Smart BMS CL 12/100

Battery Management System

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1. Safety precautions

⚠️
- Installation must strictly follow the national safety regulations in compliance with the enclosure, installation, creepage, clearance, casualty, markings and segregation requirements of the end-use application.

- Installation must be performed by qualified and trained installers only.

- Switch off the system and check for hazardous voltages before altering any connection.

- Do not open the lithium battery.

- Do not discharge a new lithium battery before it has been fully charged first.

- Charge a lithium battery only within the specified limits.

- Do not mount the lithium battery upside down or on its sides.

- Check if the Li-Ion battery has been damaged during transport.

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2. General Description

Starter battery Protection

This function is similar to that of a Cyrix Battery Combiner or Argo FET Battery Isolator. Current can flow to the LFP battery only if the input voltage (= voltage on the starter battery) exceeds 13V.

Additionaly, current cannot flow back from the LFP battery to the starter battery, thus preventing eventual damage to the LFP battery due to excessive discharge.

Alternator and battery protection

The input current is electronically limited to approximately 90% of the fuse rating. A 100A fuse, for example, will therefore limit the input current to approximately 90A. (For fuse ratings and corresponding current limit please see table 1)

Choosing the right fuse will:

1. Protect the LFP battery against excessive charge current (important in case of a low capacity LFP battery).

2. Protect the alternator against overload in case of a high capacity LFP battery bank (most 12V alternators will overheat and fail if running at maximum output during more than 5 minutes).

This Power Port can be used to either charge or discharge the LFP battery (i.e. via a charger, an inverter or inverter/charger) with a maximum continuous current of 200A in both directions.

Can also be used as a load output, thus DC loads can be connected directly to this port. The port is short-circuit protected with a peak discharge current of 400A.

The Smart BMS will make sure that the battery discharge will cut-off in case of imminent cell under voltage.

The Smart BMS will enable charging through this port, but no charge algorithm can be applied internally.

Li-ion battery protection

Excessive input voltage and transients are regulated down to a safe level.

The Smart BMS will stop charging in case of cell over voltage or over temperature.

It has three outputs, similar to the smallBMS:

Load Disconnect output

The Load output is normally high and becomes free floating in case of imminent cell under voltage (default 2,8V/cell, adjustable on the battery between 2,6V and 2,8V per cell). Maximum current: 10mA. The Load output can be used to control the remote on/off input of a Battery Protect, inverter, DC-DC converter or other loads.

Pre-Alarm output

The pre-alarm output can be used as warning when the battery voltage is low and it will trip shortly before the Load Disconnect output is disabled due to cell under voltage.

The pre-alarm output may be used to drive a relay, LED or Buzzer. It can be configured as continuous or intermittent signal.

The pre-alarm output is normally free floating and becomes high in case of imminent cell under voltage (default 3,1V/cell, adjustable on the battery between 2,85V and 3,15V per cell). Maximum current: 1A (not short circuit protected.)

The minimum delay between pre-alarm and load disconnect is 30 seconds.

Charge disconnect output

The Charge disconnect output is normally high and becomes free floating in case of imminent cell over voltage or over temperature. Maximum current: 10mA. The Charge disconnect output is not suitable to power an inductive load such as a relay coil. The Charge disconnect output can be used to control: The remote on/off of a charger, a Cyrix-Li-Charge relay, a Cyrix-Li-ct Battery Combiner.

(Note: in some cases, an interface cable will be needed, please see the manual.)

A non-inverting or inverting on/off cable may be required, please consult the appendix.

Remote on/off input, also configurable as system on/off

The remote on/off input controls the charging via the alternator, while the BMS functionality will remain active regardless of the remote on/off state.

The remote on/off can also be used as system on/off switch. This can be configured with VictronConnect.

The remote on/off (or system on/off) consists of two terminals: Remote L and Remote H.

A remote on/off switch or relay contact can be connected between L and H.

Alternatively, terminal H can be switched to battery plus, or terminal L can be switched to battery minus.

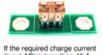**LED indicators (from left to right)**

3. Installation instructions

1. Mount the Smart BMS preferably on a vertical surface, for optimal cooling.

2. Determine the rating of fuse (see figure and table 1). The fuse doubles as a shunt, thus the Smart BMS will limit the input current according to the rating of this fuse. For fuse and corresponding current limit please see table 1.

3. Choosing the right fuse will prevent overheating of the alternator and/or DC cabling.

4. Disconnect the cabling from the minus pole of the starter battery.

5. Pull off the REMOTE on/off connector to prevent unwanted switching of the Smart BMS.

6. Install and connect the fuses and all electrical cabling, leave the minus poles of the Li-ion batteries and starter battery disconnected. **Make sure that the M8 nuts of the fuse are properly tightened.**

7. Daisy-chain the battery control cables between the Li-ion batteries and connect to the Smart BMS.

8. Connect the GND cabling to the minus of Li-ion batteries and the starter battery.

9. Reinsert the REMOTE on/off connector on the Smart BMS.

The Smart BMS is now ready for use.

Table 1: charge current per fuse rating

Fuse ratings	Max charge current
125A	100A
100A	90A
80A	60A
60A	50A
2 x 30A	40A
2 x 20A	25A
2 x 15A	20A
2 x 10A	12A
2 x 7.5A	9A

If the required charge current (input AB) is less than 40 A, please use this ATO fuse holder

4. Things to consider

Li-ion batteries are expensive and can be damaged due to over discharge or over charge. Damage due to over discharge can occur if small loads (such as: alarm systems, relays, standby current of certain loads, back current drain of battery chargers or charge regulators) slowly discharge the battery when the system is not in use. In case of any doubt about possible residual current draw, isolate the battery by opening the battery switch, pulling the battery fuse(s) or disconnecting the battery plus when the system is not in use.

> ⚠️ A residual discharge current is especially dangerous if the system has been discharged completely and a low cell voltage shutdown has occurred. After shutdown due to low cell voltage, a capacity reserve of approximately 1Ah per 100Ah battery capacity is left in the battery. The battery will be damaged if the remaining capacity reserve is drawn from the battery. A residual current of 10mA for example may damage a 200Ah battery if the system is left in discharged state during more than 8 days.

4.1. Important warning

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4.2. DC loads with remote on/off terminals

DC loads must be switched off or disconnected in case of imminent cell under voltage.

The Load Disconnect output of the Smart BMS can be used for this purpose.

The Load Disconnect is normally high (equal to battery voltage) and becomes free floating (= open circuit) in case of imminent cell under voltage.

DC loads with a remote on-off terminal that switches the load on when the terminal is pulled high (to battery plus) and switches it off when the terminal is left free floating can be controlled directly with the Load Disconnect output.

See appendix for a list of Victron products with this behavior.

For DC loads with a remote on/off terminal that switches the load on when the terminal is pulled low (to battery minus) and switches it off when the terminal is left free floating, the **Inverting remote on-off cable** can be used. See appendix.

Note: please check the residual current of the load when in off state. After low cell voltage shutdown a capacity reserve of approximately 1Ah per 100Ah battery capacity is left in the battery. A residual current of 10mA for example may damage a 200Ah battery if the system is left in discharged state during more than 8 days.

4.3. DC load: disconnecting the load with a BatteryProtect

A Battery Protect will disconnect the load when:

• input voltage (= battery voltage) has decreased below a preset value, or when -

• the remote on/off terminal is pulled low.

The Smart BMS can be used to control the remote on/off terminal of a BatteryProtect.

4.4. Charging the LiFePO$_4$ battery with an additional battery charger

Battery charging must be reduced or stopped in case of imminent cell over voltage or over temperature.

The Charge Disconnect output of the Smart BMS can be used for this purpose.

The Charge Disconnect is normally high (equal to battery voltage) and switches to open circuit state in case of imminent cell over voltage.

Battery chargers with a remote on-off terminal that activates the charger when the terminal is pulled high (to battery plus) and deactivates when the terminal is left free floating can be controlled directly with the Charge Disconnect output. See appendix for a list of Victron products with this behavior.

Battery chargers with a remote terminal that activates the charger when the terminal is pulled low (to battery minus) and deactivates when the terminal is left free floating, the **Inverting remote on-off cable** can be used. See appendix.

Alternatively, a **Cyrix-Li-Charge** can be used:

The Cyrix-Li-Charge is a unidirectional combiner that inserts in between a battery charger and the LiFePO$_4$ battery. It will engage only when charge voltage from a battery charger is present on its charge-side terminal. A control terminal connects to the Charge Disconnect of the Smart BMS.

4.5. Battery

5. System examples

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6. Specifications

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7. Appendix

7.1. Appendix A

1. **Loads which can be controlled directly by the Load Disconnect output of the Smart BMS**

   Inverters:

   All Phoenix inverters VE.Direct and Phoenix Inverters Smart:

   Connect the LOAD DISCONNECT to the left-hand terminal (H) of the 2-pole connector

   DC-DC converters:

   All Tr type DC-DC converters with remote on/off connector, and Orion 12/24-20

   Connect the LOAD DISCONNECT the right-hand terminal of the 2-pole connector

   Battery Protect and Smart Battery Protect

   Connect the LOAD DISCONNECT to terminal 2.1 (right hand terminal) for the Battery Protect and H pin for the Smart Battery Protet of the 2-pole connector

   Cyrix -Li-Load

   Connect the LOAD DISCONNECT to the control input

2. **Loads for which an inverting remote on-off cable is needed**(article number ASS030550100 or -120) All Phoenix VE.Bus inverters and VE.Bus Inverter Compact rated at 1200VA or more.

3. **Solar charge controllers which can be controlled directly by the Charge Disconnect output**

   BlueSolar MPPT 150/70 and 150/80 CAN-bus

   Connect the CHARGE DISCONNECT to the left-hand terminal of the 2-pole connector (B+)

   SmartSolar MPPT 150/45 and higher, 250/60 and higher

   Connect the CHARGE DISCONNECT to the **right**-hand terminal (marked +) or the **left**-hand terminal (marked H) of the 2-pole connector

4. **Solar charge controllers for which a VE.Direct non inverting remote on-off cable is needed**

   (article number ASS030550320)

   All BlueSolar MPPT models, except the BlueSolar MPPT 150/70 and 150/80 CAN-bus

   SmartSolar MPPT up to 150/35

5. **Battery Chargers**

   (note: no on-off cable needed when connecting the charger directly to one of the ports of the Smart BMS)

   Phoenix Smart IP43 Chargers

   Connect the CHARGE DISCONNECT to the left-hand terminal (H) of the 2-pole connector

   Skylla TG battery chargers

   Use a non inverting remote on-off cable.

   (article number ASS030550200)

   Skylla-i battery chargers

   Use a Skylla-i remote on-off cable

   (article number ASS030550400)

   Other battery chargers:

   Use a Cyrix-Li-Charge or connect the charger to the primary side of the Smart BMS.

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7.2. Appendix B

Error/ Warning Codes

E-B30: Calibration failure

Internal malfunction – calibration data failure/missing

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

E-B31: Configuration failure

Internal malfunction - configuration data failure/missing

> To recover the Smart BMS 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

E-B32: Battery BMS Cable not connected or defect

Detached or defect battery BMS cable (with M8 circular connector) detected

When BMS cables are neither detached nor defect, this can happen when the pre-alarm feature is enabled while using batteries not supported this feature.

> 1. Check if battery supports pre-alarm feature. If not:
>
> 2. Go to settings page and disable pre-alarm feature.

E-B33: Reference Voltage failure

Internal malfunction - reference voltage failure/missing

> Contact dealer for support - Fault is not user correctable and Smart BMS requires replacement

A-A12: Short Circuit

Short-circuit protection is activated in the event of a short circuit, an overload condition or excessive inrush current.

> 1. Check for a potential short circuit condition.
>
> 2. Confirm that the load current draw does not exceed the Smart BMS current rating.
>
> 3. Check for loose/high resistance connections and ensure that appropriate gauge wiring is used in the installation.

A-B11: Under voltage

Under voltage protection is activated in the event that the battery does not allow discharge

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

A-B15: Over temperature

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

> 1. Make sure that the correct fuse rating has been selected. Choosing the right fuse will also prevent overheating of the alternator and/or DC cabling.
>
> 2. Check for loose/high resistance connections and ensure that appropriate gauge wiring is used in the installation
>
> 3. Do not install the Smart BMS unit in a location exposed to high temperature or radiant heat relocate Smart BMS to a cooler position or provide additional active cooling

W-B12: Under voltage warning

Urgent intervention required to prevent system shutdown

1. Switch off/disconnect loads and recharge the battery

2. Check charging system and battery for proper operation

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