Huazheng®

HZFD-200A
Battery Discharge Tester

Huazheng Electric Manufacturing(Baoding) Co.,Ltd

Contents

I. Equipment Features

UPSs are the most fundamental guarantee for equipment and network systems with increasingly higher informatization and automation. For both AC and DC UPS systems, batteries are extremely important by serving as emergency power supplies. Batteries are in floating charge at ordinary time and serve as the only energy suppliers for loads after AC power failure or any other emergencies.

We know that some batteries failure earlier because of poor materials or structures, process defects, improper use, etc. For checks for the potential standby durations and actual capacities of battery packs and normal operation of power systems, battery packs should receive check discharge tests at regular intervals or whenever necessary as specified in the maintenance regulations of power systems so that the single batteries that have failed or tend to fail can be found and replaced early to make sure the corresponding battery packs can operate normally or their expected lives can be evaluated.

We have successfully a line of extremely intelligent and accurate battery pack capacity testers (“tester”) that can serve as discharge loads and realize discharge with the set constant currents by means of continuous control over discharge currents. When the voltage of a battery pack or the voltage of a single battery of it is smaller than the set lower limit of voltage, or the set discharge duration or the set discharge capacity has reached during discharge, the tester will automatically stop discharge and record the real-time data of all valuable and continuous process.

The voltage information of single batteries monitored by the tester is subject to wireless repeater access that is simple, secure and accurate.

The tester supports setup and data queries on its friendly man-machine screens with help of menus; it saves the process data of discharge in its memory. The process data can be read and unloaded via a data interface and analyzed through special software on the host computer. Finally the desired curves and reports can be generated.

The tester has comprehensive protection functions with help of audible and visual alarms and clear display on the screen.

1.1 Features When Without Monitoring Function

- The PTC ceramic resistor avoids the red hot phenomenon, making the whole discharge process safer;
- The internal controller includes two CPUs for the highest safety, stability and accuracy in testing so that a CPU can sound an alarm and shuts down the tester upon failure of the other CPU;
- Thanks to the all electric isolation technology, the discharge part can still operate normally in the case of strong electromagnetic interference or strong power interference;
- The tester has a 2G memory and supports a U disk up to 32G;
- The tester has functions such as check capacity test, discharge suspension, parallel load test and online compensated discharge for diversified occasions;
- The tester can upload discharge data to a U disk via its USB interface and import them to a host PC so that the data management software on the host PC can analyze the discharge and generate corresponding data reports, making data uploading easier;
- The tester is subject to intelligent single chip microcomputer ARM control and has a 7″touch screen LCD supporting menu operation and Chinese and English display;
- The tester supports automatic protection: When the set discharge duration or the set discharge capacity has reached, or the voltage of battery pack is smaller than the set minimum or the load wiring is abnormal, the tester will automatically stop discharge, sound an alarm and record the shutdown mode;
- The tester supports the setup of discharge stop conditions, including battery pack’s final voltage, discharge capacity and discharge duration to make the discharge test safe;
- The tester supports online compensated discharge and discharge tests for batteries in online service with help of external pincerlike current sensors, making discharge tests convenient. (This function is especially applicable to an

occasion with only one emergency battery pack.)

1.2 Features When With a Monitoring Function

- The PTC ceramic resistor avoids the red hot phenomenon, making the whole discharge process safer.
- The internal controller includes two CPUs for the highest safety, stability and accuracy in testing so that a CPU can sound an alarm and shuts down the tester upon failure of the other CPU.
- With the all electric isolation technology, the discharge part can still operate normally in the case of strong electromagnetic interference or strong power interference.
- The tester has a 2G memory and supports a U disk up to 32G.
- The tester has the following three wireless or wired communication modes: wireless or RS485 communication between a wireless acquisition box and the discharge main unit, which is for monitoring the voltage of each single battery in real time; wireless or RS485communication between the host PC's software and a wireless monitoring module, which is for wireless monitoring for the voltages of single batteries while the tester is not connected; RS485 communication between the host PC's software and the discharge tester with help of a communication line, which is for remote discharge control.
- The wireless acquisition box can monitor each battery, so it can monitor the whole discharge process of a battery pack.
- The tester has easy installation, debugging and maintenance and high stability and safety because its acquisition modules are isolated.
- The software on the host PC can analyze such recorded data as total voltage, discharge current and single batteries' voltages, generate corresponding data reports, curves, graphs and reports indicating the battery pack performance directly and support queries and printing of these contents.
- The tester can upload discharge data to a U disk via its USB interface and import them to a host PC so that the data management software on the host PC can

analyze the discharge and generate corresponding data reports, making data uploading easier.

- The tester is subject to intelligent single chip microcomputer ARM control and has a touch screen LCD supporting menu operation and Chinese and English display.
- The tester supports automatic protection: When the set discharge duration or the set discharge capacity has reached, or the battery pack's voltage is smaller than the set minimum or the load wiring is abnormal, the tester will automatically stop discharge, sound an alarm and record the shutdown mode.
- The tester support the setup of testing or discharge termination conditions, including single battery voltage, battery pack's voltage, discharge current and discharge duration.
- The tester can record the discharge information of each single battery during testing or discharge, such as total capacity, total voltage and total current of the battery pack and voltage changes of the single battery with the minimum voltage.
- The tester supports online compensated discharge and discharge tests for batteries in online service with help of external pincerlike current sensors, making discharge tests convenient. (This function is especially applicable to an occasion with only one emergency battery pack.)

Applicable battery	Lead-acid battery	
Model	**HZFD-200A**	
Output voltage	110V	220V
Output current	0-180A	0-90A
Operating mode	Used independently or with a constant-current module	
Protection performance	Input terminal overvoltage protection, prompts on the LCD; Reverse polarity protection, buzzer alarm; Overcurrent protection, prompts on the LCD;	

	85℃ overheat protection, prompts on the LCD, buzzer alarm.
Single battery voltage acquisition	The 433RF wireless module supports a communication distance longer than 100 m and monitoring for single battery voltages of 2V, 4V, 6V and 12V. If the total voltage is not beyond the set value, each battery pack will have an unlimited single battery quantity and can monitor one to sixteen RF wireless monitoring modules at the same time. One RF wireless monitoring module can monitor 12 single batteries at the same time.
Control accuracy	Discharge current: ≤±1%; battery pack's terminal voltage: ≤ ±0.1%; single battery voltage: ≤±0.05%
Communication with the host PC	RS485 interface
Data storage capacity	2Gbit FLASH
Operating conditions	
Cooling	Forced air cooling
Temperature	Operating temperature: -5~50℃; storage temperature: -40~70℃
Humidity	Relative humidity: 0~90% (40±2℃)
altitude	Rated altitude: 4,000 m
Noise	﹤60dB
Operating power supply	
Voltage	Single-phase three-wire system: 220V AC (–20%~+30%); frequency: 45~65Hz;
Withstand voltage test	Input--casing: 2200Vdc 1min Input--output: 2200Vdc 1min Output--casing: 700Vdc 1min
Safety	Compliance line with EN610950
Wiring	
AC output	Male socket in line with the applicable national standard, applicable to 1~1.5mm^2 cable
DC output	25mm^2 cable quick plug (red: positive; black: negative)

Note: Please consult us about the testers of other voltage levels and current levels.

II. Operating Principles

2.1Battery Measurement Principle

Due to the complicated electrochemical reaction and different materials, structures, manufacturing processes and operating conditions of batteries, the batteries produced by different manufacturers have quite different features and even those produced by a single manufacturer may have different features of single batteries. At present, there is no simple and effective method for judging battery performance quickly and accurately in the world. The testing and failure prediction of battery performance are still difficulties in the electrochemical measurement field.

For the fixed explosion-proof, acid-separated and lead-acid batteries once widely used in fields such as electric power, communication, finance and traffic, their electrolyte densities, liquid levels, temperatures and other data can be figured out by means of terminal voltage measurement. However, the sealing and barren liquor design of valve-controlled lead-acid batteries makes it difficult for us to figure out their status. Thus, the testing and maintenance methods for acid-separated and lead-acid batteries are not applicable to valve-controlled batteries, which is a difficulty in the current battery operation management.

At present, we usually measure the terminal voltages of batteries at ordinary time and do check discharge capacity tests annually. We believe that:

1. For a battery in floating charge, its terminal voltage does not correspond to its capacity.

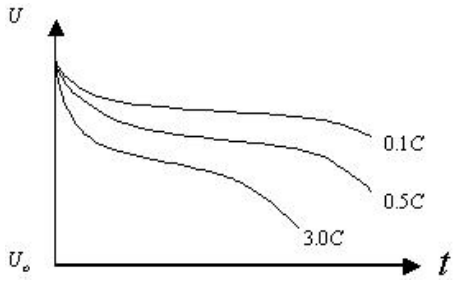
We know that even for a poor-performance battery in floating charge, its voltage can be found acceptable in measurement. Therefore, for a battery, its terminal voltage measured in the floating charge status does not indicate its actual performance.

2. Full-capacity discharge tests are still the most accurate and effective measurement method for the actual capacities of battery packs.

We know that the capacity of a battery pack is the capacity of the single battery with the worst performance in the battery pack. Therefore, to test a battery pack, just test its low single battery: Capacity of the battery pack is capacity of the low single battery.

Discharge the battery pack with the specified constant current and monitor the voltage of each single battery of it. When the voltage of any single battery has dropped to the final voltage, the capacity of this single battery is the actual capacity of the battery pack. This method is accurate and effective.

We also know that a battery has the following discharge curve.



According to the discharge curve above:

1. A single discharge curve indicates the same battery performance. The batteries of the same manufacturer, formula and manufacturing process have the same characteristic curve (the dispersion in production is not considered).

2. Due to different capacities, the single batteries in a battery pack have discharge curves with different discharge rates because they discharge at different rates because of their uniform discharge current and different capacities.

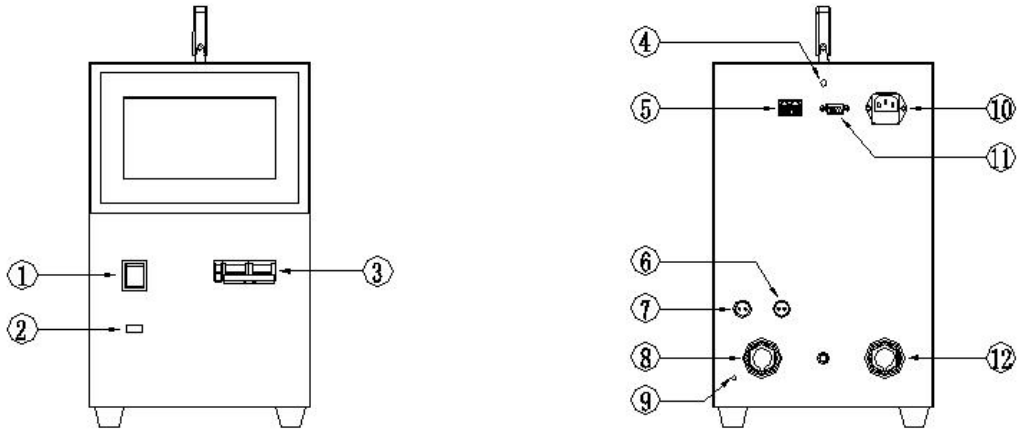
2.2 Constant-current Principle

The discharge circuit of the tester employs the PWM + PID closed-loop control technology based on CPU control so that the power circuit can operate accurately with the set discharge current.

III. Operation Instructions

3.1Operation Of Panel

See the figure below.



1: Power Switch
2: USB
3: Discharge Switch
4: Antenna
5: Collection Box
6: Total Current
7: Total Voltage
8: Charge Terminal (positive pole)
9: Ground
10: Power AC220V
11: RS485
12: Charge Terminal (negative pole)

IV.Test Conditions

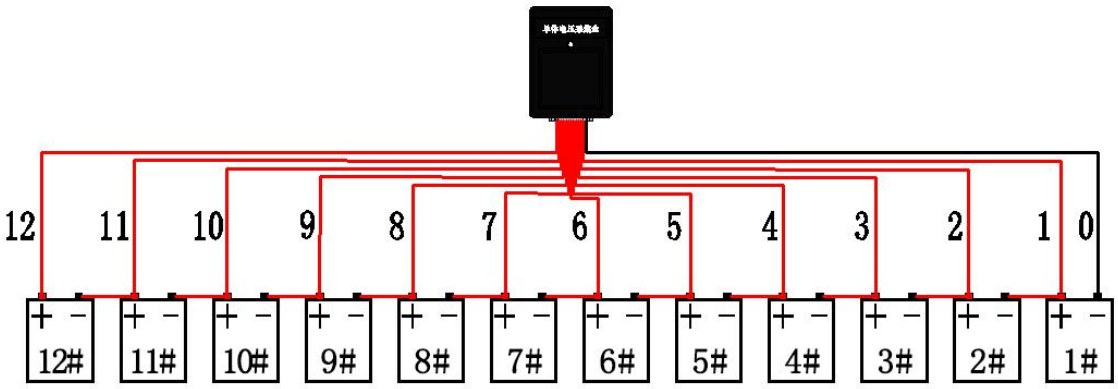
4.1 Operating Conditions

There should be no corrosive, explosive or insulation-reducing gases or conductive dust close to the tester.

4.2 Connection Between The Tester And a Battery Pack

Insert the quick plug of the discharge wire into the quick socket of the tester (red: positive; black: negative) and connect the other end of the discharge wire with two terminals of the battery pack (red: positive; black: negative) and the voltage test wire with the tester's total voltage test interface and the battery pack's positive and negative electrodes.

Connect the test wires of the single battery test module with the single batteries as shown in the following figure.

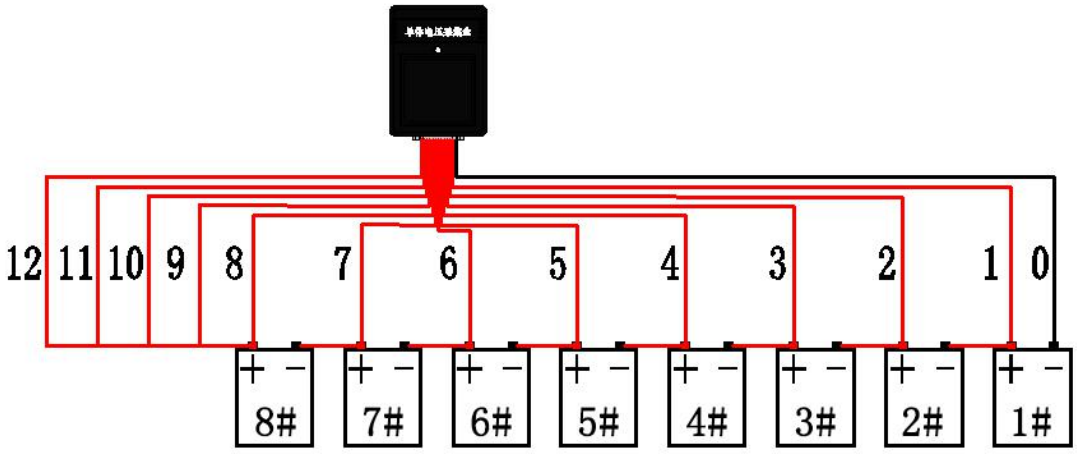


The single battery test module has twelve red wires and one black wire. These wires are arranged by length: the black wire is connected with the negative electrode of the first single battery and other red wires are connected with the negative electrodes of each single battery in an orderly way.

The single battery test module is compatible with batteries with a voltage from 2V to 12V and has an internal power supply.

The single battery test module has a voltage acquisition accuracy of ±0.05% and a resolution of 1mV.

If the single battery quantity is not 12 or any other integral multiple of it, have the unconnected testing terminals shorted with the positive electrode of the last single battery as shown in the following figure (with eight single batteries).

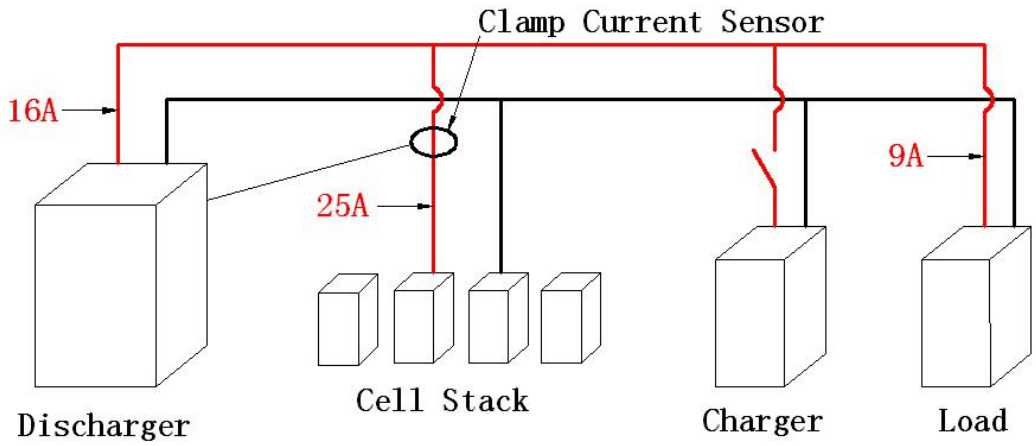


Note: The single battery test module has an internal power supply through wires 0# to 4# (inverse connection tends to burn the single battery test module), so it can monitor at least four single batteries.

4.3 Online Compensated Discharge (Operational Function)

Each single battery pack is tested while not separated from the system. This test method is especially applicable to an occasion with only one emergency battery pack.

For on online compensated test, a Hall element current clamp is necessary. Here below is the wiring diagram.



The discharge current of the main unit is still set as the battery discharge current. The internal load automatically decreases with the current value detected by the pincerlike current sensor to realize constant-current discharge for the battery pack.

The host PC displays as below: current (25A) = battery pack discharge current (25A) = the host PC's internal discharge current (16A) + actual load current (9A). The actual load current changes with the online voltage during online discharge, so the main unit's internal discharge current adjusts automatically to ensure constant-current discharge of the battery pack all the time.

(Note: In an online compensated discharge test, disable the rectifier or make its output voltage zero, otherwise the discharge current will originate from the switching power supply. Other operations are the same as those in the single battery test.)

V.Operation Screens

Operate on the touch screen according to the prompts on it.

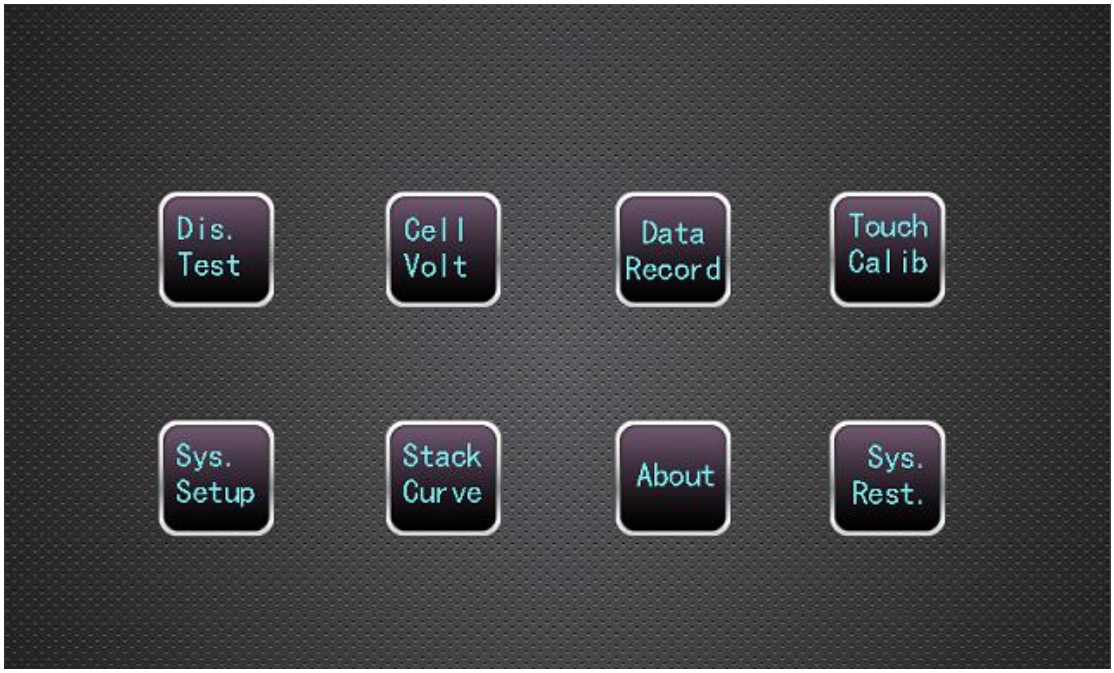
Turn on the power switch. After that, the touch screen displays a boot screen LOGO including name and scope of application of the tester and logo, Chinese name and English name of the manufacturer.

5.1 Boot Screen

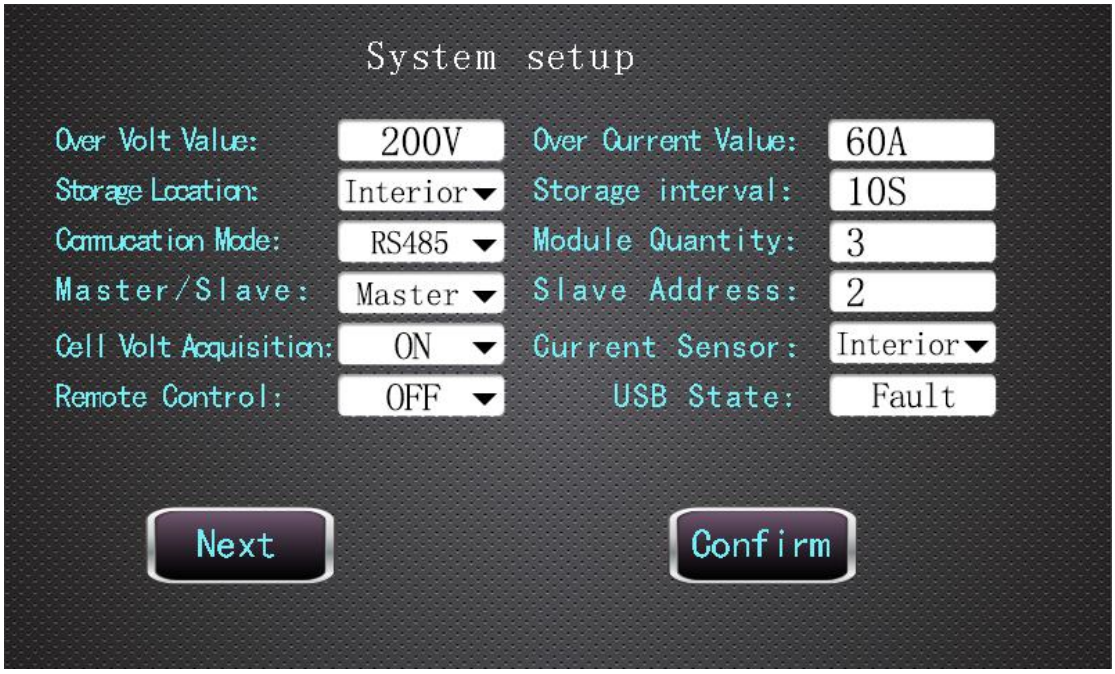
On the boot screen, click [Chinese] or [English] to enter the main menu as below.

5.2 Main Menu

Choose the desired submenus.



5.3 System Setup



[Storage location]: The internal memory or an external USB disk (Do not modify this parameter during testing)

[Storage interval]: The interval of data recording (unit: s)

[Communication mode]: Communication mode for the voltage acquisition of single batteries: RS485 or wireless

[Module quantity]: Quantity of the single battery modules connected and used in the test system

[Master-slave mode]: Used as a master or a slave in the parallel operation

[Slave address]: The RS485 communication address when the tester is used as a slave in parallel operation, or the communication address when the tester is used in remote discharge

[Cell volt acquisition]: Enabling or disabling of the single battery voltage acquisition function (if this function is disabled, no single battery voltage acquisition will be done and the function of shutdown upon low single battery voltage will be shielded.)

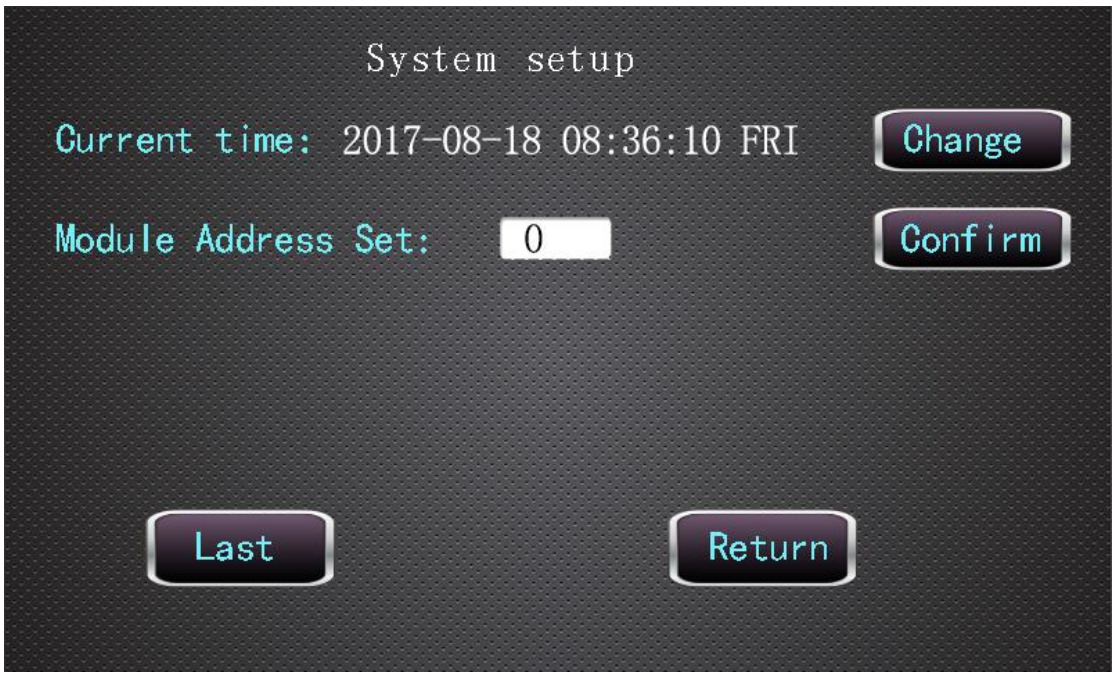
[Current sensor]: The current sensor in the instrument or external pincerlike current sensor in the discharge test (if an external pincerlike current sensor is used, online

compensated discharge can be done for the battery pack)

[Remote control]: If it is “ON”, remote control over the discharge current can be done for the tester with help of the host PC software or remote equipment and such parameters as voltage and current can be monitored in real time.

[USB status]: Real-time display of status of the external USB memory (whether it is inserted into the tester or not)

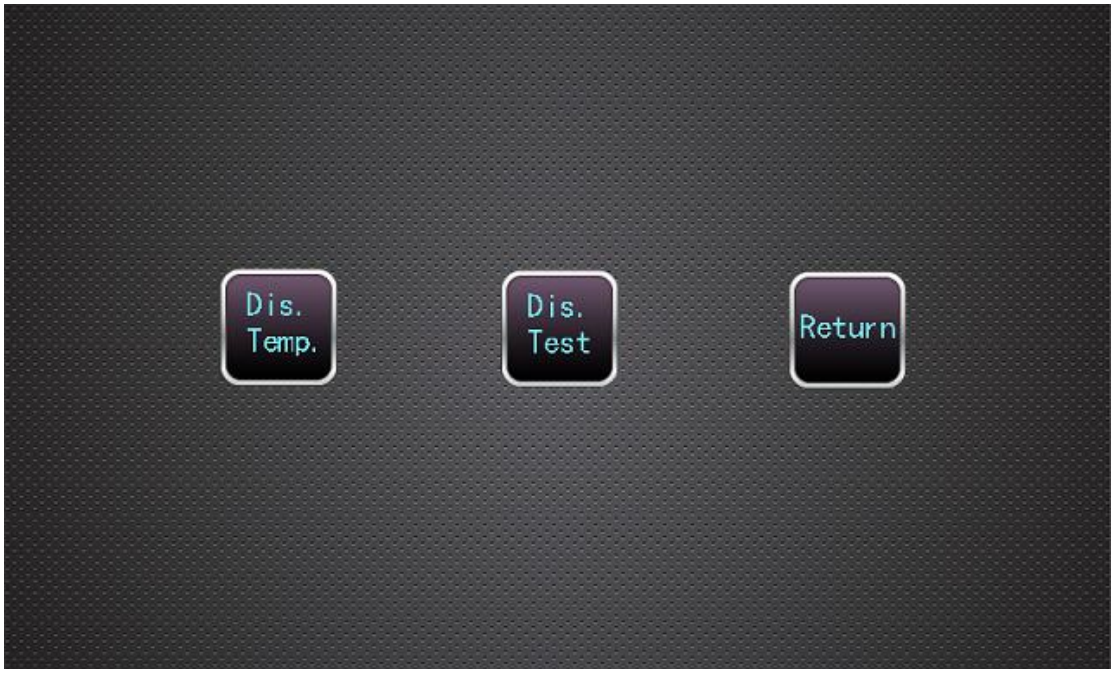
5.4 System Setup 2 Screen



[Current time]: Real-time display of the internal clock of the system (modifiable through the “Modify” button)

[Module address Set]: If the single battery voltage communication address needs to be modified, enter the desired address when the single battery module and the tester are in one-to-one connection via a RS485 bus and click “Confirm”. After modification, the status indicator on the single battery module will flicker for five successive times with an interval of 500 ms.

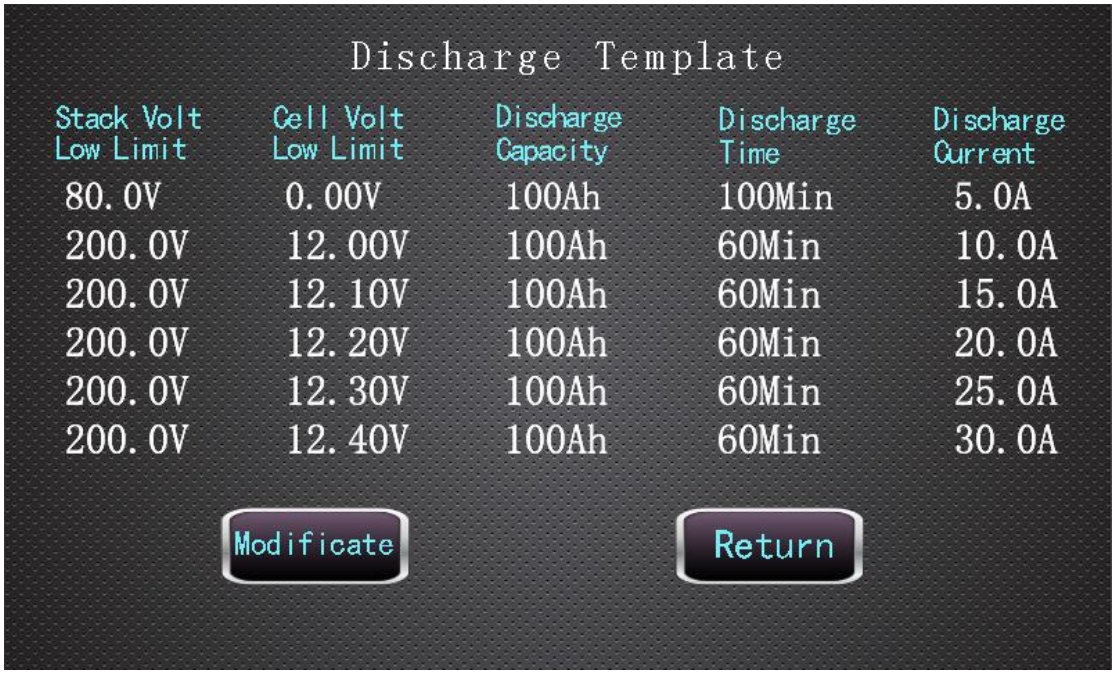
5.5 Discharge Test Selection Screen



[Discharge template] Select one of the six frequently used parameter templates entered in advance for a discharge test. (This function can avoid frequent enter of parameters and improves work efficiency greatly.)

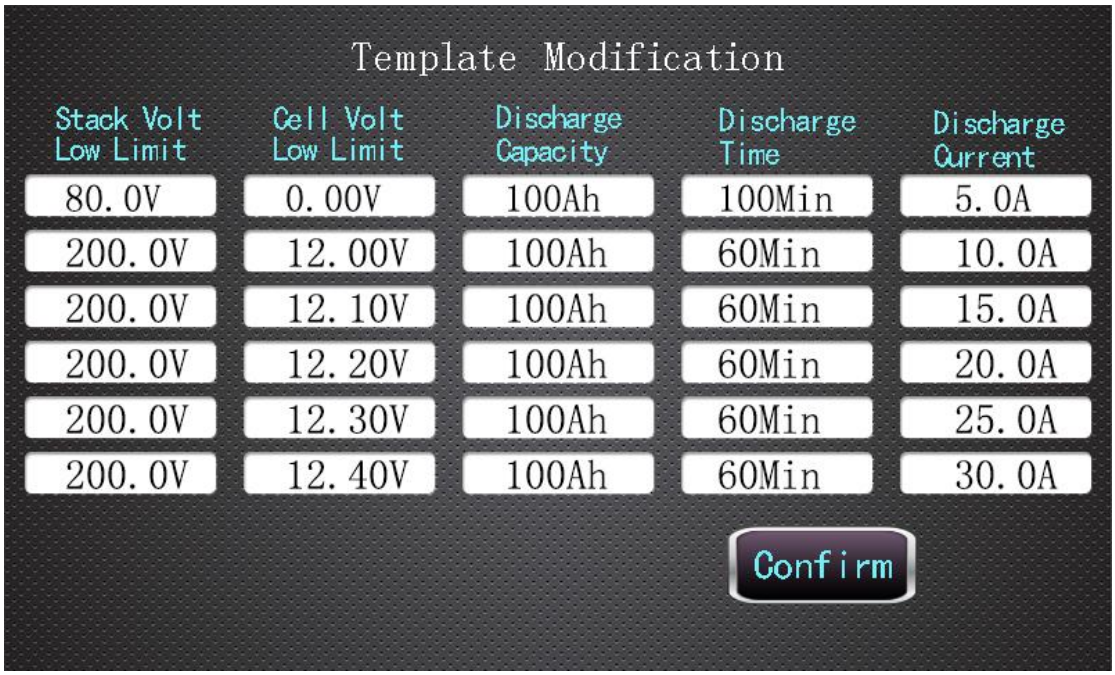
5.6 Discharge Template

A discharge test can be done based on one of the six groups of discharge parameters set in the tester in advance.



5.7 Template Modification

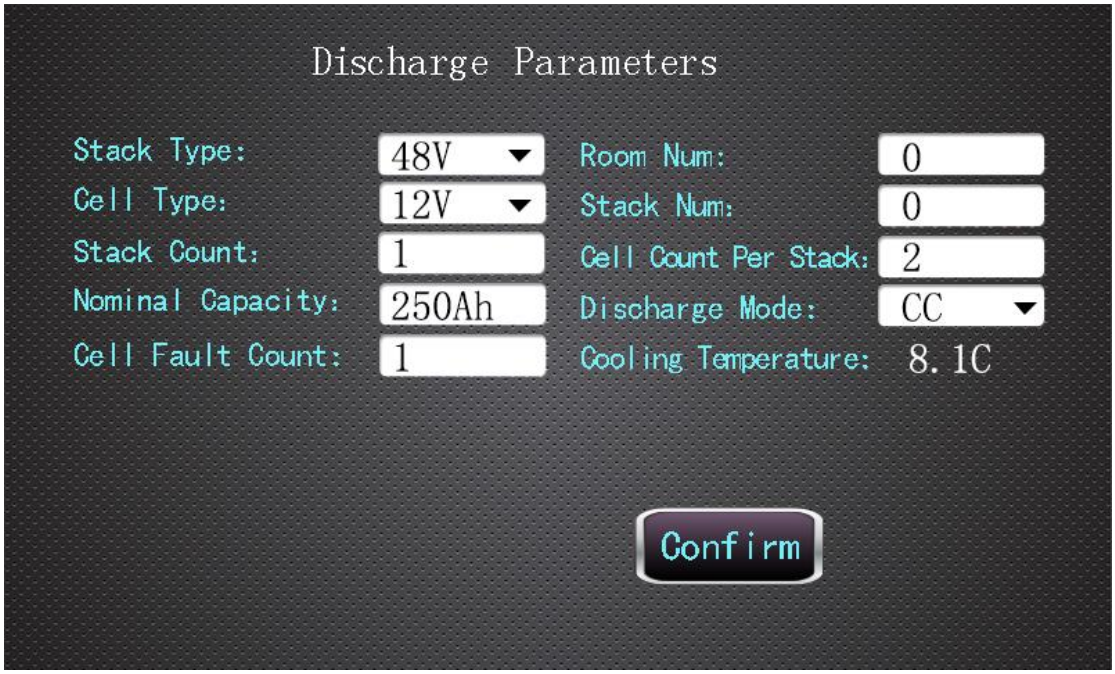
User can modify the preset templates through the “Modify template” button. After “OK” is clicked, the new template data will be saved to the Flash in the tester to avoid loss in power failure.



5.8 Discharge Parameters

After “Discharge test” is selected, the system will first enter a discharge parameter setup screen with the discharge parameters after the previous modification by the user. User

can click “OK” to enter the “Discharge test” screen.

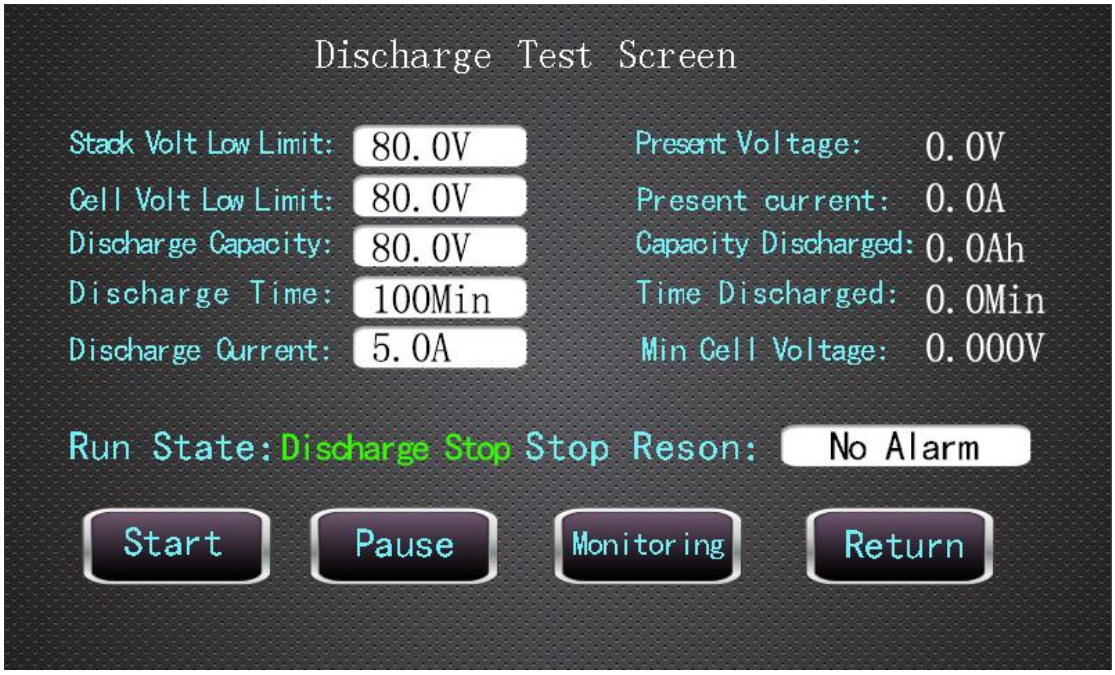


[Stack type]: Select according to rated total voltage of the battery tested.

[Cell Type type]: Select according to the measured rated voltage of each single battery.

[Cell Fault Count] The times a single battery voltage is smaller than the minimum single battery voltage during discharge (Discharge will stop when the set value is reached. This function usually applies in the testing of scrapped batteries or the activation of new batteries. It can be set as “1” in ordinary tests.)

5.9 Discharge Test Screen



[Stack Volt Low limit]: If the actual total voltage during discharge is smaller than the set value, the system will shut down and sound an alarm.

[Cell volt Low limit]: If the actual single battery voltage during discharge is smaller than the set value, the system will shut down and sound an alarm.

[Discharge capacity]: If the current discharge capacity during discharge is larger than the set value, the system will shut down and sound an alarm.

[Discharge Time]: If the current discharge duration during discharge is larger than the set value, the system will shut down and sound an alarm.

[Discharge current]: It is the set discharge current. If the actual discharge current deviates from the set value and duration and direction of the deviation are different from the corresponding set values of the system, the system will shut down and sound an alarm.

[Run status]: Real-time display of the discharge status, including “Discharge stopped”, “Discharge in process” or “Discharge suspended”

[Begin to discharge/reset/discharge ended]: It is for controlling beginning and stop of the discharge by the tester and resetting as well. After being reset, the tester will begin to discharge automatically.

[Pause/Continue]: User can click this button at any time during discharge to switch to the pause status. In the pause status, the tester does not discharge or reset values such as the current discharge capacity and the current discharge duration but keep recording the

related data. User can click this button again to do a discharge test based on the original current discharge duration and current discharge capacity.

[Stop Reson]: The cause of discharge stop is displayed after discharge. “N/A” is displayed here during discharge. The possible stop cause may be “Manual stop”, “Overcurrent stop”, “Overvoltage stop”, “Discharge current fault”, “Low single battery voltage”, “Low total voltage”, “Discharge capacity completed”, “Discharge duration expired”, “Other fault” or “Overtemperature fault”.

[Current voltage]: Real-time display of the total voltage of the test (unit: V)

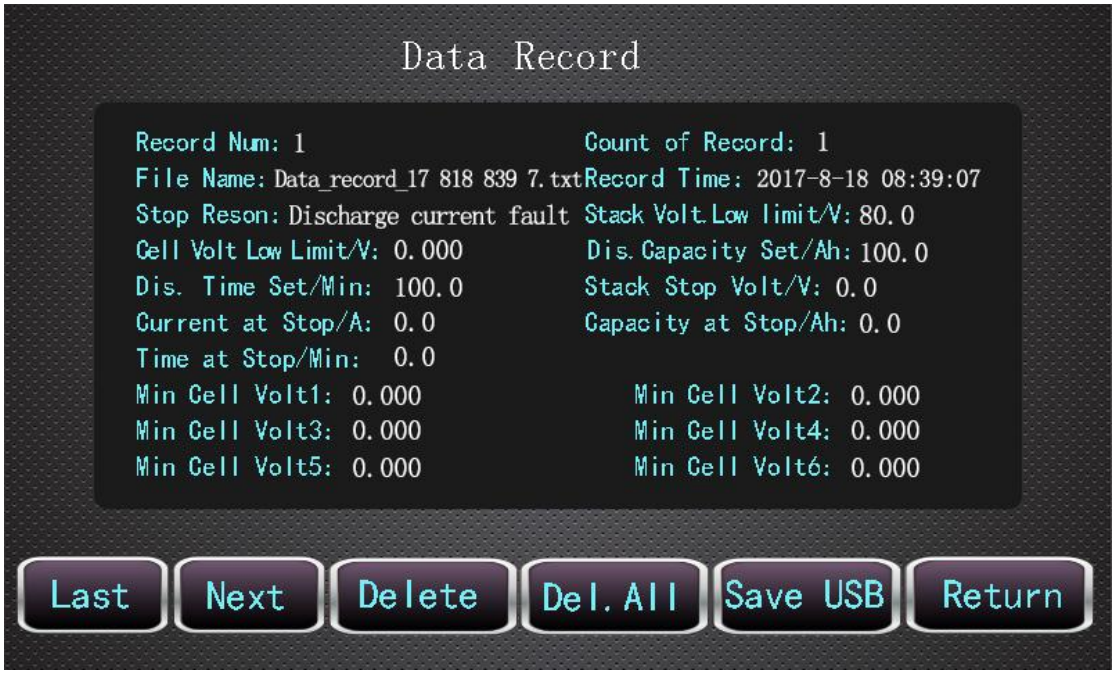
[M]: Real-time display of the current value of the tester (unit: A)

[Current discharge capacity]: Real-time display of the current discharge capacity of the tester (unit: Ah)

[Current discharge duration]: Real-time display of the current discharge duration of the tester (unit: Min.)

[Minimum single battery voltage]: Real-time display of the minimum single battery voltage in the battery pack

5.10 Data Record Screen



[Record num]: Number of the data in all data records

[count of Record]: The total number of data records

[File name]: Name of the data record

[Record time]: The beginning time of data recording (accurate to second)

Other parameters are omitted here.

5.11 Single Battery Monitoring Screen

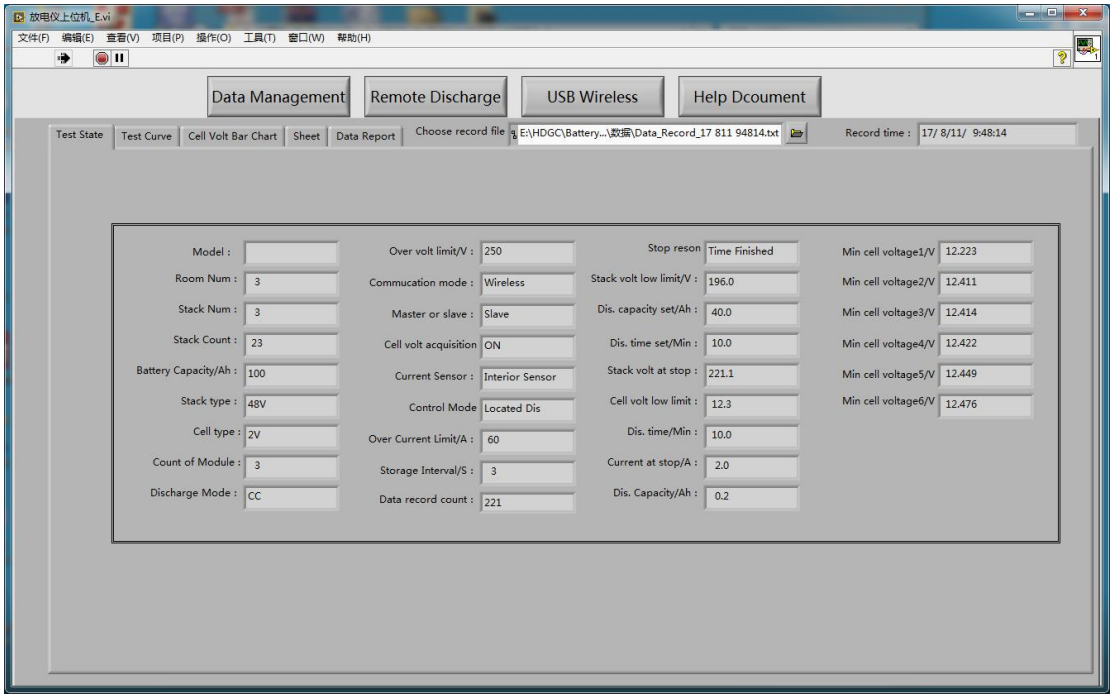
This screen can display the single battery voltages acquired from all the single battery modules.

“Minimum single battery voltage 1” to “Minimum single battery voltage 6” refers to the minimum single battery voltages among all the single battery modules. “Minimum single

battery voltage 1" is the minimum while "Minimum single battery voltage 6" is the maximum. The single battery voltage can shield the batteries with a voltage smaller than 0.5V or the open-circuit or shorted testing terminals automatically or, in other words, the voltages in these three cases are excluded among the six minimum single battery voltages.

VI.Host PC Software

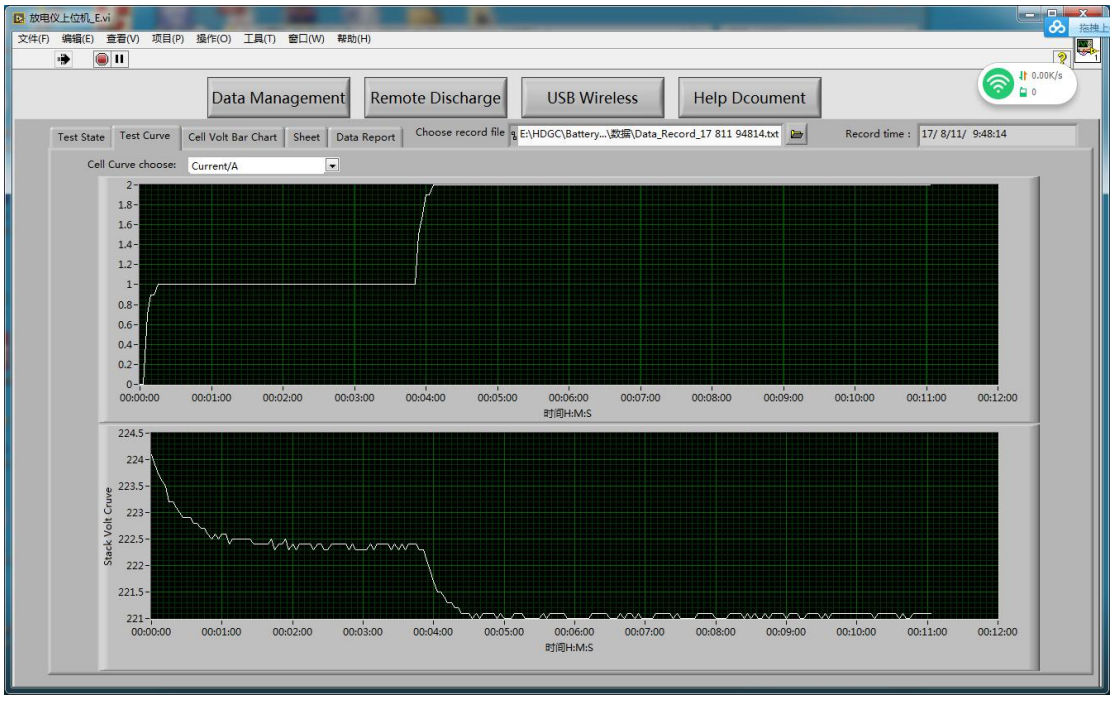
6.1 [Data management] Screen - [Test status] Screen



After  is clicked, a data record file dialog box will pop up. Find out the desired data record file and click “OK”. The screen will display information of the data record.

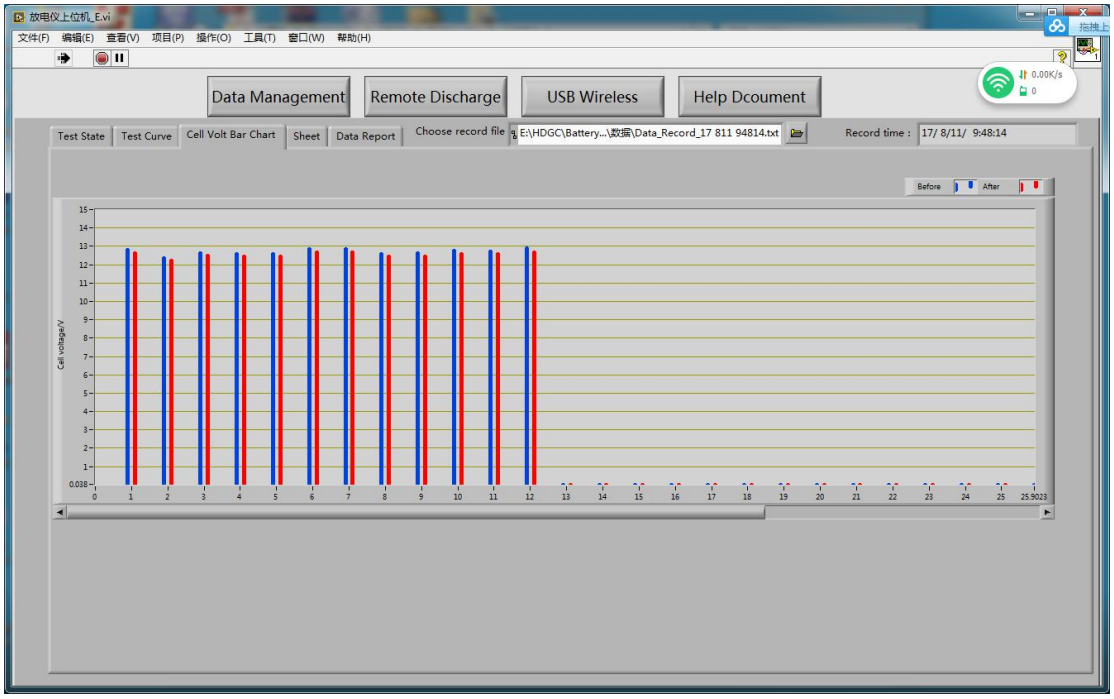
6.2 [Data management] Screen - [Curve display] Screen

On this screen, user can select a single battery voltage curve and the total voltage curve to be displayed.



6.3 [Data management] Screen - [Single battery voltage bar

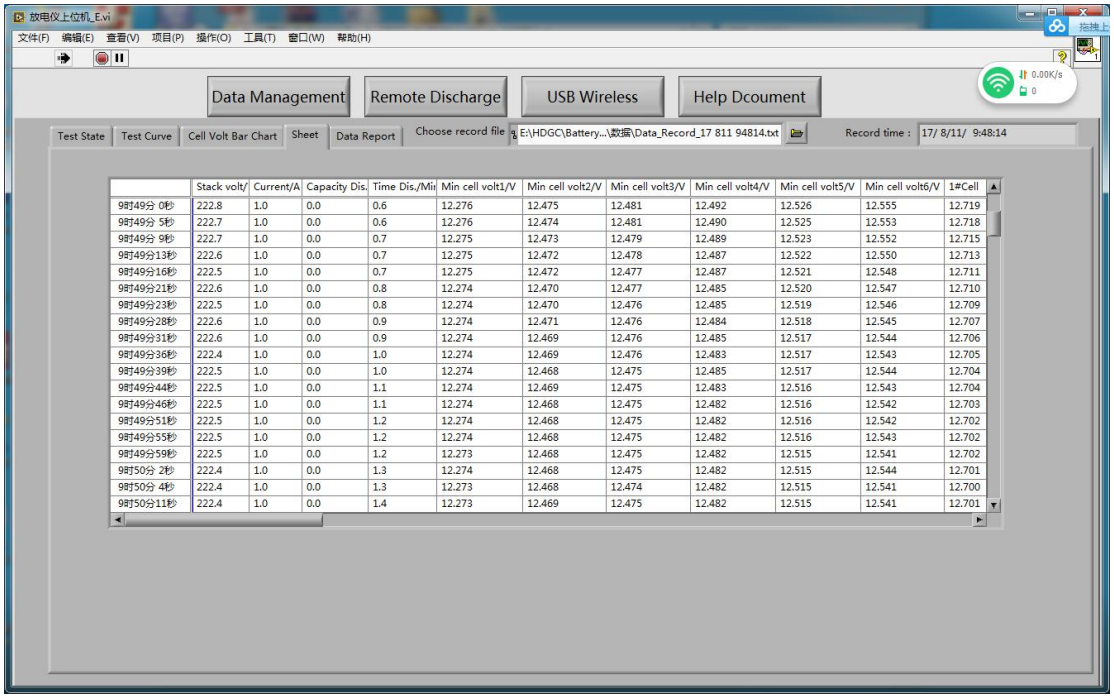
chart] Screen



This screen displays the final voltages of all single batteries in the form a bar chart. The bars in blue refer to the voltages before discharge while the bars in red refer to the voltages after discharge.

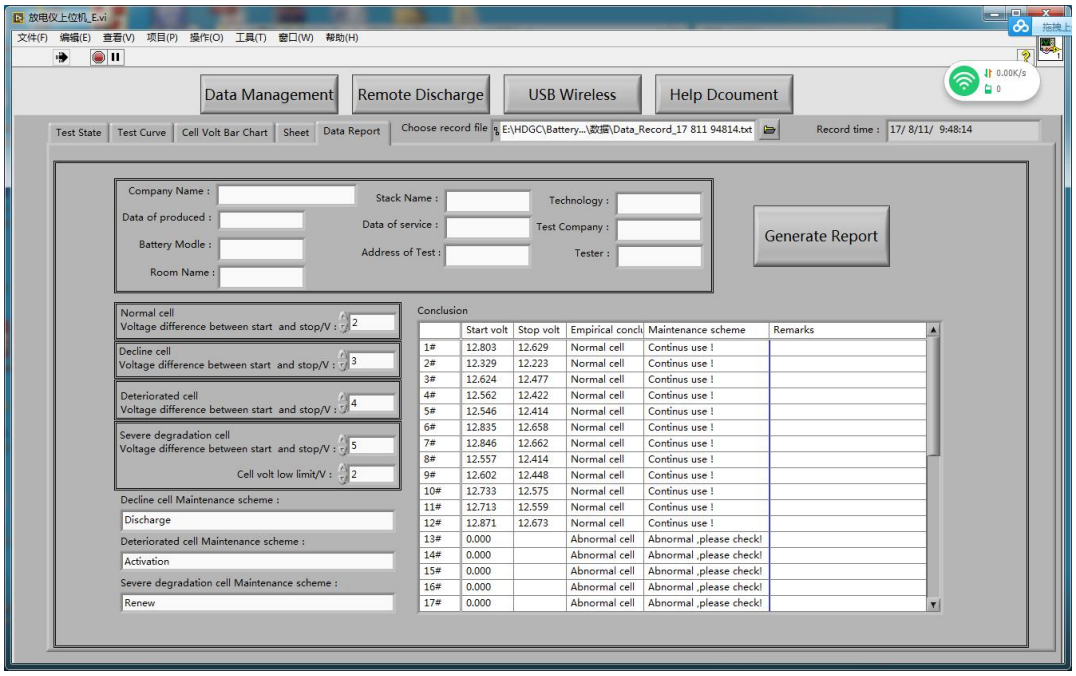
User can modify coordinate of the X axis manually according to the single battery quantity for better display of the bar chart. If there are many single batteries, drag the horizontal slider at bottom of the bar chart to display the whole bar chart. The X axis is in the automatic mode by default.

6.4 [Data management] Screen - [Form display] Screen



To update the data of the form, just click “Update form data”.

6.5 [Data management] Screen - [Data report] Screen

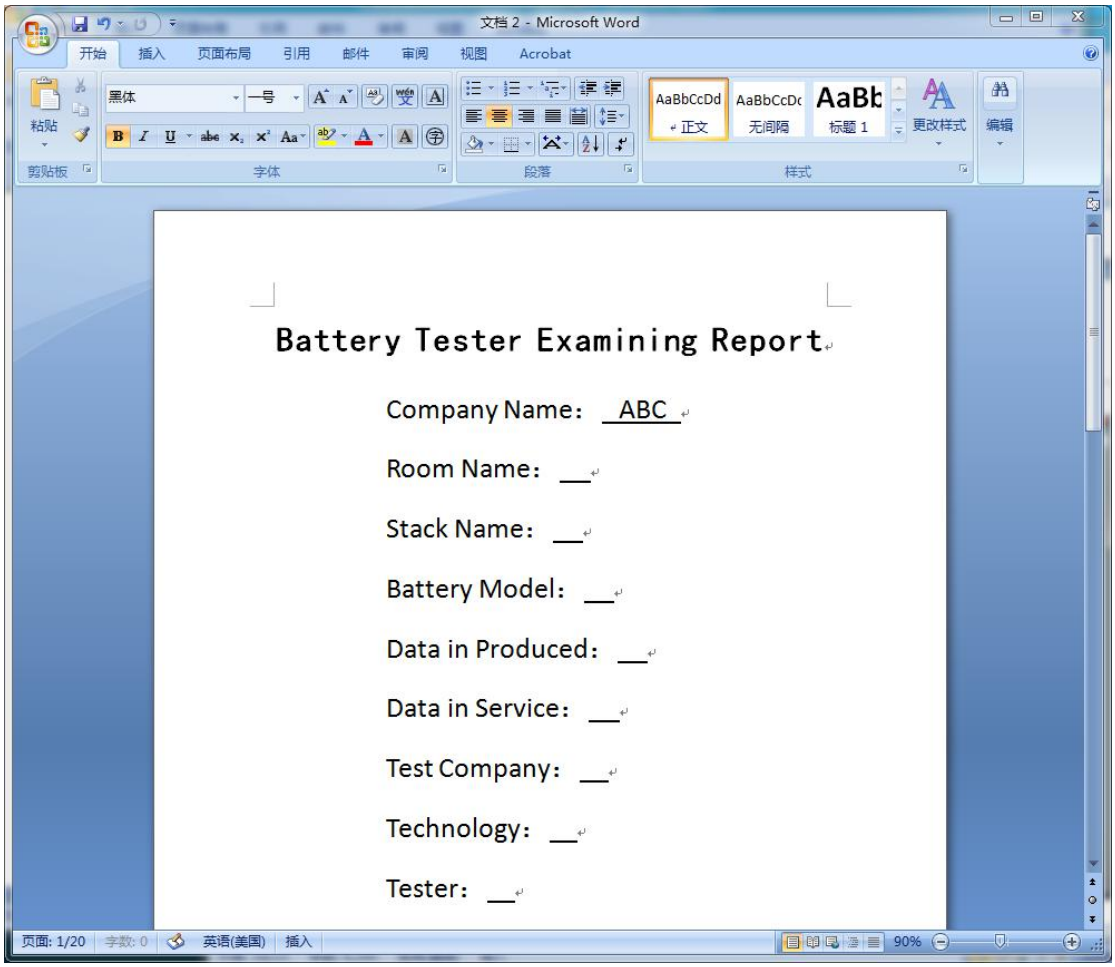


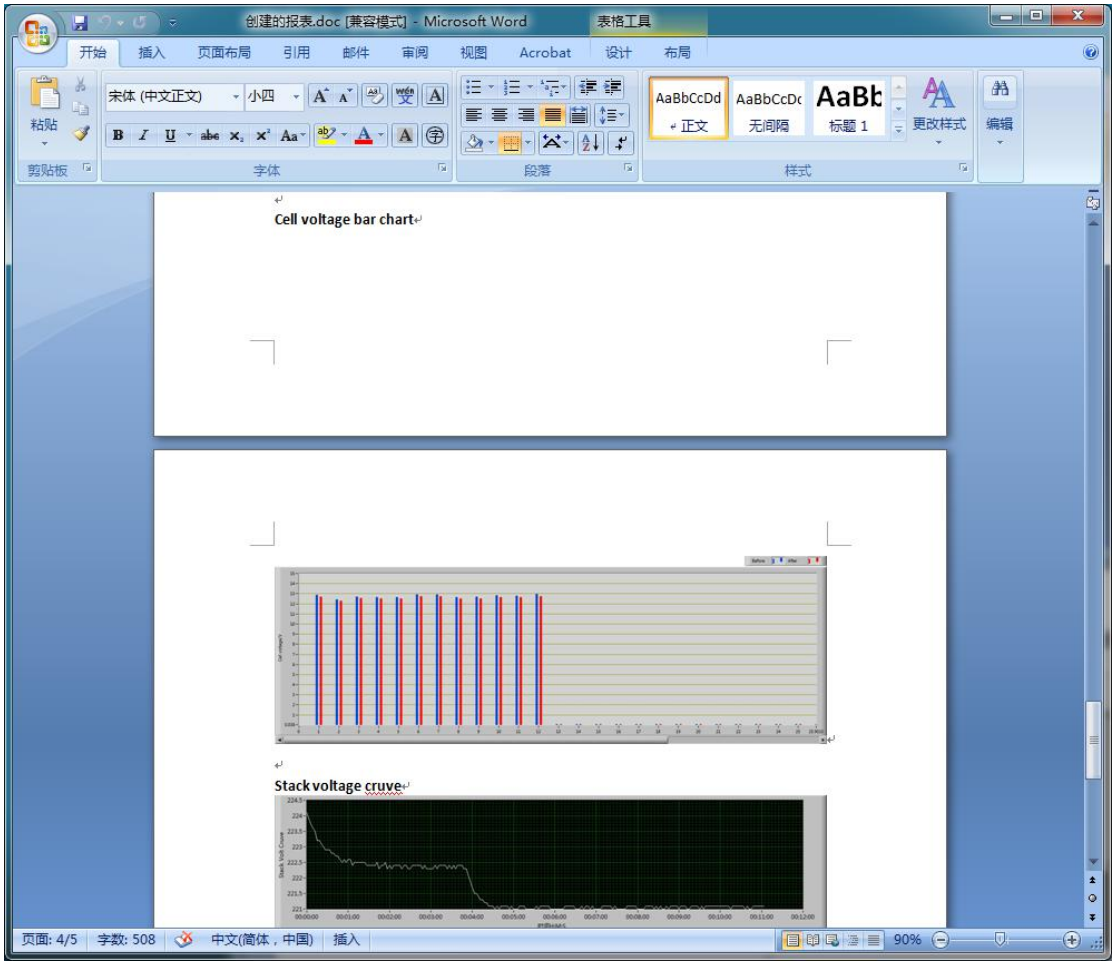
After entering information such as “Company name”, click “Update data”. On the form titled “Single battery conclusion”, each single battery will be classified and judged according to the four voltage status set on left part of the screen. Single batteries can be manually marked in the “Note” column.

After that, click “Generate a report”. The above data will be entered to the preset report

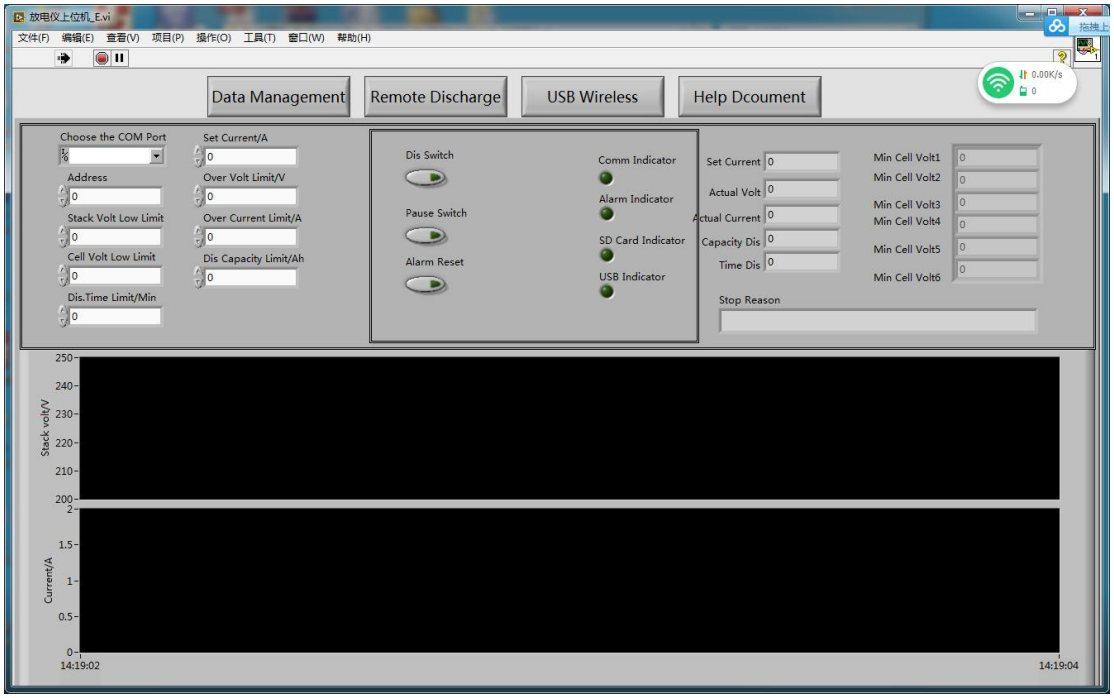
template automatically for saving or printing by user.

6.6 Report And Forms Generated





6.7 Remote Discharge Screen

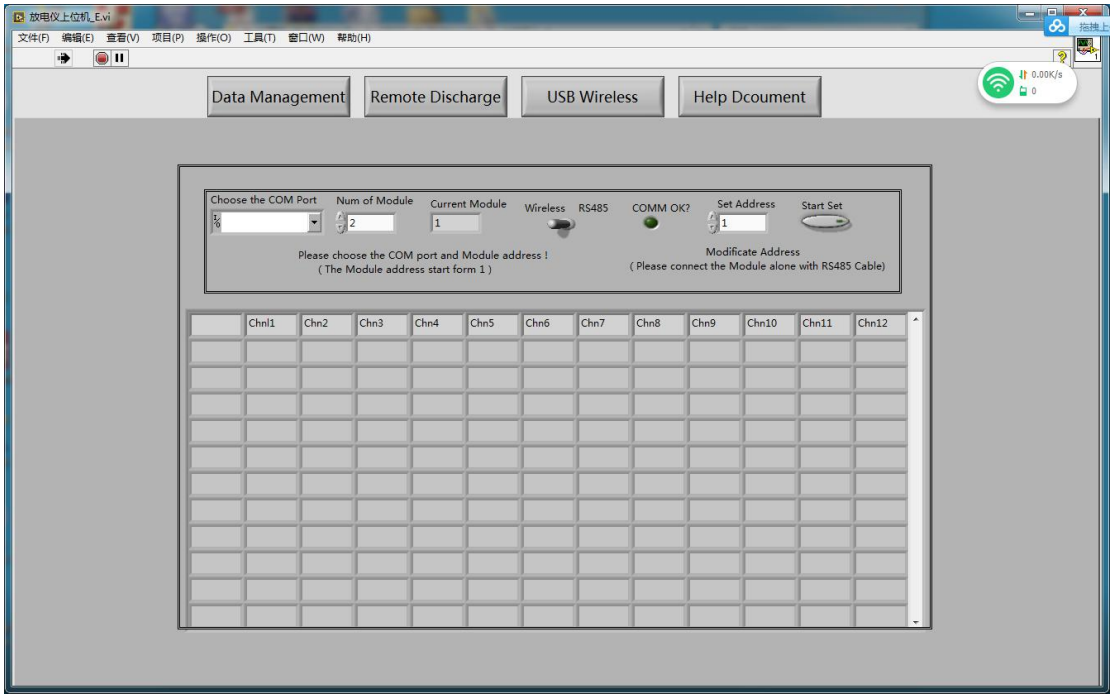


[Remote discharge]: After the remote discharge function in the tester is enabled, a USB

disk 485 communication line is connected to the host PC and the corresponding driver is installed, remote testing can be done for the tester on this screen.

User can modify coordinate of the Y axis manually according to the actual voltage for better display of the curve. The Y axis is in the automatic mode by default.

6.8 Wireless Terminal Screen



[Wireless terminal] screen (with a monitoring function):

When the host PC is connected with the “USB wireless terminal”, the single battery voltages can be monitored here in real time.

Step 1: Select the COM number of the USB module in the field under “Select USB wireless serial port”;

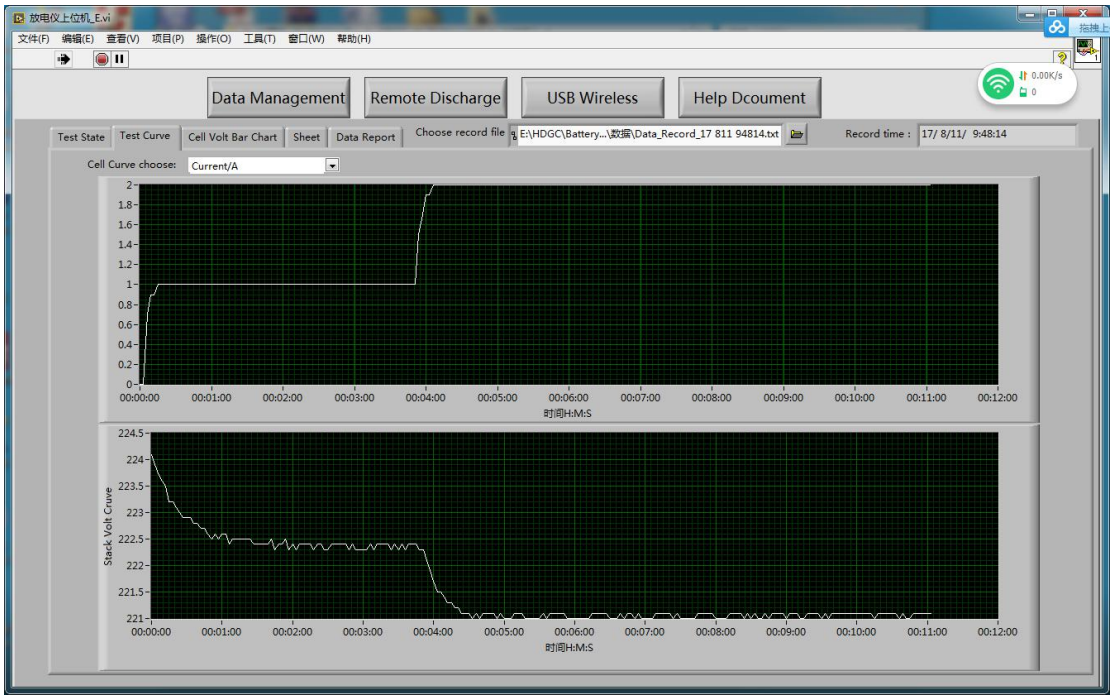
Step 2: Enter actual quantity of the monitoring modules.

Step 3: Select the wireless or wired RS485communication mode.

[Set module address] Connect a telephone line with a 4-core crystal plug at each end of it with a USB wireless single battery voltage acquisition module separately and click the “Start to set” button on right part of the screen to set the module address. After that, the indicator on the single battery module will flicker for five successive times quickly.

Note: Before the setup, the single battery module must have been powered on or. In other words, it must have been connected to the single batteries.

6.9 Curve Display



[Cell curve choose] Select the desired curve of the voltage of a single battery or the desired curve of the minimum single battery voltage through the drop-down list.

VII.Troubleshooting

No.	Fault	Solution
1	All the single batteries of a single battery module have a zero voltage.	Inspect wiring of the wireless module.
2	The first three single batteries of a wireless module have a zero voltage.	The wiring is inverse. Start from the positive electrode, from 0# to 12#.
3	The module power indicator is lit; the single batteries fail in receiving; the wiring is normal.	Solve the problem with the configuration method above.
4	The buzzer sounds during connection of the discharge cable.	The discharge cable has inverse wiring.
5	The discharge current is normal, but the voltage does not drop.	The battery pack is not isolated from the system.
6	The current monitoring is abnormal.	Shut down the tester and start it again.
7	A discharge current fault is prompted during discharge.	The air circuit breaker is not made.
8	The temperature is too high.	Inspect and make sure the tester is correctly arranged and has good ventilation and a proper heat flow direction.
9	The memory space is insufficient.	Delete the data and files with backup copies at regular intervals.
10	Data saving fails.	Start the tester again. Do not switch among the internal memory and an external storage device during discharge.

VIII.Packing List

No.	Item	Qty
1	Main engine	1
2	Red Discharge cable	1
3	Black Discharge cable	1
4	The entire group of voltage acquisition line	1
5	Power line	1
6	U disk	1
7	antenna	1
8	Touch pen	1