



Modular
Design



Energy
Recovery



High Precision
Fast Response



High Power
Density

REGENERATIVE BATTERY PACK TEST SYSTEM MODEL 17060

The Chroma 17060 is a high-power-density charge/discharge system developed specifically for rechargeable battery pack testing. It combines high precision with energy recovery capability and adopts a modular power architecture. Different power modules can be flexibly configured in series and/or parallel under specified conditions to provide multiple power-channel options. With high scalability and flexible system integration, the system can meet battery testing requirements across a wide range of applications.

The 17060 features energy recovery capability to reduce the large amount of electrical energy otherwise consumed during battery discharge. Even under dynamic charge/discharge conditions, the system maintains stable grid-side operation without harmonic interference affecting other equipment. Energy discharged from the battery pack can be recovered and fed back to the grid for reuse, reducing the energy waste and heat dissipation issues associated with conventional discharge equipment while supporting environmental requirements.

The system adopts a modular architecture, allowing power modules to be configured in series and/or parallel according to test requirements to meet different power, voltage, and current ranges. Flexible series/

parallel channel configuration allows the system setup to be adjusted according to test power requirements and supports battery validation solutions up to the megawatt level, reducing initial capital investment. This architecture flexibly accommodates different test power requirements while maintaining high scalability and application flexibility.

When paired with Chroma Battery Pro X software, recipe test steps support multi-variable calculations and conditional logic. Test conditions can be dynamically adjusted according to signals returned by the battery pack or BMS, enabling diverse and complex test scenarios. Enhanced data analysis tools also support importing and comparing multiple datasets, rapid curve generation, and customized report data.

Multiple protection mechanisms designed for battery testing automatically detect overvoltage, overcurrent, and external signals to maintain safety and stability throughout the test process. If an abnormal condition is detected on any channel, charge/discharge operation is stopped for protection. Data retention after power interruption and test recovery functions further help prevent data loss.



MODEL 17060

KEY FEATURES

- Megawatt-level high power density battery validation solution
- High-precision output and measurement, up to $\pm 0.02\%$ of F.S.
- High measurement resolution, up to 18 bit
- Fast current response, as fast as $<1\text{ms}$
- High-speed data logging (1ms)
- Parallel channel output, up to 4,000A
- Discharge energy recovery capability (regenerative series)
- Zero crossing time between charge and discharge
- Test data analysis, report output, and graphical presentation
- Data recovery and test continuation after power loss
- Fast response with optional components (delay time $<10\text{ms}$)
- Flexible system integration:
BMS data acquisition and logic; integration with climate chambers and chillers; multi-channel voltage and temperature acquisition

APPLICATIONS

- Durability testing of backup battery units (BBUs) for AI servers
- Backup battery modules
- EV battery modules
- Energy storage battery modules
- EDLC supercapacitor modules
- Lithium-ion capacitor (LIC) modules



Chroma
Advancing Excellence

SYSTEM FEATURES

Designed for high-power rechargeable battery pack testing, the Chroma 17060 Battery Pack Test System combines high power density with high-precision measurement capability. Its regenerative technology feeds energy back to the grid for reuse, effectively reducing energy consumption and improving overall energy efficiency. The system adopts a modular architecture that allows power stages to be configured in series and/or parallel according to test requirements, providing flexible multi-channel expansion capability.



HIGH EFFICIENCY

MODULAR HIGH-POWER ARCHITECTURE AND ENERGY REGENERATION

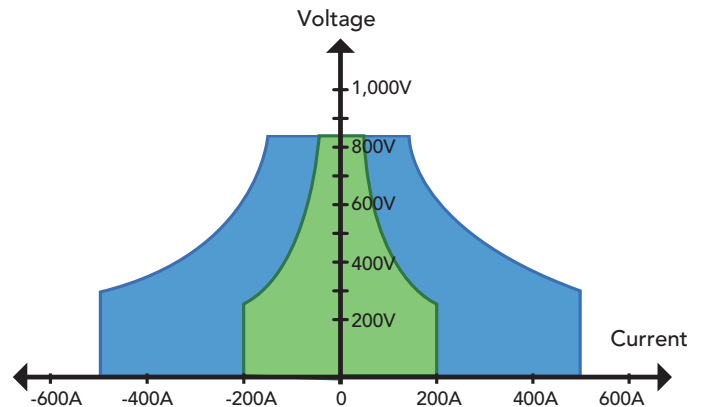
The Chroma 17060 uses a modular bidirectional DC power architecture and provides two power stages: the 69605-850-200 (50kW) and 69615-850-500 (150kW). Power stages can be flexibly configured and the system power rating expanded according to test requirements. The 50kW module provides up to 850V and 200A output, while the 150kW module provides up to 850V and 500A output, maintaining reliable output capability under either high-voltage or high-current conditions. Both power stages use a 3U design to deliver high power density within limited rack space and optimal space utilization. The modular architecture enables flexible expansion according to test requirements, improving overall configuration and integration efficiency. The 17060 also provides discharge energy recovery, returning energy generated during testing to the grid and improving overall energy utilization in high-power test environments.



Bidirectional Power Stage 69605-850-200



Bidirectional Power Stage 69615-850-500



■ CP Curve: 69605-850-200 50kW/850V/200A/1CH
■ CP Curve: 69615-850-500 150kW/850V/500A/1CH

Same power → Series configuration

1S	50kW 50kW/850V/200A	150kW 150kW/850V/500A	850V
2S	50kW 50kW 100kW/1,700V	150kW 150kW 300kW/1,700V	1,700V

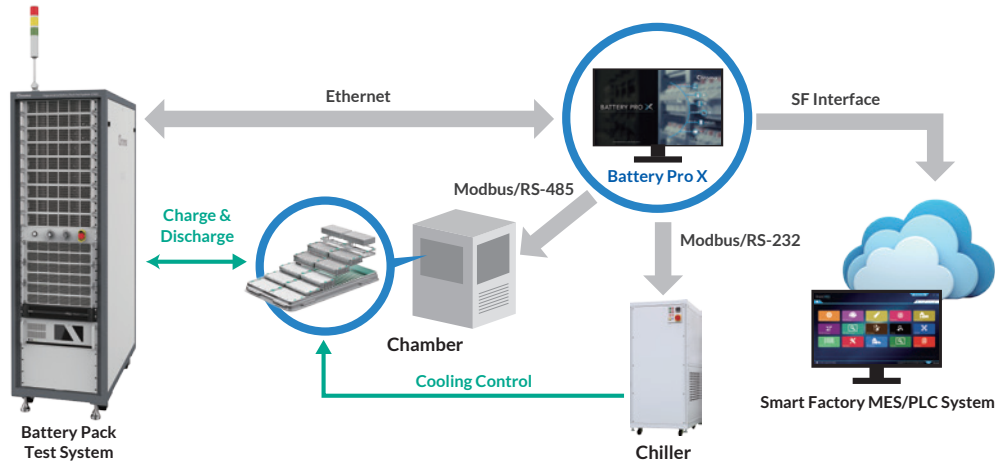
Same voltage → Parallel configuration

50kW // 50kW 100kW	50kW // 150kW 200kW	850V
50kW 50kW // 50kW 150kW 400kW		1,700V

Flexible Hardware and Software Integration

Chroma's Battery Pro X software allows integration with third-party hardware, enabling charge/discharge protection to kick in and automatically stop the test when abnormalities are detected. The software can also integrate third-party chambers and chillers for temperature and humidity control, reducing fragmented operation across devices resulting in more streamlined workflows. Data from these devices can be incorporated into test procedure control to support integrated test solutions.

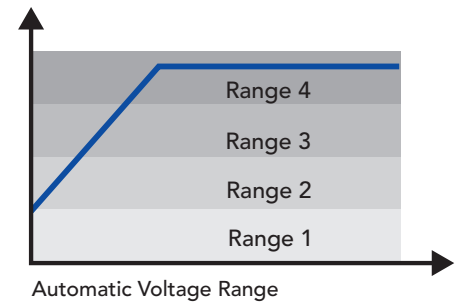
- Chamber: Temperature and humidity control integrated with charge/discharge procedures
- Chiller: Water temperature, flow, and pressure control for simulating various operating conditions



High Precision - Precise Measurement Improves Product Quality

The system features automatic voltage range switching with multiple measurement ranges. As the voltage changes dynamically, the system automatically switches to the appropriate range to optimize measurement accuracy.

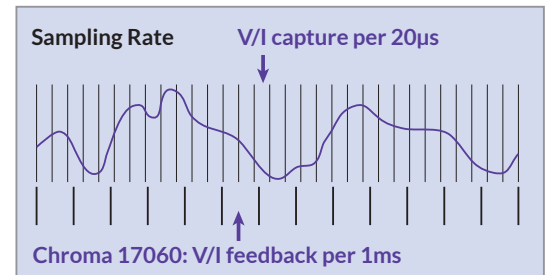
- Voltage accuracy: $\pm 0.02\%$ of range
- Current accuracy: $\pm 0.02\%$ of F.S.



High-Frequency Sampling Accurately Captures Battery Pack Capacity

The high-frequency sampling measurement technology provides a sampling rate of up to 50kHz to ensure dynamic measurement accuracy. Conventional battery charge/discharge systems directly use current values read by software for capacity calculation. However, limitations in software data reading speed can result in excessive capacity calculation errors under dynamic current conditions. By increasing the V/I sampling rate and using a double-integration method, the Chroma 17060 provides accurate capacity calculation without missing data during current changes and without being affected by the data transmission rate.

- V/I sampling rate: 50kHz (one sample every 20 μ s)

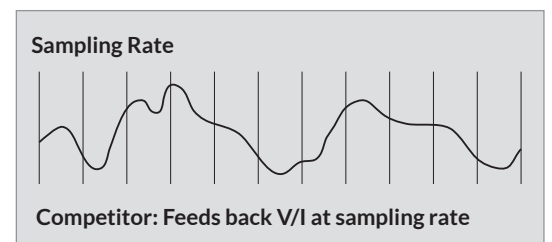


Chroma Charge/Discharge System Sampling Rate Diagram

Fast-Response Testing for Battery Pack Verification

The Chroma 17060 supports Waveform testing for dynamic operating condition simulation, reproducing the current or power profiles of actual driving conditions. It supports test standards such as NEDC, FUDS, and HPPC. With fast current response and optimized charge/discharge mode switching, the system provides smooth transitions without current surges, helping prevent damage to the DUT during testing.

- Current switching time: 4ms (-90% to 90%)



Other Charge/Discharge Systems Sampling Rate Diagram

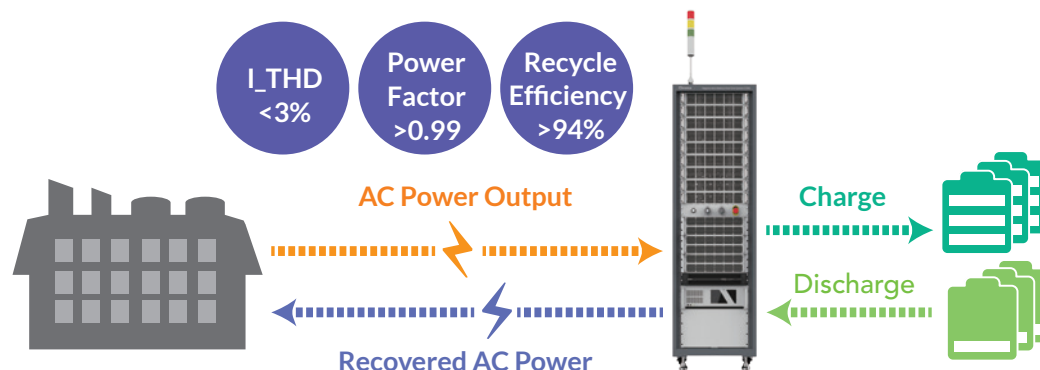


SAFETY

Safety - Bidirectional Circuit Architecture for Power Protection

The system adopts a bidirectional circuit architecture to achieve efficient discharge energy recovery. It precisely controls the forward and reverse flow of AC current, maintaining a smooth AC current waveform with real-time phase transitions. The design complies with grid requirements to prevent interference with other grid-tied equipment. When an abnormal grid condition is detected, the system actively disconnects the main circuit power to ensure safety.

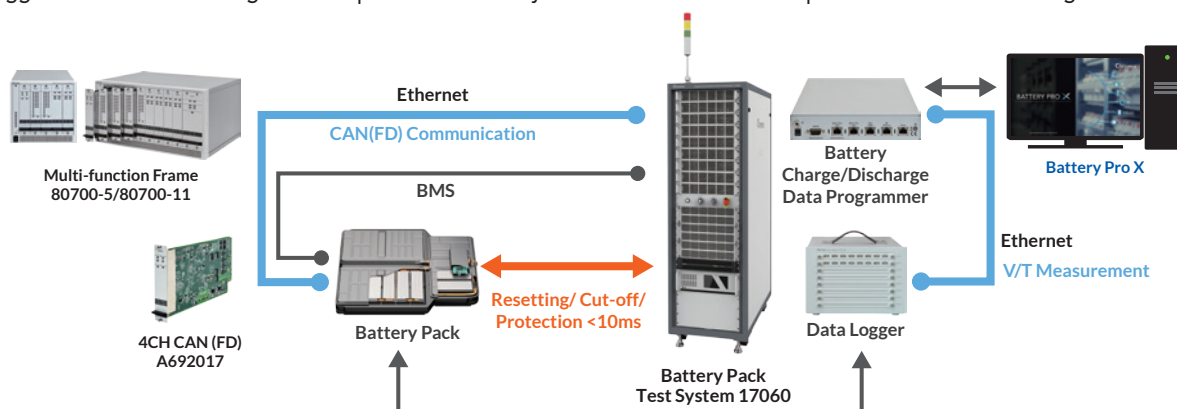
- I_{T.H.D} <3% @400VAC
- PF >0.99 @400VAC
- Max. Recycle Efficiency > 94%



INTEGRATED HARDWARE ENHANCES BATTERY PACK TEST SAFETY (OPTION)

The Chroma 17060 integrates software, a BMS data acquisition device, and a data logger through a middleware architecture to improve communication efficiency and achieve communication latency of less than 10ms, further enhancing safety protection and monitoring capability for battery pack testing. When used with the designated battery management system (BMS) data acquisition device, the system can read multiple sets of BMS data through communication interfaces such as CAN (FD) during charge/discharge testing. The acquired data can be used to configure protection parameters, helping ensure battery pack test status monitoring, data recording, fault diagnosis, and safety protection. When used with the designated data logger, the system can measure the voltage and temperature of multiple battery cells or modules during charge/discharge testing, and the measurement data can be used for protection condition settings.

- **BMS Data Acquisition Device:** Uses the Chroma 80700-5/80700-11 standard mainframe integrated with the A692017 4CH CAN (FD) bus communication card module for battery pack BMS communication and data acquisition. Test channels can be bound to BMS signals to monitor battery pack status while synchronously acquiring and recording DUT data. Charge/discharge conditions can also be dynamically adjusted based on real-time BMS signals, with cutoff and protection logic executed accordingly to better meet practical test requirements and reduce the risk of abnormal testing.
- **Data Logger:** Measures the voltage and temperature of battery cells or modules for use in protection condition settings.



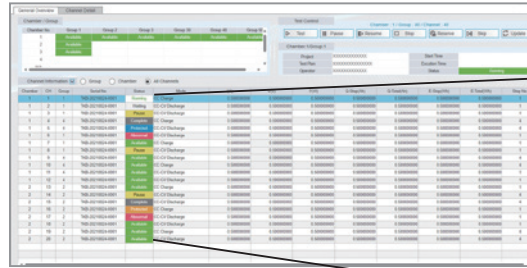
BATTERY CHARGE/DISCHARGE SOFTWARE - BATTERY PRO X

Battery Pro X is the software platform for the 17060 test system, designed to meet rechargeable battery pack testing requirements with high stability and safety. It provides data retention and recovery after power interruption to help prevent data loss. With real-time monitoring, test status can be clearly displayed and managed through different icons for at-a-glance viewing. The software also supports operation and fault log tracking, together with independent channel abnormal status display.

- **Multilingual Interface:** English / Traditional Chinese / Simplified Chinese
- **User Permission Settings:** User operation permissions can be configured for convenient management



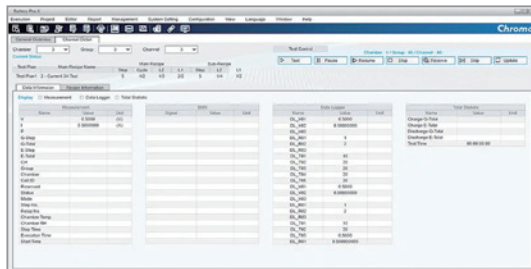
Battery Pro XMain Screen



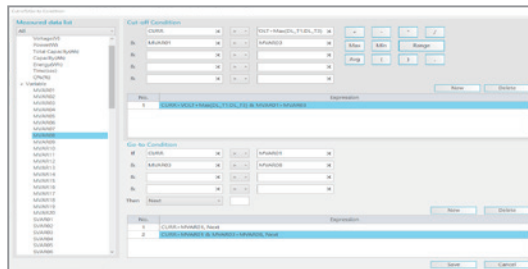
Test Plan Execution Screen

Designed for Battery Applications

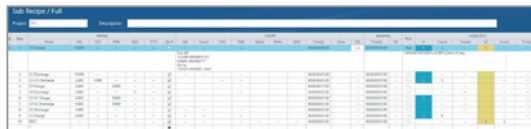
- Comprehensive control of battery charge/discharge cycles and test functions, from basic measurements to advanced data analysis, all performed with industry-leading precision and efficiency.
- The Test Plan Execution screen clearly visualizes channel status, improving workflow and reducing training time to deliver a streamlined testing experience.
- The Channel Detail screen allows users to monitor testing progress and data in real time.
- The Recipe Editor features an intuitive interface enabling users to quickly create and modify test recipes.



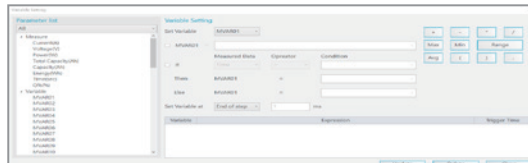
Channel Detail



Cutoff/Jump Condition Setup



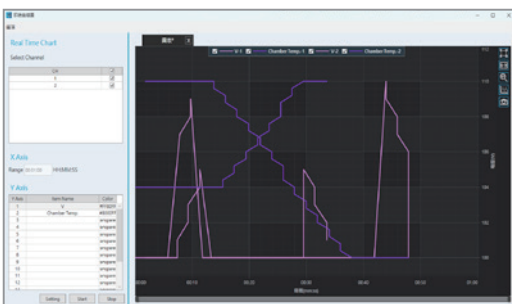
Recipe Editor



Variable Setting

Test Step Setup

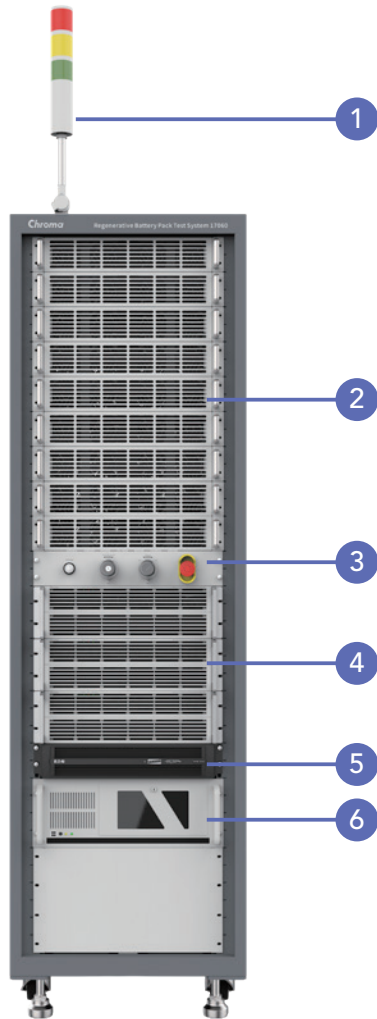
- Sub-Recipe, Main Recipe, and Test Plan
- Each Sub-Recipe can include up to 200 charge/discharge conditions
- Each Main Recipe can include up to 50 Sub-Recipes or 500 charge/discharge conditions
- Each Test Plan includes 1 Main Recipe
- Dual-level looping (Cycle & Loop): each level supports up to 999,999 cycles
- Supports dynamic charge/discharge waveform editing with a 10ms current switching speed
- Supports adjustment of cutoff conditions and protection settings for different DUTs
- Cutoff/jump conditions can be defined by time, current, capacity, cutoff voltage, cutoff current, or variable settings. Logical expressions and If-Then-Else rules are also supported, enabling flexible parameter configuration aligned with testing and verification logic.



Real-Time Chart

Report Analysis and Statistical Reporting

- Customizable report formats with export to PDF, CSV, and XLS
- Graphical reporting functions included
- Report analysis tools allow users to create customized reports by defining X- and Y-axis parameters, such as lifecycle reports, Q (Ah) – V reports, and V / I(A) / T(°C) vs. time reports
- Real-time viewing of test reports for each channel



450kW x 1CH

H205 x W60 x D120 cm (height excludes three-color tower light) / 720 kgs

1. 1. Status indicator tower light
 2. AC/DC bidirectional converter
 3. Indicator light / Auto recovery / Power switch / Emergency stop button
 4. Modular bidirectional DC power supply
 5. Industrial PC (option)
 6. Uninterruptible power supply (option)
- * Customization for other equipment is supported



1.2MW x 1CH

H230 x W180 x D120 cm
(height excludes three-color tower light) / 1,600 kgs

SPECIFICATIONS

Model		17060		17060	
Power Stage		Chroma 69605-850-200		Chroma 69615-850-500	
Max. Power per channel		50kW		150kW	
Voltage Range ^{*1}		Charge: 0 to 850V Discharge: 30 to 850V		Charge: 0 to 850V Discharge: 30 to 850V	
Max. Current per channel		200A		500A	
Channels ^{*2}		2CH		2CH	
Power in Parallel Mode		450kW ; Max. 1.2MW ^{*3}			
Control					
Constant Voltage Mode					
Voltage Range		30 to 850V		30 to 850V	
Voltage Accuracy (% of full scale)		± 0.02%		± 0.02%	
Voltage Resolution per channel		10mV		10mV	
Constant Current Mode					
Max. Current per channel		200A		500A	
Current Accuracy (% of full scale)		± 0.05%		± 0.05%	
Current Resolution per channel		5mA		8mA	
Max. Current per System		4,000A ^{*3}			
Constant Power Mode					
Max. Power per channel		50kW		150kW	
Power Accuracy (% of full scale)		± 0.07%		± 0.07%	
Power Resolution per channel		5W		9W	
Measurement					
Voltage Accuracy ± (% of range)		± 0.02%		± 0.02%	
Voltage Range & Voltage Resolution (4 Scales as full scale)	1	0 to 850V	10mV	0 to 850V	10mV
	2	0 to 400V	10mV	0 to 400V	10mV
	3	0 to 200V	10mV	0 to 200V	10mV
	4	0 to 100V	10mV	0 to 100V	10mV
Current Accuracy ± (% of full scale) ^{*4}		± 0.02%		± 0.02%	
Current Range		200A		500A	
Current Resolution		5mA		8mA	
Power Accuracy (% of full scale)		± 0.04%		± 0.04%	
Electrical Specifications					
Data Acquisition Time (HW Sampling Rate)		1ms in waveform mode ; 10ms in CC, CV, CP mode			
Current Ripple		<0.5%			
Overshoot		<0%			
Operating Mode (Charge/Discharge)		CC, CV, CP, CP-CV, CC-CV, Waveform Power, Waveform Current, Rest, DCIR, CR			
Current Rising/Falling Time (10% to 90%)	>50% full current	1ms			
	<50% full current	2ms			
Current Switching Time (-90% to 90%)	>50% full current	2ms			
	<50% full current	4ms			
Line Voltage/Frequency (3 phase/4 wire with earth ground)		380 to 400Vac ± 10% V _{LL} , 50/60Hz			
Power Factor @400VAC		>0.99			
I.T.H.D @400VAC		<3%			
Max. Regenerate Efficiency		>94%			
Operating Temperature		0°C to 40°C			
Storage Temperature		-20°C to 60°C			
Operating Humidity		5% to 80% RH, non-condensing			
Protection		OVP, UVP, OCP, OPP, FAN			
Noise Level (Standby/Operating)		Standby: <75dB Operating: <100dB			
Cooling Type		Air			
Weight		≒ 46.5 kgs		≒ 62.5 kgs	
Control Interface for System Integration ^{*3}					
Communication Interface		CANbus			
Connector		1 x DB9 male connector			
Channels		1CH			
Protocol		CAN-FD 1.0 ; CAN 2.0A (11-bit) / Extended CAN 2.0B (29-bit)			
Data Transfer Rate		Up to 5 Mbit/s via CANFD ; Up to 1 Mbit/s via CANbus			
Communication Controller		Build-in MCU AM65XX			
CAN Transceiver		ADM3050E or Compatible with ISO 11898-2			
Signal Support		CAN_H, CAN_L			
Isolation Protection		5k VDC			
Communication Interface		Ethernet			
Connector		4 x RJ-45 connectors			
Protocol		TCP/IP			
Data Transfer Rate		10BASE-T/100BASE-TX/1000BASE-TX			

Note *1: The output voltage range depends on the cable configuration. A standard 10m cable is provided for connection between the device and battery.

Note *2: Up to two bidirectional power modules can be configured in series. For system configuration requirements or inquiries, please contact your Chroma sales representative.

Note *3: This function is intended for specific applications. For details, please contact your Chroma sales representative.

Note *4: Current accuracy is ±0.02% of full scale (F.S.) at VOUT = 300V. The voltage coefficient is ±50ppm of F.S. for every 50V change from the 300V reference voltage.

* Voltage/current accuracy is specified at 25°C ±3°C. The temperature coefficient is less than 50ppm of F.S. per 1°C deviation from the 25°C ±3°C reference temperature. Based on the estimated long-term system drift (>30ppm/year), annual recalibration is recommended to ensure long-term measurement accuracy and metrological traceability.

* All specifications are subject to change without notice.

ORDERING INFORMATION

Chroma 17060 Series Models			
Model	Voltage (V)	Current (A)	Power (kW)
17060-01	0-850	0-200	50
17060-02	0-850	0-400	100
17060-03	0-850	0-500	150
17060-04	0-850	0-700	200
17060-05	0-850	0-900	250
17060-06	0-850	0-1,000	300
17060-07	0-850	0-1,200	350
17060-08	0-850	0-1,400	400
17060-09	0-850	0-1,500	450
17060-10	0-850	0-1,700	500
17060-11	0-850	0-1,900	550
17060-12	0-850	0-2,000	600
17060-13	0-850	0-2,200	650
17060-14	0-850	0-2,400	700
17060-15	0-850	0-2,500	750
17060-16	0-850	0-2,700	800
17060-17	0-850	0-2,900	850
17060-18	0-850	0-3,000	900
17060-19	0-850	0-3,200	950

Chroma 17060 Series Models			
Model	Voltage (V)	Current (A)	Power (kW)
17060-20	0-850	0-3,400	1,000
17060-21	0-850	0-3,500	1,050
17060-22	0-850	0-3,700	1,100
17060-23	0-850	0-3,900	1,150
17060-24	0-850	0-4,000	1,200
17060-25	0-1,700	0-200	100
17060-26	0-1,700	0-400	200
17060-27	0-1,700	0-500	300
17060-28	0-1,700	0-700	400
17060-29	0-1,700	0-900	500
17060-30	0-1,700	0-1,000	600
17060-31	0-1,700	0-1,200	700
17060-32	0-1,700	0-1,400	800
17060-33	0-1,700	0-1,500	900
17060-34	0-1,700	0-1,700	1,000
17060-35	0-1,700	0-1,900	1,100
17060-36	0-1,700	0-2,000	1,200
	Max. 1,700		Max. 1.2MW

ORDERING INFORMATION

Regenerative Battery Pack Test System Model 17060	
69605-850-200	Bidirectional Power Stage 50kW850V200A
69615-850-500	Bidirectional Power Stage 150kW850V500A
80700-5	80700 Multifunction Test Platform Mainframe 5 slots
80700-11	80700 Multifunction Test Platform Mainframe 11 slots
A170208	Battery Charge/Discharge Software Battery Pro X
A692017	CAN (FD)_4CH/LIN_2CH Interface Module
HIOKI LR810X/ M710X	Data Logger Measurement Unit

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