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

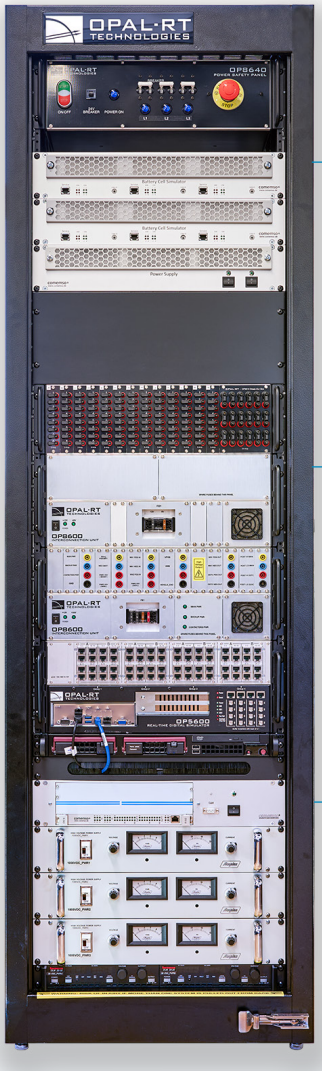
- Battery pack voltage & current monitoring
- Isolation testing and monitoring for high voltage applications
- Cell balancing
- Individual cell & temperature monitoring
- State of charge (SOC) & state of health calculations
- Power delivery and charge management
- Overall safety and performance management.

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 Cell Simulator by Comemso

Each Comemso BCS unit provide 12 cells and combine a high-precision emulation of battery cells with a high-resolution measurement technology and extended validation possibilities.

Real-Time Simulation by OPAL-RT

OPAL-RT's real-time simulation system allows users to develop or test products or designs in a safe environment. Model of battery, high fidelity power electronics & motors, cooling or virtual control unit can be simulated in real-time.

Now also available on the NI Hardware, Labview & Veristand.

State-of-the-art Engineering

OPAL-RT provides the engineering required to extend the functionalities of your BMS HIL test bench, from extra protection, shunt emulation, break-out box, current and voltage sensing to complete integration of other controls for electrical vehicle, ADAS system or the complete vehicle.

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

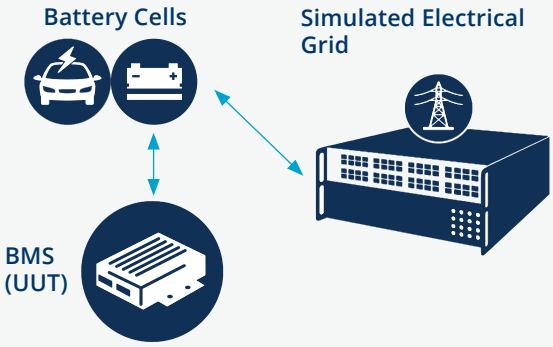
- Cell Balancing Monitoring & Protection
- Voltage, Current & Temperature Monitoring
- Control I/O
- Protection
- Fault Monitoring
- Battery Management
- System Communication

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



- 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.
- 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.

ABOUT OPAL-RT TECHNOLOGIES

OPAL-RT is the world leader in the development of PC/FPGA Based Real-Time Digital Simulator, Hardware-In-the-Loop (HIL) testing equipment and Rapid Control Prototyping (RCP) systems to design, test and optimize control and protection systems. used in power grids, power electronics, motor drives, automotive industry, trains, aircraft and various industries, as well as R&D centers and universities.

OPAL-RT TECHNOLOGIES

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