MODEL 17010H

KEY FEATURES

- High accuracy ±0.015% of F.S.
- High precision ±0.005% of F.S.
- Multiple current range 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

BATTERY RELIABILITY TEST SYSTEM MODEL 17010H

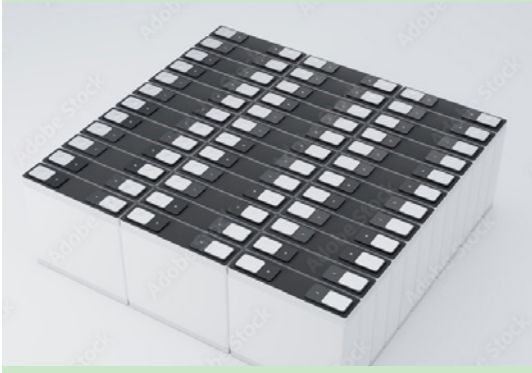
Chroma 17010H Battery Reliability Test System is high-precision charge and discharge test equipment specifically designed for high current/high power performance testing. This system is suitable for performance evaluation, life cycle testing and product selection of large Lithium-ion Battery Cells (LIB 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/precision, high-speed current response, zero-crossover time for charge-discharge conversion, as well as multiple current ranges, which help battery cell experiments to enhance capacity test accuracy, 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.

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.

Taking into account 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.

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.



Ethernet CE

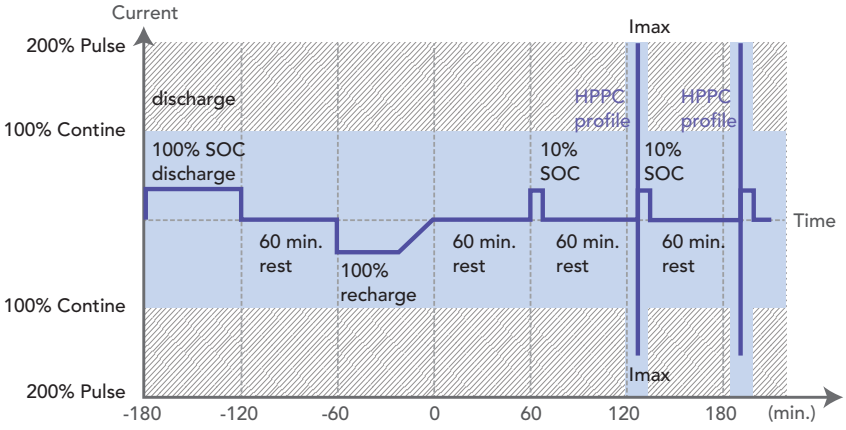
Chroma

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 200% rated pulse current and power output capability, but can also effectively save equipment costs and space.

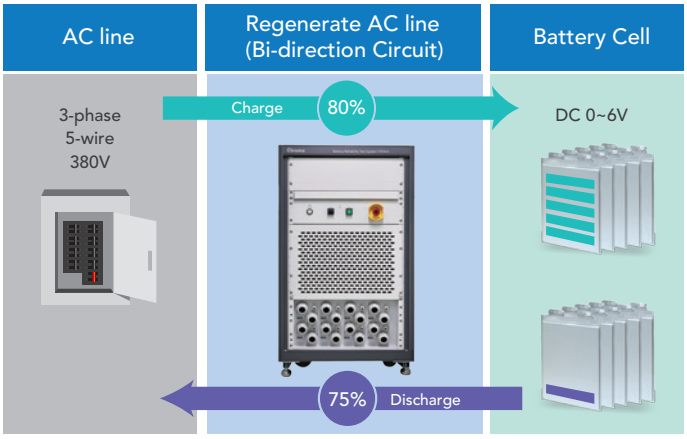


Energy Recovery Architecture

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%

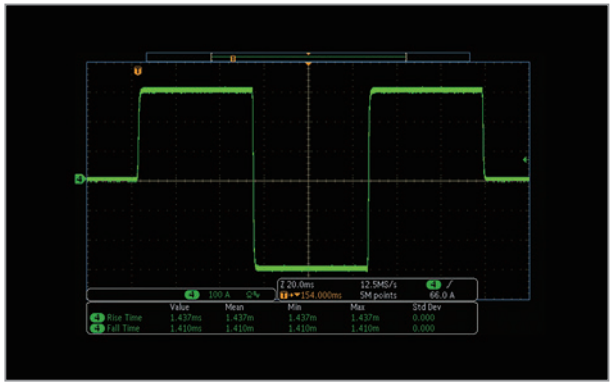


Energy Recovery Architecture

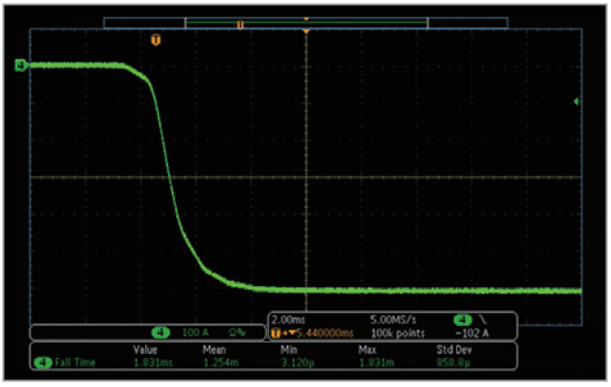
Fast Current Response Capability and Cero Crossover Time

■ 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.



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



Rise time (-20% to -180%) : <2mS @-120A ~-540A
Load: 5meter cable short circuit

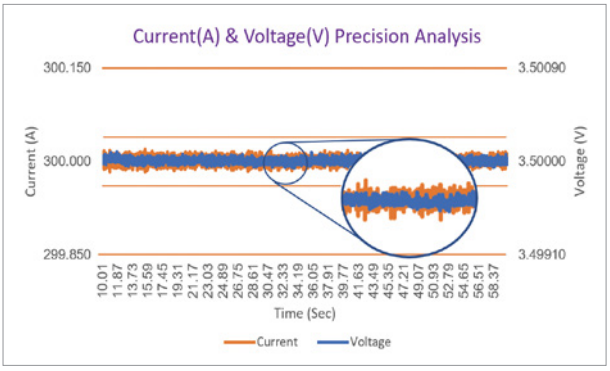
High Accuracy and High Precision

- Accuracy is key to comparison of different channel data

  Battery products often require multi-channel experiments for comparative analysis to ensure the accuracy of measured differences between different channels. The higher the accuracy, the easier it is to identify differences.

- High precision improves data analysis efficiency

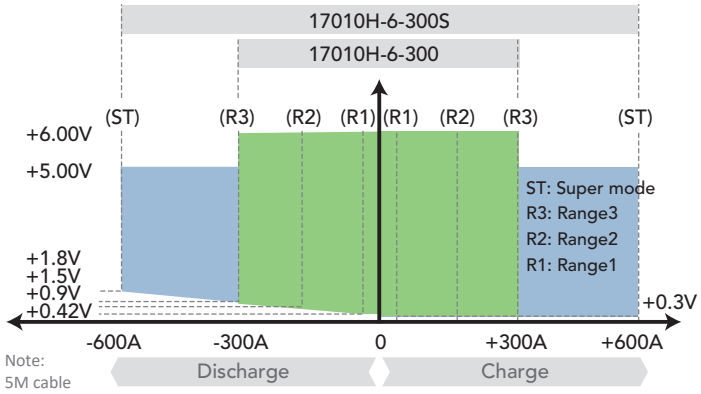
  The inside of the battery is a complex electrochemical structure, and its characteristics are changed by the current, temperature, SOC, SOH and other experimental conditions. Initial changes are subtle and easily affected by the measurement stability of the equipment. High precision ensures measurement reproducibility and reduces measurement-caused data jumps, which is very helpful for the interpretation of the testing data.

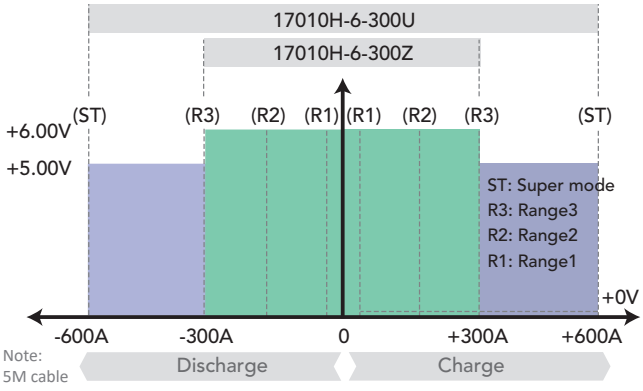


Precise measurement of voltage and current

0V Discharge (17010H-6-300Z/17010H-6-300U)

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





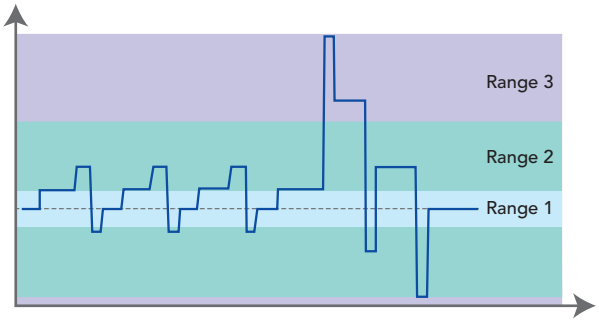
Multiple Current Range Design

- Automatically select suitable current range in constant current (CC) mode

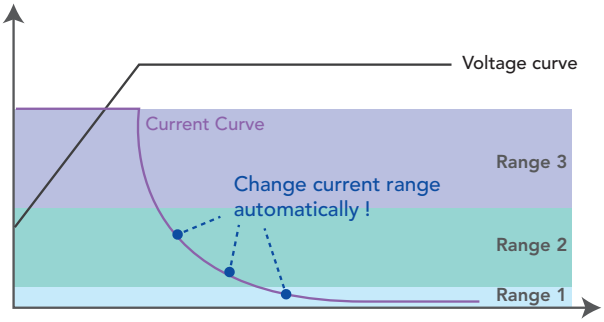
  Provides multiple current output and measurement ranges and is suitable for test plans covering both high current and small current

- 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

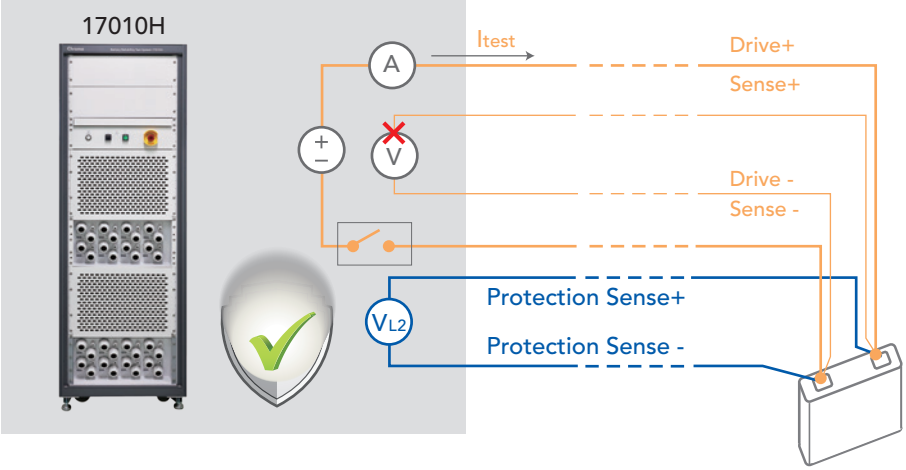


Constant voltage test current switching schematic

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.



BATTERY LEX SOFTWARE

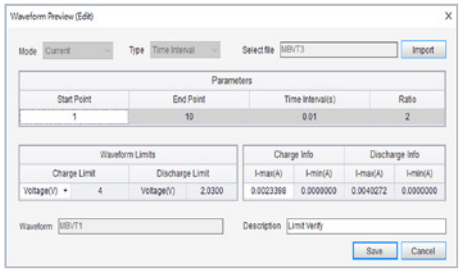
Battery Lab Expert (Battery LEx) is the testing software platform specially developed for battery cell testing:

- Group testing: Multiple channels of the same experiment are grouped to simplify operations and execute up to 50,000 steps
- Variable editing: Using 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

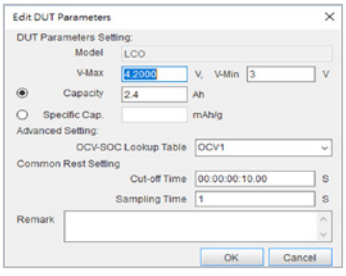
Project Browser

Create up to 500 projects and construct corresponding test plans according to different DUT types or requirements. The project browser allows for easy review or adjustment of the DUT specifications, waveform simulation data, and recipe content.

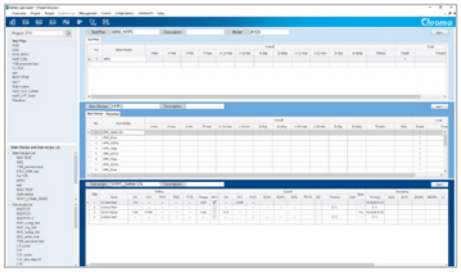
- DUT database: Quickly enter corresponding DUT parameters when editing a recipe, and easily share recipes to different DUTs
- Waveform simulation folder: Import .xlsx data points to the folder, the waveform simulation can set the time interval (fixed/user defined), output magnification, and data range
- Adjust and save parameters in real time while browsing
- Filter keywords to search for test plans
- Transmit test plans in .xlsx format



Waveform Simulation Database



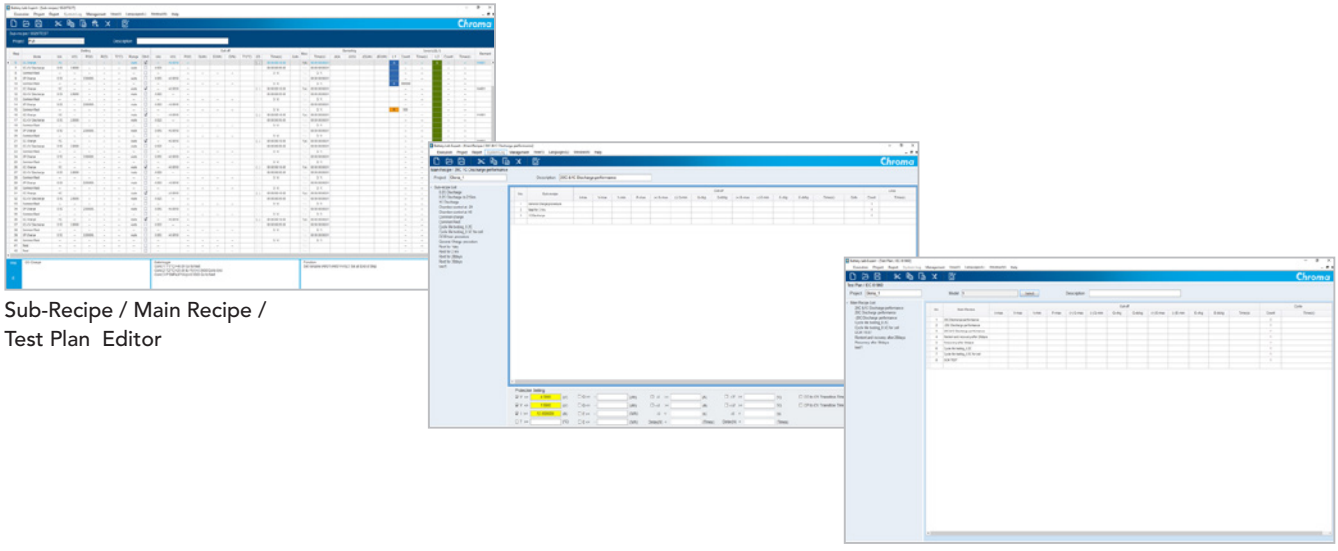
DUT Database


Project Browser

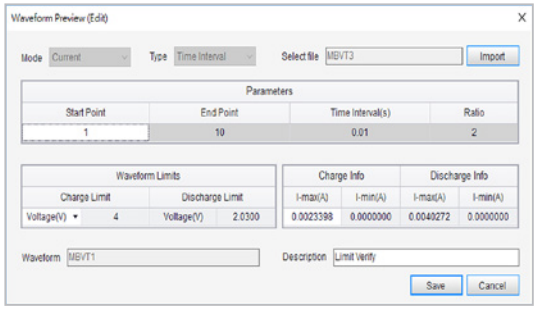
Recipe Editor

In the hierarchical editing structure (test plan → main recipe → sub-recipe), users can directly share existing recipes by replacing the DUT specifications or quickly complete a plan by flexibly combining existing sub-recipes. Easily create new recipes to meet various types of charge and discharge test applications.

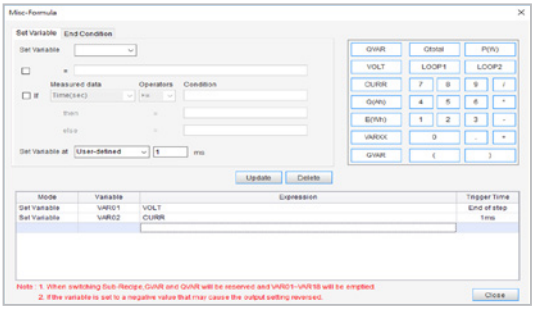
- Step types: CC/CV/CP/CC-CV/CP-CV Charge and Discharge, CR Discharge, Current/Power Waveform, Rest, Common Rest, Chamber Control, Super CC/CP Charge and Discharge
- Cut-off conditions: step cut-off → current, voltage, power, energy, capacity, time
  recipe cut-off → current, voltage, power, cumulative energy, cumulative capacity, time
  external cut-off parameters → each step contains up to 4 cut-off settings
- Go to: Next, End, Jump, If-then logic jump. Each step can support multiple cut-off conditions and jumps
- Special input methods: C-rate, OCV-SOC, Q%, ±V, Variable
- Four-level Cycles: Single cycle up to 999,999 times, providing single step repeat and cycle time cut-off
- Variable setting and cut-off conditions: 20 sets of variable setting include 2 variable functions for use across sub-recipes. 1mS~100mS transient capture of the variable at the start of the step, or records the test value at the start/end of the step and defines it as a variable for secondary calculation
- Recipe protections: Voltage, Current, Chamber Temperature, Energy, Capacity, Current/Voltage Change, CC-CV/CP-CV Transition Time/Level 2 V. Protection Function



Sub-Recipe / Main Recipe / Test Plan Editor



External Cut-Off Parameter

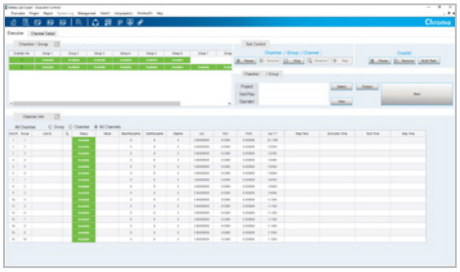


Variable Definition and Transient Capture

Recipe Executor

The recipe executor adopts group management according to different test plans. All channels in the group will simultaneously start testing and display their real-time test status. When integrated with a chamber, each channel will automatically trigger a waiting mechanism, and the temperature control will not start until all the channels reach the same condition. When there are multiple groups in the chamber, they can be set to wait between groups.

- Control modes: Start, Pause, Resume, Stop, Reserved Pause, Skip, Specified Start, Pause to Jump, Preview
- Real-time testing status display
- Dynamic parallel settings
- Multi-group start

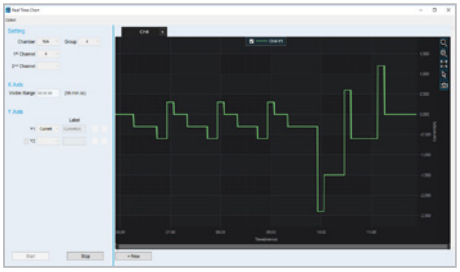


Recipe Executor

Real-time Chart Display

Display charging and discharging curves in real time while testing. Users can zoom in and out on data and display data values by dragging the mouse, as well as flexibly select any channel and axis item.

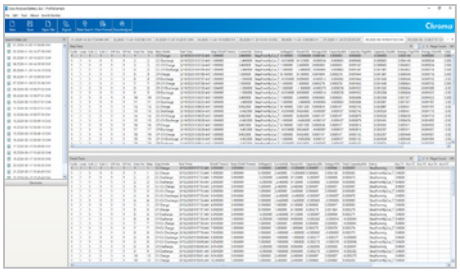
- Real-time charting based on the user-defined sampling time of up to 36,000 data points per screen
- Up to 4 sets of real-time display screens, with test comparison for up to 2 channels per screen
- Time freeze function to store test curves
- Dual y-axis data display



Real-time Chart Display

Test Report

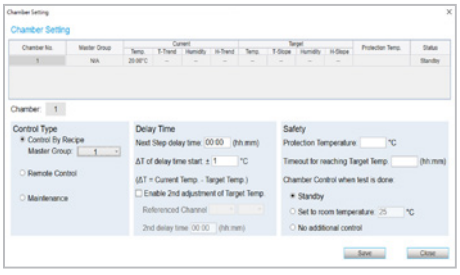
- Auto report: after the sub-recipe finished testing, its data will be automatically exported to the path and file name set by the user
- Export modes: auto export of sub-recipe, manual export of test plan
- The system can adjust effective digits in the data up to 9 decimal places
- Report types: channel report, step report
- Free adjustment of the order of report items and field orders



Test Report Preview

Chamber Control and System DI/DO Signal Control

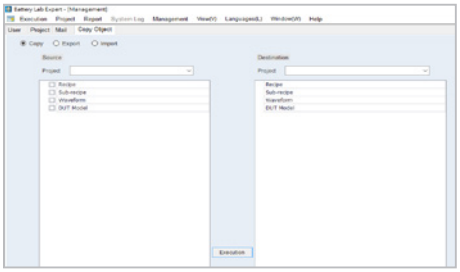
- Triple chamber control: chamber control step, real-time remote control, and maintenance mode
- Delay time: set the rest time after reaching the set temperature to secure similar temperatures between the DUT and chamber
- Double temperature adjustment: the temperature logger adjusts the chamber to ensure that the chamber and DUT's actual temperature are the exact same
- Chamber actions after testing: maintain, end, or adjust the temperature control
- Dual chamber protection control: over-temperature and overtime
- Tri-color warning light signal and relay signal are provided



Chamber Control Settings

Management

- Provide software account management and set multiple login accounts with corresponding editing permissions
- Send exception warning messages via email
- Import, export, and transfer test plans



Test Plan Import/Export

LITHIUM BATTERY TEST APPLICATION

Chroma 17010H Battery Reliability Test System meets the verification requirements of most international standards in charge/discharge testing.

Type	Regulation	Standard Number	Test Items
IEC	Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for use in industrial applications.	IEC 62620	6.3.1 Discharge performance at +25°C 6.3.2 Discharge performance at low temperature 6.3.3 High rate permissible current 6.4 Charge (capacity) retention and recovery 6.5.3 Internal d.c. resistance 6.6.1 Endurance in cycle
	Secondary lithium-ion cells for the propulsion of electric road vehicles - Part 1: Performance testing	IEC 62660-1	7.1 General charge conditions 7.2 Capacity 7.3 SOC adjustment 7.4.1 Power test method 7.5.1 Energy test method 7.6 Storage test 7.7 Cycle life test 7.8 Common tests
USABC	Battery Test Manual for 48 Volt Mild Hybrid Electric Vehicles	Rev.0 2017	3.2 Static Capacity Test 3.3 Constant Power Discharge and Charge Tests 3.4 Hybrid Pulse Power Characterization Test 3.5 Standard Self Discharge Test 3.6 Cold Cranking Test 3.7 Thermal Performance Test 3.8 Energy Efficiency Test 3.9 Operating Set Point Stability Test 3.10 Cycle Life Test 3.11 Calendar Life Test
	Battery Test Manual for 12 V Start/Stop Vehicles	Rev.2 2018	3.2 Static Capacity Test 3.3 Constant Power Discharge and Charge Tests 3.4 Hybrid Pulse Power Characterization Test 3.5 Standard Self Discharge Test 3.6 Cold Cranking Test 3.7 Thermal Performance Test 3.8 Energy Efficiency Test 3.9 Operating Set Point Stability Test 3.10 Cycle Life Test 3.11 Calendar Life Test
	Battery Test Manual for Electric Vehicle	Rev.3.1 2020	3.2 Static Capacity Test 3.3 High Rate Charge 3.4 Hybrid Pulse Power Characterization Test 3.5 Peak Power Test 3.6 Self-Discharge Test 3.7 Thermal Performance Test 3.8 Life Testing 3.9 Cycle Life Dynamic Stress Tests 3.10 Calendar Life Test
	Battery Test Manual for Plug In Hybrid Vehicle	Rev.3 2014	3.2 Static Capacity Test 3.3 Constant Power Discharge Tests 3.4 Hybrid Pulse Power Characterization Test 3.5 Self-Discharge Test 3.6 Cold Cranking Test 3.7 Thermal Performance Test 3.8 Energy Efficiency Test 3.9 Life Testing 3.10 Charge-Sustaining Cycle Life Tests 3.11 Charge-Depleting Cycle Life Test Profile 3.12 Calendar Cycle Life Test
GB	Electric vehicle power battery cycle life requirements and test methods	GB/T 31484 2015	6.1 General test conditions 6.2 Room temperature capacity and energy (initial capacity and energy) 6.3 Room temperature power (initial power) 6.4 Standard cycle life 6.5 Cycle life under working conditions
	Electric vehicle power battery performance requirements and test methods	GB/T 31486 2015	6.2.4 Single battery charging 6.2.5 Discharge capacity of single battery at room temperature (initial capacity)
	Lithium-ion batteries for electric vehicles	GB/Z18333.1	6.5 Battery charge and discharge 6.6 Discharge capacity at 20°C 6.7 -18°C discharge capacity 6.8 50°C discharge capacity 6.6.9 20°C high rate discharge capacity 6.10 Charge retention and recovery capability 6.11 Storage 12 Loop life

SPECIFICATIONS

Model		17010H						
Module		17010H-6-300	17010H-6-300Z		17010H-6-300S		17010H-6-300U	
Voltage								
Range		Charge 0.3V~6V Discharge 1.5V~6V	Charge -0.6V~6V Discharge 0V~6V		Charge 0.3V~6V Discharge 1.5V~6V		Charge -0.6V~6V Discharge 0V~6V	
Resolution	Output	0.1mV			0.1mV			
	Measurement	0.05mV			0.05mV			
Accuracy		±0.015% of F.S.			±0.015% of F.S.			
Precision		±0.005% of F.S.			±0.005% of F.S.			
Current								
Range		30A	150A	300A	30A	150A	300A	600A (ST) *1
Resolution	Output	1mA	5mA	10mA	1mA	5mA	10mA	20mA
	Measurement	0.5mA	2.5mA	5mA	0.5mA	2.5mA	5mA	10mA
Accuracy		± 0.05% of F.S.			± 0.05% of F.S.			± 0.1% of F.S.
Precision		± 0.0125% of F.S.			± 0.0125% of F.S.			± 0.025% of F.S.
Power								
Range		180W	900W	1800W	180W	900W	1800W	3000W (ST) *1
Resolution	Output	5mW	25mW	50mW	5mW	25mW	50mW	100mW
	Measurement	2.5mW	12.5mW	25mW	2.5mW	12.5mW	25mW	50mW
Accuracy		±0.065% of F.S.			±0.065% of F.S.			±0.115% of F.S.
Precision		±0.0175% of F.S.			±0.0175% of F.S.			±0.03% of F.S.
Sampling Time		10mS			10mS			
Current Rise Time (+10%~+90%)		<1.5mS			<1.5mS			
Energy Recovery Efficiency		75%			75%			
Auxiliary Voltage Protection Channel		Configure one per channel			Configure one per channel			

Note *1: ST range is the super output mode (Super mode), the limit voltage of the ST range is 5V.
*All specifications are subject to change without notice.

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

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HEADQUARTERS
CHROMA ATE INC.
88 Wenmao Rd.,
Guishan Dist.,
Taoyuan City
333001, Taiwan
T +886-3-327-9999
F +886-3-327-8898
www.chromaate.com
info@chromaate.com

U.S.A.
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
www.chromaus.com
info@chromaus.com

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

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

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

KOREA
CHROMA ATE KOREA BRANCH
3F Richtogether Center, 14,
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

CHINA
CHROMA ELECTRONICS (SHENZHEN) CO., LTD.
8F, No.4, Nanyou Tian An Industrial Estate,
Shenzhen, China
T +86-755-2664-4598
F +86-755-2641-9620
www.chroma.com.cn
info@chromaate.com

SOUTHEAST ASIA
QUANTEL PTE LTD.
(A company of Chroma Group)
25 Kallang Avenue #05-02
Singapore 339416
T +65-6745-3200
F +65-6745-9764
www.quantel-global.com
sales@quantel-global.com