SYSTEM OVERVIEW

**ELECTRIFICATION SOLUTIONS**

**Battery Management**

Automation, Connectivity and Electrification of Mobile Machines

**SYSTEM OVERVIEW**

**MELA-mBMS**

Battery-Management-System for Li-Ion Batteries
Customer specific and standardized Lithium-Ion batteries are the energy storage of choice for modern drive systems. The battery management system powerMELA-mBMS fits ideally to the drives of the powerMELA product family. The mBMS supports all kinds of popular cell chemistries within the Lithium-Ion family: LFP, NMC and LTO.

The powerMELA-mBMS is a mature and complete solution for your battery. It covers all electrical functions of a Lithium-Ion battery:
• from the sensors to status supervision of the storage.
• from balancing the cells to self-diagnosis of the electronics to an insulation guard.
STW will support you when deploying your battery system. If you plan a customer specific adaptation STW offers cost-efficient development and series production based on the mBMS reference design – the fastest and easiest way to a sophisticated, tailored solution.

Battery system (parallel, series)
- To increase capacity, performance and availability of your battery system
- Plug and play

Energy Storage System (ESS)

Battery Main Supervisor (BMS)
- Interlock signal generation and surveillance
- Insulation surveillance
- Adaptive pre-charging
- Intelligent contactor control
- Management of battery cooling

Cell Sensor Circuit (CSC)
- Cell voltage measurement
- Cell temperature measurement
- Cell balancing

Power Measurement Board (PMB)
- Current measurement up to 600A
- Voltage measurement up to 800V

Optional data management solutions
- Battery state surveillance anytime and anywhere
- Data acquisition down to cell level
- Savings of service costs by remote access and maintenance

ESS CAN-Interface
- Battery state determination (SoC, SoH, SoF …)
- Standardized interface description (DBC format)
- Support of CANopen and SAE J1939

Safety
- Self diagnosis of electronics, connectors and relays
- Multi-level safety architecture

Agricultural
Railway
Transportation
Maritime
Automotive
Stationary
powerMELA-mBMS components for realization of your complete solution

The Battery Main Supervisor (BMS) is the central control unit of the battery system. It includes three processors for highest levels of reliability and safety. It collects all information from the sensor modules, from the Cell Sensor Circuits and from the Power Measurement Board, calculates the status of the battery system and controls the HV contactors.
### powerMELA-mBMS Components

<table>
<thead>
<tr>
<th>Component</th>
<th>BMS – Battery Main Supervisor</th>
<th>PMB – Power Measurement Board</th>
<th>CSC – Cell Sensor Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>212 x 100 x 33 mm (8.3&quot; x 3.9&quot; x 1.3&quot;)</td>
<td>95 x 61 x 15 mm (3.7&quot; x 2.4&quot; x 0.6&quot;)</td>
<td>300 x 75 x 13 mm (11.8&quot; x 3.0&quot; x 0.5&quot;)</td>
</tr>
<tr>
<td>Weight</td>
<td>230 g (0.51 lbs.)</td>
<td>100 g (0.22 lbs.)</td>
<td>260 g (0.57 lbs.)</td>
</tr>
<tr>
<td>Temperature range</td>
<td>−40° C ... +80° C (−40° F ... 176° F) environment temperature</td>
<td>powered by the BMS</td>
<td>powered by the BMS and battery cells</td>
</tr>
<tr>
<td>Connector</td>
<td>23-pole AMPSEAL (TE connectivity)</td>
<td>Micro-Fit (Molex)</td>
<td>Micro-Fit (Molex)</td>
</tr>
<tr>
<td>Power supply</td>
<td>8 ... 32 V DC</td>
<td>powered by the BMS</td>
<td>powered by the BMS and battery cells</td>
</tr>
<tr>
<td>Power consumption (in operation)</td>
<td>350 mA @ UB = 12 V</td>
<td>included in the BMS consumption</td>
<td>10 mA @ Ucell = 4.2V</td>
</tr>
<tr>
<td>Power consumption (sleep mode)</td>
<td>&lt; 0.1 mA @ UB = 12 V</td>
<td>–</td>
<td>&lt; 0.01 mA @ Ucell = 4.2V</td>
</tr>
<tr>
<td>Communication Interfaces</td>
<td>4 x CAN 2.0 B CAN Wakeup</td>
<td>1 x CAN 2.0 B</td>
<td>1 x CAN 2.0 B</td>
</tr>
<tr>
<td>I/O's</td>
<td>3 x 2 A digital outputs 1 x analog input Interlock detector &amp; driver</td>
<td>Shunt for current measurement 3 inputs for high voltage measurement</td>
<td>48 x cell voltage measurement inputs 16 x Temperature sensor inputs (10k NTC)</td>
</tr>
<tr>
<td>Operation</td>
<td>Coolant temperature measurement Range: −55 ... +125 °C (−67 ... 257° F) Accuracy: ± 2 K plus sensor tolerance</td>
<td>Cell voltage measurement Range: 1 ... 5 V Accuracy: 2.5 mV @ 2.5 ... 4.3 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Insulation measurement Range: 1 ... 4500 kΩ Accuracy: 0 ... −5 kΩ @ 1 ... 20 kΩ 0 ... −25 % @ 20 ... 1000 kΩ</td>
<td>Cell temperature measurement Range: −55 ... +125 °C (−67 ... 257° F) Accuracy: ± 2 K plus sensor tolerance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High voltage measurement Range: 0 ... 800 V Accuracy: Offset ± 0.1 V, Gain 1 %</td>
<td>Cell balancing (passive) Current: 120 mA @ Ucell = 3.6 V</td>
<td></td>
</tr>
</tbody>
</table>
The powerMELA-mBMS toolchain provides the straightforward solution to configure, update and diagnose your battery system.

**powerMELA-mBMS Toolchain**

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Update</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuring the mBMS to suit your application.</td>
<td>Software update of the complete energy storage system (ESS)</td>
</tr>
<tr>
<td>Safety parameters</td>
<td>One-Click-Update</td>
</tr>
<tr>
<td>Define and manage system security limits</td>
<td>Simple and convenient system update</td>
</tr>
<tr>
<td>Application parameters</td>
<td>Version Management</td>
</tr>
<tr>
<td>Illustration of cell characteristics</td>
<td>Software packages for easiest version management</td>
</tr>
</tbody>
</table>
powerMELA-mBMS Toolchain

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th></th>
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<tbody>
<tr>
<td>Battery data</td>
<td>Running mBMS functions and displaying battery data</td>
</tr>
<tr>
<td>Failure diagnosis</td>
<td>Supports fault diagnosis by visualization of all sensor data</td>
</tr>
</tbody>
</table>

powerMELA-mBMS Diagnostic Tool

Open Architecture

With the help of an open code basis (Standard ANSI-C99 API) the battery application can be adapted to individual requirements. Specific functions and algorithms (SoC, SoH, …) can be integrated in a flexible way.

- Custom Algorithms
- STW Battery Application
- Open Application Interface (API)
- Hardware Abstraction Layer (HAL)
- Hardware (powerMELA-mBMS Modules)