BMS: Installation Manual v2.x

From Documentation

This section describes how external peripheral devices are connected and additional functions of the BMS are used. I you have not done so already, please follow Quick Start Guide to get your system running before proceeding further.

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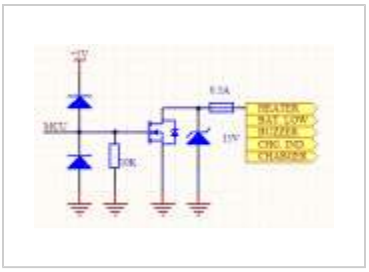
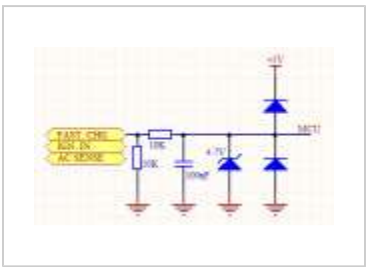
Before you start

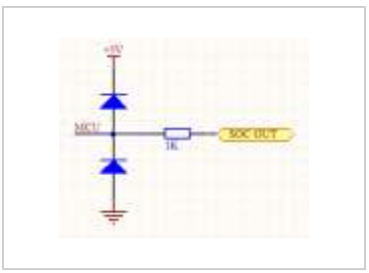
Emus BMS Control Unit has several inputs and outputs, some of them are **fixed** and some can be **remapped** in software:

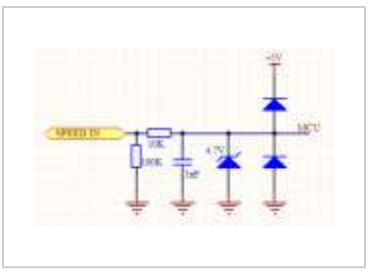
The internal circuitry of the pins is shown below. Different types of pins have different circuitry and properties. For example, output pins (BUZZER, HEATER, ...) are controlled by MOSFET open drain and can only be configured for output functions, but they can drive loads with up to 0.5A current to the ground. Other pins have protective resistors and external devices may be driven only with small currents (0.5mA). All pins are controlled by internal Micro Controller Unit (MCU) with CMOS 0-5V level signals for inputs and outputs. On the pins where there are 10k resistors and clamping diodes the inputs may be driven with signals above +5V and applying +12V signal is fully acceptable.

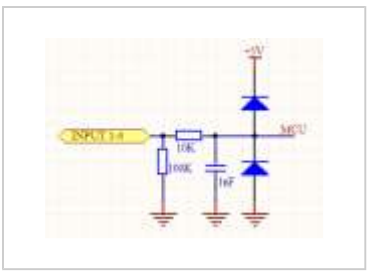
BMS Control Unit interface pins internal schematic fragments

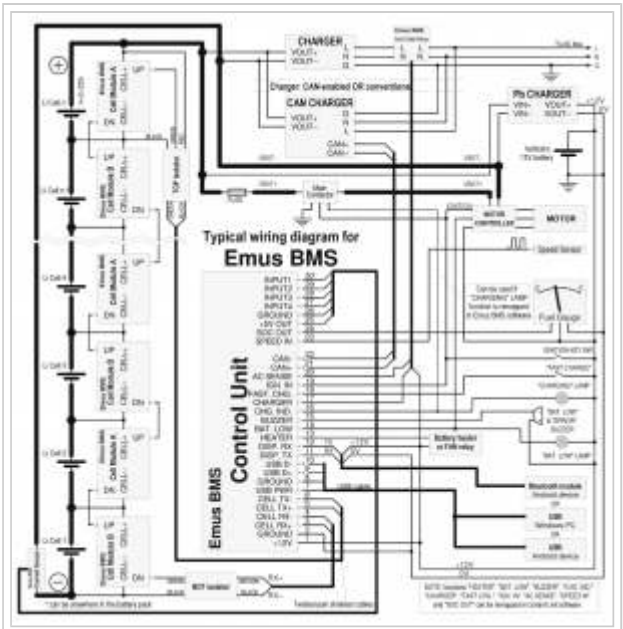












Emus BMS typical wiring diagram

Bluetooh module

Emus Bluetooth module operates from 12V supply and communicates with Emus Control Unit via RS232 port (DISP.TX and DISP.RX pins). Connection is as follows:

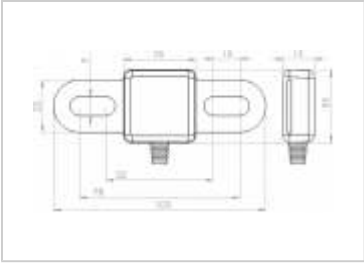
1. Black - 0V
2. Red - +12V
3. White - DISP.RX
4. Green - DISP.TX
5. Shield - not connected.

Pairing password: 1234

Please note that RS232 port is shared with USB port internally: Bluetooth will be not accessible while USB is connected. Bluetooth module can be powered from ignition key, if energy saving is required.

Current Sensor



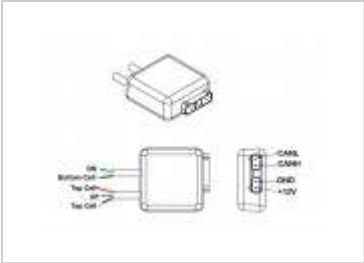


Emus current sensor is plug&play, but requires some configuration. Sensor has two hall-effect chips to provide two measurement ranges: 0-100A and 100-1000A. At high loads second range is used and on lower loads - more sensitive (0-100A) range, to get more accuracy. Typical accuracy for Emus Current Sensor is 0.5%. Each Current Sensor is calibrated at factory and calibration values are written on back of the sensor - these should be entered in the configuration of Emus Control Unit via Emus Control Panel software. Also make sure that Control Unit's INPUT1..INPUT4 pins are mapped for Current Sensor.

The Current Sensor can be mounted either way, as it will simply show current with plus or minus sign. It can be inverted in configuration.

Hall-effect chips are sensitive to magnetic fields, so current sensor should be zeroed-out after install. Current sensor comes with 4 meter twisted-pair shielded cable and Control Unit connector. As with all low-signal cables, it is recommended to instal this cable far from power cables. If it is installed in a car for example, power and signal lines should go on different sides.

CAN Cell Group Modules

Emus CAN Group Module is used as an interconnecting interface to separate the whole battery pack into cell groups. Each group of cells is served by one Emus CAN Group Module which then communicates to Emus BMS Control Unit via CAN bus. This arrangement allows better communication reliability in installations where EMI levels could pose issues for simple serial connection. CAN group modules should also be used if the whole battery pack's cells are installed in physically separate locations where EMI would likely cause communication interference errors over long single wire connecting Emus Cell Modules. CAN Group Module has optical embedded isolation circuitry so it may be connected directly to Cell Modules chain without additional isolation modules. CAN Group Module also allows to form exchangeable modules of battery pack. Optical isolation allows to build exchangeable modules each having safe voltage levels for manual handling. Please note that CAN Group Module still requires Emus BMS Control Unit to perform BMS functions.

CAN Cell Group Modules also serves another purpose of giving the possibility of arranging the cell groups intro several strings of cells connected in parallel, for applications that require more power with the same voltage.

Charging and Battery low indication

These are basic signals for user, if graphical display is not used. There are two outputs for indication lamps “Charging Indication” and “Battery Low”. The outputs are pulled low to the ground when active. The Emus Control Unit's outputs for lamps can provide up to 0.5 A current which allows to use up to 6W 12V lamps.

Lamp's one terminal must be connected to Emus BMS Control Unit's output and the other side must be connected to +12V external power source. The source could be the same as supplying the power to BMS.

LEDs can also be used but they must be connected with corresponding value resistor in series (820 Ω typically).

Sound buzzer

The warning buzzer must be of self-oscillating type which emits a sound of some warning frequency when it is connected to power source of 12V. The output is pulled low to the ground when active. Buzzer's (-) terminal must be connected to Control Unit's *BUZZER* output. Buzzer's (+) terminal must be connected to +12V power source. The buzzer may draw up to 0.5 A current maximum.

Ignition and Fast charge input switches

EMUS BMS inputs *IGN. IN* and *FAST CHG.* are activated by positive +12V signals. *IGN. IN* should be connected to vehicle's ignition key switch which supplies +12V when active. This input informs the EMUS BMS when the vehicle is being actively used. “FAST CHG.” should be connected to two position switch which is supplying +12V when fast charging mode is selected.

Charger

Emus BMS supports two types of chargers: basic and CAN-equipped chargers. CAN-equipped chargers are able to be controlled and configured over CAN line.

Connecting non-CAN charger

Non-CAN charger does not have the benefits of CAN charger but may also be used with EMUS BMS. There are two signals provisioned for such charger connection: *AC SENSE* and *CHARGER*.

AC SENSE is the input which senses the charger connection to AC mains power source. +12V voltage applied on this input informs BMS that charger was connected to AC mains socket and charging can start.

CHARGER is the output controlling the charger. It is pulled low to the ground when active. It may drive charger's input or a relay which is connecting the AC power source to charger's input.

An optional specially designed opto-isolated AC sensing non-CAN charger control relay can be ordered from JSC “Elektromotus”. This relay connects to *AC SENSE* and *CHARGER* signals on low voltage side. On high voltage side it connects to AC mains source and charger's AC input. Relay cable colors: Red - goes to BMS Control Unit "+12V", White - goes to BMS Control Unit "AC SENSE", Green - goes to BMS Control Unit "Charger", Black/chield - not connected.

CAN charger

Before connecting CAN charger a correct charger model must be selected in Charger Type field via EMUS BMS Control Panel application on PC. The connection to CAN charger is made by connecting EMUS BMS Control Unit's CAN+ and CAN- signals to corresponding charger's CAN interface signals.

Resistive termination is required for reliable operation of CAN interface. EMUS BMS Control Unit does not have internal terminator between CAN+ and CAN- signals. If charger does not have internal termination then external 120 Ohm termination resistor must be connected between CAN + and - signals. The 120 Ohm termination resistor is included in the EMUS BMS package.

Once the CAN charger is properly connected to Control Unit via CAN bus it may be verified by plugging it into AC mains. EMUS BMS Control Unit will detect the powered-up charger via CAN bus and start a charging process which can be checked by Charging Indication lamp, graphical display or via EMUS BMS Control Panel application on PC.

Display unit

EMUS BMS Control Unit sends its output parameters via serial RS232 interface. The data can be used for detailed display of BMS operation details via graphical user interface using various graphical handheld devices, such as iPAQ Pocket PC with Windows Mobile OS.

EVGUI for Windows Mobile OS

Free open-source EVGUI software for Windows Mobile handheld devices is available on Downloads page. Devices of various series which have serial interface of Bluetooth connection and are running Windows Mobile operating system can be used. Software is currently available for ARM processor platform based devices but will be expanded in the near future. Please follow updates in News section. When connecting devices the EMUS BMS Control Unit's *DISP. TX* should be connected to device „RX“ data line and *DISP. RX* should be connected to IPAQ‘s „TX“ data line.

EVGUI for Windows Mobile OS data layout





EVGUI for Android OS

Free open-source software Android EVGUI for handheld devices is available on Downloads page. Please follow updates in News section.

Fuel Gauge Display

Fuel gauges come in various shapes and signal types, analog or digital. Control Unit's "SOC OUT" pin is designed with versatility in mind: pin is internally connected directly to MCU via 1kΩ resistor, thus giving protected pulse-width-modulated CMOS 0-5V level signal. This allows it to be used with various Fuel Gauges, however, requires some additional Gauge-specific circuitry.

Digital Fuel Gauge

In case of digital gauge, which accepts pulsed PWM signal, no additional circuitry is needed and the gauge can be wired directly to SOC OUT pin.

Analog Fuel Gauge

Probably the most popular ones, as shown on this picture, have three terminals: 0V, +12V and "input". "0V" terminal should be connected to Control Unit's GROUND, "+12V" - to ignition key. The "input" terminal usually is pulled down to GROUND to indicate "full tank" and left open for "empty tank". To interface it to this kind of gauge, current amplifier is needed: N-channel MOSFET, NPN BJT or optocouple usually does the job. Other types of analog fuel gauges

Standard fuel gauge

may not work properly with pulsed PWM signal and will need filtering and, sometimes, amplification. One type of gauges requires a 0-5V DC signal. In this case, since there is an internal 1kΩ resistor, only a 10µF capacitor is needed between SOC OUT and GROUND. It will filter-out the pulses and leave a DC voltage, which is proportional to pulse width.