

BMS: Introduction v2.x

From Documentation

Emus BMS Control Unit



Manufacturer	JSC Elektromotus
Released	April 2011
Type	Distributed
Supply voltage	8 - 20 V
Power consumption	50 mA
Cell chemistry	Any in 2÷4.55 V range
Cell count	2÷255 using serial cell communication, up to 8128 using CAN cell communication
Cell form factor	Bolt-on prismatic
Battery pack voltage	Up to 2kV (limited by CAN group module isolation voltage)
Cell balancing current	Up to 1.5 A
Balancing type	Passive/Dissipative
Isolation	Optical
Interfaces	CAN (http://en.wikipedia.org/wiki/Controller_area_network) , Bluetooth, USB, RS-232 (http://en.wikipedia.org/wiki/Rs232) , basic I/O, Analog
Display	Windows Mobile, Android devices
Cell communication	Robust digital with forward error correction, or CAN (http://en.wikipedia.org/wiki/Controller_area_network) communication using CAN Cell Group Modules (http://elektromotus.lt/wiki/index.php?title=BMS:_Installation_Manual_v2.x#CAN_Cell_Group_Modules)

Recent development of rechargeable battery technology allowed wider use of electric propulsion in electric vehicles, electric motorcycles, boats etc. Most popular high performance batteries are based on Lithium chemistries. Such batteries require systems to keep them in the specified usage range while being used. The Battery Management System (BMS) is required for batteries that are sensitive to their usage conditions such as current, voltage and temperature. Emus BMS is the product intended for use with LiIon, LiPO, LiFePO4 and other chemistries prismatic battery cells which

operating voltages range is from 2V to 5V. Emus BMS is a distributed type of digital BMS with central Control Unit. It does the balancing of the cells by dissipating the excess energy of cells as heat which is often referred to as passive balancing.

It's usage is explained further in this manual.

System structure

Emus BMS is designed for batteries where cells are connected in series to form a higher voltage battery pack. Each cell of the battery has a Cell Module which monitors cell's parameters, controls the balancing current and communicates with central Control Unit over 1 wire digital interface. For better picture consult Wiring Diagram found on Downloads page.

Emus BMS Control Unit is connected to Cell Modules via double twisted-pair optically isolated interface over which it communicates and collects cell characteristic information and manages the battery. Control Unit also connects to charger via CAN bus or via Solid State Relay (SSR) if non-CAN charger is used. Collected data is sent via serial RS232 interface and CAN bus. The data can be gathered and displayed to the user by Display Module (optional add-on). Control Unit also has a USB interface for firmware updates, configuration, which is used to connect it to a PC to configure the BMS via special Emus BMS Control Panel software.

Emus BMS Control Unit also has a connection to Current Sensor Module (optional add-on) which enables the Emus BMS to act as a State Of Charge (SOC) meter allowing user to monitor remaining battery charge and plan a trip or operation. To allow such trip planning there is an input for vehicle Speed Sensor signal.

Control Unit connects to other user controls as well: Ignition Key and Slow/Fast charge selection switch. Several output connections are intended to be used as audio-visual indicators to the user: Charging and Low Battery indicators and warning audio buzzer.

Features

Here you can find only main highlights of the system. For more thorough information please contact us directly - Elektromotus (<mailto:info@elektromotus.it>)

Easy configuration

BMS has various parameters that are configurable by using convenient Emus BMS Control Panel PC software over USB connection: pre-charge, pre-heat, timeouts, cell voltages (min and max allowed, early balancing threshold, allowed disbalance, etc), currents (maximum balancing current, charge modes), cell parameter read interval, etc...

Suitable for different battery cell sizes

Small size of the cell modules and variable length „+“ terminal wire allows installation on the prismatic cells of different sizes.

Tool-less installation

Cell modules can be installed without tools (only a bolt wrench is needed for cell terminals) as cell modules have spring-loaded terminals that allow reliable connection of wires by hand. Pre-cut inter-connection wires are supplied in the shipped package for quicker installation. When connected to Control Unit blinking green LEDs on Cell Modules indicate live communication and allow quick identification of problematic cell connection.

Configurable ballancing current range

Linear zero to max, configurable maximum balancing current – useful to define maximum balancing current and amount of heat dissipated by modules during balancing.

Cell voltage measurement

Real-time bar graph on LCD or PC – useful to detect faulty cells and track battery health, or as general visualisation for advanced users.

Cell temperature measurement

Real-time value on LCD and bar graph on PC – useful for controlling charger and load in high temperatures, for setting charging mode and control of battery heater in cold weather (lithium batteries can't be charged below freezing point). Many other BMS systems are not suitable for use in cold environment.

Early cell balancing

Balancing is done while charging, battery pack is in balance when charged – takes no additional time. Many other BMS systems start the balancing only when at least one cell is fully charged and overall charging time is drastically increased (in terms of hours).

Digital one-wire interface between cells

Allows neat and robust installation with lowest count of wires that could break.

Optional CAN communication with cells

Using CAN Cell Group Modules (http://elektromotus.lt/wiki/index.php?title=BMS:_Installation_Manual_v2.x#CAN_Cell_Group_Modules) allows to separate the whole battery pack into cell groups for better communication reliability and more flexible battery pack arrangements.

Forward Error Correction algorithm

Increases data transfer robustness and drastically reduces possibility of faulty data – data is corrected by Control Unit, even if it arrives with errors caused by high EMI levels.

CAN-equipped charger control

Precise charging process control by setting required charging voltage and current and monitoring actual values. Charger models can be added by software upgrade per request.

State-Of-Charge

When current sensor is used Emus BMS calculates remaining available energy which can be displayed on graphical LCD screen, sent over CAN bus to other devices or sent to analog gauge as pulses or analog voltage of SOC output. It also estimates remaining charge and driving range/time left; on stock fuel gauge: current remaining charge (just like fuel left in the tank).

Current measurement

Dual range isolated sensor for measuring currents up to 1000A in both directions. Dual range allows precise measurement of smaller

currents up to 100A while keeping possibility to measure big currents up to 1000 A with the same sensor. If needed bigger current sensors are available upon request.

Flexible inputs and outputs function mapping

Several functional inputs and output like buzzer output and ignition key input etc. can be remapped for different functions to allow flexible customization for different applications and addition of new functions in future by software upgrade. Inputs and outputs remapping is configured via BMS Control Panel software for PC.

Moisture protection

Control Unit is hermetically sealed to meet IP55 requirements. Internal electronics protected with conformal silicone coating. Cell Module's electronic parts coated with silicone conformal coating protecting circuits from moisture and dust.

USB, RS-232, CAN interface

USB 2.0 compatible, with free, intuitive and easy to use, good quality Emus BMS Control Panel windows application.

RS-232: Periodically sending the working status and parameters which can be received by LCD display or other device. Parameters output format specification is available upon request.

CAN: Used for controlling CAN-capable charger and broadcasting working status and parameters to other devices that could be connected on CAN bus. Broadcasted parameters specification is available upon request.

Battery protection from under-voltage, over-voltage, over-current, overheat, communication loss and leakage

Enhanced BMS safety features allows users to set parameters of BMS for protecting battery cells from abusive usage. For detailed information on parameters configuration, please, refer to Configuration page.

Motor power reduction signal output

If Emus BMS is interfaced to motor controller's throttle input, it can reduce motor's power at low SoC level.

Operation status data and statistics

System accumulates over 50 statistics about BMS operation. General statistics can be cleared by the user to start fresh collection via control panel in configuration access mode.

Protected statistics for battery usage recording

For warranty or similar issues some statistics are secured from actions of users. Secure statistics are battery pack usage history statistics cannot be cleared neither by the user nor by configuration access mode. Special master clear procedure is required if secure statistics need to be cleared.

Events log

For easy monitoring, understanding and troubleshooting of actions of BMS operational events are being recorded. These are presented to a user via Control Panels Statistics menu section Events.

Configuration password protection

Configuration data might be protected from unauthorised changes using password. New function allows to set password of BMS Control Unit. The user must be in logged state to be able to set new password. Password must be from 4 to 8 characters long. If empty password is left and confirmed twice then this disables the password.

Configuration Save / Load functions for mass production

Save/Load functions were developed for easy and fast configuration of BMS. It allows system configuration files to be saved and loaded again when needed. It automatically sets the configuration parameters of BMS, sets SoC and/or password (if they were stored in the file) and resets the BMS to work with newly loaded configuration.

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