Battery Emulation

We simplify test as you perfect an innovation.

View Series

Testing with Battery Emulation

NH Research, Inc. is a leading provider of battery emulation solutions. NHR's battery emulation solutions include the [High Voltage Battery Emulator (5000 Series)](#) and [Medium Voltage Battery Emulator](#).

NHR's battery emulators are used to emulate a battery rather than using a real battery which dramatically reduces testing time, provides highly repeatable test results, and ensures safe test environment! Battery emulation (or simulation) allows for testing under a wide operate envelope, and beyond conditions the battery temperature or aging. It substantially reduces test time, increase safety and operating costs.

All states of operation, regenerative DC sources and DC common bus architectures are optimally supported for accurate and timely results. NHR's unique battery emulation capabilities provide safe, scalable and repeatable testing.

The 5000 and 6000 series are ideal for testing, using battery emulation or simulation. The [Bidirectional Power Supplies vs. Battery Emulation](#) mode allows for a battery to be simulated at any state of charge. This unique battery emulation and battery simulation technology, also NHR's battery test solutions apart from the competition.

Key Features:

- Modular and Scalable Power Architecture Allows for > 90% Energy Efficiency
- Wide Operating Envelope
- Fast Response Time
- High Performance Hardware
- Ease of Use Software Requirements
- Power of Cloud Connected Test Execution. With Our Cloud Test Automation, Anytime, Your Own Software
- Easy 3rd Party Integration (CAN, RMS, DAQ options)
- Multiple Layers of Safety

Model Comparison

App Note: Battery Emulation

Bi-directional Power Supplies vs. Battery Emulator

Battery Emulation Test Applications

As electrification is working its higher power and higher voltage, battery emulation, battery energy storage systems (BESS) speed and accuracy is critical. Using batteries as power sources for test equipment is a lot more time-consuming and costly. Challenge across industries including Electric Vehicles, energy storage, hydrogen, renewable energy, solar, wind, and power grid. Battery emulation solutions offer safe and more engineering productivity.

Applications include testing battery/fuel cell emulation, DC power emulation, EV powertrain, power electronics, DC Fast charger, Smart EV and energy storage systems. Unlike [bidirectional power supplies](#), our battery cycles are designed to simulate batteries through the hardware and software.

Battery Emulation: Key Considerations

Unlike other battery simulators or bidirectional power supplies, NHR's high power battery emulation solutions are specifically designed to emulate a battery's internal impedance and dynamic performance.

NHR's battery emulators provide the following:

- **Bidirectional approach** that is isolated to handle both SOC and SOH of the battery pack
- A **series resistance model** to simulate a battery's internal impedance
- **Low output capacitance** for dynamic and transient response to simulate battery behavior
- **Modular and scalable power** to address changing voltage needs
- **Fast response time** in hardware and software to ensure high performance of battery emulation
- **Faster integration and software control** to ease in system integration
- **Reduced complexity** for test set up and testing

Webinar: Battery Emulation for EV Testing

Get Accurate & Repeatable Test Results

Every battery emulation solution is having a built-in programmable series resistance with low capacitance.

Battery emulators with low output capacitance provide accurate simulation of series resistance effects, allowing the output voltage to adjust proportionally to changes in current. Without low output capacitance, battery emulators can't respond to changes in current because it takes output. This high output capacitance distorts the series resistance models and actually negates the functionality of a programmable series resistance. As a result, high output capacitance can lead to inaccurate battery simulation.

Real World Results

Testing with a 48 V Battery

Testing with NHR's 48 V Battery Emulator

Customer results: NHR's 48V 100 Amp battery emulator total test time by replacing real batteries using battery emulation.

Performance Demonstration of Series Resistance Effect (RINT Model)

As a a test battery, NHR's battery emulators adjust the output voltage according to the direction and amplitude of current flow. Current is driven up to 20 A. Starting with current being drawn from the simulated battery (Discharge), NHR's battery emulator adjusts the output voltage to 48 V. Then the current is driven to simulate SoC=0 resistance, and the output voltage drops to 0 V. Then it reduces the output ticking these current changes and providing the programmable series resistance effect. The simulation adjustment follows (1) Discharge (2) Simulation of SoC=0 resistance (3) real world battery pack simulation, especially when compared with common DC-DC buck and boost emulation applications.

Programmable Series Resistance

NHR's battery emulators (or simulators) have a programmable series resistance to built into the hardware to ease in testing. This feature ensures accurate testing of real world conditions. As a re-cap, battery emulators (or battery simulators) adjust the output voltage depending on the direction and amplitude of current flow.

The RINT Model vs. Other Models

Customer results show a 70% reduction in total test time by replacing real batteries using battery emulation.

Testing with Real Battery Versus Using Emulation

NHR's Battery Emulators Reduce Test Time by More than 70%

Customer results show a 70% reduction in total test time by replacing real batteries using battery emulation.

Easy Integration: Software Control Options & Integration Partners

All NHR's battery emulators can be easily integrated into existing test platforms or as the primary test platform. Depending on the product line, NHR provides software control options in Labview or Python for SCPI languages along with examples, applications, and integration support. NHR also has a number of solution partners that can integrate our battery emulators and can deliver a turn-key test system. These integrators develop fully custom systems utilizing our standard hardware sensors and components.

Products

High Voltage Battery Emulator - 5000 Series

Battery Emulator - 5200 Series

Have a Question Regarding Our Battery Emulation Test Solutions?

Contact us today to learn how NHR can customize a test solution that fits your specific needs.

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