

# Power Electronics Testing



## Electric Vehicle Test Solutions

[www.chromaate.com](http://www.chromaate.com)



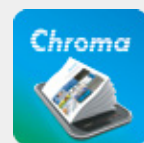
# Chroma

Test & Automation Turnkey Solution Provider

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Chroma ATE Inc., founded in 1984, is one of the world's leading suppliers of automatic test equipment providing test and measurement instrumentation and automatic test systems (ATS) for various companies in the electronics industries. In conjunction with manufacturing execution systems (MES), Chroma specializes in developing Test and Automation Turnkey Solutions to satisfy customer demands.

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

In addition to having 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 new test solutions with precision, reliability, and uniqueness. This is the key reason why Chroma is able to gain long-term support from customers for over 30 years.

## Manufacturing Capability and Service Support



Temperature & Humidity Cycling 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

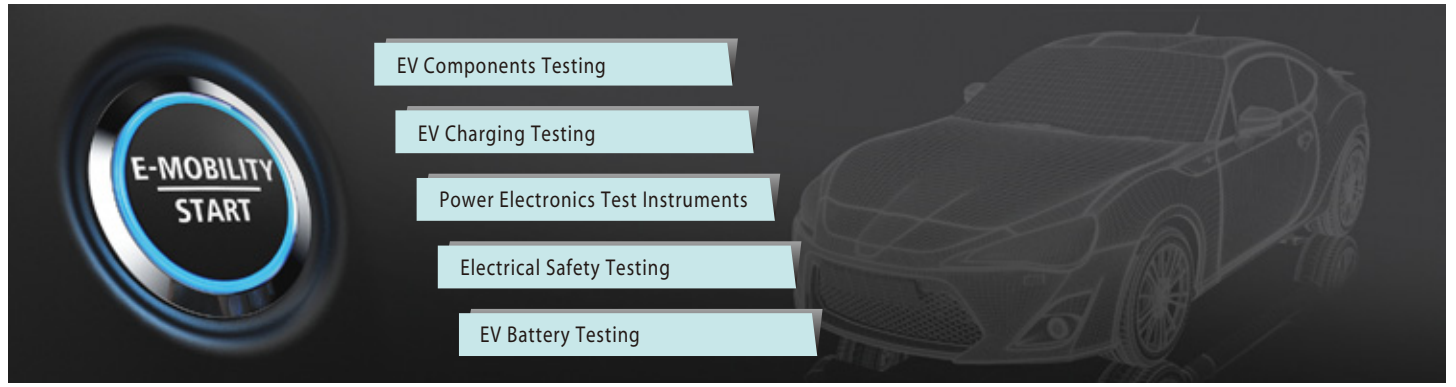


Calibration Lab



Local Support and Services

# EV Power Electronic Integrated Test Solutions



Battery Cell Charge & Discharge Test System



BMS PCBA ATS



Regenerative Battery Pack Test Systems



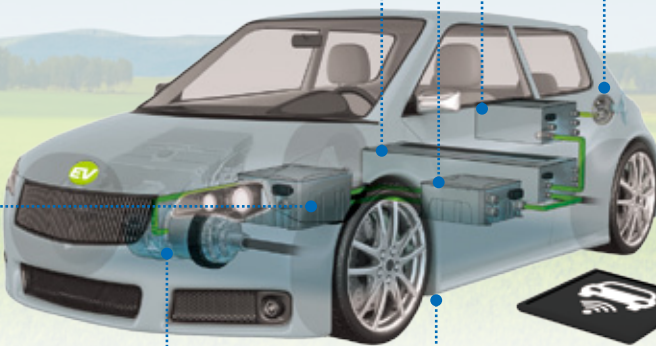
Battery Pack EOL ATS



OBC & DC-DC Converter ATS



EV AC/DC Charging Compatibility ATS



HCU(VMS/VCU) ATS



Motor Stator Test System



Electrical Safety Test System



Wireless Charger ATS



EVSE ATS



# EV Power Electronics Components Testing

## On-Board Charger (OBC) ATS | 8000

On-Board Charger (OBC) is an essential key component installed on each electric vehicle to convert the electric energy from public power grid to the DC power required by the energy storage device on board for charging. It dynamically adjusts the charging current or voltage parameters according to the data provided by the battery management system (BMS) to complete the charging process.

In addition to the OBC functions, the bidirectional OBC (BOBC) can convert the DC power from the energy storage device on board to the AC power supplying for V2L (Vehicle to Load) or V2G (Vehicle to Grid).

With complete AC and DC load product lines, Chroma is capable of providing automatic test systems for on-board chargers, which can verify their functionality and safety based on the product characteristics and testing requirements. This ATS is suitable for R&D verification/quality assurance/production line of EV components and electric car manufacturers. It has been adopted by world-renowned EV components suppliers, iconic EV manufacturers, and national accreditation laboratories.

### Key Features

- ✓ Built-in standard test items complying with PRC QC/T 895 standard requirements that can be called directly without reprogramming
- ✓ High precision to meet the industry's high reliability requirements
- ✓ Fast testing speed to meet the production line demands
- ✓ Support periodic/uninterrupted CAN Bus transmission
- ✓ Support DBC file loading for the parameters from CAN signal can be called at will



## DC/DC Converter ATS | 8000

DC/DC converter is able to convert the EV battery from DC high voltage to DC low voltage (12V/24V in usual) for headlights, wipers, and horns, etc.

To cope with the diversified EV models, bidirectional DC/DC converters have been developed for 48V hybrid vehicles, which makes it easier for bidirectional transmission to reduce the use of other electronic components. In addition to cost savings, it has the advantages of compact size and high efficiency. In terms of trends, the applications of bidirectional DC-DC converter will become more and more popular. Moreover, there is boost DC/DC converter dedicated to the fuel cell vehicles.

Chroma offers automatic test system for DC/DC converters to verify their functionality and safety based on the product characteristics and testing requirements. The power ranges from kilowatts to hundreds of kilowatts that are suitable for R&D verification/quality assurance/production line of EV components and electric car manufacturers. It has been adopted by world-renowned EV components suppliers, iconic EV manufacturers, and national accreditation laboratories.

### Key Features

- ✓ Built-in standard test items complying with the PRC GB/T 24347 standard requirements that can be called directly without reprogramming
- ✓ High precision to meet the industry's high reliability requirements
- ✓ Fast testing speed to meet the production line demands
- ✓ Support periodic/uninterrupted CAN Bus transmission
- ✓ Support DBC file loading for the parameters from CAN signal can be called at will





## Motor Control Unit ATS | 8000

A motor control unit is a device that controls the energy transmission between a power source and a driving motor. The drive receives many feedback signals from the motor and then the control board reacts based on them. Therefore, it is necessary to detect some important signals inside the drive to prevent it from no action or malfunction.

Before assembling a car, it is essential to verify that the drive is working and operating properly. Chroma's ATS can detect the control/drive board and the finished product line of motor control unit ensuring the drive makes correct responses when the internal motor or batteries are malfunctioning.

### Key Features

- ☑ Fast testing speed to meet the production line demands
- ☑ Support periodic CAN Bus transmission
- ☑ Customized as per customer's requirements (voltage/temperature/electrical signal/communication/protection, etc.)

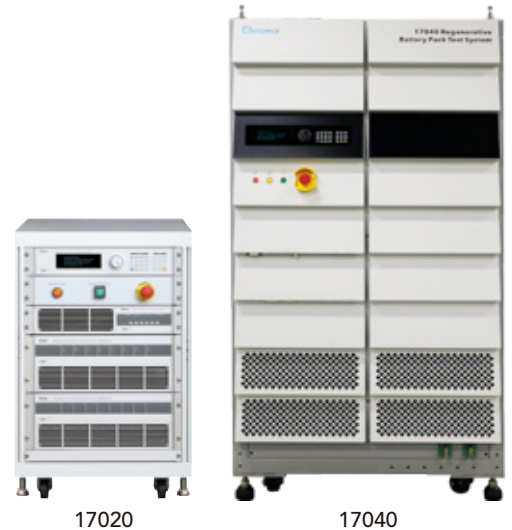


## Battery Simulator | 17020/17040

The 17020/17040 Regenerative Battery Pack Test System equipped with battery simulator function can test battery packs and the products connected to the battery. If the supplier's battery is not in place when designing and developing the product, the battery simulator function can be used to confirm whether the system function is normal. It can also use programs to control the SOC (status of charge) of battery, download different battery curves, test the product charging/discharging status for configuration evaluation. It is applicable for testing the automotive Mild-Hybrid 48V system, start-stop 12V system, motor driver, and on-board charger, etc.

### Key Features

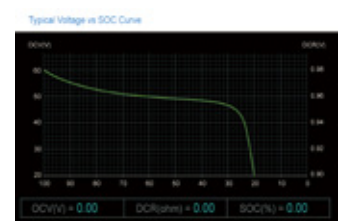
- ☑ Voltage : 30V, 60V, 100V, 200V, 500V, 1000V
- Current : Up to 2600A (17020) ; 900A (17040)
- Power : 10kW, 20kW, 30kW, 60kW, up to 360kW
- ☑ Battery pack output voltage control
  - Simulate and control the battery pack output voltage by set voltage, capacity and SOC
  - Intelligent efficiency calculation function
  - Battery pack pre-charge simulation
- ☑ Battery pack configuration setting : Import battery cell data to change battery pack character
- ☑ Battery cell curve import function: Import the battery cell data to simulate the real battery status



Battery simulator main window



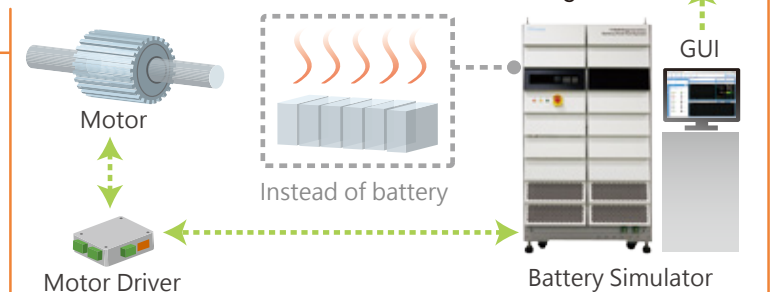
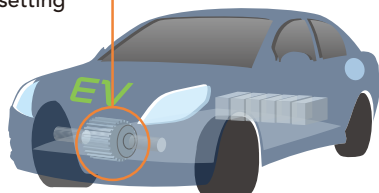
DCR setting



Battery characteristics V-SOC curve setting screen

### Battery Simulator Soft Panel (A170202)

- ☑ Support High power pre-charge and post-discharge control
- ☑ Support battery SOC setting



# EV Charging Testing

## AC/DC EVSE ATS | 8000

The EV charging devices can be divided into DC charger (fast charging), AC EVSE (regular charging) and AC/DC 2-in-1 EVSE to charge various electric vehicles by their power supply types. Since the communication interfaces and protocols between the EV and EVSE are different, the charging interfaces worldwide can be roughly divided into four regions (by connector types) and three major regulations.

Chroma has integrated the equipment required for testing including AC/DC source, AC/DC load, power meter, DSO, digital meter, and simulators and test items that meet national charging standards to form a Chroma 8000 AD/DC EVSE test system. The built-in test items include communication protocols between the charging device and EV to ensure the charging device can be switched smoothly in different modes in accordance with the EV status to maintain its functionality and safety. The test system is ideal for users to perform quick tests in R&D, verification or production line.

### Key Features

- ✓ Built-in standard test items complying with the PRC (GB/T18487.1, GB/T 27930, GB/T 34657.1&.2, GB/T 34658), CHAdeMO, DIN70121 test standards, etc.
- ✓ Provide electrical characteristics tests including communication protocol testing and simulation of real EVSE operation mode
- ✓ Able to simulate the open/short state of each signal line during charging to verify the corresponding protection and response time of EVSE
- ✓ Support periodic/uninterrupted CAN Bus transmission



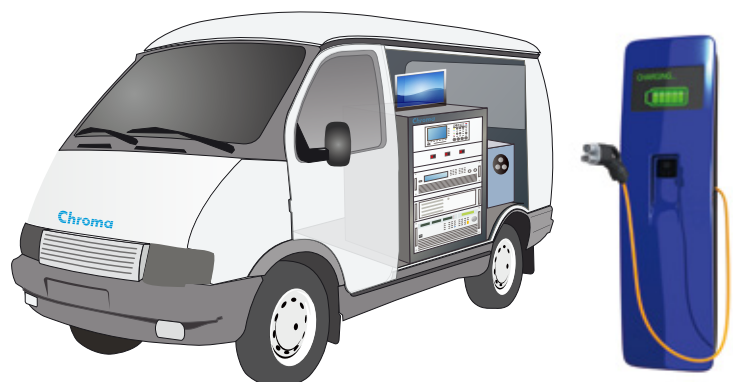
## Mobility EVSE ATS | 8000

The EVSE needs to use electronic detection and signal control technology to properly charge and communicate with the car. Meanwhile, it is necessary to measure the electrical energy transferred to car for billing. In order to maintain optimal operation of an EVSE and avoid damaging the battery, periodic diagnostic tests are required.

Chroma provides a customized mobile diagnostic test system specifically designed for verifying the EVSE that can detect if the signals and electrical operations are by standards and provide reports of test results.

### Key Features

- ✓ Built-in standard test items complying with the GB/SAE/IEC standards that can be called directly without reprogramming
- ✓ Support periodic/uninterrupted CAN Bus transmission



Mobility EVSE Test Application



## EV Charging Compatibility ATS | 8000

Presently the supply chains of charging devices and EV are different in development and production, though they both follow the same standards, the varied interpretations often caused the vehicle and pile unable to communicate and incompatible for charging. This affects people's willingness to buy electric vehicles, or even worse, it could cause damage and influence EV's popularity.

To tackle this problem, Chroma integrated the required equipment comprising AC/DC source, power meter, DSO, digital meter, simulators and test items that meet the international charging standards to develop a Chroma 8000 EV charging compatibility ATS. The built-in test items include:

1. Simulate the EVSE behavior based on the standards requirements and test if the EV can perform correct action or react properly when there is a signal error.
2. Test the EV response using the limit value of signal transmitted by EVSE according to the standards, and ensures the compatibility of various types of EVSE.

These are the mandatory essential test items for EV manufacturers!

### Potential risk of using real AC-DC EVSE for charging compatibility

- ☑ Unable to store the test waveforms in time for repeated verification
- ☑ Unable to determine whether the problem is on the EVSE or the car when the testing fails
- ☑ Unable to protect the vehicle when the EVSE is malfunction.
- ☑ The EVSE cannot be used anymore and must be repurchased when the national standards are modified

### Advantages for using Chroma test system

- ☑ Follow various standards in the world for repetitive testing
- ☑ All data can be store with traceability
- ☑ Disconnect and protective the vehicle when problem occurs during charging
- ☑ Able to update the software in time when the standards are modified

### Key Features

- ☑ Built-in standard test items complying with the PRC (GB/T18487.1, GB/T 27930, GB/T 34657.1&2, GB/T 34658), CHAdeMO, DIN70121... test standards
- ☑ Provide electrical characteristics tests including communication protocol testing and simulation of real EVSE operation mode
- ☑ Able to set the EVSE signals value to be normal, limit and the over limit for compatibility test
- ☑ Able to simulate the open/short state of each signal line during charging to verify the corresponding protection and response time of EVSE
- ☑ Support periodic/uninterrupted CAN Bus transmission

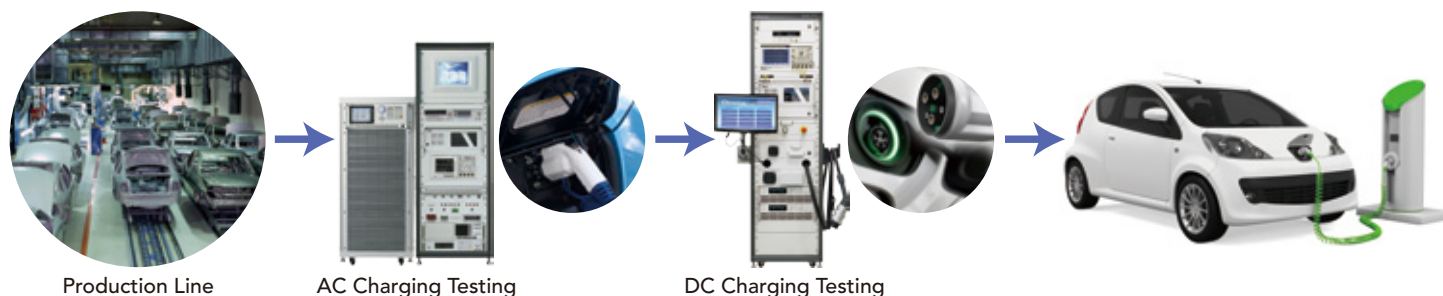


DC Charging Compatibility ATS



AC Charging Compatibility ATS

## EV Assembly line (Charge Compatibility) Test Solution





# EV Charging Testing

## EV Wireless Charging ATS | 8000

Wireless electric vehicle charging (WEVC) is the latest EV charging technology that can be applied to the cutting-edge EV charging systems equipped with automated driving and wireless power transfer (WPT) technologies. Compared to the conventional cable charger, WEVC is safer and more convenient without any concerns for wearing out the charging connector or getting electric shocked. Same as the bidirectional on-board charger, the WPT technology nowadays is able to convert the DC power on the vehicle energy storage device to AC power paralleled to the public power grid.

Chroma supplies EV wireless charging ATS to verify the products functionality and safety based on their characteristics and testing requirements. It is suitable for R&D verification/quality assurance/production line of EV components and electric car manufacturers. The system has been adopted by world-renowned EV components suppliers, iconic EV manufacturers, and national accreditation laboratories.

### Key Features

- ✓ High precision to meet the industry's requirements for high reliability
- ✓ Chroma WPT test platform providing 3-axis or 6-axis automated test to shorten the test efficiency of misalignment
- ✓ Metallic foreign object detect(FOD) automated test application
- ✓ Compliant with SAE J2954 and IEC61000-4-11 for testing Voltage Dips, Short interruptions and voltage variations immunity tests
- ✓ Compliant with SAE J2954 and EN60204-1 for testing and simulating AC input voltage distortion waveform



## ATS Software Platform | Power Pro III

The Chroma 8000 ATS is equipped with an industrial leading software platform, Power Pro III, which runs under the Windows 7/10 operating environment, providing users with an open software architecture. It allows users to configure the hardware devices as desired, program the test items, test automatically for PASS/FAIL, and generate reports for analysis.

### Key Features

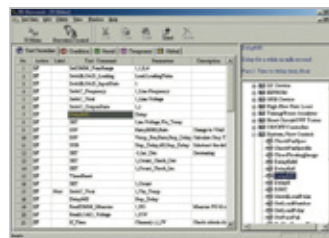
- ✓ Hardware devices expandable as per requirements
- ✓ Support GPIB/RS232 or RS485/CAN interface instrument
- ✓ Editable test items
- ✓ Editable test programs
- ✓ Editable reports
- ✓ User authority and program release control
- ✓ Operation log
- ✓ Support Shop-Floor
- ✓ Remote control via network



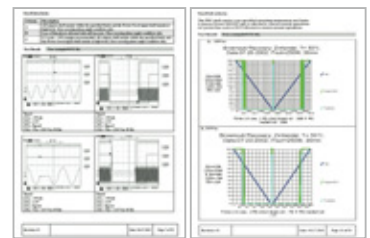
Software Main Panel



Customized Operating Panel



Test Item Editor



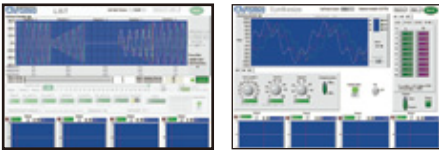
Test Reports





## Programmable AC Source 61500 Series Regenerative Grid Simulator 61800 Series

- ☑ Output characteristics :  
0.5kW-60kW / 1 or 3-phase
- ☑ 150V/300V, 15Hz-1000Hz (61500 Series)
- ☑ Up to 300kW in parallel (61800 Series)
- ☑ Full four-quadrant with regenerative function (61800 Series)
- ☑ Grid simulation with AC load option, applicable for V2G/V2H EV and microgrid simulation test

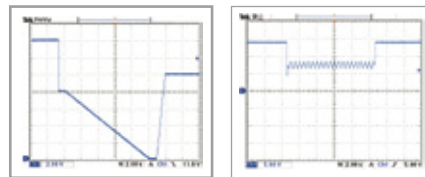


Programming Sudden Voltage      Editing Output Waveform



## Programmable DC Power Supply 62000H Series

- ☑ Output characteristics :  
5kW-15kW / 0-1000V / 0-375A
- ☑ 3U/15kW high power density
- ☑ Simple master/slave operation and up to 1.5MW when connected in series or parallel
- ☑ Comply with road vehicle standards (ISO16750-2, GS95024-2, VW80000, LV123) for automotive electronic components testing



Battery Voltage Drop Simulation      ISO 16750-2 Start Voltage Curve Test

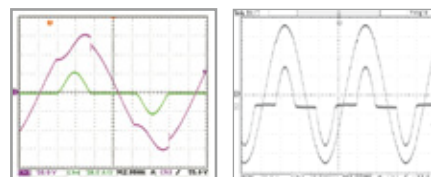
## Programmable DC Electronic Load 63200A Series

- ☑ Output characteristics :  
0-24kW/0-150V/0-600V/0-1200V/0-2000A
- ☑ CC, CR, CV, CP modes
- ☑ Master/Slave parallel control mode with power up to 240kW
- ☑ User defined waveform to simulate the current waveform on actual load. Up to 20kHz high-speed dynamic load simulation and sine wave loading simulation are suitable for testing automotive components such as D2D, OBC, relay, temperature control MCU, car generator, fuse, harness, and wiper. It can also simulate power window, fuel cell AC impedance, and start battery surge, etc.

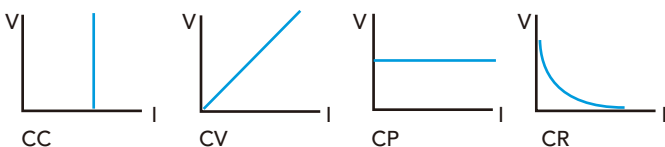


## Programmable AC/DC Electronic Load 63800 Series

- ☑ Output characteristics :  
1.8kW-4.5kW  
50Vrms-350Vrms  
45-440Hz
- ☑ Measurement : V, I, PF, CF, P, Q, S, F, R, Ip+/-, THDv
- ☑ Master/Slave up to 67.5kW in 3-phase mode
- ☑ Able to simulate the rectified RLC mode and suitable for bidirectional OBC and AC EVSE inverter (V2H) for AC voltage distortion VTHD%, dynamic, and protection parameters



Rectified RLC Mode Simulation      Setting Crest Factor



# Electrical Safety Testing



Electrical safety test is the most important for electric vehicles as persistent electrical quality is requisite for the drivers that have to drive the cars every day. For the environment the electric vehicles are in use, the application of electrical safety covers the power system, the charging system, the power wiring, the charging line, the charging connector and the EVSE, etc.

## Standards

- ✓ Insulation resistance test (ISO 6469-1, GB/T 18384-1)
- ✓ Withstand voltage test (ISO 6469-3, GB/T 18384-3)
- ✓ Continuity test for potential equalization (ISO 6469-3, GB/T 18384-3)
- ✓ Related standards: UL 2202, UL 2251, ECE R100, UL 2580, GB 18488



19032 Series



19200

## Electrical Safety Analyzer 19032 Series

- ✓ Combines AC/DC hi-pot test, insulation resistance (IR) test, ground bond GB) test, dynamic leakage current test (LC/ALC/DLC) and dynamic function test
- ✓ Equips the state-of-the-art Open Short Check (OSC) function that can make customers totally worry-free when testing the finished products

## Electrical Safety Test Scanner 19200

- ✓ Relay control and Module system
- ✓ Supporting WV/IR/GB Test, Function Test



8900

## Electrical Safety ATS | 8900

The safety testing requirements of EV related products have more standards than the general electricity products in terms of testing items and multi-channel points. Therefore, Chroma 8900, Electricity Safety ATS, has provided an outstanding integrated testing solutions and multi-channel points to the customers.

## Wound Component EST Analyzer 19036

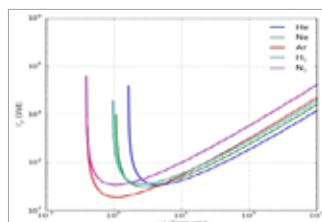
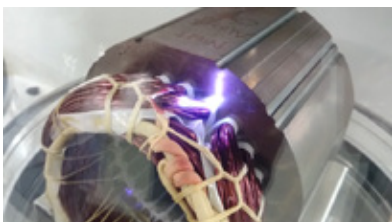
- ✓ 5-in-1 EST analyzer (AC hi-pot, DC hi-pot, insulation resistance, layer short circuit, DC resistance)
- ✓ Hi-pot test: 5kVac / 6kVdc
- ✓ HSCC (high speed contact check)
- ✓ Insulation resistance (IR) test: Max. 5kV
- ✓ Impulse winding test (IWT)
- ✓ DC resistance test
  - 10-channel 4-wire DC resistance test
  - $\Delta$  type/Y type motor winding resistance calculation
- ✓ L/Q measurement with model 3252 (option)



19036

## Motor Stator Test System | 1920

The motor stator is like the heart of an electric car. Its quality is very important as it matters to the driver's safety. In addition to the basic electrical safety testing for EV motor stators (AC hi-pot, DC hi-pot, insulation resistance, layer short circuit, and DC resistance), the 1920 can also be used with a vacuum cap to detect the motor stator pinhole in a vacuum environment (about 1~1.5 Torr) to improve the quality, lifespan, and safety of a motor stator.



1920





## Battery Charge & Discharge Test System | 17011

Chroma 17011 battery charge and discharge test system is a high precision test equipment specifically designed for testing the energy storage components like lithium-ion battery cell (LIB Cell), electric double layer capacitor (EDLC) and lithium-ion capacitor (LIC). The system is suitable for product development, quality control, characteristics research, cycle life testing, product selection and quality assessment. The 17011 has developed high-precision linear circuit series and high-efficiency energy renewable series for different applications. The linear circuit series is feasible for testing small and medium energy storage components with very low output noise and ultra-high measurement accuracy while the energy regenerative series is suitable for testing large or power type storage component with merits in high efficiency, energy saving, and low heat.

10V  
6A



17216M-10-6

6V  
30A



17208M-6-30

### High-precision Linear Circuit Series

17216M-10-6

Voltage range : -5V~+5V/ 0~+5V/ 0~+10V

Current range : 200μA/6mA/200mA/6A

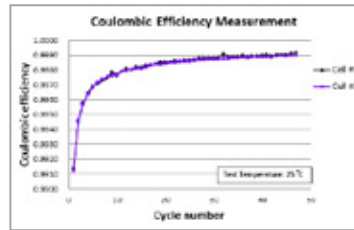
17208M-6-30

Voltage range : 0~+6V

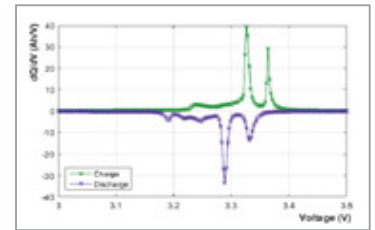
Current range : 1mA/100mA/10A/30A

### Key Features

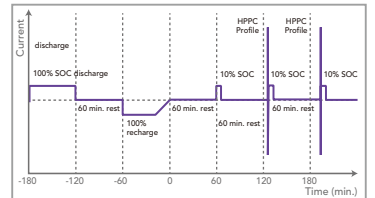
- ✓ Voltage measurement accuracy:  $\pm 0.015\%$  F.S.
- ✓ Current measurement accuracy:  $\pm 0.02\%$  F.S.
- ✓ Fast current response time < 100μS
- ✓ Auto switching multi-current range with no interruption
- ✓ Up to 10mS high data sampling speed
- ✓ Up to 64 expandable channels
- ✓ LIB discharge measurement
- ✓ Built-in multiple operating modes
- ✓ CC/CV/CP/CR/CC-CV/CP-CV
- ✓ Built-in DCIR test function in compliance with IEC 61960 standard
- ✓ Built-in EDLC/LIC test function in compliance with IEC 62391/IEC 62813 standard
- ✓ Able to integrate with multi-functional temperature data logger and temperature and humidity cycling test chamber



Coulomb Efficiency test



dQ/dV Test



HPPC Test

### Energy Regenerative Series

Model 17212R-5-60

Voltage range : 0 ~ +5V

Current range : 60A

Model 17212R-5-100

Voltage range : 0 ~ +5V

Current range : 100A

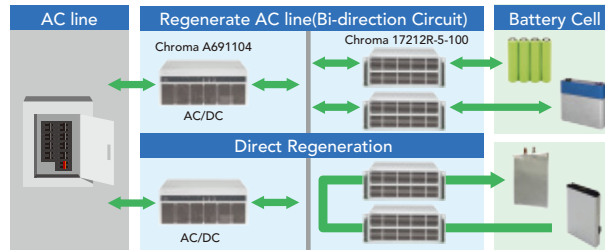
Model 17212M-6-100

Voltage range : 0 ~ +6V

Current range : 25A/50A/100A

### Key Features

- ✓ Voltage measurement accuracy:  $\pm (0.02\% \text{ rdg.} + 0.02\% \text{ F.S.})$
- ✓ Current measurement accuracy:  $\pm 0.05\%$  F.S.
- ✓ Fast current response time < 10 mS
- ✓ Discharge energy renewable function up to 80% efficiency
- ✓ Up to 1200A output for paralleled channels
- ✓ Up to 48 expandable channels
- ✓ Dynamic waveform simulation (current/power mode)
- ✓ Built-in HPPC test function in compliance with USABC standard
- ✓ Built-in DCIR test function in compliance with IEC 61960 standard
- ✓ Built-in EDLC test function in compliance with IEC 62391 standard
- ✓ Able to integrate with ripple current superposition unit
- ✓ Able to integrate with multi-functional data logger and temperature and humidity cycling test chamber



17011 System : 100A, 41U

# EV Battery Testing

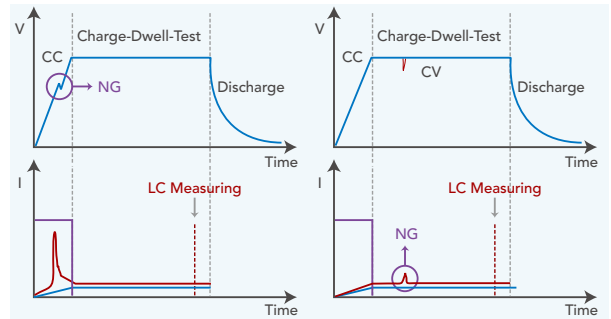
## Battery Cell Insulation Tester | 11210

With the development of the green energy industry, the demand for batteries continues to grow. The insulation hi-pot test is a very basic and important process for batteries during production as quality and safety are two major criteria. The test not only needs to filter out the defect products but also inspect their quality.

The Chroma 11210 battery cell insulation tester can accurately measure the battery jelly-roll/dry-cell or the leakage current (LC) and insulation resistance (IR) of other insulating materials. Moreover, the 11210 can detect if there is any internal partial discharge/flashover occurred during high-voltage detection to filter out the defective products before filling the electrolyte, preventing any potential hazards from occurring. The 11210 provides a completely new concept for detecting the battery quality contrasted to the traditional insulation test method.

### Key Features

- ✓ DC voltage measurement: Up to 1KV (dc)
- ✓ Charging current measurement: Max. 50mA
- ✓ Precision wide range leakage current (LC) detection (10pA ~ 20mA)
- ✓ Insulator internal partial discharge/ flashover detection (option)
- ✓ Built-in contact check function
- ✓ Automatically test in sequence: Charge→Dwell→Test→Discharge
- ✓ High speed and accurate measurement (20ms/device)
- ✓ Suitable for various types of capacitance LC/IR measurement in addition to the battery cell insulation test



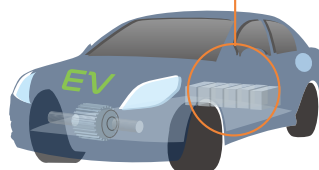
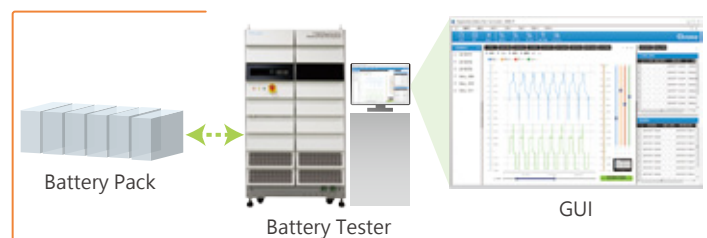
PD/Flashover detection in both the CC (charging) & CV (measurement) phase

## High Power Regenerative Battery Pack Test System | 17040

The Chroma 17040 Regenerative Battery Pack Test System is a high precision system specifically designed for secondary battery module and pack tests. It has an energy regenerative function to greatly reduce power consumption during discharge. Besides bringing huge economic effects to users, it also solves the problem of heat generated from work area and meets the environmental protection requirements. The system has built in parallel channels and dynamic profile simulation functions that can increase the efficiency and flexibility of device usage. The profile simulation is in line with the ISO, IEC, UL and GB international testing standards.

### Key Features

- ✓ Voltage : 60V~1000V  
Current : 150A, 300A, 450A, 600A, 750A  
Power : 60kW,120kW, 180kW, 250kW, 300kW
- ✓ High precision measurement  
Voltage :  $\pm 0.02\%$  rdg.+0.02% F.S.  
Current :  $\pm 0.05\%$  rdg.+0.05% F.S.
- ✓ Support CC/CV/CP/DCIR charging/discharging mode
- ✓ Dynamic power or current waveforms to simulate the drive cycle or any real world application
- ✓ Current response speed (10 to 90%): 1ms
- ✓ Fastest report sampling speed: 2ms
- ✓ System integration capability:  
Temperature chamber, multi-channel voltage/temperature data logger, and BMS
- ✓ Auto bidirectional voltage source with optional battery simulator function
- ✓ Regenerative battery energy discharge >90%



- ✓ Support current waveform loading simulation of real vehicle
- ✓ Dynamic battery discharge and charge function
- ✓ Support up to 10ms periodic CAN Bus communication via BMS
- ✓ Support DBC file import for CAN signal reading and calling
- ✓ Support UDS diagnostic service command set





## Regenerative Battery Pack Test System | 17020 & 17020E

The 17020 Series can be configured as per customer's requirements for the UUT amount and specifications. It supports up to 60 channels of independent or parallel operation. The 17020E is specifically designed for testing the battery modules and 100V Battery packs during mass production. Both systems are equipped with multiple independent channels to support dedicated charge/discharge tests on multiple battery modules/packs, each with discrete test characteristics. Channels can easily be paralleled to support higher current requirements achieving a high utilization rate of the equipment.

- ☑ High precision current/voltage measurement
  - Voltage : 0.02% rdg.+0.02% rng.
  - Current : 0.1% rdg. + 0.05% rng.
- ☑ Dynamic charge/discharge current waveforms to simulate the DRIVE CYCLE or actual application
  - Ability to import the current waveforms from an Excel file and store a maximum of 720,000 points to memory
  - Maximum charge and discharge current switching speed for 10ms
- ☑ V/I sampling rate: Capture test data per 50 KHz for more accurate capacity calculation
- ☑ Built-in DCIR function (IEC61960-2004)
- ☑ Battery discharge energy regenerative function achieves energy saving, environmental protection, low heat output
  - Regenerative battery energy discharge up to 85% efficiency (regenerate to grid) when the rated power is over 20%

### Key Features - 17020

- ☑ CC/CV/CP charge/discharge (parallel control up to 60 channels)
  - Voltage: 0~20V, 60V, 100V, 200V, 500V
  - Current: Up to 2600A for parallel
- ☑ Power: 600W, 1.25kW, 2.5kW, up to 60kW for parallel

### Key Features - 17020E

- ☑ CC/CV/CP charge/discharge (parallel control up to 800A per channel)
  - Voltage: 60V, 100V
  - Current: Up to 800A for parallel
- ☑ Power: 10kW, 20kW, up to 80kW for parallel



17020 System for flexible customized configuration



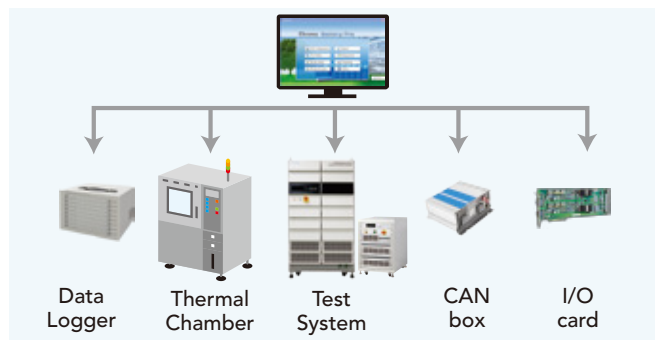
17020E System for mass production cycle test

## Battery Charger and Discharge Test Software Platform | Battery Pro

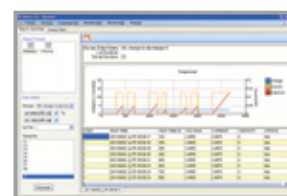
Battery Pro is specifically developed software platform for testing secondary battery packs that can be applied to 17040, 17020 and 17020E systems with multilingual interface support (Traditional Chinese/Simplified Chinese/English). It has real-time status monitor and icon manager, authority management, fault record tracking and security detection, data storage and recovery during power failure functions. The system can integrate temperature chamber, data logger, and communication interface devices through Battery Pro, and read external parameters to enable protection or cut-off condition during charging or discharging process.



Main panel



Real time monitoring multi-channel panel



Plentiful reports

## Battery Management System ATS | 8710

The Battery Management System (BMS) manages the batteries, which is usually capable of measuring the battery cell voltage preventing abnormal conditions such as over discharge, over charge, and over temperature, etc. from occurring. Many functions are gradually added in the wake of technology development. The common functions include voltage measurement, communication, SoC and SoH estimation, abnormal warning and protection, equalization (passive or active), other control circuits (such as battery loop relay control), temperature and current measurement, and diagnosis tool simulation.

The Chroma 8710 BMS ATS is a test system for verifying battery management system (BMS) of battery packs. It is a device equipped with multi-channel battery cell simulator, high-precision real current and high voltage source, programmable temperature simulator and isolation resistance simulator. The system structure can be configured to support master/slave and centralized architecture based on the UUT designed from the customer.

### 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 measurement testing and calibration
- ☑ Isolation 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
- ☑ CANBUS communication related tests
  - Periodical CANbus frame with check sum (Customized check sum service): min 10ms per CAN frame
  - Equipped with "Unified Diagnostic Services (UDS)" battery management capability
  - Support \*.dbc format parsing function

## 16CH Battery Cell Simulator 87001

Chroma 87001 Battery Cell Simulator is a high precision, programmable, and bidirectional DC power source with both voltage source and current source functions. In addition, the model can be used as a multi-channel DC power supply or an electronic load as well. A single simulator has 16 channels and each of them can set voltage and current respectively via software.

- ☑ Battery cell simulation mode: Maximum 480 cells in series for simulation
  - Channel power 25W
  - Channel voltage 5V
  - Channel current 5A (parallelable)
- ☑ 2 current ranges (0~5A/0~500mA)
  - 0~5A range meets the active balance design circuit test requirements
  - 0~500mA range meets the passive balance design circuit test requirements and current consumption measurement of each cell.
- ☑ Provide soft panel to remote control battery simulator
  - Individually adjust the voltage of each string battery, up to 50ms refresh rate
  - Access the battery cell curve loading function to view voltage status changes according to the voltage compared with SOC
  - Set the voltage change procedure: OVP/UVP/OVP release /UVP release test
- ☑ Can be integrated via software commands to become an HIL test system of BMS



Integrated BMS test system (32S)



Distributed BMS test system (96S)



Multichannel real time monitoring panel





## Battery Pack EOL ATS | 8720

The Chroma 8720 ATS can be applied to testing the battery packs in end of line (EOL) production for comprehensive Pass/Fail tests including mechanism assembly process, pressure insulation, BMS communication, internal high voltage relay parts, battery balance, and temperature measurement, etc. before the product is completed.

The application of this test solution is not limited to production line. It can also be used to do a comprehensive inspection on the incoming battery packs during end of research or for EV/energy storage station. Automated tests avoid human errors and ensure personal safety, which is crucial for EV, electric scooters, and battery modules for energy storage systems.

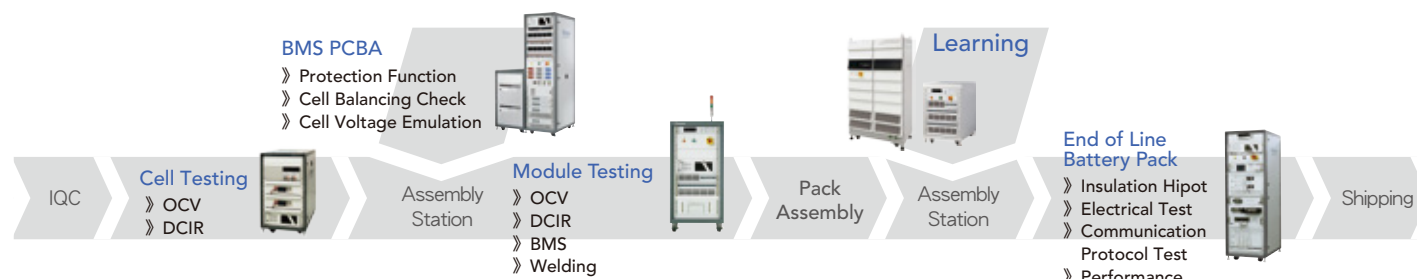
### Key Features

- ☑ Specifically for battery module production or R&D unit testing and verification
- ☑ Improve product inspection efficiency and greatly reduce test time
- ☑ Charge and discharge power range: 5kW ~ 500kW
- ☑ Charge and discharge voltage/current range: 0V~1,000V/0A~2,600A
- ☑ Standard test items: Insulation test, electrical test, BMS communication test, performance test
- ☑ Achieve auto switch for testing when used in tandem with automated production line
- Auto upload traceability report when integrated Manufacturing Information System (MES)



## Battery Module / Battery Pack Production Line Test Process

Chroma provides customized ATS for each station in the battery pack production line with automation companies to perform high efficiency production verification, including cell sorting test, module assembly inspection, BMS PCBA test, and battery pack EOL test.

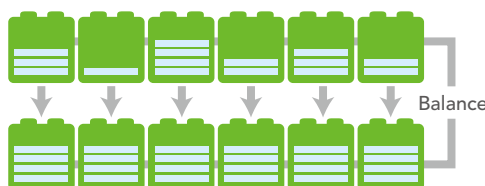


## Battery Balance Maintenance ATS | 8700

When the battery packs are used or placed for a period of time, functional test and maintenance are required to extend the battery cell life. The Chroma 8700 Balance ATS can apply to inspecting the battery module, cell internal resistance and voltage status in the battery pack ensuring the internal unit condition. In addition, it has module/battery cell independent charging and discharging for balance as well as temperature status monitoring functions.

### Key Features

- ☑ Module/battery cell independent charging and discharging function
  - Battery state simulation test and calibration:  
1V~5V (cell) · 1V~80V (module)/ 20A
- ☑ Module /battery DCIR inspection
  - In compliance with IEC61690 DCIR test standard
- ☑ Module/cell capacity inspection
  - Ensure each module/cell capacity status
- ☑ Module/cell voltage inspection
  - Ensure each module/cell voltage status



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