

CE-6000 Series Equipment Commissioning Line Manual

Applicable equipment: CE-6000 Cell/Module/Pack



LabTech



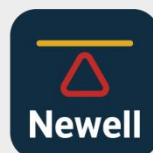
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Version number: CE-6000-Guide-EN-20260723-V1.0

**Note**

- Read the user manual thoroughly before operation.
- Keep this user manual properly for future reference.
- Fully read and understand the safety precautions before using the product.

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Preface

Thank you for choosing our products. We provide not only high-quality products, but also reliable after-sales service. To ensure personal safety and equipment

integrity, read this user manual thoroughly before using the equipment. This manual describes the equipment principles, applicable standards, structure, operating procedures, maintenance, possible faults and troubleshooting methods, electrical diagrams, and related information. References to test specifications or standards in this manual are for reference only. If there is any dispute, please consult the relevant standards or documents independently.

This manual is intended to guide users in the correct use of the equipment. Only by reading and fully understanding this manual can the equipment be used correctly and its functions fully utilized.

Scope of Liability:

The manufacturer shall not be liable for accidents or equipment damage caused by improper use. Use the equipment in accordance with this User Manual to avoid unnecessary equipment damage and other losses.

Notes:

After reading this manual, keep it properly for future reference.

If pages are missing or misprinted, the company will replace them.

Manual Structure:

This manual consists of four independent parts and may be used as needed.

Name	Content
Preface	Explains the structure, purpose, and symbol types used in this manual.
Installation Section	Provides an overview of work involved in installing the equipment. Refer to this manual for issues encountered during installation or relocation.
Operation Section	Introduces the basic principles of the equipment, explains operating methods, and describes how to handle problems.
Reference Materials	Related reference materials for the equipment, such as controller user manuals.

Explanation of Safety Symbols:

The following symbols are used in this manual.

 Danger	Incorrect operation may create a hazardous situation that could result in death or serious injury. Do not use the equipment under this condition. Do not attempt to operate it.
 Warning	Incorrect operation may create a hazardous situation that could cause moderate or minor injury to the operator, and may also damage the equipment or sample.
 Note	Indicates information necessary for fully utilizing the equipment functions or preventing equipment failure or damage.

Keywords:

The keywords used in this manual are listed below.

Step: indicates an operating method.

Reference: indicates reference information.

Test Equipment Model Description:

The test equipment model is named according to the series, number of

channels, voltage and current ratings, whether separate charge/discharge ports are provided, whether negative-voltage capability is supported, and acquisition frequency.

Verify the product model on the test equipment nameplate.

This manual covers multiple models in this series. Read only the sections applicable to your selected model.

Model		CE-6001	EOL	200V	200A	
Identifier		①		②	③	
Meaning	①	Power battery test equipment; 01 indicates the number of channels				
	②	Single-channel output voltage				
	③	Single-channel output current				

Installation Section

CE-6000 EOL Power Battery End-of-Line Test Equipment



Note

- This section explains how to install the test equipment.
- Refer to this chapter when the equipment needs to be relocated and reinstalled.
- Read this installation section even if the test equipment was installed by the company or its agent.

1. Accessories and Spare Parts Inspection

When unpacking the equipment, check all supplied accessories and spare parts against the Packing List.

If any optional part is specified in the contract, check it carefully against the Packing List.

If any part is missing or damaged, contact your supplier immediately.

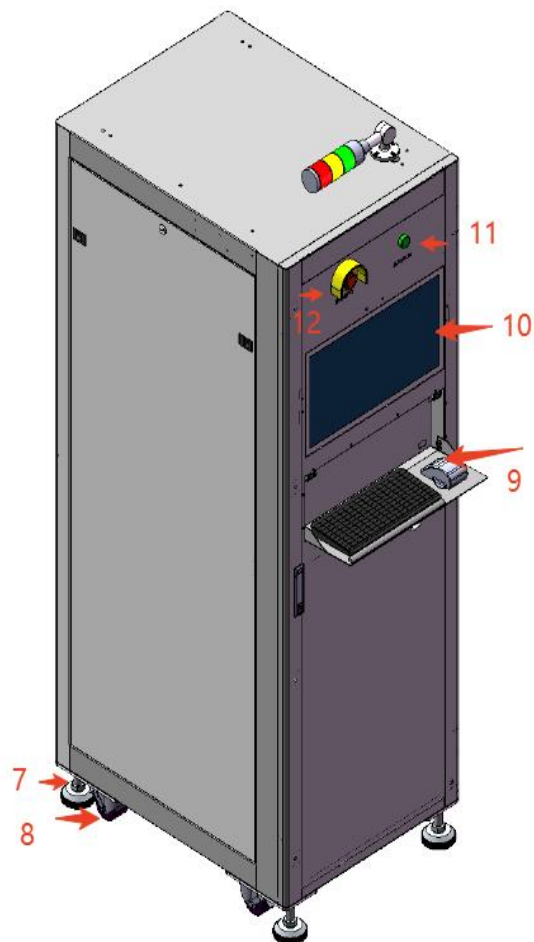
Note: The Packing List is shipped with the equipment.

2. Installation

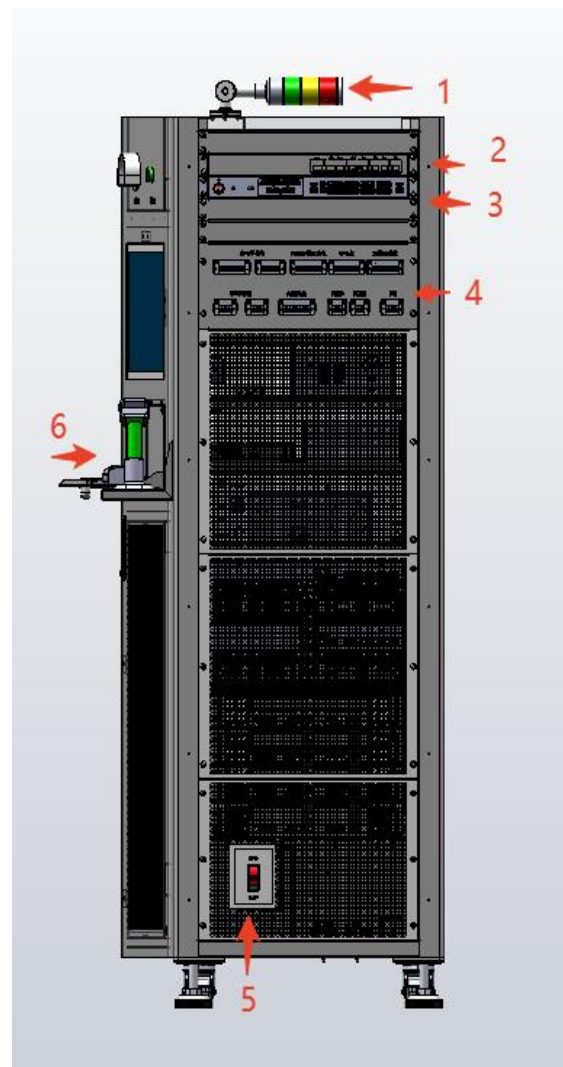
This chapter introduces the appearance and structure of the test equipment and describes the environmental and electrical conditions required for installation. The user shall ensure that all of the following conditions are met.

2.1 Cabinet Appearance and Structure

Front



Rear



Cabinet appearance drawing (refer to the corresponding model)

No.	Name	Function / Purpose
1	Alarm indicator	Indicates operating status
2	BMS communication box	CAN and RS485 communication box
3	Auxiliary channel	Cell voltage acquisition and temperature acquisition
4	Wiring panel	Test cable interface
5	Circuit breaker	Turns the main power of the equipment on or off
6	Barcode scanner	
7	Leveling foot	Facilitates equipment positioning
8	Caster	Facilitates short-distance equipment movement
9	Keyboard and mouse	Network communication port
10	Display	Channel cable for battery connection
11	Indicator light	Indicates equipment startup
12	Emergency stop button	Emergency protection

2.2 Cabinet Installation

Installation Site Confirmation

This section describes the site and space requirements required to ensure safe and normal operation of the test equipment.

■ Installation Site Requirements

- Install the equipment on a flame-retardant floor surface or channel-steel

support structure. The foundation must be flat, firm, and capable of bearing the weight of the installed equipment.

- No direct sunlight and good ventilation;
- Temperature: -10 °C to 40 °C, without sudden temperature changes;
- Relative humidity: 5% to 95% RH;
- Altitude: less than 2000 m;
- Free from high concentrations of dust, flammable gas, and corrosive gas;

■ Space Requirements

The battery test equipment is designed for indoor installation.

The protection rating is IP20. During installation, place the equipment on a level concrete floor or support blocks. The concrete floor or support blocks must be designed to support the cabinet weight. To reduce the effect of dust on equipment reliability, take appropriate engineering measures to filter the air so that the air quality meets the design requirements.

The air inlet of the equipment shall keep an appropriate distance from fixed objects and adjacent objects to ensure sufficient ventilation. To ensure reliable operation, suitable ventilation devices may be provided so that the ambient operating temperature stays within the permitted range.

During installation, keep proper clearance from fixed objects, such as walls, and adjacent cabinets to ensure ventilation and safe evacuation in case of danger. Leave at least 600 mm of passage space around the equipment for one person to pass;

Reserve sufficient space above the equipment for ventilation, operation, and maintenance. In general, the clearance shall be no less than 500 mm.

■ Cable Tray Requirements

For easier installation and maintenance and to reduce interference from power circuits to communication and control signal cables, communication/control cables and power cables shall be routed separately, and DC circuits and AC circuits shall be routed separately.

■ Moving and Installation

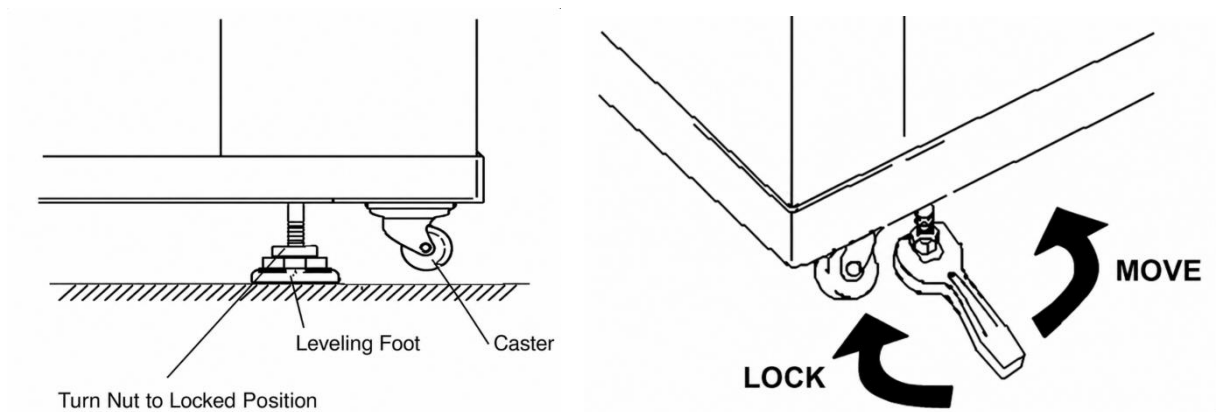
The equipment may be transported by forklift or pallet truck. Pay attention to the equipment weight, ensure that the handling equipment has sufficient load capacity, and determine proper support points.

A forklift is the most suitable method for transporting this equipment. During transportation, keep the cabinet center of gravity between the two fork arms and perform a trial lift. When lifting, lowering, or moving the equipment with a forklift, move slowly and steadily. Place the equipment only on a solid and level surface. Strictly follow forklift safety operating procedures throughout transportation.



Warning

When moving the equipment, use a forklift with suitable rated lifting capacity and fork spacing. The cabinet must be lifted from the bottom. When lifting, support the cabinet from all four sides and take precautions to prevent tilting during transportation.



The leveling feet, if equipped, are installed at the four bottom corners of the test equipment. Their height can be adjusted by tightening or loosening the nuts with a wrench. Turning the nut in the fixing direction lifts the casters off the ground and fixes the equipment in place. Turning it in the moving direction lowers the casters to the ground and allows the equipment to be moved.

2.3 Electrical Connection

- Power Connection

Connect the utility power supply to the EOL equipment, then close the power switch. This system requires a three-phase five-wire 380 VAC power supply.

- Output Cable Connection

When using EOL spare ports or extending output circuits, follow the steps below:

Disconnect the EOL power supply and confirm that the EOL equipment is completely powered off.

Open the rear sheet-metal cover of the EOL equipment and connect the standard cable corresponding to the port to be extended to the input plug.

EOL Output Signals

a. High-level signal

No.	Positive	Negative	
1	ACC+	GND	GND is the reference ground for high-level signals
2	CHG+	GND	
3	KEY_ON+	GND	
4	FAN_ON+		
5	CLSD+		
6	WCLSD+		
7	DC2+	DC2-	12 V 2 A power output
8	DC2+	DC2-	

B. PWM and GB charging signal

No.	Positive	Negative	Remarks
1	CARSH	GND	GND is signal reference ground
2	CC2-2	GND	
3	CC2-1	GND	
4	CC		
5	PWM1+		24 V, 1000 Hz, 50% duty cycle
6	PWM2+		24 V, 1000 Hz, 50% duty cycle

C. Dry contact

No.	Positive terminal	Negative terminal	
1	HIL1	HIL1	Dry contact for HVIL test;

2	HIL2	HIL2	can control relay closing circuit
3	IN1	GND	
4	IN2	GND	
5	OUT1	GND	
6	OUT1	GND	

D. Multimeter measurement

No.	Positive terminal	Negative terminal	Remarks
1	DMM1+	DMM1-	Multimeter measurement channel
2	DMM2+	DMM2-	
3	DMM3+	DMM3-	
4	DMM4+	DMM4-	

E. BMS power supply

No.	Positive terminal	Negative terminal	Remarks
1	DC+	DC-	36 V 10 A programmable power output; four interfaces in parallel
2	DC+	DC--	
3	DC+	DC-	
4	DC+	DC-	

F. Internal resistance measurement

No.	Positive terminal	Negative terminal	Remarks
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1	SOU1+	SOU1-	AC internal resistance test interface, 2 channels total
2	SEN1+	SEN1-	
3	SOU2+	SOU2-	
4	SEN2+	SEN2-	

G. High-voltage measurement

No.	Positive terminal	Negative terminal	Remarks
1	HV1+	HV1-	Hipot tester leakage current and insulation resistance test interface, 2 channels total
2	HV2+	HV1-	

Cable Requirements

- The selected cables must have sufficient current-carrying capacity. Conductor ampacity depends on ambient conditions, insulation material type, routing method, conductor material, cross-sectional area, and other factors.
- Cable cross-sections shall be selected according to the maximum current on the AC and DC sides of the equipment, with sufficient margin.
- Connecting cables on the same side shall use conductors of the same specification and type.
- Use flame-retardant cables.

Recommended connection specifications for CE-6001n-EOL-200V200A

Connection type	Recommended cable size	Mounting hole size	Torque
Battery-side	25 mm ² (200 A)	M8	30 N·m

wiring			
AC-side wiring	16 mm ² (50 A)		
Grounding cable	10 mm ²	M6	10 N·m

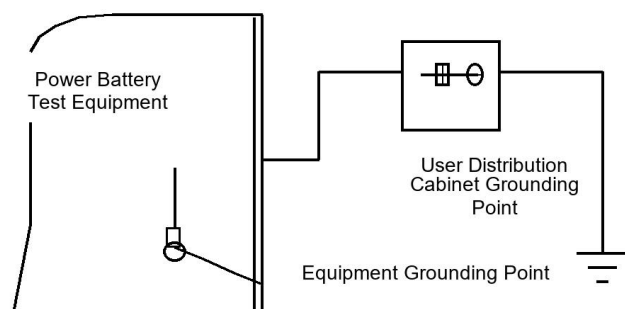
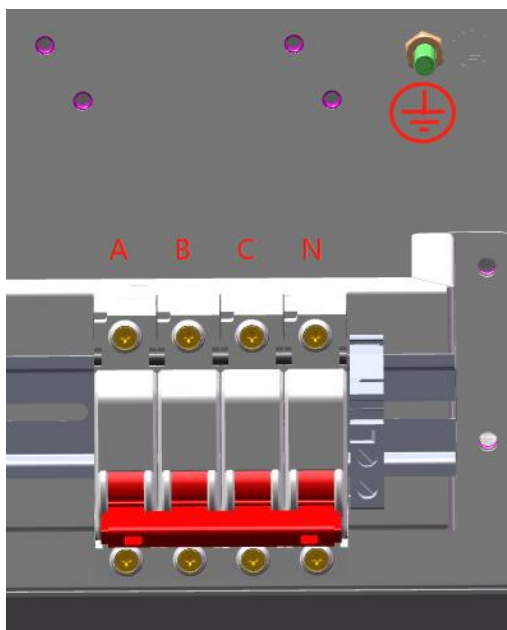
Power Supply Requirements

The power supply shall meet the following conditions:

- AC voltage: 380 V $\pm$ 15%, three-phase four-wire plus protective earth;
- Frequency: 50/60 Hz $\pm$ 5%;
- Protective earth resistance less than 4 Ω ; TN-S or TT power supply system;
- The user shall provide an air circuit breaker or power switch of corresponding capacity at the installation site, and this switch must be dedicated exclusively to this equipment.

Utility Cable Connection

Connect the equipment power cable to the upper end of the air circuit breaker shown below.



Operating Procedure

After the equipment is fully positioned, connect the input cable according to the following steps:

1. Confirm that all input distribution switches of the equipment are completely disconnected and that all internal cabinet power switches are off. Attach warning labels at these switches to prevent operation by others;
2. Open the protective cover on the top of the equipment;
3. Connect the protective grounding cable to the corresponding grounding screw marked PE as shown below;
4. Connect the three-phase AC cables (A, B, C phase wires and neutral wire) to the equipment circuit breaker;
5. After confirming that all cables are connected, reinstall the metal protective cover.

Grounding Cable

Equipment grounding prevents electric shock and noise caused by poor operation. The equipment is supplied with a grounding wire. Prepare the grounding terminal in advance. The protective earth terminal is located near the circuit breaker at the rear of the cabinet. Connect the prepared grounding cable reliably to the system protective earth.

The grounding cable cross-section shall be no less than 2.5 mm^2 , and the contact resistance shall not exceed $4 \text{ } \Omega$.

Operating Procedure:

Refer to step 3 in the Cable Connection procedure above.

 Danger

- **Explosion hazard:** do not connect electrical wires to gas pipelines.
- **Reliable grounding is mandatory.** Otherwise, the leakage circuit breaker may fail during leakage, causing electric shock and loss of interference protection.

 Warning

- **Do not share a grounding terminal with equipment that has no leakage circuit breaker.** Otherwise, in the event of leakage, the leakage circuit breaker will not trip, which may result in electric shock.
- **Do not cross-ground with other equipment.**
- **Do not use a knife switch or power socket as the external power supply.**
- **Tighten the power cable with screws.** Loose connections increase contact resistance and may cause severe heating, sparks, or fire.
- **Do not turn the main power switch ON.**
opening the distribution cabinet cover
inspecting circuits
- **During operation, the supply voltage must stay within $\pm 10\%$ of the rated voltage.** Exceeding this range may trigger an equipment alarm.

 Note

- During electrical connection, Comply with the safety rules below.
- Disconnect all internal and external power/control circuits.
- Hang warning signs and apply safety locks to prevent accidental re-energizing.

- Cover and isolate nearby live parts with insulating cloth, plates, or similar materials.
- Arrange safety grounding and short-circuit protection connections.
- Use a multimeter to confirm that the DC bus, AC bus, high-voltage capacitors, and other parts are not energized.

2.4 Installation Tools

Prepare the following tools before installation:

No.	Name	Specification	Description
1	Diagonal cutting pliers	-	Cut cable ties.
2	Wire stripper	-	Strip cable insulation.
3	Cable cutter	-	Cut cables.
4	Crimping tool	-	Crimp terminals.
5	Multimeter	-	Check whether grounding and other connections are correct.
6	Steel tape measure	-	Measure distance.
7	Level ruler	-	Ensure level cabinet installation.
8	Protective gloves	-	Protect the operator's hands during equipment installation.
9	Insulating gloves	-	Protect the operator from electric shock.

Remark: The installation tools are not limited to those listed in the table. Prepare tools

according to actual site requirements.

Operation Section

CE-6000 EOL Power Battery End-of-Line Test Equipment



Note

For first-time use, it is recommended to read this manual in sequence from Chapter 3. Even if you have operating experience with similar equipment, read Chapter 3 Safety Precautions carefully.

3. Safety Instructions

This chapter describes the safety precautions that must be observed when using the equipment. Read this chapter carefully before using the equipment and strictly follow the instructions to ensure operator safety and prevent damage to test samples or equipment.

3.1 Safety Precautions

- Arrange for a certified electrician to check whether the equipment is properly installed and meets grounding requirements.
- Only qualified personnel with relevant training experience may maintain or service the battery test equipment.
- Use appropriate safety protection devices and procedures when testing or operating the battery test equipment.
- Do not perform repair or maintenance on the battery test equipment in wet areas.
- If a wet environment cannot be avoided, stand on a dry rubber mat or dry wood and use insulated
- gloves. Do not work alone.
- Equipment installation and maintenance must comply with applicable laws and regulations of the country or region where the equipment is used.
- Regularly check insulation and connectors for damage. Replace cracked or worn cables in time.
- Do not overload cables.

The safety warnings listed in this manual represent only those known to the company. The company shall not be liable for losses caused by violation of

general safety operating requirements or violation of equipment safety standards for design, production, or use.

3.2 Personnel Safety Requirements

Only professional electricians or qualified personnel may transport, install, or perform similar operations on this product.

- Before operating the equipment, remove jewelry, watches, and other conductive objects to avoid electric shock or burns.
- Wear insulated gloves and protective insulating shoes during equipment operation.
- Before using tools, understand their correct use to avoid injury or equipment damage.
- When operating in a humid environment, prevent the equipment from getting damp. If water or moisture is found inside the cabinet, turn off the power immediately.

3.3 Equipment Label Requirements

- Warning labels on the equipment and inside the cabinet contain important operating information. Do not tear off or damage them.
- Nameplates are installed on the rear cover and inside the front door of the battery test equipment. The nameplates contain important product parameter information. Do not tear off or damage them.

3.4 Safety Warning Requirements

During installation, routine maintenance, or service of the battery test equipment, observe the following requirements to prevent unrelated persons from approaching and causing misoperation or accidents:

- Place clear warning signs at the upstream and downstream switches of the equipment to prevent accidental closing.
- Set warning signs or safety warning tape near the installation area.
- After installation is completed, lock the cabinet doors and keep the keys properly.

3.5 Fire Exit Requirements

To ensure that personnel can evacuate quickly in an emergency, observe the following requirements:

- Reserve two evacuation doors at the cabinet installation position so personnel can leave quickly in case of fire.
- During installation and other operations on the equipment, ensure that the evacuation
- routes remain completely unobstructed.
- Do not stack objects in evacuation routes or occupy evacuation routes in any form.

3.6 Equipment Installation Requirements

To avoid noise generated during equipment operation and other possible emergencies affecting residents or causing safety incidents, the equipment must be installed in an electrical control room.

- The control room should be as far away as possible from residential areas, and appropriate sound insulation measures should be taken.
- Do not store flammable or combustible materials in or around the control room to prevent fire.
- The control room design shall meet requirements for equipment

ventilation, heat dissipation, and safe evacuation of personnel.

- The control room shall comply with relevant EMC design standards.

3.7 Electrical Connection Requirements

Electrical connection must strictly follow the descriptions in this manual and the electrical wiring schematic. Battery pack configuration and related current, voltage, power, and other parameters must meet the technical parameters of the battery test equipment.

Grounding Requirements

- For electrical connection, install the protective earth conductor first. When removing the equipment, remove the protective earth conductor last.
- Before operating the equipment, ensure that it is reliably grounded. Poor grounding may cause personal injury.
- Do not operate the battery test equipment before the grounding conductor is installed!

AC/DC Operation Requirements

- The equipment supply voltage is hazardous. Direct contact, or contact through moisture, may cause danger.
- Improper or incorrect operation may cause fire, electric shock, or other accidents.
- Before making electrical connections, disconnect the upstream protective switch of the equipment.
- Before energizing, ensure that the electrical connections have been completed.

Electrostatic Discharge Requirements

- Before touching circuit boards, wear anti-static gloves or an anti-static wrist strap, and connect the other end of the wrist strap to a good ground.
- When holding a board, hold the board edge where there are no components. Do not touch chips by hand.
- Removed boards must be packaged, stored, or transported with anti-static packaging materials.

3.8 Power-Off Operation Requirements

Operations may be performed only after confirming that the equipment is completely de-energized.

- Ensure that the equipment cannot be accidentally re-energized.
- Use a multimeter to confirm that the inside of the equipment is completely de-energized.
- Use insulating cloth to cover and isolate nearby parts that may be live.
- Apply necessary grounding and short-circuit connections.
- Keep evacuation routes unobstructed throughout the operation.
- After the equipment has completely stopped, wait at least 5 minutes to ensure that the internal capacitors are fully discharged before operating on the machine.

3.9 Product Disposal Requirements

When the equipment is to be discarded, do not dispose of it as ordinary waste. Contact a local authorized professional recycling organization to prevent environmental pollution.

3.10 Other Protection Requirements

During transportation, installation, and other operations on the equipment,

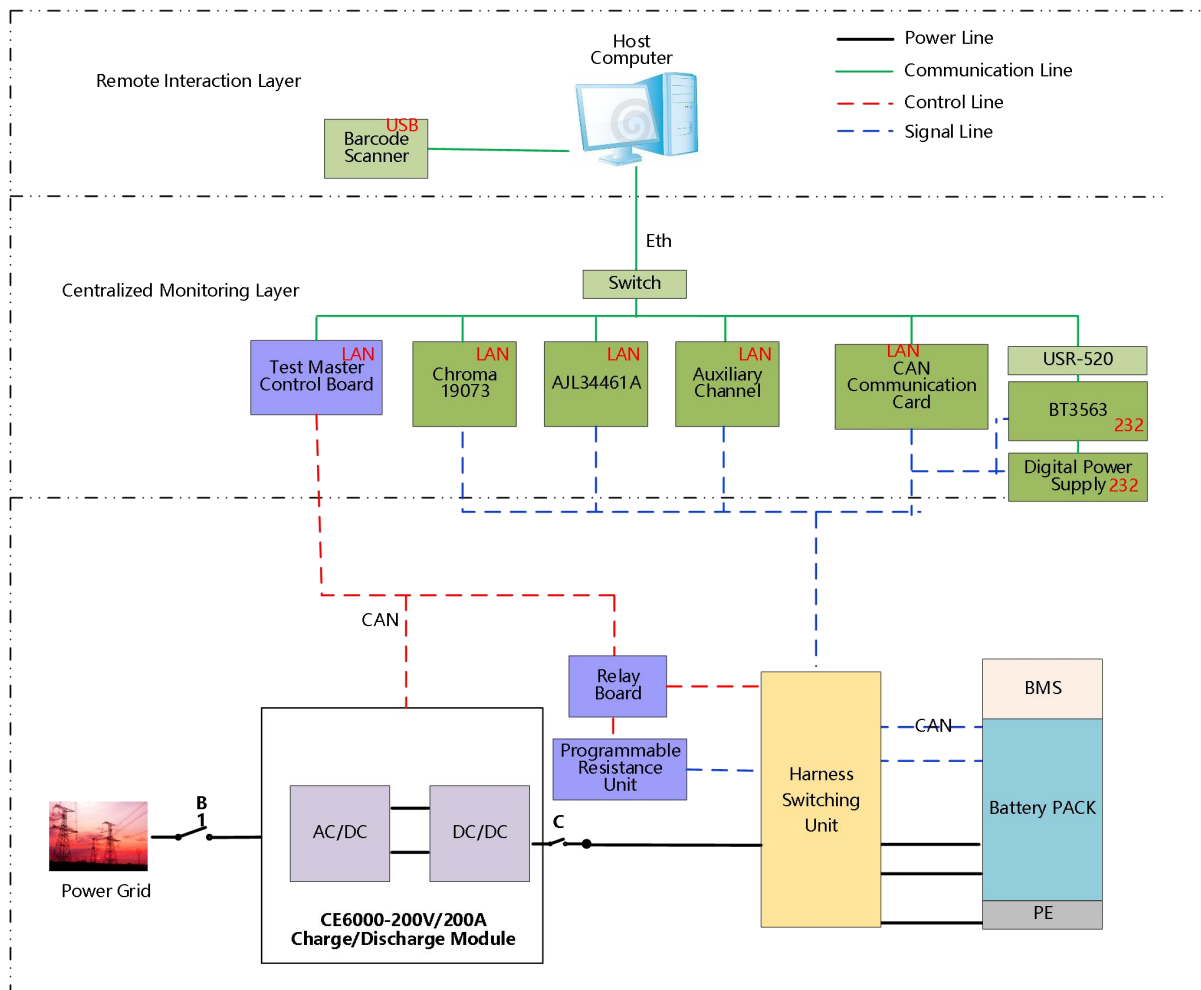
personnel shall take appropriate protective measures as needed, such as wearing noise-protection earplugs, insulating shoes, and anti-scald gloves.

If a person is injured, implement first-aid procedures according to local medical and safety procedures. If abnormal symptoms occur, an electric-shock victim shall be examined by a doctor and sent to hospital immediately.

4. Equipment Introduction

This chapter introduces the system composition, topology, technical specifications, operating principle, and related information of the equipment.

4.1 System Composition



As shown in the figure, the EOL test system consists of three system layers: the power system layer, centralized monitoring layer, and remote interaction layer. Each layer is independent and performs its own function to ensure reliable system operation.

The power system layer uses CE6000 series charge and discharge test equipment. This equipment adopts AC/DC and DC/DC two-stage

high-frequency isolated modular design, featuring high power density, independent modules, high reliability, and convenient maintenance.

The centralized monitoring layer contains multiple functional units to meet various customer test requirements, such as charge and discharge tests, ACIR and IDR resistance measurement, relay control channels, input/output I/O functions, and other related test functions.

4.2 System Performance Parameters

CE-6001 EOL Technical Specification	
I. Equipment Model	
1. Material Code	CE-6001n-EOL-200V200A

II. Input Specifications		
1.Input Power Supply		380 V AC $\pm 15\%$; 50/60 Hz $\pm 5\%$
2.Power Factor		$\geq 99\%$ (full load)
3.THDi		$\leq 5\%$ (full load)
4.Input Power		40 kW
5.Input Current		100 per phase
6.Input Power Wiring Method		Three-phase five-wire

III. Functional and Performance Specifications			
1.Charge/Discharge Module	1.Voltage	Measurement range per channel	Charge: 0 V to 200 V
			Discharge: 3 V to 200 V
		Minimum discharge voltage	3V
		Accuracy	$\pm 0.02\%$ of FS
		Resolution	24bit

	2.Current	Measurement range per channel	1A ~ 200A
		Accuracy (independent range)	±0.1% of FS
		Constant-voltage cutoff current	200 mA
		Resolution	24bit
	3.Power	Channel output power	24 kW
	4.Time	Current response time	≤ 3 ms
		Current transition time	≤ 6 ms
		Minimum step time	0.1s
	5.DCIR	DCIR measurement	Supports custom sampling points for DCIR calculation
	6.Safety Protection	Software protection	Power-failure data protection
			Supports offline testing
			Safety protection conditions can be set. Configurable parameters include: voltage lower limit, voltage upper limit, current lower limit, current upper limit, and delay time.
		Hardware protection	Reverse-connection protection, overvoltage protection, overcurrent protection, overtemperature protection, etc.
2.AC Internal Resistance Tester	Key Specifications	ACIR internal resistance measurement	Range: selectable ranges from 3 mΩ to 300 Ω
			Resolution: up to 0.1 μΩ
			Accuracy: up to ±0.5%rdg. ±

			10dgt
3.Hipot Tester	Key Specifications	Insulation resistance test	0.001 MΩ to 100 GΩ
		DC hipot test	DC(0.05 ~ 7.2.00)kV
		AC hipot test	AC (0.05 ~ 5.000)kV
4.Multimeter	Key Specifications	Resolution	6.5 digits
		DCV, ACV	100 mV to 1,000 V
		DCI, ACI	100 μA to 10 A
5.Temperature and Humidity Measurement	Key Specifications	Humidity	±2% RH (60% RH, 25 °C)
		Temperature	±0.4 °C (at 25 °C)
		Operating range	-20 °C to +60 °C, 0% RH to 95% RH (non-condensing)
6.Barcode Scanner	Key Specifications	Readable barcodes	1D/2D barcodes
		Communication method	Wireless
		Scanning principle	Image-based scanning
7.Programmable Power Supply	Key Specifications	Rated voltage	0~36V
		Rated current	0~10A
		Noise	2 mV _{rms} , 6 mA _{rms}
8.Insulation Resistance Simulator	Key Specifications	Resistance range	50 Ω to 100 MΩ
		Maximum withstand voltage	2000V
		Adjustment resolution	50Ω
9.Auxiliary Channels	Temperature auxiliary channel	Temperature range	Thermistor: -30 °C to 120 °C
			Thermocouple: -200 °C to 260 °C
		Temperature accuracy	±1 °C (cable length within 2 m)
		Temperature	0.1 °C

		resolution	
	Voltage auxiliary channel	Voltage range	0V ~ 5V
		Voltage accuracy	±0.05% of FS
		Voltage resolution	0.1 mV
	AUX Overview	Monitors battery surface/tab temperature; data can be linked with voltage/current and used for step control or protection.	

IV. EOL Test Items				
No.	Test Item	Function Description	Remarks	Software /Hardware
1.	Safety performance test	Insulation resistance test	Disable BMS insulation monitoring, then measure insulation resistance from output to PE. 1) Pack+ to PE insulation resistance; 2) Pack- to PE insulation resistance;	Hipot tester
2.		Hipot test	Run hipot test between output terminals and PE. 1) Pack+ to PE leakage current I1; 2) Pack- to PE leakage current I2; 3) Pack+ to PE reverse leakage current I3; 4) Pack- to PE reverse leakage current I4;	Hipot tester
3.		Insulation alarm function check	Use the insulation simulator to apply a 50-100 MΩ fault between	Insulation resistance simulator

			Pack+/Pack- and PE. The EOL software reads BMS insulation values/alarms and judges against preset limits.	
4.		HVIL check	With all MSD plugs inserted, no HVIL fault shall appear. If any plug is missing, BMS shall report HVIL fault; EOL software verifies the preset status/sequence.	Software, CAN
5.		Short-circuit detection	Before MSD connection, measure resistance from Pack+/Pack- to PE and between Pack+ and Pack-.	Multimeter
6.		Simulated collision signal	Send PWM square-wave signal and verify BMS feedback.	Hardware board
7.		AC internal resistance test	Measure pack AC internal resistance.	AC internal resistance tester
8.		DC internal resistance test	Measure pack DC impedance and cell voltage difference to verify power performance and connections.	Charge/discharge equipment
9.	Battery body	Relay check	Command BMS relays and verify operation of fast/slow charge, heating, main $\pm$ relays, and related circuits. 1. Close target relays through BMS. 2. Measure fast-charge, slow-charge, and	Multimeter, CAN, software

			discharge port voltages. 3. Read relay status via CAN.	
10.		Precharge function check	Verify HV power-on/off relay sequence: negative -> precharge -> positive, then precharge opens; power-off opens $\pm$ relays. EOL software checks BMS sequence against preset criteria.	CAN, software
11.		Charge/discharge test	Run pack charge/discharge cycles per process, including CV, CC, CP, and rest steps.	Charge/discharge equipment
12.		Nominal capacity test	Measure constant-current discharge capacity to cutoff voltage and compare with nominal capacity.	Charge/discharge equipment
13.		Charge/discharge cycle life test	Evaluate cycle life, capacity retention, stability, and degradation through repeated cycles.	Charge/discharge equipment
14.		Charge/discharge circuit test	Control charge/discharge relays via BMS and verify interface voltage: present when closed, 0 V when open.	CAN, voltmeter
15.		SOC adjustment	Charge the pack, read BMS-SOC in real time, and verify it is within the specified range.	Charge/discharge equipment
16.		Overcharge/overdischarge protection	At cell overcharge/overdischarge	Charge/discharge equipment, CAN

		function test	limits, verify correct CAN fault and 0 V output at the charge/discharge interface.	
17.	BMS test	BMS initialization	Power on BMS and establish host communication.	CAN, software
18.		Charging communication test	Check charging CAN communication.	CAN, software
19.		Vehicle communication test	Check vehicle CAN communication.	CAN, software
20.		CAN communication test	Check internal CAN communication.	CAN, software
21.		Balancing function diagnosis	Read BMS cell voltage/temperature extremes and compare with preset limits to verify pack balance and BMS balancing function.	CAN
22.		Ambient temperature comparison	Compare BMS temperature with ambient temperature.	Temperature and humidity meter
23.		BMS static power consumption	Power on BMS and measure static power consumption.	Multimeter
24.		Fast-charge status test	Switch in 1000 Ω and CC2 enable signal; verify fast-charge function per GT27930.	CAN, hardware board
25.		Slow-charge status test	Output CC/CP slow-charge signals and verify BMS	CAN, hardware board

			charging information.	
26.		Cell voltage check	Read BMS cell voltage and verify range.	CAN
27.		Cell voltage difference check	Read max/min cell voltages and verify voltage difference.	CAN
28.		Cell temperature check	Read BMS cell temperature and verify range.	CAN
29.		Total voltage accuracy check	Measure pack total voltage by DMM and compare with BMS reading to verify voltage accuracy.	Software, multimeter
30.		Software and hardware version number check	Read BMS software version and verify battery match.	Software, CAN
31.		Clear fault codes	Send command to clear fault codes.	Software, CAN
32.	Auxiliary functions	Heating film resistance test	Close heating-film relay and measure fast-charge $\pm$ resistance by DMM.	CAN, multimeter
33.		Resistance check	Measure target resistance by DMM; host software judges result.	Multimeter, software
34.		Integrated inspection instrument	Collect voltage and NTC data through quick-change tooling: 40 voltage channels, 10 NTC channels.	Auxiliary channel
35.		Shipping status test	1. Read max/min cell voltage and voltage difference; 2. Close output relay and read pack total voltage; 3. Read BMS error level, SOH, and	CAN, software

			shipping SOC.	
--	--	--	---------------	--

V. Data Management and Analysis		
1.Step setting method		Table editing
2.Data recording	Recording conditions	Minimum time interval: 10 ms (100 ms when auxiliary channels are connected)
		Minimum voltage interval: 0.24 V
		Minimum current interval: 0.4 A
	Recording frequency	100 Hz (10 Hz when auxiliary channels are connected)
3.Database		Uses a MySQL database for centralized management of test data
4.Data output method		Excel、Txt
5.Curve type		Custom plotting is supported, with 4 Y axes.
6.Barcode scanning		Supports barcode scanning; implementation can be based on the battery barcode.

VI. Communication Method	
1.Host computer communication method	Based on TCP/IP protocol
2.Communication interface	Ethernet
3.Lower computer communication baud rate	1 M bandwidth
4.Host computer communication baud rate	10 M to 100 M adaptive
5.Networking method	Build a LAN through switches and routers.
6.Communication expansion (optional)	Supports CAN and RS485 communication with the BMS, with DBC configuration function.

VII. Environmental Requirements, Dimensions, and Weight	
1.Operating temperature	-10 °C to 40 °C (within 25 ±10 °C, measurement accuracy is guaranteed: accuracy drift 0.005% of FS / °C)
2.Storage temperature	–20 °C to 50 °C
3.Operating ambient relative humidity	<=70% RH (no condensation)
4.Storage ambient relative humidity	<=80% RH (no condensation)
5.Equipment dimensions W*D*H	\
6.Weight	\

5. Equipment Software Operation Instructions

This chapter describes in detail the operations required during testing. Perform the operations described in this chapter before each test.

5.1 Overview

■ System Features

- High efficiency: the system can complete complex test items in a short time, improving production efficiency.
- High accuracy: advanced control programs are used to ensure accurate test results.
- Stability and reliability: the system design emphasizes stability and supports long-term continuous operation in high-intensity production environments.
- Easy operation: the user interface is simple and intuitive, and operators can use it after basic training.
- Scalability: the system supports modular expansion and can be flexibly configured and upgraded according to different production needs.

■ Application Scope

This EOL system is specially designed for battery products at the end of the production line. It can quickly and accurately determine battery performance and quality, ensuring product reliability and safety. It is widely applicable to battery manufacturing scenarios, including but not limited to:

- Power battery production lines
- Consumer battery production lines
- Industrial energy-storage battery production lines

■ Main Functions

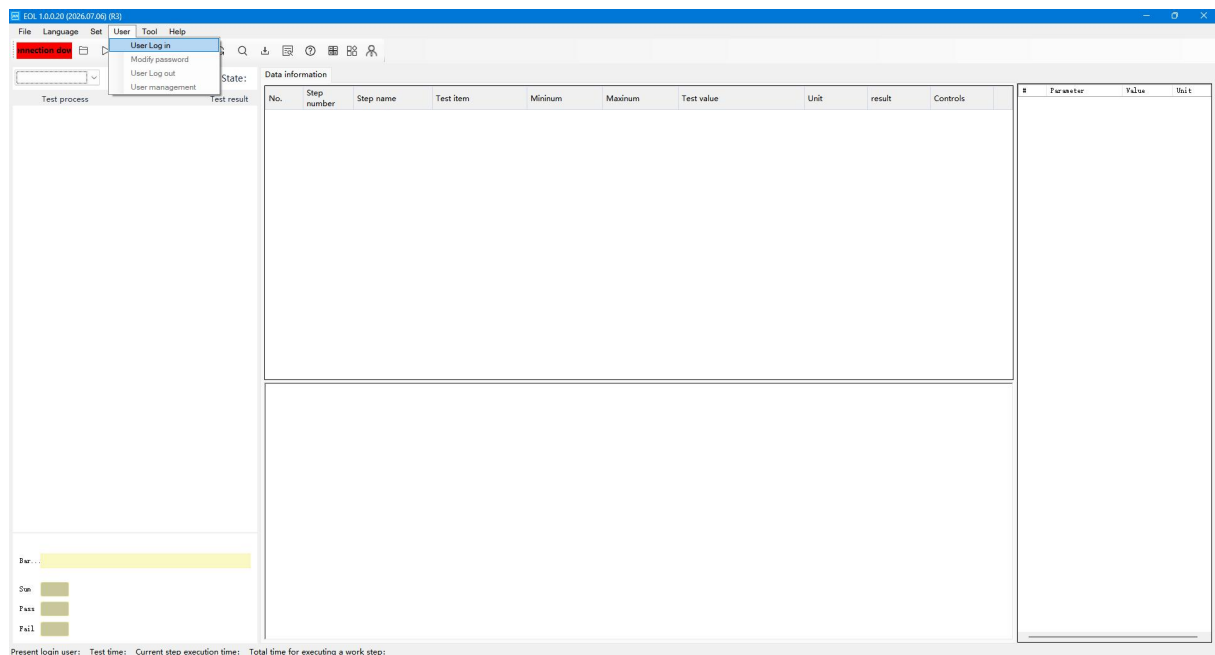
By integrating multiple test devices and automated control systems, the EOL system performs a series of battery test items. Typical functions include but are not limited to:

- Battery performance tests: such as internal resistance test, capacity test, and insulation resistance test, ensuring that the electrical performance of the battery meets design requirements.
- Automated operation: during the test, the system can automatically identify barcodes, select the corresponding test process, and execute all test steps without manual intervention.
- Data acquisition and management: the system automatically records and stores each test data set, supports historical data query and export, and provides a basis for subsequent data analysis and quality traceability.

5.2 Software Login and Startup

■ Login Function

Double-click the EOL application, then click the user login button on the main EOL interface to open the login window. Enter the user name and password, and click OK to enter the system. Note: before successful login, most EOL system functions are locked.



Modify password

User name:

Password ☐ Show password:

☐ Remember last login password

OK Cancel

■ Password Change Function

Click the password change button on the main EOL interface. Enter the user name, old password, and new password, then click OK to change the password.

Modify password

User name

Password

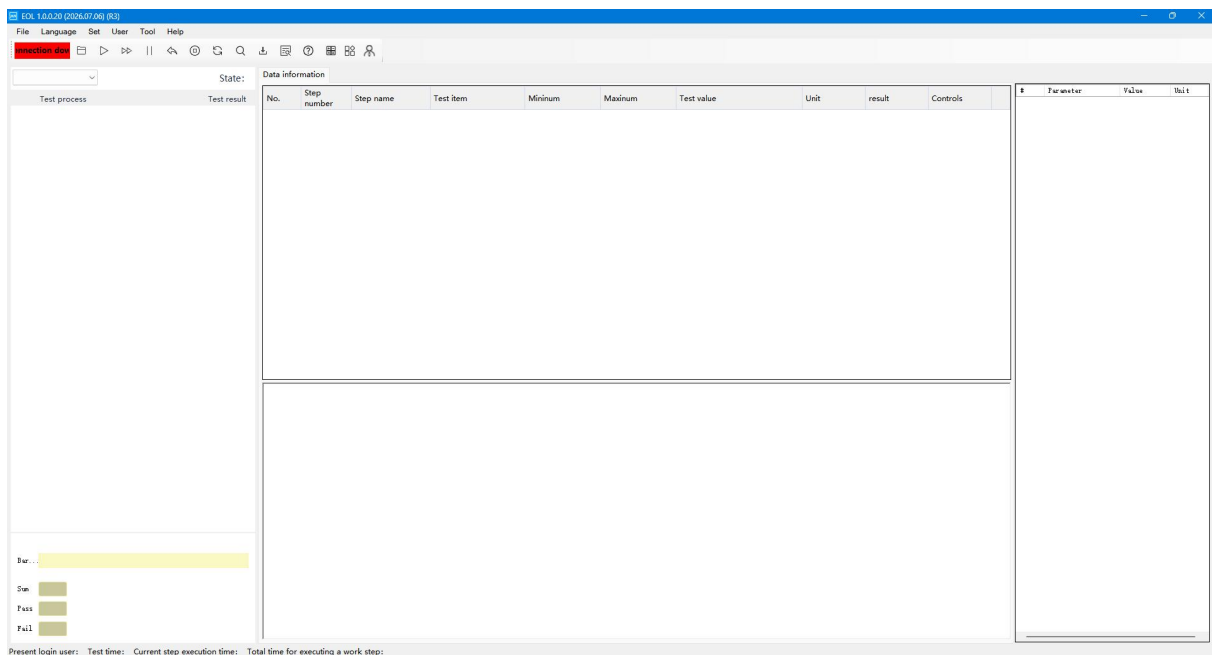
New password

Confirm new password ☐ Show password

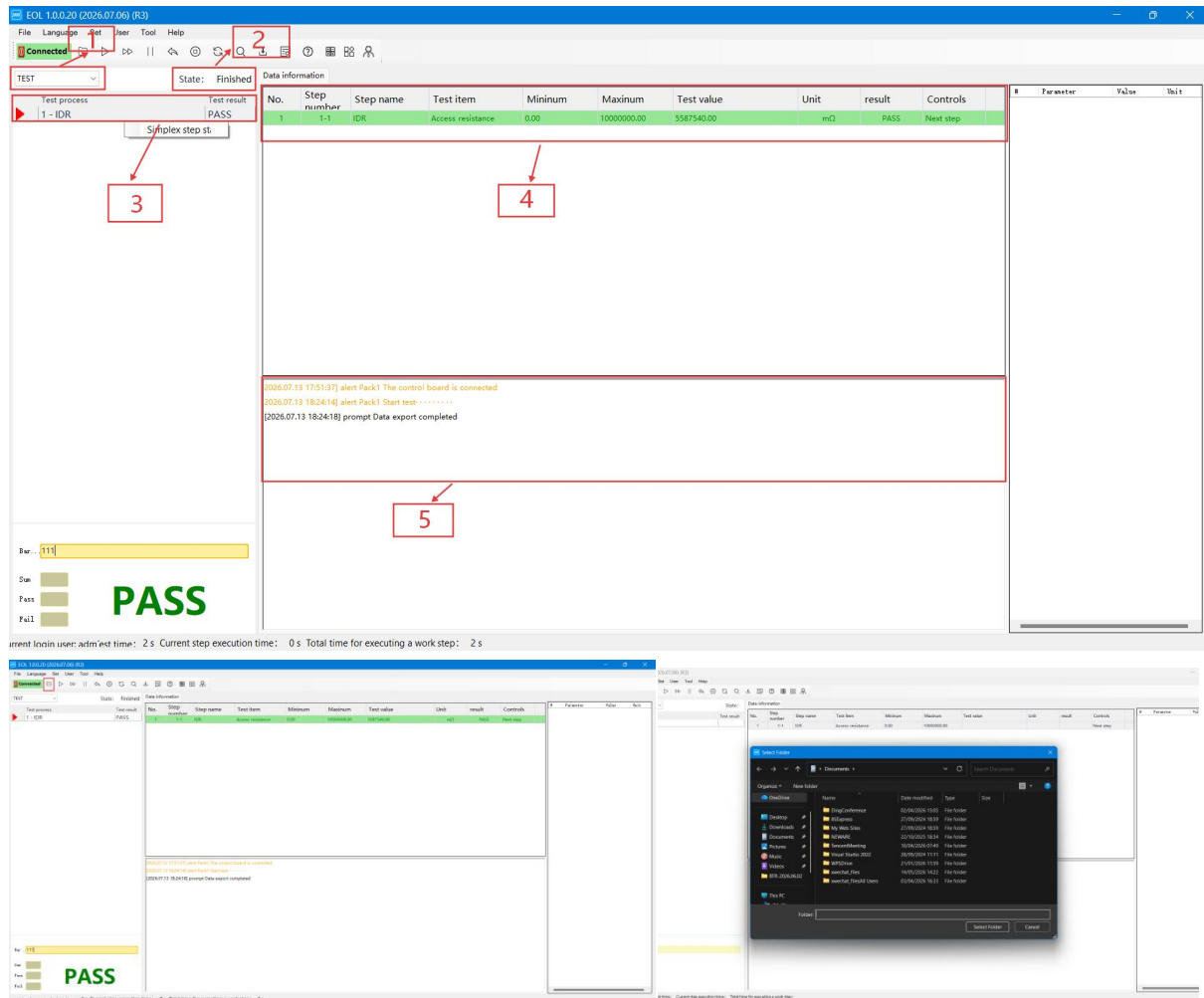
OK Cancel

5.3 Main Interface and Operation

5.3.1 Software Main Interface



The main interface mainly displays the test step flow, test data, and real-time data of auxiliary channels.

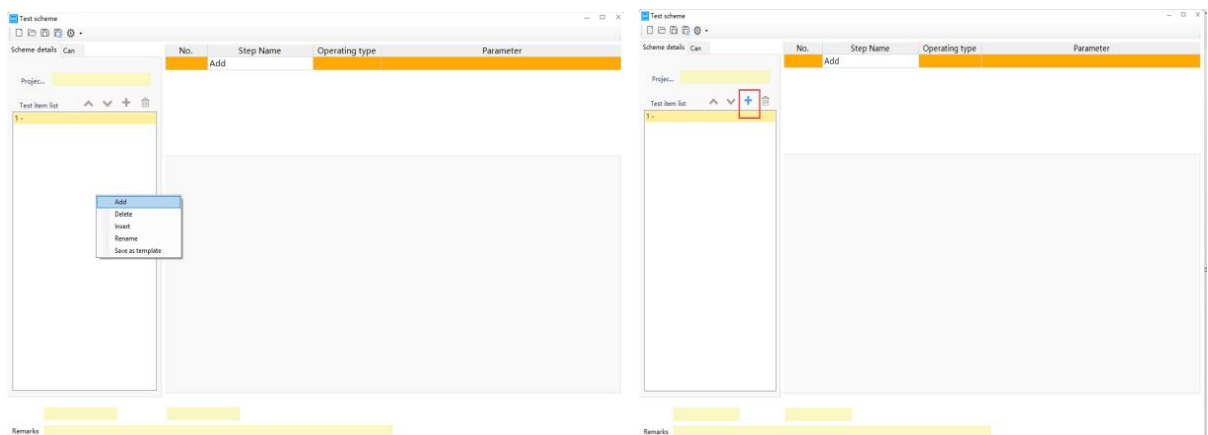
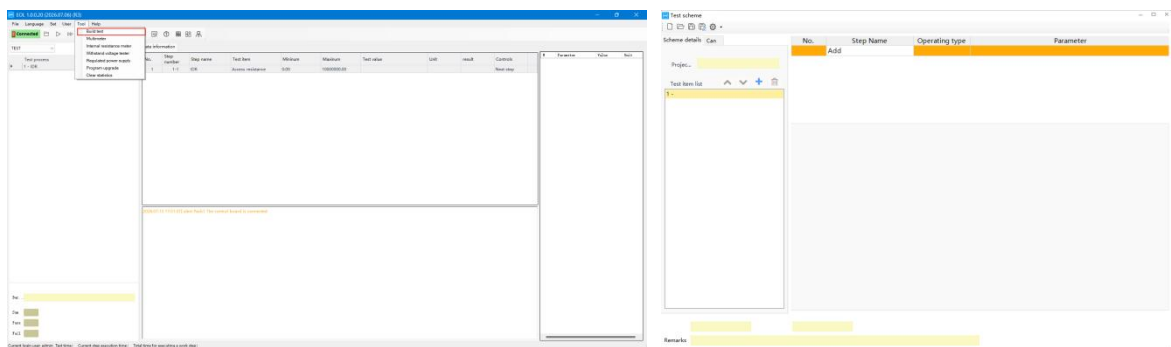


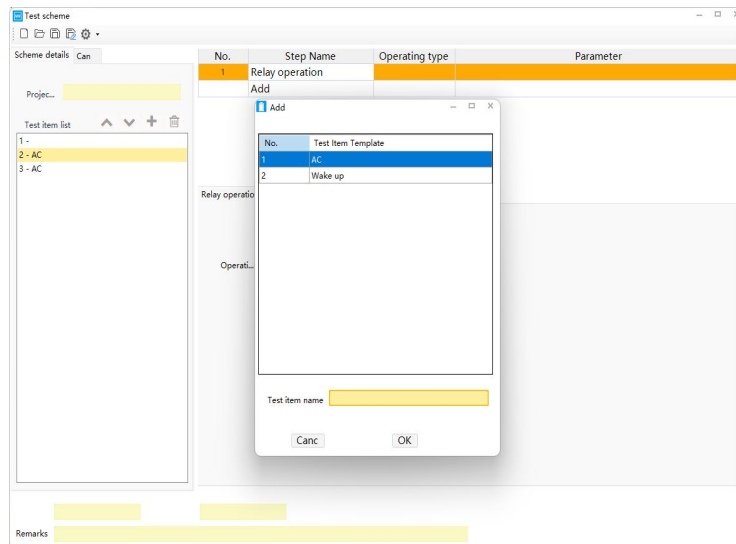
1. Step file selection box: click the test plan management button to the right of the connected icon to select the folder where XML step files are stored. Step files in the folder will be displayed in the selection box. Click a step file in the selection box to view the step flow and result judgment in areas (3) and (4).
2. Channel test status: includes completed, offline, testing, paused, and stopped.
3. Step flow area: this area shows the steps configured by the user in the step editor. Click a step to enter the editor page and view the configured parameters. In this mode, editor data cannot be modified.
4. Judgment result and data acquisition area: inequality or equality conditions set in condition judgment obtain test data from the EOL machine. If the

obtained data meets the user-defined condition, the background and font colors are green and the test result is PASS. If the test data does not meet the condition, the background and font colors are red and the test result is Fail. If the data is from the hipot tester, the logic is different. The PASS/Fail result of the hipot tester is not related to whether the test data meets the user condition, but to the command code returned by the hipot tester to the EOL system. When the hipot test ends, PASS or Fail is displayed on the screen, and the test result on the main interface is consistent with it.

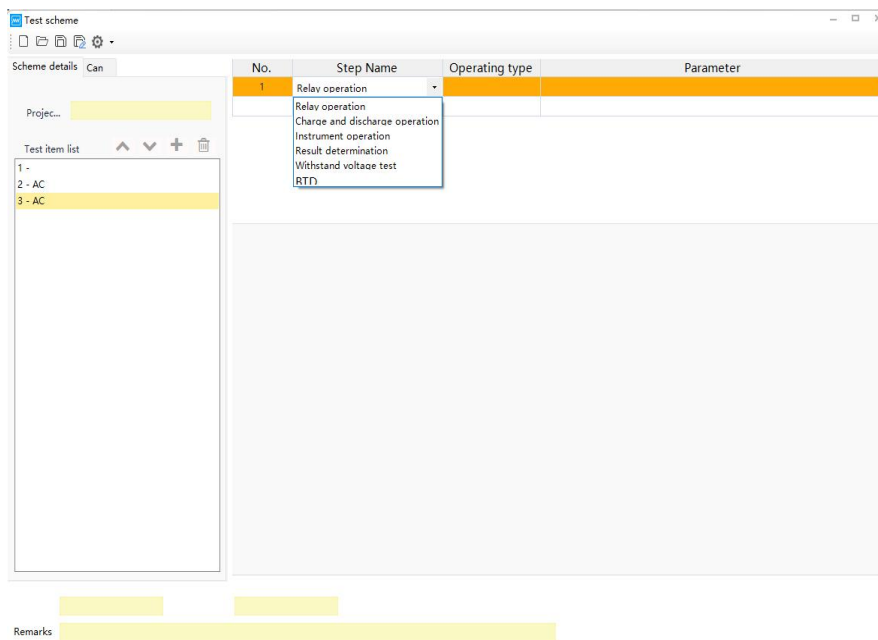
5. Log print area.

5.3.2 Step Setting and Running Operation





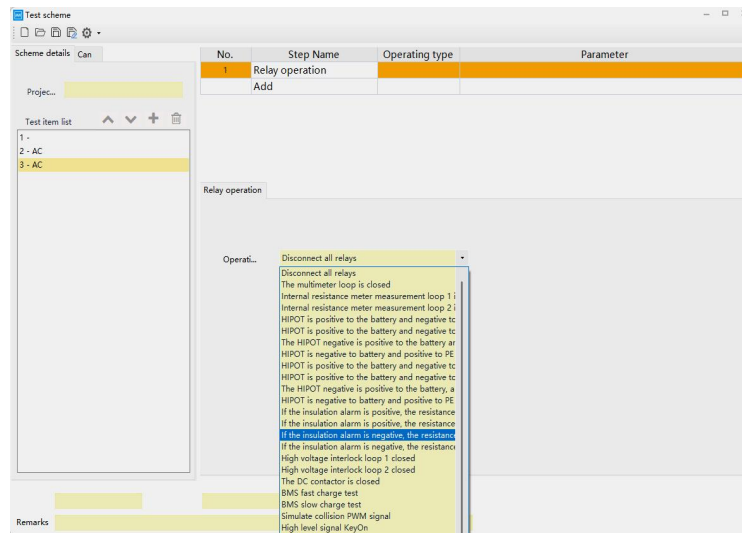
Click Step Editor on the toolbar to enter the test plan interface. Right-click the white box below the test item list and click Add, or click the Add button directly. In the Add window, enter the step name and click OK to enter the following interface.



Step types include relay operation, charge/discharge operation, hipot test, BTD, instrument operation, and result judgment. Except for BMS power consumption, relay operation is a required step. Set a relay closing step at the beginning of all steps and a relay opening step at the end. Hipot test configures hipot tester

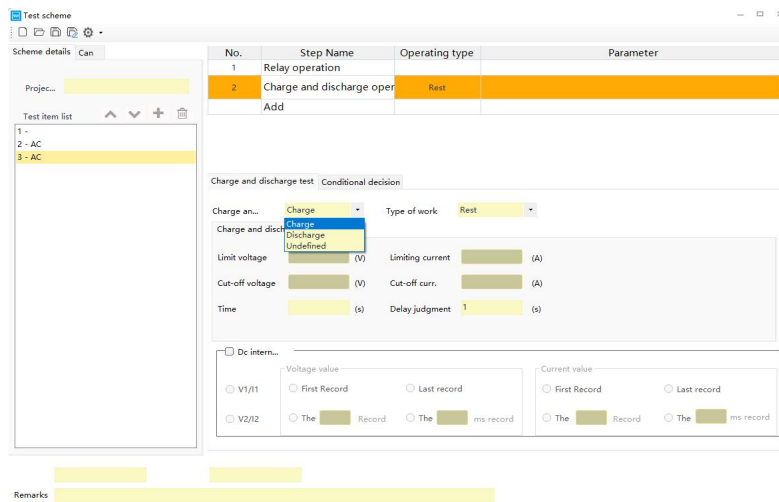
steps. Instrument operation configures multimeters, internal resistance testers, and regulated power supplies.

■ Relay Operation



Relay operation steps have multiple operation types, including open all relays, multimeter circuit closed, internal resistance measurement circuit 1 closed, high-voltage interlock circuit 1 closed, BMS fast-charge test, etc. Generally, a relay operation step of Open All Relays is added at the end of all steps, and the relay to be closed is selected at the beginning according to test requirements. If configuring a regulated power supply step (BMS power consumption), no relay operation step is required.

■ Charge and Discharge Operation



The following parameters shall be set for a charge/discharge step:

1. Charge/discharge type: charge and discharge.
2. Working type: includes rest, constant voltage, and constant current.
3. Limit voltage: maximum voltage allowed during charge/discharge.
4. Limit current: maximum current allowed during charge/discharge.
5. Cutoff voltage: when the voltage reaches this setting during charge/discharge, the system automatically stops charge/discharge.
6. Cutoff current: when the current reaches this setting during charge/discharge, the system automatically stops charge/discharge.
7. Time: when the charge/discharge time reaches this setting, the system automatically stops charge/discharge.
8. Delayed judgment: when charge/discharge starts, current data may be 0, so a 1 s delay is set.

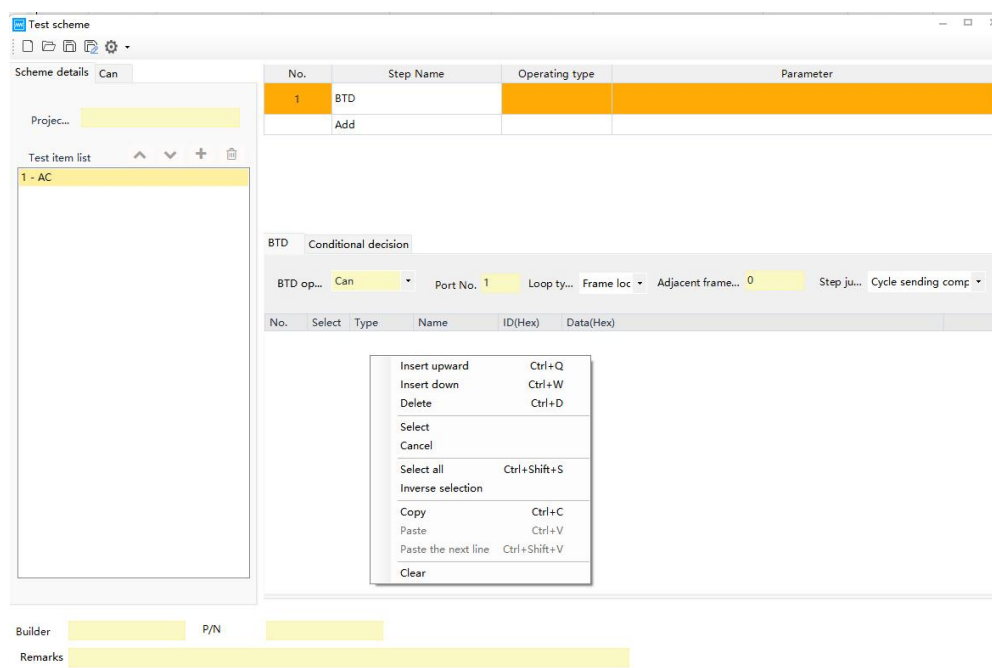
After setting the charge/discharge step, set a result judgment step. Select voltage or current as the variable, and set the comparison value, comparison operator, and operation as needed.

The charge/discharge step also includes DC internal resistance measurement.

The operation is as follows:

1. Select DC internal resistance test.
2. V1/I1 or V2/I2 can be selected as needed. If V1/I1 is selected, only the first or last charge/discharge current and voltage data can be used to calculate DC internal resistance. If V2/I2 is selected, the Nth data point or data at N ms can be selected freely.
3. In condition judgment, select the DC internal resistance parameter, and set the comparison operator, comparison value, and operation.

■ BTD



The BTD step is operated as follows:

Select CAN frame sending configuration. Set the CAN serial port number, frame type, CAN ID, and data as required. On the CAN interface, click DBC Edit to open the DBC editor window, then set the CAN file and corresponding CAN port as required.

Then add a judgment result step below the BTD step and select the required

DBC variable value.

■ Hipot Test

The screenshot shows the 'Test scheme' window with a table of test steps. Step 3, 'Withstand voltage test', is selected and highlighted in orange. Below the table, the configuration for this test is shown. The 'Test mode' dropdown is set to 'Ac withstand voltage'. The 'Parameter settings' section includes fields for 'Rise time', 'Descent time', 'Dwell time', 'Test time', 'Source voltage', 'Upper leakage...', and 'Lower limit of ...'. The 'Test current' is set to 0. The 'Remarks' field is at the bottom.

No.	Step Name	Operating type	Parameter
1	Relay operation		
2	Charge and discharge oper	Rest	
3	Withstand voltage test		
	Add		

Withstand voltage test Conditional decision

HipotControls Set Test mode Ac withstand voltage

Parameter settings

Rise time (0~999s) Upper insulation resista... (0~50000MΩ)

Descent time (0~999s) Lower insulation resista... (0~50000MΩ)

Dwell time (0.1~1s)

Test time (0~999s)

Source voltage (0/50~5000V) Upper limit of groundin... (0.1~5Ω)

Upper leakage... (0~20mA) Lower limit of groundin... (0~5Ω)

Lower limit of ... (0~20mA) Test current 0 (0/0.1A)

Remarks

The hipot test includes four test modes: AC withstand voltage, DC withstand voltage, insulation resistance, and ground resistance. Each measurement parameter has a value range. Set parameter values strictly according to the specified range.

After the hipot test step, set a result judgment step. Select leakage current or insulation resistance as the variable, and set the comparison value, comparison operator, and operation as needed.

■ Instrument Operation

The left screenshot shows the 'Test scheme' window with a table of test steps. Step 3, 'Instrument operation', is selected and highlighted in orange. Below the table, the configuration for this test is shown. The 'Instrument operation' dropdown is set to 'Regulated press'. The 'Operating type' is set to 'Current'. The 'Set voltage' is set to 0~380V and the 'Set current' is set to 0~10A. The 'Remarks' field is at the bottom.

The right screenshot shows the 'Test scheme' window with a table of test steps. Step 3, 'Instrument operation', is selected and highlighted in orange. Below the table, the configuration for this test is shown. The 'Instrument operation' dropdown is set to 'Regulated press'. The 'Operating type' is set to 'Voltage'. The 'Set voltage' is set to 0~380V and the 'Set current' is set to 0~10A. The 'Remarks' field is at the bottom.

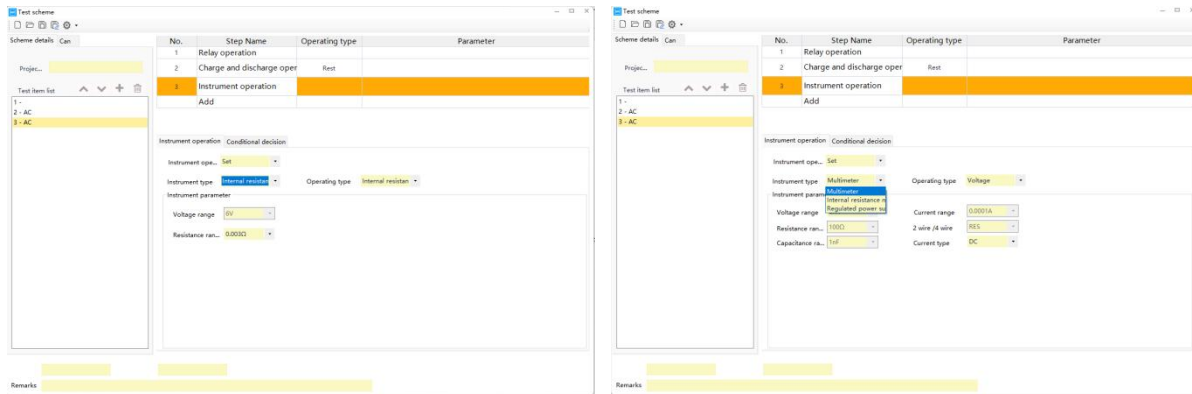
No.	Step Name	Operating type	Parameter
1	Relay operation		
2	Charge and discharge oper	Rest	
3	Instrument operation		
	Add		

Instrument operation Conditional decision

Instrument operation Set Instrument type Regulated press Operating type Current

Set voltage (0~380V) Set current (0~10A)

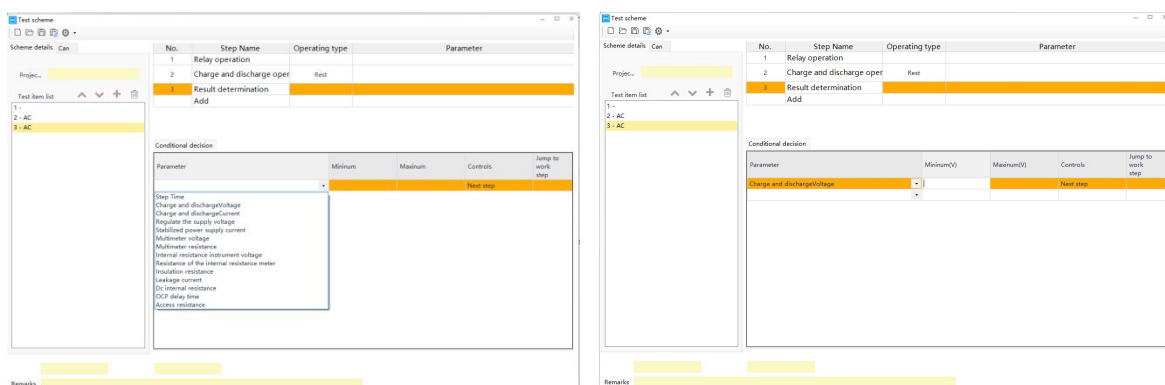
Remarks

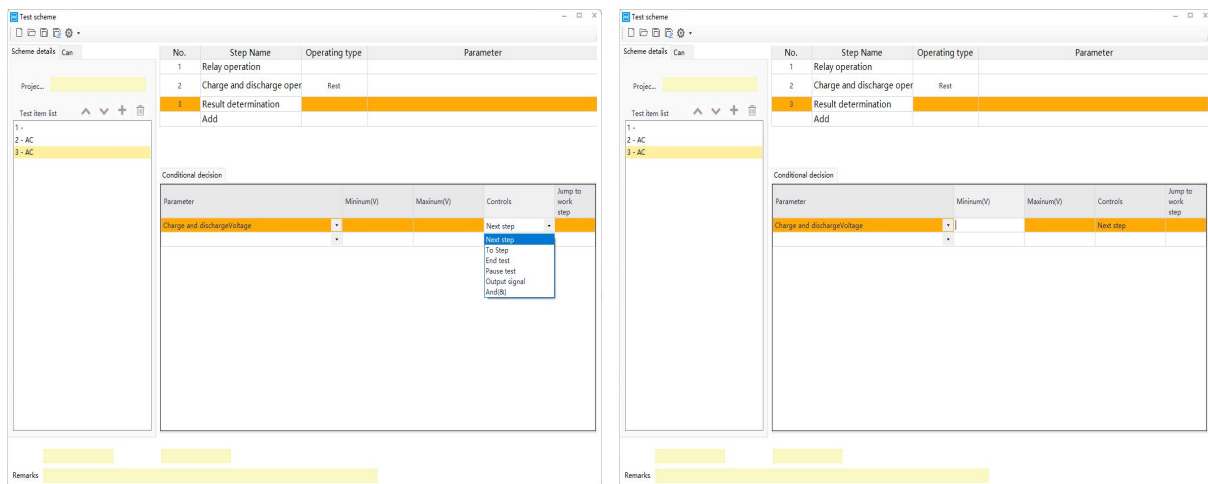


Instrument operation supports three instrument types: multimeter, internal resistance tester, and regulated power supply. Multimeter operation types include current, voltage, resistance, and capacitance. Internal resistance tester operation types include internal resistance, voltage, and internal resistance & voltage test. Regulated power supply operation types include current, voltage, and current & voltage.

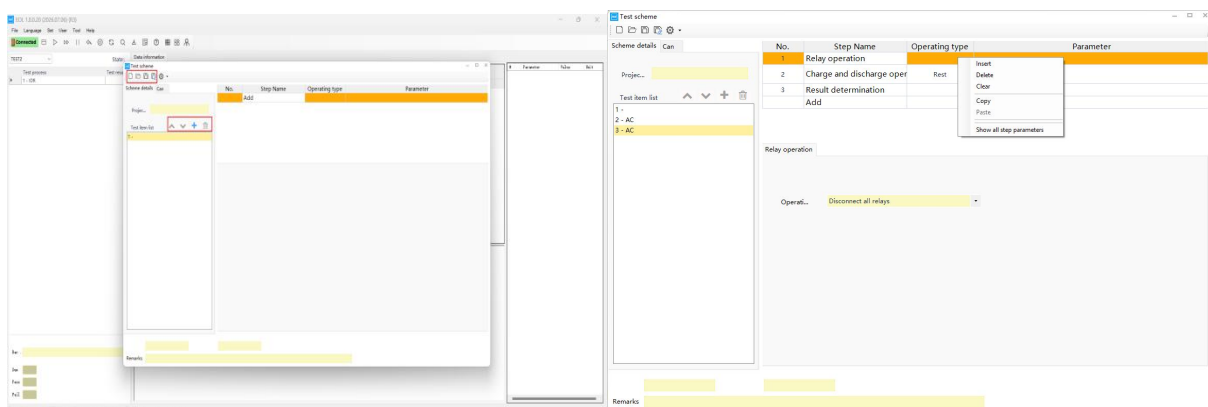
After setting the instrument operation step, add a result judgment step after it. Select a variable corresponding to the instrument, and set the comparison value, comparison operator, and operation as needed.

■ Result Judgment



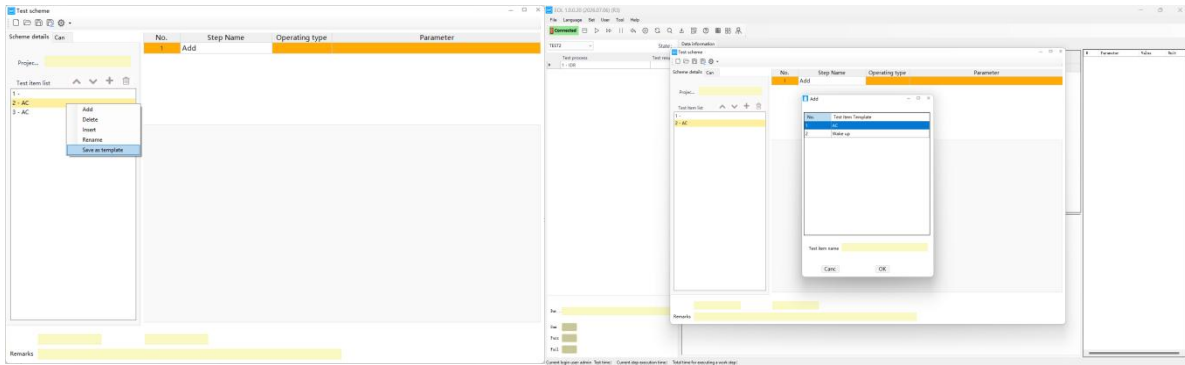


The result judgment step obtains data and can be configured to jump to a specified step when conditions are met, pause a step, stop a step, and perform AND (&) operations. The output signal function is currently unavailable.

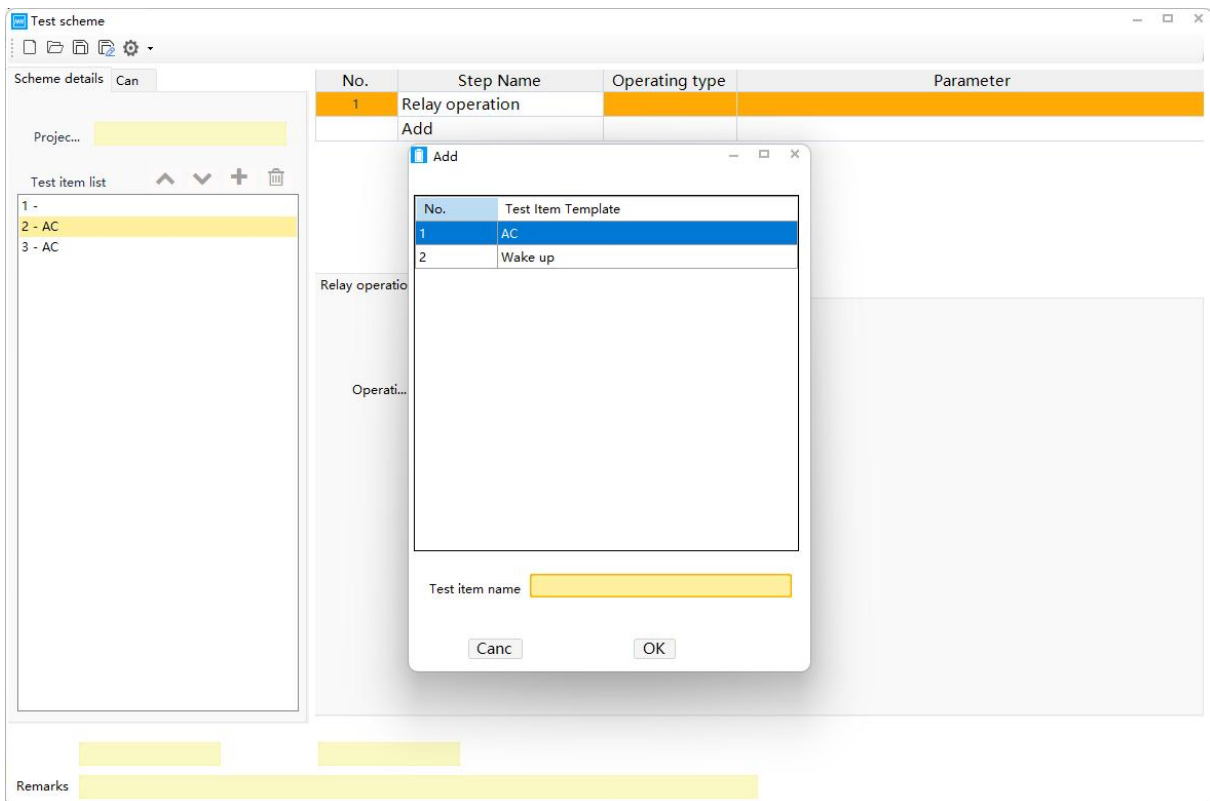


Right-click any of the six step types above to use Insert, Delete, Clear, Copy, Paste, and other functions. The four buttons on the right side of the test item list (Move Up, Move Down, New, and Delete) can also adjust the step order and delete steps.

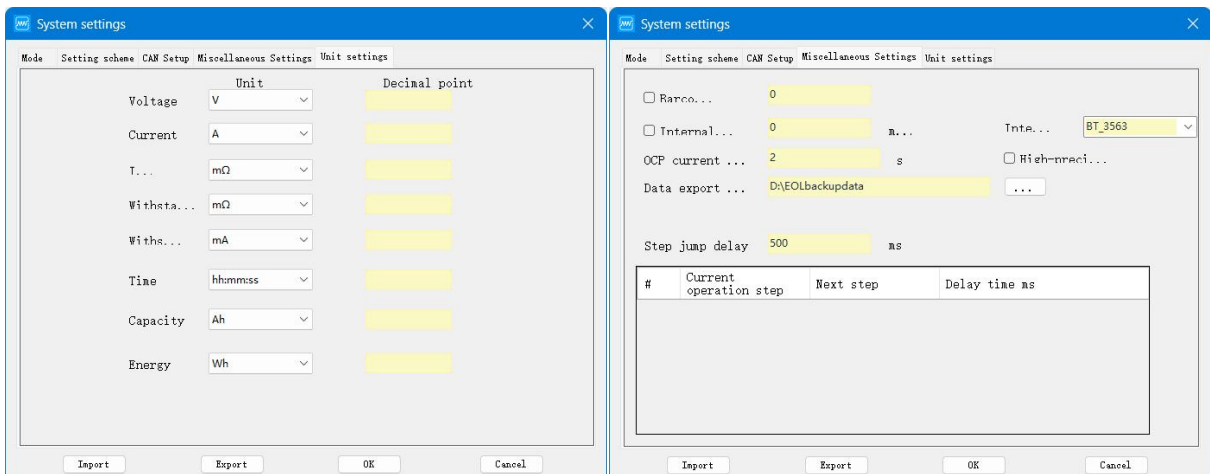
After editing steps, enter the plan name, creator, battery batch number, and remarks (optional), then click the third or fourth icon at the upper left to save or save as a file. The exported step editing file is in XML format. During step editing, the second icon can import a saved step XML file for user convenience.



The edited steps can also be saved as a template for direct use next time.

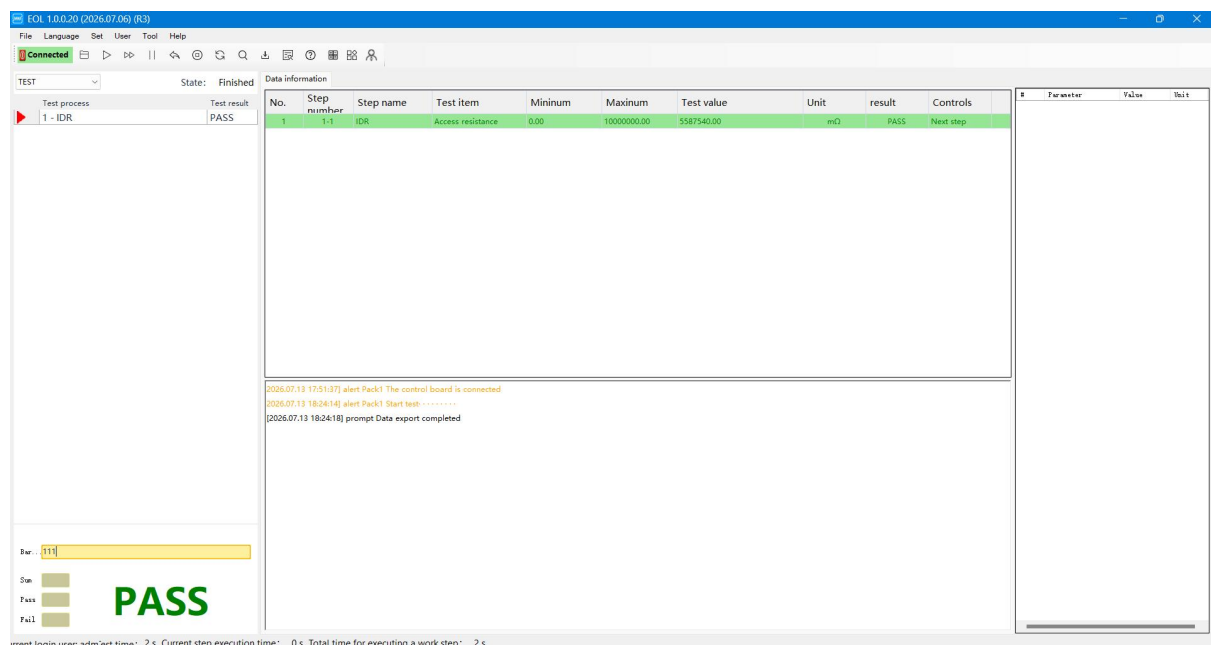


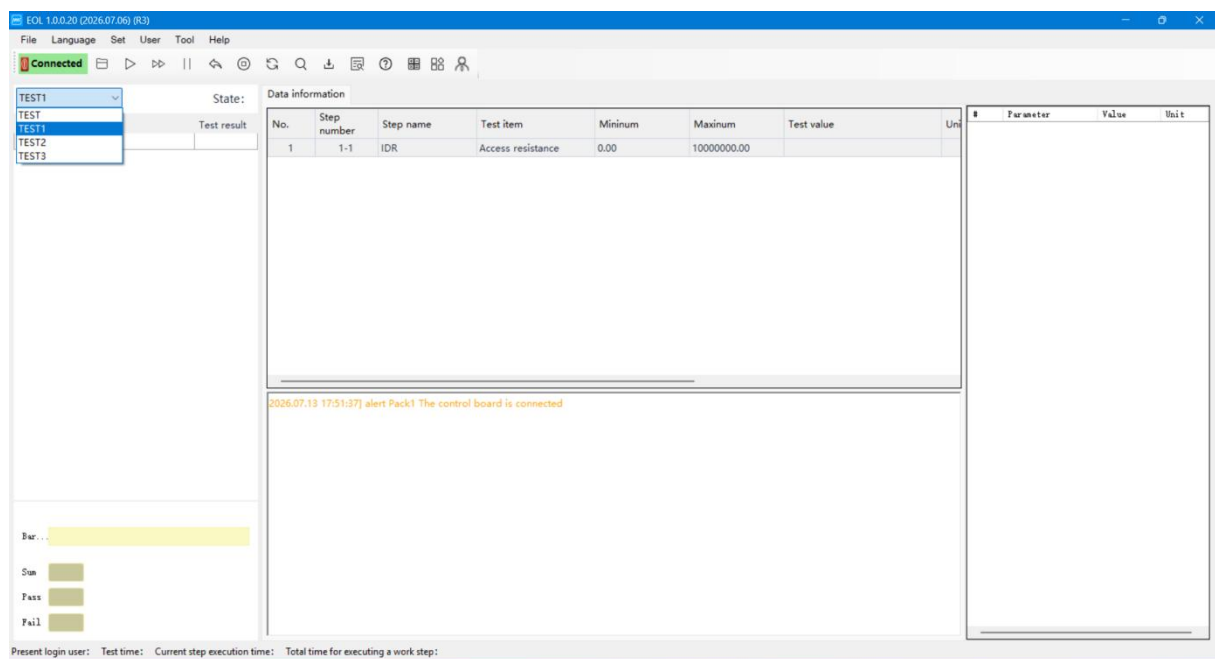
Saved templates can be called directly in the Add window.



After editing the steps, click System Settings in the settings area of the main interface. In the System Settings interface, units can be customized and the test data export path can be set. After units are set, the judgment step in the step editor displays the selected units, and the data information area displays data according to the selected units. The instrument IP addresses and ports in the plan are configured. Do not change them arbitrarily.

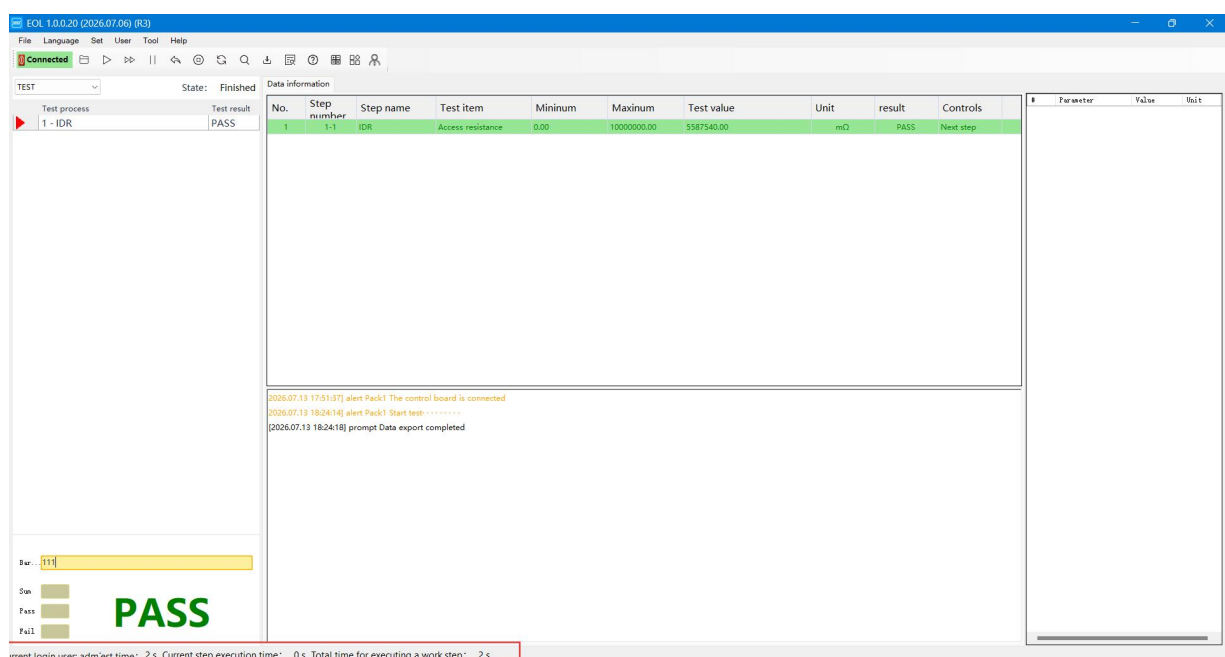
After editing the steps, first confirm that the icon at the upper left of the main interface is green and connected. If so, the software communicates normally with the equipment and step testing can start. If not, check whether the instrument IP address and port in the System Settings window are correct. After scanning with a barcode scanner, click Test Plan Management on the main interface, open the step folder, select the edited step in the selection box, and click Start to begin the step test.



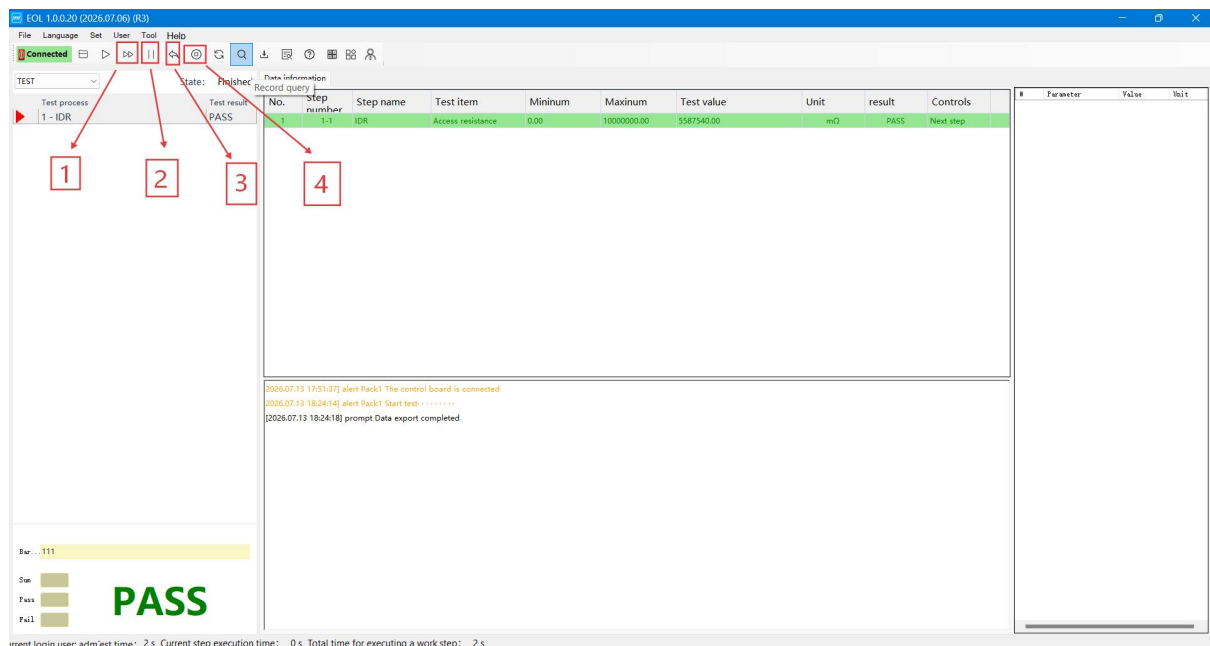


In addition to clicking Start to run the step test, you can right-click a step and click Single Step Test to start testing.

Data in the data information window can be downloaded by clicking the download button above or exported to Excel by right-clicking the window. After the test ends, test data is automatically exported to the path entered in the System Settings interface. The lower part of the main interface can also display the running time of the current step and total steps.



1. Jump to Next Step: this button allows step n in the data information to jump directly to step n+1.
2. Pause: click this button to pause the test. Click Resume to restart the test.
3. Resume: after the test is paused, click this button to restart the test from the paused step.
4. Stop: this button forcibly stops the test. The test cannot be resumed and must be restarted by clicking Start.



The real-time data window displays real-time charge/discharge voltage and current data and DBC variable values.

5.3.3 Historical Data Query

Project n... TEST

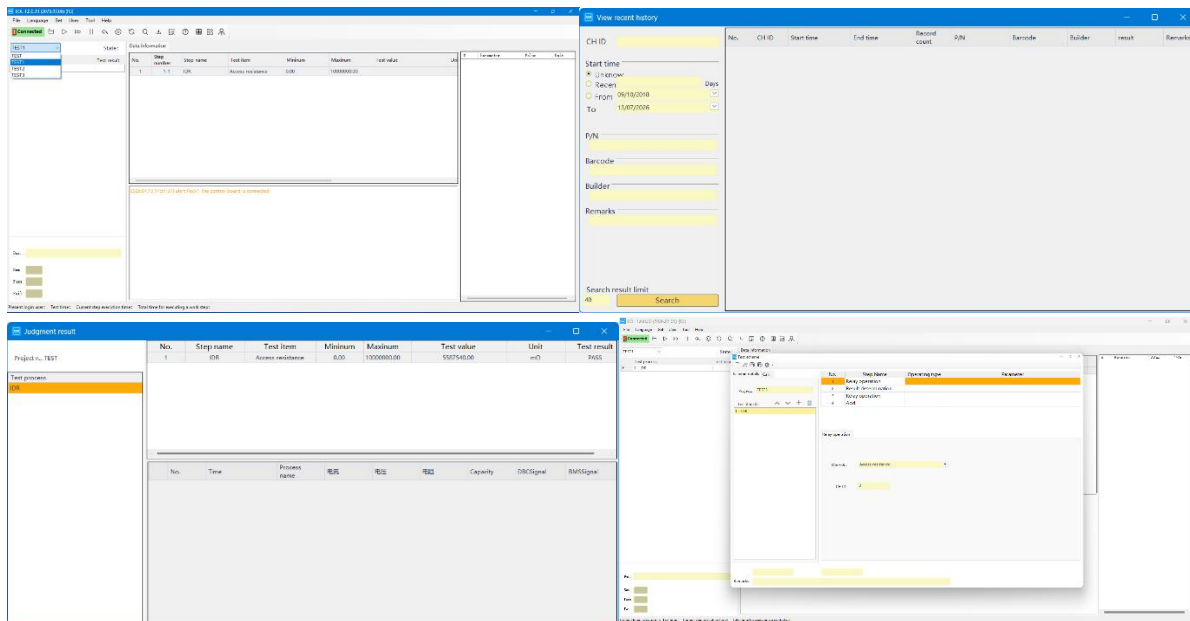
Test process

IDR

No.	Step name	Test item	Minimum	Maximum	Test value	Unit	Test result
1	IDR	Access resistance	0.00	10000000.00	5587540.00	mΩ	PASS

No.	Time	Process name	电流	电压	电阻	Capacity	DBCSignal	BMSSignal
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operation logs within one month.



Click Record Query on the main interface, enter the specified battery batch number and other information, and click Search. Right-click a search result to view channel data and channel information. Channel data includes the data information on the main interface plus detailed test data, such as real-time charge/discharge data and DBC variable values. Test information is the step loaded in the step editor and cannot be modified.

6. Operation

This chapter describes pre-test preparation and inspection, test start, test end, and related operations. Perform the operations described in this chapter before each test.

6.1 Startup

- All installation and connections have been completed according to the user manual and circuit diagrams, and all connections are secure.
- The EMERGENCY STOP button is released, and the manual ON/OFF switch is in the OFF position.
- Use instruments to check whether the AC and DC side voltages meet equipment startup conditions and whether there is any overvoltage hazard.
- If restarting after a fault, ensure that the fault has been completely cleared.
- Turn the manual switch to ON. The equipment performs power-on self-check. After the self-check passes, it runs automatically.

6.2 Shutdown

This model supports the following two shutdown methods:

- Quick shutdown (using the EMERGENCY STOP button or ON/OFF manual switch), used only in emergencies or fault conditions.
- Controlled shutdown, using the touch screen to shut down. This method is used under normal conditions.



Warning

- **Before opening the cabinet door for internal cabinet operations, wait at least 5 minutes after shutdown and use a multimeter or other instrument to verify safety. After shutdown, the DC input terminal and AC output terminal may still be live. Do not touch them.**
- **Only qualified and trained operators may operate the converter.**

7. Maintenance and Servicing

This chapter describes inspection and maintenance of the test equipment.

Periodic inspection and maintenance are necessary to keep the test equipment in good operating condition. Regular inspection and maintenance help solve problems at an early stage and keep the test equipment in optimal and therefore safest operating condition.

7.1 Precautions

Follow the safety rules below during all maintenance work on the equipment:

- Disconnect all internal and external power circuits and control power of the equipment.
- Hang warning signs and apply safety locks to ensure that the equipment cannot be accidentally re-energized.
- Use insulating cloth, plates, or similar insulating materials to cover and isolate nearby parts that may be live.
- Arrange safety grounding and short-circuit protection connections.
- Use a multimeter to ensure that the DC bus, AC bus, high-voltage capacitors, and other parts of the equipment are not energized.

7.2 Inspection and Maintenance

If any of the following inspection results is abnormal, contact the company after-sales service department.

Inspection Item	Inspection Method	Maintenance Interval
Cabinet	● Check whether the equipment appearance is	Once a year

inspection	damaged, deformed, dusty, or dirty. ● Check whether the door hinges are too tight or difficult to operate. If so, spray high-quality silicone oil lubricant on the hinges.	
Grounding reliability	Check whether protective grounding and power input grounding are reliable	Once a year
Power distribution reliability	Operation test of the main power switch (leakage circuit breaker)	Once a month
Equipment operating status	● Check whether all devices inside the equipment operate normally. ● Check whether the surge protector operates normally.	Once every six months
Electrical connection	● Check whether cable connections are loose or disconnected. ● Check whether cables are damaged, and check whether the insulation where cables contact metal surfaces has cuts.	Once a year
Fan inspection	Regularly inspect and clean fans. If a fault occurs, repair or replace the fan promptly to ensure normal cabinet ventilation and heat dissipation.	Once every six months
Instrument	Multimeters, safety testers, AC internal resistance	Once a year

calibration	testers, and similar instruments shall be calibrated once a year.	
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7.3 Cleaning and Maintenance

When cleaning dust inside the equipment, first blow low-pressure compressed air into the equipment from the bottom, then blow low-pressure compressed air from the top.

7.4 Torque Requirements

Specification	Torque (N.m)
M3	0.7-1
M4	1.8-2.4
M5	4-4.8
M6	7-8
M8	17-20
M10	34-40
M12	60-70
M16	119-140

8. Repair

This chapter explains equipment faults and describes how to resolve them.

8.1 Fault Recovery Operation



Electric shock hazard! Disconnect the power supply before servicing circuits.

Before removing the distribution cabinet cover, disconnect the external power switch. If the cover falls accidentally, it may crush the power cable.

When a fault is detected, the corresponding alarm screen appears on the control panel or display. Maintenance personnel can locate possible causes according to the fault information.

When a fault occurs

Restore equipment operation only after clearing the fault through the following steps. If the fault cannot be cleared, contact the relevant equipment maintenance personnel for service in time.

1. If the test equipment is running, shut down the equipment first and confirm that it has stopped operating.
2. Turn off the main power switch (leakage circuit breaker).
3. Clear the fault according to the alarm prompt.
4. Close the main power switch (leakage circuit breaker).

8.2 Common Faults

Small omissions during preparation, rather than faults in the equipment itself, may prevent normal operation. Therefore, carefully review the table below,

which summarizes information useful for solving the most common problems.

Problem	Possible Cause	Solution
Power indicator does not light	Mains input cable is not connected	Check whether the input cable is correctly connected
	Upstream leakage protection switch is triggered	Reset the protection switch. Note: confirm whether other branch equipment is causing switch overload.
	Input breaker is not turned on	Turn on the equipment input breaker
Poor communication	Communication cable is too long	Connect a communication cable that works normally to the abnormal equipment, then use the software to connect online and check whether the equipment connection is normal. Pay attention to serial port settings.
	Communication cable is aged	
	Computer serial port card performance is unstable	
	Incorrect software settings	Check software settings
Power indicator is on, but the equipment has no charge	Equipment is in rest mode	Check software settings and confirm that step settings are correct
	Voltage sampling cable is not connected	Confirm that the voltage sampling cable is correctly connected

/discharge current	Output connection cable is loose or disconnected	Confirm that the battery connection cable is reliably connected
	Output connection cable is reversed	Check whether the positive and negative terminals of the battery connection cable are correctly connected

9. Equipment Warranty

The warranty period of this product shall be subject to the contract. During the warranty period, the company will repair faulty products free of charge or replace them with new products.

For repair or replacement during the warranty period, the company requires the customer to present the purchase invoice. The trademark on the product shall be clearly identifiable; otherwise, the company has the right to refuse warranty service.

The company has the right to refuse warranty service in the following cases:

1. Damage during transportation.
2. Incorrect installation, modification, or use.
3. Operation in extremely harsh environments.
4. Damage caused by irresistible natural disasters.
5. Machine faults or
6. damage caused by installation, repair, modification, or disassembly by service organizations or personnel not authorized by the company.
7. Machine faults or damage caused by use of non-standard parts, non-company parts, or software.
8. Any installation or use beyond the requirements specified in relevant international standards.

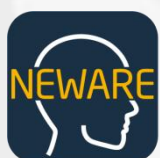
For product faults caused by the above conditions, if the customer requests repair service, paid repair service may be provided after assessment by the company service organization.

Product Warranty Record

Product Name		Product Model		Product Serial No.	
Date	Content		Service Personnel	Customer Representative	Remarks

**After-sales service hotline: (+86-755) 83128100 / 83128600 / 83128900
800-830-8866**

Tech support



LabTech



Tele-Control & Tech-Support
Smart-Lab Solutions Platform

The manual is subject to update without prior notice.

You can check the latest version of the document on 's official website.

If you have any questions or suggestions about the documentation, please contact us at the e-mail address below:

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