The Turnkey Solution To Test Your Battery Management System

Real-Time Simulation for Battery Management Systems (BMS)

OPAL-RT’s flexible BMS approach allows the integration of new technology as it is introduced into the vehicle. OPAL-RT’s real-time solution facilitates the migration of existing physical testbeds onto real-time HIL simulation platforms when testing your BMS.

**OPAL-RT’S REAL-TIME SIMULATOR CONTROLS EVERY ASPECT OF YOUR BMS SYSTEM**

- Battery pack voltage & current monitoring
- Isolation testing and monitoring for high voltage applications
- Cell balancing
- Individual cell & temperature monitoring
- State of charge (SOC) & state of health calculations
- Power delivery and charge management
- Overall safety and performance management.

**Scalability:**
The OPAL-RT’s BMS real-time simulation testbeds, which are based on real-time battery simulation capabilities combined with Comemso’s Battery Cell Simulator, protection and fault injection, allow engineers to validate their BMS controllers. OPAL-RT’s solution provides advanced BMS testing through accurate battery models that drive robust hardware.

**Performance:**
Extend your BMS HIL test coverage with high fidelity power electronics and motors for extended test capabilities. Real-time simulation of power electronics remains one of the greatest challenges to HIL simulation. The I/O capability for capturing PWM frequency, the overall latency of the closed-loop simulation, and mathematical solving of coupled switches and fault injection on all stages of complex power electronics schematics are just some of the complexities of this evolving industry.
**Battery Management Systems HIL Overview**

**REAL-TIME SIMULATION**

- Cell Models, Pack Models & Vehicle Models
- Communication Buses
  - CAN, Serial, Modbus
- I/O
  - Current Sensor, RTD, Analog I/O, Digital I/O
- Cell Emulation
- Fault Injection, Break-out Box
- Protection

**BATTERY MANAGEMENT SYSTEM**

- Cell Balancing Monitoring & Protection
- Voltage, Current & Temperature Monitoring
- Control I/O
- Protection
- Fault Monitoring
- Battery Management
- System Communication

**HIGHLIGHTS**

**Beyond BMS: Vehicle-to-Grid (V2G/G2V)**

Ability to simulate the battery and its surrounding environment, in real-time:

- Simulate the battery along with the entire electrical network and mechanical dynamics of an electrical vehicle, or along with the grid/microgrid in which the battery operates
- Study the effects of having vehicles charge and discharge their batteries while connected to a complete simulated electrical grid
- The simulator can emulate Simulink or Simscape Power Systems-based battery models, such as lead-acid, lithium ion, nickel cadmium, nickel metal hydride, etc.
- Communication includes standard analog and digital I/O, CAN and EtherCAT
- High levels of safety for BMS real-time simulators

- Ability to simulate full stack voltage regardless of the number of cells being physically emulated
- OPAL-RT’s simulator cabinets are equipped with rear and front door switches that immediately cut power when opened. Complete high-voltage protection is also provided for all I/Os.