
# BMS POWER HIL TESTBED MODEL 8630

Chroma introduces its latest innovation in Battery Management System (BMS) testing. This BMS Power Hardware-in-the-Loop (PHIL) testbed is designed to simulate a range of BMS component characteristics, including cell simulation, battery module voltage/current simulation, and temperature signal simulation. Various hardware options are available for seamless integration, such as a DC power supply, a digital meter, and an insulation tester.

Chroma 8630 BMS Power HIL Testbed is designed specifically for BMS research and development. Combining a real-time system with an open software architecture, the testbed provides users with a flexible and powerful dynamic test system capable of performing test items such as charge/discharge testing, dynamic voltage and current measurement and calibration, battery balance testing, CAN signal measurement and control, fault injection, insulation measurement, and EVSE charging simulation.

The versatile testbed allows for a wide range of customizable setups to simulate and verify the most criticial and high-risk composite scenarios in the EV's environment (such as communication and physical signaling failures during cyclic discharge). In-depth testing of the BMS without the need for a real vehicle or battery pack significantly increases development efficiency.

Chroma 8630 simulates the communication and operation of the entire system. It can simulate the high-speed dynamic charging/discharging current of the battery pack, different cell conditions, temperature signals, system insulation resistance, as well as the various BMS protection functions. The testbed comes equipped with a high-precision programmable power supply, which can be used to conduct a more comprehensive dynamic test of the complete system based on any manually set or recorded real-world conditions.

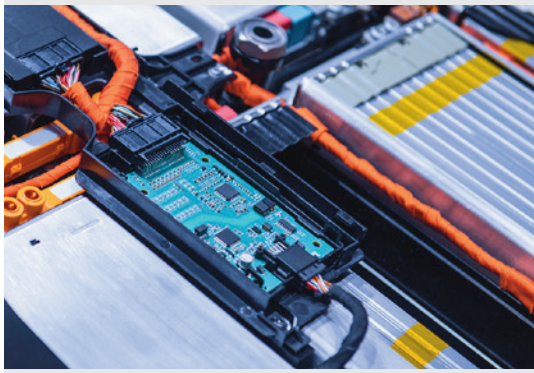
## MODEL 8630

### KEY FEATURES

- Up to 1200V battery module simulation voltage
- Up to 600A battery module simulation current, actual verification and calibration of SOC, SOH and other BMS parameters
- Battery cell simulation hardware single channel power of 25W/5V/5A, average cell voltage response time <10ms
- Test BMS protection mechanisms for OVP, UVP, OCP, OTP or UTP under static or dynamic conditions
- Hi-pot test and insulation resistance simulation
- Dynamic verification of active and passive balancing strategies for battery cells
- Real-time monitoring of high battery voltage relay open/close, initial power output, CAN signal and other timings
- Supports CAN, CAN FD, LIN interfaces
- Integrated Fault Injection Unit for comprehensive ISO26262
- Supports importing Simulink-based vehicle models to verify dynamic performance with NEDC, WLTP, etc. driving pattern
- Supports advanced automated test software through ASAM XIL and ASAM XIL-MA
- Independent PLC monitoring system to ensure the safety of the testbed

### APPLICATIONS

- BMS calibration and verification
- Reliability and durability testing
- Simulation of vehicle driving cycle conditions
- System integration testing



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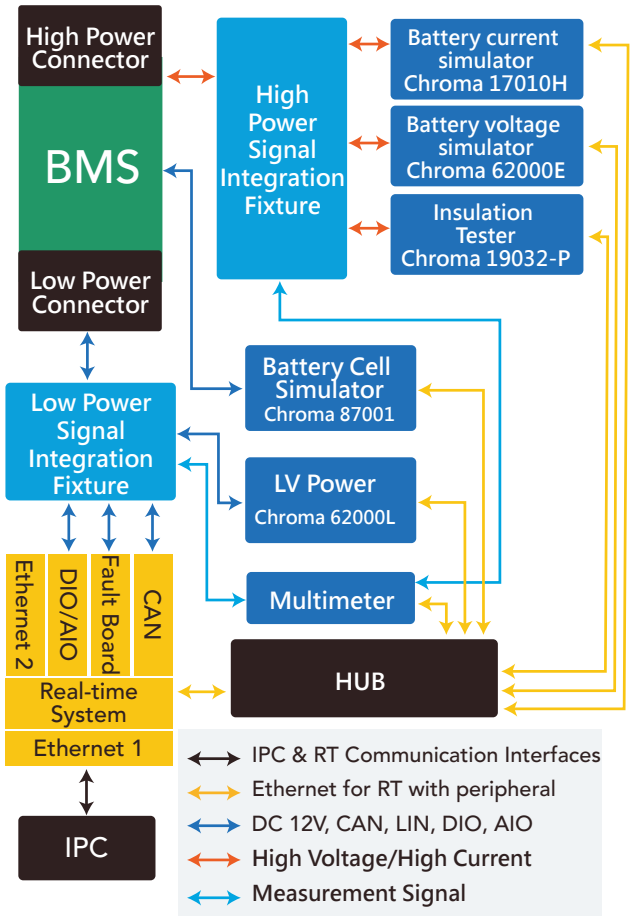
## REAL-TIME CONTROL, DATA ACQUISITION, COMMUNICATION AND PROTECTION FUNCTIONS

Chroma 8630 enables thorough testing of BMS alarm functions and protection mechanisms such as over-current protection, over-voltage protection, under-voltage protection, short-circuit protection, temperature monitoring, and insulation abnormalities. Its open-architecture control software enables integration of the real-time system, power equipment, measurement modules and various models such as vehicles, battery cells, and EVSE for comprehensive real-time dynamic testing of the battery management system.

The communication interface supports the commonly used CAN, CAN FD and LIN protocols, as well as the .dbc files required for CAN communication. The testbed's advanced test software adopts ASAM XIL as its interface for automatic testing, which records the monitoring parameters of the system after the completion of the automatic test procedure for subsequent analysis.

The test interface allows the user to set the data collection time, display the value of each parameter (speed, voltage, current, input power, output power, efficiency, temperature, operation mode, etc.) in real time, and generate graphs and reports for each parameter during the test.

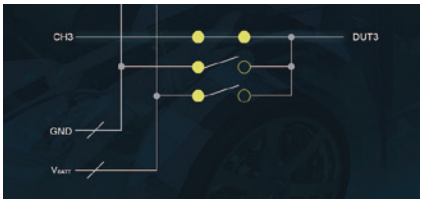
Chroma 8630's open real-time control platform supports various communication protocols and can simulate up to 480 battery cells (240S2P, voltage <1,000V) with full hardware, or instead use the cell software model to construct a complete battery pack system to achieve the best balance between cost and test performance. The testbed is equipped with an independent PLC monitoring system that can monitor the system software and power equipment operation status in real time. It can immediately stop the battery cell voltage and high-voltage and high-current simulation processes if any error occurs to protect both the product and the test equipment.



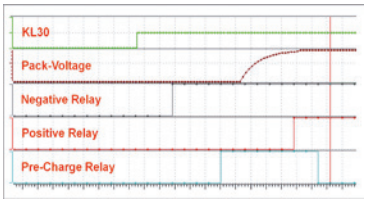

## WHOLE-VEHICLE DYNAMIC CHARGE/DISCHARGE AND COMPOUND APPLICATIONS

Chroma 8630 can simulate the dynamic loading and recharging behavior of the powertrain, including cell balance current, high battery voltage and high current. It also supports importing vehicle models and various Simulink Model-based real-time mathematical models to realize driving cycles compliant with international standards such as NEDC, WLTP, and FTP-75. In addition, users can freely combine various test functions such as signal measurement and control, fault injection, insulation measurement, and simulated EVSE charging to achieve complex working conditions and to subject the device under test (DUT) to more rigorous inspection.

User Interface




Fault Injection



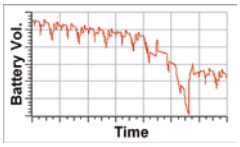

Timing Control & Measurment

EV model

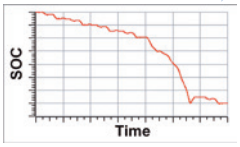
Battery model

BMS Testbed 8630

Alarm




SOC v.s. Time




Voltage v.s. Time

Communication

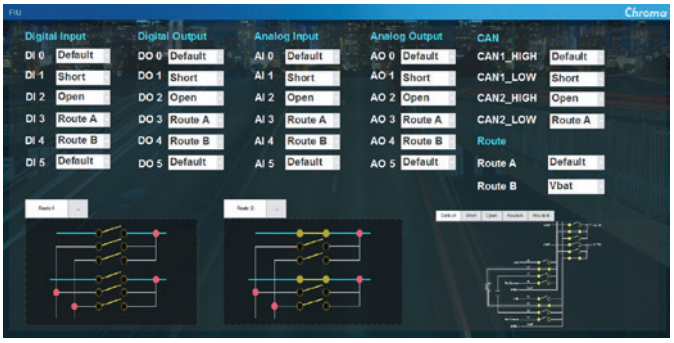
Start Timing Detection

## SUPPORTS VEHICLE DEVELOPMENT AND FUNCTIONAL SAFETY TESTING REQUIREMENTS

Chroma BMS PHIL Testbed 8630 not only facilitates the basic functions and signal control tests, but also simulates actual power behavior such as cell balance current, as well as high battery voltage and current. Compared with traditional signal-level HIL solutions, the system covers a more complete testing range of high-power EV and energy storage system components. Our solution allows users to conduct more extensive verification work for BMS components at the right side of the standard V-model development process, including system-level functions and various kinds of complex working conditions tests. In this way, problems can be detected and corrected at an early stage before entering whole-vehicle testing, which effectively reduces development costs and improves testing efficiency.

In order to cover the complex real-life behavior of vehicles, the automotive industry has been actively promoting the ISO 26262 functional safety specification for road vehicles as a standard for car manufacturers and their suppliers to follow in product development. ISO 26262 focuses on safety requirements from the product system down to hardware and software: functional safety requirements → technical safety requirements → hardware safety requirements → software safety requirements. The standard also stipulates that hardware-in-the-loop and fault injection tests are required at any automotive safety integrity level (ASIL) to ensure the validity of the safety mechanisms at the whole-vehicle level as well as the effectiveness of their failure coverage.

Chroma 8630 integrates a Fault Injection Unit to test various control and communication signals of the system under test, and can combine it with dynamic discharge, insulation resistance change and static charging behavior simulation. The testbed can simulate the most important, complex, and risky operating conditions for validating the BMS, and conducts in-depth tests. Without the need for actual battery modules, the testbed not only improves product design but also complies with the fault injection test sections of the ISO 26262 and facilitates the acquisition of ASIL safety level certification.




## VERSATILE AND INTUITIVE HUMAN-MACHINE INTERFACE

The user interface (UI) is a crucial component of any test system as it directly impacts the convenience and efficiency of R&D test personnel. The Chroma 8630 testbed comes equipped with various integrated instruments that create an optimal environment for flexible control and test program development. Users can freely write and modify test programs, as well as edit and customize UI screens, allowing them to continuously optimize test items and processes.

### Display for Equipment and DUT Parameters

Using numbers, meters and graphs, the battery charge/discharge status, voltage, current, power, battery capacity, protection alarm, insulation level, etc. are displayed and updated in real time.

### Control Parameters for Test Project Setup

Includes battery charge/discharge start and stop, charge/discharge voltage, current, insulation measurement start, fault injection signal selection, test condition selection, and more. Values can be changed digitally as well as by dragging and switching.

## UPGRADING TO BATTERY PACK POWER HIL TESTBED

Chroma 8630 has a highly flexible hardware and software integration architecture. If users expand their product range to include battery packs, they can pair the original system with Chroma's battery pack charger/discharger and high/low voltage equipment shown in the right figure to achieve the functions of the Chroma 8610 Battery Pack PHIL testbed. This enables conducting real-time dynamic tests on the battery pack, including simulation of international standard conditions like NEDC, WLTP, etc., high voltage battery relay open/close, CAN signal and other related timing monitoring. This approach reduces learning costs and minimizes time spent on equipment redeployment.

Battery Management System Power HIL Testbed

Regenerative Battery Pack Charger/Discharger

Low Voltage Insulation Fixture Case

High Voltage Switching Fixture Case

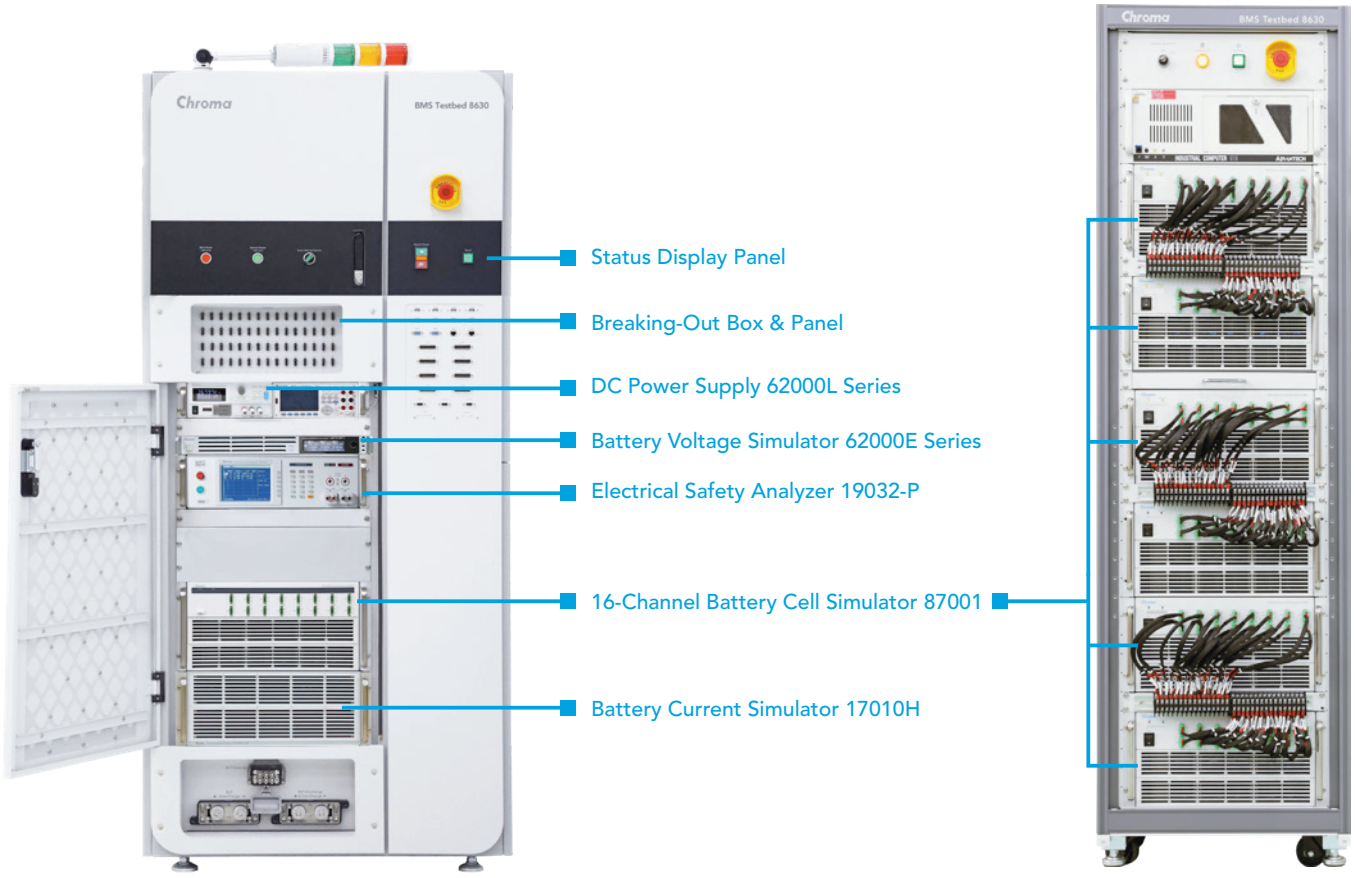
## HIGH PERFORMANCE EQUIPMENT

### Single Test Functions

1. Cell voltage simulation and measurement
2. Cell current simulation and measurement
3. OVP, UVP protection test
4. Charge and discharge temperature protection test
5. Charge and discharge over-current protection test
6. Verification of power up/down control and various protection mechanism timings
7. Calibration of dynamic current measurement values
8. SOC, SOH functions testing and calibration
9. Battery cell active/passive balance test
10. Arbitrary charge/discharge pattern reproduction
11. High-voltage interlock mechanism verification
12. AC/DC withstand voltage test

### Compound Test Functions

1. Fault injection to check and verify insulation and voltage withstand during the discharge phase of the driving cycle.
2. Fault injection to check and verify insulation and voltage withstand when any discharge and recharge pattern recurs
3. Check the effect of fault injection on power calculation and various protection functions
4. Verify effectiveness of battery cell active/passive balancing strategy
5. Full charge calibration mechanism test
6. Fault injection during charging to check and verify insulation and voltage withstand
7. Battery SOC, cell and total voltage, fault signal and charging energy change related tests




## ORDERING INFORMATION

8630: BMS Power HIL Testbed
IPC-610: Industrial computer
87001: 16-channel Battery Cell Simulator
17010H: Battery Reliability Test System
62000E: Programmable DC Source
62000L: Programmable DC Source
19032-P: Electrical Safety Analyzer

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