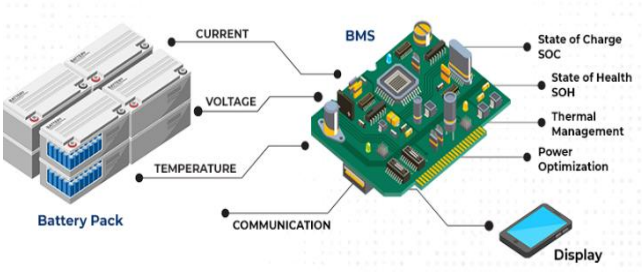
BMS HIL System

The BMS Hardware-in-the-Loop (HIL) Test System is a high performance platform providing all necessary input signals used for battery pack simulation.

Working with Blauplug software and hardware ensures shorten system development time, guarantee system reliability, simplify test automation scenario implementation, and make maintenance and repair easier.

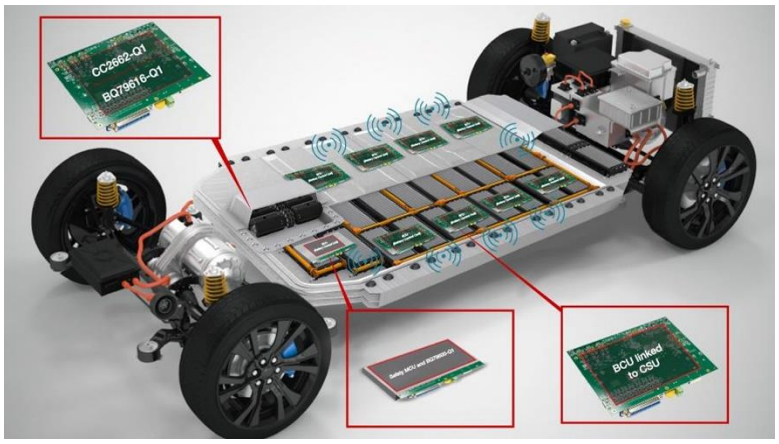


Creating a hardware-in-the-loop (HIL) simulation environment for battery management system (BMS) external connection quality diagnosis with a cell voltage replica of a high-voltage battery, simulation of current sensor and temperature sensor attached to a high-voltage battery, and simulation of possible errors associated with a high-voltage battery.

Using LabVIEW software to easily implement a GUI and support various functions, and a battery model using the LabVIEW Simulation Interface Toolkit to link to models created using MathWorks, Inc. Simulink® software.

BMS HIL automated test system software is based on BLAUPLUG LabVIEW to manage the test system, VeriStand to run the cell/pack models in real-time on RT engine. The software provides the configuration and execution of tests, custom stimulus profiles as well as manual control. The real-time execution of models and flexibility of LabVIEW meets the system specifications and performance.

System Overview



- BMS HIL system is used to simulate the high-voltage battery used in an electric or hybrid car to evaluate a BMS control logic and failure diagnosis.
- Simulink is used to create a battery model and then used the LabVIEW Simulation Interface Toolkit to apply the battery model to the development platform.
- To ensure reliable operation and high-quality performance, NI PXI system is used.
- LabVIEW is preferred for fast system implementation and NI PXI to quickly produce and collect signals to accurately reproduce changes in the battery cell voltage, including its current and temperature changes, in the BMS.

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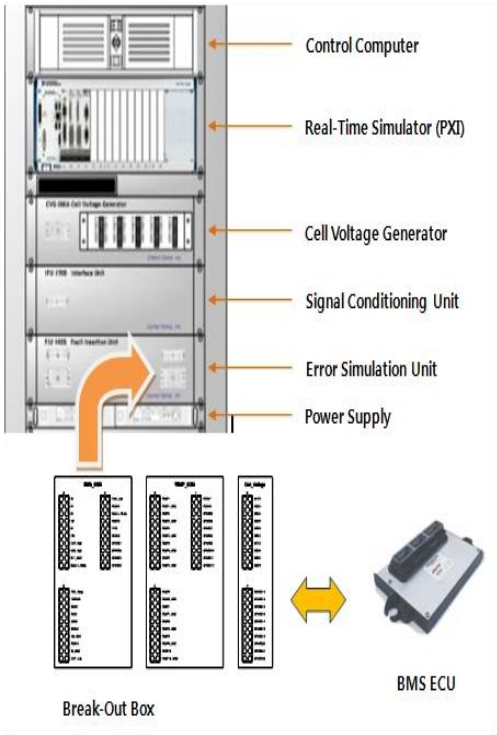
- Furthermore, by using NI TestStand, we can use BMS performance evaluation test cases to implement simplified test automation scenarios.

Hardware System Configuration

- The configuration of the BMS HIL simulation system consists of
  - → a computer to control the entire system with LabVIEW
  - → a real-time PXI simulator that collects and provides signal output
  - → a cell voltage generator that simulates a battery cell
  - → a signal conditioBlauplugng uBlauplugt.
  - → It also includes an error simulation uBlauplugt that simulates errors in various test case applications, a power supply for the BMS ECU, and a break-out box that connects the HIL simulation system and the ECU.

Figure 1BMS HIL Simulation System Hardware Configuration

System Software Configuration



- The BMS HIL simulation system software is largely divided into two different systems.

→ With the **first system**, we can manually produce errors and configure various settings to check the ECU performance.

→ The **other** is an automatic system that uses BLAUPLUG TestStand to configure various errors beforehand and then automatically checks ECU performance.

- When the host computer receives the control comment request generated by the user, the PXI real-time simulator allocates real-time signal collection or output roles. Through a field-programmable gate array (FPGA), these distributed roles perform designated tasks in real time.
- Stack voltage, battery temperature, and discharging cell current derived from the battery model are simulated through the FPGA. Because the FPGA supports high-speed performance, we can increase response speed for current generated from each battery cell.

Our BMS HIL simulation development system reduces the cost and risks associated with testing real batteries from electric or hybrid vehicles. It also provides a testing environment that encompasses stack voltage, current, and temperature, which are hard to collectively configure. In addition, using BLAUPLUG products increases hardware reliability and reduces development time.

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