NHR 9200 Battery Module/Pack Test System

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Applications

AEROSPACE	ELECTRIC VEHICLES	FUEL CELLS	ENERGY STORAGE	MICROGRID	SOLAR PV

BEST FOR:

Regenerative Battery Pack Test System for EV, Solar PV, Aerospace, Energy Storage, and more.

KEY FEATURES:

- Bi-Directional Source/Load and Battery Cycler
- Modular and scalable power – 12 to 252kW at 40 or 120V
- High configuration flexibility up to 21 channels
- Regenerative power provides high energy efficiency
- Current, voltage and mode transitions <1 mSec

- Built-in digital measurements for charting
- Touch panel, LabVIEW® and IVI drivers
- Flexible, easy control and integration with H/W and S/W
- Battery Emulation Mode
- Multiple layers of safety

PHYSICAL AND SAFETY:

MODEL	9200-4904		9200-4912	
Physical				
Test Channel Connectors	Buss Bars		Anderson EBC A32	
Cabinet² Dim. (HxWxD)	72" x 28" x 31"/1829mm x 711mm x 787mm		72" x 56" x 31"/1829mm x 1422mm x 787mm	
Cabinet Weight (3 Ch.)	1475lbs/669kg	Operating Temperature	0-35°C full power	
Input Power³ per Module	3 Ø, 50 - 60Hz, 200VAC/30A, 208VAC/29A, 220VAC/27A, 380VAC/16.5A or 480VAC/13A			
Safety				
Isolation UUT Input	600V UUT to chassis		1000V UUT to chassis	
Isolation AC Input	1000V AC to DC Output / 1000V AC Input to chassis	Interlocks	External user input, emergency stop, and rear service door	
Programmable Safety Limits	Over-Voltage (OV) / Under-Voltage (UV), Over-Current (OC), Over-Power (OP)	Watchdog Timer	Continuously monitors control communications	
Internal Protection	Over/Under-Voltage, Over-Current, Over-Power, Internal Over-Temperature			

Battery Test Applications

NHR's Regenerative Battery Pack Test System (9200) is ideal for lab and production testing of battery modules and energy storage devices. The 9200 includes expandable power ranges from 12kW up to 252 kW with 40 or 120V bi-directional DC power modules. This battery cycler provides optimal configuration that enables companies the flexibility to expand power levels as needed. It addresses the evolving battery test requirements for electric vehicles, renewable energy storage and critical power applications. NHR's battery test systems are used as battery cyclers, regenerative, bi-directional DC sources, regenerative DC loads, high power DC sources, or Battery/DC emulators.

Highly Flexible Tester-per-Channel Design

9200 Testers are configured with independent, 12kW DC DC power modules that can be dynamically programmed both within a cabinet and from cabinet-to-cabinet to run in parallel or independently. This capability provides for simultaneous testing a number of smaller batteries each with a different test plan, power level and start/stop times. Alternately, a higher power battery can be tested by connecting the power modules in parallel. The simplified diagram to the left illustrates (Fig. 1) how these can be configured to run both in parallel and independently at the same time. For a laboratory or production facility that has a wide mix of batteries to test, this configuration flexibility provides optimizing tester usage at all times.
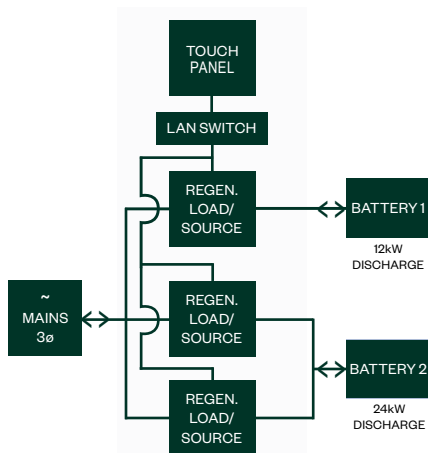

FIGURE 1

Independent testing of 2 different battery types
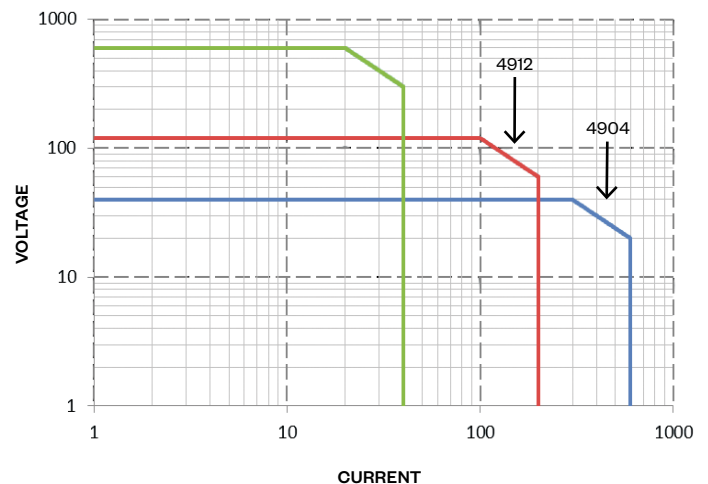
FIGURE 2

Discharge Operating Envelope

Recycle Discharge Power Back onto the AC Line

Over 87% of the energy that ends up as waste heat during battery discharge can be saved by converting it back to electrical power that precisely matches the facility AC line. The savings attained can increase the ROI of the entire test system within a few years. Further advantages include a cooler work environment, smaller air conditioning capacity, and elimination of elaborate water cooling systems. In addition, using regenerative power helps reduce your carbon footprint and support your company's environmental sustainability efforts.

Wide Operating Envelopes

Battery cycling testers are best evaluated on operating power envelopes rather than simply maximum kilowatts. The reasoning here is that users often do not know what combination of voltage and current they will be required to test in the future. NI provides an exceptionally wide operating envelope to ensure that future test requirements will be met (Fig. 2).

Digital Measurements, Scope Display and Charting Capability Built-In

A vast amount of precision measurement information is provided by the high-speed digitization of analog measurement signals within each power module. One example is the simultaneous measurements of voltage, current, amp-hours and watt-hours that are continuously available. The extent of this measurement information minimizes the need for supplemental instruments added to the test system. Another benefit is that waveforms can now be displayed in real-time much like an oscilloscope and also charted (Fig. 3). Reports can incorporate such waveforms to document how the battery-under-test behaved during certain transient conditions.

FIGURE 3

Chart Recorder

Sub-millisecond Current, Voltage and Mode Transitions

9200 power modules are able to simulate demanding real-world transient conditions through hyper- fast, slew-rate-controlled settings and Macros. Macros are mini-programs up to 1000 steps that for speed purposes will execute within the power module rather than PC. In combination with the 1.2Ms/sec digitized waveform captures (Fig. 4), a unique fast transient simulation and resulting UUT waveform display/ record is provided. Macros can be saved to a library and then called by the PC test program when needed.
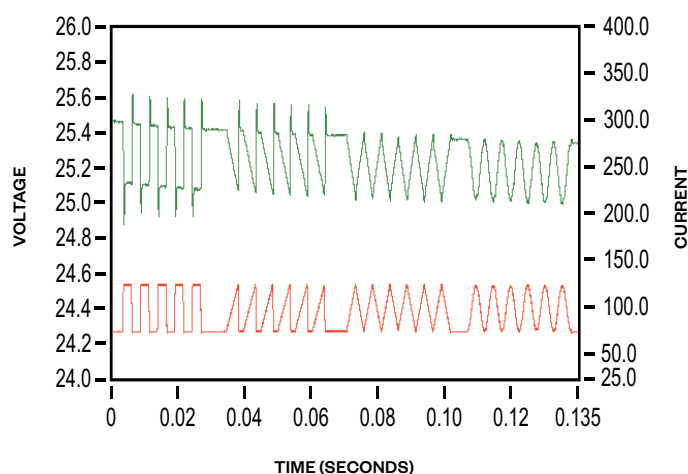

FIGURE 4

High Speed Waveform Set (Red) and Capture (Green)

Programmable Bi-Directional Power

Each test channel is an 8kW source, a 12kW sink and operates as a fully programmable power supply, load, or battery. All of these operating modes support constant-voltage (CV), constant-current (CC), and constant-power (CP) regulation (Fig. 5). More than one regulation mode may be enabled at the same time, creating standard charge profiles like CCCV and CPCV.

Series Resistance provides a programmable emulation of voltage effects caused by the resistances found in wire harnesses, protection circuits, or batteries.
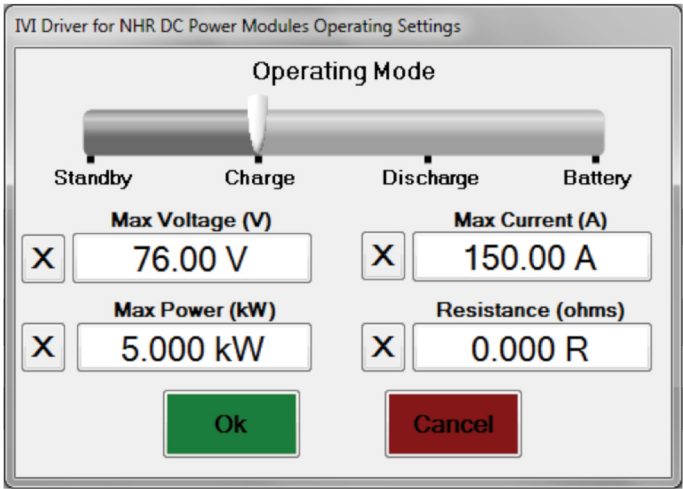

FIGURE 5

Power Supply, Electronic Load, and Programmable Battery Modes

Multiple Layers of Safety

NI offers multiple layers of safety already designed into the system. In addition to safety contactors, reverse polarity checkers and pre-charge circuits, we also have additional layers of hardware and software protection. Each test channel provides programmable safety limits (Fig. 6) to prevent damage that could occur caused by operator error, programming errors, external or internal faults. When a safety limit is triggered, the test channel opens its output contactors isolating the test channel from the battery-under-test and prevents further operation until the test channel fault is cleared. These programmable safety limits can be set through the Touch-Panel manual interface, programmatically through LabVIEW, Enerchron® and other programming languages.

Each test channel also provides a separate interlock input that can be connected to an external test fixture. The test channel will open its output contactors isolating it if the interlock input is triggered. The user can also abort testing and disconnect the battery/module through an emergency power-off switch on the front of the cabinet.
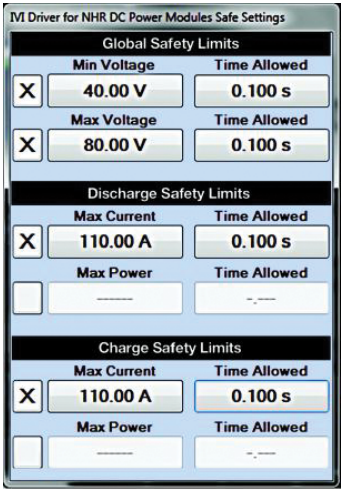

FIGURE 6

Safety Settings

The Power of Choice: Multiple Control Options

Each 9200 cabinet, which contains up to three 12kW power modules, has a Touch-Panel that controls and displays voltage, current, power along with other settings, limits and test status (Fig. 7). This Touch-Panel provides the ability to create, run, monitor, chart and report battery charge/discharge profiles without writing any code. The Touch-Panel can be used to manually control the operating modes or program a simple, time- based, test profile that can be saved for repeated use.

Another control option is the Enerchron® Test Executive which is best suited for running long-term tests and includes a data collection option. NI Battery Test Systems are designed to easily integrate with your existing assets or future test requirement set-ups.

The third option is where user can utilize their own PCs and test software to communicate with the 9200 through its IVI drivers. This works well in instances where the customer has already written test programs and doesn't want to replicate all this work.
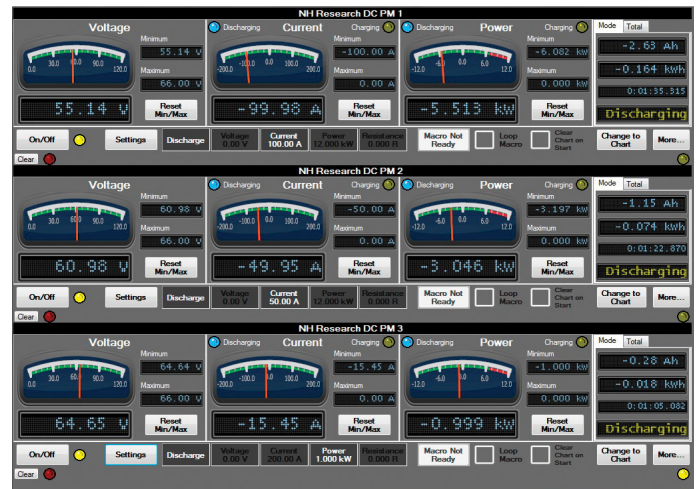

FIGURE 7

Three Channel Monitor Panel

Enerchron® Test Executive (Option Available)

Enerchron is a powerful but easy to use test executive created for battery testing to simplify and accelerate your test automation. It's a comprehensive battery test environment that includes integration with H/W and S/W tools. Enerchron is your shortest path to market. Enerchron breaks the mold of traditional battery cycling software through its unique variable-based formulas.

Key Features

- Dramatically reduce software development and post- processing time
- Streamline your battery test process and workflow
- Increase productivity and eliminate errors and repeated tests
- Reduce stress and testing difficulties Stay on schedule and budget
- Get to market faster

Battery Emulation and Burn-In Applications

A Battery Emulation Mode provides testing of power electronic systems that use a real battery. In this Emulation Mode, the test channel will source and sink current as needed to maintain voltage regulation. Having a programmable battery emulator provides a more consistent testing capability for products such as chargers, regenerative braking systems, and on board DC/DC converters. NHR's battery emulation mode precisely matches real-world characteristics of batteries due to its minimal use of output capacitance unlike off-the-shelf Bi-Directional DC sources.

Another key 9200 application is DC power supply burn-in and long-term reliability testing. This type of testing takes advantage of the regenerative power capability resulting in an increased ROI; energy savings; and a safer and cooler work environment.

NHR 9200 Battery Module/Pack Test System Specifications

MODEL NUMBER	9200-4904			9200-4912		
Functional Capability						
Operating States	Charge (Source), Discharge (Load), Standby, Battery					
Charge/Discharge Modes	Constant-Voltage(CV), Current (CC), Power (CP), Resistance (CR)					
Charging Envelope	0 - 40V, 8kW, 600A			0 - 120V, 8kW, 200A		
Discharging Envelope	1 - 40V, 12kW, 600A			4 - 120V, 12kW, 200A		
Slew Rate	0.011V/S - 40kV/S, 0.0165A - 600kA/S			0.033V/S - 120kV/S, 0.055A - 200kA/S		
Current Change Time	Less than 5mS		Current Reverse Time	Less than 10mS		
Parallelability	Synchronous control for up to 12 channels (144kW)					
Macros						
Development Source	Touch-Panel, Import from Excel or User's System Controller		Minimum Time Delay	50uS		
Maximum Steps	1000		Maximum Step Delay	1mS - 7 Days		
Programming	Range	Accuracy[1]	Res[1]	Range	Accuracy[1]	Res[1]
Voltage	0-40V	0.025% + 0.025%	0.005%	0-120V	0.025% + 0.025%	0.005%
Current	±600A	0.1% + 0.1%	0.005%	±200A	0.1% + 0.1%	0.005%
Power	+8/-12kW	0.12% + 0.12%	0.005%	+8/-12kW	0.12% + 0.12%	0.005%
Resistance	0-34Ω	2%	0.005%	0-100Ω	2%	0.005%
Slew Rate						
Voltage	0.011V/s – 80V/ms			0.033V/s – 240V/ms		
Current	0.17A/s – 3000A/ms			0.055A/s – 1000V/ms		
Resistance	0.01Ω/s – 34Ω/ms			0.028Ω/s – 100Ω/m		
Power	2W/s – 8kW/s			2W/s – 8kW/s		
Test Measurement (4-Wire)	Range	Accuracy[1]	Res[1]	Range	Accuracy[1]	Res[1]
Voltage, DC Avg.	0-40V	0.025% + 0.025%	0.005%	0-120V	0.025% + 0.025%	0.005%
Current, DC Avg., Amp-Hr	0-600A	0.1% + 0.1%	0.005%	0-200A	0.1% + 0.1%	0.005%
Power, Ah, kWh	±12kW	0.12% + 0.12%	0.005%	±12kW	0.12% + 0.12%	0.005%
Time	1ms - 1Yr	0.1%	0.005%	1ms - 1Yr	0.1%	0.005%
Control						
Local User Interface	Touch-Panel with graphic meters and controls plus Macro development/execution screens					
Ext. System Communication	LAN (Ethernet)		Analog Current Monitor	0 - +10V chrg/0 - -10V discharge		
Drivers (Win XP or Win 7)	LabVIEW, IVI-COM, IVI-C		Analog Voltage Monitor	0 to +10V full scale voltage		
Calibration	Semi-Automatic, closed cover with standard lab equipment					

Specs apply after 30 min. warm-up. Refer to User's Manual for additional product specs. [2] Standard cabinet contains 1, 2 or 3 Modules, [3] Input Voltage set at placement of order

ORDERING INFORMATION

TYPICAL CONFIGURATIONS	9200-4904-36	9200-4912-36-2
Test Channels[3], Maximum Test Power	3 @ 12kW, 36kW	6 @ 12kW, 72kW
Power Modules, Voltage, Max. Current	4904, 40V, 1800A	4904, 120V, 1200A
Cabinets, Space (WxD), Height	1, 28 x 31" or 711 x 787mm, 72" or 1829mm	2, 56 x 31" or 1422 x 787mm, 72" or 1829mm
Part Number Construction	9200-4912-36-2 4912 – Power Module, 36 – kW per cabinet (1 module=12kW, 2 modules=24kW, 3 modules=36kW), 2 – Cabinets	