

16CH BATTERY CELL SIMULATOR MODEL 87001

Chroma 87001 Battery Cell Simulator is a highprecision, programmable, and bidirectional DC power source with both voltage source and current source functions. In addition, the model can be used as a multi-channel DC power supply or an electronic load as well. A single simulator has 16 channels and each of them can set voltage and current respectively via Chroma software.

The Chroma 87001 Battery Cell Simulator can be used in place of lithium-ion batteries to provide a reliable and safe testing environment. The equipped battery management unit (BMU) and its cell supervisor circuit (CSC) subsystem can test the battery cells used in electric vehicles and energy storage batteries.

The simulator has voltage isolated channels that can simulate a 480-cell battery pack (240S2P, Voltage <1,000V) connected in series. It is used to imitate the power characteristics when charging and discharging the battery cell energy. This high-precision battery cell simulator with flexible voltage source and current load regulation has voltage and current measurement capabilities. Each channel provides 0~5V voltage adjustment capability and 0~5A bidirectional current function, with serial and parallel capabilities between channels. The current can be increased by paralleled channels; moreover, the battery cell short circuit simulation tests can be performed via the battery management system (BMS). The BMS testing can be performed directly even when the cable length is 5m long.

The customized Chroma BMS automated test system integrates an 87001 battery simulator and a programmable resistor board. The system provides both temperature simulation for BMS temperature sensors as well as battery voltage data for BMS battery monitoring circuits, offering a comprehensive BMS test solution.

The simulator has a variety of protection features such as over-current protection (OCP), over-voltage protection (OVP), under-voltage protection (UVP), fan fail protection, and output circuit compensation voltage to make sure that the tests are conducted under safe conditions.



MODEL 87001

KEY FEATURES

- Operating mode : CC/CP
 - Channel power 25W
 - Channel voltage 5V
- Channel current 5A (parallelable)
- Bidirectional power supply design
- Serial and parallel connection function
- 480-cell battery pack voltage simulation ability (240 cells in series and 2 cells in parallel)
- High precision current and voltage measurement
- 4 current ranges for selection per channel
- Current sharing design for parallel operation mode
- Fast voltage setting for rise/fall speed : time (1ms)
- Switch between fast charge and discharge current in current source mode without any interruption
- Low output noise
- Independent channel over-voltage, current limit, and over-temperature protection
- Standard Ethernet control interface
- CE certification granted

APPLICATIONS

- BMS (Battery Management System) testing and verification
- Power tools production tests





APPLICATION ARCHITECTURE (Master/Slave Architected Battery Management System)

The battery cell simulator 87001 can simulate voltage of battery cells in series and provide current to balanced circuits of BMS boards. When integrated into an automatic BMS test system, the 87001 can test BMS boards as shown in the architecture diagram below.



BATTERY CELL STATUS IN PARALLEL AND SERIAL OPERATION MODE

For applications that require more than 16 battery cell strings, users can connect up to 15 units of 87001 simulators in series.

- Users can also independently connect each 87001 through an Ethernet hub. Where the Ethernet bandwidth is sufficient, the upper-layer controller can perform synchronous remote control, issuing voltage modulation commands to multiple 87001 simultaneously with a voltage control response time of less than 10ms for each individual unit.
- The hardware configuration can achieve up to 240S 2P (voltage < 1,000V). The simulator supports co-existing connections of channels in both series and parallel, with an automatic current balancing design in parallel connection mode.</p>

Note: The voltage control response time (phase delay time) = upper-layer controller command sending time + 87001 command processing time + voltage rise/fall time.



SCPI command by Ethernet HUB

PRECISION VOLTAGE/CURRENT MEASUREMENT

The Chroma 87001 Battery Cell Simulator has voltage source and bidirectional current source modes with a built-in 16-bit high-precision A/D converter. The voltage measurement accuracy is up to ± 1 mV (0.02%FS) with resolution up to 0.1mV.

Catering to the market trend of active and passive balance design, the current measurement is divided into four ranges, $0 \sim 9A$ (<500ms), $0 \sim 5A$, $0 \sim 500$ mA and $0 \sim 250$ uA, with 0.02%FS accuracy. For the $0 \sim 5A$ (power increased in parallel connection) range, the accuracy is ± 1 mA, which meets most industry requirements for testing actively balancing designed circuits with a current measurement resolution up to 100uA.

For the $0\sim500$ mA range, the accuracy is ±100 uA (0.02%F.S.), satisfying the needs of most of the industry's passive balance designs with a measurement resolution of up to 10uA. In addition to current measurement for passive balance designs, it can also be used to measure the current consumption of battery cells in a cell supervision circuit (>10mA for general consumption).

SEQUENCE PROGRAMMING

The battery cell simulator has 16 channels. Through the software interface, users can set the voltage and current limits for each channel individually and control settings such as the rise and fall of output voltage and synchronized startup between channels. Its low output noise feature allows it to maintain the DC characteristics of a battery cell without any ripples during dynamic load changes, guaranteeing a stable DC output in a timely manner. Additionally, this feature reduces surge voltage caused by load changes, which could otherwise harm the Unit Under Test (UUT). This makes it an ideal solution for non-static products and test applications requiring a reliable DC voltage source.

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The Chroma 87001 Battery Cell Simulator provides a high-speed, programmable, dynamic, and bidirectional load mode with less than 100us load change capability, simulating a variety of real load current waveforms.











High speed voltage response <1ms

Voltage change of all channels

Low output noise < 0.35 mV rms

Stable DC output generated from load change

SYSTEM INTEGRATION AND SUPPORT

- Chroma offers two types of commands (SCPI through the Ethernet interface and CANbus commands through the CANbus interface) as well as Labview and Labwindow driver programs, allowing users to develop their own application software for controlling the 87001 Battery Cell Simulator.
- Chroma's system integration capability enables us to provide customized automated test systems for BMS functional testing.





Integrated BMS Test System (16S)



Distributed BMS Testy System (96S)

REMOTE CONTROL FUNCTION

Chroma's proprietary Softpanel is provided to control the battery cell simulator, allowing the user to:

- Individually adjust the voltage of each battery string
- Set the voltage change procedure: OVP/UVP/OVP release /UVP release test

Note: The softpanel is only for a single unit of 87001.

Battery	Cell Simulator	Parameter Setting	Tot 0.00	100				
seni Drting	N-UDW						111 All 14	() tagita
		Output				Input		
OH (S)	V (V)	1 (nA)	P (W)	V (0) 🚖	1 (mA) 📥	P (W)	LIDW BEE	ON/OFF (2)
1.1				C.0000	2.2000	25		
1				£.0000	0.0000	25		
3				6.0000	3.2000	25		
4				6.0000	0.0000	25		
5				0.0000	0.0000			
6				6.0000	0.0000			
1				£.0000	0.0000	25		
6.00				6.0000	0.0000	25		
_			1000					and a

87001 Softpanel



SPECIFICATIONS

	Model	87001		Protection Function (w/	Software)	
	Channels	16		Protection	OVP, UVP,	
	Power Out	Normal 400W, Max. 560W (including compensation)		Transient Overvoltage Mains Supply	2500V	
	Constant Voltage			Isolation Voltage	1000V CH	
ĺ		Setting Range: 0mV ~ 5000mV		Program Response Time		
		Accuracy: \pm (0.02% of F.S.)		Current Rise/Fall Times 100us (co		
	0~5V	Reading Resolution: 0.5mV Reading Range: 0 ~ 5200mV Accuracy: ± (0.02% of F.S.) Reading Resolution: 0.1mV		Programming	Full load	
				Voltage Speed	No Load	
				Load Pogulation	Voltage	
	Constant Current			Load Regulation	Current	
		Setting Range: 0.1uA ~ 250uA Accuracy: ± (0.02% of F.S.) Setting Resolution: 0.1uA		Line Regulation	Voltage	
	250				Current	
	250UA	Reading Range: 0 ~ 250uA			Voltage	
		Accuracy: \pm (0.02% of F.S.) Reading Resolution: 10nA Setting Range: 0.1mA ~ 500mA Accuracy: \pm (0.02% of F.S.) Setting Resolution: 0.1mA Reading Range: 0 ~ 500mA Accuracy: \pm (0.02% of F.S.) Reading Resolution: 0.01mA		Ripple and Noise	Voltage	
Ì					Current	
				General Specifications		
5/	500mA			Operable Environment	0°C ~40°0 0~90% RI	
				Altitude	2000 m	
		Setting Range: 1mA ~ 5A Accuracy: ± (0.02% of F.S.) Setting Resolution: 1mA Reading Range: 0 ~ 5 A Accuracy: ± (0.02% of F.S.) Reading Resolution: 0.1mA		Input Voltage	1 Ф 100V~	
				Input Current	Max. 10A	
	5A			Input Power	1.2kVA	
				Safety & EMC	CE	
				Communication Mode	Ethernet	
		Setting Range: 1mA ~ 9A		Dimension (WxHxD)	428 x 221	
	9A (Super mode)	Accuracy: \pm (0.02% of F.S.)		Weight	42 kg/92.	
		Reading Range: 0 \sim 9A Accuracy: \pm (0.02% of F.S.) Reading Resolution: 0.2mA	1 ,	Note *1: The command * Specifications are subje	update rat ect to char	

Protection	OVP, UVP, OCP, OTP (FAN Fail)						
Transient Overvoltage Mains Supply	2500V						
Isolation Voltage	1000V CH-TO-CH ; 1000V CH-TO-GND						
Program Response Time	2						
Current Rise/Fall Times	100us (condition: 0A to 5A @200cm Wire)						
Programming	Full load	Up	1m sec.				
Voltage Speed	No Load	Down	1m sec.				
Lead Demulation	Voltage	<0.01% + 2 mV					
Load Regulation	Current	<0.01% + 250µA					
Line Developier	Voltage	<0.01% + 2 mV					
Line Regulation	Current	<0.01% + 250µA					
	Voltage	<0.35 mV rms					
Ripple and Noise	Voltage	<2 mV p-p					
	Current	<2 mA rms					
General Specifications							
Operable Environment	0°C ~40°C 0~90% RH (non condensing)						
Altitude	2000 m						
Input Voltage	1 0 100V~240V±10%V _{LN}						
Input Current	Max. 10A						
Input Power	1.2kVA						
Safety & EMC	CE						
Communication Mode	Ethernet interface, CANbus interface *1						
Dimension (WxHxD)	428 x 221 x 697mm / 16.9 x 8.8 x 27.5 inch						
Weight	42 kg/92.6 lb						

ate via CANbus is 10ms/CANID.

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