

# Power Electronics Testing

## Electric Vehicle Test Solutions

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



**Chroma**

Turnkey Test & Automation Solution Provider



Headquarters: Hwa-Ya Technology Park, Taiwan

Chroma, founded in 1984, is one of the World's leading suppliers of Automatic Testing Equipment (ATE) and provides test and measurement instrumentation and systems for various technology related industries. We specialize in turn-key test and automated solutions, which work in conjunction with manufacturing execution systems (MES).

Chroma's strength lies in test and measurements for: power electronics, passive component, electrical safety, video & color, LCD/LCM, automotive electronics, and semiconductor industries. More importantly, Chroma supports the clean energy initiative by providing solutions to test photovoltaics, LEDs, Li-batteries, power battery packs, electric vehicles and any ongoing new eco-driving industry developments.

In addition to having a large diverse group of R&D engineers, Chroma puts a large investment 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 success in providing innovative new test solutions with precision, reliability, and uniqueness.

## Chroma Group & Global Operation Sites



### CHROMA GROUP

### CHROMA ATE INC.

Neworld H.K.	MAS Automation/Taiwan	Chroma Investment	Chroma New Material	Testar Electronics
Chroma/Shenzhen	MAS Automation/Nanjing	Chroma/USA	Novatest Electronics	EVT Technology
Chroma/Suzhou	MAS Automation/Xiamen	Chroma/Netherlands		DynaScan Technology
Chroma/Shanghai		Chroma/Finland		ADLINK Technology
Chroma/Beijing		Chroma/Japan		
Chroma/Dongguan				
Chroma Xiamen				

## Power Electronics Test Instruments

Over the years, Chroma ATE has gained extensive knowledge and know-how through participation in the electronics test industry by providing the right solution throughout different phases of product development and fabrication. These test solutions are not limited to power testing and are offered throughout the EV/PHEV industry.

Chroma ATE offers various AC/DC power source and electronic load products with a broad selection of power ratings, ranging from several hundred watts to a few hundred kilowatts, which can be used to test EV/PHEV related components and devices. Utilizing these in conjunction with our versatile Automated Test System, provides a full range of test solutions for EV/PHEV related applications such as battery storage system, EVSE charger station, DC/DC converter unit and motor traction drivers.



### Programmable AC Source 61500 Series

0.5KW-18KW/ 1 or 3-phase  
150V/300V, 15Hz-1000Hz  
Parallelable for higher power up to 180KW



Transient Voltage  
Programming

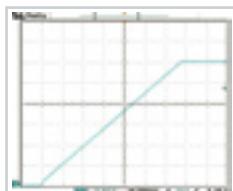


Distorted Waveform  
Editor

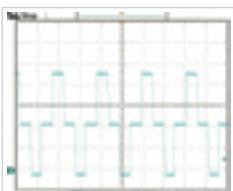


### Programmable DC Power Supply 62000H Series

5KW-15KW/ 0-60DV/ 0-375A  
High power density (15KW in 3U)  
Easy Master / Slave parallel & series  
operation up to 150KW



Voltage Ramp Function



Programmable Voltage  
Sequence

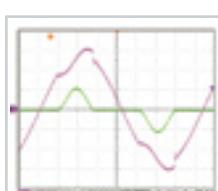
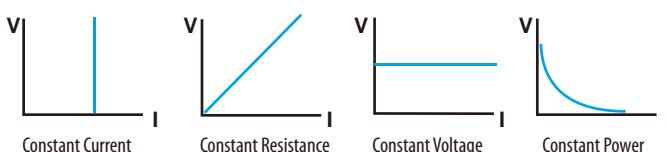
### Programmable DC Electronic Load 63200 Series

2.6kW-15.6kW/ 0-80V/ 0-500V/ 0-1000A  
CC, CR, CV, CP load modes  
Master/Slave paralleling control mode  
up to 6 units  
Dynamic loading: Up to 20kHz

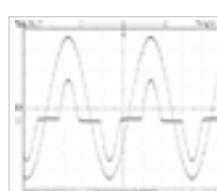


### Programmable AC Electronic Load 63800 Series

1.8KW-4.5KW/ 50V-350V/ 45-440Hz  
V, I, PF, CF, P, Q, S, F, R, Ip+-&  
THDv measurement  
Easy Master/Slave parallel &  
3-phase operation up to 67.5KW



Rectified RLC Mode



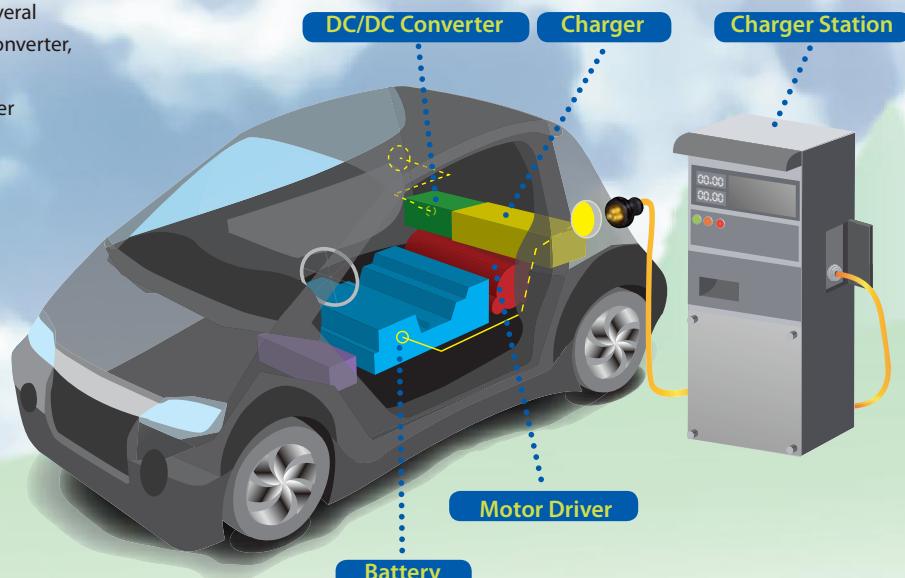
Programmable Crest Factor  
of Loading Current



## High Performance Hardware Devices and Software Architecture

### Automatic Test System - Chroma 8000

The power conversion section of EV/HEV is composed of several power electronic units, which include the charger, DC/DC converter, motor driver, etc. The Chroma ATS (Automatic Test System) addresses the specialized effort involved in testing the power electronics during not only the development phase, but also the production phase. The benefits of implementing ATS are not limited to the reduction of manpower and prevention of human error; they also include advanced features such as automatic test data recording and creation of statistical analytical reports for later design review or product improvement. There are custom-built systems that are designed specifically for certain power electronic units; however, these systems are usually difficult to maintain and lack flexibility. These shortcomings will definitely impede the product development process as test methodologies evolve.



The Chroma 8000 ATS is a standard test platform that can solve the conventional problem of self designed ATS's for power electronics testing. It is built on testing technology and experience in the power electronics industry, where Chroma has been a technological leader for over 20 years. Chroma has provided over 1,500 Chroma 8000 ATSs to customers worldwide that are being used in R&D, QA departments and production lines. Our test system was designed to have an open architecture, allowing the user to easily integrate various instruments. Now, the Chroma 8000 ATS includes a wide range of hardware choices such as AC/DC power supplies, Electronic Loads, Power analyzers, Oscilloscopes, Digital multi-meters, as well as various digital/analog I/O cards. This flexibility combined with an open architecture gives the user a flexible, powerful and cost effective test system for the EV/HEV power electronics. The Chroma 8000 test system includes a sophisticated test executive, which includes pre-written test items. Users may also create new test items by using the Test Item Editor function. This provides the flexibility to expand your test library without limits. The Chroma 8000 ATS's ability to satisfy the test requirements for multiple power electronic units is key to keeping consistency and reducing costs during the transition between R&D and production.

The following pictures of Chroma ATS show some applications for EV/HEV. The system will not only perform the tests and report it to an isolated PC, but it will also network to the shop-floor (MES) system for production line for data log-in, analysis and monitoring.



EV Charger ATS



DC-DC Converter ATS



HEV Controller/ DC-DC ATS



Motor Driver ATS

Software Platform of ATS Chroma 8000

## PowerPro III

PowerPro III provides users with an open software architecture suited to a wide range of applications and devices. The test item editor is a powerful tool which is similar to C language, but much easier to use. It allows users to define test procedures, test condition variables, test result variables and temporary variables. The test program editor also provides a useful means to link several pre-defined test items for batch testing.

PowerPro III includes extended reporting capabilities, statistic and management functions, various test document generation and system administration. The unique report wizard and generator provide the total solution for any documentation requirement. It allows users to integrate different types of presentations, like tabular test data, DSO waveform and correlation charts in M/S Word format. Users may also edit and store report formats for future use, thus saving time creating test reports. The Statistic function provides off-the-shelf statistical reporting tools. All the test conditions defined in the test program as well as the test readings can be stored and analyzed by the statistic report function. The report and raw data may be printed out or stored in a file.

Power Pro III runs under the Windows 2000/XP/7 operating environment, providing the test engineer a dedicated test system with easy access to Windows resources.

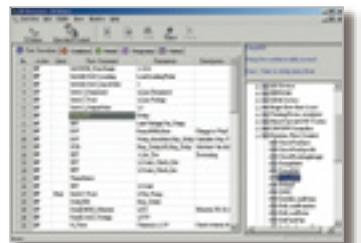
- Expandable hardware support
- Support GPIB instruments & RS232/RS485/CAN bus interface
- User editable test library
- User editable test programs
- User editable reports
- User authority control and Release control
- Activity log
- Support Shop-floor control
- Remote monitoring via internet

## Customized Test Fixtures

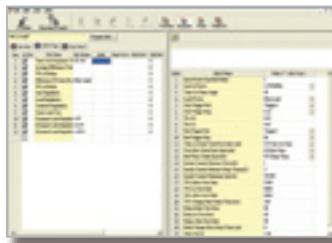
The test fixture, a device that interfaces between the ATS and the UUT, is a necessary for EV/HEV power electronics unit testing. Due to the different form factors and various connector types, it is impossible to find an off the shelf test fixture that can fit all testing requirements. The Chroma 8000 ATS support team not only helps to plan and develop the ATS, but they also provide their expertise to tailor a test fixture to the customer's needs.



## Software Main Screen



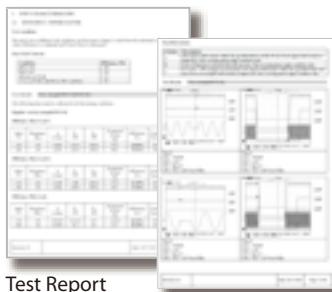
## Test Item Editor



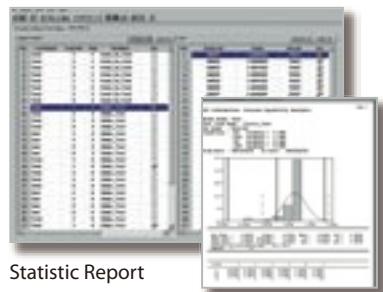
## Test Program Editing



## Running GO/NOGO



## Test Report M/S Word File



## Statistic Report



## Customized Test Fixtures



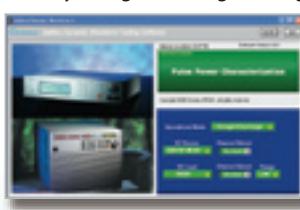
## Battery Pack Test



Battery Charge/Discharge Testing Software



Chroma provides two software modules that integrate a DC power supply and an electronic load for battery pack testing. The first one is the Battery Charge/Discharge Testing Software that can program the test sequence, loop and stop conditions. The measured voltage/current/electricity will be recorded in a file for future analysis. The second software is the Dynamic Current waveform Simulation Software. It can read the Excel file that is recording the real discharge current waveform from battery, and instruct the electronic load to sink the same current. This is used to simulate real world applications and evaluate the battery pack in the lab.



## Dynamic Current Waveform Simulator Software



## Customized ATS for EV/PHEV Maintenance Application

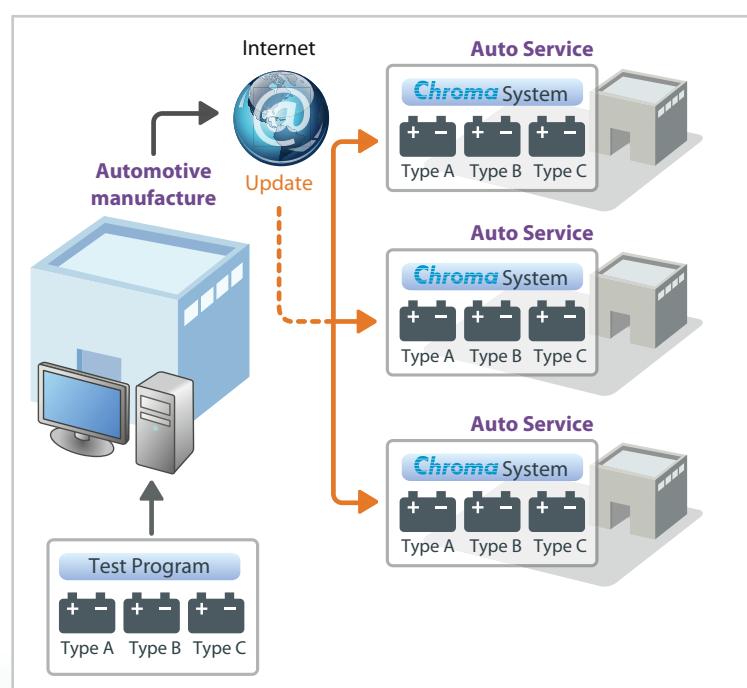
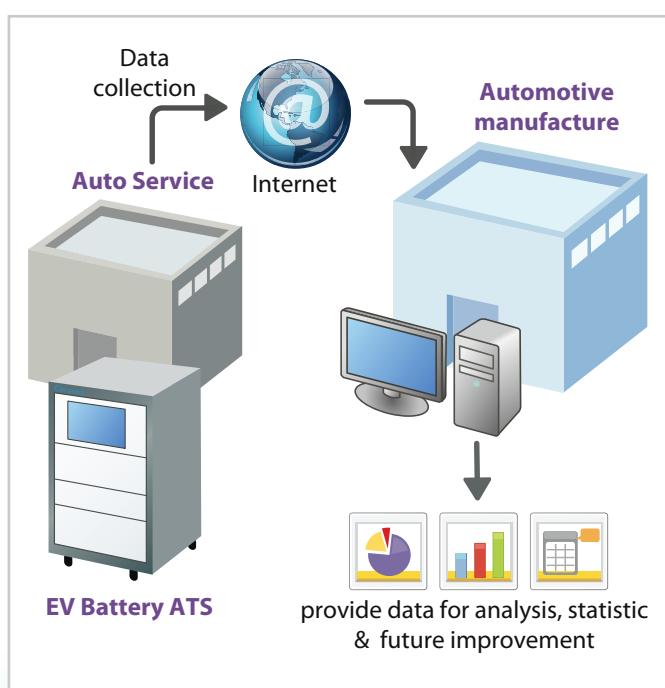
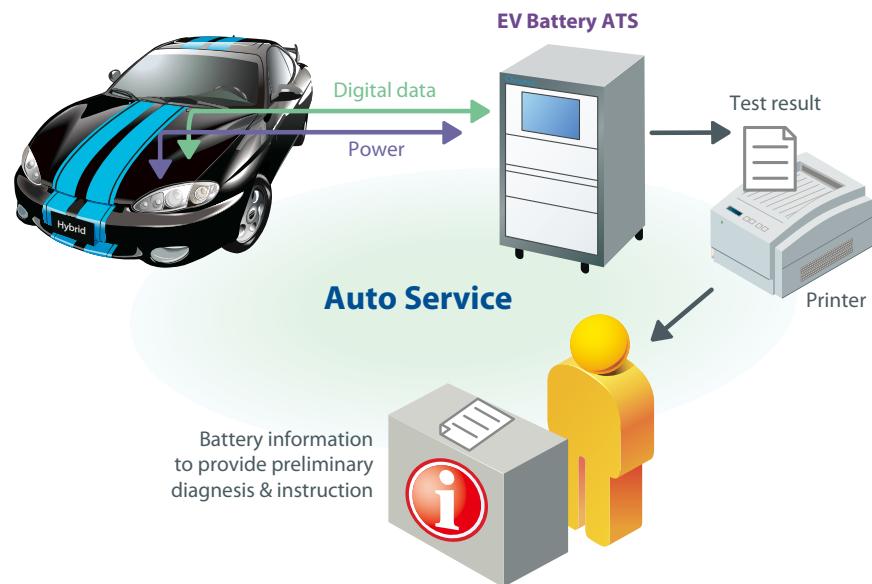
### Charger station

The demand for charging stations is steadily growing as EV/PHEV's gain popularity. Unlike the conventional gas station, which mainly consists of mechanical parts, the EV/PHEV charging station has implemented sophisticated electronics for metering, controlling, and measuring the amount of energy required and transferred to the vehicle. In order to keep the charging station in optimum operating condition and maintain its accuracy, frequent service and calibration is required. Chroma ATE has the capability to provide a customized mobile service system, which is specifically designed to perform diagnosis, measurement and meter calibration for these charging stations.



### Auto Service

With the powertrain system switching from internal combustion engine (ICE) mechanical design to fully electric powertrain design, ICE oriented auto mechanics must quickly familiarize themselves with the electrified system. In order to provide optimum vehicle operating condition, maintain serviceability and minimize the chance of a mechanics exposure to electric shock hazards, the Chroma 8000 provides unique, dynamic diagnostic capabilities. These include: vehicle battery unit testing, voltage/current parameter measurement reading, CAN bus interface, diagnostic reporting, etc. The test system provides diagnostic data through the internet directly to the vehicle manufacturer for data analysis.





## Battery Cell Testing

### Discharge Energy Recycling

### Li-ion Cell Formation System

### 17000 Series

Chroma 17000 series is specifically designed for the formation of Lithium Ion and Lithium Polymer secondary batteries. The 17000 series is a complete turn-key system, including carrier trays, robust battery probe contacts, high quality charge/discharge modules and intuitive software all under computer control.

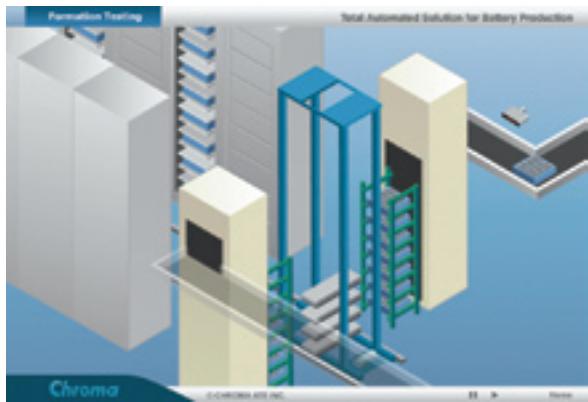
Patented Battery Voltage Tracking (BVT) DC-DC conversion power modules minimize power consumption in battery charging, and Energy Recycle Modules (ERM) recycle the discharged energy directly back to the DC power system for increased power efficiency. These power saving designs provide a planet friendly solution along with cost savings by reducing energy consumption.

The intuitive software provides a flexible selection in the charge / discharge channel, current rating, and modules under test. These features allow the Series 17000 to be used for final cell development, pilot line production, high volume production and Ongoing Reliability Monitoring / Quality Control.

#### Key Features

- ERM (Energy Recycling Module) Recycles discharged energy
- BVT (Battery Voltage Tracking) reduces power consumption while battery charging
- Energy savings monitor: Tracks kW, kWh, reduced CO2 or plated-tree display
- Plug-in module design simplifies service and maintenance
- Real-time outer-loop resistance check
- System Safety / Test Reliability through PLC/IPC monitoring of all sensors (Temperature, smoke, device type and battery tray position)
- Systems are linked as a LAN offering remote monitoring and control.
- Automated handling and sorting available.

#### Turnkey Solutions



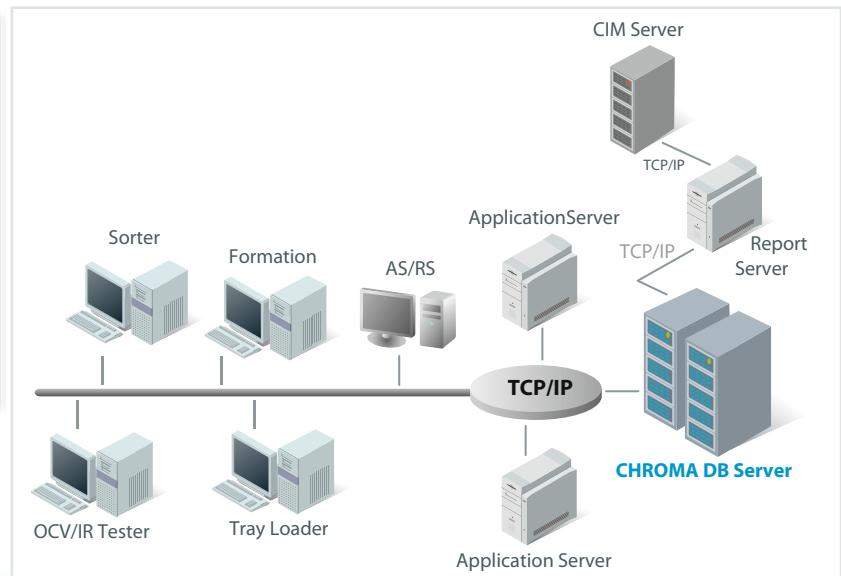
With OCV/IR Tester, Sorter & Automation



Hot Swap & Redundant DC Power Supplies



Plug In & Precise Electronic Modules



With Manufacturing Execution System

# Chroma



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