



MODEL 17010H

KEY FEATURES

- High accuracy $\pm 0.015\%$ of F.S.
- High precision $\pm 0.005\%$ of F.S.
- Multiple current range 100% / 50% / 10%
- Fast current response $< 1.5\text{mS}$
- 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

BATTERY RELIABILITY TEST SYSTEM MODEL 17010H

The Chroma 17010H Battery Reliability Test System is high-precision charge and discharge test equipment specifically designed for high current/high power performance testing. This system is suitable for performance evaluation, life cycle testing and product selection of large Lithium-ion Battery Cells (LIB Cells), Electric Double Layer Capacitors (EDLCs) and Lithium-ion Capacitors (LICs).

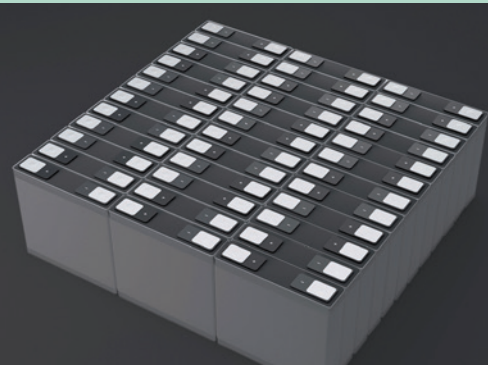
The 17010H's energy recovery circuit architecture offers a marked improvement over traditional switching power supply equipment. It features high measurement accuracy and precision, high-speed current response, zero-crossover time for charge/discharge conversion, as well as multiple current ranges. These characteristics enhance the accuracy of battery cell capacity tests, improve performance parameter validation, and facilitate realistic dynamic current and power testing. In addition, Chroma 17010H features a powerful 30-second 200% pulse current output function. For instance, a unit with a single-channel continuous current of 300A can produce a 30-second 600A pulse current. This provides a highly cost-effective and space-saving solution for applications such as power capability and DC internal resistance testing, which require short but high-rate test currents.

High-current life cycle tests highlight the importance of testing the equipment's energy conversion efficiency. Benefits include not only reduced power demand, but also a large decrease in heat production. The

control circuit operates at a relatively low temperature, effectively suppressing thermal drift and extending components' life cycles. In this way, the 17010H achieves accurate and stable test performance. Compared with linear circuit products, it offers more efficient energy conversion and higher power density, reduces power distribution requirements for laboratories, saves operating power and air conditioning costs, and improves space utilization.

Designed with the diversity of battery cell products and experiments in mind, Chroma 17010H features a channel parallel function with a continuous current up to 2400A and a pulse current up to 4800A. The performance of paralleled channels remains unchanged, with the exact same precision specifications and no response delay, significantly enhancing the equipment's applicability.

With regards to safety, each channel is additionally equipped with Level 2 V. Protection, and an independent measurement loop prevents battery overvoltage when a single component fails, enhancing testing safety. In addition, the system's product maintenance design has been improved: the circuit units are modularized and can be individually assembled and disassembled quickly, enabling convenient maintenance and channel backup.



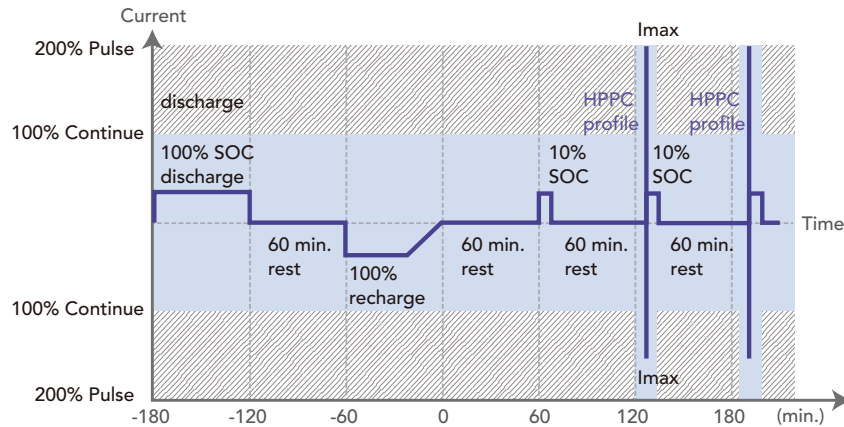
Chroma
Advancing Excellence

Key Features

Pulse output high current & high power function

■ Accurate output capability that meets test standards

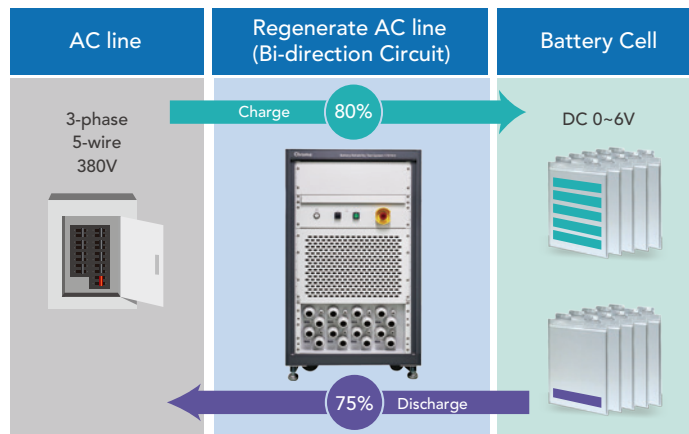
Run power capability tests and driving simulations to test compliance of vehicle batteries with international standards. Test parameters for high-rate current and power are based on battery operating conditions (such as BEV, PHEV and HEV) with an output time of 30S, which makes purchasing full-power equipment unnecessary. Chroma 17010H not only provides up to 200% rated pulse current and power output capability, but can also effectively save equipment costs and space.



Energy Recovery Architecture

Chroma 17010H feeds the electric energy released during discharge back to the AC power grid, which greatly reduces the generation of waste heat, realizes green energy manufacturing with low carbon emissions, reduces power distribution requirements, and saves operating power and air conditioning costs.

- Discharged energy is fed back to the regional power grid with a recovery rate of 75%
- System feedback grid current's total harmonic distortion <5%

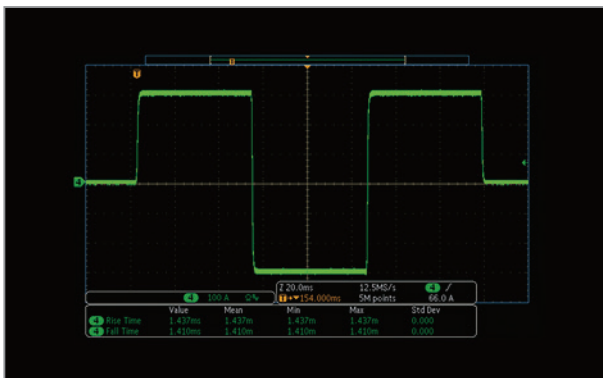


Energy Recovery Architecture

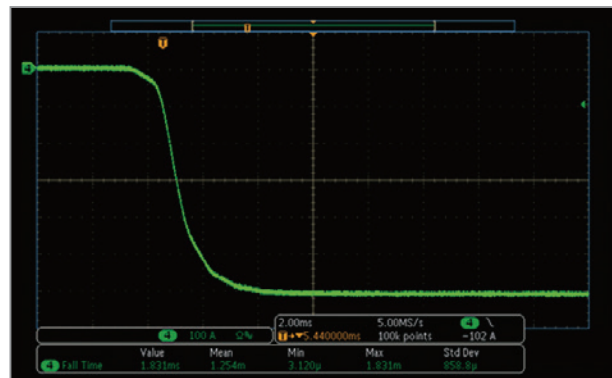
Fast Current Response Capability and Zero Crossover Time

■ Fast current response <1.5mS / 200% pulse current output <2mS

The fast current response provides ideal experimental conditions, reduces occurrence of cumulative errors during the fast-changing dynamic test and obtains low-distortion data.



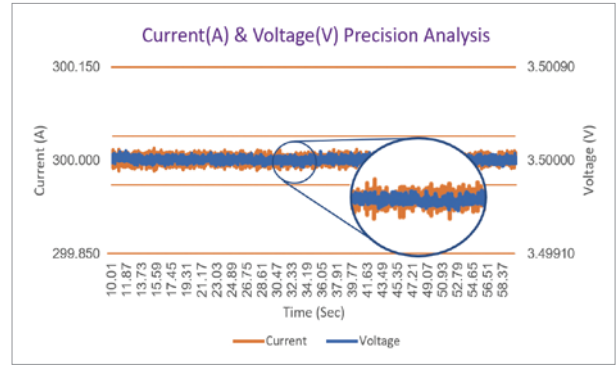
Rising time (10% to 90%): <1.5mS @30A to 270A
Switching time (+90% to -90%): <2mS @270A to -270A
Load: 5 meter cable short circuit



Rise time (-20% to -180%): <2mS @-60A to -540A
Load: 5 meter cable short circuit

High Accuracy and High Precision

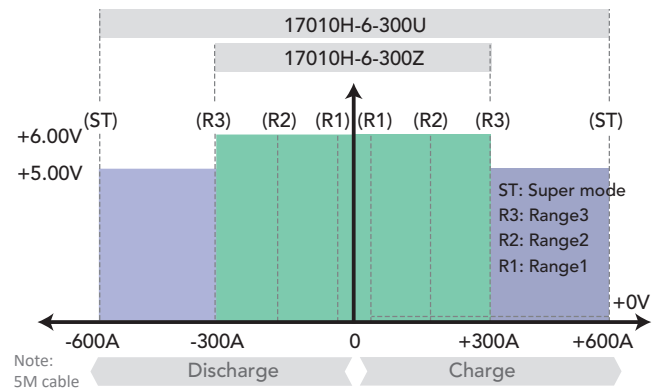
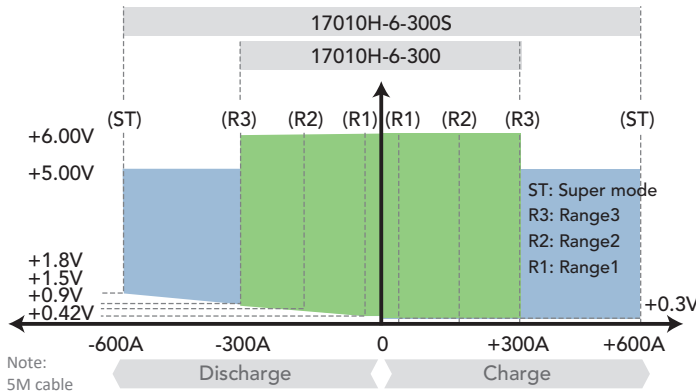
- Accuracy is key to comparison of different channel data
 Battery products often require multi-channel experiments for comparative analysis. High accuracy ensures that the data's baseline deviation between different channels is minimal, making comparisons more objective.
- High precision improves data analysis efficiency
 The inside of the battery is a complex electrochemical structure, and its characteristics are changed by the current, temperature, SOC, SOH and other experimental conditions. Initial changes are subtle and easily affected by the measurement stability of the equipment. High precision ensures measurement reproducibility and reduces measurement-caused data jumps, which is very helpful for the interpretation of the testing data.



Precise measurement of voltage and current

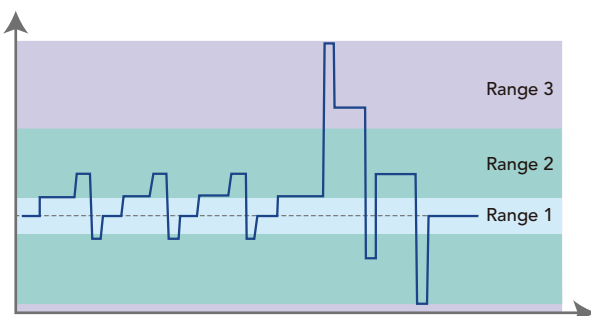
0V Discharge

- Can perform battery cell 0V abuse test
- Suitable for EDLC testing

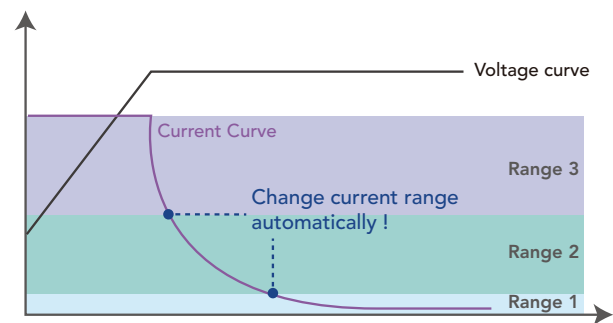


Multiple Current Range Design

- Automatically select suitable current range in constant current (CC) mode
 Provides multiple current output and measurement ranges and is suitable for test plans covering both high current and small current
- Automatically switch suitable current ranges in constant voltage (CV) mode
 Supports automatic switching of current ranges in constant voltage (CV) test mode with no output interruption during the process, improving current resolution and consistency of the cut-off judgment



DTS application test and corresponding diagram of current range

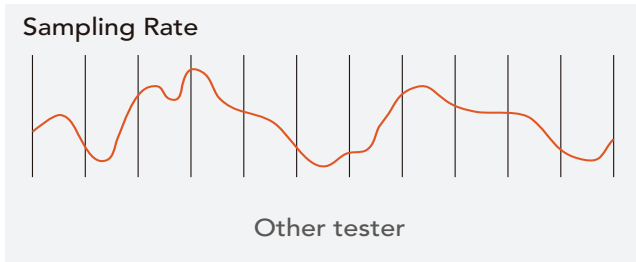


Constant voltage test current switching schematic

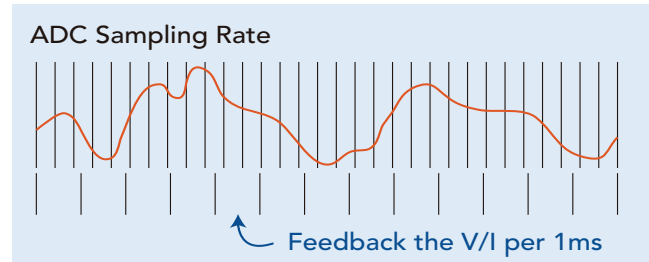
High-speed Sampling Technology

The Chroma 17010H uses high-speed voltage and current sampling with double-integration computing to accurately capture transient changes during testing without distortion. This approach provides highly reliable capacity calculations, eliminating the significant cumulative error seen with conventional test equipment that records key data at report sampling speeds.

- Hardware internal voltage/current sampling rate: 1mS
- Report single point transient sampling rate: 1mS
- Report sampling rate: 10mS



General Testers Charging/Discharging Sampling Rate

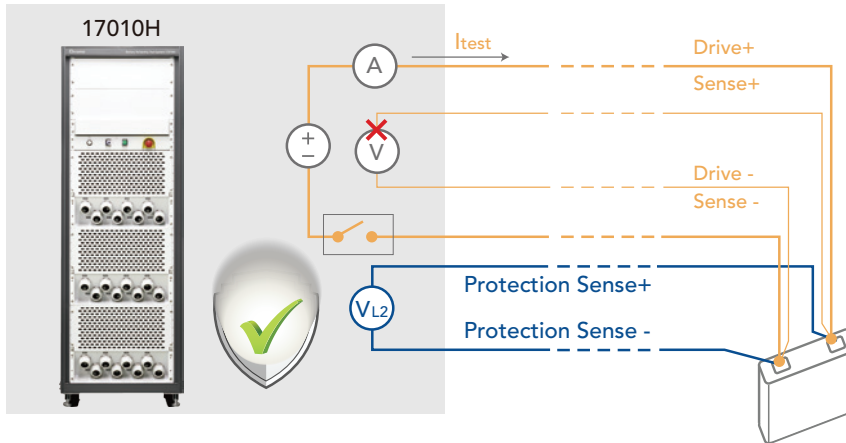


Chroma 17010H Charging/Discharging Sampling Rate

Independent Hardware Level 2 V. Protection

- Level 2 V. Protection reduces the risk of voltage measurement failure

Accidents caused by large battery cells are unpredictable. In order to strengthen the safety of the experiment, an auxiliary voltage is independently set in each channel to protect the measurement circuit, which independently memorizes the protection parameters and operates autonomously. When an abnormality occurs, the output circuit is forcibly closed immediately.



System Integration and Protection

Chroma 17010H supports integration of environmental chambers of various well-known brands as well as multi-functional data loggers. With the Battery LEx software, you can set parameters and monitor data simultaneously. Test data is automatically compiled into test reports, all in all providing a fully comprehensive test solution.

Integrable data logger

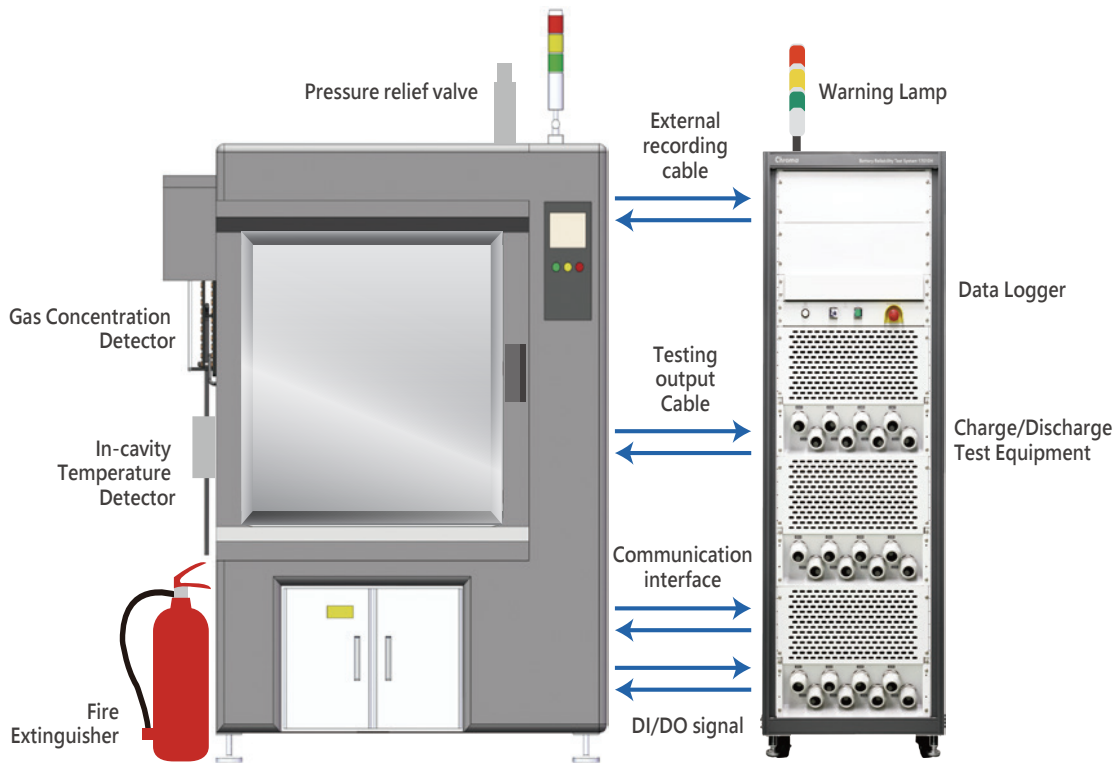
- Records temperature (°C), voltage (V), pressure (mPa), force (kg).
- Recorded real-time data can be used as judgment criterion for cut-off or temperature protection measures.

System protection and abnormality detection

- Test recipes include various built-in protections; the protection mechanism monitoring these has a response speed of 1mS when triggered. An optional external voltage/temperature meter relay can be added to provide reliable dual-layer protection.
- Real-time abnormality detection allows each individual unit to automatically detect abnormalities based on independent logic. When the system is interrupted, the test can be continued after the exception is cleared without data loss.

Chamber integration and peripheral safety engineering

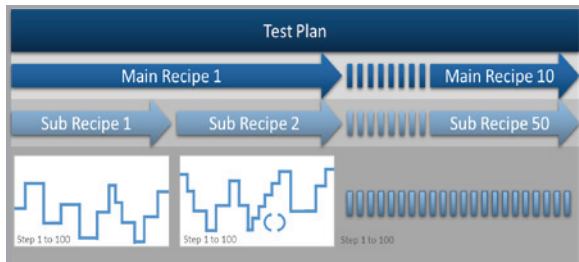
- The Battery LEx software provides built-in chamber setting control and control steps for temperature, humidity, timeout, and over-temperature protections while indicating temperature control time, delay time, and standby temperature.
- To ensure consistency of the test conditions, the grouping management structure allows all testing channels in the same chamber to enter the temperature control phase at the same time.
- The built-in DI/DO function can be connected to smoke/gas detection, a fire extinguisher, and alarms for over-temperature, over-voltage, and open door. The system performs different levels of handling according to the degree of damage, including stopping the test or powering off. Alarm data can be sent remotely via e-mail.



Battery LEx Software

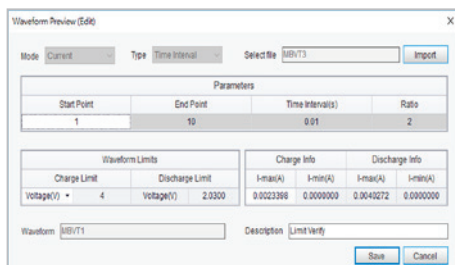
Battery Lab Expert (Battery LEx) is the testing software platform specially developed for Chroma 17010/17010H and offers:

- **Group Testing:** each group can control up to 96 channels and execute up to 50,000 steps.
- **Variable editing:** use data from the external data logger for flexible programming and complex applications
- **Chamber integration:** real-time monitoring of chamber status and protection mechanisms through DI/DO expansion.

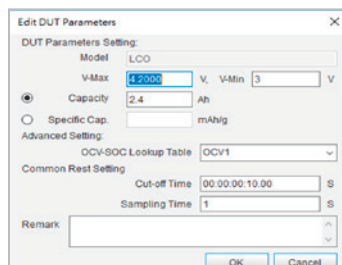


Project Browser

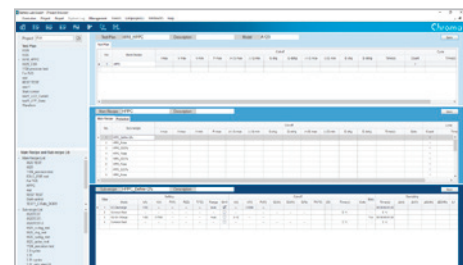
- **Streamlined Management:** Easily create and organize up to 500 test plans tailored to specific DUT types or test requirements.
- **Intuitive Display and Real-time Editing:** Effortlessly browse, inspect, and adjust test plans, DUT specifications, waveform simulation data, and recipe content. Modify parameters on the fly and save them instantly for maximum efficiency.
- **DUT Database:** establish a central repository for all your DUT specifications, allowing you to quickly map parameters during recipe editing. Use recipe sharing for efficient testing across different projects.
- **Operation Simulation:** import data points directly from xlsx files to simulate operating conditions. Define time intervals (both equal and custom), output multiplier, and data ranges to create highly realistic test scenarios.



Waveform Simulation Database



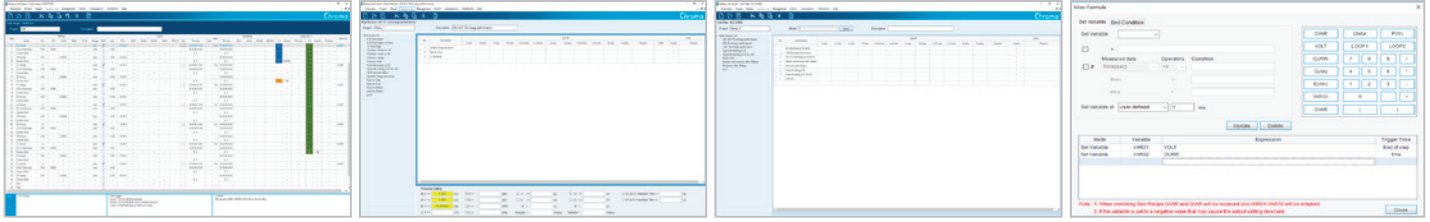
DUT Database



Project Browser

Recipe Editor

- Layered Structure: craft intricate test plans with a hierarchical structure including up to 50,000 steps (SR -> MR -> TP).
- Easy Creation: design new recipes from scratch to address a wide range of test applications.
- Quick Editing: combine existing recipes to rapidly build comprehensive test plans.
- Special Settings: utilize special settings for C-rate, OCV-SOC, Q%, $\pm V$, and variables to create highly customized recipes.
- Variable Settings and Cutoff Conditions: define up to 20 variables, including 2 variables that can be leveraged across sub-recipes. The 1-100mS transient capture function meticulously records transient changes at the start or end of each step, then defines them as variables for secondary calculation.



Sub-Recipe / Main Recipe / Test Plan Editor

Variable Definition and Transient Capture

Recipe Executor

- Multi-channel group management
- Multi-group start
- Various Control Options: start, pause, resume, stop, scheduled pause, specified start, skip to next step, pause and skip to next step, recipe preview
- Real-time Test Status: real-time display of test data for individual channels and entire group
- Supports dynamic paralleling

Real-time Chart Display

- Real-time Data Plotting: plots data in real-time based on the set sampling time, with up to 36,000 data points displayed on a single screen.
- Multi-chart Monitoring: view up to 4 independent graphs simultaneously, allowing for comparison of up to 2 test channels per graph.
- Graph Capture: use the time freeze function to capture and save test curves.
- Multi-axis Analysis: provides dual-Y-axis data display for more comprehensive analysis.

Test Report

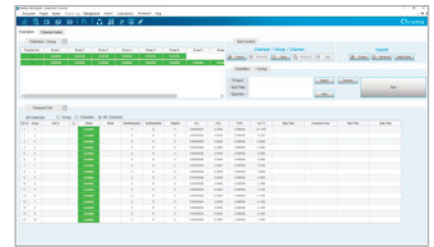
- Automatic Export: automatically exports to user-specified path based on defined export mode and filename.
- Export Modes: choose between manual export or automatic export based on either sub-recipes or time settings.
- Adjustable data precision up to 9 decimal places.
- Report Types: channel-level report, step-level report
- Customization: Freely adjust report items and column orders to tailor the report to your needs.

Chamber Control and System DI/DO Signal Control

- Three Control Modes: chamber control steps, real-time remote control, maintenance mode.
- Delay Function: set a rest time after reaching the set temperature to ensure consistency between the temperatures of the chamber and the DUTs.
- Cycle Temperature Setting: paired with a data logger, the system can adjust the chamber temperature based on the actual DUT temperature to accurately ensure temperature consistency.
- End-of-test Setting Modes: end temperature control, adjust to the specified temperature, or maintain temperature.
- Dual Protection Control: over-temperature protection, temperature control timeout protection.
- External Device Control: provides three-color light signal control and relay signal control.
- Synchronized Temperature Control: automatic sync. mechanism ensures that the chamber temperature control starts only when all channels reach the "temperature control step", ensuring test consistency.
- Temperature Control Inheritance: automatically transfer chamber control to another group upon completion of the main group's test.

Management

- Account and Permission Management: establish multiple user accounts with passwords and assign corresponding editing permissions.
- Alert Notifications: set up email alerts for warning messages.
- Recipe Transfer: import/export/move recipes and test plans.
- Data Management: administrators can set up automatic or manual deletion of system data.
- Forced Global Protection: set mandatory protection items for recipes to prevent human error and enhance test safety.

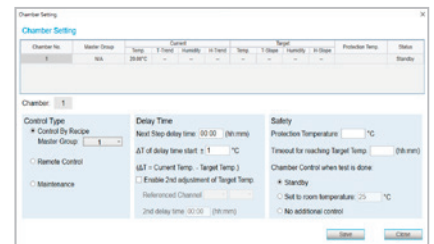


Recipe Executor

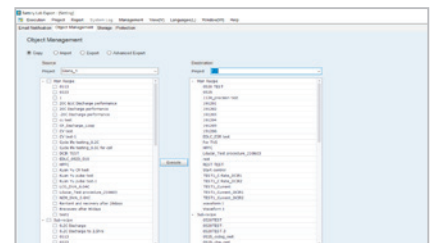


Real-time Chart Display

Test Report Preview



Chamber Control Settings



Test Plan Import/Export

Battery Cell Test System Auto Calibrator

Chroma A170108 is a complete automated calibration and verification unit with a variety of high-precision calibration standard components built-in for programmable test tasks. Chroma A170103 applies to Chroma 17010H products up to 600A in order to ensure that the equipment maintains its high precision and traceability.

- Consistent Standards Verification: minimizes human errors and variation in test results.
- Efficient Calibration and Verification: cuts down labor costs.
- Automated Report Generation: convenient management of maintenance records and traceability.



Specifications	
Voltage	0-10V
Current	20A/30A/60A/100A/200A/300A/600A (7 ranges)
Channel	1CH
Input	Single-phase AC 200V-240V ± 10%
Dimensions (W x D x H) (mm)	600 x 900 x 1100
Weight (Kg)	<215
Equipment	
Standard	A170108, A820001 S/W, IPC & Windows 10 & Office, RS-485 card, 7230 I/O card
Option	30ppm digital DMM, Monitor, Keyboard & mouse

Battery Cell Testing Data Logger

The Chroma A172013 multi-channel voltage and A172014 multi-channel temperature data loggers can serve as auxiliary channels for the 17010H system, providing real-time temperature and voltage monitoring of the DUT during charge and discharge tests. Through the Battery LEx software, the data can be integrated into the test report and upper and lower limit protection can be set to ensure test safety.

- Each channel adopts independent 24-bit ADC sampling
- Equipped with cold junction compensation function
- Can be used as a standalone unit or connected to voltage or temperature modules, expandable up to 128 channels



Multi-Channel Voltage Data Logger A172013						
Channels	16					
Number of Modules Connected ^{*1}	Up to 8 pcs					
Interface	Ethernet					
Measurement Range	± 10V	± 5V	± 1V	± 0.5V	± 100mV	± 20mV
Accuracy ^{*2}	± 0.015% of F.S.				± 0.05% of F.S.	
Resolution	0.3mV	150µV	30µV	150µV	3µV	0.6µV
Max. Voltage to Ground	± 300V					
Max. Voltage between Channels	± 250Vdc					
Wire Connection	M3 screw					
Sampling Time ^{*3}	10ms					

Multi-Channel Temperature Data Logger A172014 (Thermocouple Type)		
Channels	16	
Number of Modules Connected ^{*1}	Up to 8 pcs	
Interface	Ethernet	
Measurement Range	Range	Measure Range
	K 100°C	-100°C to 100°C
	K 500°C	-200°C to 500°C
	K 2000°C	-200°C to 1350°C
	J 100°C	-100°C to 100°C
	J 500°C	-200°C to 500°C
	J 2000°C	-200°C to 1200°C
	T 100°C	-100°C to 100°C
T 500°C	-200°C to 400°C	
T 2000°C	-200°C to 400°C	
Accuracy ^{*2}	± 0.05% of F.S. ± 1°C	
Resolution	0.1°C	
Temperature Transducer	J, K, T type Thermocouple	
Wire Connection	M3 screw	
Sampling Time ^{*3}	10ms	

Note*1: A172013 and A172014 modules can be integrated and used simultaneously.
 Note*2: The accuracy specification does not include errors caused by the testing cables, under the condition of 100ms sampling and 23±5°C.
 Note*3: The sampling time is for the single unit specification and does not include data integration and transmission.

Operating Environment Specifications and Cabinet Dimensions		
Operating temperature	0°C-40°C	
Operating humidity	<90 RH%	
Input	3Φ 200-220Vac ± 10% V _{LL} 3Φ 380-400Vac ± 10% V _{LL} Frequency 47-63Hz	
Dimensions (W x D x H) (mm)	25U (23")	700 x 1260 x 1340
	36U (23")	700 x 1260 x 1830
	42U (23")	700 x 1260 x 2100
Weight (Kg)	25U (23")	<450
	36U (23")	<510
	42U (23")	<640



Specifications


Model		17010H							
Module		17010H-6-200		17010H-6-200Z		17010H-6-200S		17010H-6-200U	
Voltage									
Accuracy		± 0.015% of F.S.				± 0.015% of F.S.			
Precision		± 0.005% of F.S.				± 0.005% of F.S.			
Range		Charge 0.3V-6V Discharge 1.5V-6V		Charge 0V-6V Discharge 0V-6V		Charge 0.3V-6V Discharge 1.5V-6V		Charge 0V-6V Discharge 0V-6V	
Resolution	Output	0.1mV				0.1mV			
	Measurement	0.05mV				0.05mV			
Current									
Accuracy		± 0.05% of F.S.				± 0.05% of F.S.			
Precision		± 0.0125% of F.S.				± 0.0125% of F.S.			
Range		20A	100A	200A	20A	100A	200A	300A (ST) ^{**}	
Resolution	Output	0.5mA	2.5mA	5mA	0.5mA	2.5mA	5mA	10mA	
	Measurement	0.25mA	1.25mA	2.5mA	0.25mA	1.25mA	2.5mA	5mA	
Power									
Accuracy		± 0.065% of F.S.				± 0.065% of F.S.			
Precision		± 0.0175% of F.S.				± 0.0175% of F.S.			
Range		120W	600W	1200W	120W	600W	1200W	1500W (ST) ^{**}	
Resolution	Output	2.5mW	12.5mW	25mW	2.5mW	12.5mW	25mW	50mW	
	Measurement	1.25mW	6.5mW	12.5mW	1.25mW	6.5mW	12.5mW	25mW	
Sampling Time		1-24 10mS				1-24 10mS			
Current Rise Time (+10%~+90%)		<1.5mS				<1.5mS			<2mS
Energy Recovery Efficiency		75%				75%			
Auxiliary Voltage Protection Channel		Configure one per channel				Configure one per channel			

Module		17010H-6-300		17010H-6-300Z		17010H-6-300S		17010H-6-300U	
Voltage									
Accuracy		± 0.015% of F.S.				± 0.015% of F.S.			
Precision		± 0.005% of F.S.				± 0.005% of F.S.			
Range		Charge 0.3V-6V Discharge 1.5V-6V		Charge 0V-6V Discharge 0V-6V		Charge 0.3V-6V Discharge 1.5V-6V		Charge 0V-6V Discharge 0V-6V	
Resolution	Output	0.1mV				0.1mV			
	Measurement	0.05mV				0.05mV			
Current									
Accuracy		± 0.05% of F.S.				± 0.05% of F.S.			
Precision		± 0.0125% of F.S.				± 0.0125% of F.S.			
Range		30A	150A	300A	30A	150A	300A	600A (ST) ^{**}	
Resolution	Output	1mA	5mA	10mA	1mA	5mA	10mA	20mA	
	Measurement	0.5mA	2.5mA	5mA	0.5mA	2.5mA	5mA	10mA	
Power									
Accuracy		± 0.065% of F.S.				± 0.065% of F.S.			
Precision		± 0.0175% of F.S.				± 0.0175% of F.S.			
Range		180W	900W	1800W	180W	900W	1800W	3000W (ST) ^{**}	
Resolution	Output	5mW	25mW	50mW	5mW	25mW	50mW	100mW	
	Measurement	2.5mW	12.5mW	25mW	2.5mW	12.5mW	25mW	50mW	
Sampling Time		10mS				10mS			
Current Rise Time (+10%~+90%)		<1.5mS				<1.5mS			<2mS
Energy Recovery Efficiency		75%				75%			
Auxiliary Voltage Protection Channel		Configure one per channel				Configure one per channel			


Note *1: The ST range is super output mode (Super Mode), with a voltage range of 1.8V to 5V.


*All specifications are subject to change without notice.

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