

# Electric Vehicle Test Solutions



## AC Grid

V2G, EV Load Testing, Peak Shaving, Grid Utility Test



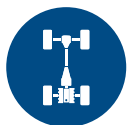
## EV Charging

DC Fast Charging, Onboard Charger, EVSE



## Battery

Drive Cycle, Life Cycle Performance, Charge/Discharge, BMS Development



## Powertrain

Battery Emulation, Motor Driver, Dynamometer, Alternator, Start-stop



## Power Electronics

APM/DC-DC Converter, Inverter, In-vehicle Electronics

NH Research (NHR) provides Electric Vehicle (EV) test equipment and software for testing individual components and systems including battery modules/packs, electric powertrain, DC fast charging and power electronics (EVSE, APM, V2G and on-board chargers, etc.). NHR's EV test solutions include battery test systems, battery emulators, grid-simulators, AC/DC loads, AC/DC sources and test management software.

With the accelerated growth of transportation electrification, engineers must address new testing challenges. Voltage and power levels are transitioning from a traditional nominal 300/400VDC to 800/1000VDC and transients up to 1200V. Higher voltages permit faster charging and increase power transfer while reducing vehicle weight. These factors are driving development for higher performing batteries, drive-trains, power converters, inverters and faster chargers.

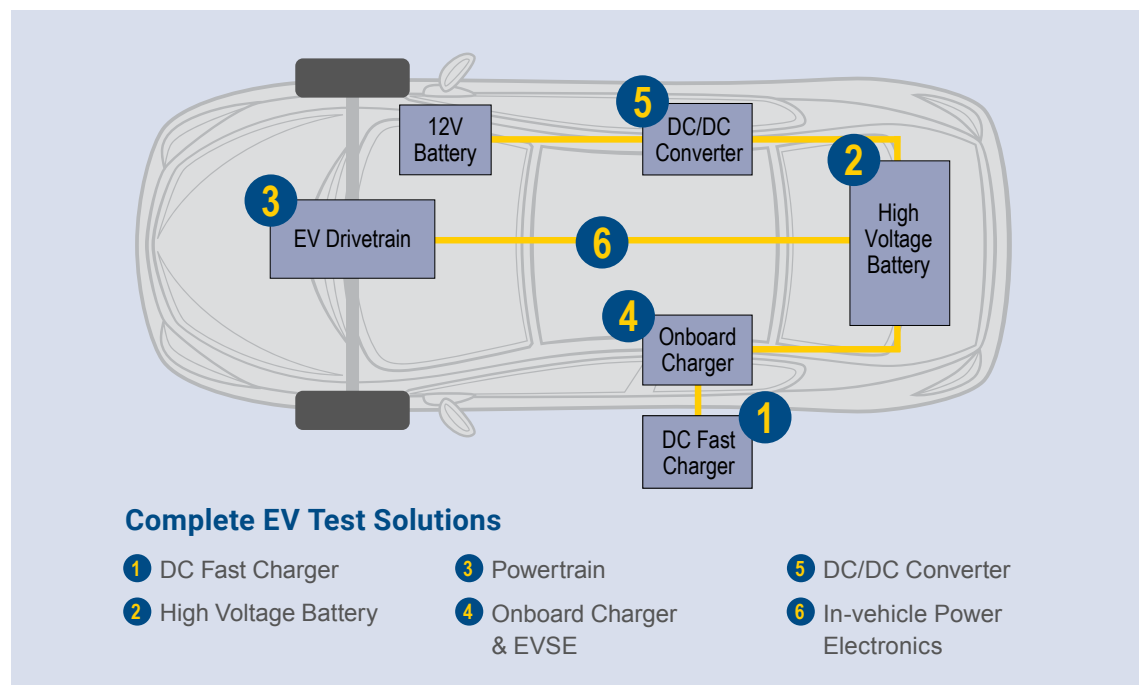
Today, customers desire test solutions with modular configurations, expandable power, integrated safety, wider operating envelopes, built-in measurements, and faster transient response-times for today's and tomorrow's products. NHR's advanced test solutions substantially reduce development and test time, reduce cost and increases energy efficiency.



*"The NHR Advantage is scalability & flexibility. It's not an engineered solution; it's a COTS solution that allows for more use cases and makes a strong business case to purchase. When you factor in the value and excellent support from the company, it's an easy choice. We use the 9300 Series for testing in our powertrain application."*

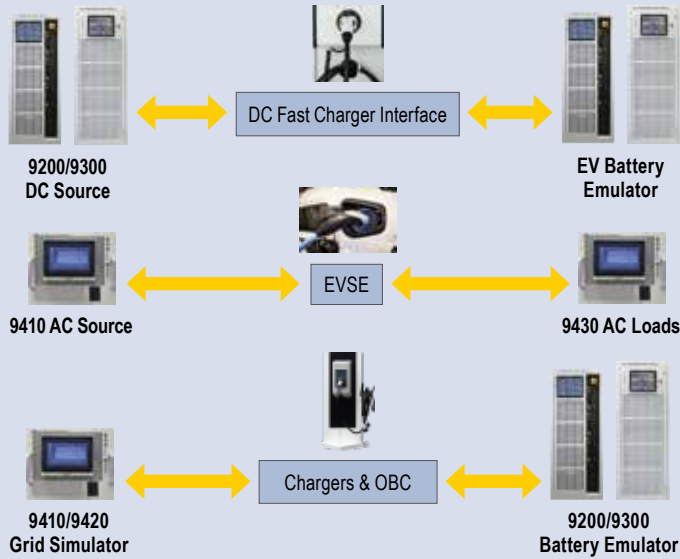
**- E-mobility Subject Matter Expert, EV Industry**

Figure 1: Diagram of a typical EV electrical system.



# NHR Electric Vehicle Test Equipment

## EV CHARGING & UTILITY GRID



### Fast Charger

NHR's bi-directional sources can emulate a fast charger or a high voltage battery that can accept fast charging with layered, built-in safety features.

- Battery emulation: sinks & sources to maintain voltage regulation
- Source mode (charge) emulates level 3DC chargers
- Regenerative DC load mode (discharge) > 90% energy efficiency

### Bi-directional DC Source & Battery Emulation

- **9300 Series** - 100kW modules up to 2.4 MW, Dual range (600 V, 1200V)
- **9200 Series** - 12kW modules parallel up to 21 channels

### Charger, V2G, ESS & Grid Tied Products

NHR's AC/DC Sources & Loads are ideal for testing EV chargers & the grid.

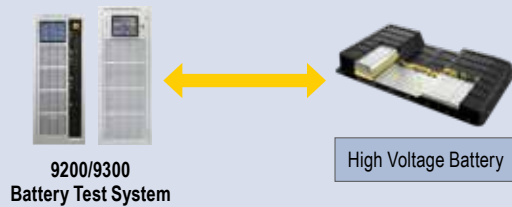
**AC Source** for testing inverters, V2G, ESS & grid-tied products

- **9410 Grid Sim/ 9420 AC Source** – 4 to 96 kW, programmable 1, 2, 3 phase

**AC/DC Load** to simulate any inductive, capacitive, resistive load

- **9430 Regenerative 4 Quadrant Load** - 4 to 96 kW, 2 x reactive power
- **9200/9300** - Bi-directional DC Power to simulate load & battery emulation

## BATTERY MODULE/PACK



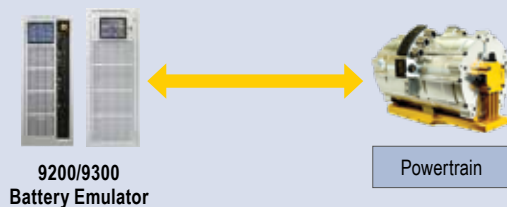
NHR's battery test systems are ideal for life/drive cycle & performance testing.

- Modular power configuration for traditional & modern EVs
- Fast transient capabilities
- Easy third-party integration & data management., optional software

**High Performance Battery Cycler** with fast transient speed

- **9300 Series** - 100kW modules up to 2.4 MW, Dual range (600 V, 1200V)
- **9200 Series** - 12kW modules parallel up to 21 channels

## ELECTRIC POWERTRAIN – DRIVETRAIN, MOTOR, ALTERNATOR



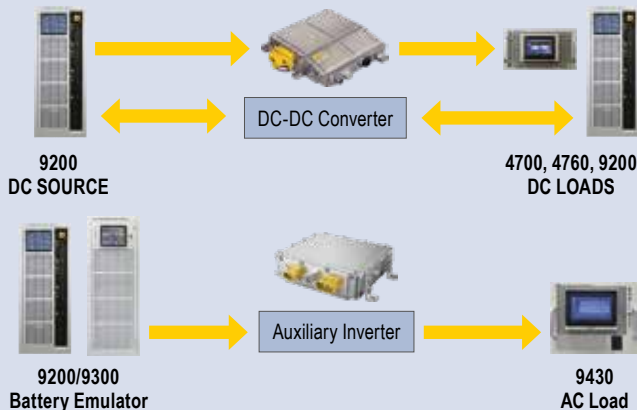
NHR's bi-directional approach provides speed to emulate real world conditions.

- Battery emulation sinks & sources to maintain voltage regulation
- Accepts back EMF and prevents safety hazards
- Isolated input and output paths eliminates single points of failure

**Scalable Bi-directional DC Source** with fast transient speed

- **9300 Series** - 100kW modules up to 2.4 MW, Dual range (600 V, 1200V)
- **9200 Series** - 12kW modules, parallel up to 21 channels

## IN-VEHICLE POWER ELECTRONICS



NHR offers AC-DC, DC-DC products for testing in-vehicle power electronics.

**Bi-directional DC Source** for Battery Emulation

- **9300 Series** - 100kW modules up to 2.4 MW, Dual range (600 V, 1200V)
- **9200 Series** - 12kW modules, parallel up to 21 channels

**DC Load** for transient & accessory load inrush simulation

- **4700/4760** for 120VDC & 600VDC
- **9200/9300 Series** - Regenerative DC load mode (discharge) > 90%

**DC Power Source** to provide high power with fast transient speed

- **9300 Series** - 100kW modules up to 2.4 MW, Dual range (600 V, 1200V)
- **9200 Series** - 12kW modules, parallel up to 21 channels

**AC 4 Quadrant Load** to simulate any inductive, capacitive or resistive load

- **9430 Regenerative 4 Quadrant Load** - 4 to 96 kW, 2 x reactive power