Electric Vehicle Testing

NH Research, Inc.

NH Research, Inc. (NHR) manufactures test equipment for evaluating the operation, the performance, the safety, and the endurance of electrical components utilized in Electric Vehicles (EVs).

The EV industry is constantly improving technologies in order to meet the evolving market demands. The market demands for more features, lower emissions and higher performance are driving the development of improved battery performance, more efficient power converters and faster charging. The simplified EV diagram below (*Fig. 1*) illustrates a few of the many EV sub-assemblies that utilize NHR test equipment including: batteries, chargers, alternators, DC/DC converters, inverters, lighting control modules (LCM), and fuse boxes. For example, NHR's test equipment is used to test EV batteries using drive-cycle simulation and emulating real-world transients. Additionally, a state of the art battery emulation mode dramatically simplifies the testing of chargers, DC/DC converters, inverters, and Vehicle to Grid (V2G) features.

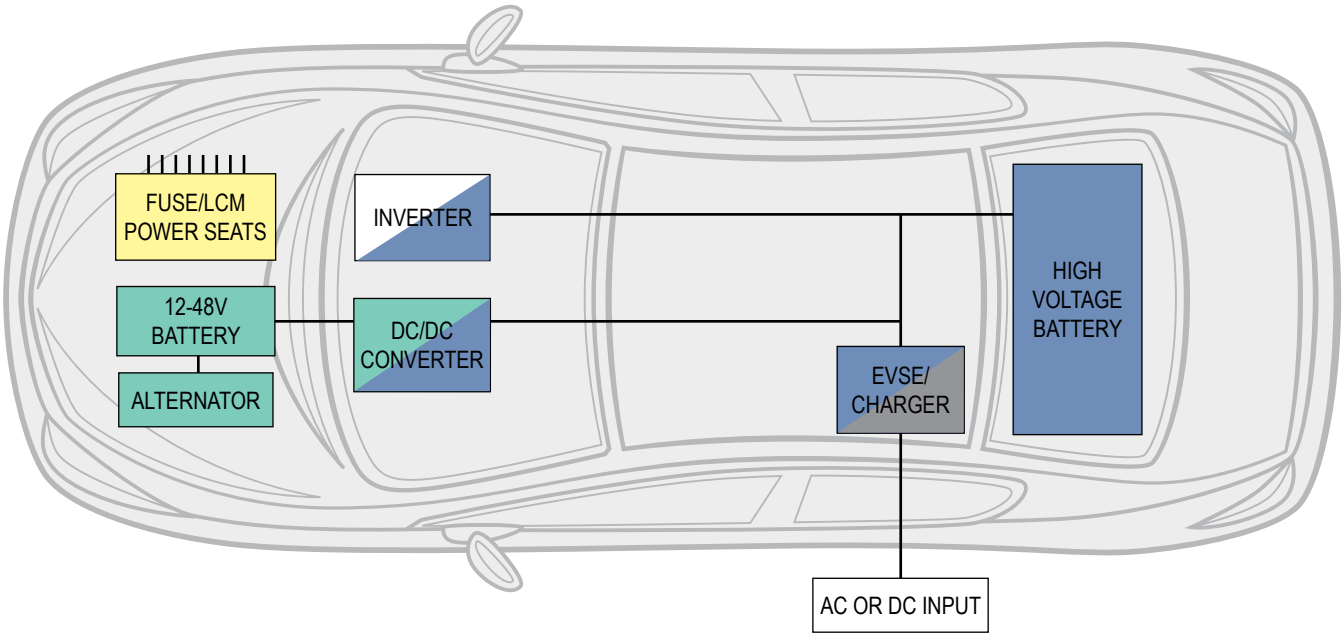

Figure 1: *Simplified diagram of a typical EV electrical system.*

NHR Products: 4700/4350 9200-4912/4700 9200-4960/4760 9410/4600

NHR's test equipment and software tools simplify testing. Our products provide engineering and manufacturing with the right tools needed to validate designs and confirm manufacturing processes by using real-world simulations. Testing performed using real-world simulations reduces cost, reduces risk, improves test coverage, and improves overall design confidence. Refer to the following page for some example solutions for Electric Vehicle sub-assembly testing.

NH Research, Inc. Solutions for Electric Vehicle Testing

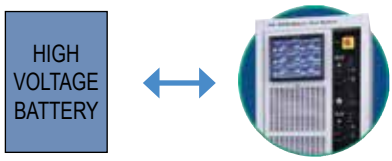

Figure 2: High Voltage Battery Testing

9200 Test System & 4760 DC Load

- Drive Cycle Testing & Battery Performance Tests
- BMS Calibration
- Safety Certification Testing

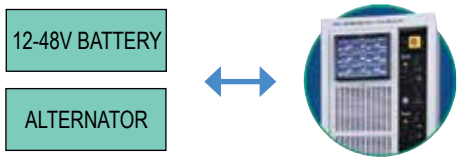

Figure 3: Low Voltage Battery & Alternator Testing

9200 Test System & 4700/4760 DC Load

- Cranking Amp & Cycle Life Testing
- Battery Emulation (for Alternator/Starter Testing)
- Product Endurance & Certification Testing

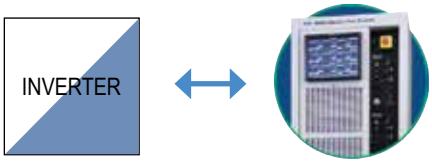

Figure 4: Powering The Drive Train Inverter

9200 Test System

- Battery Emulation – Bi-directional DC Power
- Simulate Old & Cold Batteries
- Safely Simulate Potential Battery Failures

Figure 5: DC/DC Converter Testing

9200 Test System & 4700/4760 DC Load

- Battery Emulation – Bi-directional DC Power
- Product Endurance & Certification Testing
- Transient & Accessory Load Inrush Simulation

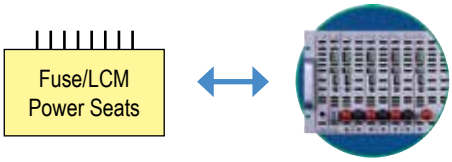

Figure 6: Fuses, Seat Controllers, Lighting Control Modules (LCM)

4350 Multi-Channel Load & 4700 DC Load

- Individual Per-channel Loading Control
- Simulate Motor & Lamp Inrush
- Product Endurance & Reliability Testing

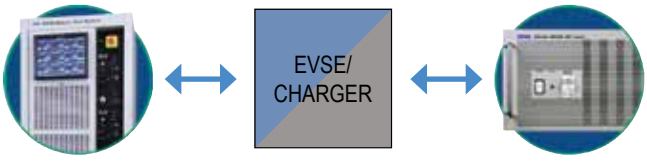

Figure 7: Charger, EVSE & V2G Testing

9200 Test System, 9410 Grid Emulator & 4600 AC Load

- Battery Emulation (for Charger Testing)
- AC Loads & Grid Emulators For EVSE & V2G
- DC Source for Level 3 Charging

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