The DMC Battery Production Test (BPT) System

Elevating quality with fully automated, high performance, and scalable test solutions for battery production In-Line, End-of-Line, and warranty/remanufacturing test.

See where we can help!

- ✓ Cell Test
- ✓ Module Test
- ✓ Pack Test
- ✓ Turnkey Delivery
- ✓ Custom Hardware Solutions
- ✓ Test Design Consulting

Tell us about your test needs and see why today's battery test leaders are choosing DMC.

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Smart People. Expert Solutions.®

The DMC Battery Production Test (BPT) System meets scalability and reliability demands of high volume production while providing agility and flexibility to serve the dynamic needs of a startup battery producer. DMC's modular, fully automated, feature-rich, and software-centric solution enhances quality today via rigorous production test regimens and anticipates tomorrow's emerging requirements so your tests evolve with your product.

Assembly / Electrical Verification Tests

- Pack Connection Verification
- Ground Bond Test
- Hipot - Insulation Test
- Contactor Control Verification
- High Voltage Interlock Verification
- AC Internal Resistance (ACIR) Test
- Terminal Continuity / Resistance / Capacitance / Protection Verifications
- Pack & Coolant Leak Test

BMS Verification Tests

- BMS Wake / Sleep Current Verification
- CAN Bus Verification
- Cell and Pack Voltages Reporting / Accuracy Verification
- Pack Current / SOC Verification
- Cell / Pack Temperatures Verification
- Diagnostic Trouble Code Check / Clear
- Cell Balancing Verification
- BMS Firmware Flashing / Calibration
- BMS SW Version Verification

Power Capability Tests

- DC Internal Resistance (DCIR)
- Pre-Charge Contactor Functional Verification
- Peak Power Test
- Auxiliary / DCDC Power Output Verification
- Outgoing SoC Pre-Shipment Test

Test Applications

- Production End of Line (EOL)
- Production In-Line
- Remanufacturing / Warranty Service
- Field or Lab Diagnostics

Notable Features

- Flexible, modular, configurable hardware schema
- Sleek, intuitive user interfaces
- Powerful, open Test Executive framework
- User-defined sequences, drag & drop editing
- Integrates with your PLC / MES / SCADA systems
- Test Points and Fault Codes
- Continuous DAQ for traceability and visualization
- Fully customizable test workflows
- Complete RX/TX CAN Port Trace Logs
- Hardware Plugin (Abstraction) Layer supports numerous Cycler models (NHR, EA, etc.)
- Data Analytics via NI SystemLink
- IT-synced User Permissions Management
- Soft-front panel HMIs for manual device control and diagnostics

A Trusted Solution

Designed by DMC's Battery Test experts and leveraging two decades worth of battery test experience, the BPT is a highly capable pack and module testing solution designed to enhance test coverage and to scale with your organization. All stakeholders have been considered, from the operator using the intuitive software interface, to the test engineer developing a test script for multiple product variants, to the product engineer reviewing the data to determine root cause analysis and correlating test results from cell through pack assembly.

Solution Highlights

User-Centric Station Operation

- Simple and intuitive operator workflows ensure consistent and streamlined daily production operation with minimal required interaction with the software
- Role-based permission controls for screen and feature access

Physical Station Configurations

- Consolidate full suite of tests in a one station system or utilize a modular multi-station layout to segment and parallelize test stages for optimized cycle times and throughput

Software Configuration

- Highly flexible and powerful test scripting/sequencing tools allow test engineers to design and adapt test procedures for evolving product requirements.
- High-level, battery test-specific sequence steps for easy test configuration
- Powerful hardware abstraction layer allows hardware interoperability and swappability
- Remotely edit sequences, DUT model parameters, and other configuration files
- Deploy and synchronize entire configuration sets (workspaces) to one or more stations through a centralized configuration management system

Reliability & Maintenance

- Advanced, integrated self-diagnostics save time for technicians and engineers by "testing the tester" to ensure integrity of all test runs and to triangulate any system maintenance needs.
- Swappable HW submodule design allows for an effective sparing strategy and calibration scheduling to maximize uptime

Test Data Insights

- Live data visualizations allow immediate insights and diagnostic assistance
- Trace test results to continuously aquired waveform data for easy troubleshooting and improved test comprehension. Easily trace test results back to the engineering time-series data to pinpoint problems.
- Detailed, lossless data logs and CAN bus logs provide necessary data records to diagnose pack issues
- **NI SystemLink** Integration: With centralized test data analytics designed as a priority rather than afterthought, test engineers can extract valuable manufacturing process and product insights from test results aggregated from facilities around the world, all from the comfort of their own desks

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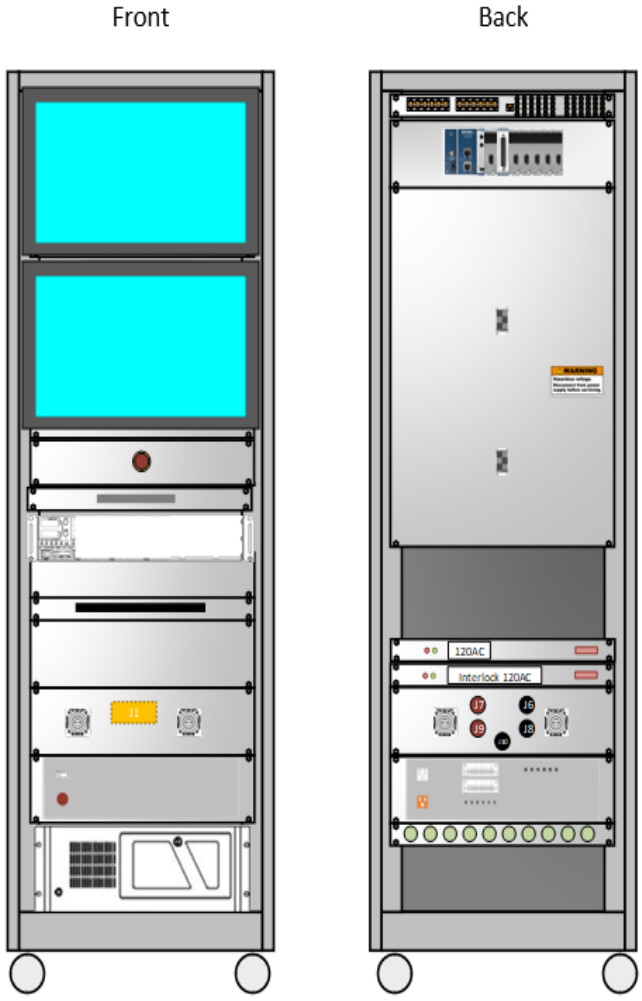
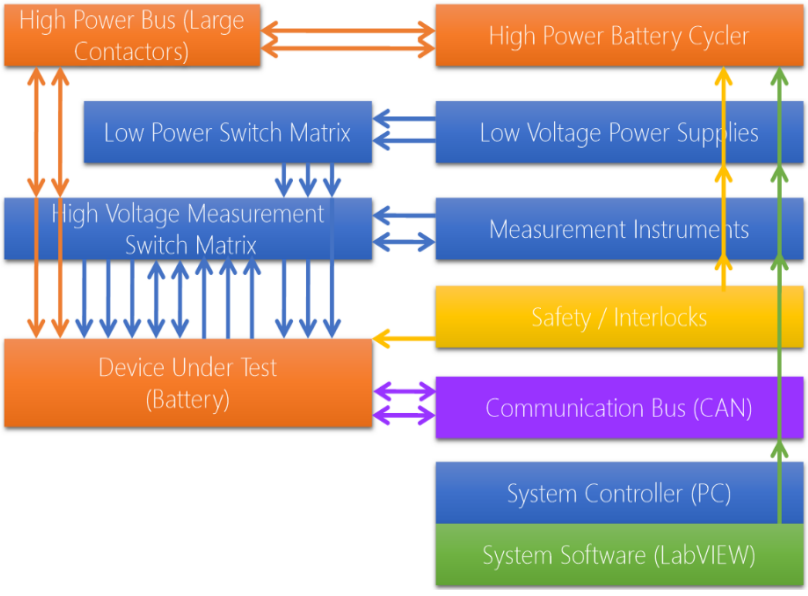
System Architecture

DMC's BPT Platform takes a **compositional approach to battery testing**, assembling collections of interconnectable hardware "building blocks" (including both off-the-shelf devices and DMC purpose-built modules) to create modular and scalable test stations.

DMC has designed **several common BPT models** for standard battery test scenarios. For unique applications, DMC can tailor a configuration anywhere on the capability spectrum to match your specific needs.

DMC's single rack platform comprehensively addresses all battery production test and warranty & remanufacturing needs in a single station. Alternately, the same hardware modules can be split across multiple stations for segmented and parallelized testing to enhance production volume and tact time. Both scenarios leverage DMC's powerful BPT Application Framework that provides a unified testing experience and centralized configuration and data management.





The DMC BPT Platform allows you to test your battery pack or module today and be ready for the changes of tomorrow.

With reliable battery test hardware based on a variety of standard rack-mount instruments and **NI's powerful PXI and cDAQ platforms**, you can readily expand your system for the evolving battery test needs of the future.

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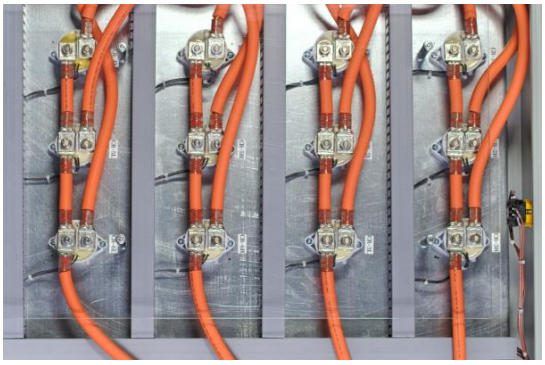
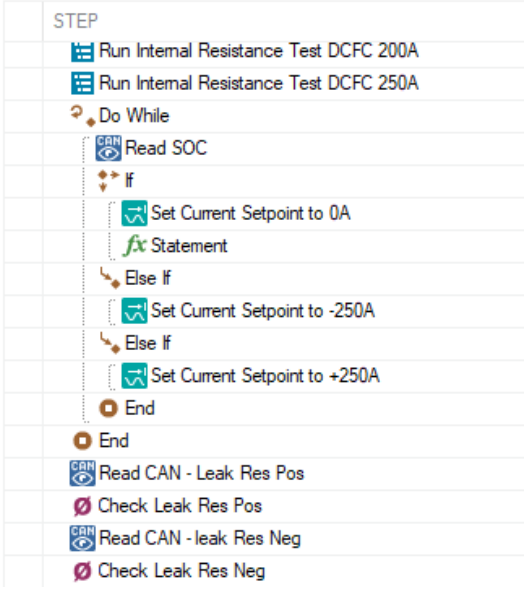
The BPT platform is designed for easy integration with a variety of off-the-shelf instrumentation and power electronics (e.g., DMMs, Power Supplies/Loads, Hipot Meters, Battery Cyclers, etc.). **DMC's BPT Platform includes support for common battery cycler manufacturers and models**, including NHR, Electro-Automatic, and many more.

Whether internal or external to your BPT test station, your battery cycler will be plug-and-play and swappable, thanks to the BPT's flexible hardware abstraction layer and configurable software plugins.

High Power Multiplexer / Combiners

DMC can even improve your cycler utilization with our BPT platform's high-power multiplexing and distribution modules to share a single cycler among numerous test stations and amplify the value of your cycler assets.





Versatile Test Sequences

DMC's BPT Platform allows simple and repeatable end of line test operation, dynamically selected test recipes for the particular battery model coming down the line.

Multiple types of packs can be serviced by the same suite of end of line BPT testers and parameterized test sequences.

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System Capabilities

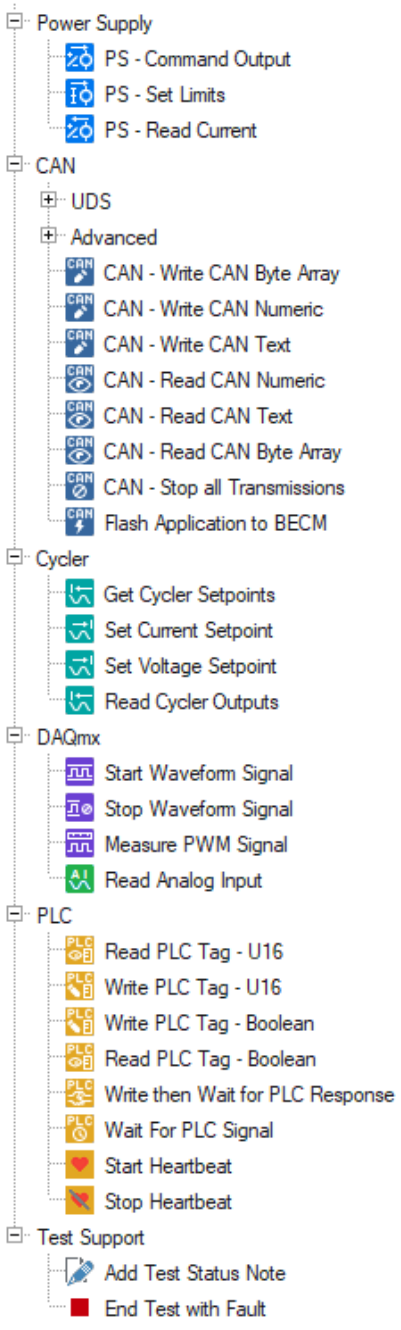
The BPT offers both standard elements and optional upgrade modules to configure the system to desired signal types, signal counts, and required test capabilities.

Don't see what you need? **Every element of the BPT can be fully customized and extended by DMC's battery test experts to meet your specialized requirements.**

Test Type	Model A	Model B	Custom
Assembly / Electrical Verification Tests			
Pack Connection Verification	✓	✓	OPTIONAL
Thermocouple-Temperature Verifications	✓	✓	OPTIONAL
Terminals Protection (Diode) Verifications	✓	✓	OPTIONAL
Pack & Coolant Leak Test	✓	✓	OPTIONAL
Contactor Control Verification	✓	✓	OPTIONAL
High Voltage Interlock Verification	✓	✓	OPTIONAL
High Voltage Interlock Electrical Diagnostics		✓	OPTIONAL
Terminal Continuity / Resistance Verifications		✓	OPTIONAL
Terminal Capacitance Verifications			OPTIONAL
AC Internal Resistance (ACIR) Test			OPTIONAL
Thermal Imaging Test			OPTIONAL
Ground Bond Test			OPTIONAL
Hipot - Insulation Test			OPTIONAL
BMS Verification Tests			
BMS Wake Current Verification	✓	✓	OPTIONAL
CAN Bus Verification	✓	✓	OPTIONAL
Cell and Pack Voltages Reporting / Accuracy Verification	✓	✓	OPTIONAL
Pack Current / SOC Verification	✓	✓	OPTIONAL
Cell / Pack Temperatures Verification	✓	✓	OPTIONAL
Diagnostic Trouble Code Check / Clear	✓	✓	OPTIONAL
Voltage Accuracy Verification	✓	✓	OPTIONAL
Cell Balancing Verification	✓	✓	OPTIONAL
BMS Firmware Flashing / Calibration	✓	✓	OPTIONAL
BMS SW Version Verification	✓	✓	OPTIONAL
BMS Sleep Current Verification		✓	OPTIONAL
Power Dropout Sensitivity			OPTIONAL
Power Capability Tests			
DC Internal Resistance (DCIR)	✓	✓	OPTIONAL
Pre-Charge Contactor Functional Verification	✓	✓	OPTIONAL
Peak Power Test	✓	✓	OPTIONAL
Auxiliary / DCDC Power Output Verification	✓	✓	OPTIONAL
Outgoing SoC Pre-Shipment Test	✓	✓	OPTIONAL
Fuse Performance Test			OPTIONAL

BPT Software Platform

The BPT software strikes a **perfect balance of ease of use by operators with the flexibility and capability test engineers need to scale** their operations. The test executive backbone of the BPT software is built using NI TestStand.



The platform abstracts the detailed intricacies of test into simple sequence step "building blocks" that Test Engineers can intuitively use without extensive programming knowledge – **no programming required.**

One primary benefit of the BPT software is that in addition to all the powerful functionality NI TestStand provides out of the box, it comes with a **suite of sequence steps that provide easy access to common operations required for battery testing**. These sequence steps provide high-level control over test equipment and measurements, using terminology familiar to test engineers. Examples include turning on power supplies for powering the pack, writing CAN signals or DIDs, setting limits or setpoints on a cycler, and handshaking with a line PLC. Using these built-in step types specific to production battery testing, Test Engineers are just a few clicks away from quickly developing new test recipes, even if they're relatively unfamiliar with software development.

The BPT's plugin framework combined with a Hardware Abstraction Layer allows for easy addition of new hardware or models of battery cyclers, power supplies, DMMs, and other instrumentation as your production scales and test requirements change, **without needing to modify your test sequences**.

Reduce your time spent managing multiples copies of test sequences by writing your test script once. Use the abstraction layer to execute the same test script on different BPT test stations that connect to different types of battery cyclers. Parameterize your test sequence to run the same test on two different batteries that have different cell configurations, test limits, or other parameters.

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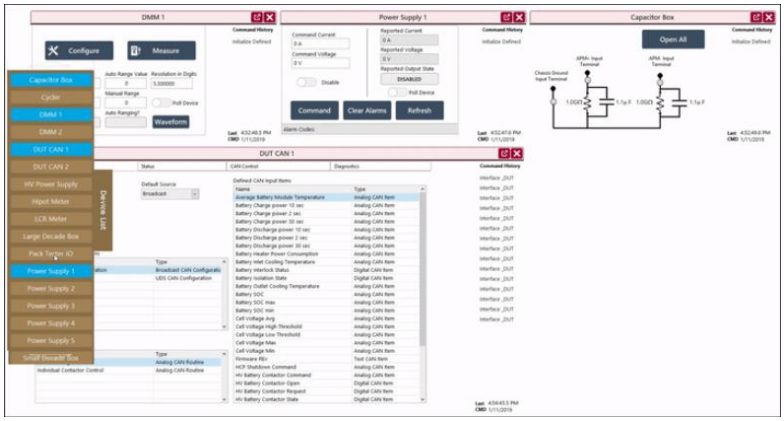
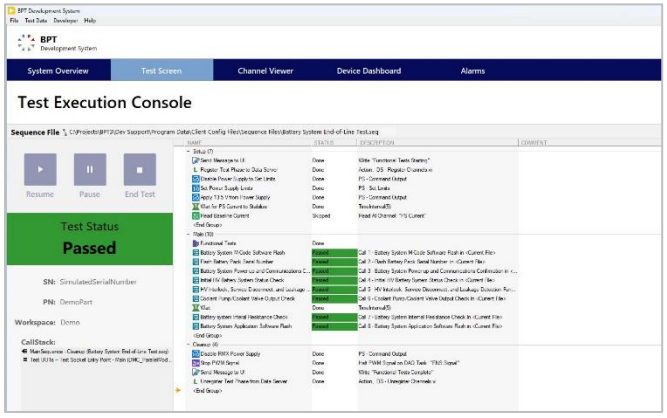
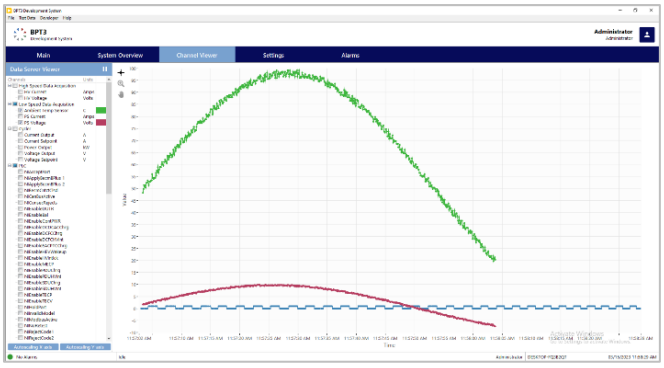
Troubleshoot DUTs with efficiency by using the software's manual mode. This powerful and differentiating feature of the DMC BPT can quickly identify equipment failures and provide insights to act and reduce downtime, without any need for sequence modifications. Technicians and test engineers have access to an advanced user interface that visually represents each connected device in the system allowing for better system comprehension and faster issue diagnostics.

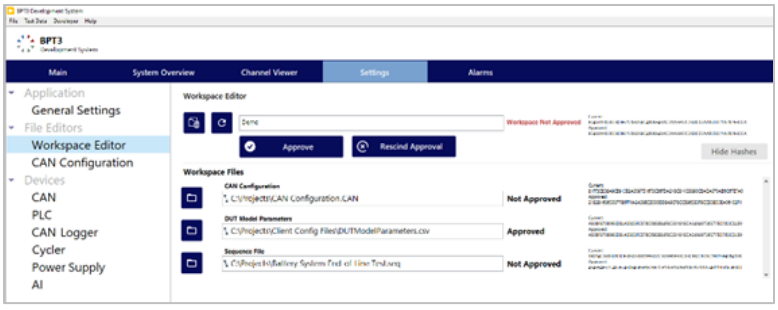




Test execution is easy to visualize in the BPT software. The User Interface provides operators with high level feedback on the test execution status and control options to pause, abort, and debug the test. For more detailed overview of the test status, DMC can add custom operator views or even allow your engineering team to develop and plugin custom screens that render visuals of test data.

Automatic data collection and live parameter plotting are built-in. View loss-less data on specific channel(s) in an overlaid chart or stacked channel-by-channel charts. Everything seen in the viewer is also recorded to lossless TDMS log files that are automatically pushed up to a specified network location or SystemLink server for easy remote access.





Engineers can ensure proper testing and traceability with BPT's workspace configuration management that provides a documented link between the input configuration files that go into test and the output data. Checksums of files are recorded with test results for traceability. All deployed test systems can be networked to use a shared set of centrally maintained test specification and DUT model parameters. Systems can also integrate with NI SystemLink to easily centralize, manage, and view all your test assets and data remotely.

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About DMC

Company Overview

DMC is a well-known and established controls engineering & consulting firm focused on automation, engineering, product development, and business consulting. We develop and implement solutions for a wide range of industries using a variety of technologies. DMC has successfully delivered solutions for hundreds of companies including 3M, Abbott Laboratories, Argonne National Labs, Bosch, BRP, Caterpillar, Chrysler, Fermilab, Ford, John Deere, UL, Wrigley, and Yaskawa. Every solution we develop is based upon a solid understanding of engineering principles with the primary objective of helping our client increase profitability and productivity with world-class solutions.

DMC is a certified member of the Control Systems Integrators Association (CSIA). DMC passed a rigorous third party audit of 200 criteria that span all aspects of business performance in the areas of:

- General Management
- Human Resources Management
- Marketing & Business Development
- Financial Management
- Project Management
- System Development Lifecycle
- Quality Assurance Management

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