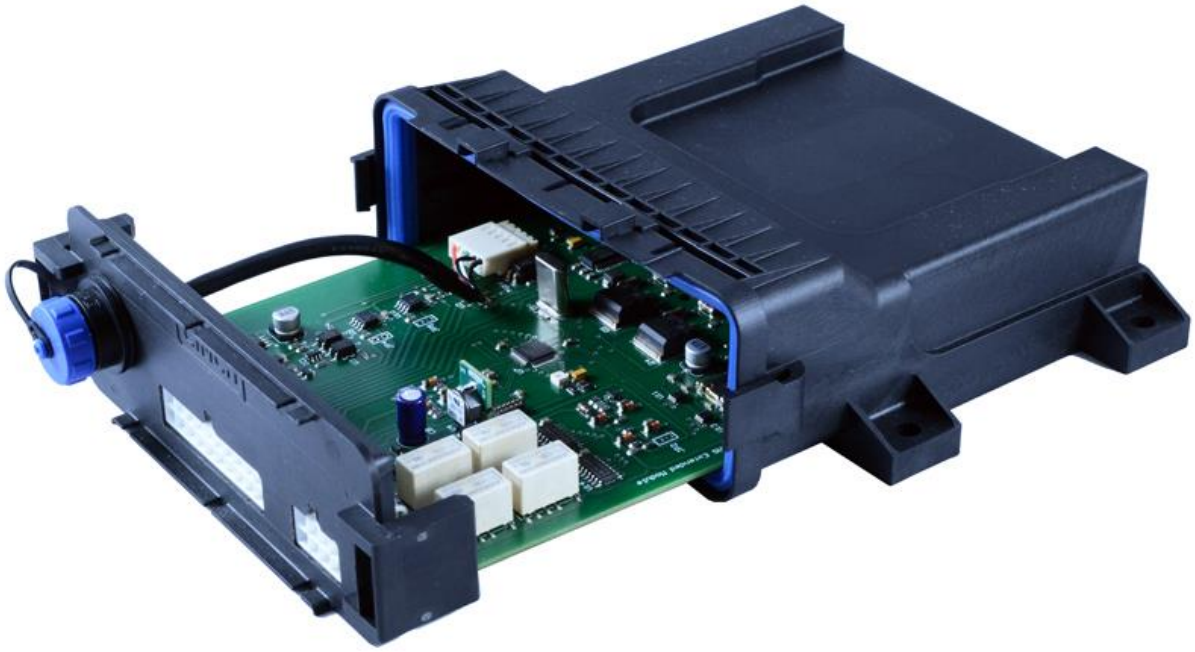
Albertronic

123SmartBMS Extended Module manual



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Introduction

123SmartBMS is a battery management system for lithium cells. The last cell – called Out board – has two relays to signal some conditions. To add extra functionality, the 123SmartBMS Extended Module has been developed. This module was designed for many more advanced applications like automotive, boat and other applications.

Functionality

The module adds the following functionality to the 123SmartBMS system:

- 4 configurable relays – switch relay on at time or conditions
- 2 individual CAN bus connections
- Control Elcon/TC Charger via CAN bus interface
- Broadcast BMS settings on CAN bus
- Compatible with EV charging stations using the J1772/IEC 62196 protocol – adaptive charging current limits the charger current tot the maximum current for the charging station
- Control two analog gauges to indicate fuel level (state of charge) and current consumption
- Isolation detection – measure the isolation resistance between the power supply and an isolated battery pack

Connecting the module

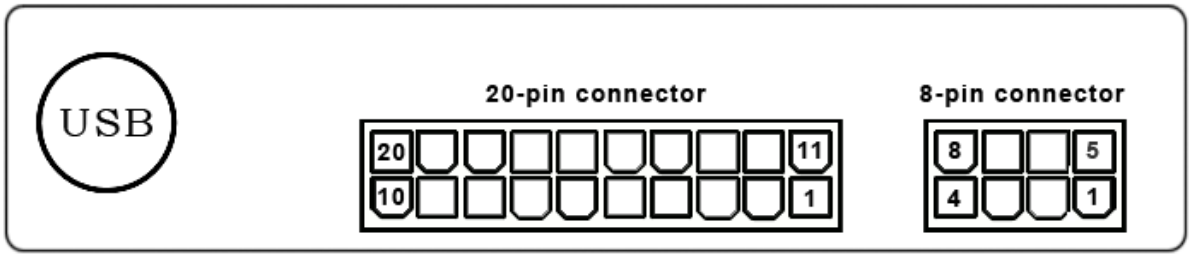

Figure 1 - Front view of the module panel

The 20-pin and 8-pin connector are Minifit Junior connectors. The USB connector is of the mini-USB type.

20-pin connector

Pin number	Name	Description
1	Supply ground	Ground supply for module
11	Supply voltage	Power supply for module. Range 8-80V
2	J1772 charging proximity (PP)	Charging station proximity pin from charging connector
12	J1772 charging pilot (CP)	Charging station pilot pin from charging connector
3	-	

13	-	
4	Fuel meter	Analog fuel meter signal wire
14	Current meter	Analog current meter signal wire
5	-	
15	-	
6	BMS data in	One of two wires from BMS for BMS data
16	BMS data in	One of two wires from BMS for BMS data
7	CAN1 Low	CAN bus 1: CAN low
17	CAN1 High	CAN bus 1: CAN high
8	CAN2 Low	CAN bus 2: CAN low
18	CAN2 High	CAN bus 2: CAN high
9	Elcon enable	Elcon/TC Charger enable pin
19	Isolation ground	Ground from isolated supply to measure isolation fault detection
10	Elcon ground	Elcon/TC Charger ground pin
20	Elcon +12V	Elcon/TC Charger +12V pin

8-pin connector

Pin number	Name	Description
1	Relay 1 pin A	One of two pins from relay 1. When relay closes, pin A connects to pin B.
2	Relay 2 pin A	One of two pins from relay 2. When relay closes, pin A connects to pin B.
3	Relay 3 pin A	One of two pins from relay 3. When relay closes, pin A connects to pin B.
4	Relay 4 pin A	One of two pins from relay 4. When relay closes, pin A connects to pin B.
5	Relay 1 pin B	One of two pins from relay 1. When relay closes, pin A connects to pin B.
6	Relay 2 pin B	One of two pins from relay 2. When relay closes, pin A connects to pin B.
7	Relay 3 pin B	One of two pins from relay 3. When relay closes, pin A connects to pin B.
8	Relay 4 pin B	One of two pins from relay 1. When relay closes, pin A connects to pin B.

Connecting with 123SmartBMS

To connect the module with the 123SmartBMS, use a twisted wire from the OUT board to the module. There is no polarity.

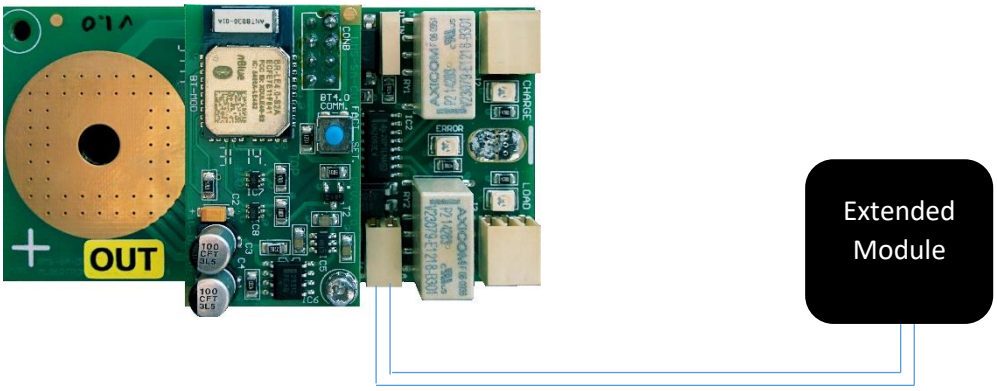

Figure 3 – Connecting the OUT module with the Extended Module

Charging station (J1772) for vehicles

Electric vehicles can be charged at charging stations using the J1772 protocol. The Extended Module communicates with the charging station and gets the maximum allowed current. This advertised current will be used when controlling a charger via the module.

The PE - earth of the inlet connector in the vehicle - has to be connected to the GND of the module (normally negative pole of 12V supply).

The PP – proximity – has to be connected to pin 2 of the Extended Module.

The CP – charging pilot – has to be connected to pin 12.

Note: only use official charging cables as they contain a resistor on each side of the connector. The system will not work otherwise.

Isolation detection

Some battery packs, especially when high voltage, need to be isolated from the electronic power supply like a 12V battery. It is important to continuously measure this isolation resistance between the high voltage pack which the BMS manages and the power supply of this Extended Module. This can be done with the isolation detection.

To make use of this functionality, the Extended Module needs to be powered from the low voltage supply (like 12V). Connect the negative pole of the high voltage battery pack to pin 19 of the Extended Module connector. You should see a very high resistance (i.e. 999kOhm) in the "monitor" tab in the Extended Module software. If the value is low, it seems like the pack is not galvanic isolated from the low voltage power supply.

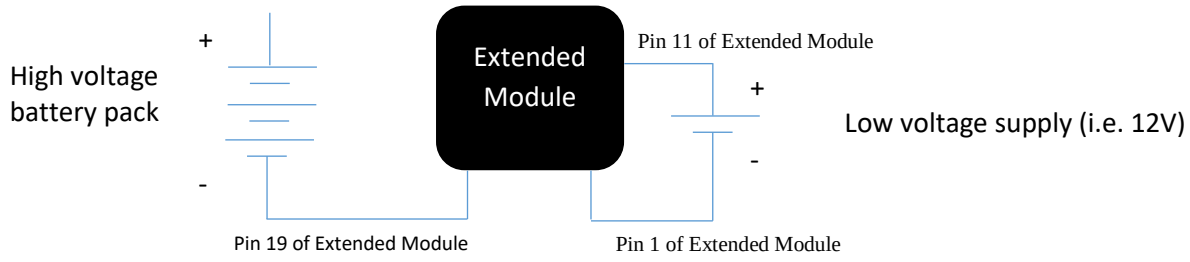

Figure 4 – Isolation resistance connection circuit

Software

The software for the Extended Module consists of different sections, divided by tabs.

General

This contains the module firmware version, connection status and current date/time running on the module. This date will be used by the configurable relays in time mode.

Monitor

The most important data like total pack voltage, state of charge and individual cell voltages will be shown here.

BMS data

Global BMS settings like minimum cell voltage, maximum cell voltage and temperatures have to be configured here. Also all BMS data can be send on the CAN bus.

NOTE: the BMS does NOT use the minimum voltage, maximum voltage, minimum temperature and maximum temperature configured by the Bluetooth module.

CAN BUS messages

It is possible to send the most important BMS data like voltages, temperatures, settings and status on a CAN bus. Choose the the desired CAN bus network (1 or 2) and fill in the start message ID. The BMS will send a 8 different CAN bus messages. The first one on the start address (N), second one N+1 etc.

See Appendix A for more information about each specific message and its data bytes.

Configurable relays

Four relays can be independently configured on day of week, hysteresis or boolean logic. There is also an “invert output” option. In this case, the relay

Day of week - relay is active on selected days and between selected time.

Example: during weekends between 11:00 and 15:00, the system has to charge the battery pack. Select Saturday + sunday and 11:00 – 15:00.

Hysteresis – select a variable and choose above which value the relay turns on. Also choose a value when the relay turns back to the off state. This second value always has to be smaller than the first value.

Example: you want to turn on a charger when the state of charge is below 50% and off at 80%. You fill 80% in as the first value and 50% as the second. The relay turns on when above 80% and off again when under 50%. However, when we check the “invert output” box, the relay now turns off above 80% and on below 50%.

Parameter	Unit
Total pack voltage	0.1V
State of charge	%
Lowest cell voltage	mV
Highest cell voltage	mV
Lowest cell temperature	°C
Highest cell temperature	°C
Isolation resistance	kΩ

Boolean logic

Simple logic variables called booleans can also be used to set the relay active. The relay will be on when one of the logic values is true.

Analog gauges

Two analog gauges can be controlled to indicate fuel (state of charge) and current consumption.

Indicator style

There are three indicator styles:

- No regen – display only the outgoing current. The indicator will stay at 0A when the total current is regenerative.
- Centered indicator – The indicator will turn counter clockwise when the total current is regenerative. When the total current is outgoing (from the pack), the indicator will turn clockwise from the center.
- Absolute value – show both incoming and outgoing currents.

Current range

This is the maximum current value which will be displayed. The maximum value correspondents to 100% on the meter.

Gauge calibration

To calibrate a gauge, click on the percentage you want to calibrate. When the value has focus, the gauge should go to that value. Minimum value is 0, maximum is 255. The module will interpolate the current value with these calibration values.

Example: you are calibrating the 25%. Click on the box next to 25%. If the gauge indicator stays below 25%, you have to increase the value until the indicator reaches 25%. Do this for 0%, 25%, 50%, 75% and 100%.

Appendix A – BMS data CAN bus messages

All data will be send in "Big Endian" format.

Signed data is formatted as two's complement.

CAN bus start address (N) and bitrate can be programmed by the 123SmartBMS Extended Module PC Software

Address:	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
N+0	Total voltage		Current IN		Current OUT		Current Battery	
N+1	Energy stored				Battery capacity		SOC	-
N+2	Energy today collected				Energy today consumed			
N+3	Total energy collected				Total energy consumed			
N+4	Cell voltage MIN		Cell voltage MAX		Cell voltage Bypass		-	-
N+5	Cell voltage Lowest		Low Nr	Cell voltage Highest		High Nr	Sbyte 1	Sbyte2
N+6	Tmp,Lowest	Low Nr	Tmp,Highest	High Nr	Min charg temp	Min dis temp	Max temp	-
N+7	Current cell voltage		Cur.Temp	Cur. Nr	Cell cnt	-	Isolation resistance	

Message	Step	Size	Signed	Example 1	Example 2
Total Voltage	0.1 Volt/bit	16 bit	-	0x15FF = 563.1V	
Current IN	0.1 Amp/bit	16 bit	Signed	0x0230 = 56.0 Amp	0xFF6E = -14.6 Amp
Current OUT	0.1 Amp/bit	16 bit	Signed	0x0230 = 56.0 Amp	0xFF6E = -14.6 Amp
Current Battery	0.1 Amp/bit	16 bit	Signed	0x0230 = 56.0 Amp	0xFF6E = -14.6 Amp
Energy stored	Wh/bit	32 bit	-	0x00A3 = 163 kWh	
Batery capacity	0.1 kWh/bit	16 bit	-	0x00A0 = 16.0 kWh	
SOC (state of charge)	1%/bit	8 bit	-	0x32 = 50%	
Energy today collected	Wh/bit	32 bit	-	0x64 = 100 Wh	
Energy today consumed	Wh/bit	32 bit	-	0x64 = 100 Wh	
Total energy collected	kWh/bit	32 bit	-	0x00A3 = 163 kWh	
Total energy consumed	kWh/bit	32 bit	-	0x00A3 = 163 kWh	
Cell voltage MIN	1mV/bit	16 bit	-	0x09C4 = 2.500V	OUT Board settings
Cell voltage MAX	1mV/bit	16 bit	-	0x0E74 = 3.700V	OUT Board settings
Cell voltage Bypass	1mV/bit	16 bit	-	0x0DAC = 3.500V	OUT Board settings
Cell Voltage lowest	1mV/bit	16 bit	-	0x0B86 = 2,950V	
Low nr.	Nr/bit	8 bit	-	0x64 = cell nr 100	
Cell Voltage highest	1mV/bit	16 bit	-	0x0E10 = 3,600V	
High nr.	Nr/bit	8 bit	-	0x32 = cell nr 50	
Cell temp lowest	1°C/bit	8 bit	Signed	0x14 = 20 °C	0xFA = -6 °C
Low nr.	Nr/bit	8 bit	-	0x16 = cell nr 22	
Cell temp highest	1°C/bit	8 bit	Signed	0x14 = 20 °C	0xFA = -6 °C
High nr.	Nr/bit	8 bit	-	0x16 = cell nr 22	
Minimum charging temperature	1°C/bit	8 bit	Signed	0x14 = 20 °C	
Minimum discharge temp	1°C/bit	8 bit	Signed	0x15 = 21 °C	
Maximum temperature	1°C/bit	8 bit	Signed	0x16 = 20 °C	
Current cell voltage	1mV/bit	16 bit	-	0x0B86 = 2,950V	
Current cell temperature	1°C/bit	8 bit	Signed	0x14 = 20 °C	0xFA = -6 °C
Current nr.	Nr/bit	8 bit	-	0x18 = cell nr 24	
Cell count	Nr/bit	8 bit	-	0xFF = 255 cells	
Isolation resistance	kΩ/bit	16 bit	-	0x258 = 600kΩ	

Status byte 1	MSB	Allow to charge
8 bit	6	Allow to discharge
	5	Cell communciation error
	4	BMS communication error
	3	Exceed minimum voltage
	2	Exceed maximum voltgae
	1	Exceed minimum temperature
	LSB	Exceed maximum temperature

Status byte 2	MSB	-
8 bit	6	J1772 = connected
	5	J1772/Elcon/TC = charging
	4	-
	3	-
	2	-
	1	-
	LSB	-