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1. Product Overview

EP401 is a battery module charge-discharge equipment developed by Smartsafe. It adopts the most advanced charging and discharging technology, according to the charging and discharging characteristics of batteries, has built-in various test and maintenance modes, which are suitable for the discharge, charging, cycle charging and discharging tests of various batteries on the market. The equipment adopts an intelligent operating system and supports wireless data transmission, so that users and managers can easily and scientifically maintain and manage the battery pack, thus extending the service life of the battery pack.

1.1 Product Features

- Adopting the latest charging and charging test technology, it will not cause interference to the BMS management system, and is suitable for daily discharge and charging of battery packs.
- Wide voltage design, can be applied to the current battery test of different voltage levels.
- Voltage and temperature monitoring and protection during test can prevent over-charge and over-discharge.
- Multiple discharge auto-stop conditions make testing mode more intelligent and flexible, and avoid over-charge and over-discharge.
- Support multiple protection design and alarm settings of voltage, current, temperature abnormal to protect the battery and the equipment.
- Support functions such as overvoltage, undervoltage, overcurrent, output short circuit, anti-reverse protection and overheating protection.
- Charging completion condition: The charging procedure can be completed by setting the total charging time, constant voltage time, charging capacity, and charging current.
- 7-inch touch screen, easy to operate.
- Built in memory, supporting automatic storage of operation records.
- Portable design: easy to carry and transport.

1.2 Main Function and Test Range

Mainly used for battery charge and discharge test, suitable for voltage levels of 2~400V.

1.3 System Components

The equipment is composed of main unit, 24CH sampling box and discharge cable. The main unit includes color display screen, data processing unit, data monitoring unit, auxiliary power unit, power consuming unit, and panel operation unit.

1.4 Working Conditions

NO CORROSIVE, NO EXPLOSIVE, NO ELECTRICAL BREAKDOWN AIR OR CONDUCTIVE DUST.

1.5 Environment & Energy Impact

The equipment can convert the tested battery energy into heat and use cooling system to blow the heat out of the unit, so during the discharge test, please pay more attention to heat dissipation and ventilation.

1.6 Protection & Alarm

This equipment has hardware and software protection functions such as reverse connection, overvoltage, overcurrent, overtemperature, communication error, etc.

2. Precautions for Safe Use

2.1 Safe Working Period & Production Date

The designed safe working period for this equipment is 5 years, please refer to the factory inspection list for the production date.

2.2 General Rule

Please follow the user manual to use this equipment.

2.3 Common Incorrect Operation

- 1) Tools for connecting is not well insulated.
- 2) Operating without following the user manual.

2.4 Damage Probably Caused By Incorrect Operation

- 1) Short circuit accident: Tools is not well insulated, or battery pack positive and negative electrodes are too close.
- 2) Failure to follow the correct operation method will cause the equipment not working properly.

2.5 Emergency Treatment In Exceptional Cases

Disconnect the equipment power supply and test cables.

2.6 Precautions In Exceptional Circumstances

If the operator uses tools without well insulation or improper operate to cause short circuit, please separate the cables immediately.

2.7 Other Safety Alerts

Strict compliance with safety operating norms and correct operating procedure.

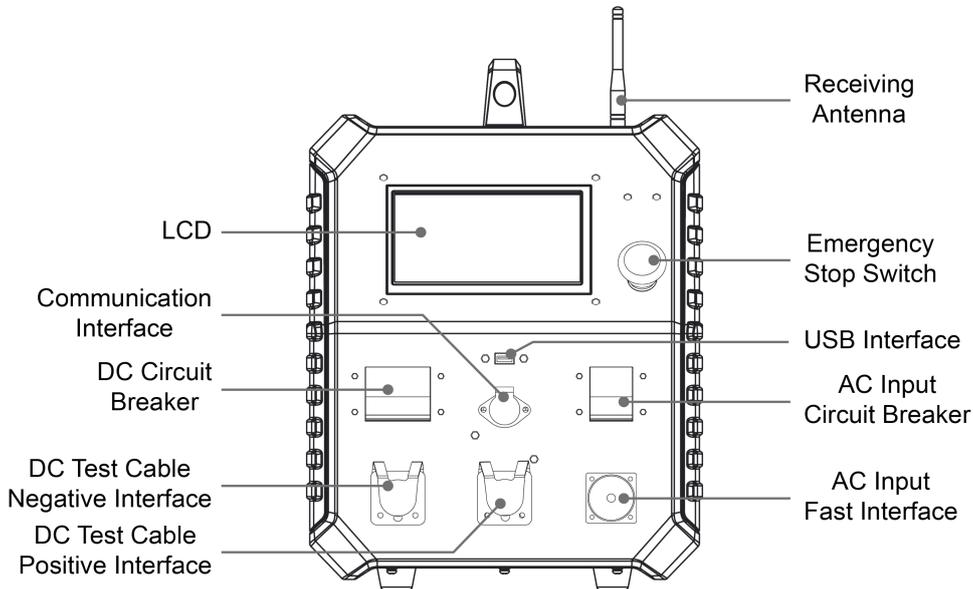
3. Technical Features

Parameter	Description
Model	EP401
Power input	AC 90~265V
Display	7-inch TFT LCD screen with resolution 1024*600
Data communication	CAN, RS485
Data dump	U disk
Data storage	16G
Battery box data acquisition communication	CAN data bus

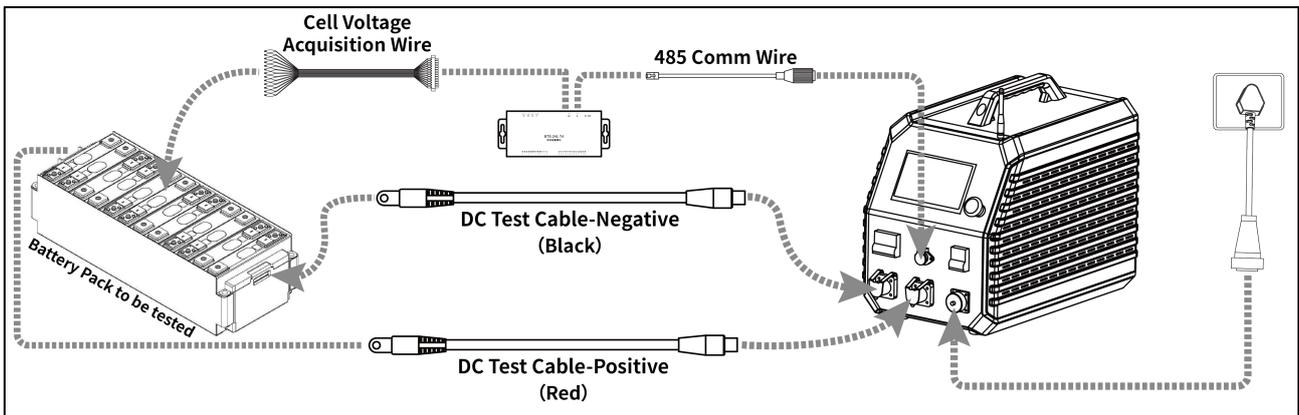
Module data acquisition communication	Harness sampling
Group voltage accuracy	$\leq \pm 0.5\%FS + 0.3V$, resolution: 0.1V
Cell voltage accuracy	$\leq \pm 0.1\%FS + 5mV$, resolution: 0.001V
Current measurement accuracy	$\leq \pm 1\%FS + 0.2A$, resolution: 0.1A
Charging voltage range	DC 2~400V
Discharge voltage range	DC 2~400V
Charge current range	0~100A, maximum power 4.4kw
Discharge current range	0~100A, maximum power 7.2kw
Charge control	Constant current charging + constant voltage charging
Discharge mode	Constant current discharge
Charge and discharge data acquisition	In-camera active measurement + external can communication data acquisition
Electric box charging and discharging protection	Battery string overcharge and over discharge, battery string temperature is too high protection
Main unit protection	Over temperature, over current, current runaway trigger shutdown protection
Shutdown actuator	DC air circuit breaker + release
Reverse connection protection	Available
Abnormal protection	Power failure of power line and main cable
Over-temperature protection	100°C Resistance box over temperature 85°C; radiator over temperature 100°C
Alarm prompt	LCD prompt + buzzer
Safety Testing	
Breaking down test	AC input-metal shell: 2200Vdc 1min AC input-metal shell
	DC input-Output: 2200Vdc 1min DC input-metal shell
Working Environment	
Cooling	Forced air cooling
Temperature	Operating temperature range: -5-40 °C ; storage temperature:-20~70°C
Humidity	Relative humidity 0-90% (40±2°C)
Elevation	Rated altitude of 2000 meters
Dimension	445*329*540mm
Weight	25.6kg

4. Operating Instructions

4.1 Panel Description



4.2 Main Unit Connection



4.2.1 Test Cable Connection

First, insert the DC test cable into the positive and negative interface of the equipment (red for positive and black for negative), then connect the other end of the DC test cable to both ends of the battery pack (red for positive and black for negative).

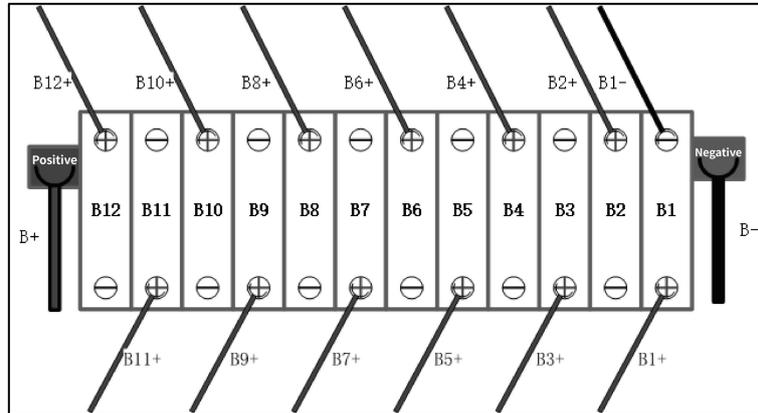
4.2.2 Working Power Supply Connecting

Connect the AC power cord provided with the equipment to the corresponding access interface, pay attention to the load output of the power outlet (AC 90~265V input) or the load of the distribution box, and set the maximum charging current according to the size of the AC input load. (See the parameter table for details) to prevent overcurrent.

4.2.3 Voltage Sampling - Module Sampling

1. Please close the AC circuit breaker when starting
2. Set 24L communication type
3. Set charge and discharge parameters and protection conditions

4. Close the DC circuit breaker before starting the test.
5. The 485 communication wire is from aviation plug to the IN interface of the 24CH sampling box.
6. Connect cell voltage acquisition wire to the OUT interface of the 24CH sampling box.
7. According to the wire label on the cell voltage acquisition wire, B1 - is connected to the negative electrode of No. 1 single cell (B1), B1 + is connected to the positive electrode of No. 1 single cell (B1), B2 + is connected to the positive electrode of No. 2 single cell (B2), and connected in sequence.



4.2.4 Voltage Sampling - CAN

Connect the dedicated CAN communication cable to the communication interface between the equipment and the battery pack.

Note: Protocol support is required, and corresponding CAN low-voltage communication line is required.

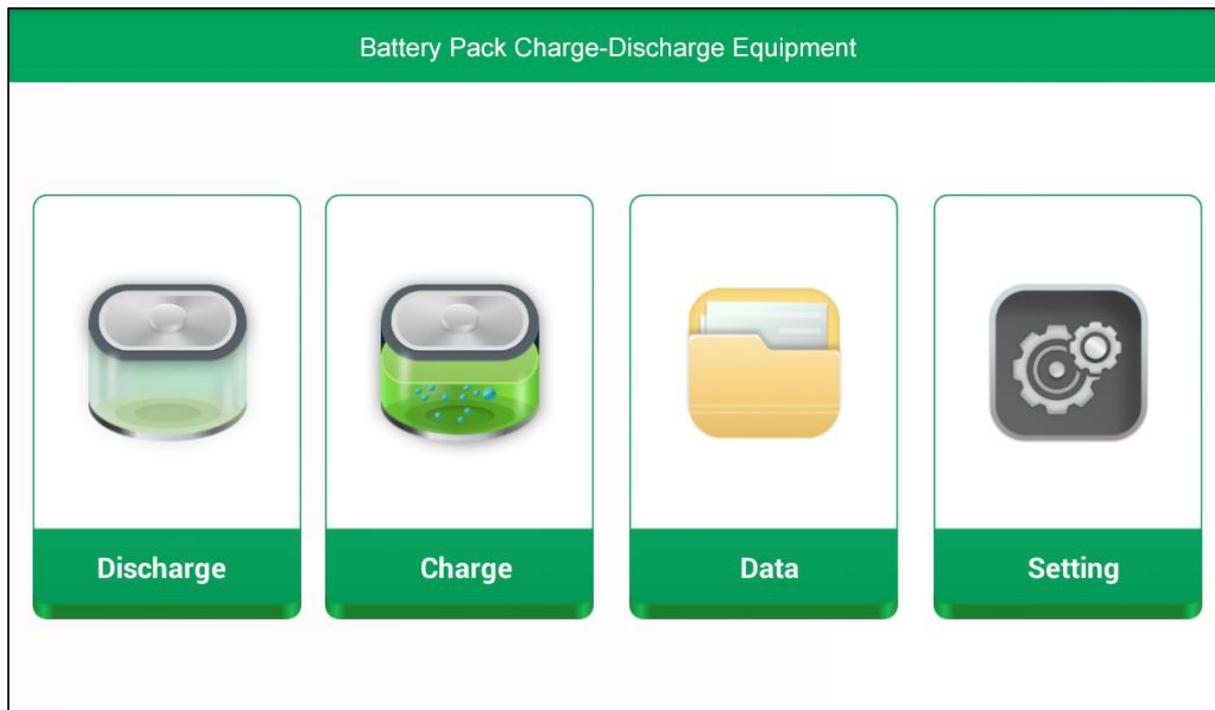
4.3 Main Unit Operation

4.3.1 Welcome Screen



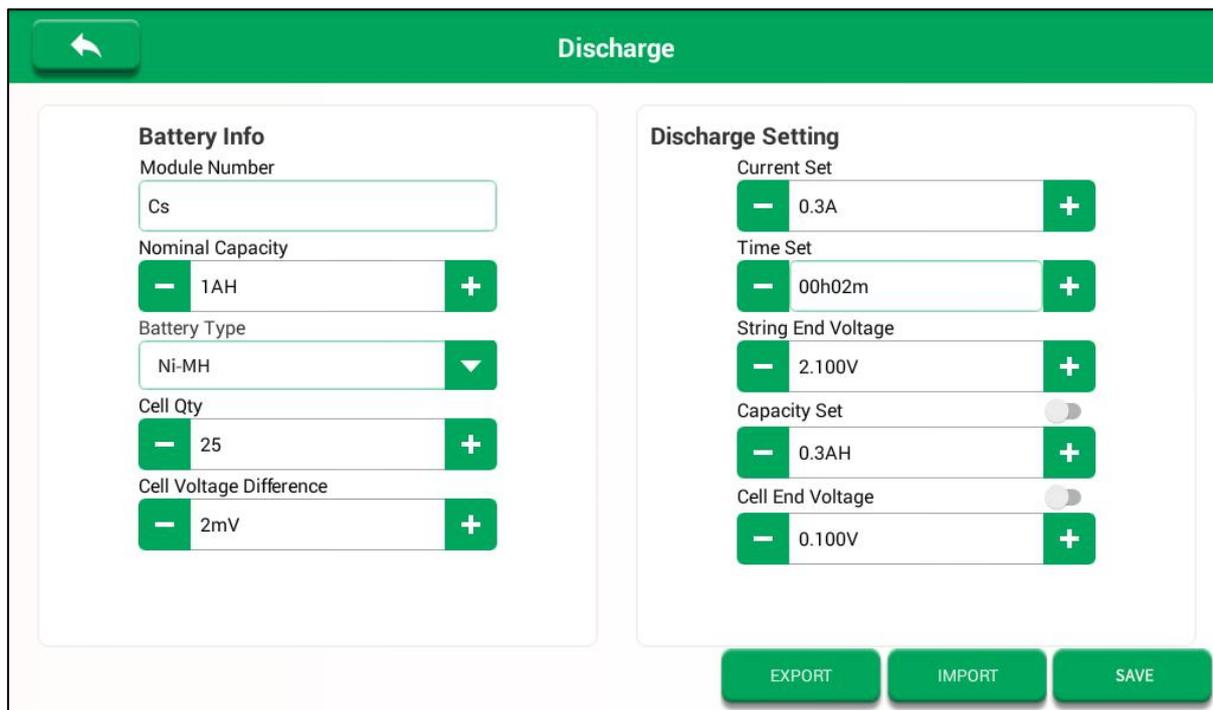
4.3.2 Main Menu

Click the function module on the main menu to enter the corresponding function operation interface.



4.3.3 Discharge Test

1) The function “Discharge” is a single discharge test mode.



Parameter Description :

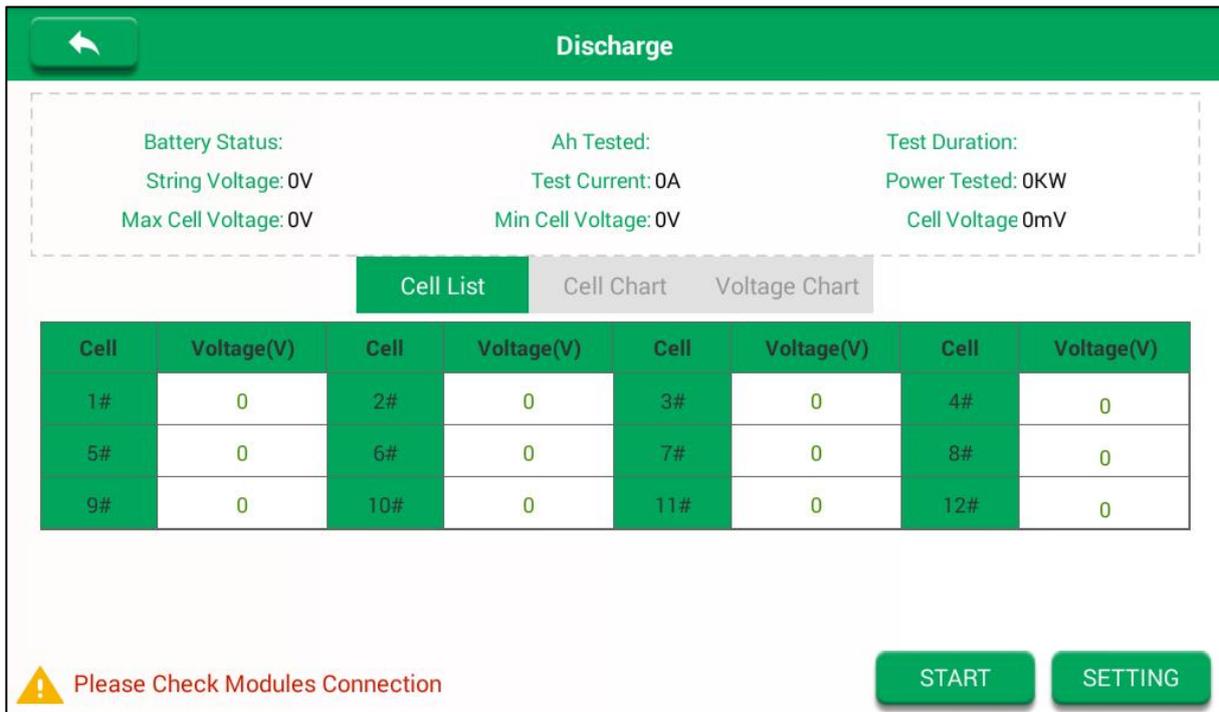
Battery Information

- Module Number**
The serial number of the battery pack or module.
- Nominal Capacity**
The nominal capacity of the battery pack, according to the actual input, can be identified from the rating plate.
- Battery Type**
Select battery type.
- Cell Quantity**
Fill in according to the actual number of strings.
- Cell Voltage Difference**
Differential voltage protection value, one of the shutdown conditions.

Discharge Parameters

- Current Set**
Discharge test current value.
- Time Set**
Discharge test time setting, one of the shutdown conditions.
- String End Voltage**
Group end voltage lower limit protection, one of the shutdown conditions.
- Capacity Set**
Discharge capacity ah, one of the shutdown conditions.
- Cell End Voltage**
Single string lower limit voltage protection value, one of the shutdown conditions.

2) Click  to save configuration and enter the test interface. Close the DC switch, tap **Start** to start the test.



The current battery status, the test current, the test duration, the current voltage of the battery pack and the cell information can be viewed on the test interface. The configuration can be modified during the test.

3) In the process of threshold protection test, if any shutdown threshold is reached, it will stop automatically. Type of shutdown conditions: discharge time, lower limit of group end, pre-discharge capacity (in case of opening discharge capacity limitation) and cell lower limit (in case of opening discharge capacity limitation).

4) In addition to the above shutdown threshold protection, there are also multiple hardware protections: abnormal voltage of discharge module, abnormal current of discharge module, abnormal temperature of discharge module, short circuit protection and fan failure.

4.3.4 Charge Test

1) The function “Charge” is a single charge test mode.

Parameter Description :

Battery Information

Module Number

The serial number of the battery pack or module.

Nominal Capacity

The nominal capacity of the battery pack, according to the actual input, can be identified from the rating plate.

Battery Type

Select battery type.

Cell Quantity

Fill in according to the actual number of strings.

Cell Voltage Difference

Differential voltage protection value, one of the shutdown conditions.

Charge Parameters

CC Charge Voltage

The target value of the charging voltage.

Protection Voltage

The upper limit voltage protection value of the group end, one of the shutdown conditions.

CC Charge Current

Charging test current value.

Current threshold

When the voltage reaches, the current is less than the value, then it stops, and one of the shutdown conditions.

CC+CV Charge time

Charging test time, one of the shutdown conditions.

Cell High Voltage

Single core voltage upper limit protection value, one of the shutdown conditions.

2) Click  to save configuration and enter the test interface. Close the DC switch, tap **Start** to start the test.

←
Charge

Battery Status:

String Voltage: 0V

Max Cell Voltage: 0V

Ah Tested:

Test Current: 0A

Min Cell Voltage: 0V

Test Duration:

Power Tested: 0KW

Cell Voltage 0mV

Cell List
Cell Chart
Voltage Chart

Cell	Voltage(V)	Cell	Voltage(V)	Cell	Voltage(V)	Cell	Voltage(V)
1#	0	2#	0	3#	0	4#	0
5#	0	6#	0	7#	0	8#	0
9#	0	10#	0	11#	0	12#	0

!
Please Check Modules Connection

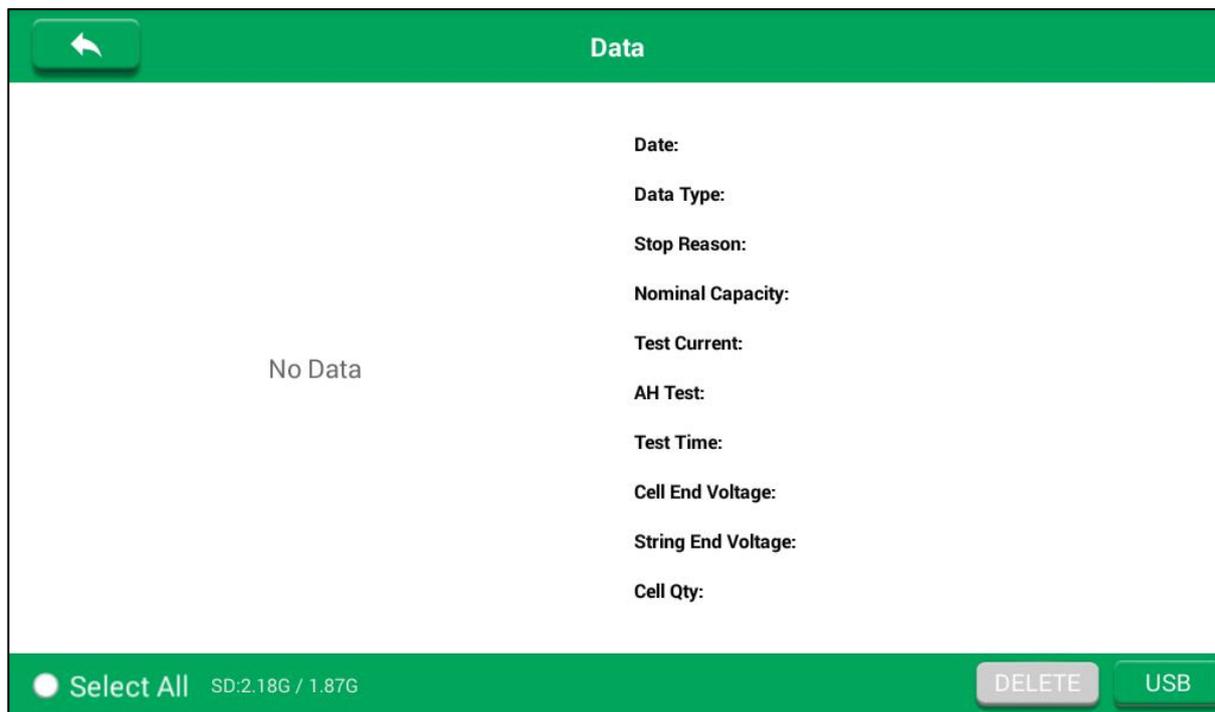
START

SETTING

The current battery status, the test current, the test duration, the current voltage of the battery pack and the cell information can be viewed on the test interface. The configuration can be modified during the test.

- 3) In the process of threshold protection test, if any shutdown threshold is reached, it will stop automatically. Type of shutdown conditions: charge time, current threshold, upper limit of cell voltage and group voltage.
- 4) In addition to the above shutdown threshold protection, there are also multiple hardware protections: charging module undervoltage protection, charging module overvoltage protection, charging module overtemperature protection, charging module overcurrent protection, short circuit protection and fan failure, etc.

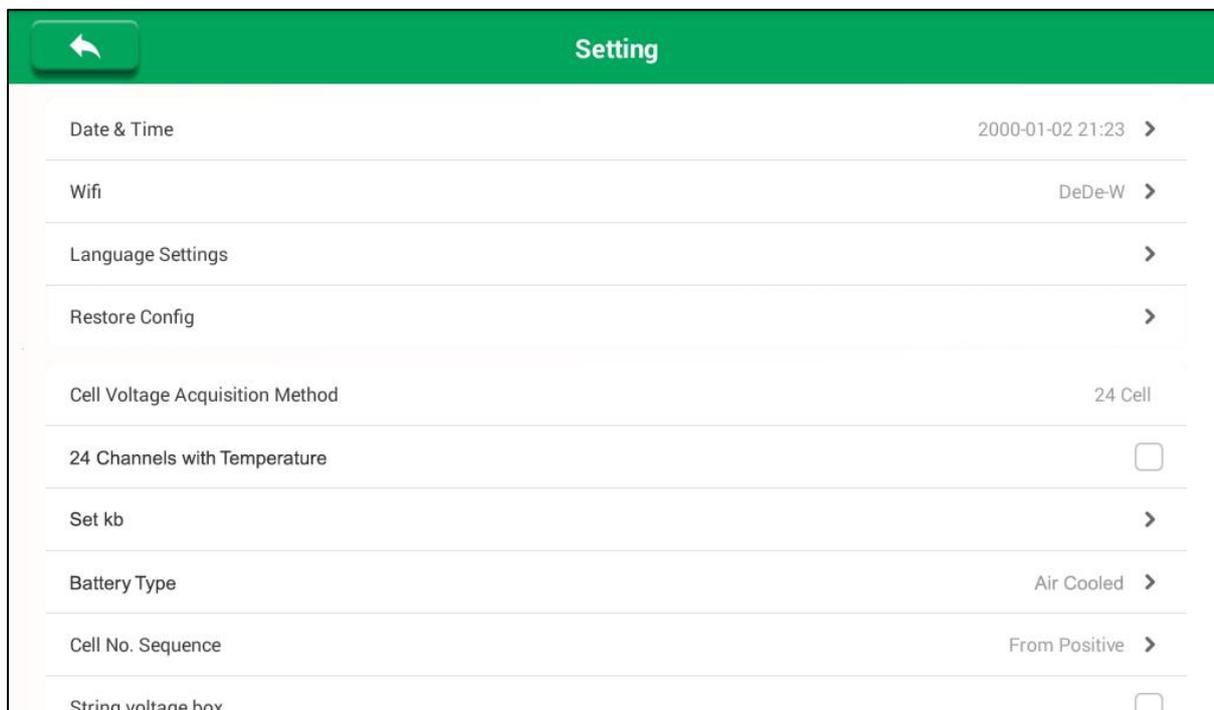
4.3.5 Data Management

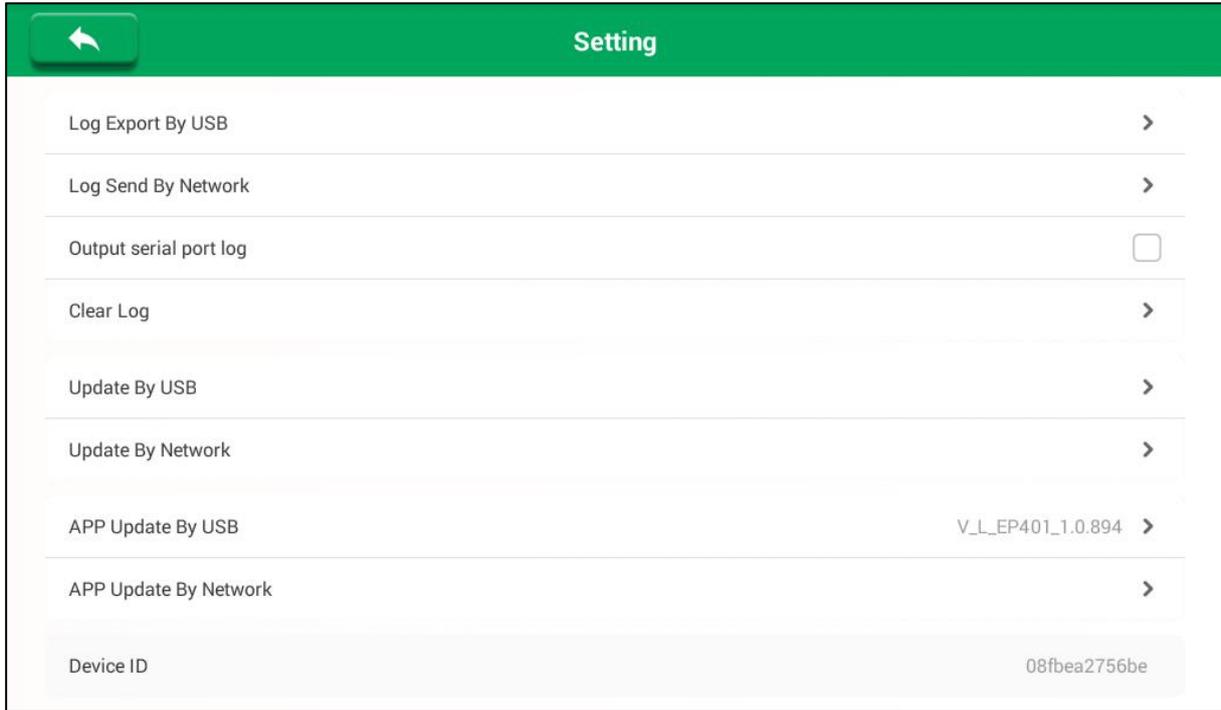


Insert a U-disk into the USB port on the panel, select the data to be saved, and tap USB button to transfer the corresponding discharge data and charge data to the U-disk.

4.3.6 System Setting

Tap Settings on the main interface to enter the following interface, and slide the screen to view more settings.





System Parameter Setting

- Date & Time** Used to set the system date and time.
- Wi-Fi Connection** Used to set the Wi-Fi connection of the equipment.
- Language Setting** Used to change the system language.
- Restore Configuration** Used to initialize settings.

Cell Voltage Acquisition Method Setting

- 24 Channels with Temperature** Used to select/cancel 24 channels with temperature.
- Set kb** Used to set kb value.
- Battery Type** Used to select battery type.
- Cell No. Sequence** Positive or reverse order.
- String Voltage Box** Used to turn on / off string voltage box acquisition at group end.
- Sampling Frequency** Used to set data acquisition storage interval.

Log management

- Log Export by USB** Used to export log files.
- Log Send by Network** Used to send log files.
- Output Serial Port Log** Used to select / cancel output serial port log.
- Clear Log** Used to clear logs.

Upgrade management

- Update by USB** Copy the upgrade package to the U disk. After connecting the

equipment, select the corresponding upgrade package to upgrade.

Update by Network Used to upgrade online after the equipment is connected to Wi-Fi.

Device Information

Device ID Used to view the device id.

5. Fault Analysis and Troubleshooting

No.	Fault Situation	Troubleshooting Methods
1	Communication failure!	Check BMS communication can connect.
2	Boot discharge prompt cable connection error	1) The positive and negative poles of the discharge cable are reversed. 2) The DC open circuit breaker is not closed. 3) Test input voltage is too high.
3	Abnormal current monitoring	Restart the machine.
4	Main unit temperature is too high	Confirm the placement of the equipment, pay attention to ventilation, heat flow.
5	Internal memory insufficient	Periodically transfer data files to USB disk and delete some files to release the space
6	USB Error	Check the free space in USB disk

6. Transport & Storage

- 1) This equipment is equipped with special equipment box for packing, which is has anti-vibration and reliable for transportation.
- 2) Storage conditions: dry storage room, temperature: -20~70℃, Humidity: 95%Within.

7. Environmental Protection and Others

- 1) The outer carton of this equipment is made of recyclable material.
- 2) The main unit and other components are non pollution sources.

Warranty

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SMARTSAFE electronic product is warranted against defects in materials and workmanship for one year from date of delivery to the user.

This warranty does not cover any part that has been abused, altered, used for a purpose other than for which it was intended, or used in a manner inconsistent with instructions regarding use. The exclusive remedy for any automotive meter found to be defective is repair or replacement, and SMARTSAFE shall not be liable for any consequential or incidental damages.

Final determination of defects shall be made by SMARTSAFE in accordance with procedures established by SMARTSAFE. No agent, employee, or representative of SMARTSAFE has any authority to bind SMARTSAFE to any affirmation, representation, or warranty concerning SMARTSAFE automotive meters, except as stated herein.

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Purchase Order

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- Order quantity
- Part number
- Part name

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