EOL comprehensive testing system

Technical Specifications

（For reference, The actual product may be slightly different）

application area ： Electric vehicles, buses,
household energy storage, container energy storage,
Offline testing and quality control of battery modules and PACKs

（Test object diagram, for reference only）

1 Product specifications and models:

Model	EOL-100V100C400D

2 Product Overview:

2.1 Introduction:

The EOL comprehensive testing system is a device used to test the insulation and voltage resistance performance of finished and semi-finished battery packs, as well as the comprehensive performance of BMS communication. After manual wiring, the system automatically tests and determines whether it is qualified, and records data automatically. Based on ASP The upper computer developed on the. NET platform has powerful data processing capabilities, is stable and reliable, and can save test data in real-time to the database and upload it to the MES system.

2.2 Product Features:

◆ Modular design of the entire machine, strong stability and reliability, and convenient maintenance and upgrading;

◆ Equipped with charge discharge reverse protection and reverse connection prompt function;

◆ The main control chip adopts high-performance ARM, and the equipment runs smoothly and stably;

◆ Adopting a 24 bit ADC, it has higher precision in voltage and current testing than in the industry;

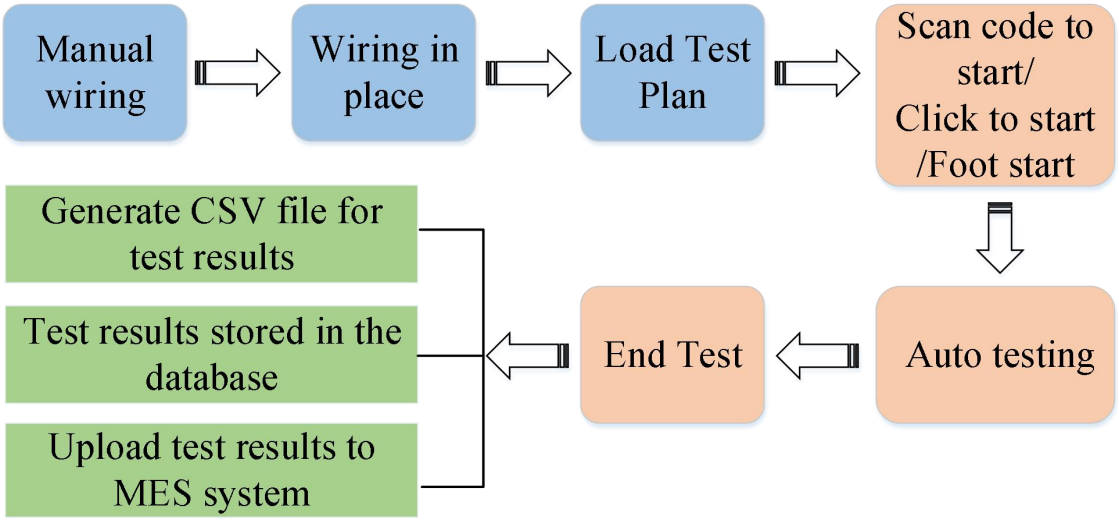
◆ The upper computer software operation interface is concise and clear, the testing step sequence can be edited, and the testing parameters can be adjusted;

◆ The voltage and current are sampled using a four wire system, with high voltage sampling accuracy and good long-term stability;

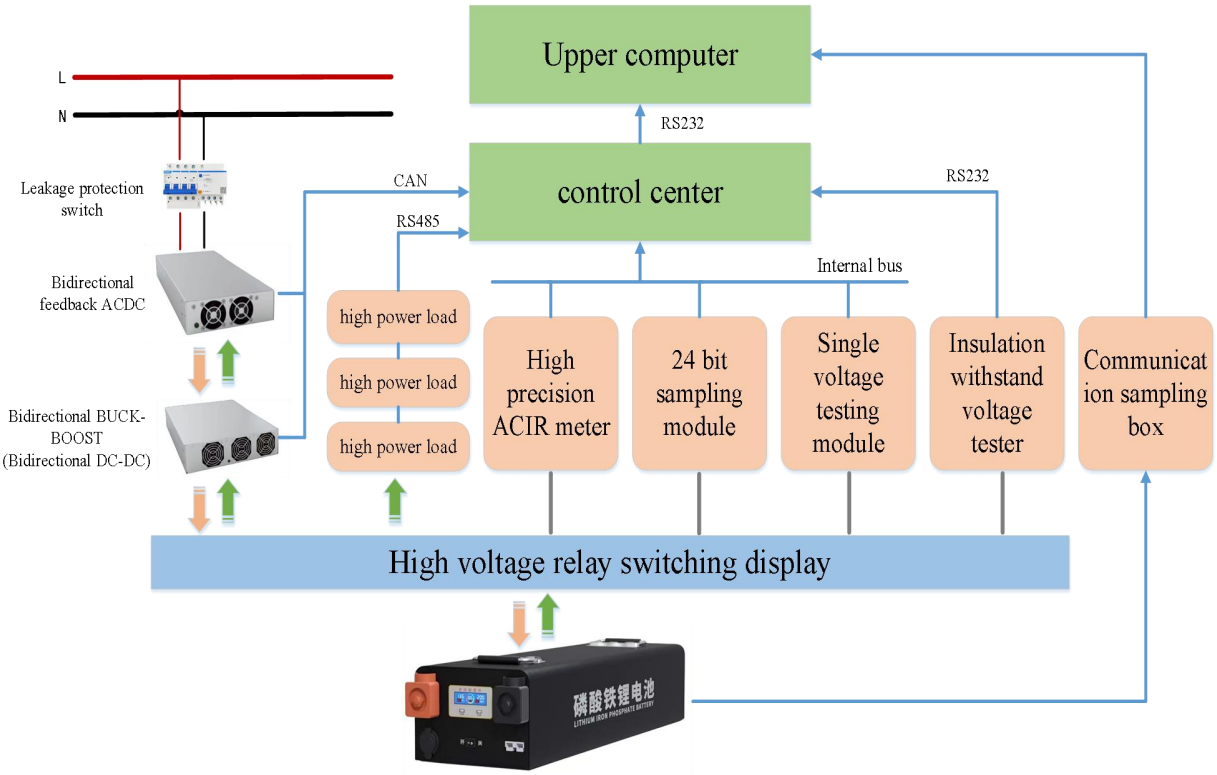
◆ Support one-dimensional and two-dimensional codes, and support scanning/foot start;

◆ Test data can be automatically saved, and a powerful database facilitates quality traceability.

2.3 Basic testing process：



2.4 2.4 Product Design Principle Block Diagram:



2.5 system function(Test items)：

Basic functions	
1.Open circuit voltage （OCV）	The battery voltage measured by the device when the battery pack is not being charged or discharged.
2.AC internal resistance （ACIR）	The AC internal resistance of the battery is measured using a four wire measurement method. A sine wave current signal (with a frequency of 1KHZ and a constant current of ≤ 100mA) is injected into the positive and negative terminals of the battery pack, and a series of processes such as voltage sampling, rectification, and filtering are used to accurately measure the AC impedance of the battery.
3.Foot switch Start	Mechanical foot switch, which replaces manual operation with foot stepping, improves work efficiency and safety.
4.Scan Code Start (Barcode Record)	By scanning one-dimensional and two-dimensional codes to activate the device for testing, the convenience and intelligence of the device can be improved. The scanned barcode is saved together with the test results in the database, and the test results can be queried and traced based on this barcode in the later stage.
5.Insulation resistance (positive electrode and shell of battery pack)	Insulation resistance refers to the resistance between the live and exposed parts of the tested component. In order to avoid leakage accidents, the insulation voltage must be sufficiently high. This project tests the insulation resistance value between the positive electrode of the battery pack and the battery casing.
6.Insulation resistance (battery pack negative electrode and shell)	This project tests the insulation resistance value between the negative electrode of the battery pack and the battery casing.

7.AC withstand voltage/leakage current (positive pole and shell of battery pack)	Leakage current can easily cause electric shock injury to the human body, and withstand voltage/leakage current testing is a very important part of safety testing. Testing principle: Apply high voltage to the tested object and detect the leakage current generated under this condition. If the detected leakage current is within the specified range, the withstand voltage/leakage current performance meets the requirements. This project tests the AC withstand voltage performance between the positive electrode of the battery pack and the battery casing.
8.AC withstand voltage/leakage current (battery pack negative electrode and shell)	This project tests the AC withstand voltage performance between the negative electrode of the battery pack and the battery casing.
9.DC withstand voltage/leakage current (positive electrode and shell of battery pack)	This project tests the DC withstand voltage performance between the positive electrode of the battery pack and the battery casing.
10.DC withstand voltage/leakage current (battery pack negative electrode and shell)	This project tests the DC withstand voltage performance between the negative electrode of the battery pack and the battery casing.
11. DC internal resistance（DCIR）	Connect high current discharge loads at both ends of the battery pack, and calculate the resistance value using Ohm's law based on the voltages U1 and U2 at different currents I1 and I2. This equipment adopts the IEC (International Electrotechnical Commission) testing method for fast and accurate testing.
12. Charging activation (Wake Up)	The battery pack needs to be charged and activated when it is in idle, BMS sleep or protection state.

13. Charging voltage	Conduct a charging test on the battery pack based on the set voltage, current, and charging time to check if the charging function of the battery pack is normal. (1) Charging voltage: the voltage output by the device to charge the battery pack (2) Charging current: Charge the battery pack according to the set current value (3) Charging voltage difference: the voltage difference between the beginning and end of charging
14. Charging current	
15. Charging drop voltage	
16. Charging overcurrent protection (OCP)	Charging overcurrent protection refers to the protective measures automatically taken by the BMS in the battery pack during the charging process, when the charging current exceeds the preset safe value, to prevent damage to the battery pack caused by excessive current. This device can test whether the battery pack has charging overcurrent protection function and the specific current value of the protection current.
17. Discharge voltage (load voltage)	Test the discharge function and load capacity of the battery pack based on the set discharge current size and time. (1) Discharge voltage: The voltage measured during the discharge of a battery pack (2) Discharge current: the current value output by the battery pack during discharge (3) Discharge voltage difference: the voltage difference between the beginning and end of discharge
18. Discharge current (load current)	
19. Discharge drop voltage	
20. Discharge overcurrent protection (OCP)	Discharge overcurrent protection refers to the protective measures automatically taken by the BMS in the battery pack during the discharge process, when the discharge current exceeds the preset safe value, to prevent damage to the battery pack caused by excessive current. This device can test whether the battery pack has discharge overcurrent protection function and the specific current value of the protection current.
21. MES system connection	After the testing is completed, the test results of this device can be easily and quickly uploaded to the MES system (Manufacturing Execution System).

3 Technical Indicators：

model	**EOL-100V100C400D**
Power	1. Charging power 10KW 2. Discharge power 40KW
AC input interface	1. Input three-phase AC380V ± 10% 2.Input current： max 16A 3. Frequency 50Hz
Measure voltage range	±100V
Charging voltage range	0~100V
Discharge voltage range	8~100V
Charging current range	1~100A
Charging OCP range	1~100A
Discharge current range	1~400A
Discharge **OCP range**	1~400A
Voltage accuracy	±0.05% of F.S±0.05% of F.D
Charging Current accuracy	±0.5% of F.S±0.5% of F.D
Discharge Current accuracy	±0.2% of F.S±0.2% of F.D
Charging and discharging time	0~60S
Overcurrent delay time	0~20S

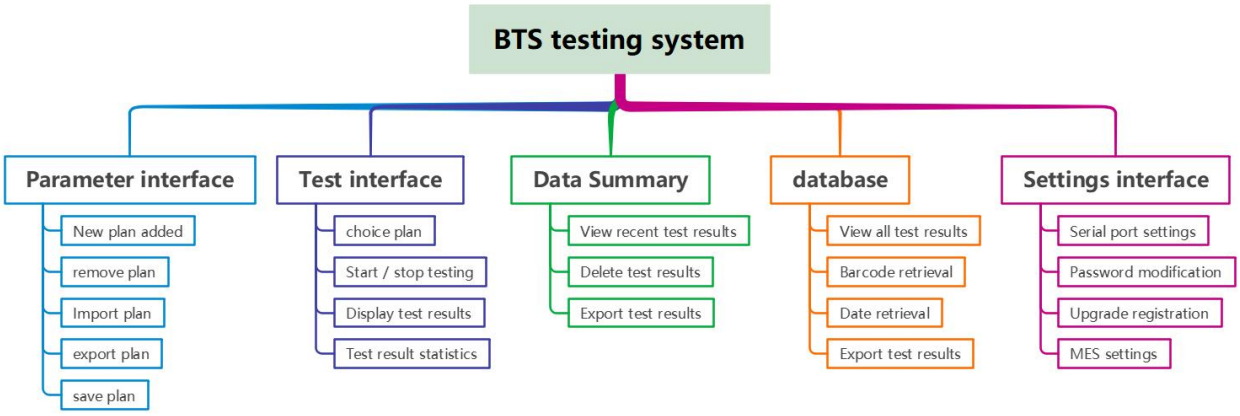
Discharge **OCP Current accuracy**	±2A	
Charging **OCP Current accuracy**	±2A	
Voltage resolution	1mV	
Current resolution	1mA	
data save mode	1. Save data in CSV file format 2. Database storage, providing query and traceability by barcode, scheme, date, and other methods	
Voltage withstand test parameters	AC voltage withstand test	0.05KV～5KV；0.001mA～10mA；
	DC withstand voltage test	0.05KV～6.0KV；0.1uA～5mA
	precision	± (2% x reading+5 words)
Insulation test parameters	testing voltage	+50V~+1200V accuracy: ± 0.5% FS
	0.001MΩ≦R＜10MΩ	Accuracy: ± (2% reading+0.003M Ω)
	10MΩ≦R＜100MΩ	Accuracy: ± (2% reading+0.03M Ω)
	100MΩ≦R＜1GΩ	Accuracy: ± (2% reading+0.3M Ω)
	1GΩ≦R＜5GΩ	Accuracy: ± (2% reading+3M Ω)
	R≥5GΩ	Accuracy: ± (10% reading+30M Ω)
Internal Resistance (ACR)	1~20000mΩ	
Communication method	Serial port RS232（Devices and computers）	
power-off protection	Automatically disconnect the electrical connection between the battery and the device after an unexpected power outage in the communication input	
Emergency stop function	Pressing the emergency stop button will disconnect the electrical connection between the battery and the device, and turn off the load power of the device	

Cooling method	Forced air cooling
Dimensions (W * D * H)	680*850*1710mm
environment	-20℃~50℃
temperature	10-90%RH

4 computer software

4.1 Software architecture

The upper computer software architecture of the system is as follows, based on the modular design concept, divided into 5 large modules. The interface is concise and clear, easy to navigate, and users can easily browse and switch between different functional modules. The upper computer of this system is based on ASP NET platform development has extremely high stability, reliability, and scalability.



4.2 Login interface

The login interface can select three languages: Simplified Chinese, Traditional Chinese, and English. User management includes three types of users, corresponding to different operation permissions, which are defined as follows:

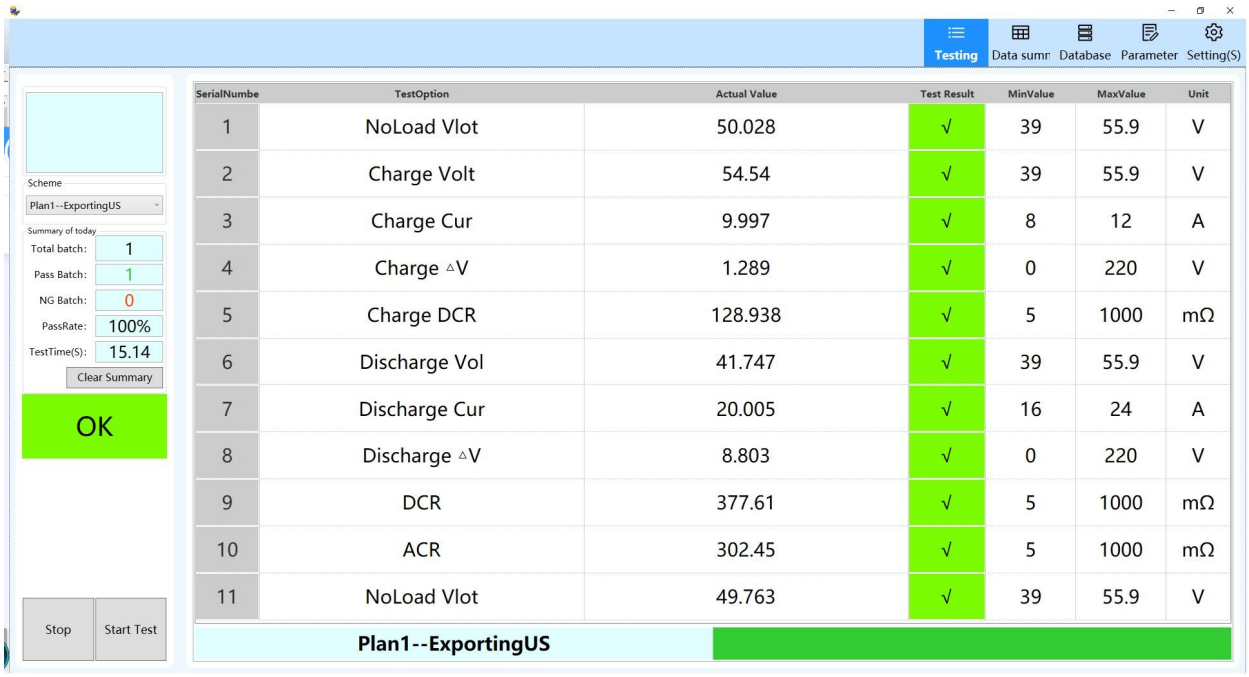
(1) Operator: Can operate the testing interface, view data summaries, and view databases. This permission only allows basic operations and viewing test results, and cannot perform parameter settings or other operations.

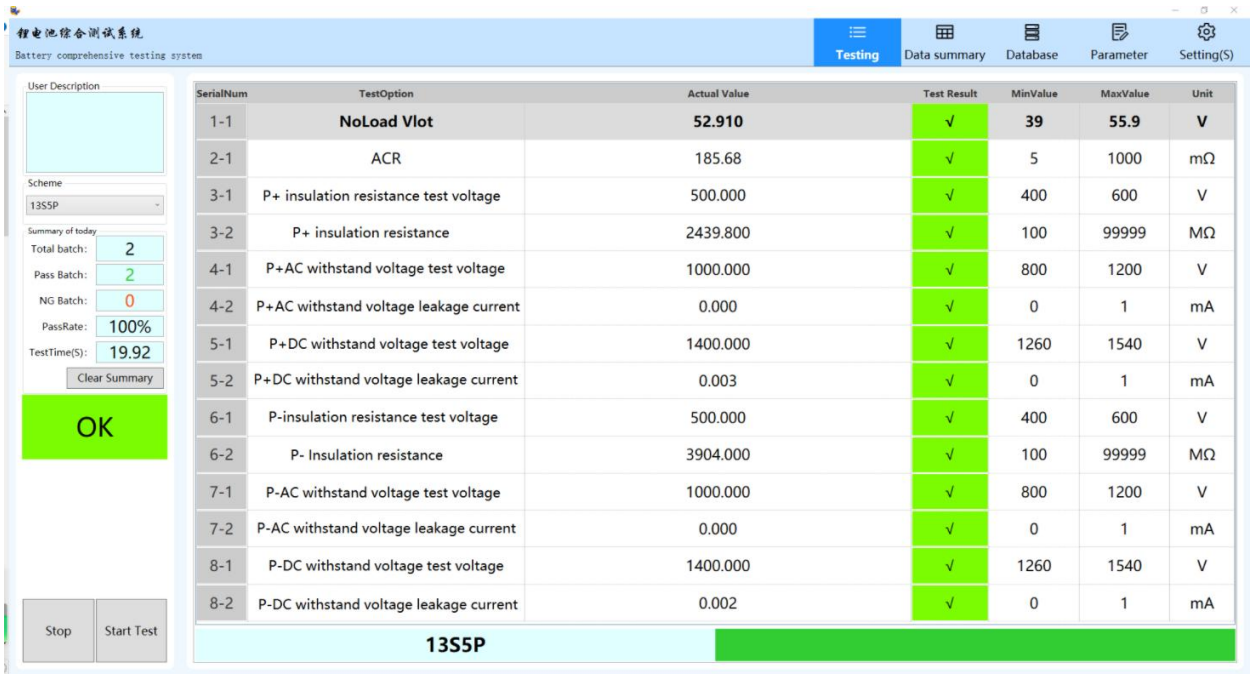
(2) Technician: Can operate the testing interface, view data summary, view database, set execution plan parameters, set serial communication parameters, modify operator and technician passwords, etc.

(3) Administrator: The manufacturer reserves a debugging interface to view parameters when the device is running abnormally.

4.3 Main interface（Testing interface）

After setting the parameters and saving them, the system actively jumps to the testing interface. In the testing interface, different testing schemes can be selected based on different models and batches of batteries. After selecting the solution, click "Start Testing", and the system will automatically complete the testing and display the test results as shown in the following figure. When the test results are incorrect or errors such as battery reverse connection are detected, the system will stop the test and report an error. In emergency situations, you can click "stop testing" or press the emergency stop button.

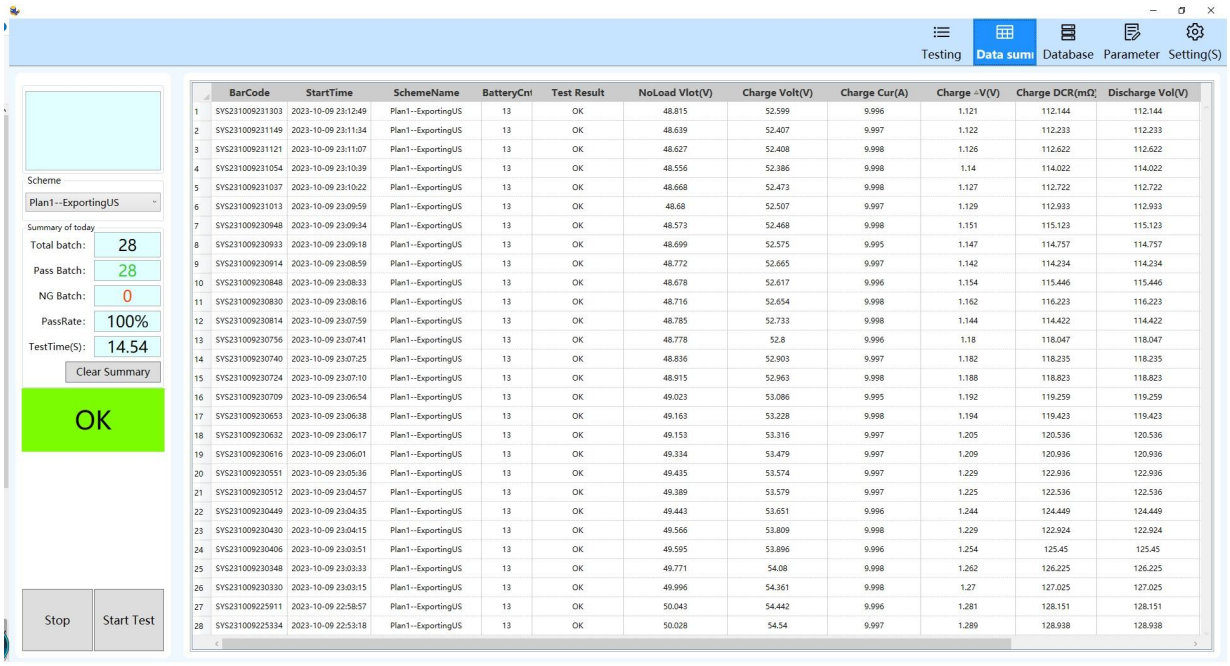




SerialNum	TestOption	Actual Value	Test Result	MinValue	MaxValue	Unit
1-1	NoLoad Vlot	52.910	√	39	55.9	V
2-1	ACR	185.68	√	5	1000	mΩ
3-1	P+ insulation resistance test voltage	500.000	√	400	600	V
3-2	P+ insulation resistance	2439.800	√	100	99999	MΩ
4-1	P+AC withstand voltage test voltage	1000.000	√	800	1200	V
4-2	P+AC withstand voltage leakage current	0.000	√	0	1	mA
5-1	P+DC withstand voltage test voltage	1400.000	√	1260	1540	V
5-2	P+DC withstand voltage leakage current	0.003	√	0	1	mA
6-1	P-insulation resistance test voltage	500.000	√	400	600	V
6-2	P- Insulation resistance	3904.000	√	100	99999	MΩ
7-1	P-AC withstand voltage test voltage	1000.000	√	800	1200	V
7-2	P-AC withstand voltage leakage current	0.000	√	0	1	mA
8-1	P-DC withstand voltage test voltage	1400.000	√	1260	1540	V
8-2	P-DC withstand voltage leakage current	0.002	√	0	1	mA

4.4 Data Summary Interface

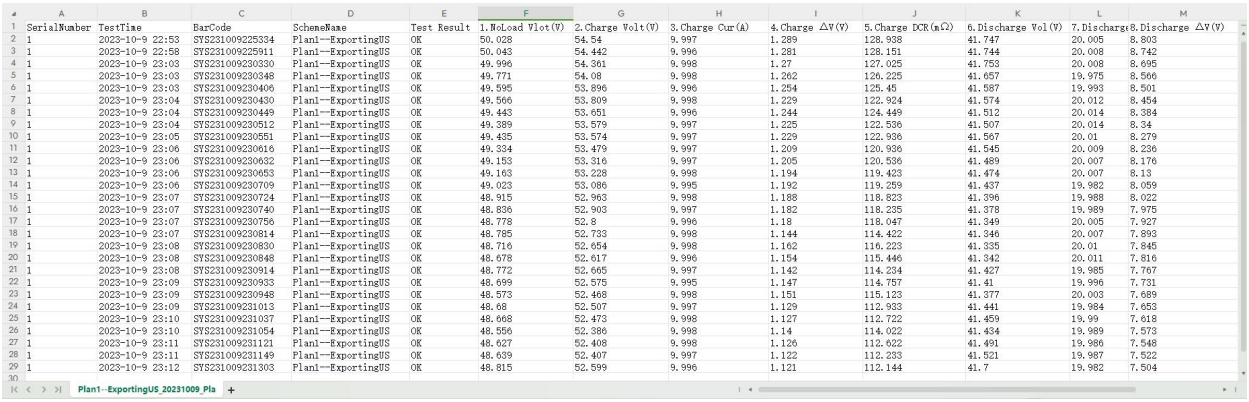
The data summary interface will display the test results of all battery packs tested by the most recent test plan. Provide the function to delete a test result when the technician has permission. The test results are arranged in reverse chronological order, and the final test result is placed in the first row for the convenience of customers to view.



	BarCode	StartTime	SchemeName	BatteryCnt	Test Result	NoLoad Vlot(V)	Charge Volt(V)	Charge Cur(A)	Charge -V(V)	Charge DCR(mΩ)	Discharge Vol(V)
1	SYS231009231303	2023-10-09 23:12:49	Plan1--ExportingUS	13	OK	48.815	52.599	9.996	1.121	112.144	112.144
2	SYS231009231149	2023-10-09 23:11:34	Plan1--ExportingUS	13	OK	48.639	52.407	9.997	1.122	112.233	112.233
3	SYS231009231121	2023-10-09 23:11:07	Plan1--ExportingUS	13	OK	48.627	52.408	9.998	1.126	112.622	112.622
4	SYS231009231054	2023-10-09 23:10:39	Plan1--ExportingUS	13	OK	48.556	52.386	9.998	1.14	114.022	114.022
5	SYS231009231037	2023-10-09 23:10:22	Plan1--ExportingUS	13	OK	48.668	52.473	9.998	1.127	112.722	112.722
6	SYS231009231013	2023-10-09 23:09:59	Plan1--ExportingUS	13	OK	48.68	52.507	9.997	1.129	112.933	112.933
7	SYS231009230948	2023-10-09 23:09:34	Plan1--ExportingUS	13	OK	48.573	52.468	9.998	1.151	115.123	115.123
8	SYS231009230933	2023-10-09 23:09:18	Plan1--ExportingUS	13	OK	48.699	52.575	9.995	1.147	114.757	114.757
9	SYS231009230914	2023-10-09 23:08:59	Plan1--ExportingUS	13	OK	48.772	52.665	9.997	1.142	114.234	114.234
10	SYS231009230848	2023-10-09 23:08:33	Plan1--ExportingUS	13	OK	48.678	52.617	9.996	1.154	115.446	115.446
11	SYS231009230830	2023-10-09 23:08:16	Plan1--ExportingUS	13	OK	48.716	52.654	9.998	1.162	116.223	116.223
12	SYS231009230814	2023-10-09 23:07:59	Plan1--ExportingUS	13	OK	48.785	52.733	9.998	1.144	114.422	114.422
13	SYS231009230756	2023-10-09 23:07:41	Plan1--ExportingUS	13	OK	48.778	52.8	9.996	1.18	118.047	118.047
14	SYS231009230740	2023-10-09 23:07:25	Plan1--ExportingUS	13	OK	48.836	52.903	9.997	1.182	118.235	118.235
15	SYS231009230724	2023-10-09 23:07:10	Plan1--ExportingUS	13	OK	48.915	52.963	9.998	1.188	118.823	118.823
16	SYS231009230709	2023-10-09 23:06:54	Plan1--ExportingUS	13	OK	49.023	53.086	9.995	1.192	119.259	119.259
17	SYS231009230653	2023-10-09 23:06:38	Plan1--ExportingUS	13	OK	49.163	53.228	9.998	1.194	119.423	119.423
18	SYS231009230632	2023-10-09 23:06:17	Plan1--ExportingUS	13	OK	49.153	53.316	9.997	1.205	120.536	120.536
19	SYS231009230616	2023-10-09 23:06:01	Plan1--ExportingUS	13	OK	49.334	53.479	9.997	1.209	120.936	120.936
20	SYS231009230551	2023-10-09 23:05:36	Plan1--ExportingUS	13	OK	49.435	53.574	9.997	1.229	122.936	122.936
21	SYS231009230512	2023-10-09 23:04:57	Plan1--ExportingUS	13	OK	49.389	53.579	9.997	1.225	122.536	122.536
22	SYS231009230449	2023-10-09 23:04:35	Plan1--ExportingUS	13	OK	49.443	53.651	9.996	1.244	124.449	124.449
23	SYS231009230430	2023-10-09 23:04:15	Plan1--ExportingUS	13	OK	49.566	53.809	9.998	1.229	122.924	122.924
24	SYS231009230406	2023-10-09 23:03:51	Plan1--ExportingUS	13	OK	49.595	53.896	9.996	1.254	125.45	125.45
25	SYS231009230348	2023-10-09 23:03:33	Plan1--ExportingUS	13	OK	49.771	54.08	9.998	1.262	126.225	126.225
26	SYS231009230330	2023-10-09 23:03:15	Plan1--ExportingUS	13	OK	49.996	54.361	9.998	1.27	127.025	127.025
27	SYS231009225911	2023-10-09 22:58:57	Plan1--ExportingUS	13	OK	50.043	54.442	9.996	1.281	128.151	128.151
28	SYS231009225334	2023-10-09 22:53:18	Plan1--ExportingUS	13	OK	50.028	54.54	9.997	1.289	128.938	128.938

4.5 Excel file

The test results will be automatically saved as an Excel file, and the system will classify the test result files. The "OK" and "NG" files will be stored separately. The Excel file is named after the barcode name and the test time.



SerialNumber	TestTime	BarCode	SchemeName	Test Result	1.NoLoad Vlot(V)	2.Charge Volt(V)	3.Charge Cur(A)	4.Charge ΔV(V)	5.Charge DCR(mΩ)	6.Discharge Vol(V)	7.Discharge	8.Discharge ΔV(V)
1	2023-10-9 22:53	SYS23109225334	Plan1--ExportingUS	OK	50.028	54.54	9.997	1.289	128.938	41.747	20.005	8.803
1	2023-10-9 22:58	SYS23109225911	Plan1--ExportingUS	OK	50.043	54.442	9.996	1.281	128.151	41.744	20.008	8.742
1	2023-10-9 23:03	SYS23109230330	Plan1--ExportingUS	OK	49.996	54.361	9.998	1.27	127.025	41.753	20.008	8.695
1	2023-10-9 23:03	SYS23109230348	Plan1--ExportingUS	OK	49.771	54.08	9.998	1.262	126.225	41.657	19.975	8.566
1	2023-10-9 23:03	SYS23109230406	Plan1--ExportingUS	OK	49.595	53.896	9.996	1.254	125.45	41.587	19.993	8.501
1	2023-10-9 23:04	SYS23109230430	Plan1--ExportingUS	OK	49.566	53.809	9.998	1.229	122.924	41.574	20.012	8.454
1	2023-10-9 23:04	SYS23109230449	Plan1--ExportingUS	OK	49.443	53.651	9.996	1.244	124.449	41.512	20.014	8.384
1	2023-10-9 23:04	SYS23109230512	Plan1--ExportingUS	OK	49.389	53.579	9.997	1.225	122.536	41.507	20.014	8.34
1	2023-10-9 23:05	SYS23109230551	Plan1--ExportingUS	OK	49.435	53.574	9.997	1.229	122.936	41.567	20.01	8.279
1	2023-10-9 23:06	SYS23109230616	Plan1--ExportingUS	OK	49.334	53.479	9.997	1.209	120.936	41.545	20.009	8.236
1	2023-10-9 23:06	SYS23109230632	Plan1--ExportingUS	OK	49.153	53.316	9.997	1.205	120.536	41.489	20.007	8.176
1	2023-10-9 23:06	SYS23109230653	Plan1--ExportingUS	OK	49.163	53.228	9.998	1.194	119.423	41.474	20.007	8.13
1	2023-10-9 23:06	SYS23109230709	Plan1--ExportingUS	OK	49.023	53.086	9.995	1.192	119.259	41.437	19.982	8.059
1	2023-10-9 23:07	SYS23109230724	Plan1--ExportingUS	OK	48.915	52.963	9.998	1.188	118.823	41.396	19.988	8.022
1	2023-10-9 23:07	SYS23109230740	Plan1--ExportingUS	OK	48.836	52.903	9.997	1.182	118.235	41.378	19.989	7.975
1	2023-10-9 23:07	SYS23109230756	Plan1--ExportingUS	OK	48.778	52.8	9.996	1.18	118.047	41.349	20.005	7.927
1	2023-10-9 23:07	SYS23109230814	Plan1--ExportingUS	OK	48.785	52.733	9.998	1.144	114.422	41.346	20.007	7.893
1	2023-10-9 23:08	SYS23109230830	Plan1--ExportingUS	OK	48.716	52.654	9.998	1.162	116.223	41.335	20.01	7.845
1	2023-10-9 23:08	SYS23109230848	Plan1--ExportingUS	OK	48.678	52.617	9.996	1.154	115.446	41.342	20.011	7.816
1	2023-10-9 23:08	SYS23109230914	Plan1--ExportingUS	OK	48.772	52.665	9.997	1.142	114.234	41.427	19.985	7.767
1	2023-10-9 23:09	SYS23109230933	Plan1--ExportingUS	OK	48.699	52.575	9.995	1.147	114.757	41.41	19.996	7.731
1	2023-10-9 23:09	SYS23109230948	Plan1--ExportingUS	OK	48.573	52.468	9.998	1.151	115.123	41.377	20.003	7.689
1	2023-10-9 23:09	SYS23109231013	Plan1--ExportingUS	OK	48.68	52.507	9.997	1.129	112.933	41.441	19.984	7.653
1	2023-10-9 23:10	SYS23109231037	Plan1--ExportingUS	OK	48.668	52.473	9.998	1.127	112.722	41.459	19.99	7.618
1	2023-10-9 23:10	SYS23109231054	Plan1--ExportingUS	OK	48.556	52.386	9.998	1.14	114.022	41.434	19.989	7.573
1	2023-10-9 23:11	SYS23109231121	Plan1--ExportingUS	OK	48.627	52.408	9.998	1.126	112.622	41.491	19.986	7.548
1	2023-10-9 23:11	SYS23109231149	Plan1--ExportingUS	OK	48.639	52.407	9.997	1.122	112.233	41.521	19.987	7.522
1	2023-10-9 23:12	SYS23109231303	Plan1--ExportingUS	OK	48.815	52.599	9.996	1.121	112.144	41.7	19.982	7.504

5 List of Main Accessories

NO	Main components	MAker	number	unit
1	Testing system software	Self-developed	1	PCS
2	Industrial computer	YANHONG	1	PCS
3	relay	HONGFA	14	PCS
4	chassis	Self-developed	1	PCS
5	power supply	Taiwan Mingwei	4	PCS
6	Code scanning gun	Guangzhou Wangbai	1	PCS
7	Leakage switch	chnt	1	PCS
8	fuse	US Littelfuse	1	PCS
9	Main CPU	US TI	1	PCS
10	Isolation module	MORNSUN	3	PCS
11	Internal resistance tester HP3563A	HePu	1	PCS
12	Insulation voltage tester RJ6835H	Rui Jie	1	PCS
13	High voltage relay switching module	Boompai	1	PCS
14	High power charging and discharging module	Self-developed	1	PCS

6 Shipping List:

Number	specific configuration	quantity
1	lithium battery comprehensive testing system (with industrial computer)	1 set
2	Integrated testing system upper computer software	1 PCS

3	Software manual	1 copy
4	code scanning guns	1 set
5	Foot switch	1 set
6	Battery test connection wire	1 set

7 After sales service:

(1) 1 year warranty for the entire equipment; Lifetime maintenance;

(2) Video guided installation or on-site installation and usage training;

(3) If the equipment malfunctions during use, a preliminary solution will be provided within 4 hours, and if necessary, after-sales personnel will arrive at the site within 48 hours(Within China);

Party A (seal):

Technical leader:

Date:

Party B (seal):

Technical leader:

Date: