# XENES BMS2

## LiFePO4 battery management system



## SMART BMS

The battery management system (BMS) **XENES BMS2** monitors the charging and discharging of 4, 8, 12, 15 or 16 connected LiFePO4 cells. The BMS measures the voltage of each cell and protects the battery from overload and short circuits. Another task is to use the cells evenly in order to optimize their service life. The low self-consumption of the BMS enables the battery to last and be stored for a long time.

## DEFINITION

In order to keep the wording simple, in these instructions the term battery stands for an accumulator, i.e. a rechargeable battery consisting of several cells, the cell assembly and a battery management system. A cell, of course also an accumulator, should be distinguished from the cell compound in the text.

The correct German name for a battery management system of this type is **battery protection module.** However, this term is rarely used in practice.

A battery management system is a measuring and control circuit consisting of semiconductors and passive components, mounted and connected on a printed circuit board. The battery management system supplements the cell network to form a fully usable battery and is abbreviated to BMS.

## FUNCTIONALITY

The battery management system uses a shunt to measure the electrical flow (current) in and out of the battery. Semiconductors (field effect transistors) make it possible to limit the electric flow. In simplified terms, the function can be compared to an adjustable valve for liquids.

At the same time, the individual voltage of each connected cell is determined. When a cell reaches a threshold voltage and has a voltage mismatch with a neighboring cell, a small discharge to ground is activated for the affected cell. This is a continuous process to keep all cells within a voltage range.

If an upper voltage limit per cell is exceeded, the BMS also activates the procedure described above. In addition, further charging of the entire battery is prevented with the help of the charge flow control.
If the voltage falls below a lower limit per cell, further discharging of the entire battery is also prevented via the charge flow control. This provides protection against under-discharging and over-charging of the battery here.

When the charging and discharging current is too high the overload protection is activated and the BMS prevents any charging or discharging until a certain time has elapsed or when a maximum temperature is reached on the circuit board.

## PROTECTIVE MEASURES

This section does not describe protective measures with regard to lithium-ion batteries or other accumulators. It is essential to find out about these in advance from the respective manufacturer.

The battery management system does not require any special hazard labeling. is chemically stable when used as intended and has no reactivity.

Water, acids, oxidizing agents, metals and conductive materials should be kept away from the battery management system unless otherwise specified.

No hazards are to be expected from the product.

## SAFETY INFORMATION

Never open or modify in any way the BMS or cell.

If the cell housing is damaged, eg by an object penetrating it or the casing expanding, the battery must be deactivated immediately. Protective measures must be observed immediately in accordance with the cell instructions!

DC voltages from 120 V are life-threatening.
Even with a single cell or an incompletely connected BMS, a strong electrical flow can occur.

When making connections with the cells, an electrical flow is created. The connections of
Cells are always live. No tools or other conductive objects on the contacts
lay or fasten. Short circuits can damage batteries or cells and the battery management system

Only use suitable tools. Do not use electric screwdrivers.

When working on the cells hand jewelry, clocks;
Temporarily remove bracelets, cufflinks, low-hanging chains and other jewellery, ornaments and similar items

Note the connection sequence for battery management.

Always secure the battery against other components, e.g. inverters, solar controllers, chargers
etc.

The capacity of the battery depends on the discharge current of the cells, the capacity of the BMS and the wiring.

Despite battery management system are compatible
Charger or charge controller required.

Pay attention to the ambient temperature at the installation site. In mobile installations, pay particular attention to fixed mounting.

Use only indoors or in comparable dry environments out of direct sunlight. Otherwise use suitable containers.

## REQUIREMENTS

### NOMINAL VOLTAGE

The nominal voltage of the battery is achieved by connecting cells in series. The number of cells connected in series is also abbreviated xS. The placeholder x stands for the number of cells connected in series.

Example: 4S stands for 4 cells connected in series. The voltage is therefore 4 × 3.2 V = 12.8 V, which approaches the desired nominal voltage of 12 V. The nominal voltage determines the number of cells and vice versa. A 16S BMS requires 16 cells and cannot be operated with 15 or fewer.

48V 15S and 48V 16S batteries have different nominal voltages. Many solar inverters designed for 48V batteries require a 16S battery rated at 51.2V.

### CAPACITY

The capacity of the battery is the product of the charge of a single cell and the battery voltage.

Example: A battery consists of 4 cells, each with a charge of 100 Ah and a nominal voltage of 3.2 V. The capacity of the battery is 4 × 3.2 V × 100 Ah = 1280 Wh.

The capacity can also be increased by connecting two or more cells in parallel. In this case, the same number of cells are connected in parallel per cell in series connection. The number of cells connected in parallel is also abbreviated xP. The placeholder x stands for the number of cells connected in parallel per sub-element of the series connection.

Example: A 24 V 100 Ah battery consists of 8 cells of 100 Ah each, 8S1P for short. The capacity is to be doubled, which is possible with the addition of 8 more cells. This creates a battery with 24 V 200 Ah consisting of 16 cells each 100 Ah, 8S2P for short.
In both cases, i.e. 8S1P and 8S2P, an 8S BMS must be used.

### CELLS

The BMS is only suitable for a certain type, voltage rating and number of cells.

Example: A BMS LiFePO4 4S can only be used for 4 cells connected in series, each with a nominal voltage of 3.2 V and LiFePO4 technology. It is not suitable for fewer or more cells and is therefore only suitable for building a 12 V battery.

### PERFORMANCE

The performance of the battery is influenced by various factors, with the discharge current and the consumer voltage being the basis.

The discharge current is determined by the charge and the C rating of the cell, which usually corresponds to 1 for LiFePO4 cells. The ratio of charge and C rating corresponds to the electrical flow per hour.

Example: A cell has a charge of 100 Ah and a C rating of 1. This corresponds to an electrical flow of 100 A for one hour. In other words, the maximum discharge current of the cell is 100A.

However, since the electric flow has to be carried by the semiconductors (MOS FETs) of the BMS, its load capacity determines the actual maximum discharge current.

Example: A BMS with a capacity of 100 A is connected to cells that have a charge of 200 Ah. The maximum

Although the discharge current of the cells corresponds to 200 A, the BMS can process a maximum of 100 A. The maximum discharge current of the battery is therefore 100 A. The capacity is not reduced as a result.

The loading capacity of the BMS should not be higher than the maximum discharge current of the cells.

Example: 4 cells of 50 Ah each with a 100 A BMS form a 12V 50Ah battery. The C rating of 1 allows a discharge current of 50 A. The BMS can be loaded up to 100 A, which is too high for the cells. A BMS with 35 A or 60 A capacity makes more sense here.

The product of the load capacity of the BMS and the consumer voltage determines the rated output or discharge capacity of the battery.

The charging capacity of the battery is at most half the discharging capacity of the battery.

Tip: The Solar-Point.de team will be happy to advise you on choosing the right BMS. The contact information can be found at the end of the documentation.

# CONNECTION TO THE CELLS

## PREPARATION

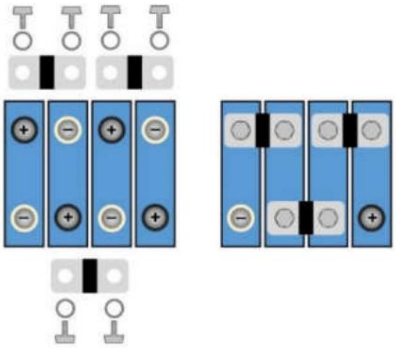
Before the battery management system is connected, the cell assembly must be prepared in accordance with the relevant documentation.

Tip: If there is no documentation for the cells or the manufacturer does not offer any, then contact the Solar-Point.de team for further support. Have pictures or technical data of the cells ready.

Basically, a block is built up from several cells. In the block, the cells are arranged side by side on the long edges. The first cell is arranged on the left, the last cell is arranged on the right.

The adjacent cells are connected using a suitable electrical connection method so that all cells are connected in series. come at it mostly metal rails and screw connections are used.

Figure 1: prepared cell assembly



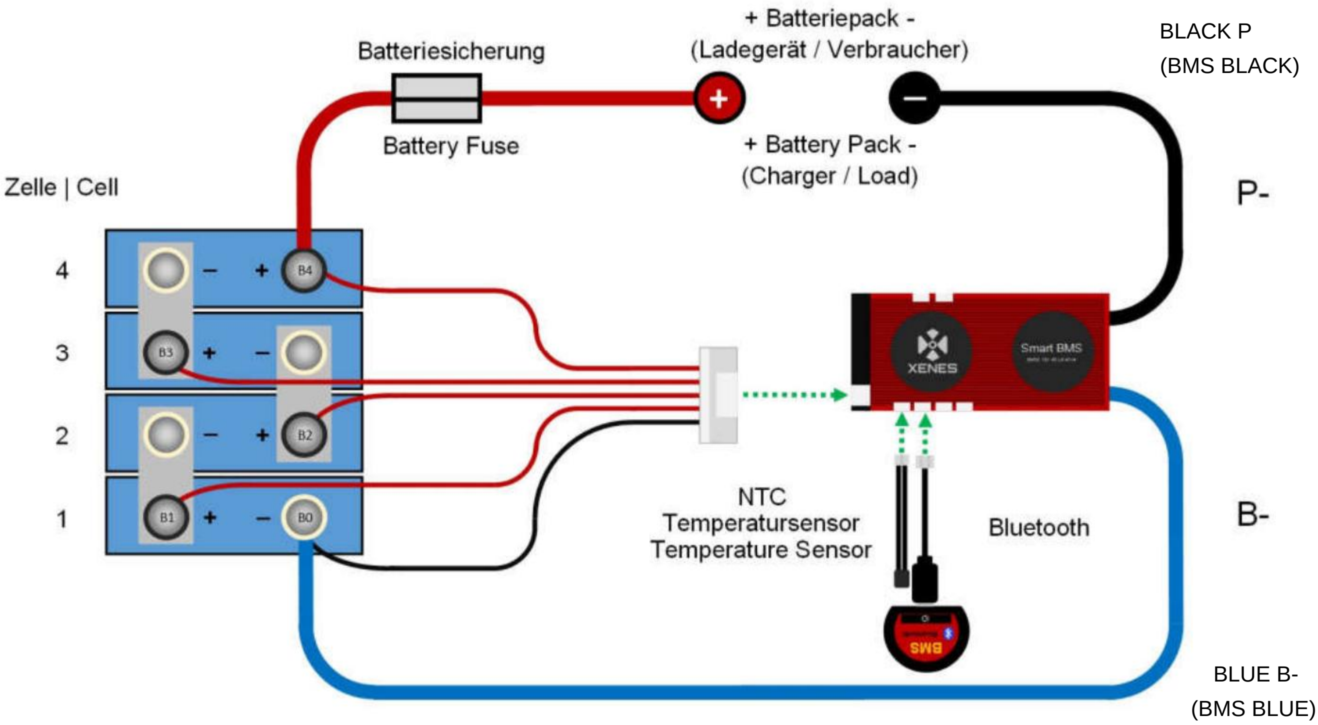
The series circuit is created by connecting the positive pole of the first cell to the negative pole of the second cell and the positive pole of the second cell to the negative pole of the third cell, etc.
The end result is a block of several cells in which the negative pole (B0) of the first cell (left) and the positive pole (B4) of the last cell (right) are not connected.

With an 8S block for a nominal voltage of 25.6 V, the last pole B8 is on the eighth cell, or with a 16S block for a nominal voltage of 51.2 V, the last pole B16 is on the sixteenth cell.

## CONNECTION DIAGRAM

The schematic below shows a 4S configuration for a nominal voltage of 12.8V. Here 4 cells and a BMS are shown.

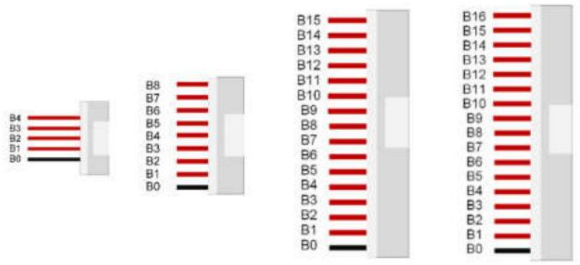
With higher rated voltages, there are more cells and measuring lines. Instead of B4, B8 is connected to the battery fuse or battery fuse in an 8S configuration.
Battery pack + connected. For a 16S configuration it is B16.



## TEST LEADS

There is a multi-pole connection for the measuring lines on the BMS. These are connected to the cells, since the BMS can use them to determine the individual voltages of the cells.

Figure 2: Connectors for test leads




B0 is the common ground wire for all measurement points and is connected to the first cell at the negative pole. B1 is the measuring line for the first cell and is connected to the positive pole there. The other measuring lines are connected one after the other to the positive pole of each subsequent cell.

When connecting the measuring lines to the cells, the plug contact must not be connected to the BMS.

The enclosed cable lugs simplify the connection to the cells if they have connection contacts with metric threads of size 6 or smaller.

## P AND B

The BMS has two individual large cross-section connectors of different colors. These are referred to as BMS Blue (B-) and BMS Black (P-).

If there are multiple versions of these connections, they are connected to each other by color. The multiple execution serves to increase the cross-section to allow a greater electrical flow.

The connection BMS blue (B-) is connected to the first cell at the negative pole.

## NOTES ON WIRE CONNECTIONS

The measuring cables may be shortened or lengthened as required, but always of the same length. In addition, they all have to be fastened with the same connection method. It is preferable to use suitable ring or pin terminals at the cable ends to ensure a firm and low-resistance connection of the test leads to each cell.

The BMS Blue (B-) line should remain unchanged.

## TEMPERATURE SENSOR

A temperature sensor (NTC) is either permanently connected to the BMS or pluggable.

Figure 3: NTC temperature sensor

The temperature sensor (NTC) should preferably be in the

be attached near the cells. The sensor and the cable must not become loose.

See also the Temperature Compliance section.

## BLUETOOTH

For models with Bluetooth, a pluggable module is available with the transceiver. Unless otherwise specified, this is connected to the socket labeled UART, the next or the next but one to the right of the NTC temperature resistor.

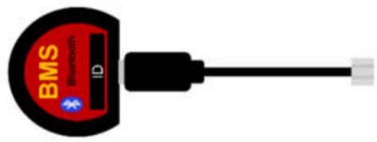



Figure 4: Bluetooth module

In principle, models with Bluetooth also work without Bluetooth, but the set protection parameters should be checked during commissioning and corrected if necessary.

Only the models with Bluetooth are suitable for querying the state of charge and other key figures. In addition, an application is required, which is not provided when purchasing the BMS. Compatible applications can be downloaded for free for devices running Android (Google) or iOS (Apple)
operating system to be downloaded.

The Bluetooth module will be switched on during the automatic
Energy saving mode (sleep mode) of the BMS deactivated and therefore does not appear in the application. However, a short charge will immediately re-enable the transceiver.

## COMPLETION

After the BMS and the measuring lines are connected to the cell pack, the plug contact of the measuring lines can be plugged into the BMS. The battery is now ready to be connected and used.

## CONNECTING TO OTHER DEVICES

The BMS has a common connection for the charger and consumers and can therefore be used for solar inverters, but also for combinations of individual devices such as solar charge controllers and inverters.

The negative and positive terminals of the battery are the cable BMS Black (P-) and the positive pole of the last cell. Chargers and consumers may only be connected to these two poles.

The cabling must be adequately dimensioned at all points so that no thermal overload can occur. The larger the cross-section of the cable, the lower the resistance. Tubular cable lugs are recommended for connecting the charger or consumers.

The battery must be secured with a suitable battery fuse. The size is to be determined based on the maximum discharge current of the battery or the expected power consumption of the consumer (e.g. inverter).

## OPERATION

#### CHARGE CONTROLLER

The charge of a LiFePO4 battery uses a charge controller with two-phase charge ahead. Where it came from is irrelevant the charge controller draws its energy. Charger and charge booster are other names for a charge controller.

A fixed voltage source (e.g. a laboratory power pack), an alternator or other batteries are not suitable charging sources **without a charge controller .** The BMS **does not** replace the function of a charge controller.

The charge controller uses the end-of-charge voltage to detect when a battery is charged and then switches off the main charge. The charge controller also adjusts the incoming voltage from an alternator or solar cell to the charging voltage. If necessary, the charging current is also limited by the charge controller so that commercially available batteries are not overloaded.

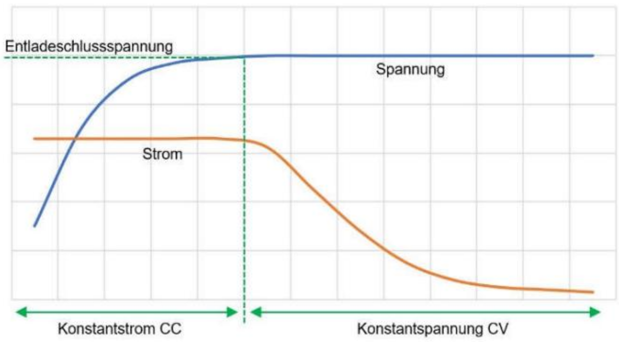
Tip: We will be happy to advise you on the right choice of charge controller or check whether your existing charge controller can be compatible.

### TWO-PHASE CHARGING

Two-phase charging consists of a constant current phase with increasing voltage and a constant voltage phase with rapidly decreasing charging current.
The change is carried out when the end-of-charge voltage is reached. The constant voltage phase can be interrupted at any time, since no significant charging takes place here, but the open-circuit voltage of around 3.35 V per cell is reached.

The two-phase charge is also abbreviated CCCV, IU, IUoU, IU0U1 and stands for Constant Current Constant Voltage charge (Continuous Current Continuous Voltage charge method).

Figure 5: 2-phase charge




In general, a permanent charging current of up to 0.2 C is recommended for LiFePO4 cells. Brief excesses of up to 0.5 C, even over several hours, do not have an unfavorable effect on the service life, provided this is not a regular occurrence and the temperatures are close to room temperature at the same time.

Example: A battery with 12V 100 Ah has a recommended charging current of 20 A and is charged with an average of 15 A by a solar charge controller. In optimal weather conditions, the charging current can also increase to 30 A. The permanent charging current of maximum 20 A and the maximum charging current of 50 A are maintained.

Tip: You can find suitable chargers and charge controllers as well as solar inverters in the Solar-Point.de range.

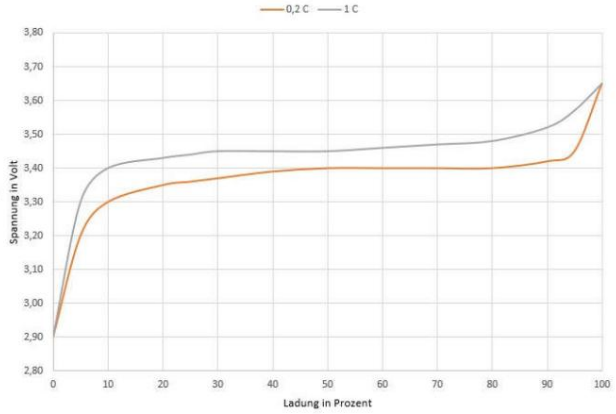
### AVAILABLE AND USABLE CAPACITY

The state of charge (state of charge SOC), i.e. the available charge and the usable charge (state of health SOH) are variable values depending on the C rating, charging and discharging currents and temperature.

Tip: Available and usable charge can be easily described with an analogy. The usable charge determines the size (volume) of a glass and the available charge determines the level of the same glass.

The higher the current, the lower the usable charge, depending on whether charging or discharging is taking place.

Figure 6: Voltage depending on electrical charge and charging current




### COMPLIANCE WITH TEMPERATURES

The temperature ranges of LIFePO4 cells are different when charging and discharging. The BMS only serves as emergency protection here, so suitable temperature control must be monitored by the charging technology and, if necessary, by the consumption technology.

Maintaining the temperatures and, in particular, approaching room temperature significantly improves the quality of life of the cells and contributes to achieving the cycle times specified for the cells.

The information in the technical data provides an insight into the temperatures at which the BMS wants to interrupt charging or discharging. The end-of-charge or end-of-discharge voltage is applied to the output B-.
The charging technology and consumption technology recognize the associated voltages and interrupt the charge or extraction of energy.

For models with Bluetooth, the temperature ranges must be set before permanent use.

### STORAGE

The battery management system activates after one hour the power-saving mode and also deactivates a connected Bluetooth module. The monitoring is therefore not permanent, so that the low self-discharge rate of LiFePO4 cells is maintained.

## REMOTE MONITORING

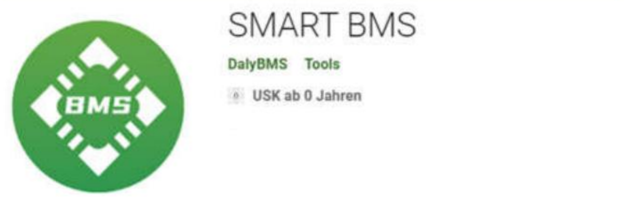
Remote monitoring of the BMS and the connected cells is possible using a Bluetooth module. Only the models with Bluetooth function can be equipped with such a module.

Information, such as the state of charge, can only be queried when the charging technology is activated and connected. Modern charge controllers supply the open-circuit voltage and can thus maintain remote monitoring.

An application is not included in the scope of delivery and is also not provided by the provider. Compatible, partially restricted or not fully translated

Applications are available free of charge. However, the advertised basic function, querying the relative state of charge, is guaranteed.

Figure 7: SMART BMS application

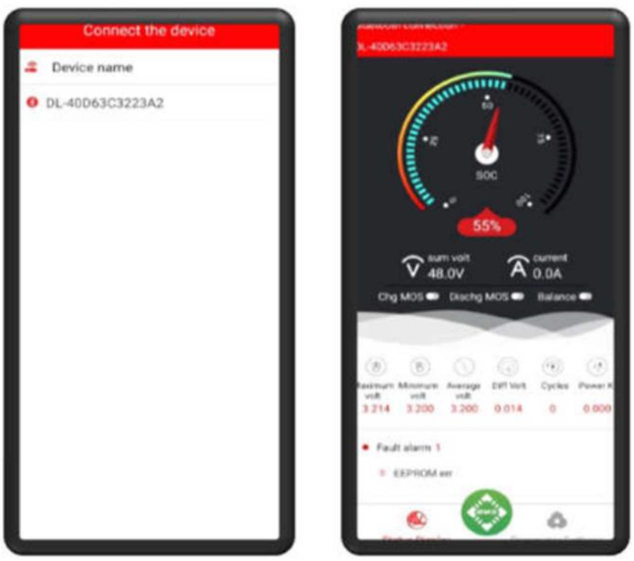



Use Smart BMS application from Daly BMS. Can be found in the Google PlayStore or Apple AppStore by searching for "Smart BMS". Alternatively, scan the QR code below with a compatible device.

Figure 9: Smart BMS for Android (left) and Apple (right)

After installing and opening the application, the identification code of the Bluetooth module must be entered.
This identification code can be found on the module and consists of a twelve-digit sequence of numbers and letters with a prefixed identifier DL-. It is not necessary to enter the identifier. Only the twelve-digit code is relevant. If the Bluetooth
module is within range, then after entering the code, the Bluetooth module is listed below the entry.

Figure 8: Selection and display of the BMS display




Once entered, the Bluetooth module can now be selected. The application starts communicating with the BMS.

It may be necessary to accept the end user agreement and activate the location services once. The application supports the GPS extension for the BMS, which is why the enabling of the standard location services is requested.

If no entry is listed despite entering the identification code correctly (without entering DL-), then either the BMS is in energy-saving mode or no charger is connected.

When the entry is selected, the characteristic values determined by the BMS are transferred to the software.

## SETTINGS

The settings are divided into several tabs. Changes must be confirmed with a password.
The password is 123456.

Only make the recommended changes or use the recommended values. The documentation for the cells used provides further information. Incorrectly configured values have the potential to damage cells.

The protection parameters, cell properties and temperature values allow the BMS to be individually adapted to the cell or application scenario used. All information is suitable for commercially available LiFePO4 cells with a nominal voltage of 3.2 V and a 1 C rating, unless otherwise stated. The order of the values corresponds to the representation in the application.

### PROTECTION PARAMETERS

Table 1: Protection parameters

| | |
|---|---|
| Cell voltage protective shutdown maximum<br>Cell volt high protect | 3.75V |
| Cell voltage protective shutdown minimal<br>Cell volt low protect | 2.5V to 2.9V |
| Total voltage protection shutdown maximum<br>Sum volt high protect | These values are calculated from the individual voltage and number of cells and assigned automatically by the BMS. |
| Total voltage protective shutdown minimal<br>Sum volt low protect | |
| Cell differential voltage protection<br>Diff Voltage Protect | 0.5V |
| Maximum current protection charging<br>Chg Overcurrent protect | See text |
| Minimum current protection charging<br>Dischg Overcurrent Protect | See text |

The general protection parameters include overvoltage and undervoltage protection for the cell and cell assembly, as well as charging and discharging current limitations. Normally no settings have to be made here.
Note the explanations of the settings at the end of the table.

**Cell voltage protective shutdown maximum**
This property determines at which individual voltage the BMS stops further charging of the cell assembly.
The recommended value is 3.75 V, i.e. 0.1 V above the charging voltage.

**Cell voltage protective shutdown minimum**
This property determines at which individual voltage the BMS stops further charging of the cell assembly.
The recommended value is 2.6 V for commercially available 3.2 V LiFePO4 cells, i.e. 0.1 V above the normal minimum voltage. In principle, however, an increase up to

2.75 V for about 20% depth of discharge makes sense as a protection parameter.

**Total voltage protection shutdown maximum**
This property determines the total voltage at which the BMS stops further charging of the cell assembly.
The recommended value is 3.75 V multiplied by the cells connected in series and corresponds to the charging voltage of the cell pack.

**Total voltage protective shutdown minimal**
This property determines the total voltage at which the BMS stops further discharging of the cell assembly. The recommended value is 2.75 V multiplied by the number of cells connected in series and corresponds to a depth of discharge of about 80%.

**Cell differential voltage protection**
The maximum differential voltage between the cells is set here. If this is exceeded, the BMS interrupts further charging/ discharging of the cell assembly until the necessary adjustment has taken place.

**Maximum current protection charging**
This is the overload protection function when charging. If the threshold value is exceeded, the BMS activates the overload function with the help of the charge flow control. The cell group can no longer be loaded.

Both overload functions are not a limitation of the charging flow — there is no regulation of the charging or discharging current. If the threshold values are exceeded, the charge flow control becomes highly resistive and the cell assembly is deactivated. The charge controller is responsible for limiting the charging current.

**Maximum current protection discharging**
This is the overload protection function when discharging. If the threshold value is exceeded, the BMS activates the overload function with the help of the charge flow control. The Cell Network cannot be discharged further.

## CELL PROPERTIES

Cell properties require one-time setup.
Here the charge of the cell is determined and, after the first charge, the state of charge (SOC) is automatically set to 100%. All other charge changes are calculated based on the incoming and outgoing charge flows (current).

Table 2: Cell properties

| | |
|---|---|
| type of battery | LFP/LiFePO4 |
| rated capacity<br>Rated Capacity | 100 Ah or the nominal charge of the cells (200 Ah 300 Ah) |
| cell reference voltage<br>cell reference | 3.2V |
| Waiting time until standby<br>Sleep waiting time | 3600s |
| SOC setup<br>SOC set | Feature not supported |
| Balanced opening voltage Ba lance<br>Balanced open start volts | 3.45V |
| Balanced differential voltage Ba lance<br>Balanced open diff volts | 0.05V |

**rated capacity**
The nominal charge of the cell group in ampere hours (Ah), which corresponds to the nominal charge of a single cell in a 1P configuration. This information is required to calculate the state of charge.

**cell reference voltage**
Leave at the default value.

**Waiting time until standby**
Delay to activate power saving mode.

**SOC setup**
This feature is no longer supported. The BMS calibr
is automatically activated when the "cell voltage protective shutdown maximum" setting is exceeded on any cell. The BMS then assumes a full charge.

**Balanced opening tension balance**

Correct translation: Threshold voltage for cell balancing

Activation voltage for cell equalization. When the threshold value is exceeded and the differential voltage between all cells is reached (see next setting), the cells start to adjust. The recommended value is 3.45 V, the open-circuit voltage of the cell. In this way, the compensation process is always kept active.

**Balanced differential voltage balance**

Correct translation: differential voltage for cell balancing

The differential voltage must exist at least so that the adjustment of the cells is activated. The recommended value is 0.05V.

## TEMPERATURE PROTECTION

The temperature protection of the BMS is activated when the respective values are exceeded or fallen below. The charge flow control is used again here. Discharging or charging of the cell group is prevented, the charger or the electrical consumers must switch off automatically. An adjustment of the charging current depending on the temperature is made possible by special charge controllers.

Table 3: Temperature values

| | |
|---|---|
| Maximum charging temperature<br>Charge high temp protect | 40°C |
| Minimum charging temperature<br>Chg low temp protect | 0°C |
| Maximum discharge temperature<br>Dischag high temp protect | 55°C |
| Minimum discharge temperature<br>Dischag low temp protect | -10°C |
| Diff temp protect | 0°C |
| Maximum temperature BMS<br>MOS temp protect | 0°C |

The temperature settings should also be checked and adjusted according to the data sheet of the cells or the use. Note the order of maximum and minimum charging temperature protection followed by maximum and minimum discharging temperature protection.

Leave the other temperature settings at the preset values.

## TECHNICAL SPECIFICATIONS | TECHNICAL INFORMATION

Table 4: General values

| | All | 12V 4S | 24V 8S | 36V 12S | 48V 15S | 48V 16S |
|---|---|---|---|---|---|---|
| required cells<br>required cells | S | 4 | 8th | 12 | 15 | 16 |
| nominal voltage<br>nominal voltage | 3.2V×S | 12.8V | 25.6V | 38.4V | 48.0v | 51.2v |
| charging voltage<br>ChargeVoltage | 3.65V×S | 14.6V | 29.2v | 43.8V | 54.8V | 58.4v |
| end-of-charge voltage<br>Charge Cut Off Voltage | 3.6V×S | 14.4v | 28.8V | 43.2V | 54.0v | 57.6v |
| Open circuit voltage / trickle charge<br>Open circuit voltage / float charge | 3.4V × S ±0.075V × S | 13.6V ±0.3V | 27.2V ±0.6V | 40.8V ±0.9V | 51.0V ±1.1V | 54.4 V±1.2V |
| end-of-discharge voltage<br>Discharge Cut Off Voltage | 2.5V × S ±0.5V | 10V±0.5V | 20V ±0.5V | 30V±0.5V | 37.5V±0.5V | 40V±0.5V |

Table 5: Dimensions

| | length (mm)<br>lenght (mm) | width (mm)<br>width (mm) | height (mm)<br>height (mm) | weight (g)<br>weight | connection<br>connectors |
|---|---|---|---|---|---|
| 12V 4S 40A | | | | | |
| 12V 4S 60A | | | | | |
| 12V 4S 100A | | | | | |
| 12V 4S 120A | | | | | |
| 12V 4S 150A | | | | | |
| 12V 4S 200A | | | | | |
| 12V 4S 250A | | | | | |
| 12V 4S 300A | | | | | |
| 12V 4S 400A | | | | | |
| 12V 4S 500A | | | | | |
| 24V 8S 40A | | | | | |
| 24V 8S 60A | | | | | |
| 24V 8S 100A | | | | | |
| 24V 8S 150A | | | | | |
| 24V 8S 200A | | | | | |
| 24V 8S 250A | | | | | |
| 24V 8S 300A | | | | | |
| 48V 16S 40A | | | | | |
| 48V 16S 60A | | | | | |
| 48V 16S 100A | | | | | |
| 48V 16S 150A | | | | | |
| 48V 16S 200A | | | | | |
| 48V 16S 250A | | | | | |
| 48V 16S 300A | | | | | |

Table 6: Additional data for all models and default parameters for models without Bluetooth

| | BMS2 |
|---|---|
| suitable cells | 3.2 V LiFePO4 (LEP) cells<br>designs cuboid "Prismatic", cylindrical cells or polymer or pocket cells 3.2 V LiFePO4 (LFP)<br>lithium-ferrophosphate cells Prismatic, Polymer/Pouch, Cylindrical<br>CCCV / IU / U0U1 / constant current / constant voltage process |
| charging characteristics<br>Charge Method | CCCV / IU / U0U1 / Contionous Current / Continous Voltage **SURGE PROTECTION \| CHARGING PROTECTION** |
| | |
| overcharge protection<br>Over charge protection | 3.75 V cell voltage<br>3.6 V cell voltage |
| recovery voltage<br>recovery voltage | |
| return delay<br>recovery delay | 2 s |
| | **DEEP DISCHARGING/UNDERVOLTAGE PROTECTION \| DISCHARGE PROTECTION** |
| deep discharge protection<br>Over Discharge Protection | 2.5 V cell voltage<br>2.5 V cell voltage |
| recovery voltage<br>recovery voltage | 2.8 V cell voltage<br>2.8 V cell voltage |
| return delay<br>recovery delay | 2 s |
| | **OVERLOAD PROTECTION \| OVERCURRENT PROTECTION** |
| overload protection<br>Overcurrent rating | Resilience × 2<br>Operating current × 2 |
| delay<br>delay | 5 s |
| function<br>Method | Interruption of charging / discharging<br>Disconnect Charger / Load |
| release delay<br>Release Delay | 32s |
| | **SHORT CIRCUIT PROTECTION \| SHORT CIRCUIT PROTECTION** |
| function<br>Method | Interruption of charging / discharging<br>Disconnect Charger / Load |
| delay<br>delay | < 1ms |
| | **BALANCE \| BALANCE** |
| activation voltage<br>Balanced turn on voltage | 3.45 V cell voltage |
| equalizing current<br>balanced current | 30±5mA |
| | **TEMPERATURE PROTECTION \| TEMPERATURE PROTECTION** |
| Charge Thresholds1<br>Charge Temperature Voltages | lower threshold -5° C, upper threshold 65° C lower<br>value -5° C (23° F), upper value 65° C (149° F) lower |
| return charge1<br>Release charge temperature | threshold > 0° C upper threshold < 55° C lower value 0°<br>C (32° F), upper value 55° C (131° F) lower threshold < |
| Discharge Thresholds1<br>Low/high discharge temperature | -10° upper threshold > 75° C lower value -10° C (14° F),<br>lower value 75° C (167° F ) lower threshold > 0° C upper |
| return discharge1<br>Release Discharge Temperature | threshold < 65° C lower value -5° C (23° F), upper value<br>65° C (149° F) |
| | **SELF CONSUMPTION \| SELF CONSUMPTION** |
| operation<br>operating mode | 20mA |
| standby<br>Sleep mode | 0.2mA |
| standby activation<br>Sleep delay | 10 s after no load or load 10 s after no charge<br>or load or line |

1 See notes under “Temperature compliance” and “Temperature settings”.

## TROUBLESHOOTING

1. Check all connections. It must be a series connection of cells and BMS.
2. Measuring lines must be connected, otherwise a Error voltage of the cells is assumed.
3. Temperature sensor must be plugged in, otherwise an error temperature is assumed.

### CHECK VOLTAGES

**Voltage of the cell group Ucells**
UCELLS is the sum of all individual cell voltages and is measured between the last cell being positive and the first cell being negative.

$$U_{CELLS} = U_{CELL}(1) + U_{CELL}(2) + U_{CELL}(3) + \cdots + U_{CELL}(n)$$

**Battery voltage Ubat**
UBAT is the voltage at the output of the BMS and is measured between the last cell positive and BMS B- (BLACK).
senior

### COMPARE VOLTAGES

**Ubat < end-of-discharge voltage**
Error or power saving mode

**Ubat = end-of-discharge voltage**
Discharge protection, due to discharged cells or temperature

**UBAT > end-of-discharge voltage & UBAT ÿ UCELLS**
normal state

**UBAT = charge voltage (with charger)**
Charger in bulk charge

**UBAT = end-of-charge voltage (with or without charger)**
Charging protection, due to fully charged cells or temperature.

### POWER SAVING & BLUETOOTH

The communication interfaces of the BMS are provided via an additional microcontroller. This is deactivated after a short time in the event of an error, in energy-saving mode and also during normal operation in order to reduce the BMS's own consumption. Even without activated Bluetooth, all protective functions of the BMS are activated.

To activate the Bluetooth, it is necessary to bring the BMS into the normal state. This requires a charger or a fixed-voltage power supply, which is set to the correct charging voltage. The charger or fixed voltage power pack must be connected to the battery for 3 seconds and then disconnected again.

## DISPOSAL INSTRUCTIONS

The following information is intended for those who Use batteries or products with built-in batteries and no longer resell them in the form in which they were supplied (end users):

### RETURN OF OLD BATTERIES

Batteries must not be disposed of with household waste. You are legally obliged to return old batteries so that professional disposal can be guaranteed. You can hand in used batteries to a municipal collection point or to local retailers. As a battery distributor, we are also obliged to take back old batteries, whereby our obligation to take back is limited to old batteries of the type that we have or have had as new batteries in our range.

You can either return old batteries of the aforementioned type to us with sufficient postage or hand them in free of charge directly to our shipping warehouse at the address given in the imprint.

### MEANING OF THE BATTERY SYMBOLS

Batteries are marked with the symbol of a crossed out wheelie bin. This symbol indicates that batteries must not be disposed of with household waste. Batteries that contain more than 0.0005% by mass of mercury, more than 0.002% by mass of cadmium or more than 0.004% by mass of lead have the chemical name of the pollutant used under the garbage can symbol – “Cd” stands for Cadmium, "Pb" stands for lead, and "Hg" for mercury.

### ELECTRICAL APPLIANCES

The battery management system and its wiring is comparable to a small device as defined by the ElektroG but is not covered by it. However, it must not be disposed of with household or residual waste. The battery management system can be handed in free of charge at the recycling center or disposal center.

### RETURNS

Batteries, battery management systems or comparable electrical, electronic or electro-mechanical products as well as cable material can be returned to the address below for disposal. Prior contact is required for this.

## CONTACT

**Solar Point GmbH**

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Tax number: 44/667/01537
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