. Maximum load on the alarm output: 50mA (short circuit proof).

### 3.2. Warning when connecting inverters and inverters/chargers



Under no circumstances is it permitted to connect inverters or inverter/chargers to a SBP via their DC inputs, a reverse current may flow that damages the SBP. In case you want to control an inverter or inverter/charger via a SBP, you must use the SBP to control the inverter or inverter/charger via its remote port. See example below. Note that the image shown below is an example for all BatteryProtect models including the smart models.



*Left image: Inverter DC input connected via a BatteryProtect - **strictly forbidden***

*Right image: Inverter controlled by its remote port via BatteryProtect*

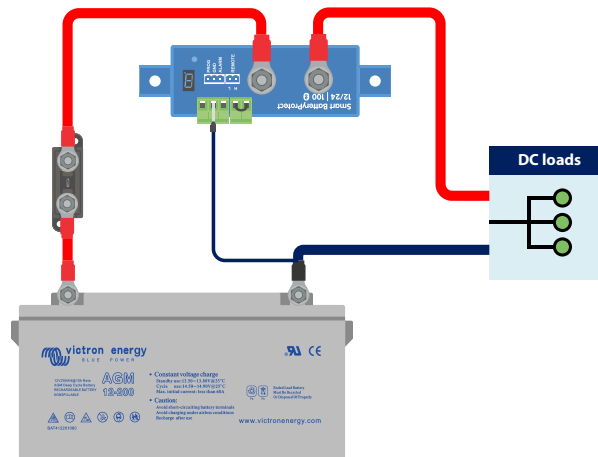
### 3.3. Wiring examples

This section contains various wiring examples to show all the possibilities of wiring.

#### 3.3.1. Smart BatteryProtect in a simple system

The example below shows a Smart BatteryProtect with the wire loop (default) between L and H of the remote terminal. When the wire loop is removed, the SBP disconnects the load after 90 seconds.

However, if the wire loop remains plugged in and the battery voltage drops below the programmed value for under voltage shutdown (see section [Programming \[10\]](#)), the SBP disconnects the load after 90 seconds automatically.

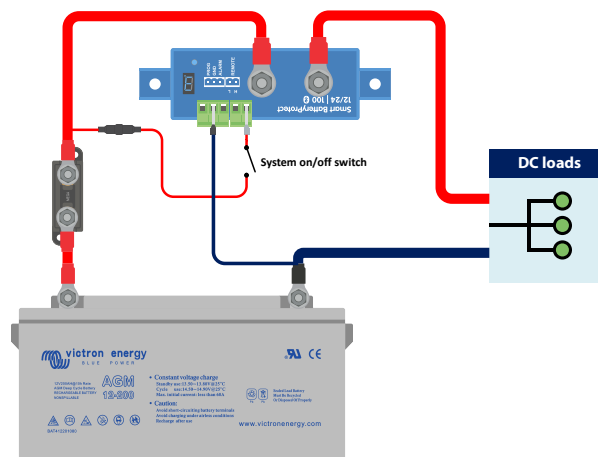


*Smart BatteryProtect in a simple system with wire loop between L and H input (factory default)*

The same example below. This time the switch is wired between battery positive and the H input of the remote terminal.

When switched off, the H input becomes low. The load is disconnected after 90 seconds. When the switch is turned on again, the H input becomes high and the load is turned on with a delay of 30 seconds.

This works in the same way between battery minus and the L input of the remote terminal.

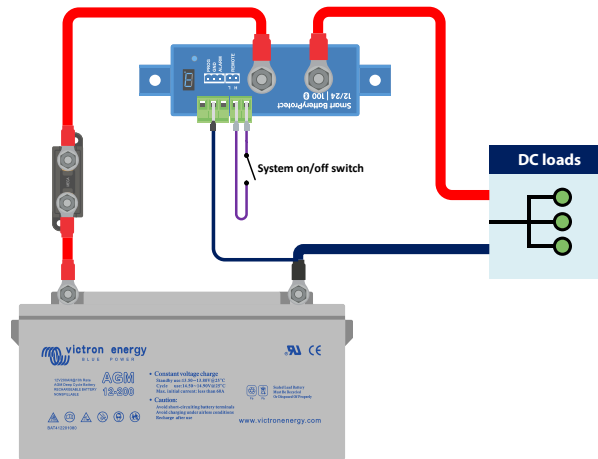


*Switch wired between battery positive and H input of the remote terminal*

### 3.3.2. Smart BatteryProtect remote on/off switch

The below example shows a Smart BatteryProtect in a simple system with a remote on/off switch wired to the remote terminals.

This switch can be used, for example, to turn the system remotely on and off. The power consumption of the Smart BatteryProtect is negligible at less than 1mA when switched off (check the [Specifications chapter \[14\]](#)).



Smart BatteryProtect with remote on/off switch

### 3.3.3. Smart BatteryProtect in a lithium battery system with external BMS

The image below shows a Smart BatteryProtect in a lithium battery system with external BMS. The external BMS ([Victron Lynx Smart BMS](#) in this example) has an ATD (allowed to discharge) and ATC (allowed to charge) output. Designed as a dry contact, ATD and ATC function as a switch that directly controls the SBP via its remote terminal.

For this, the Smart BatteryProtect must be programmed to Li-ion mode.

The dry contact is wired between the L and H connectors of the remote terminal.

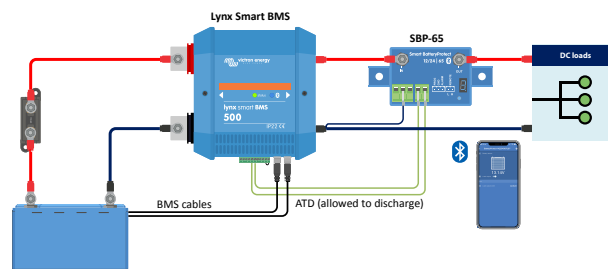
If, for example, ATD opens in the event of a lithium battery cell undervoltage, the SBP will immediately disconnect the load without delay.

The SBP will remain disengaged for 30 seconds, even if ATD closes within this period. After this 30 seconds, it responds immediately and connects the load to the battery.

Please note that the under voltage thresholds and alarm output of the SBP are inactive in this mode.



If you have a lithium battery with internal BMS (so-called drop-ins) that does not have an output for controlling loads or chargers, the SBP must be programmed in mode A or B. Mode C is not applicable in this case.



Smart BatteryProtect in Li-ion mode controlled by ATD from a Lynx Smart BMS



### 3.3.4. Smart BatteryProtect in a lithium system with external BMS and load disconnect output

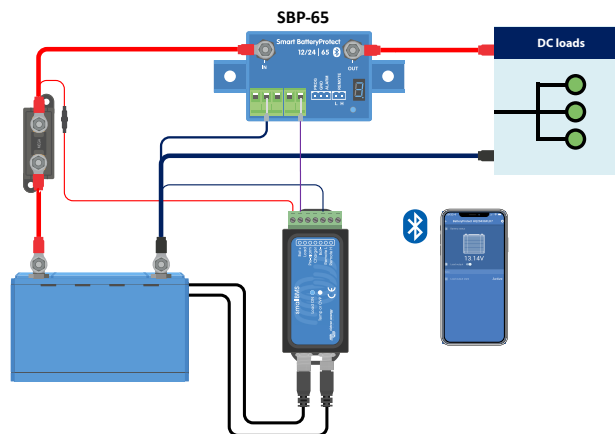
This wiring example shows a Smart BatteryProtect wired into a lithium system that is controlled by an external BMS (Victron [smallBMS with pre-alarm](#)). This BMS has a load and a charge disconnect output that can be wired directly to the Smart BatteryProtect H input of the remote terminal.

As with the previous example, it is necessary to program the SBP into Li-ion mode (see chapter [Programming \[10\]](#)).

If, for example, the smallBMS triggers the pre-alarm because of an imminent low cell voltage, the load output becomes free floating (normally high) when there is an actual low cell voltage and the SBP will disconnect the load and remains off for 30 seconds, even if it receives a restart signal (H becomes high again) within this period. After this 30 seconds, it responds immediately to a restart signal.



If the system has been switched off due to low cell voltage, the SBP will remain off for 30 seconds, even if it receives a restart signal within this period (which is most likely the case if no other loads are connected to the battery). After 3 attempts, the SBP will remain off until the battery voltage has risen above 13V (or 26V for a 24V system) for at least 30 seconds (which is an indication that the battery is being recharged).



*Smart BatteryProtect uses the load disconnect of a smallBMS*

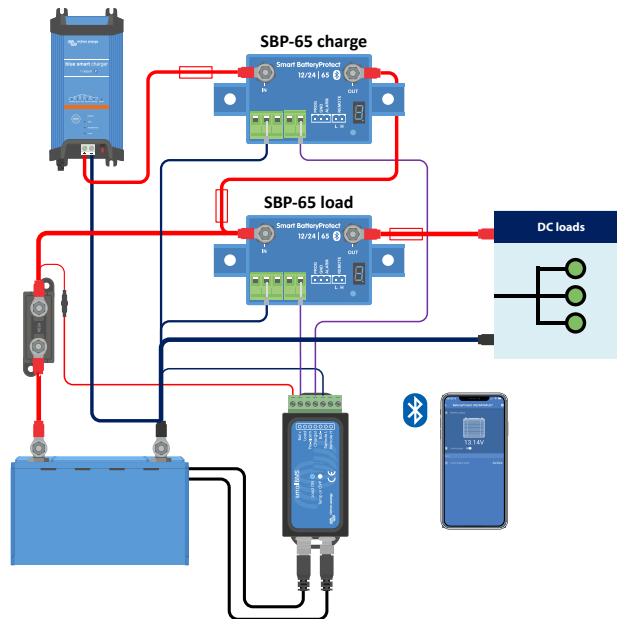
### 3.3.5. Two Smart BatteryProtects for load and charger control

It is also possible to have several Smart BatteryProtect in one system, for example, to control chargers and loads at the same time.

If the BMS signals a cell undervoltage, the SBP responsible for the load will disconnect the load from the battery to protect the battery from further discharge.

If the BMS signals a cell overvoltage or too low temperature to charge the lithium battery, the SBP will disconnect the charger from the battery immediately.

Please also note the correct connection of the SBPs: always follow the current flow from IN to OUT. The positive terminal of the charger goes to the IN input of the SBP.

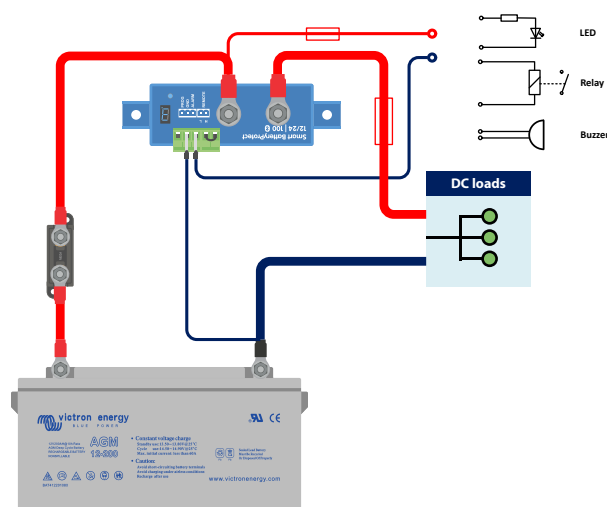


Two Smart BatteryProtects take control of a charger and a load circuit

### 3.3.6. Smart BatteryProtect Alarm output wiring

The alarm output can be wired e.g. to an LED, a buzzer or a relay. For this, the Smart BatteryProtect must be programmed in the respective mode because of slight differences in the behavior. See also the section [Operation modes \[9\]](#) for more details.

Make sure that the LED, buzzer and relay match the system voltage.



Wiring an LED, Buzzer or Relay to the Smart BatteryProtect output

## 4. Operation and programming

### 4.1. Operation modes

The Smart BatteryProtect has three operating modes, the appropriate mode can be selected via the VictronConnect app or a programming procedure (see chapter [Programming \[10\]](#)).

- Mode A: Buzzer or LED mode (default).
- Mode B: Relay mode.
- Mode C: Li-ion mode.

Modes A and B affect the behavior of the alarm output.

Mode C, the Li-ion mode, takes into account lithium batteries that have an external BMS or a BMS with load and/or charge disconnect.

#### Buzzer or LED mode behaviour

- In case of under voltage, a continuous alarm will start after 12 seconds. The SBP will disconnect the load after 90 seconds and the alarm will stop. Reconnect delay: 30 seconds.
- In case of over voltage, the load will be disconnected immediately and an intermittent alarm will remain on until the overvoltage problem has been corrected. There is no reconnect delay.

#### Relay mode behaviour

- In case of under voltage, the relay will engage after 12 seconds. The SBP will disconnect the load after 90 seconds and the relay will disengage.
- In case of over voltage, the load will be disconnected immediately and the alarm output will remain inactive. Overvoltage trip levels: 16V (for a 12V system) respectively 32V (for a 24V system).

#### Li-ion mode behaviour

Only select the Li-Ion mode if your BMS has a load disconnect and/or a charge disconnect output. This is usually not the case for so-called drop-in batteries with internal BMS. For lithium batteries/BMS without load disconnect output, select mode A or B instead.

Connect the load or charge disconnect (depending on application) output of the BMS to the Remote H terminal of the Smart BatteryProtect.

- The load or charger is disconnected **immediately** when the load or charge disconnect output of the BMS switches from 'high' to 'free floating'. The under voltage thresholds and alarm output of the Smart BatteryProtect are inactive in this mode.
- It will remain disengaged for 30 seconds, even if it receives a re-engage signal within that time period. After 30 seconds it will respond immediately to a re-engage signal.

## 4.2. Programming

There are two ways to program a Smart BatteryProtect:

- Via a Bluetooth enabled smartphone or tablet using our [VictronConnect App](#).
- or by connecting the PROG pin to GND pin method.

### 4.2.1. Programming via VictronConnect app

#### Programming via VictronConnect app

Requirements prior to programming::

- The battery positive must be connected to the IN terminal. Do not connect the OUT terminal yet.
- The included ground wire must be connected to the battery minus and the GND terminal of the Smart BatteryProtect.

#### Programming procedure:

1. Open the VictronConnect app on your mobile device. All available Bluetooth devices are displayed.
2. Select the Smart BatteryProtect from the Device list and tap on it. This will open the status screen, showing battery and load output state.
3. Tap on the cog wheel in the top right corner.
4. Check whether the detected battery voltage matches the system voltage.
5. Select the operation mode (A, B or C - see the [Programming table \[11\]](#) and [Operation modes \[9\]](#) for details). In case of C (Li-ion), nothing further needs to be set.
6. Choose between Relay and Buzzer/LED to set the alarm output.
7. Set the preset to the desired combination of shutdown and restart voltage or tap on User defined to define a custom combination.
8. In case of a user defined preset, tap on Shut down to set the shutdown voltage and tap on Restart to set the restart voltage.
9. Click on the 3 dots in the top right corner and then on Product info.
10. In the Product info menu the PIN code can be changed, a custom name can be set and Bluetooth can be disabled.



If Bluetooth is disabled via the VictronConnect app, this process can only be reversed with programming via PROG pin procedure as explained in the next paragraph.

### 4.2.2. Programming via PROG pin to GND pin method

Requirements prior to programming:

- The battery positive must be connected to the IN terminal. Do not connect the OUT terminal yet.
- The included ground wire must be connected to the battery minus and the GND terminal of the Smart BatteryProtect 12/24V.
- The wire loop in the remote on/off terminal block must be removed.

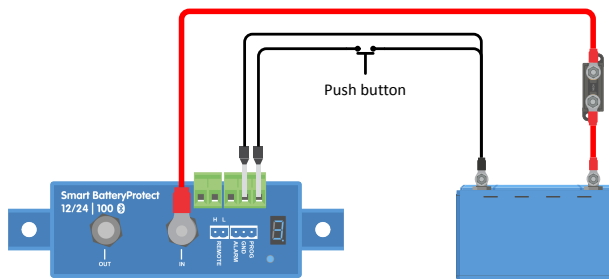
#### Programming procedure:

1. Use a wire loop or a wired switch (preferably a push button) between the PROG pin and the GND pin.
2. While there is a connection between the PROG pin and the GND pin, the 7-segment display will first step through the shutdown and restart voltage combinations, as indicated by the numbers 0..9 (see the [Programming table \[11\]](#)).
3. Remove the wire loop or release the push button when the desired voltage mode is displayed.
4. The display will confirm the chosen voltage and default mode (A) twice.
5. Reconnect the wire loop or press the push button again, if a different operation mode (B, C or D) is required (see the [Programming table \[11\]](#)).
6. Disconnect the wire loop or release the push button when the required mode is displayed.

7. The display will confirm the chosen voltage and operation mode twice.

The PIN code can be reset by selecting the P option. Bluetooth pairing information needs to be removed from any previously paired devices after selecting this option.

Bluetooth can be disabled/re-enabled by selecting F (enable) or H (disable).



Push button wired to program the Smart BatteryProtect

### 4.2.3. Programming table

Programming table for Smart BatteryProtect 12/24V

7-segment display	Under voltage shutdown 12/24V system	Under voltage restart 12/24V system
0	10.5V/21.0V	12.0V/24.0V
1	10.0V/20.0V	11.5V/23.0V
2	9.5V/19.0V	11.5V/23.0V
3	11.25V/22.5V	13.25V/26.5V
4	11.5V/23.0V	13.8V/27.6V
5	10.5V/21.0V	12.8V/25.6V
6	11.5V/23.0V	12.8V/25.6V
7	11.8V/23.6V	12.8V/25.6V
8	12.0V/24.0V	13.0V/26.0V
9	10.0V/20.0V	13.2V/26.4V
-	User defined settings with Bluetooth	
A	Buzzer or LED mode	
b	Relay mode	
C	Lithium mode	
d	Detect system voltage	
F	Bluetooth Enable	
h	Bluetooth Disable	
P	PIN code reset	

### 4.3. Status indicator

The decimal point of the 7-segment display is used for status indication:

- Illuminated: the Smart BatteryProtect is attempting to activate the output.
- Flash every 5 seconds: output is active.
- Flash every 2 seconds whilst in Li-ion mode: output 'connecting'. When in Li-ion mode the SBP will observe a dead period of 30 seconds after the remote input of the SBP has become free floating.

## 4.4. Remote control and short circuit behavior

This section describes the behaviour of the Smart BatteryProtect when it is controlled via the remote on/off input and when a short circuit has been detected.

- The Smart BatteryProtect will connect the load 1 second after the remote input is closed.
- The Smart BatteryProtect will disconnect the load immediately when the remote input is opened.
- When in Li-ion mode, the Smart BatteryProtect will observe a dead period of 30 seconds after the remote input of the Smart BatteryProtect has become free floating. See the note below for a detailed description.
- In case of a short circuit, the Smart BatteryProtect will attempt to connect the load every 5 seconds. After two attempts the display will show E1 (short circuit detected).



When in Li-ion mode, the SBP will disengage when the H input becomes free floating and will remain disengaged for 30 seconds, even if it receives a re-engage signal within that time period. After 30 seconds it will respond immediately to a re-engage signal. Therefore, there will normally be no waiting time if the SBP is used as a system on/off switch (wire the system on/off switch to the positive supply of the BMS for this purpose).

Similarly, if a system shutdown occurred due to low cell voltage, the SBP will remain disengaged for 30 seconds, even if it receives a re-engage signal within that time period (which most likely will happen when no other loads are connected to the battery). After 3 attempts to re-engage, the SBP will remain disengaged until battery voltage has increased to more than 13.0V (resp. 26.0V for a 24V system) for at least 30 seconds (which is a sign that the battery is being recharged). The under voltage thresholds and alarm output of the SBP are inactive in this mode.

## 4.5. Error & Warning modes

There are 9 possible error modes and 2 warning codes, indicated by the 7-segment display and within the VictronConnect app when using a Bluetooth enabled smartphone or tablet:

- E0 Calibration failure
- E1 Short circuit
- E2 Over temperature / P2 Over temperature warning
- E3 Under voltage / P3 Under voltage warning
- E4 Over voltage
- E5 Configuration Failure
- E6 Reference Voltage Failure
- E7 BMS Lockout
- E8 Reverse current
- P2 Over temperature warning
- P3 Under voltage warning

After 5 minutes the error is no longer displayed to reduce current consumption.

Please refer to the appendix chapter [Error and Warning codes \[15\]](#) for more info on each error.

## 5. Compliance Statement

### Compliance statement (part 15.19)

This device complies with part 15 of the FCC Rules.

Operation is subject to the following two conditions:

1. this device may not cause harmful interference, and
2. this device must accept any interference received, including interference that may cause undesired operation.

### Warning (part 15.21)

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### Information to the User (part 15.105b)

*Note:* This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device contains a transmitter with FCC ID: SH6MDBT42Q

## 6. Technical specifications

### 6.1. Technical specifications

Smart BatteryProtect	SBP-65	SBP-100	SBP-220
Max. continuous load current	65A	100A	220A
Peak current	250A	600A	600A
Operating voltage range	6 - 35 V		
Current consumption	BLE On and when on: 1.4mA When off or low voltage shutdown: 0.9mA BLE Off and when on: 1.2mA When off or low voltage shutdown: 0.7mA		
Alarm output delay	12 seconds		
Max. load on alarm output	50mA - short circuit proof		
Load disconnect delay	90 seconds (immediate if triggered by a BMS)		
Load reconnect delay	30 seconds		
Default thresholds	Disengage: 10.5 V or 21 V Engage: 12 V or 24 V		
Operating temperature range	Full load: -40 °C to +40 °C (up to 60% of nominal load at 50 °C)		
Connection	M6	M8	M8
Mounting Torque	5 Nm	9 Nm	9 Nm
Weight	0.2 kg 0.5 lbs	0.5 kg 1.1 lbs	0.8 kg 1.8 lbs
Dimensions (hxwx) d)	40 x 48 x 106 mm	59 x 42 x 115 mm	62 x 123 x 120 mm
	1.6 x 1.9 x 4.2 inch	2.4 x 1.7 x 4.6 inch	2.5 x 4.9 x 4.8 inch



## 7. Appendix

### 7.1. Error and Warning codes

This appendix gives a list of error and warning codes and possible solutions.

#### **E0: Calibration failure**

Internal malfunction – calibration data failure/missing

- Contact dealer for support – Fault is not user correctable and SBP requires replacement.

#### **E1: Short circuit**

Short circuit protection is activated in the event of a short circuit, an overload condition or excessive inrush current - such as when attempting to directly power an inverter or inverter/charger.

1. Check for a potential short circuit condition.
2. Confirm that the load current draw does not exceed the SBP current rating.
3. Use the SBP to control the remote on/off switch on loads with high inrush currents, rather than directly powering/ disconnecting the DC supply.
4. Check for loose/high resistance connections and ensure that appropriate gauge wiring is used in the installation.

#### **P2: Over temperature warning**

**Urgent intervention required to prevent load disconnection.**

Internal temperature close to the limit. Over temperature protection will be activated if temperature continues to rise.

#### **E2: Over temperature**

Over temperature protection is activated in the event of excessive internal temperature.

1. Confirm that the load current draw does not exceed the SBP current rating.
2. Check for loose/high resistance connections and ensure that appropriate gauge wiring is used in the installation.
3. Do not install the SBP unit in a location exposed to high temperature or radiant heat - relocate SBP to a cooler position or provide additional active cooling.

#### **P3: Under voltage warning**

**Urgent intervention required to prevent load disconnection.**

Under voltage protection will be activated in 90 seconds if no action is taken.

#### **E3: Under voltage**

Under voltage protection is activated in the event that the input voltage drops below the under voltage limit selected for 90 seconds.

1. Switch off/disconnect loads and recharge the battery.
2. Check charging system and battery for proper operation.

#### **E4: Over voltage**

Over voltage protection is activated in the event that the input voltage exceeds 16V (for 12V systems) or 32V (for 24V systems).

1. Confirm the configuration of all charging devices in the system - particularly system voltage and charge voltage settings.
2. Check charging system for proper operation.
3. Confirm SBP system voltage configuration is correct.

#### **E5: Configuration failure**

Internal malfunction - configuration data failure/missing.

To recover the SBP from this condition;

1. Reset the unit to factory defaults under - Settings > More options > Reset to defaults
2. Disconnect all power and wait 3 minutes before reconnecting.

3. Reconfigure the unit as required.

**E6: Reference voltage failure**

Internal malfunction - reference voltage failure/missing.

- Contact dealer for support - Fault is not user correctable and SBP requires replacement.

**E7: BMS lockout**

BMS lockout protection is activated in the event the external BMS requests the SBP to consecutively disengage and then re-engage 3 times (typical behaviour during a shut down due to low cell voltage).

Once E7 is activated, the SBP will remain disengaged until input voltage exceeds 13 V (for 12 V systems) or 26 V (for 24 V systems).

1. Check BMS error codes/log to identify the cause of shut-down and rectify issue.
2. Switch off/disconnect loads and recharge the battery.
3. Check wiring between BMS and SBP Remote terminal.
4. Check BMS for proper operation.

**E8: Reverse current**

Reverse current protection is activated in the event that reverse current flow is detected.



CAUTION: The SBP is designed to allow or prevent current flow from IN to OUT terminals ONLY. Reverse current flow is strictly forbidden and may permanently damage the SBP.

Uncontrolled reverse current will flow through a Smart BatteryProtect if  $V_{out} > V_{in}$ . Therefore, never use a Smart BatteryProtect for battery to battery charging.

1. Check that the SBP installation orientation is correct - current flow must be from IN to OUT (refer to example wiring diagrams).
2. Confirm that no charging sources are inadvertently connected to the SBP OUT terminal/circuit.
3. If the SBP is used to disconnect a charge source, confirm that no loads are inadvertently connected to the SBP IN terminal/circuit.