



MODEL 8610

KEY FEATURES

- Integrated FIU hardware, to simulate fault injection and improve ISO 26262 functional safety testing
- Supports various Simulink real-time models import, to verify on-road battery dynamic charging and discharging through standard driving conditions like NEDC and WLTP
- Supports CAN, CAN FD, LIN communication interfaces
- Integrated AC/DC EVSE charge interfaces, incl. CAN Bus and PLC signals, for various compatibility tests
- Real-time monitoring of timing sequences, incl. high power relay open/close, initial power output, CAN signal
- Integrated Hi-Pot safety analyzer, to measure and compare battery insulation and grounding status
- Extensive modular hardware, to ensure test accuracy and repeatability; expandable according to users' needs
- Supports upper-level automated test software through ASAM XIL and ASAM XIL-MA
- Independent PLC real-time monitoring, to ensure safety during testing

APPLICATIONS

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

BATTERY PACK POWER HIL TESTBED MODEL 8610

Chroma ATE launches the 8610 Battery Pack Power HIL Testbed for testing battery systems and components of new energy vehicles, incl. the battery module, battery management system, and cooling/heating system. Various hardware options are available for integration, such as a DC power supply, battery charge/discharge system, digital meter, Hi-Pot tester, and short-circuit and overvoltage protection devices.

Chroma 8610 is designed for development of battery modules and packs and provides users with a flexible and powerful dynamic testbed through the real-time hardware and software with open architecture at the core. Besides basic test functions like vehicle driving cycles importing, CAN signal monitoring, fault injection, insulation measurement, and EVSE charging simulation, Chroma 8610

can execute the most important compound scenarios for real vehicle and composite operation conditions with the highest risk of failure (e.g. physical and communication signal errors during cyclic discharge). Greatly improve R&D efficiency by performing more in-depth tests on battery packs without the need to test a real car.

Chroma 8610 testbed integrates the high-performance Chroma 170X0 Battery Chargers and Dischargers. The series simulate fast and dynamic discharging/regenerating of the battery pack driven by the e-propulsion system under various driving conditions for increased reliability of testing on the whole vehicle level. During testing, Chroma 170X0 will also feed the power output from the battery pack back into the grid to increase energy efficiency and save costs.

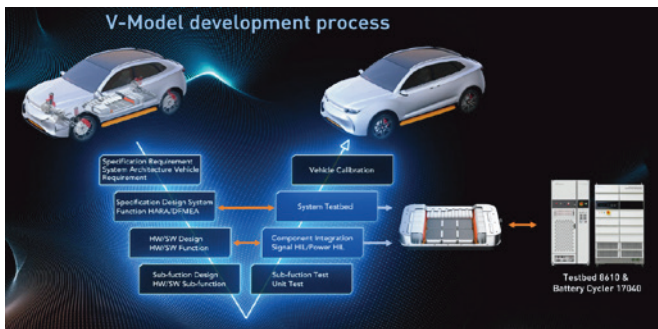


Vehicle Development Process and Functional Safety Test Requirements

Chroma 8610 Battery Pack Power HIL Testbed can both test functions on the traditional signal-level basis and verify actual power behavior, more completely covering the test range of EV high-power components. Chroma 8610 highly supports the validation requirements at the right side of the vehicle's standard V-model development process, from the integration of battery pack components to system-level functions; encompassing battery packs, battery modules, battery management systems, cooling/heating systems and other components. The testbed can implement various composite and simulated vehicle scenarios in advance before entering real vehicle testing. Users can so discover and correct problems early to reduce development costs and improve test efficiency.

In order to cover the complex behaviors of the real vehicle's operation, many car manufacturers and their supplies have started to adhere to ISO 26262 as the functional safety standard in product development. ISO 26262 extends from the product system down to hardware and software, and stipulates the content of safety requirements: functional safety → technical safety → hardware safety → software safety. At any automotive safety integrity level (ASIL), HIL and fault injection tests are necessary to verify the accuracy of the vehicle safety mechanism and the effectiveness of the failure coverage.

The integrated fault injection unit performs arbitrary open and short fault tests for various control and communication signals of the device under test. Chroma 8610 can integrate dynamic discharge, insulation resistance change and static charging, and other vehicle behavior simulations, to simulate and verify the most important compound vehicle scenarios for real vehicle and composite operation conditions with the highest risk of failure. Greatly improve the fault injection test from the ISO 26262 process and obtain ASIL certification by performing more in-depth tests on battery packs without the need to test a real car.



V-model Development Process



Fault Injection Interface

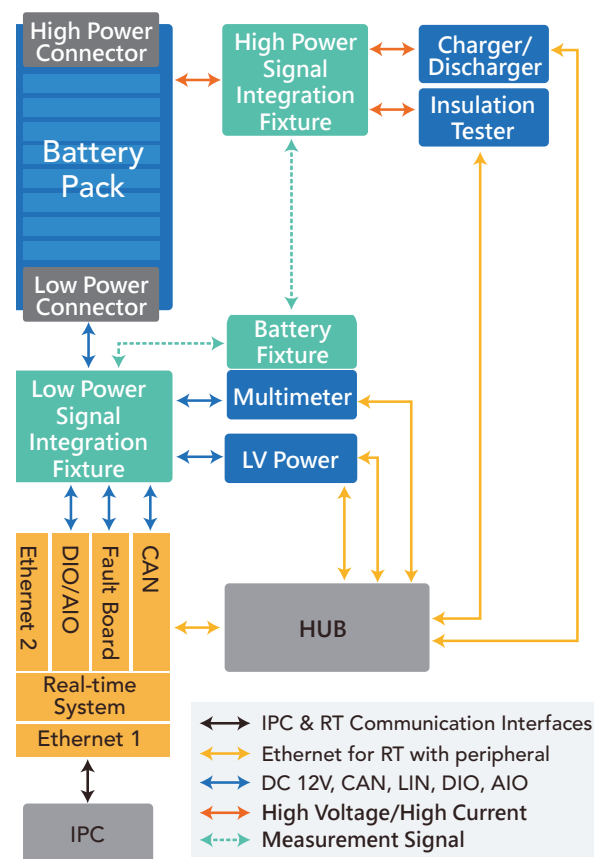
Real-time Control, Data Collection, Communication, and Protection

Chroma 8610 warning functions and protection mechanisms include over-current, overvoltage, undervoltage, short-circuit, and temperature monitoring. The software with open architecture can easily integrate real-time systems, power equipment, measurement modules, along with designated simulation models for vehicle-level, highly dynamic testing of battery packs.

The testbed supports the common CAN, CAN FD, and LIN communication interfaces and can accept the .dbc file for quick parametric configuration. For manual testing, it has great flexibility to edit and manipulate the UI functions so that users can continuously optimize test items and procedures. For automated testing, Chroma 8610 supports the upper-level test software following ASAM XIL and, upon the completion of each test sequence, can record the system's monitoring parameters for subsequent analysis.

The test interface sets the data collection time and displays various parameter values in real time (vehicle speed, voltage, current, input power, output power, efficiency, temperature, operating mode, etc.). Users can acquire test data to generate reports with graphical feature for all the parameters during or after testing.

The independent PLC system monitors the operational status of the system and power equipment in real time. If any error occurs, the charging and discharging power can be cut off immediately for instant protection of the product and equipment.



Highly Flexible and Intuitive User Interface

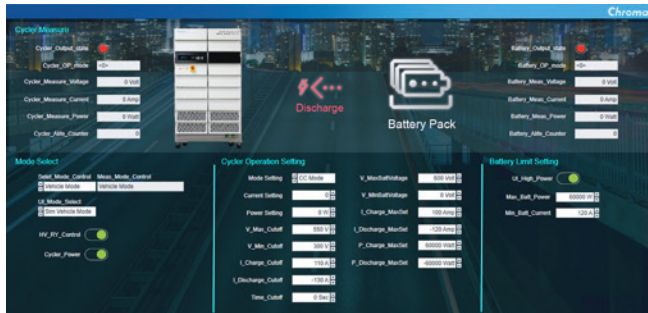
Central to the test system is the user interface (UI), directly influencing both the convenience and efficiency of testing by R&D. According to users' test plans, Chroma 8610 can customize various functions and integrate diverse equipment to establish a flexible control and test program development environment. Users are able to write and modify test sequences as well as to edit the UI screens. The main functions include:

Display for equipment and DUT parameters:

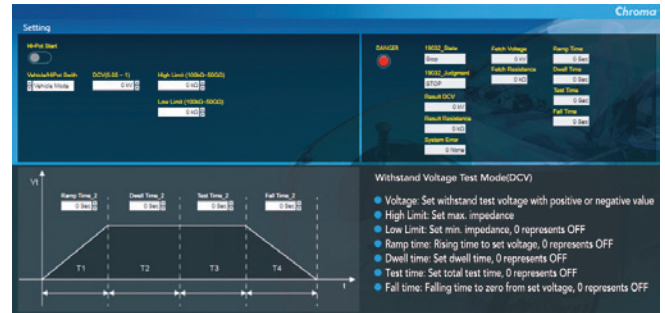
Such as the battery charge/discharge status, voltage, current, SOC, protection alarm, insulation level, et cetera. Update the values in real time digitally, instrumentally, and through plotting.

Control parameters for test project setup:

Such as the battery charge/discharge start and stop, charge/discharge voltage/current/power settings, insulation measurement start, fault injection signal selection, test condition selection, et cetera. Control the values digitally and through dragging and switching.



Battery Charge & Discharge interface



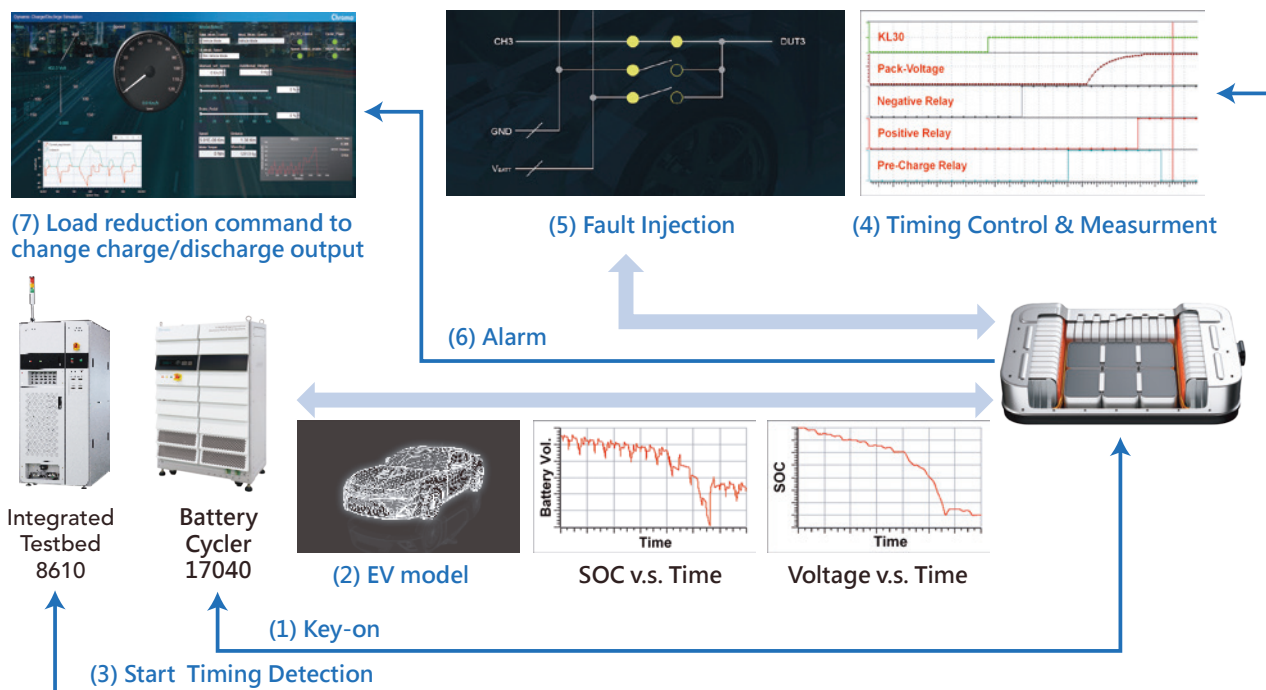
Hi-Pot & Insulation Interface

Dynamic Charging/Discharging & Compound Vehicle Scenarios

Chroma 8610 can connect to a Chroma 170X0 series battery charger and discharger. The combination can simulate the e-propulsion system's dynamic loading and regenerating on the battery pack and supports the import of Altair Activate vehicle models and various real-time mathematical models with Simulink model-based design. Integration of predefined or standard driving cycles like NEDC and WLTP serves to verify the dynamic discharge and regeneration functionality of car batteries directly.

Compared with other battery test systems that need to preload the actual on-road charge/discharge records for replay, the Chroma 8610 system can directly perform its dynamic battery pack test functions. Various test functions include charging/discharging, signal measurement and control, fault injection, insulation measurement, and simulated EVSE charging. Users can arrange and combine test functions with great flexibility to achieve all kinds of compound vehicle scenarios, for more thorough testing of battery packs.

The example below illustrates charging and discharging after loading the real on-road profile as well as simulation of charging changes right after a fault injection.



Single Test Functions

- (1) CC and CV charge/discharge tests
- (2) Vehicle driving cycle discharge
- (3) Arbitrary charge/discharge pattern reproduction
- (4) Voltage measurement and voltage difference detection
- (5) Current measurement and current difference detection
- (6) High Power ON/OFF control logic and timing
(relay self-test mechanism confirmation)
- (7) High voltage interlocking mechanism
- (8) Battery protection function timing check
- (9) Insulation resistance measurement
- (10) AC/DC withstand voltage tests
- (11) Dynamic leakage current
- (12) GB/T, CHAdeMO, CCS AC/DC charging and interoperability tests

Compound Test Functions

- (1) Checking insulation & withstand voltage status after fault injection while discharging with vehicle driving cycle importing
- (2) Checking insulation & withstand voltage status after fault injection while arbitrary charge/discharge pattern reproduction
- (3) Impact of fault injection on SOC calculation and protection functions
- (4) Checking insulation & withstand voltage status after fault injection while AC and DC charging process
- (5) Charging energy and strategy verification with different SOC, cell & total voltage and fault signals
- (6) Fully charged calibration mechanism test

High Performance Equipment

