

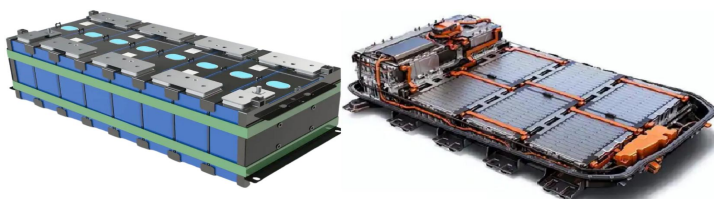
EOL comprehensive testing system

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-300V
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2 Product Overview:

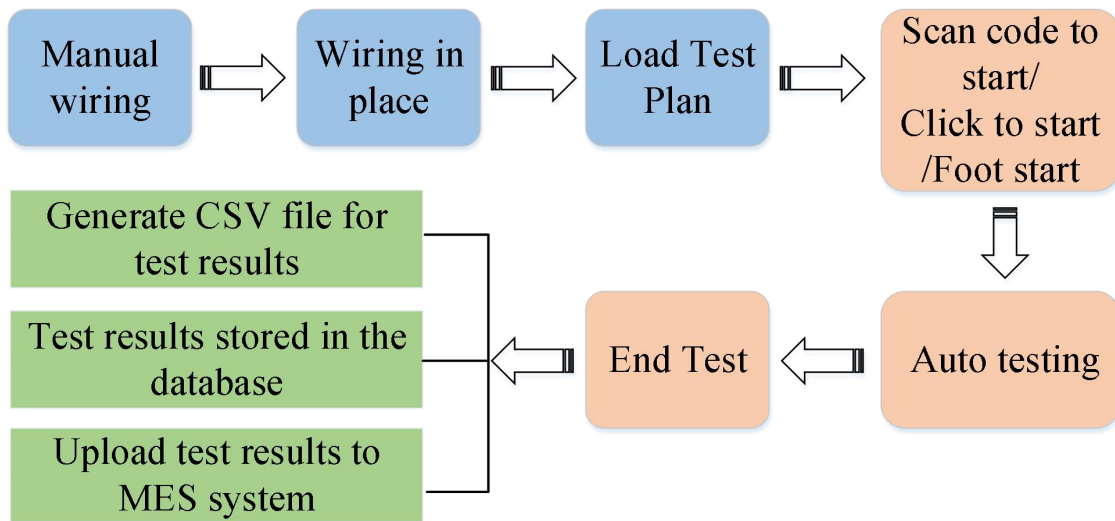
2.1 Introduction:

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.

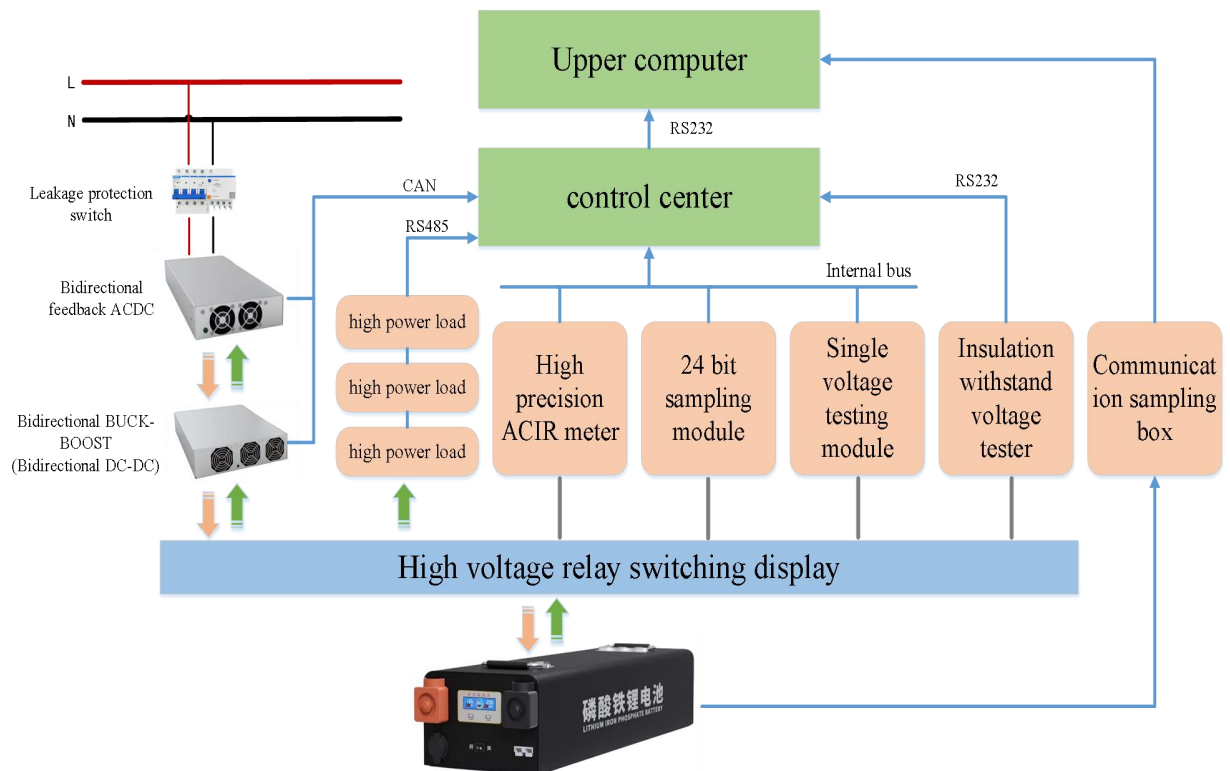
2.2 Product Features:

- ◆ 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 $\leq 100\text{mA}$) 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.
12.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 :

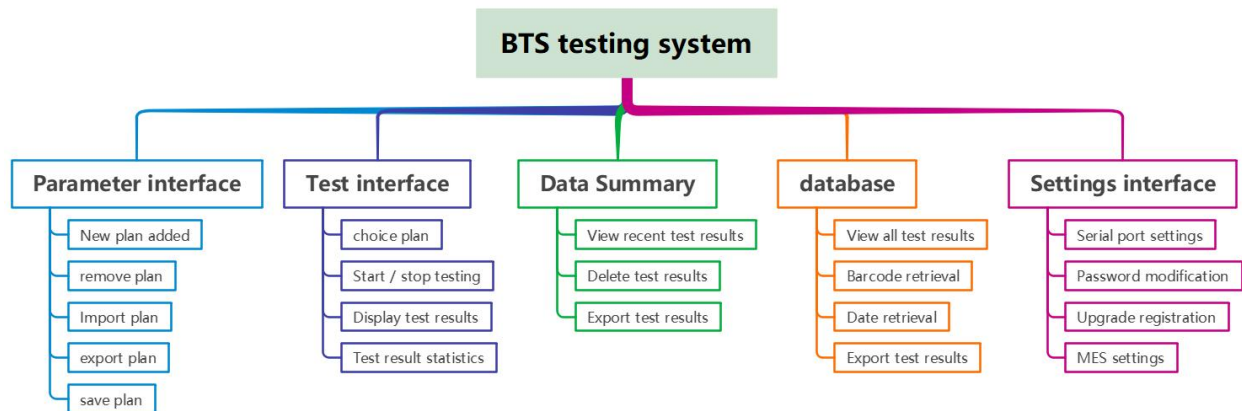
model	EOL-300V	
Power	2KW	
AC input interface	1. Input single-phase AC220V $\pm 10\%$ 2. Input current: max 9A 3. Frequency 50Hz	
Measure voltage range	0~ $\pm 300.000V$	
Voltage accuracy	$\pm 0.05\%$ rdg. ± 2 dgt	
Voltage resolution	1mV	
data save mode	1. Save data in CSV file format 2. Database storage, 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	$\pm (2\% \times \text{reading} + 5 \text{ words})$
Insulation test parameters	testing voltage	+50V~+1200V accuracy: $\pm 0.5\%$ FS
	$0.001M\Omega \leq R < 10M\Omega$	Accuracy: $\pm (2\% \text{ reading} + 0.003M\Omega)$
	$10M\Omega \leq R < 100M\Omega$	Accuracy: $\pm (2\% \text{ reading} + 0.03M\Omega)$
	$100M\Omega \leq R < 1G\Omega$	Accuracy: $\pm (2\% \text{ reading} + 0.3M\Omega)$
	$1G\Omega \leq R < 5G\Omega$	Accuracy: $\pm (2\% \text{ reading} + 3M\Omega)$
	$R \geq 5G\Omega$	Accuracy: $\pm (10\% \text{ reading} + 30M\Omega)$
Internal Resistance (ACR)	1~20000m Ω	
Communication method	Serial port RS232	

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°C~50°C
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

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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.

The screenshot shows a software interface with a menu bar (Testing, Data sum, Database, Parameter, Setting(S)) and a sidebar with controls for Scheme (Plant1-ExportingUS), Summary of today (Total Batch: 28, Pass Batch: 28, NG Batch: 0, PassRate: 100%, TestTime(S): 14.54), and buttons for OK, Stop, and Start Test. The main area displays a table of test results.

	BarCode	StartTime	SchemaName	BatteryCn	Test Result	NoLoad Volt(V)	Charge Volt(V)	Charge Cur(A)	Charge -V(V)	Charge DCR(mΩ)	Discharge Vol(V)
1	SV23100923103	2023-10-09 23:10:40	Plant1-ExportingUS	13	OK	48.815	52.599	9.996	1.121	112.144	112.144
2	SV231009231149	2023-10-09 23:11:34	Plant1-ExportingUS	13	OK	48.639	52.407	9.997	1.122	112.233	112.233
3	SV231009231121	2023-10-09 23:11:07	Plant1-ExportingUS	13	OK	48.627	52.408	9.998	1.126	112.622	112.622
4	SV231009231054	2023-10-09 23:10:39	Plant1-ExportingUS	13	OK	48.556	52.386	9.998	1.114	114.022	114.022
5	SV231009231037	2023-10-09 23:10:22	Plant1-ExportingUS	13	OK	48.668	52.473	9.998	1.127	112.722	112.722
6	SV231009231013	2023-10-09 23:09:59	Plant1-ExportingUS	13	OK	48.68	52.507	9.997	1.129	112.933	112.933
7	SV231009230948	2023-10-09 23:09:34	Plant1-ExportingUS	13	OK	48.573	52.468	9.998	1.151	115.123	115.123
8	SV231009230933	2023-10-09 23:09:18	Plant1-ExportingUS	13	OK	48.699	52.575	9.995	1.147	114.757	114.757
9	SV231009230914	2023-10-09 23:08:59	Plant1-ExportingUS	13	OK	48.772	52.685	9.997	1.142	114.234	114.234
10	SV231009230903	2023-10-09 23:08:31	Plant1-ExportingUS	13	OK	48.678	52.617	9.996	1.154	115.446	115.446
11	SV231009230890	2023-10-09 23:08:16	Plant1-ExportingUS	13	OK	48.716	52.654	9.998	1.162	116.223	116.223
12	SV231009230814	2023-10-09 23:07:59	Plant1-ExportingUS	13	OK	48.785	52.733	9.998	1.144	114.422	114.422
13	SV231009230756	2023-10-09 23:07:41	Plant1-ExportingUS	13	OK	48.778	52.8	9.996	1.18	118.047	118.047
14	SV231009230740	2023-10-09 23:07:25	Plant1-ExportingUS	13	OK	48.836	52.903	9.997	1.182	118.235	118.235
15	SV231009230724	2023-10-09 23:07:10	Plant1-ExportingUS	13	OK	48.915	52.963	9.998	1.188	118.823	118.823
16	SV231009230709	2023-10-09 23:06:54	Plant1-ExportingUS	13	OK	49.023	53.086	9.995	1.192	119.259	119.259
17	SV231009230653	2023-10-09 23:06:38	Plant1-ExportingUS	13	OK	49.163	53.228	9.998	1.194	119.423	119.423
18	SV231009230632	2023-10-09 23:06:17	Plant1-ExportingUS	13	OK	49.153	53.316	9.997	1.205	120.536	120.536
19	SV231009230616	2023-10-09 23:06:01	Plant1-ExportingUS	13	OK	49.334	53.479	9.997	1.209	120.936	120.936
20	SV231009230551	2023-10-09 23:05:36	Plant1-ExportingUS	13	OK	49.435	53.574	9.997	1.229	122.936	122.936
21	SV231009230512	2023-10-09 23:05:21	Plant1-ExportingUS	13	OK	49.389	53.579	9.997	1.235	123.536	123.536
22	SV231009230449	2023-10-09 23:04:45	Plant1-ExportingUS	13	OK	49.443	53.651	9.996	1.244	124.449	124.449
23	SV231009230430	2023-10-09 23:04:30	Plant1-ExportingUS	13	OK	49.566	53.896	9.998	1.229	123.834	123.834
24	SV231009230406	2023-10-09 23:04:05	Plant1-ExportingUS	13	OK	49.595	53.896	9.996	1.254	125.45	125.45
25	SV231009230348	2023-10-09 23:03:33	Plant1-ExportingUS	13	OK	49.771	54.08	9.998	1.262	126.235	126.235
26	SV231009230330	2023-10-09 23:03:15	Plant1-ExportingUS	13	OK	49.996	54.351	9.998	1.27	127.025	127.025
27	SV23100923011	2023-10-09 22:58:57	Plant1-ExportingUS	13	OK	50.043	54.442	9.996	1.281	128.151	128.151
28	SV23100923134	2023-10-09 22:53:18	Plant1-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.

The screenshot shows an Excel spreadsheet with columns for SerialNumber, TestTime, BarCode, SchemaName, Test Result, and various voltage and current measurements. The data is organized in a grid with rows and columns labeled A through M.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	SerialNumber	TestTime	BarCode	SchemaName	Test Result	1.NoLoad Volt(V)	2.Charge Volt(V)	3.Charge Cur(A)	4.Charge ΔV(V)	5.Charge DCR(mΩ)	6.Discharge Vol(V)	7.Discharge ΔV(V)	8.Discharge ΔV(V)
2	1	2023-10-9 22:53	SV231009225334	Plant1-ExportingUS	OK	50.028	54.54	9.997	1.289	128.938	41.747	20.005	8.803
3	1	2023-10-9 22:58	SV231009225911	Plant1-ExportingUS	OK	50.043	54.442	9.996	1.281	128.151	41.744	20.008	8.742
4	1	2023-10-9 23:03	SV231009230330	Plant1-ExportingUS	OK	49.996	54.351	9.998	1.27	127.025	41.753	20.008	8.695
5	1	2023-10-9 23:03	SV231009230406	Plant1-ExportingUS	OK	49.771	54.08	9.998	1.262	126.235	41.697	19.975	8.596
6	1	2023-10-9 23:03	SV231009230430	Plant1-ExportingUS	OK	49.595	53.896	9.996	1.254	125.45	41.587	19.993	8.501
7	1	2023-10-9 23:04	SV231009230449	Plant1-ExportingUS	OK	49.566	53.896	9.998	1.229	122.924	41.574	20.012	8.454
8	1	2023-10-9 23:04	SV231009230451	Plant1-ExportingUS	OK	49.443	53.651	9.996	1.244	124.449	41.512	20.014	8.384
9	1	2023-10-9 23:04	SV231009230512	Plant1-ExportingUS	OK	49.389	53.579	9.997	1.235	123.536	41.507	20.014	8.34
10	1	2023-10-9 23:05	SV231009230551	Plant1-ExportingUS	OK	49.435	53.574	9.997	1.229	122.936	41.567	20.01	8.279
11	1	2023-10-9 23:06	SV231009230616	Plant1-ExportingUS	OK	49.334	53.479	9.997	1.209	120.936	41.545	20.009	8.236
12	1	2023-10-9 23:06	SV231009230632	Plant1-ExportingUS	OK	49.153	53.316	9.997	1.205	120.536	41.489	20.007	8.176
13	1	2023-10-9 23:06	SV231009230653	Plant1-ExportingUS	OK	49.163	53.228	9.998	1.194	119.423	41.474	20.007	8.13
14	1	2023-10-9 23:06	SV231009230709	Plant1-ExportingUS	OK	49.023	53.086	9.995	1.192	119.259	41.437	19.982	8.059
15	1	2023-10-9 23:07	SV231009230724	Plant1-ExportingUS	OK	48.915	52.963	9.998	1.188	118.823	41.396	19.988	8.022
16	1	2023-10-9 23:07	SV231009230740	Plant1-ExportingUS	OK	48.836	52.903	9.997	1.182	118.235	41.378	19.989	7.975
17	1	2023-10-9 23:07	SV231009230756	Plant1-ExportingUS	OK	48.778	52.8	9.996	1.18	118.047	41.349	20.005	7.927
18	1	2023-10-9 23:07	SV231009230814	Plant1-ExportingUS	OK	48.785	52.733	9.998	1.144	114.422	41.346	20.007	7.893
19	1	2023-10-9 23:08	SV231009230830	Plant1-ExportingUS	OK	48.716	52.654	9.998	1.162	116.223	41.335	20.01	7.845
20	1	2023-10-9 23:08	SV231009230848	Plant1-ExportingUS	OK	48.678	52.617	9.996	1.154	115.446	41.342	20.011	7.816
21	1	2023-10-9 23:08	SV231009230914	Plant1-ExportingUS	OK	48.772	52.685	9.997	1.142	114.234	41.427	19.985	7.767
22	1	2023-10-9 23:08	SV231009230933	Plant1-ExportingUS	OK	48.699	52.575	9.995	1.147	114.757	41.41	19.996	7.731
23	1	2023-10-9 23:09	SV231009230948	Plant1-ExportingUS	OK	48.573	52.468	9.998	1.151	115.123	41.377	20.003	7.689
24	1	2023-10-9 23:09	SV231009231013	Plant1-ExportingUS	OK	48.68	52.507	9.997	1.129	112.933	41.441	19.984	7.653
25	1	2023-10-9 23:10	SV231009231037	Plant1-ExportingUS	OK	48.668	52.473	9.998	1.127	112.722	41.459	19.99	7.618
26	1	2023-10-9 23:10	SV231009231054	Plant1-ExportingUS	OK	48.556	52.386	9.998	1.14	114.022	41.454	19.989	7.573
27	1	2023-10-9 23:11	SV231009231121	Plant1-ExportingUS	OK	48.627	52.408	9.998	1.126	112.622	41.491	19.986	7.548
28	1	2023-10-9 23:11	SV231009231149	Plant1-ExportingUS	OK	48.639	52.407	9.997	1.122	112.233	41.521	19.987	7.522
29	1	2023-10-9 23:12	SV231009231303	Plant1-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	AOC	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

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):

Party B (seal):

Technical leader:

Technical leader:

Date:

Date: