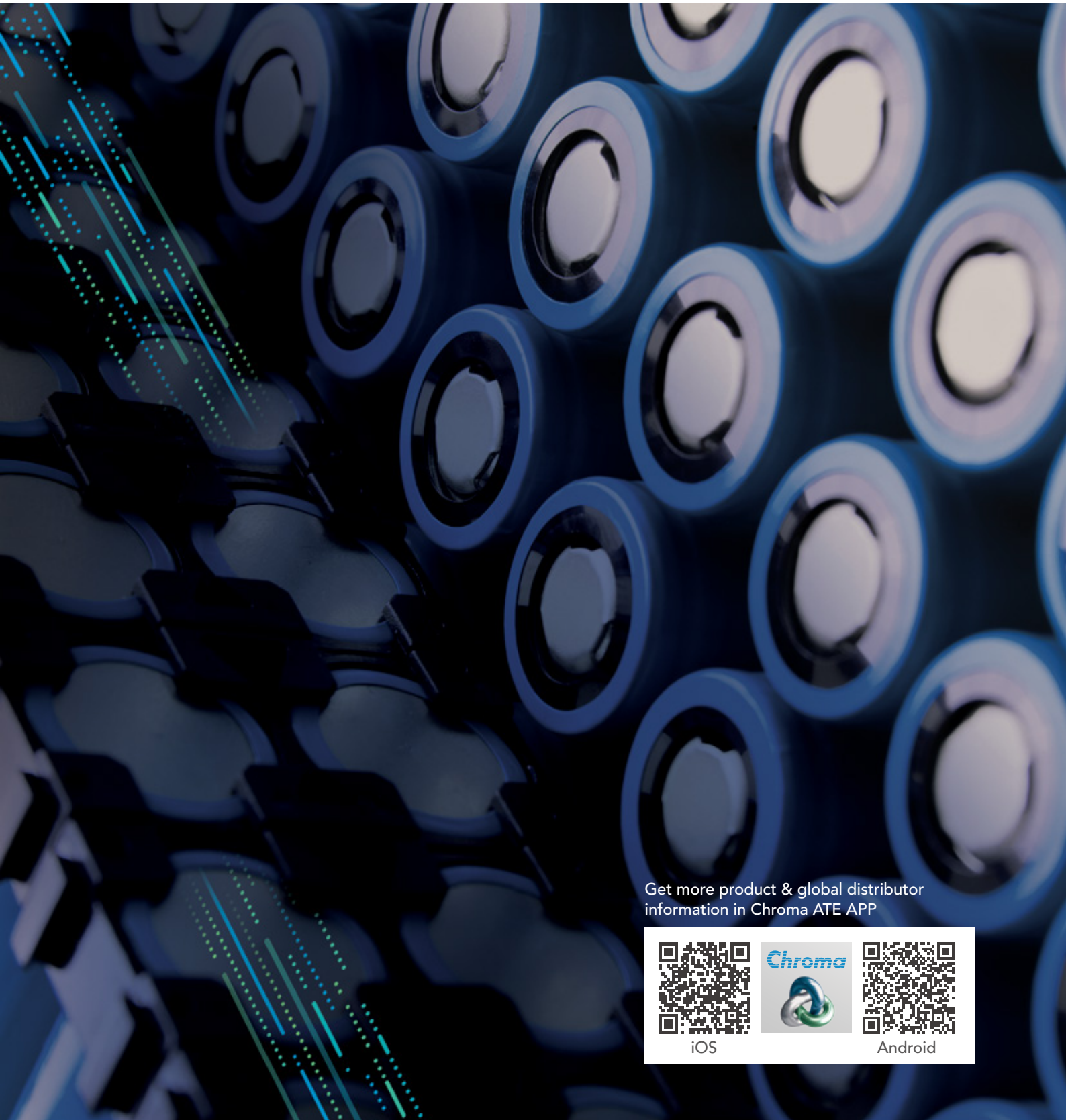
Chroma
Advancing Excellence

Battery Test Solutions

Battery Cell/Battery Module/Battery Pack



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Chroma ATE Inc. was founded in 1984 and has since become one of the world's leading suppliers of automated test equipment, providing test and measurement instrumentation and automated test systems (ATS) for the electronics industry. Advanced technological capabilities combined with production line automation and manufacturing execution systems (MES) enable us to develop Test and Automation Turnkey Solutions that satisfy and exceed customer demands.

Chroma has been competitive in the electric vehicle (EV) industry for many years, setting up long-term relationships with well-known car manufacturers as well as key EV component and battery providers. Chroma also has comprehensive test solutions for battery cells, battery modules, battery packs, battery management systems (BMS), on-board chargers, DC converters, EVSE, wireless chargers, and electrical safety.

In addition to maintaining a large and diverse group of R&D engineers, Chroma invests heavily in research and development each year to ensure its continued technological leadership. Core technologies in power electronics and optics have fueled Chroma's drive forward into various new markets and its success in providing innovative test solutions with precision, reliability, and uniqueness. This is the key reason why Chroma has been able to gain the long-term support of its customers for over 30 years.

Manufacturing Capability and Service Support

Temperature & Humidity Cycle Test Chamber

EMC Lab - Electromagnetic Wave Testing

Highly Accelerated Life Testing Equipment

Smart Auto Production Line

High Power Burn-In Testing

Customized Assembly

Automated Test Equipment and Software

Calibration Lab

Local Support and Services

Turnkey Battery Test Solutions

Battery Cell

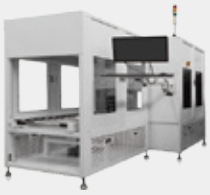
Regenerative Battery Cell Test Instruments & Systems

Battery Reliability Test System

Barcode Binding Equipment

Formation System

DCIR Test Equipment



OCV & ACIR Test Equipment

Grouping

Charge/Discharge Tester

Battery Cell Insulation Tester

Battery Cell Surge Tester

RT Aging Formation HT Aging

Barcode Binding

OCV & ACR Test

Battery Module

Battery Pack

Regenerative Battery Module/Pack Test Instruments & Systems

BMS PCBA ATS

Functional ATS

Battery Module/Pack Test Systems

Battery Pack EOL ATS

Maintenance ATS

Battery Pack Power HIL Testbed

BMS Power HIL Testbed

16 CH Battery Cell Simulator

Hipot Analyzer

Multi-Channel Hipot Tester

DC Power Supplies

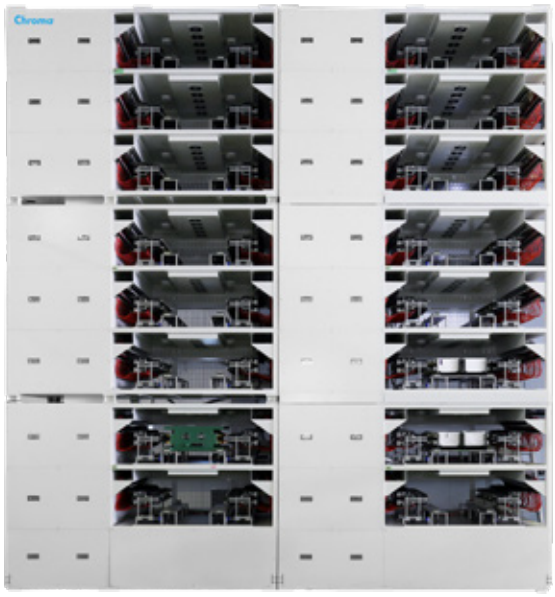
DC Electronics Loads

Battery Cell Production Line Solutions

Turnkey Battery Formation | 17000 Series

Chroma 17000 series is a turnkey solution for the cell formation process. The 17000 series has been integrated with test equipment and a control software system; with formation, grading, pre-charge, OCV/ACIR station, DCIR station, etc. for testing equipment, and an automation stacker crane, conveyer, logistics control system, grouping, sorting, and rework stations for automation equipment.

As the capacity of mass production lines keeps growing, full automation is required. Chroma has developed a system for formation information management (called Formation Management System, FMS), which plays an important role in the automated formation system, just like the central nervous system of the human body. The most distinguishing features are versatility and customizability to connect with each process station and procedure. It interacts with complicated information such as: status of station, test report, raw data, calibration/verification results, and schedules. Furthermore, it can set recipes, Pass-Fail, sorting rules, and an analysis data sheet for each station.



Formation System

Key Features

- ☑ Formation/grading voltage measurement accuracy: ±0.05% F.S. (typical)
- ☑ Formation/grading current measurement accuracy: ±0.1% F.S. (typical)
- ☑ Formation/grading testing current range: 10A ~ 120A
- ☑ AC regeneration mode
- ☑ Probing contact resistance value monitoring (single circuit loop)
- ☑ Auto configuration for calibration (measurement)/ verification (adjustment)
- ☑ Protection functions include: OVP/UVP/OCP/OTP/OQP/±ΔV/±ΔI
- ☑ Chroma FMS for configuration, monitoring, and control (optional)

Performance Design

- ☑ Formation deck design: Open frame; Chamber type
- ☑ Provides vacuuming function during formation process
- ☑ Provides probe/gripper technology
- ☑ Robust fixture of clamping unit and deck design
- ☑ Abnormality detection (polarity/real-time/contact loop resistance/ deck temperature/channel temperature/smoke detection/ power-off protection)
- ☑ Fireproof design
- ☑ Modular design, easy to maintain

Automation Features

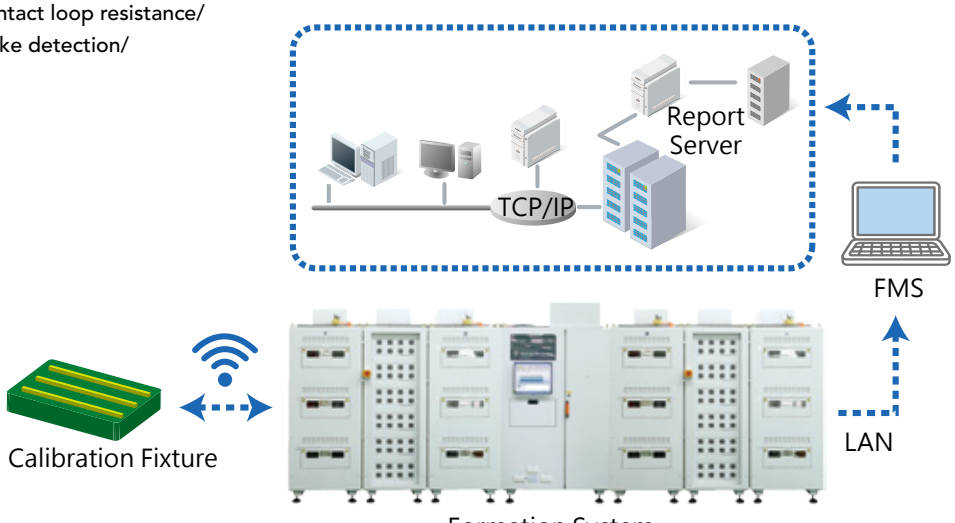
- ☑ High-speed/low-noise automated cart (anti-collision, anti-spark, anti-static)
- ☑ High-efficiency production process layout

FMS

- ☑ Technology management
- ☑ Human error prevention
- ☑ Complete production history
- ☑ Data analysis to improve production process

DCIR Test Equipment

OCV/ACIR Test Equipment

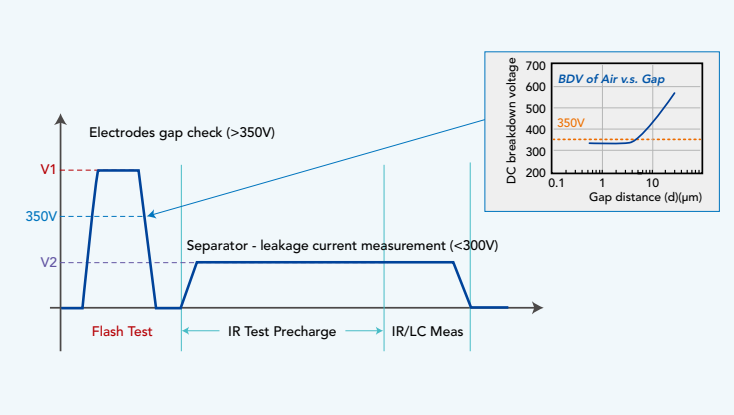


Battery Cell Insulation Tester | 11210

The Chroma 11210 is suitable for lithium-ion battery (dry cell) insulation testing, featuring a unique electrical flashover and +Flash Test function to check the effective distance between the electrodes and detect excessive leakage current. This can greatly reduce the risk of fires caused by the negative electrode material inflating and metallic particles piercing the separator when charging the lithium-ion batteries used in new energy products such as EVs, energy storage systems (ESS), and electronic appliances.

Key Features

- ☑ Test voltage: up to 1KV (DC)
- ☑ Charge current: 50mA max.
- ☑ Wide range of Leakage Current (LC) measurement (1pA ~ 20mA)
- ☑ Fast measurement (20mS)
- ☑ Partial discharge (PD)/Flashover detection for inspection on potential internal short circuits (option of A112100):
  - PD/Flashover level and number of occurrence display
  - PD/Flashover events and V/I waveform monitor
  - Programmable PD/Flashover level limit setting
  - PD/Flashover and V/I waveform real-time display and storage (option of A112101)
- ☑ Built-in +Flash Test function
- ☑ Built-in fast contact check function
- ☑ Automatic test with sequence: charge → dwell → test → discharge
- ☑ Applicable to various capacitance LC/IR tests
- ☑ Can also measure the withstand voltage margin of multi-layer ceramic capacitors (MLCCs), solid state capacitors, high-voltage electrolytic capacitors and insulating materials



+ Flash Test function during inspection of Li-ion Battery insulation quality

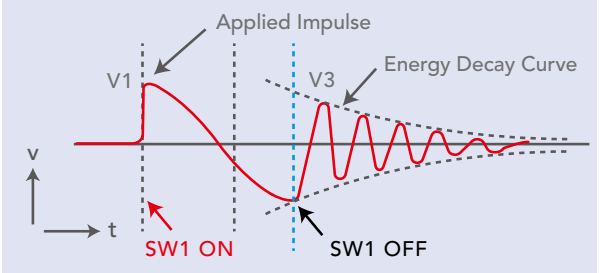
Battery Cell Surge Tester | 19311 Series

For lead-acid battery cell insulation testing

The Chroma 19311 tests the insulation quality between the positive and negative plates of the lead-acid battery cell by applying a high-voltage surge before electrolyte injection. It has a surge output voltage that can reach 6kV, four terminal measurement, a 200MHz sampling rate, and can analyze the insulation quality by using the resonant waveform. It tests the positive and negative plates on insulation distance and quality, presence of the separator, and possible short circuits. This surge test can decrease the defect rate of lead acid battery production and increase battery cell insulation. The 19311-10 multi-cell scanning test is extremely efficient; saving test time (6 cells in <1.5s), decreasing labor costs, and increasing production line throughput.

Key Features

- ☑ Max. output voltage: 6kV (depending on DUT's capacitance)
- ☑ Pulse interval: 30ms ~ 3000ms
- ☑ 8 types of judgements:
  - Area
  - Flutter
  - 1st Peak Voltage (V1)
  - Peak Ratio
  - Differential Area
  - Laplacian
  - 3rd Peak Voltage (V3)
  - △Peak%
- ☑ Contact Check
- ☑ Breakdown Voltage Mode (BDV Mode)
- ☑ Supports up to 25 channels for scanning test (19311-10 with A190362 option)
- ☑ Standard remote interfaces: LAN, USB & RS232



SW1 ON (WV Test)
- Area
- Differential Area
- Flutter
- Laplacian
- V1

SW1 OFF (Rp/Q Check)
- V3
- Peak Ratio
- △Peak %

Surge Test

Battery Reliability Test System | 17010

Chroma 17010 Battery Reliability Test System is a high-precision system designed specifically for testing lithium-ion battery (LIB) cells, electric double-layer capacitors (EDLCs), and lithium-ion capacitors (LICs). The test equipment is suitable for product development and quality control by providing characteristics research, cycle life testing, product screening, and quality assessment.

The Chroma 17010 system comes in two design architecture types. The linear circuit series produce low output noise and high measurement accuracy, suitable for reliability evaluation of small and medium-sized energy storage components in the development phase. The regenerative AC/DC bi-directional series with power saving and low heat generation fit the bill for standard product life evaluation as well as medium and large-sized energy storage components or power battery cell testing.

25U Rack　36U Rack　41U Rack

Key Features

- ☑ High accuracy±0.01% of F.S.
- ☑ High precision±0.002% of F.S.
- ☑ Fast current response < 100μS
- ☑ High sampling rate (10mS)
- ☑ High single point transient sampling rate (1mS)
- ☑ Integrating up to 96 channels
- ☑ Channel parallel output up to 1200A
- ☑ High-efficiency charge and discharge with low heating
- ☑ Energy recycling during discharge (AC/DC bi-directional regenerative series)
- ☑ Waveform simulation (current/power modes)
- ☑ Multi-level safety protections
- ☑ Integrable data logger and chamber
- ☑ Compliant with IEC and GB/T standards

17208M-5-12C　17208M-6-60　17216M-10-6

System	17010						
Model	Current Ranges	Voltage Ranges	Super Mode	0V Discharge	Regenerative Mode	Channels	Rack
17216-6-6	6A/1.2A/0.6A/1mA	0~6V	--	--	--	16/32/48/64/80/96	19" Rack (25U) (36U) (41U)
17216-6-12	12A/2.4A/1.2A/1mA	0~6V	--	--	--	16/32/48/64/80/96	
17216M-10-6	6A/0.2A/6mA/0.2mA	0~10V/0~5V/±5V	--	Yes	--	16/32/48/64/80/96	
17216M-6-12	12A/3A/1A/0.1A	0~6V	--	Yes	--	16/32/48/64/80/96	
17208M-5-12C	12A/4A/0.4A/0.04A	0~5V	--	Yes	--	8/16/32/40/48/56/64	
17208M-6-30	30A/10A/0.1A/1mA	0~6V	--	Yes	--	8/16/24/32/40/48/56/64	
17208M-6-60	60A/15A/5A/0.5A	0~6V	--	Yes	--	8/16/24/32/40/48/56/64	
17212M-6-100S	100A/50A/25A	0~6V	Yes	--	Yes	12/24/36/48	

Battery Cell Test System Auto Calibrator | A170103

Chroma A170103 is a complete automated calibration and verification instrument with a variety of high-precision calibration standard components built-in for programmable test tasks. Chroma A170103 applies to Chroma 17010 products up to 150A in order to ensure that the equipment maintains its high precision and traceability.

Key Features

- ☑ Consistent standards verification: reducing human errors and measurement variability
- ☑ Efficient calibration and verification: cutting down labor costs
- ☑ Automated report generation: managing maintenance records and traceability

Model	A170103
Voltage	0~10V
Current	1mA/10mA/100mA/1A/6A/30A/150A (7 ranges)
Channels	16CHs

Battery Reliability Test System | 17010H

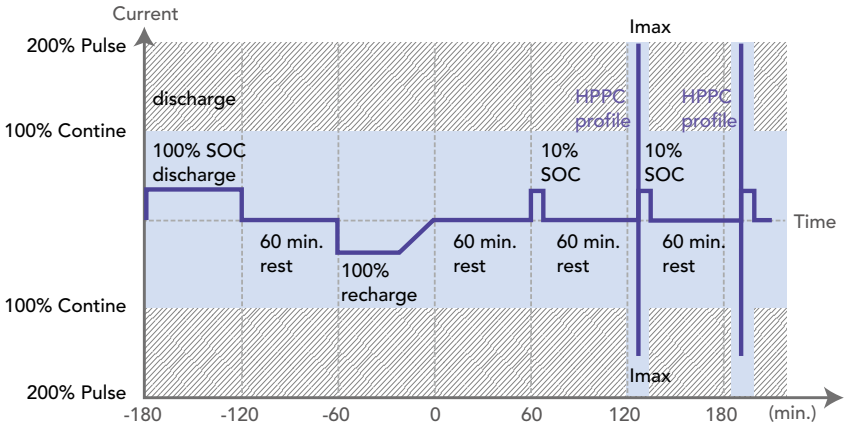
The 17010H's energy recovery circuit architecture offers a marked improvement over traditional switching power supply equipment. It features high measurement accuracy/precision, high-speed current response, zero-crossover time for charge-discharge conversion, as well as multiple current ranges, which help to enhance the capacity test accuracy of battery cell experiments, improve performance parameter identification, and facilitate realistic dynamic current and power testing. In addition, Chroma 17010H has a 200% pulse current output function, a 300A single-channel continuous current, and provides a 30S pulse test current of 600A, beneficial to applications such as power capability and DC internal resistance testing which require short-term and high-rate test currents, while also reducing equipment purchase costs.

To accommodate the diversity of battery cell products and experiments, Chroma 17010H features a channel parallel function with a continuous current up to 2400A and a pulse current up to 4800A, greatly improving the applicability of the system.

25U Rack　36U Rack　42U Rack

Key Features

- ☑ High accuracy ±0.015% of F.S.
- ☑ High precision ±0.005% of F.S.
- ☑ Multiple current ranges: 300A/150A/30A
- ☑ Fast current response <1.5mS
- ☑ Charge and discharge with zero crossover time
- ☑ 200% pulse current
- ☑ Channel parallel output up to 4800A
- ☑ Efficient recycling of discharged energy (75%)
- ☑ High-speed data logging (10mS)
- ☑ High single point transient sampling rate (1mS)
- ☑ Level 2 V. Protection
- ☑ Integrable data logger and chamber
- ☑ Compliant with IEC and GB/T standards



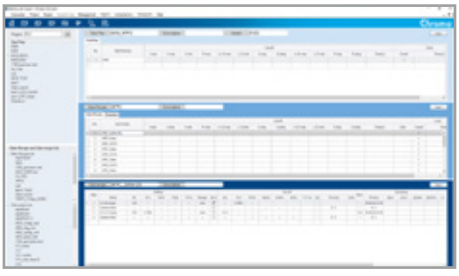
System	17010H					
Module	Current Range	Voltage Range	Super Mode	0V Discharge	Regenerative Mode	Rack
17010H_6-300	300A/150A/30A	Charge 0.3V~6V ; Discharge 1.5V~6V	--	--	Yes	23" Rack (25U) (36U) (42U)
17010H_6-300Z		Charge -0.6V~6V ; Discharge 0V~6V	--	Yes	Yes	
17010H_6-300S	600A(ST)*/300A/150A/30A	Charge 0.3V~6V ; Discharge 1.5V~6V	Yes	--	Yes	
17010H_6-300U		Charge -0.6V~6V ; Discharge 0V~6V	Yes	Yes	Yes	

Note *1: ST range is the super output mode (Super mode), the limit voltage of the ST range is 5V.

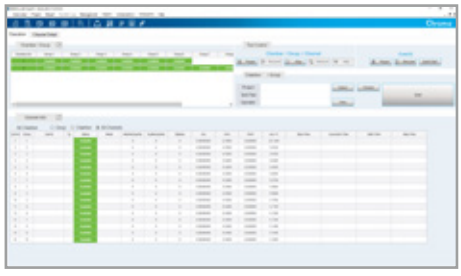
BATTERY LEX Software

Battery Lab Expert (Battery LEx) is the testing software platform specially developed for battery cell testing:

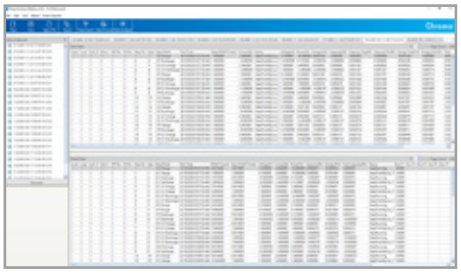
- ☑ Group testing: Multiple channels of the same experiment are grouped to simplify operations and execute up to 50,000 steps
- ☑ Variable editing: Use the data from the external data logger for flexible programming and complex applications
- ☑ Chamber integration: DI/DO amplification monitors the chamber's status and protection mechanisms in real time



Project Browser



Recipe Executor



Test Report Preview

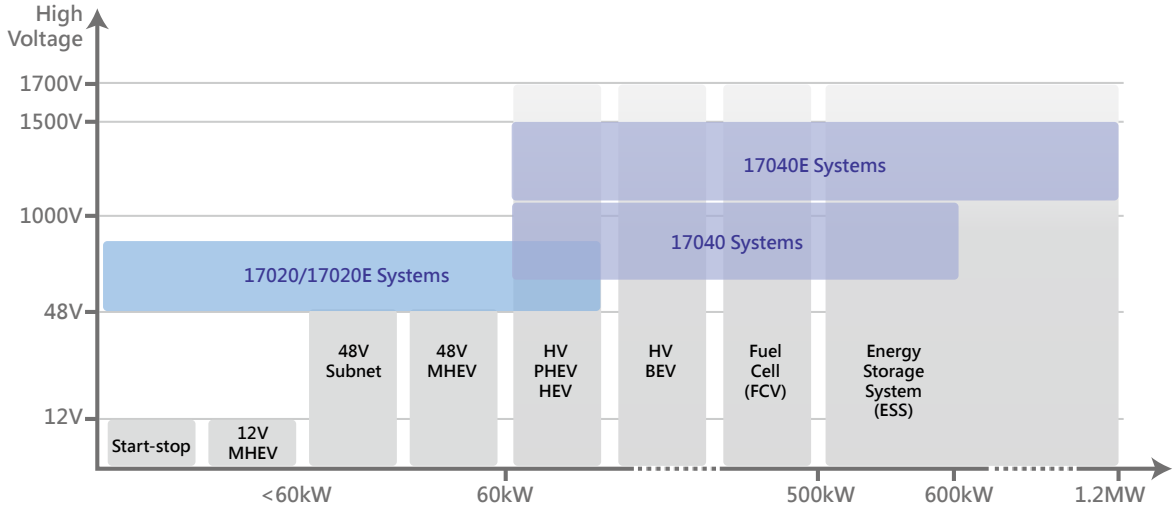
Charge/Discharge Test Solutions for Battery Modules, Packs, and Systems

Chroma 17020, 17020E, 17040, and 17040E series battery charge and discharge test systems are designed for testing secondary batteries. Used in the electric vehicle industry, they are capable of simulating VCU (Vehicle Control Unit) behavior and sending diagnostic service ID. During the test, the fully automatic and independent process can power-on the device under test (DUT), unlock (seed & key) and start the relay, and then start charging/discharging the battery pack.

The battery charge/discharge test systems can conduct thermal control during the test. Through the diagnostic service ID, the systems read the data and DTC (diagnostic trouble code) returned by the BMS (battery management system). With these protection function parameters, the systems can completely monitor the battery charge/discharge tests to ensure the safety of the testing process.

The battery charge/discharge test systems are equipped with driving cycle simulation functions, real EV power systems, and battery pack handshake processes, and can adjust the output power, voltage, and current of the charge/discharge equipment in real time. The systems can simulate EV over-temperature load reduction, the Mild-Hybrid 48V system, 12V power system interaction, and other real automotive working conditions.

Users can configure the battery charge/discharge test systems according to the testing needs, quantity, and specifications of the DUT. These systems are designed to perform complete product verification at different stages for various battery test equipment. They can execute fully automated testing procedures, offer fully BMS integrated and automated testing solutions, and support various BMS communication interfaces, incl. CANbus, LINBus, RS232, RS485, and MODBUS. With fast testing times and accurate results, our charge/discharge test systems provide reliable and worry-free testing solutions for your battery packs, modules, and battery management systems.



17020 | 17020E | 17040 | 17040E

Regenerative Battery Pack Test System | 17020 & 17020E

The 17020 and 17020E series are Chroma's battery pack charge/discharge systems with a choice between versatility (17020) and affordability (17020E). The 17020 can be customized for channel power and quantity according to the testing needs of the DUT, ideal for R&D and accreditation teams. The 17020E can be configured with a minimum unit of 10kW, particularly suitable for battery pack life cycle testing or production line EOL ATS.

17020 System
48CH

17020E System

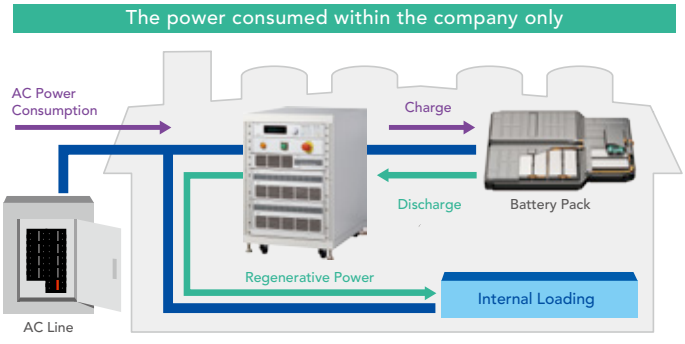
17020 specifications:
20V/65A/1.25kW/4CH
60V/13A/0.6kW/8CH
60V/62.5A/1.25kW/4CH
60V/62.5A/2.5kW/4CH
100V/50A/2.5kW/4CH
200V/30A/2.5kW/4CH
500V/13A/2.5kW/4CH
(parallel limit: 60 channels)

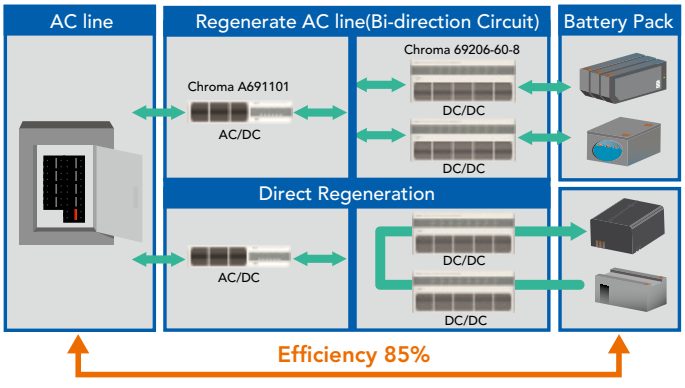
17020E specifications:
60V/180A/10kW/2CH
60V/360A/20kW/2CH
60V/180A/10kW/4CH
100V/100A/10kW/2CH
100V/100A/10kW/4CH
200V/100A/10kW/2CH
200V/100A/10kW/4CH
(parallel limit: 8 channels)

Key Features

- ☑ High precision voltage and current measurements:
  Voltage: 0.02% rdg.+ 0.02% rng.
  Current: 0.05% rdg. + 0.05% rng.
- ☑ Charge/discharge modes: CC, CV, CP
- ☑ Two-stage software and firmware protection for optimal safety
- ☑ Driving cycle simulation with current and power state of real driving conditions
  - Trip time between maximum charge and maximum discharge current only 10 ms.
  - Smooth current conversion without overshoot, delay time 0 sec.
- ☑ Built-in various standard test functions: IEC61960 DCIR, IEC-62391 EDLC Capacitance & DCR, IEC 60896 short circuit current and Ri
- ☑ Battery discharge energy recovery function: when the rated power exceeds 20%, the recovery efficiency can reach 85% (feedback to the grid)

Regenerative Energy Function





High Power Regenerative Battery Pack Test System | 17040 & 17040E

Chroma 17040/17040E system is equipped with parallel channel capability that boosts the maximum charge/discharge current and power, as well as a dynamic profile simulation function that allows users to load the battery waveform of a given drive profile. The bi-directional structure ensures uninterrupted current during the charge/discharge transient state. Two modes of current and power can be selected to meet the various NEDC/FUDS requirements and comply with international test standards such as ISO, IEC, UL, and GB/T.

17040 specifications:
1000V/150A/60kW/1CH
1000V/150A/60kW/2CH
1000V/300A/120kW/1CH
1000V/450A/180kW/1CH
1000V/300A/125kW/2CH
1000V/600A/250kW/1CH
1000V/750A/300kW/1CH
1000V/450A/180kW/2CH
1000V/600A/250kW/2CH
1000V/750A/300kW/2CH
(Parallel limit: 2 channels
of the same specification)

17040E specifications:
1700V/800A/200kW/1CH
(Parallel limit: 6 channels
of the same specification)

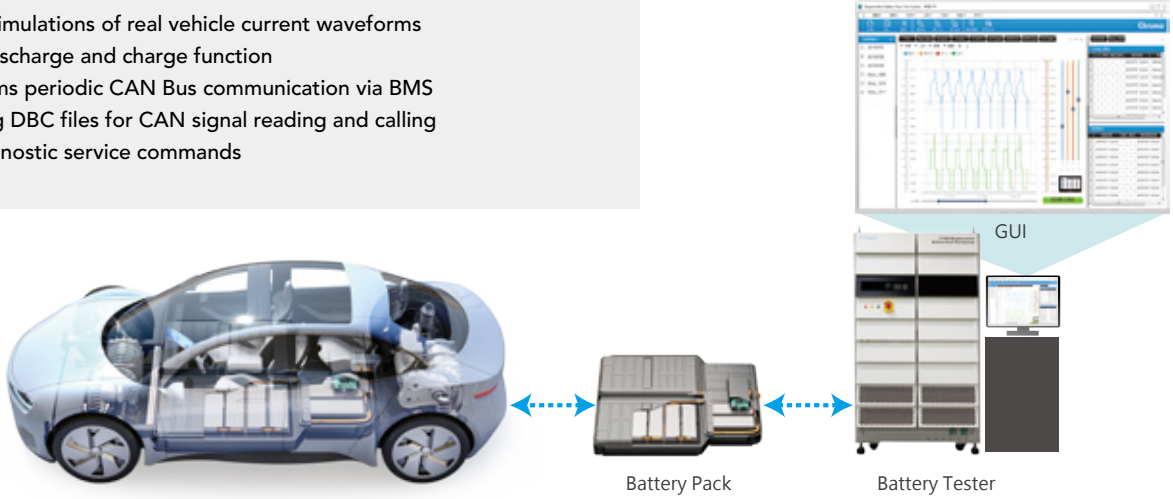
17040 250kW

17040E 200kW

Key Features

- ☑ High accuracy measurement:
  Voltage: ±(0.02% rdg.+0.02% F.S.) (17040 system)
  Current: ±(0.05% rdg.+0.05% F.S) (17040 system)
  Voltage: ± (0.02% rdg.+0.02% F.S) (17040E system)
  Current: ±(0.05% r.n.g.) (17040E system)
- ☑ Current response speed (0 to 90%): 1ms
- ☑ Current switching process without interruption, 0 seconds delay time
- ☑ Supports CC/CV/CP/DCIR charging/discharging mode
- ☑ Software/firmware two-stage protection ensures the safety of the test process
- ☑ Power and current charging/discharging profiles for driving simulation test
- ☑ Built-in standard test functions: ISO12405, GBT31467, GBT31484
- ☑ Battery discharge energy recovery function: power saving, environmental protection, low heat energy production; when the rated power exceeds 20%, the recovery efficiency can reach up to 85% (recovery to the grid)

- ☑ Supports loading simulations of real vehicle current waveforms
- ☑ Dynamic battery discharge and charge function
- ☑ Supports up to 10ms periodic CAN Bus communication via BMS
- ☑ Supports importing DBC files for CAN signal reading and calling
- ☑ Supports UDS diagnostic service commands

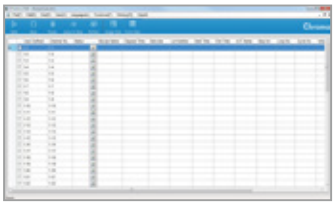


Test Software Platform | Battery Pro

Battery Charger and Discharge Test Software

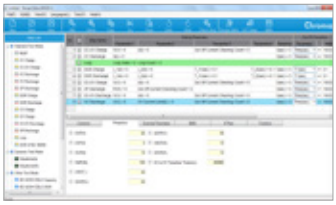
Battery Pro is a software platform specifically developed for testing secondary battery packs and can be applied to Chroma 17040, 17040E, 17020, and 17020E systems. It is equipped with multilingual interface support (Traditional Chinese/Simplified Chinese/English), real-time status monitor and icon manager, authority management, fault record tracking and security detection, and data storage and recovery during power failure functions.

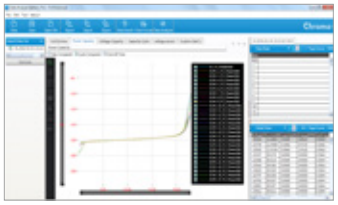
BatteryPro Main Panel

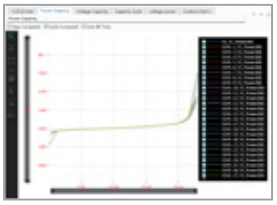


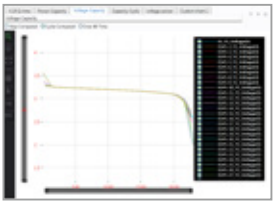
Recipe Executor

- ☑ Data display is updated in real-time, without a click
- ☑ Graphical and list mode display switching, flexible display depending on number of channels









Recipe Editor

- ☑ Test curves include ISO12405, GBT31467, GBT31484, and IEC61960 DCIR
- ☑ BMS data control charge/discharge settings interface
- ☑ Equipped with variable editing, external parameter, if-then procedure, and judgement functions

BMS Function

- ☑ Automatically adjust the power output of the device according to BMS instructions with the BMS performance prediction function
- ☑ Configurable power-on program function, with the Chroma multi-function box, for heartbeat transmission and UDS SID execution to switch the battery pack relay

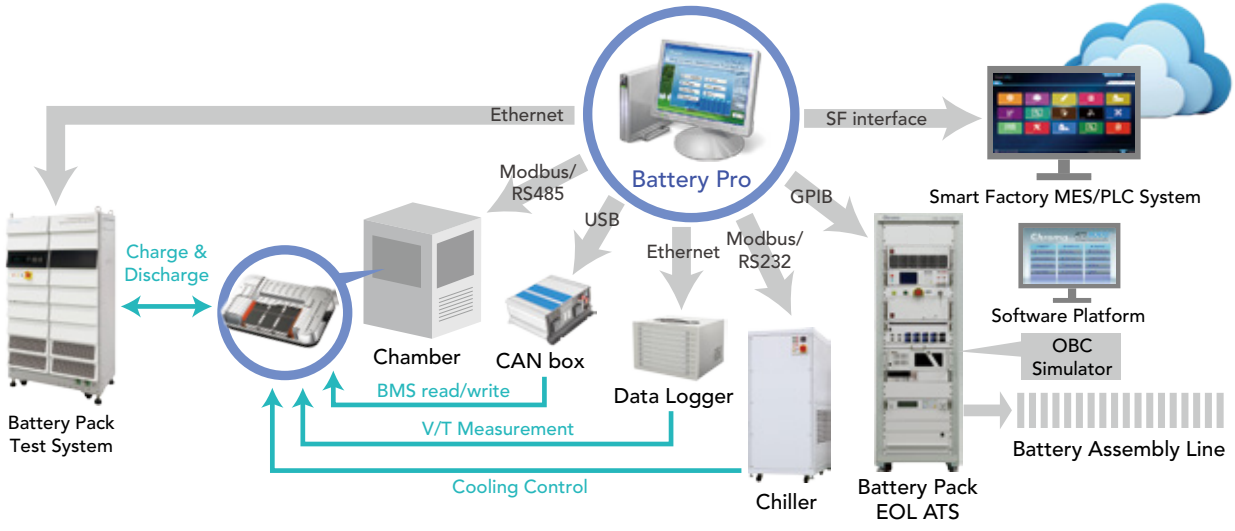
Data Analyzer

- ☑ One-click draft test diagrams
- ☑ User-defined chart and favorite features
- ☑ Comparison of multiple DUTs

System Integration

Chroma offers software integration technology to meet a wide range of testing needs. In combination with the fully automated test solutions and the high-speed product verification, this will reduce hassle and allow untroubled testing.

- ☑ Test functions include simulation of On-Board Diagnostics (OBD), real automotive working conditions, driving condition changes, as well as reading of standardized diagnostic trouble codes (DTCs) and CANbus signals (*.dbc), and load shedding protection verification.
- ☑ Software integration of a thermal chamber, data logger, and communication interface. During charging and discharging, it reads the external parameters and sets these as conditions for protection and cut-off.
- ☑ BMS communication interface software integration to support CAN, RS232, RS485, LinBus, SMbus, and other signals. During testing, it reads the modules' BMS parameters and can use these as conditions for protection and cut-off.



Battery Simulator | 17020/17040/17040E

The 17020/17040/17040E regenerative battery charger/discharger features a battery simulator for testing battery modules and related battery pack-connected products. With the battery simulator software, the 17020/17040/17040E can be used to simulate battery pack characteristics such as power level (SOC/Capacity), load battery characteristic curves, and configure the battery pack's series-parallel structure. Applications include testing various products such as automotive start-stop systems, motor control units, on-board chargers, and DC EVSE.

Key Features

- ☑ Battery pack output voltage control
  - Simulate and control the battery pack output
- ☑ voltage by setting up voltage, capacity and SOC
  - Intelligent efficiency calculation function
  - Battery pack pre-charge simulation
- ☑ Battery pack configuration: Set the configuration of the battery pack to simulate different voltages and capacities
- ☑ Battery cell curve importing: Import cell data into the software to simulate battery characteristics
- ☑ Pair with Chroma Battery Pro Charge/Discharge software to convert battery test data to battery characteristic data with one click

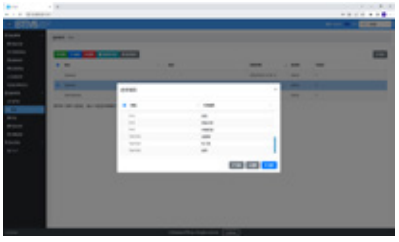
17020 17040 17040E

Battery Lab Management System Solutions

Battery Test Monitoring System | 17091

BTMS (Battery Test Monitoring System) is a battery test system monitoring platform developed for battery labs that enhances convenience and work efficiency. It has three main features:

- ☑ Centralized management: BTMS centrally manages accounts, authority, and recipes, simplifying test system maintenance
- ☑ System grouping management: battery test systems are grouped according to model and specifications, enabling users to better understand the capacity and usage status of various equipment
- ☑ Real-time monitoring: Users can connect to the BTMS via a browser for remote operation and monitoring, providing easy access to testing progress and equipment status



Permission Management

Set user operation authority based on different roles and projects involved.

- ☑ Roles setting: Set functional permissions that can be operated based on the user's job
- ☑ Project setting: Limit the users' work scope according to the projects they participate in

Recipe Management

Centrally manage recipe and battery specification parameter information to streamline system maintenance.

- ☑ Battery specifications upload and download: Edit battery specifications at one station and upload them for download at other stations
- ☑ Test plan upload and download: The test plan uploaded from one station can be downloaded at other workstations in the same group

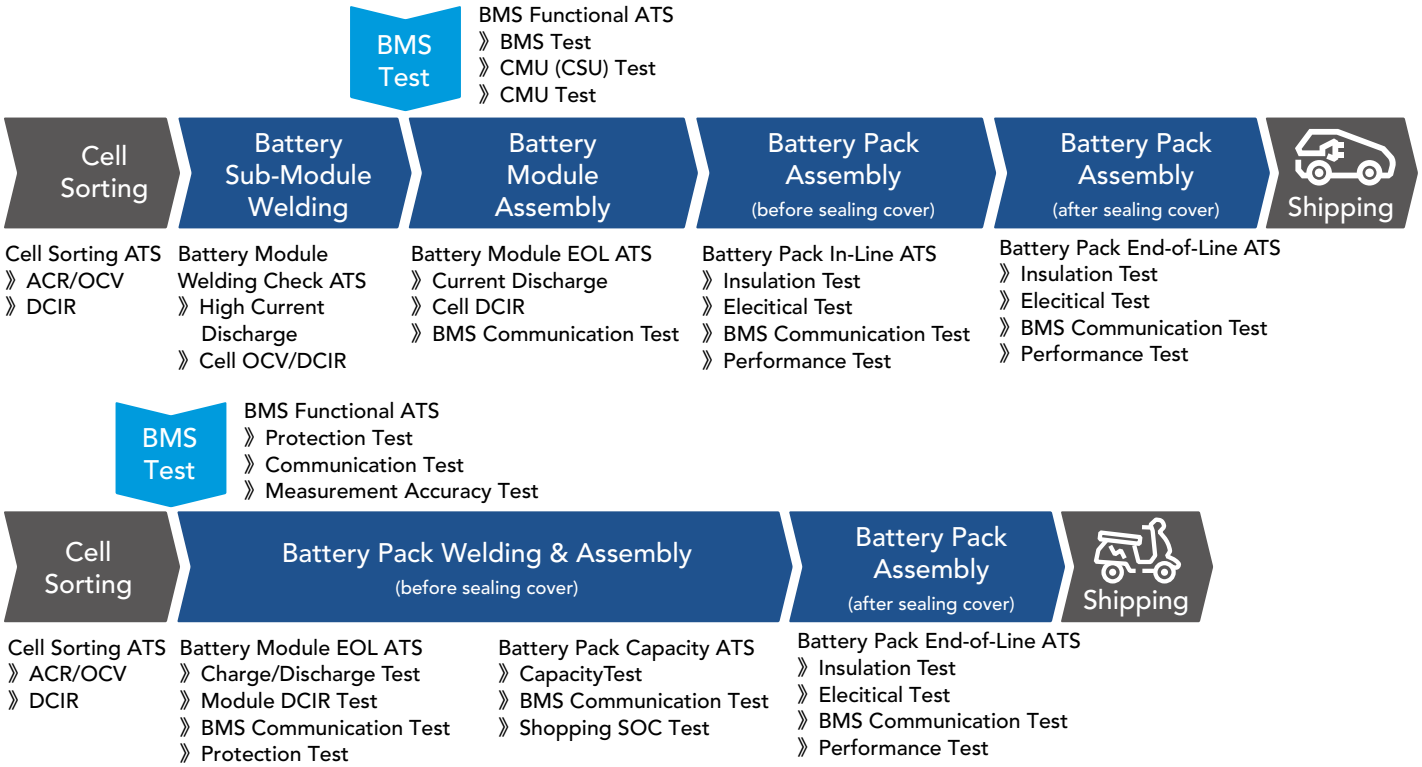
Real-time Monitoring

- ☑ Remote control: Remote viewing of channel operation status; pause, resume, stop, or start commands can be issued to the channel remotely
- ☑ Monitoring dashboard: Clearly grasp the overall system operating status through the laboratory monitoring dashboard

Battery Pack/System Production Line Solutions

Battery Pack/Module Production Line Testing Procedure

Chroma offers customized automated test systems for battery pack production lines, designed to test welding quality as well as semi-finished and finished battery modules. Integrated with third-party automation equipment for efficient production verification, these solutions ensure the quality of battery pack assembly at the end of the production line (EOL). This includes battery cell capacity assessment as well as module welding, BMS PCBA functional, module functional, and pack functional inspections



Battery Management System ATS | 8700

The Chroma 8700 BMS ATS is a test system for verifying battery pack BMSs. It is equipped with a multi-channel battery cell simulator, high-precision real current and high voltage source, programmable temperature simulator and isolation resistance simulator. The system can be configured to support master/slave and centralized architecture based on the DUT's specific needs.

Key Features

- ☑ Battery cell simulator
  - Cell state simulation test and calibration: 5V/ 5A/ 16CH
- ☑ High precision real current source
  - Current testing and calibration: charge/discharge current 600A or larger
- ☑ High precision voltage source
  - High voltage testing and calibration: 450V/600V/1000V
- ☑ Temperature simulator
  - Temperature testing and calibration
- ☑ Insulation resistance simulator
  - Insulation measurement circuit test and calibration: insulation resistance
- ☑ simulation under high voltage 1000V
- ☑ On-board Charger signal simulation: CC, CC2, CP signal
- ☑ Customized test items
- ☑ BMS communication tests

Distributed BMS Test System (96S)

Distributed BMS Test System (96S)

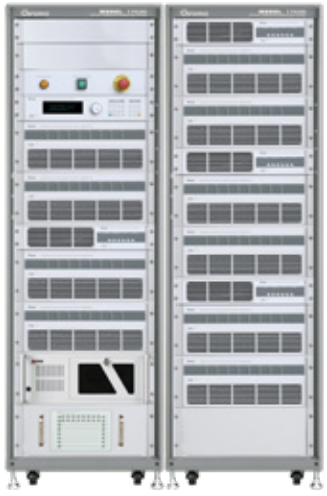
16CH Battery Cell Simulator | 87001

- ☑ Battery cell simulator mode: can simulate 240 cells in series/2 cells in parallel battery pack configurations
  - Channel power 25W; channel voltage 5V (in series); channel current 5A (up to 10A in parallel)
- ☑ 2 current ranges (0~250uA/0~500mA/0~5A/0~9A super modes)
  - 0~250uA: Used to determine whether the leakage current is too large
  - 0~500mA: For passive balanced line test requirements
  - 0~5A/9A: For active balanced line test requirements
- ☑ Control the battery cell simulator remotely with the SoftPanel
  - Individually adjust the voltage of each battery cell string
  - Set the voltage change procedure: OVP/UVP/OVP release/UVP release test
- ☑ Control commands and interfaces:
  - SCPI command via Ethernet port
  - CANbus commands via CAN bus cable
  - Command delivery time: 10ms (varies depending on unit configuration)

Multichannel real time monitoring panel

Battery Module Welding Check ATS | 8700

Chroma provides a customized battery module welding quality automated test system designed for highly efficient production verification of battery module welding quality.



Key Features

- ☑ Battery module welding tabs DC internal resistance measurement
- ☑ Battery module open circuit voltage test
- ☑ Battery module charge/discharge test
- ☑ Battery module DC internal resistance measurement
- ☑ Battery module cell strings DC internal resistance measurement

Battery Module Function ATS | 8700

Chroma provides a customized battery module function automated test system designed for highly efficient production verification of battery module quality after assembly.

Key Features

- ☑ Comparison of BMS readback data and device measurement values
- ☑ Battery module open circuit voltage test, DC internal resistance measurement, individual cell string DC internal resistance measurement
- ☑ Battery module charge/discharge test, charge/discharge over current protection test

Battery Cell Sorting ATS | 8700

Chroma provides a customized battery module function automated test system designed for highly efficient production verification of battery module quality after assembly.

Key Features

- ☑ Battery cell open circuit voltage test, AC/DC internal resistance measurement
- ☑ Designed with third-party production line automation manufacturer's mechanism for battery cell capacity sorting

Battery Pack End-of-Line ATS | 8720

The 8720 automated test system can be applied to the battery pack production line to perform the following pass/fail test items: insulation voltage, BMS communications, internal power switches, battery balancing consistency, and temperature distribution.

The application of this test solution is not limited to production lines. It also covers the final stages of R&D, incoming materials inspection of battery packs for EVs/ESS, and the routine battery pack inspection in battery swap mode. Automated test procedures prevent human errors and ensure personnel safety for applications such as battery packs for electric vehicles, electric scooters and energy storage systems.

Key Features

- ☑ For battery module production line or R&D unit testing and verification
- ☑ Improves product inspection efficiency and significantly reduces test time
- ☑ Charge and discharge power range: 5kW~600kW
- ☑ Standard test items: insulation test, version detection, software refresh, controller addressing, fault code detection, battery pack mode switching, temperature sensor detection, battery voltage detection, read and clear, insulation monitoring detection, voltage withstand test, signal line function detection, insulation resistance test, AC pile charging test, DC pile charging test, Y capacitance test
- ☑ Automatically switch for testing when used in an automated production line
- ☑ Automatically upload traceability report when integrated with Manufacturing Information System (MES)

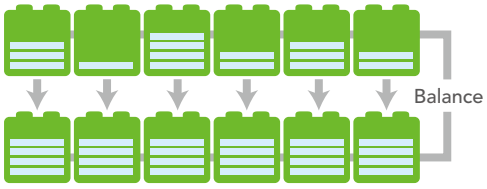
Battery Module/Pack Maintenance ATS | 8700

Battery Pack Function Testing and Battery Balancing

After a battery pack has been in use for a while, function testing and maintenance is required to extend battery life. Chroma 8700 Balance ATS is an automated test system designed for exactly that purpose. Internal resistance and battery capacity tests determine whether to continue to use the battery pack according to its deterioration rate. The ATS ensures the internal state of health within battery packs by inspecting the battery cell modules, internal resistance, and voltage. The system is also equipped with a balancing function that adjusts module and individual cell charge/discharge to restore the consistency between batteries. The real-time temperature status control ensures a safe testing process.

Key Features

- ☑ Module/battery cell independent charging and discharging function
  - Battery state simulation test and calibration: 1~5V (cell), 1~80V (module)
- ☑ Module /battery DCIR inspection
  - Compliant with IEC61960 DCIR test standard
- ☑ Module/cell capacity inspection
  - Ensure each module/cell's capacity status
- ☑ Module/cell voltage inspection
  - Ensure each module/cell's voltage status



Battery Test System Software Platform

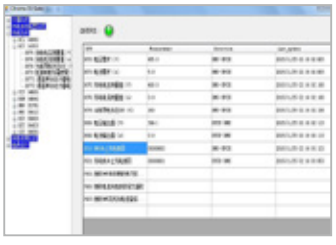
The Chroma 8700 ATS is equipped with Chroma Power Pro software, which is widely used in battery production line testing. The software platform has a range of secondary development features, allowing it to adapt to the constantly evolving needs of the battery industry. This provides users with an open software framework, including hardware control commands and the ability to create custom test items, automated test procedures, pass/fail judgment and test report generation.

Key Features

- ☑ Hardware expandable as per requirements
- ☑ Supports GPIB/RS232 or RS485/CAN interface instruments
- ☑ Editable test items
- ☑ Editable test programs
- ☑ Editable reports
- ☑ User authority and program release control
- ☑ Operation log
- ☑ Supports Shop-Floor
- ☑ Remote control via network

Software Main Panel


Customized Operating Panel


CAN Monitor


Test Reports

Battery Power HIL Test Solutions

Battery Pack Power HIL Testbed | 8610

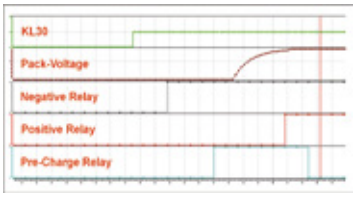
The Chroma 8610 battery pack integrated test system is specially designed for the development and design of battery modules and battery packs. Combined with an open software architecture, it provides users with a flexible and powerful dynamic test system, which can perform Hardware in Loop (HIL) tests such as importing vehicle models to simulate actual driving conditions on different road for charging and discharging, CAN signal measurement and control, fault injection, insulation measurement, and EVSE charging simulation, etc. The Chroma 8610 testbed implemented with flexible configurations can execute the most important compound scenarios for complete vehicle and composite operation conditions with the highest risk of failure (e.g. communication and physical signal errors during cyclic discharge). The system greatly improves R&D efficiency by performing more in-depth tests on battery packs without the need to test a real car.

Key Features

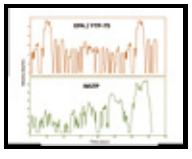
- ☑ Integrated Fault Injection Unit (FIU) hardware that simulates fault injection to complete ISO 26262 functional safety testing
- ☑ Supports importing various Simulink Model-Based designs to verify on-road battery dynamic charging and discharging through standard driving conditions like NEDC and WLTP
- ☑ Supports CAN, CAN FD, LIN communication interfaces
- ☑ Integrated AC/DC EVSE charge interfaces, incl. CAN Bus, PLC, and related control signals, for various compatibility tests to satisfy the needs of different charging specifications
- ☑ Real-time monitoring of timing sequences, incl. battery high voltage relay open/close, initial power output, and CAN signal
- ☑ Can measure and compare battery insulation and grounding status when integrated with a Hi-Pot tester
- ☑ Diversified modular hardware provides test accuracy and repeatability; expandable according to users' needs
- ☑ Supports upper layer automated test software through ASAM XIL and ASAM XIL-MA
- ☑ Independent PLC real-time monitoring ensures a safe testing process

Load reduction command to change charge/discharge output

Fault Injection



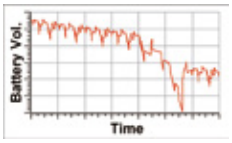
Timing Control & Measurment



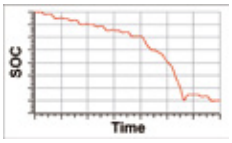
Integrated Testbed 8610

Battery Cycler 17040

Alarm



SOC v.s. Time



Voltage v.s. Time

EV Model

Key-on

Start Timing Detection

BMS Power HIL Testbed | 8630

The Chroma 8630 BMS Power HIL Testbed is a test platform that includes related modules such as real-time systems, high and low voltage instruments, human-machine interfaces, test project editing, system wiring and fixture integration. It can simulate various BMS input and output signals to perform a closed-loop test for real-time response requirements, as well as verification of various single functions of the BMS (e.g. monitoring and power calculation). The testbed's open software and hardware architecture provides high convenience and flexibility for system function adjustment and future modification.

In addition, the 8630 is able to import vehicle battery, drive system, road simulation and driving behavior models. After being fed actual vehicle conditions, it can carry out test items such as charge and discharge, CAN signal measurement and control, fault injection, insulation measurement and EVSE charging simulation. The system can also verify the fault conditions for the most important compound operation scenarios (such as a failure of the safety mechanisms during actual operation of the vehicle). This kind of system-level, compound working condition test capability greatly improves the test scope and reliability and eliminates the need to test a real vehicle.

Key Features

- ☑ Integrated Fault Injection Unit hardware injects simulated faults for comprehensive ISO 26262 functional safety testing
- ☑ Import a variety of Simulink Model-Based real-time vehicle models to verify the dynamic charging and discharging performance of EV batteries, under conditions that comply with NEWC, WLTP and other international standards
- ☑ Integration of the battery cell and current simulator enables real-time changes in dynamic cell voltage, balance current, and large actual current in the battery system
- ☑ The battery cell simulator is equipped with 5V/5A power to deliver the range of energy required for the cell's passive and active balancing functions
- ☑ Integrated Hi-Pot withstand voltage test equipment can measure and compare BMS insulation and grounding status

Battery Pack/System Electrical Safety Test Solutions

To enhance the performance and endurance of electric vehicles, multiple batteries need to operate in parallel at a voltage of 300V or more, which exceeds the regulated <60Vdc low voltage safety regulations. In order to protect the user, it is of high importance to comply with the electrical safety standards for the battery packs/systems. General inspection items for electrical safety assessments of battery packs and systems are:

- ☑ Hi-pot withstand voltage from the positive/negative battery terminals to the case body
- ☑ Hi-pot withstand voltage from the fast and slow charging ports to the case body
- ☑ Hi-pot withstand voltage between the condenser tube and the positive/negative battery terminals

Related Regulations

- ☑ IEC 62133-2 Safety requirements for portable sealed secondary lithium cells, and for batteries made from them, for use in portable applications
- ☑ UL 2054 Standard for Household and Commercial Batteries
- ☑ UL 2580 Batteries for Use in Electric Vehicles
- ☑ UL 2271 Batteries for Use in Light Electric Vehicle Applications

Hipot Analyzer | 19055-C

- ☑ ACW/DCW/IR
- ☑ High Frequency Contact Check (HFCC)
- ☑ Open Short Check (OSC)
- ☑ Corona Discharge Detection
- ☑ Floating output function
- ☑ GFI human body protection circuit

Electrical Safety Analyzer | 19032-P

- ☑ ACW/DCW/IR/GB/LC
- ☑ Dynamic Function Test (Function Test)
- ☑ Twinport Function (Hipot & Ground Bond)
- ☑ Open/Short Check (OSC)
- ☑ Floating output function
- ☑ GFI human body protection circuit

Power Electronics Test Instruments

Programmable Bidirectional DC Power Supply 62000D Series

- ☑ Output rating:
  6kW~18kW
  0~100V、600V、1200V、1800V
  0~540A
- ☑ High power density: 18kW in 3U height
- ☑ Simulation of I-V curves for photovoltaics, batteries and fuel cells
- ☑ Easy master/slave parallel & series operation up to 540kW
- ☑ Two-quadrant operation: source and load functions
- ☑ 3-phase 4-wire universal AC power: 200~480 Vac
- ☑ Applications: Charge-discharge testing and longevity testing, bidirectional car chargers, energy storage, PCS and energy feedback tests

Programmable DC Power Supply 62000E Series

- ☑ 3CH output models (1U height):
  Power rating: 1.7kW/CH;
  Voltage rating: 230V/300V/450V/600V
- ☑ Single output models (1U height):
  Power rating: 1.7kW/3.4kW/5kW
  Voltage rating: 230V/300V/450V/600V/800V/1000V/1200V
- ☑ Master/slave parallel up to a max of 20kW
- ☑ Fixed or Auto-ranging output models
- ☑ Suitable for EV component testing, D2D modules, batteries and other multi-channel power supply applications

Programmable DC Power Supply 62000H Series

- ☑ Output rating:
  5kW~18kW/0~1800V/0~375A
- ☑ 3U/18kW high power density
- ☑ Master/slave control interface for current sharing in parallel operation mode
- ☑ Voltage ramp function (time range: 10 ms~99 hours)
- ☑ Voltage & Current slew rate control
- ☑ Applicable to many automotive regulations for electrical characteristics testing, including ISO16750-2, GS95024-2, VW80000, LV123, and LV148
- ☑ Solar array simulation function

DC Electronic Load 63200A & 63200E Series

- ☑ Output rating:
  0~24kW
  0~150V/0~600V/0~1200V
  0~2000A
- ☑ CC, CR, CV & CP operation modes
- ☑ Master/Slave parallel control with power level up to 240kW
- ☑ User defined waveform for simulating real-world waveforms
- ☑ High-speed dynamic loading up to 20kHz and sine wave loading function
- ☑ Suitable for testing automotive components: D2D, OBC, fuel cell AC impedance, battery surge, etc.

Chroma

Headquarters
Chroma ATE Inc.
88 Wenmao Rd., Guishan, Taoyuan City 333001, Taiwan
T +886-3-327-9999 F +886-3-327-8898
info@chromaate.com www.chromaate.com

Chroma Syatems Solutions, Inc.
19772 Pauling, Foothill Ranch, CA 92610
T +1-949-600-6400 F +1-949-600-6401
sales@chromausa.com www.chromausa.com

Chroma ATE Inc. (U.S.A.)
7 Chrysler Irvine, CA 92618
T +1-949-421-0355 F +1-949-421-0353
Toll Free +1-800-478-2026
info@chromaus.com www.chromaus.com

Chroma ATE Europe B.V.
Morsestraat 32, 6716 AH Ede, The Netherlands
T +31-318-648282 F +31-318-648288
salesnl@chromaeu.com www.chromaeu.com

Chroma Germany GMBH
Südtiroler Str. 9, 86165 Augsburg, Germany
T +49-821-790967-0 F +49-821-790967-600
salesde@chromaeu.com www.chromaeu.com

Chroma Electronics (Shenzhen) Co., Ltd.
8F, No.4, Nanyou Tian An Industrial Estate, Shenzhen, China 518052
T +86-755-2664-4598 F +86-755-2641-9620
info@chromaate.com www.chroma.com.cn

Chroma Japan Corp.
888 Nippa-cho, Kouhoku-ku, Yokohama-shi, Kanagawa, 223-0057 Japan
T +81-45-542-1118 F +81-45-542-1080
info@chroma.co.jp www.chroma.co.jp

Chroma ATE Korea Branch
312, Gold Tower, 14-2, Pangyoyeok-ro 192, Bundang-gu,
Seongnam-si, Gyeonggi-do, 13524, Korea
T +82-31-781-1025 F +82-31-8017-6614
www.chromaate.co.kr info@chromaate.com

Quantel Pte Ltd. (a company of Chroma Group)
25 Kallang Avenue #05-02 Singapore 339416
T +65-6745-3200 F +65-6745-9764
sales@quantel-global.com www.quantel-global.com

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