



## MODEL 17020E

### KEY FEATURES

- Charge/discharge modes (CC, CV, CP)
  - Power Range: 10kW/20kW/30kW/40kW/50kW/60kW/70kW/80kW per channel
  - Voltage Range: 60V/100V
  - Current Range: 100A/200A/300A/400A/500A/600A/700A/800A per channel
- Regenerative battery energy discharge with 85% efficiency
- Paralleled channels for higher currents
- Driving cycle simulation
- High precision measurements
- Fast current conversion without interruption
- Smooth current transition without over shoot when switching between CC-CV-CP modes
- Test data analysis function
- Data recovery protection (after power failure)
- Independent protection for each channel

### FIELDS OF APPLICATION

- EV battery module
- Electric scooter
- Electric bike
- UPS
- Energy storage battery
- Power tools
- Car battery
- Lead-acid battery

## REGENERATIVE BATTERY PACK TEST SYSTEM MODEL 17020E

Chroma's 17020E is a high precision system specifically designed for secondary battery module and pack testing. Highly accurate sources and measurements ensure that the test quality is suitable for performing repetitive and reliable tests crucial for battery modules/packs, incoming and outgoing inspections, as well as performance, production, and qualification testing.

Three safety features are designed for battery testing: software for DUT communication protection, firmware for over voltage and over current protection, and multiple hardware protection circuits to ensure test procedures are performed safely.

The Chroma 17020E system is equipped with 2/4 independent channels to support dedicated charge/discharge tests on multiple battery modules/packs, each with discrete test characteristics to achieve a high utilization rate of the equipment.

The Chroma 17020E system has flexible programming functions and may be operated with Chroma's powerful "Battery Pro"

software. The software can create cycling tests that range from basic charge or discharge to complex drive cycle testing for each channel or channel groups. In the unlikely event of power or computer communication loss, the data is securely stored in the system's non-volatile memory, protecting against potential data loss and allowing for continuous flow after restart.

The Chroma 17020E, with its high precision output and measurement specifications, insures consistent test quality. A seamless transition function between charge and discharge allows programming a dynamic driving curve that can simulate the actual use of the battery pack on an electric vehicle.

The Chroma 17020E has a regenerative energy feature that recycles the electrical energy sourced by a battery module during discharge either back into the channels in the system that are performing a charging test or to the utility mains.



# Chroma

## SYSTEM FEATURES

### Security - Reinforce Risk Management

- Ability to directly input test, cut-off, and protection criteria to a charging/discharging device to achieve multi-layer protection through internal software and hardware
- Ability to integrate external hardware to get real-time monitoring parameters from a Battery Management System Data Communication Unit (BMS), Data Logger, Thermal Chamber, and I/O signals to execute warning/cut-off/ power off protection
- Ability to monitor various voltage and temperature values of battery packs through readings from BMS and measurements on a Data Logger; also able to make fast decisions and trigger protection based on set values
- Built-in multiple warning and protection modes : OVP, UVP, OTP, WIR\_LOSS, CAL\_ERR, POW\_ERR, RMT\_RVS

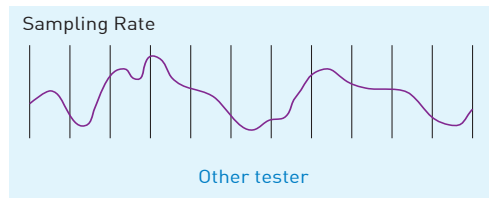
### Precision - Improve Product Quality

- High frequency sampling measurement technology: Max. sampling rate 50kHz to ensure dynamic measurement accuracy
- Voltage accuracy:  $\pm(0.02\% \text{ of rdg. } \pm 0.02\% \text{ of F.S.})$
- Current accuracy:  $\pm(0.1\% \text{ rdg.} + 0.05\% \text{ rng.})$
- Quick response test technology: 50ms (-90% to 90%) current slew rate applicable for various test applications
- Supports dynamic driving profile simulation (waveform), which simulates the current and power state of real driving conditions to comply with the NEDC, FUDS and HPPC standards

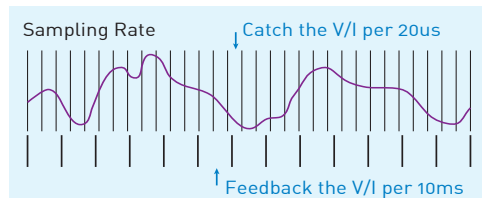
### High Frequency Sampling Measurement Technology

Generally, battery chargers/dischargers use software to read current values for calculating power; however, limited data sampling rates could result in large errors when calculating the dynamic current capacity. By increasing the V/I sampling rate and using a double integration method, Chroma is able to provide a capacity calculation with much higher accuracy. When the current changes, the data is not lost and the transmission speed is not affected.

- V/I sampling rate: 50KHz (per 20 $\mu$ s)
- Integration calculus: I for capacity; V x I for energy



General charger/discharger sampling rate

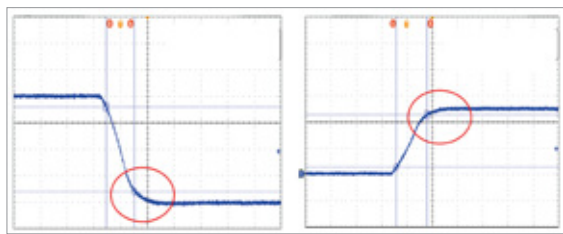


Chroma charger/discharger sampling rate

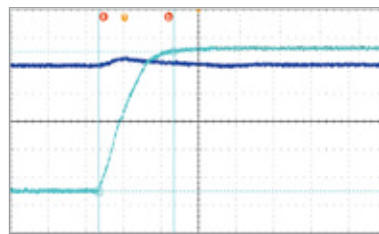
### Quick Response Test Technology

Smooth current change between charge and discharge without overshoot to avoid damaging the battery

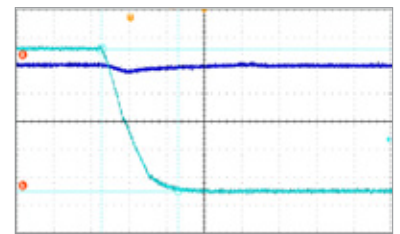
- Current ripple noise <1%, Overshoot <1%



Overshoot <1%



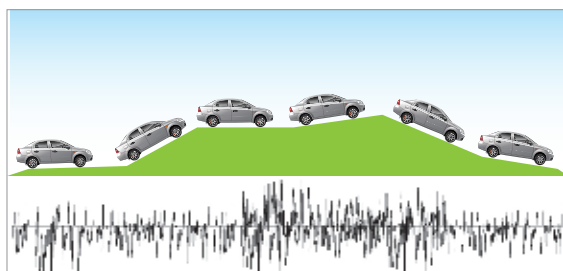
Current slew rate 50ms (-90% to 90%)



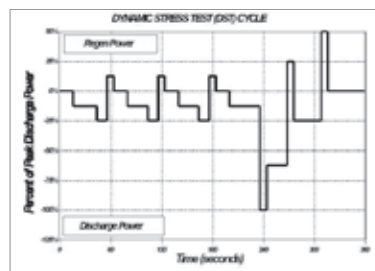
### Dynamic Driving Profile Simulation

Battery packs are used under fast and irregular current conditions. The 17020E system simulates real conditions on the battery pack via the working condition simulator

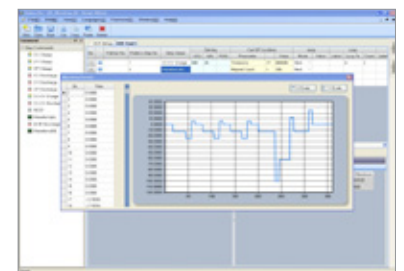
- Dynamic charge/discharge power or current waveforms simulate the drive cycle or any real world application. In the dynamic current mode (waveform), the current transition time from maximum discharge to maximum charge is only 10ms
- Ability to import stored current/power waveforms from an Excel file
- 720,000 points of driving profile memory are available to save the waveform profile in each channel
- Interval for profile condition changes: 10ms



Driving profile simulation



Regulatory compliance testing standards



Profile simulation data loading equipment



### Regenerative Battery Pack Test System



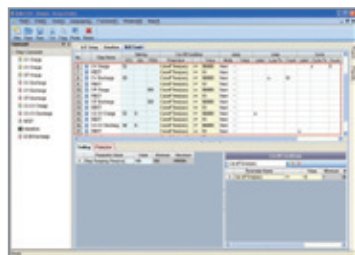
## GRAPHIC USER INTERFACE - BATTERY PRO

The 17020E test system is specifically designed to meet the diversified requirements for testing secondary battery packs with a high degree of safety and stability. Charge and discharge protection will abort tests when abnormal conditions are detected. Data loss, storage and recovery are protected against power failure.

- Language support: Traditional Chinese / Simplified Chinese / English
- Displays Real-time multi-channel battery pack status
- Icon manager: the test status of each channel is displayed using different icons that are easy to read and understand
- Security management: sets user access for secure operation
- Fault record tracking: independently records any abnormal state for each channel



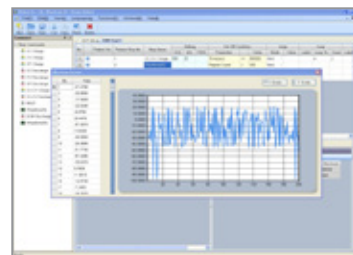
Battery Pro main panel



Charge/Discharge test program editor



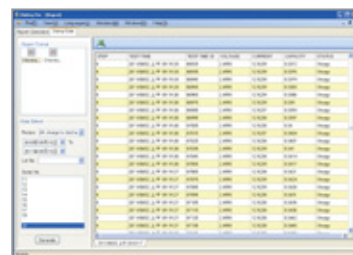
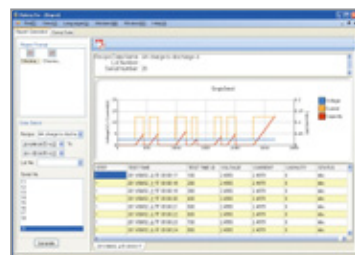
Real time monitoring



Waveform current test editor

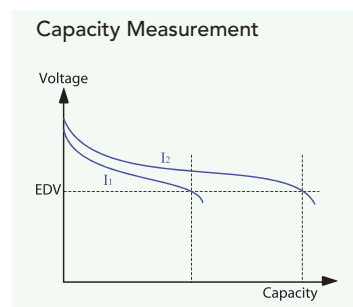
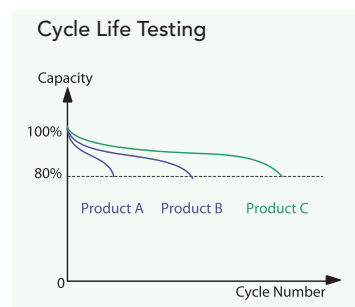
### Recipe Editor

- 255 charge/discharge conditions
- Sets dual layer loops (cycle & loop) with 9999 loops per layer
- Ability to edit dynamic charge/discharge waveform with 10ms current switching speed
- Testing step: CV / CC / CP / CC-CV / Waveform current / DCIR)
- Cut-off conditions (time, current, capacity, cut-off voltage, cut-off current, etc.)
- Next Step: Next / End / Jump / Rest



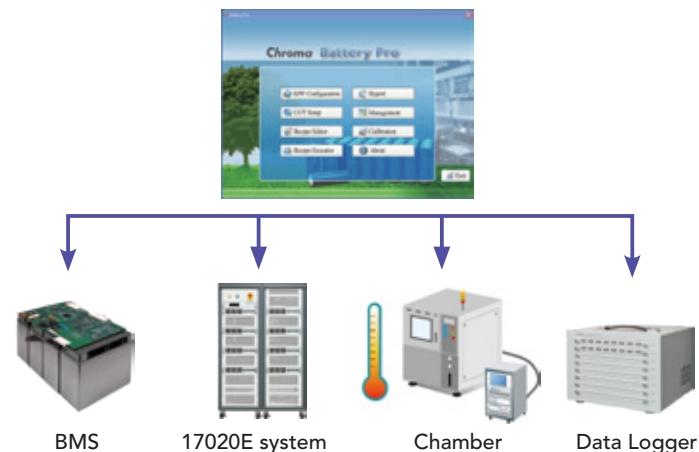
### Statistical Reports

- Customized report formatting and exporting of test reports to PDF, CSV and XLS
- Graphical report and analysis functions
- Report analysis function: allows creation of customized reports such as life-cycle reports, Q-V reports, V/I/T-time reports, etc., through the user-defined X and Y axis parameters



### Software Integration

- Thermal chamber: Synchronizes temperature control with the charge/discharge profile
- Data logger: records temperature or voltage data that can be used for setting cut-off and protection conditions
- BMS data record: Software setting to read data from a BMS data communication unit (A692000/A692001) that supports RS485 and CAN bus. The data can be used for setting cut-off and protection conditions



## SPECIFICATIONS

| Model                   | 17020E                                                                                          |                       |                       |                       |                       |
|-------------------------|-------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Channel                 | 2                                                                                               | 4                     | 2                     | 4                     | 2                     |
| Max. Power              | 20kW                                                                                            | 40kW                  | 20kW                  | 40kW                  | 40kW                  |
| Voltage                 | 100V                                                                                            | 100V                  | 60V                   | 60V                   | 60V                   |
| Max Current             | 200A (Parallelable)                                                                             | 400A (Parallelable)   | 360A (Parallelable)   | 720A (Parallelable)   | 720A (Parallelable)   |
| Charge/Discharge Mode   |                                                                                                 |                       |                       |                       |                       |
| Voltage Range           | 0V-100Vdc                                                                                       | 0V-100Vdc             | 0V-60Vdc              | 0V-60Vdc              | 0V-60Vdc              |
| Maximum Current         | 100A                                                                                            | 100A                  | 180A                  | 180A                  | 360A                  |
| Max Power               | 10kW                                                                                            | 10kW                  | 10kW                  | 10kW                  | 20kW                  |
| CC mode accuracy        | 0.1% stg.+0.05%F.S.                                                                             | 0.1% stg.+0.05%F.S    | 0.1% stg.+0.05%F.S.   | 0.1% stg.+0.05%F.S.   | 0.1% stg.+0.05%F.S    |
| Current Resolution      | 5mA                                                                                             | 5mA                   | 10mA                  | 10mA                  | 20mA                  |
| CV mode accuracy        | 0.1% stg.+0.05% F.S.                                                                            | 0.1% stg.+0.05% F.S.  | 0.1% stg.+0.05% F.S.  | 0.1% stg.+0.05% F.S.  | 0.1% stg.+0.05% F.S.  |
| Voltage Resolution      | 3mV                                                                                             | 3mV                   | 2mV                   | 2mV                   | 2mV                   |
| CP mode accuracy        | 0.2% stg.+0.1% F.S.                                                                             | 0.2% stg.+0.1% F.S.   | 0.2% stg.+0.1% F.S.   | 0.2% stg.+0.1% F.S.   | 0.2% stg.+0.1% F.S.   |
| Power Resolution        | 0.5W                                                                                            | 0.5W                  | 0.3W                  | 0.3W                  | 0.3W                  |
| Measurement             |                                                                                                 |                       |                       |                       |                       |
| Voltage range           | 0V-100Vdc                                                                                       | 0V-100Vdc             | 0V-60Vdc              | 0V-60Vdc              | 0V-60Vdc              |
| Voltage accuracy        | 0.02% rdg.+0.02% rng.                                                                           | 0.02% rdg.+0.02% rng. | 0.02% rdg.+0.02% rng. | 0.02% rdg.+0.02% rng. | 0.02% rdg.+0.02% rng. |
| Voltage resolution      | 3mV                                                                                             | 3mV                   | 2mV                   | 2mV                   | 2mV                   |
| Current range           | 25A/100A                                                                                        | 25A/100A              | 45A/180A              | 45A/180A              | 90A/360A              |
| Current accuracy        | 0.1% rdg.+0.05% rng.                                                                            | 0.1% rdg.+0.05% rng.  | 0.1% rdg.+0.05% rng.  | 0.1% rdg.+0.05% rng.  | 0.1% rdg.+0.05% rng.  |
| Current resolution      | 5mA                                                                                             | 5mA                   | 10mA                  | 10mA                  | 20mA                  |
| Power range             | 10,000W                                                                                         | 10,000W               | 10,000W               | 10,000W               | 20,000W               |
| Power accuracy          | 0.12% rdg.+0.07% rng.                                                                           | 0.12% rdg.+0.07% rng. | 0.12% rdg.+0.07% rng. | 0.12% rdg.+0.07% rng. | 0.12% rdg.+0.07% rng. |
| Power resolution        | 0.3W                                                                                            | 0.3W                  | 0.3W                  | 0.3W                  | 0.3W                  |
| Temperature Coefficient |                                                                                                 |                       |                       |                       |                       |
| Voltage/Current         | 50ppm/°C                                                                                        |                       |                       |                       |                       |
| Other                   |                                                                                                 |                       |                       |                       |                       |
| Protection              | OVP, UVP, OCP, OQP, OTP, ODVP, UDVP, ODCP, UDCP                                                 |                       |                       |                       |                       |
| Efficiency (Typical)    | 85%                                                                                             |                       |                       |                       |                       |
| Interface               | Ethernet                                                                                        |                       |                       |                       |                       |
| Operating Temperature   | 0°C~40°C & 0~90RH%                                                                              |                       |                       |                       |                       |
| Humidity                | -40°C~85°C (Storage)                                                                            |                       |                       |                       |                       |
| AC input                | 3 $\Phi$ 200~220Vac $\pm$ 10% VLL/3 $\Phi$ 380~400Vac $\pm$ 10% VLL/ 47~63Hz for input AC power |                       |                       |                       |                       |
| Safety & EMC            | N/A                                                                                             |                       |                       |                       |                       |
| Dimension               | 1826mm x 600mm x 1000mm (H x W x D)                                                             |                       |                       |                       |                       |
| Weight (master/slave)   | 260/250 kg                                                                                      | 390/380 kg            | 260/250 kg            | 390/380 kg            | 390/380 kg            |

\* All specifications are subject to change without notice.

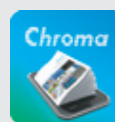
## ORDERING INFORMATION

| Model  | Power and Channel combinations                                                       |                 |                                                     |
|--------|--------------------------------------------------------------------------------------|-----------------|-----------------------------------------------------|
| 17020E | Regenerative Battery Pack Test System 100V/100A/10kW/2CH/20kW                        | A170201         | IPC for battery test system                         |
| 17020E | Regenerative Battery Pack Test System 100V/100A/10kW/4CH/40kW                        | A692000         | BMS data communication unit, 4 Channels             |
| 17020E | Regenerative Battery Pack Test System 100V/100A/10kW/6CH/60kW                        | A692001         | BMS data communication unit, 8 Channels             |
| 17020E | Regenerative Battery Pack Test System 100V/100A/10kW/8CH/80kW                        | A692009         | Parallel block for 17020E (100V/60V)                |
| 17020E | Regenerative Battery Pack Test System 60V/180A/10kW/2CH/20kW                         | A692010         | Parallel cable for 17020E (500A)                    |
| 17020E | Regenerative Battery Pack Test System 60V/180A/10kW/4CH/40kW                         | A692011         | Parallel output fixture for 17020E (100V/60V)       |
| 17020E | Regenerative Battery Pack Test System 60V/180A/10kW/6CH/60kW                         | A692012         | Parallel block on bottom side for 17020E (100V/60V) |
| 17020E | Regenerative Battery Pack Test System 60V/180A/10kW/8CH/80kW                         | A692003         | Thermal sensor with cable (for OTP)                 |
| 17020E | Regenerative Battery Pack Test System 60V/360A/20kW/2CH/40kW                         | HIOKI 8423/8948 | Data Logger Measurement Unit                        |
| 17020E | Regenerative Battery Pack Test System 60V/360A/20kW/4CH/80kW                         | HIOKI 9683      | Connection cable caption for HIOKI 8423             |
| 17020E | Regenerative Battery Pack Test System 60V/100V<br>More power or channel combinations |                 |                                                     |

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HEADQUARTERS  
CHROMA ATE INC.  
66 Huaya 1st Road,  
Guishan, Taoyuan  
33383, 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.chromaate.com  
info@chromaate.com

CHROMA SYSTEMS  
SOLUTIONS, INC.  
19772 Pauling, Foothill Ranch,  
CA 92610  
T +1-949-600-6400  
F +1-949-600-6401  
www.chromausa.com  
sales@chromausa.com

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

CHROMA ATE GERMANY  
Südtiroler Str. 9, 86165,  
Augsburg, Germany  
T +49-821-790967-0  
F +49-821-790967-600  
support-germany@chroma.eu.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.com  
erica.shih@chromaate.co.kr

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)  
46 Lorong 17 Geylang  
# 05-02 Enterprise  
Industrial Building,  
Singapore 388568  
T +65-6745-3200  
F +65-6745-9764  
www.quantel-global.com  
sales@quantel-global.com