Battery Charge-Discharge Testing System

ITS5300 User Manual

Model: ITS5300-IT6000
Version: V1.5

Notices

Manual Part Number

ITS5300

Revision

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CAUTION

A CAUTION sign denotes a hazard.
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NOTE

A NOTE sign denotes important hint. It calls attention to tips or supplementary information that is essential for users to refer to

Content

Chapter1 System Overview

1.1 System Introduction

ITS5000 is a kind of battery test system software. By editing test steps, the user may perform constant current charge, constant voltage charge, and constant current/power/resistance discharge tests. It supports charge/discharge under fixed value and pulse mode, and is available for recycle operation.

During the charge-discharge testing process, the user can conduct all-round protection and alarm settings, and set conditions and select data saving. After test, provide report and other methods to inquire data for data statistic analysis.

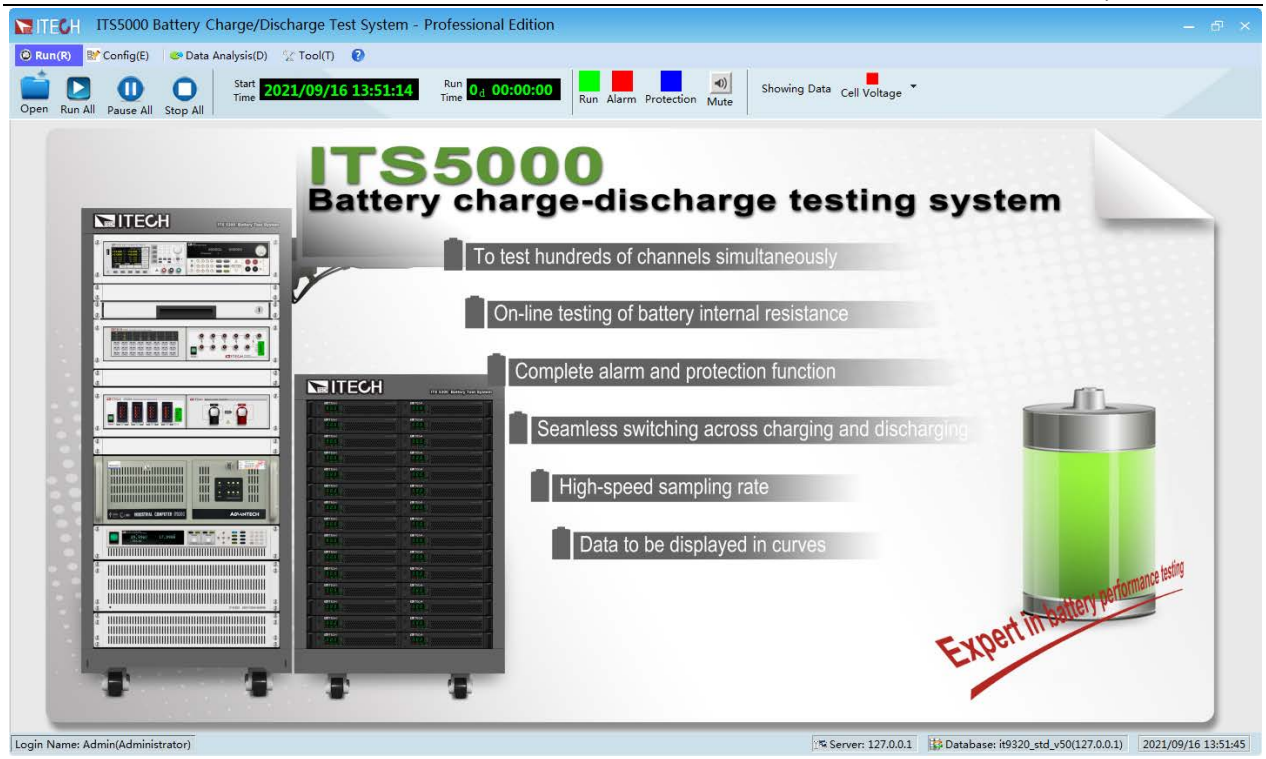
1.2 System Features

Advantages of ITS5300 battery charge-discharge testing system are shown in the following:

- It is built based on the WINDOWS test system and adopts the graphical test interface. Therefore, it can be operated easily and conveniently.
- The software supports both Chinese and English operation interfaces
- It has the user permission setting function, thereby preventing error operations of the unauthorized testing personnel
- It is provided with a wizard configuration interface for configuring basic characteristic parameters of the DUT, thereby saving test time.
- Support ITECH multi-series power supply and electronic load, with wide range of optional power;
- Support RS232, USB, CAN and Network interface communication;
- Standard modular design not only makes it easy for hardware extension and follow-up maintenance but also expand its applications;
- Power-off memory protection function (optional)
- Complete charge/discharge protection.
- Support battery internal resistance test.
- ITS5300 Test System integrates an ITECH multi-channel temperature logger used for temperature monitoring.
- A complete alarm and protection setup for effectively preventing overcharge, over-discharge and other unexpected faults;
- It is capable for long-time data record and save;
- The user can display the test curve, and run and save the data curve;
- The user can inquire several test data for convenient comparison;
- The test data form is named automatically by date and time. Various data screening conditions are provided for convenient check;

1.3 Function Introduction

ITS5000 software is divided into the following functions based on modules. The initial login interface displays each module at “Navigation”, as shown below.



Main module functions:

- **Run:** control the operation and stop of the test program.
- **Config:** configure test programs, including battery information, test equipment, test steps and relevant parameters.
- **Data Analysis:** include Statistic Analysis, Integrated Query, CAN Message Query, Test Data Management.
  Statistic Analysis: view statistic analysis report of test data.
  Integrated Query: view several test data report.
  CAN Message Query: view the received CAN message.
  Test Data Management: query and delete the test data.
- **Tool:** includes Database Configuration, Server Configuration, User Management, Formula, System Log, Data Accuracy, and Language.

  Database Configuration: configure the database information of system connection.
  Server Configuration: configure the server information of system connection.
  User Management: configure the user information and user permissions.
  Formula: create a new formula, used to be a condition parameter for cut-off conditions, alarm setting and protection setting.
  System Log: view system log information.
  Data Accuracy: set the interface accuracy and report accuracy.
  Language: set the language.

1.4 Supporting Hardware

ITS5300 test system is a complete battery test solution provided by ITECH with a series of software and hardware options. You can choose different models based on different measurement ranges.

Chapter2 Test Configuration

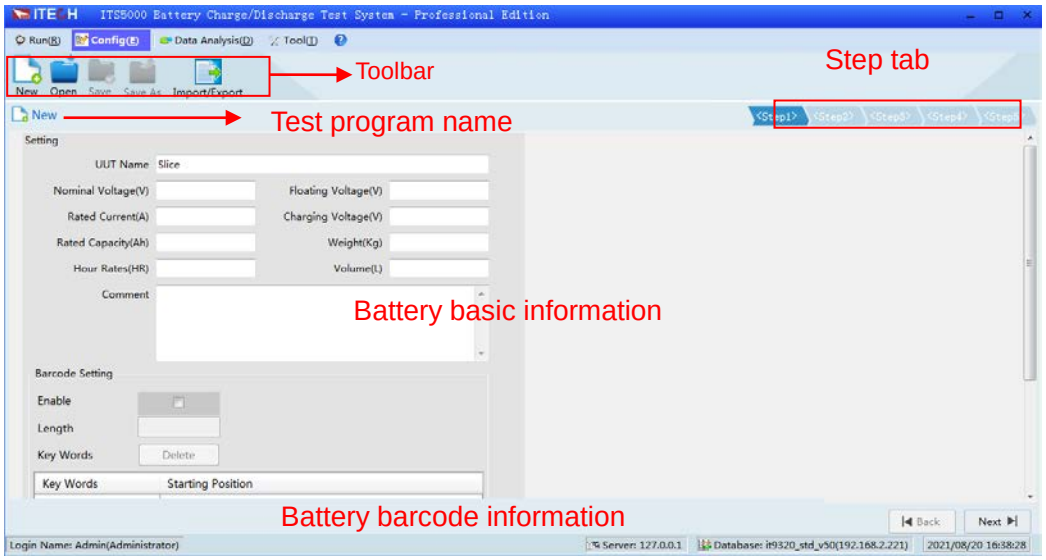
This chapter introduces test program configuration methods of ITS5300 test system software.

2.1 Brief Introduction

Test programs and test steps of ITS5300 battery test system are configured in the “Test Configuration” menu, which are saved in the database; during test, the user can select existing test programs in the “Test Run” interface for test.

The test configuration functions are divided into five steps for configuring battery information, test equipment information, channel information, deployment of test equipment and test work steps. The configuration process is performed based on sequence with simple operation and clear process. The user can make step-by-step configuration based on interface prompts.

Click “Test Configuration” menu to enter the Test Program Configuration Interface, as shown below.



- Toolbar:
  - New: create a new test program.
  - Open: open already-existed test program files.
  - Save: save the test program files under operation.
  - Save as: save the test program as a new file.
  - Import/Export: Export the configuration content in the Step1~Step5 tab page as a database file or import an existing configuration file.
- Step tab: Step1-Step5.
- Test program name: newly-created or already-opened test program name.
- Battery basic information: input basic information of battery under test.
- Battery barcode information: input barcode information of battery under test.

2.2 Configuring Test Program

In the ITS5300 test system, different hardware platforms are selected based on supporting instruments.

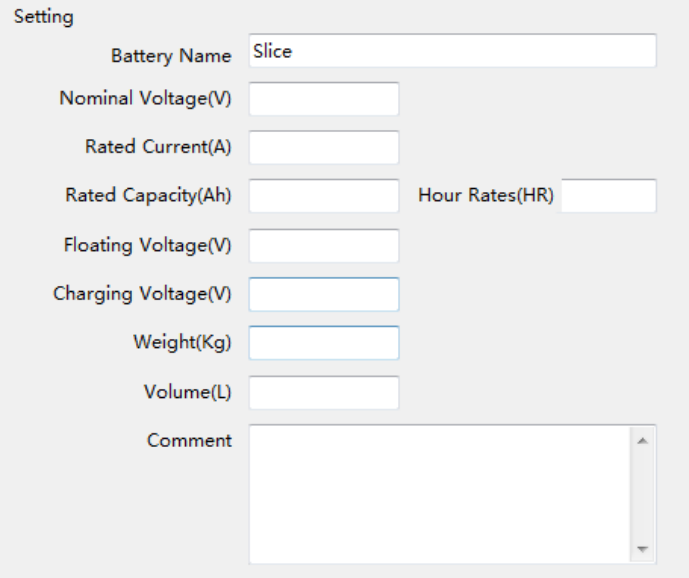
The test program configuration of the IT6000 platform is introduced as below. For detailed hardware introduction, please refer to System Description. The user can create new test program files based on DUT requirements and hardware device configuration. The test program configuration method is introduced below with specific examples.

2.2.1 Configuring Battery Information

This is the first step of test program configuration. The user needs to fill in the battery information, which serves as the search basis in later report viewing and data statistics. The battery name cannot be empty. The user can select to fill in other information based on actual conditions.

1. Click “Test Configuration” to enter the Step1 Interface of Test Program Configuration.

   In the Step1 Battery Information Configuration interface, the user can configure battery-related information, as shown below.

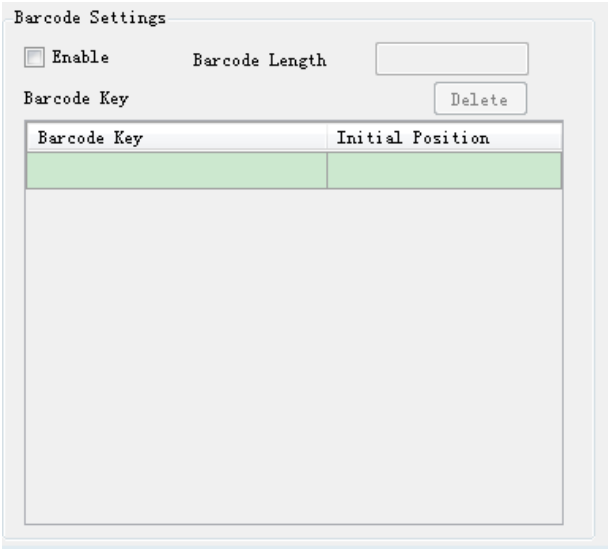


   Parameter description：

   Cell Name: Name the cell under test. Please keep the name unique as much as possible for further check.

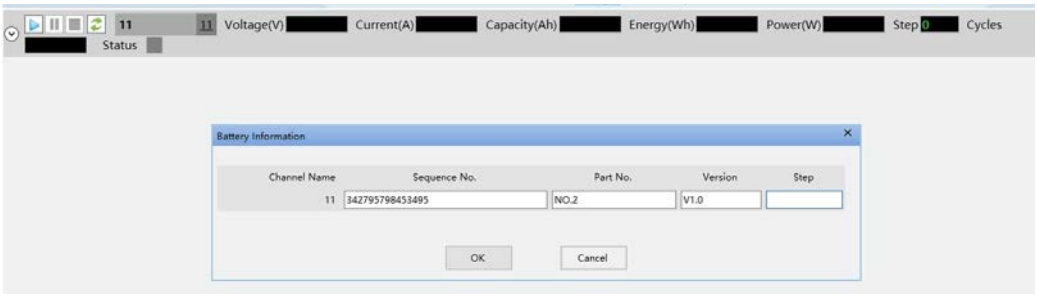
- Nominal Voltage: rated voltage provided for external usage.
- Rated Current: rated current provided for external usage.
- Rated Capacity: rated capacity value of the battery.
- Hour Rates: discharge rate shown by discharging hours.
- Floating Voltage: floating voltage of the battery.
- Charging Voltage: maximum charging voltage of the battery.
- Weight: battery weight.
  Volume: battery volume.

2. When there are several cells under test, the user can distinguish cells with barcodes. In the barcode setting area, the user can input barcode information, as shown below.



- Enable: enable the barcode function.
- Barcode Length: input the total length of Barcode.
- Barcode key: input barcode keyword.
- Initial Position: start bit of barcode key.

If the battery barcode information is set, when running the test, the system will prompt the following interface, prompting you to enter the barcode of the battery under tested.



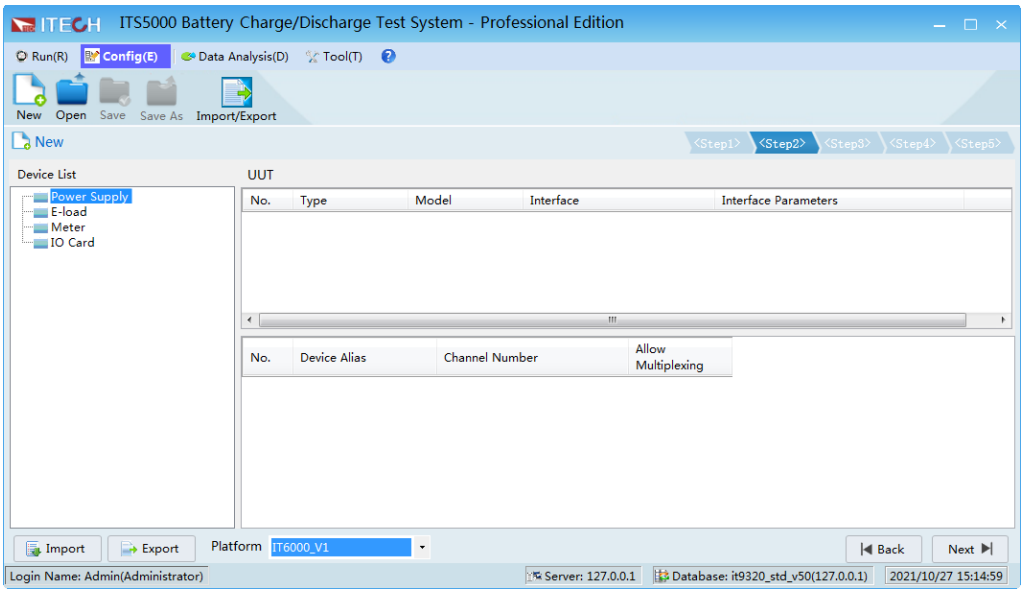
Note: You can input the barcode (serial number) data as shown in the figure above by the code scanner or manually inputting it.

2.2.2 Configuring Physical Hardware Device

ITS5300 test system can be configured with several ITECH supporting hardware devices. For details, refer to system description.

During configuration of physical devices, please select power supply, load, measuring instrument and IO card. The user can also configure interface parameters and channel information for each hardware device. Detailed steps are as follows.

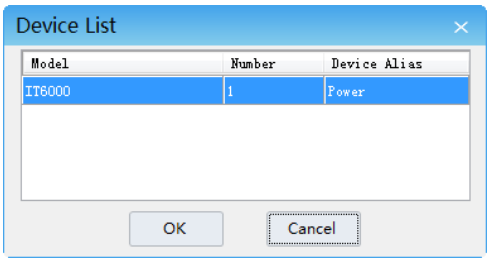
1. After configuring battery information, click “Next Step”. Enter the step2 Hardware Device Configuring Interface.



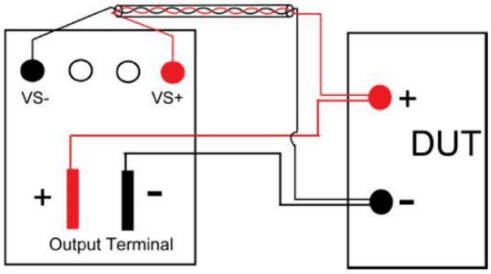
- Device List: list of supporting hardware devices of this system, including power supply, load, measuring instrument and IO card.
- UUT: configured device information and channel information.
- Import/Export: import existing hardware configuration file/export and save configuration files of existing hardware.

  Note: The import/export here only involves the contents of the Step2 tab.
- Platform: supporting hardware platform of ITS5300 test system.

2. Select and right click “Power”, and select “Add Device”.



Note: For IT6000 series devices, the ITS5300 system software will automatically turn on the Sense function. Before adding hardware devices, make sure that the Sense terminals are connected to the DUT.

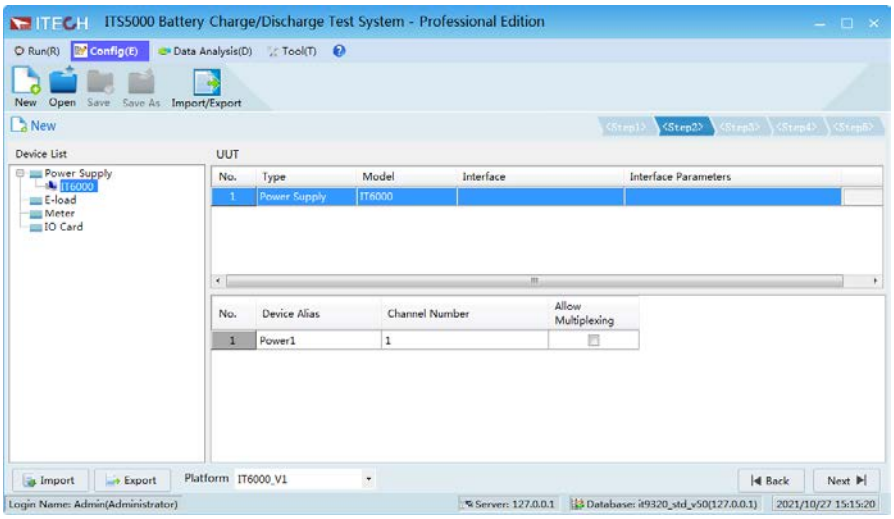


3. In the “Select Device” pop-up box, select the power supply model in the supporting hardware device of existing test system.

   If there are several devices with same model, the user can simultaneously add several devices by setting “Count”. “Mapping Name” is the mapping name of the instrument channel automatically generated by the system.

4. Click “OK”, and the Test Device column appears existing-configured power supply model.

   The channel information automatically generated by the system is displayed on the bottom area of the window.
   Include mapping name generated based on creating sequence, and channel number automatically generated based on instrument channel count.



   - No.: The device number in present device column.
   - Type: The device type in present device column.
   - Model: The device model.
   - Interface: existing communication interface for PC connection, which can be selected based on actual conditions.
   - Interface Parameters: detailed parameters of communication interface.
   - Device Alias: The alias name of device that generated automatically.
   - Channel Number: The channel number of device.

Note

- **Each device has corresponding channel information. The system automatically generates channel information based on instrument model. For example, IT5601 and IT5102 are multi-way measuring instruments. When such device is selected, the system automatically creates several channels.**
- **"Allow Multiplexing" is applicable to the situation where one CAN card corresponds to multiple DUTs. If it is not involved, please do not check it.**

5. Add “Measuring Instrument” and other devices in the same way.

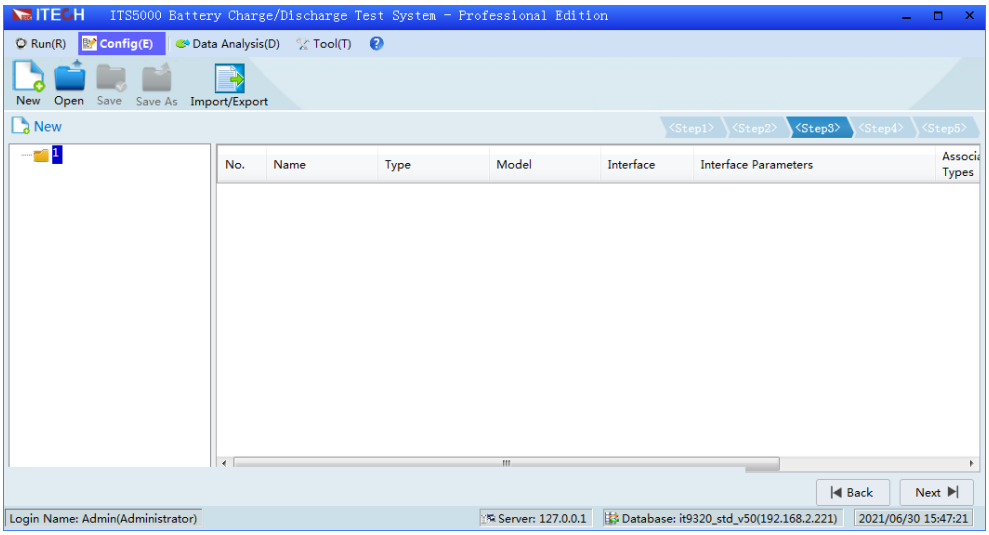
2.2.3 Configuring Channel

There is no one-to-one correspondence between the physical hardware device in the ITS5300 test system and the functional role in the actual channel. For example, IT64 series power supply can be used both as equalized charging power supply and equalized discharging load. Therefore, after configuration of physical hardware device, it is necessary to configure detailed information (such as channel power supply and load) in the system.

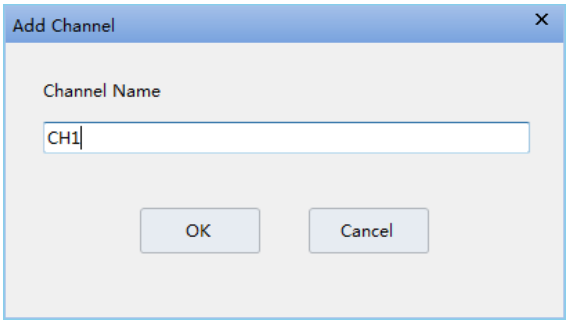
At first, the user creates grouping information. Each group can have several

channels, in which, each channel can be created with several test sequences, and each sequence comprises several work steps. The step3 Channel configuration means to configure physical hardware information necessary for all channels during test. Detailed configuration steps are as follows.

1. After hardware configuration, click “Next Step” to enter the step3 Channel Configuring Interface.



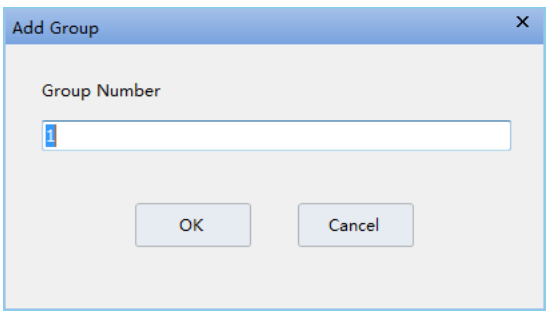
2. Select existed group (such as “1” in the figure above) from the left grouping column. Right click and select “Add Channel”, and input test channel name in the “Add Channel” pop-up box.



If several groups are required during actual test, refer to step 3 for adding. Otherwise, enter step 4.

3. Right click the left device area, and select “Add Group” from the pop-up menu. Input number of groups to be added in the “Add Group” pop-up box, and click “OK”.

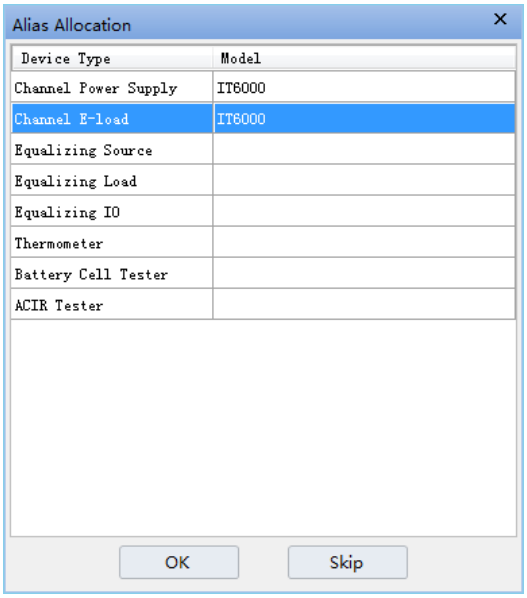
If “2” is input, 2 groups will be added, and each group is numbered from top to bottom.



4. Click “OK” and the system pops up the mapping relationship configuration

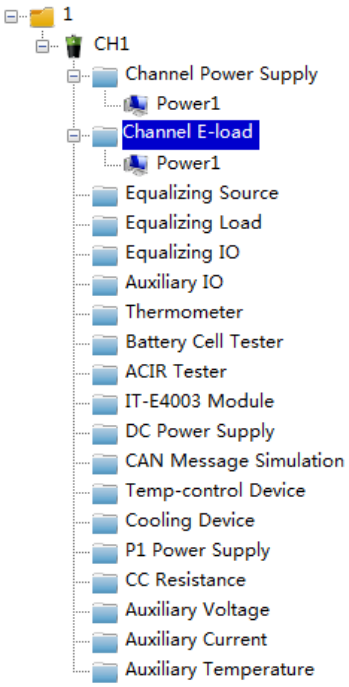
window of all virtual devices.

The user can directly configure device model corresponding to each device type in this window. The user can also skip this step and make additional setting in the left window.



Note: Equalizing Source / Equalizing Load is a situation where the battery pack contains multiple cells. If your DUT does not involve cells, you do not need to set related parameters.

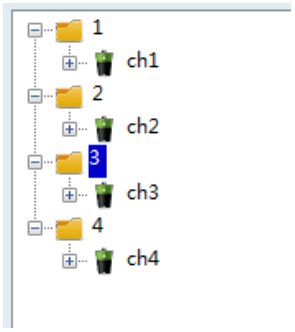
5. Click “OK” and all device information of the existing channel will be displayed.



Note: For example, "Temp-control Device", "Cooling Device", etc., are customized, optional types of equipment, if your system is not configured with related hardware, you do not need to configure here.

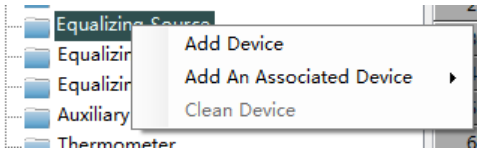
The following is a sample configuration screenshot. Taking the 4-channel IT6000 series equipment as an example, configuring it in the following way

(i.e. setting up 4 groups) can achieve 4 channels of simultaneous runs, which can relatively improve the test efficiency compared to adding 4 channels in a single group (4 channels perform tests in turn).



- The user can independently configure physical device information for the virtual device. Select virtual device type, and right click and select “Add Device”. Select mapping relationship between this virtual device and physical device in the pop-up box. The user can also remove existing device information or add associated device. The instructions are as follows.
  - Add device

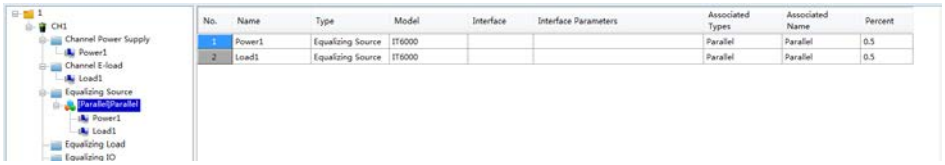
    Configure physical device information for the present selected virtual device.



  - Add an associated device

    Configure associated device information for the present selected virtual device such as series or parallel.

    The figure below displays two devices connected in parallel mode, in right of interface shows the device information.



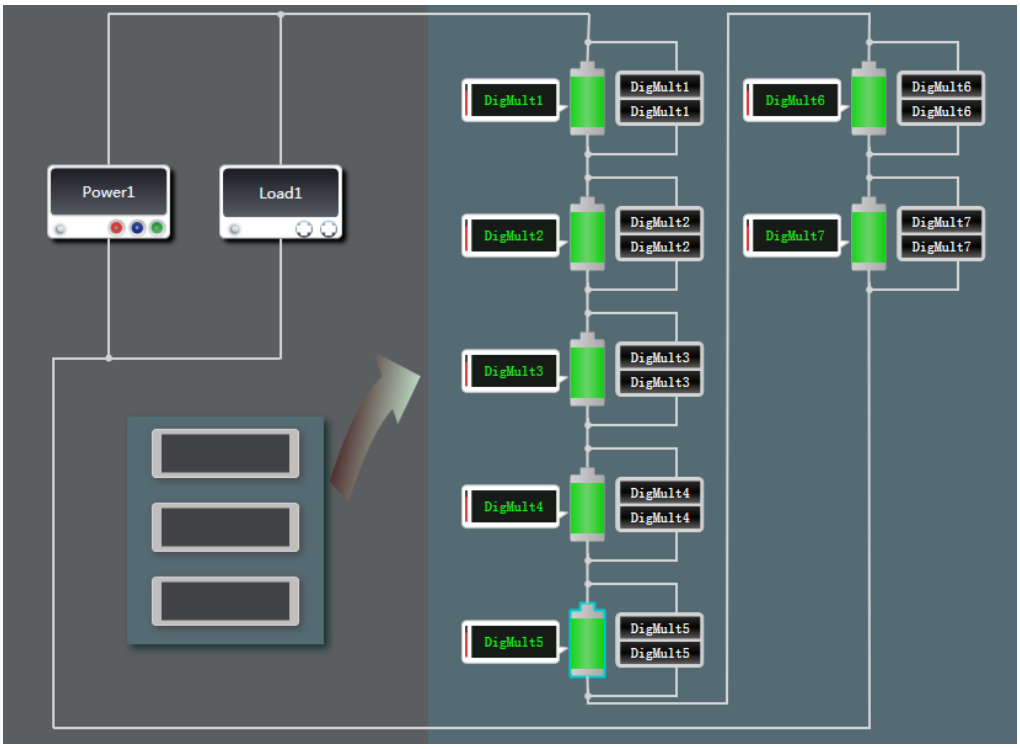
  - Clean device

    Remove the added physical devices from the virtual mapping relationship.

2.2.4 Deploying Hardware Device

After configuration of channel information, click “Next Step” to Step4 check the schematic diagram of existing channel configuration and to deploy test configuration.

Under initial status, the cell count is 1. If the user needs to add cell count, right click the battery and select Setting Cell Count to add cell counts of existing channel or all channels.

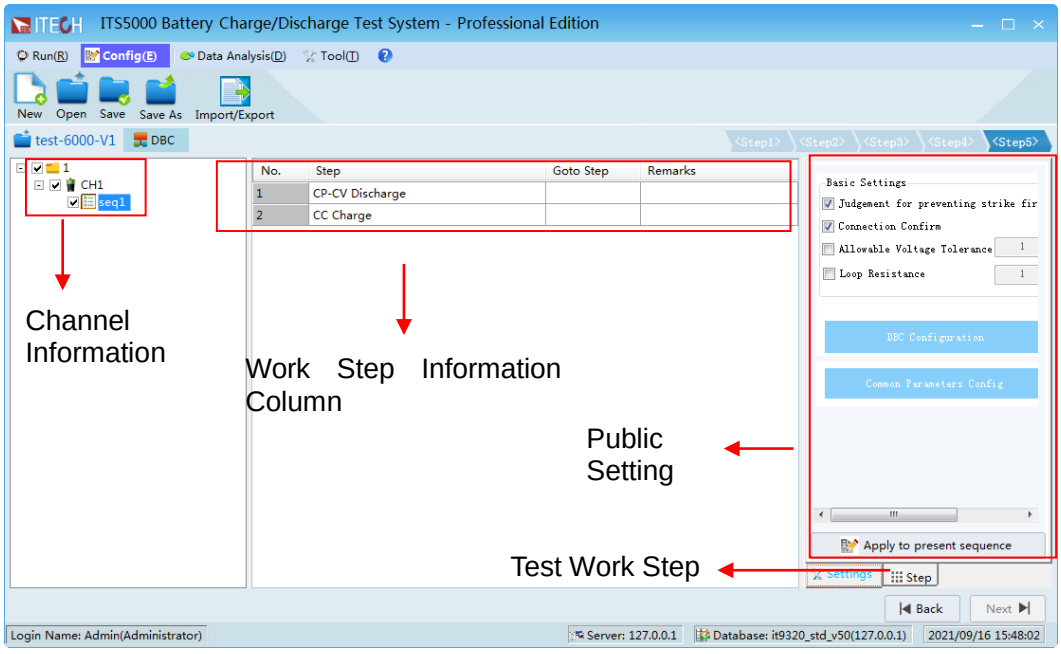


On this page, the system automatically numbers each cell starting from 1, and displays corresponding relationship between the battery and the device during measurement. The user can right click the battery for “Custom Rename”, “Auto Rename” and “Reset Device”.

2.2.5 Configuring Test Items

Each test sequence has a specific test requirement. Based on the test requirement, the user can add different test items for each sequence to form specific test steps.

1. After hardware device deployment, click “Next Step” to enter the Step5 Configuring Test Work Step interface.

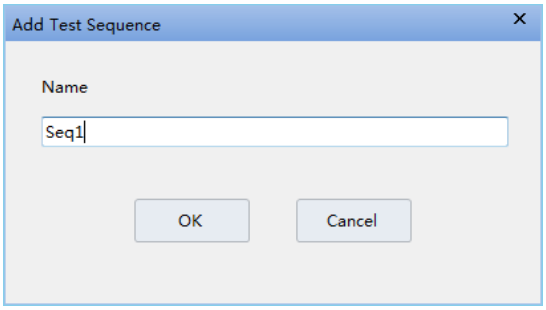


- Channel information: display channel information configured by the user.

The user can select channel and add test sequence for the channel.

- Work Step Information Column: display information of the work step added in the sequence. The user can select and edit the work step parameter.
- Public Setting: alarm setting, protection setting, sampling rate and protection data condition. After this setting, the user can click “Apply to existing sequence” to uniformly apply this setting to each work step of this sequence.
- Test Work Step: detailed steps forming the test sequence.

2. Select CH1 channel, and right click and select “Add Test Sequence”. Input test sequence name in the pop-up box.



3. Click “OK” to display existing test sequence information in the left channel information column. Select this test sequence Seq1. The user can edit detailed test work steps for this test sequence. Detailed steps are as shown below.

Add Test Work Step

The test work step serves as the subject of the test program. The “Test Work Step” column at the right bottom corner of the interface provides different test methods. The user can double click the test work step needed to add it into the Work Step Information Column. Several work steps form a test program sequence based on sequence, and are executed based on sequence.

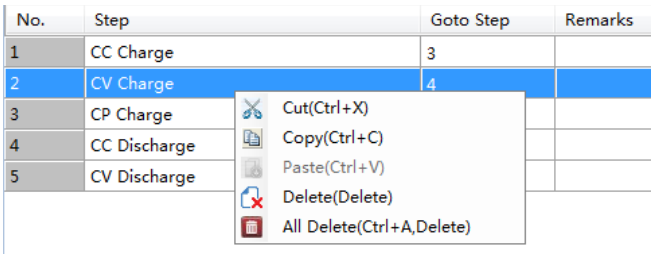
Double click corresponding work step in the “Work Step Information Column” to open detailed parameter setting page of this work step.

1. Double click the test work step in the “Test work step” column to add it into the work step information column.
2. Double click corresponding test work step in the “Work Step Information Column” to edit work step information.

   The work step information divided into five tabs include “Working Mode”, “Basic Setting”, “Cut-off Conditions”, “Alarm”, “Protection”. Different work steps have different parameter setting interfaces. For detailed description of work step parameters, please refer to **2.3Introduction of Test Items**.
3. After the test step is added, you can customize the execution sequence of the test step and set the sequence number to jump to the next step.

No.	Step	Goto Step	Remarks
1	CC Charge	3	
2	CV Charge	4	
3	CP Charge		
4	CC Discharge		
5	CV Discharge		

Also you can select a test step and right click to select copy, delete, or other operation.

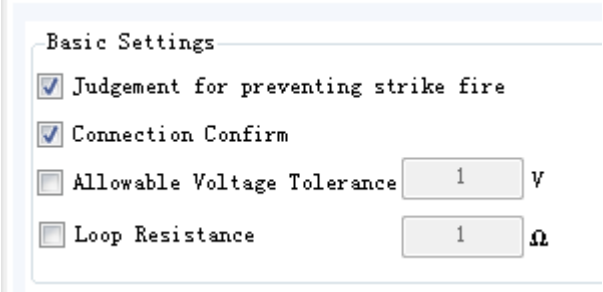


4. After the test step sequence adjustment is completed, double-click a step command to open the edit page of the step to set the parameters (for details, see **2.3Introduction of Test Items**).
5. When the parameter settings for the test step are completed, click OK.

2.2.6 Public Setting

The user can set public settings for each sequence at the right side of Step5 interface, and apply the existing setting value to all settings of the sequence.

Settings



- Basic Settings
  - Judgement for preventing strike fire: Identifies whether the system is equipped with an anti-sparking module. If yes, select this item, otherwise, do not select this item.
  - Connection Confirm: Judge the DUT connection state and the voltage value of DUT is 1V, please tick it off in the box always.
  - Allowable Voltage Tolerance: The allowable voltage difference between with charge voltage and battery voltage, if tick it off in the box, if the difference is larger than this setting, the test cannot be executed.
  - Loop Resistance: It is used to set the impedance judgment value in the test circuit. During the execution of the test, the current and voltage in the loop will be collected in real time, and then calculated to obtain the actual impedance value in the loop, which is compared with the set value here. If the set value is exceeded, the test will stop.

DBC

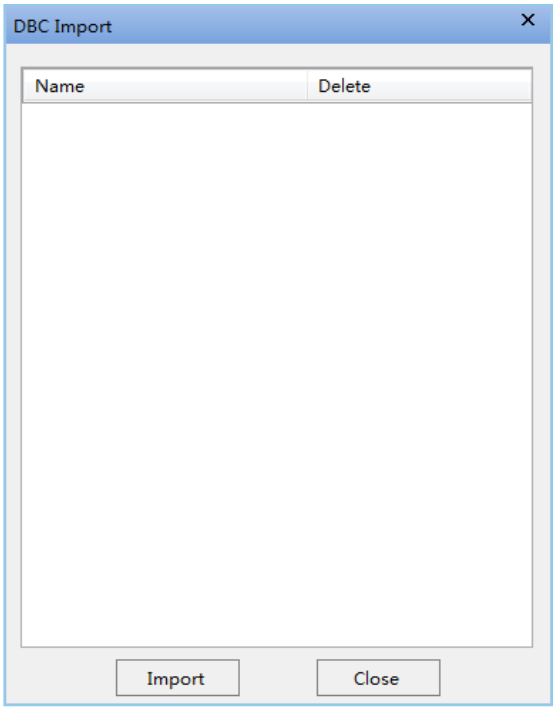
The software provides control interfaces for special devices and systems, and supports the parsing of CAN communication protocols, sending and receiving of messages and handling of related data. The interface is available for import of DBC files related to CAN communication so that the sub-module can automatically parse and handle different protocols.

1. Click the “DBC” button at the left top of the interface. Select to import or create new DBC files.

Select Import: Import existing DBC files from the local.

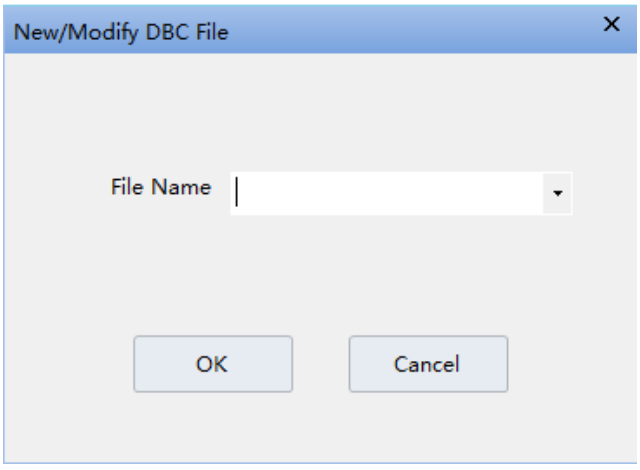
Select New/Modify: The user can create a new DBC file or select and edit existing DBC file in the system based on original CAN message.

- Import existing DBC file, and select Import. Click “Import” in the popped-up Import box, and select the DBC file.



After the importing is completed, close the “DBC Import” window.

You can click “DBC” button at the left top of the interface again, and select “New/Modify” to modify the DBC file, or create a new DBC file.



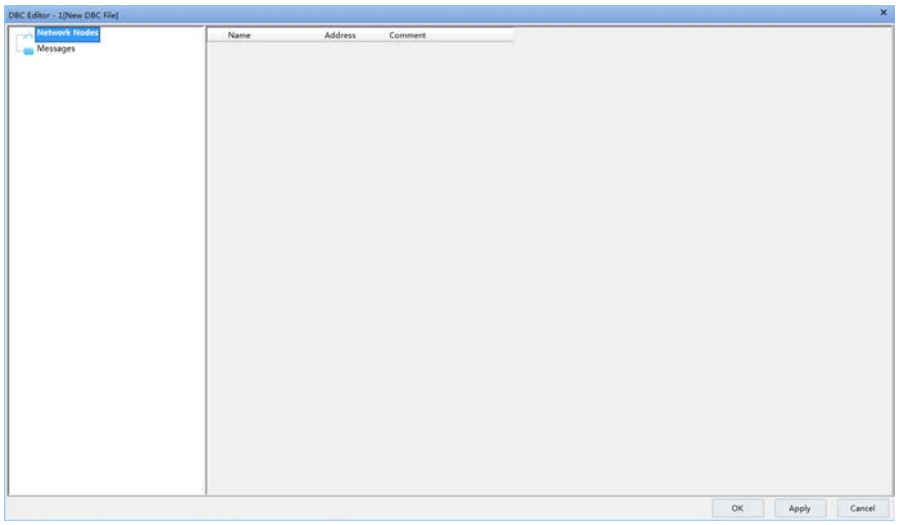
  - Fill in the new file name in the window, and click “OK” to create new DBC file and enter the editing status.
  - Select the file name in the window, and click “OK” to edit the existing DBC file.

- Create a new DBC file.

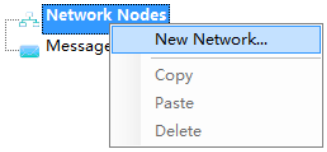
  a) Fill in the new file name in the window, and click “OK” to enter the

editing status.

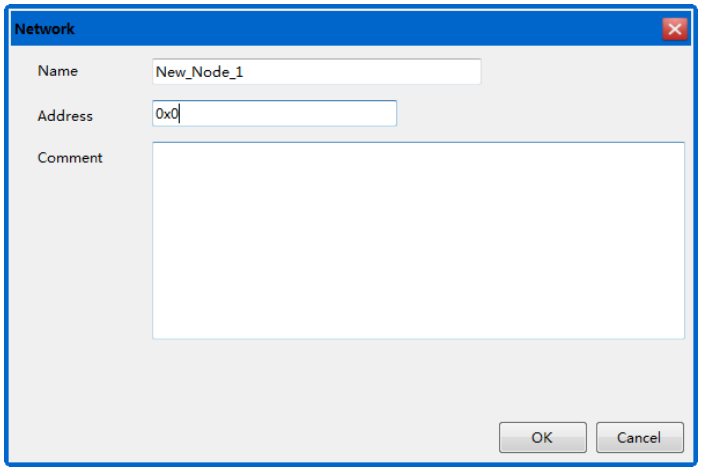
The user can edit and modify the real-time messages or add new message information in the Editing interface.



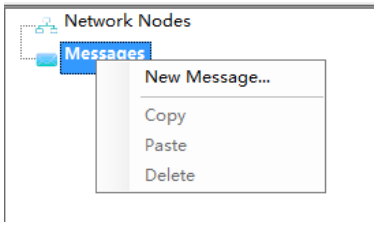
b) Right-click "Network Nodes" to add a node and other operations.



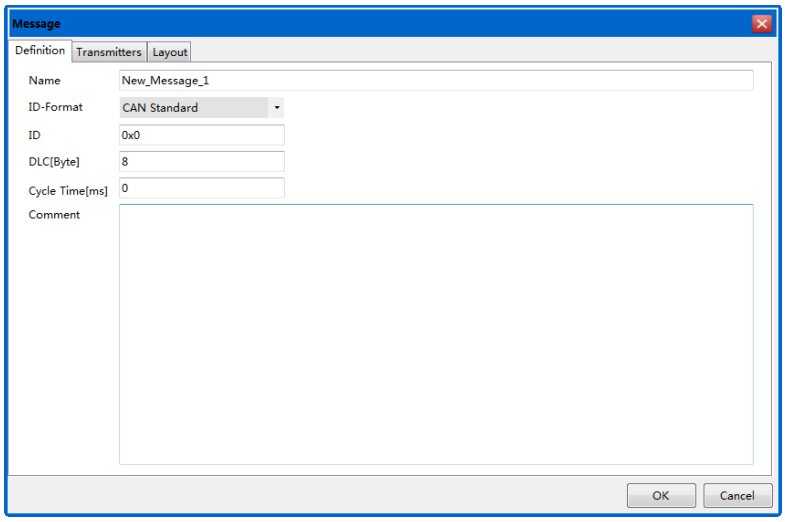
c) Edit the details of the network node.



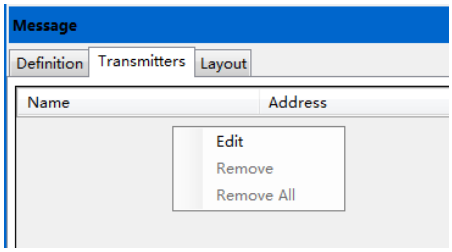
d) Right-click "Messages" to add a message and other operations.



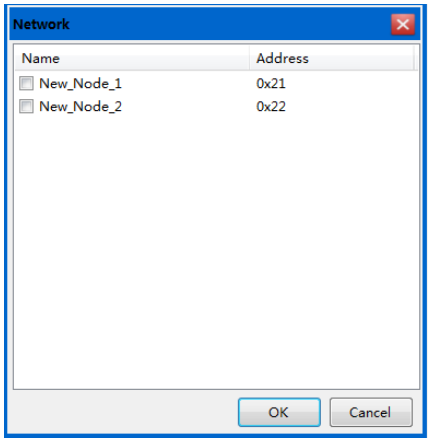
e) Edit the details of the message.



f) Select the **Transmitters**, right click on the blank and select **Edit**.

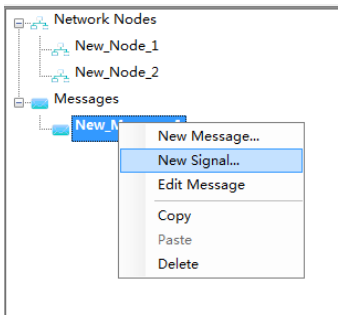


g) Select the network node.

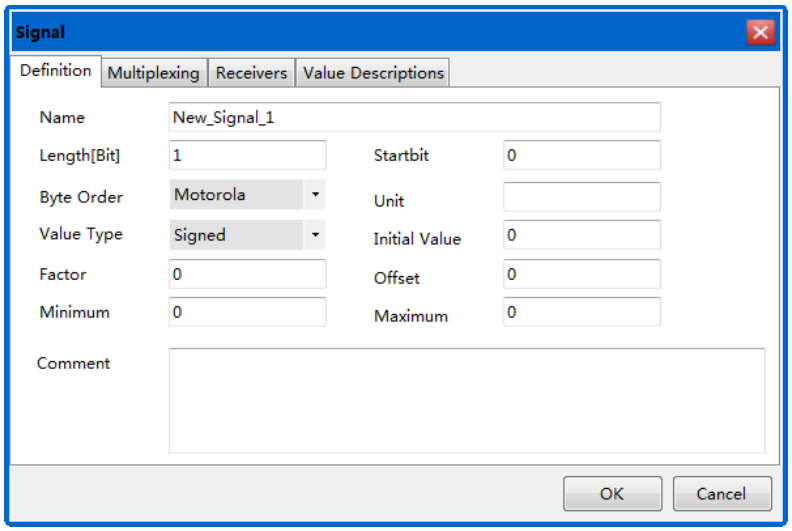


h) After the message details are set, click **OK**.

i) Right-click the message information to add signals and other operations.



j) Edit the detailed signal information.



k) After the signal details are set, click OK.

l) After the above information is set, click OK on the DBC Editor interface.

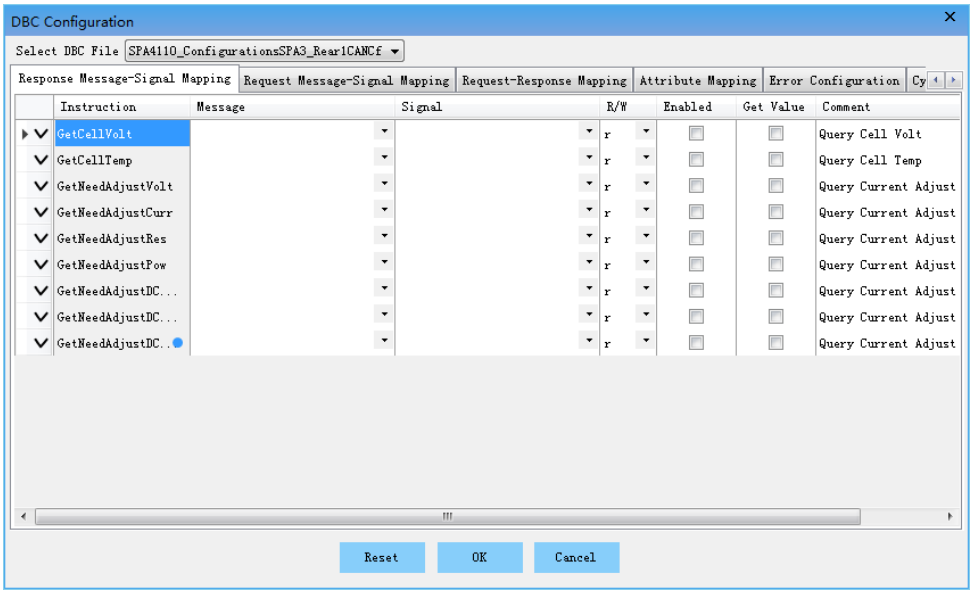
2. DBC file configuration.

- Select the test sequence in the left column. If the test sequence is not created, it is unable to execute the DBC configuration.
- Click “DBC Configuration” in the public configuration, and set the DBC configuration for this test sequence.

  – Response Message-Signal Mapping

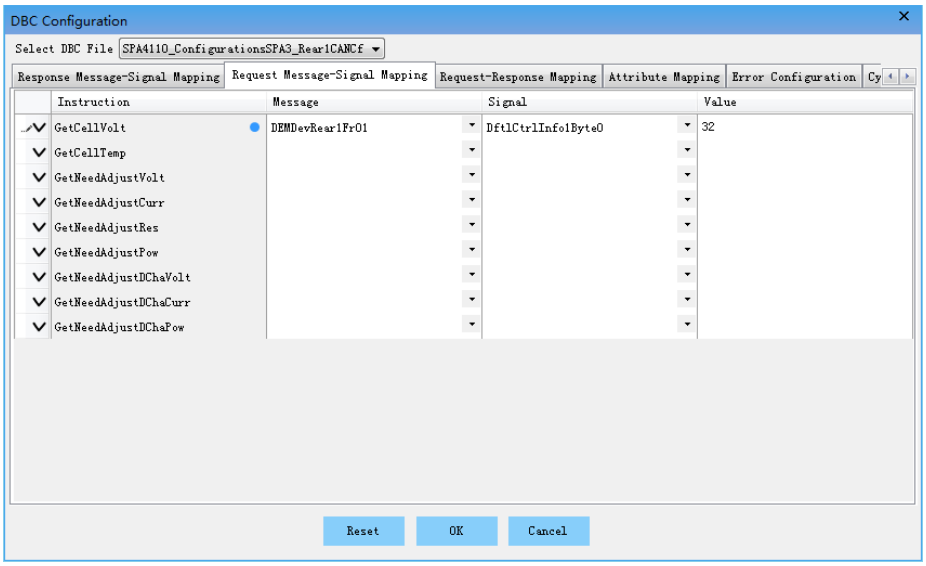
  Indicates that the message information from the battery is continuously received.

  The user can configure corresponding message name and corresponding signal name based on the real-time command function. After the configuration is completed, tick and initiate this option.



  – Request Message-Signal Mapping

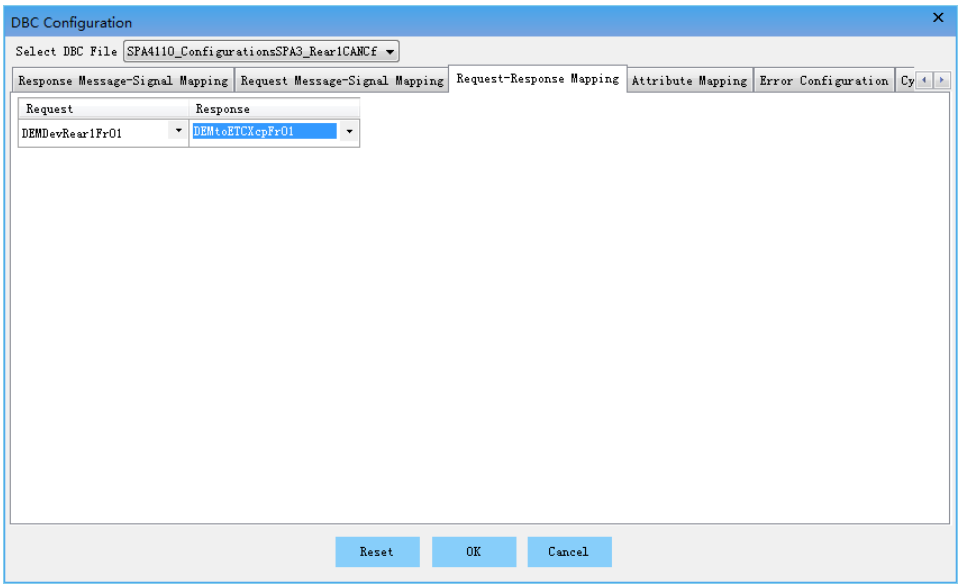
  Indicates that a request message needs to be sent before receiving a message, and the battery sends a response message after receiving this request message.



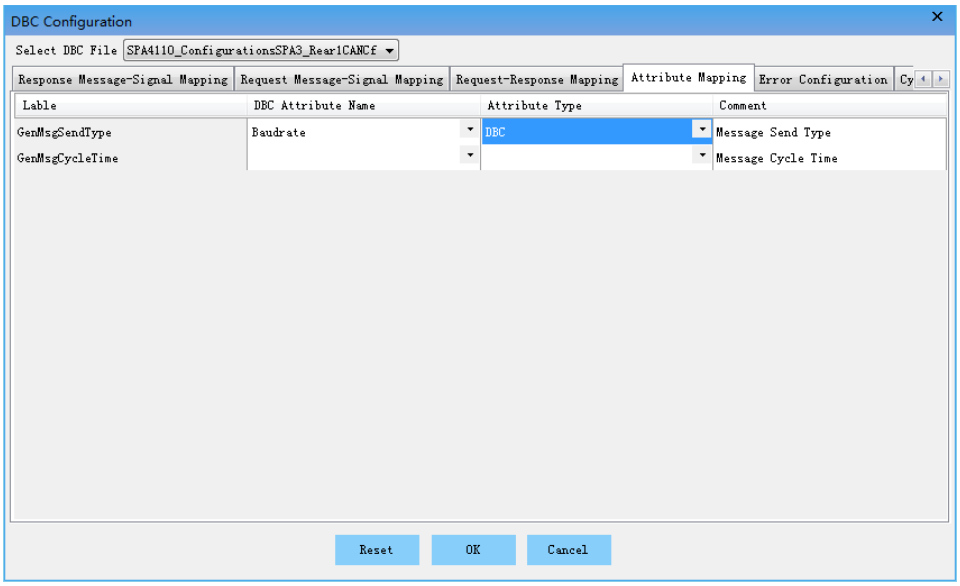
– Request-Response Mapping

Configure the mapping relationship between request message and response message.

Right-click in the blank and select Add to configure the request-response message mapping relationship.



- Configure “Attribute Mapping”. If the user redefines the property in the DBC file, it is necessary to configure the corresponding mapping relationship in the “Attribute Mapping” tab. If the definition in the DBC file is consistent with the naming method of the system, no setup is required.



Label: the property name of the message sending type of the DBC file in the system, and the property name of the recycled sending time interval of messages.

DBC Attribute Name: the name in the actual DBC file to which the property corresponds, which can be selected based on the DBC definition.

Attribute Type: the objective type to which the property belongs, which can be automatically displayed based on selected property.

Comment: the explanation of the property.

At the same time, you can customize the **Label** and **Comment** of **Message Signal Mapping** and **Attribute Mapping** with the built-in tools of the system.

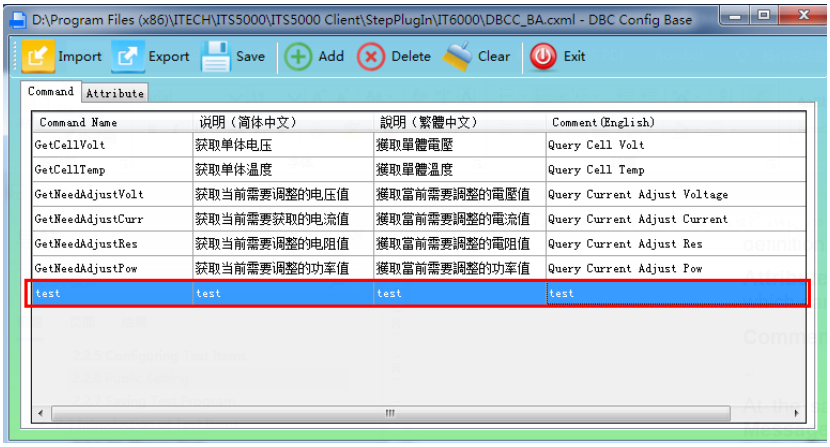
i. Enter the system software installation directory, for example:

   D:\Program Files (x86)\ITECH\ITS5000\ITS5000 Client\StepPlugIn\IT6000

ii. Run the **DBCConfigBase.exe**

iii. Click **Import** and select **DBCC_BA.cxml**

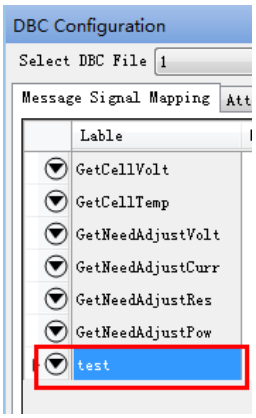
iv. Select the **Command** or **Attribute** tab and click **Add** to add and set.



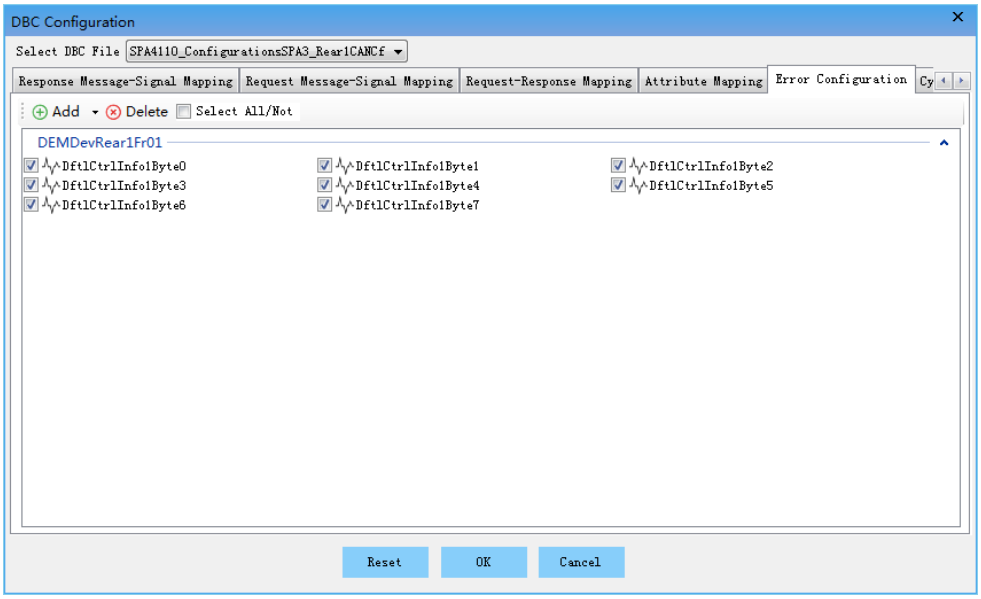
v. When the setup is complete, click **Save**.

vi. Close the **DBCConfigBase.exe**

vii. Click **DBC** on the **Step 5** interface and a user-defined **Label** will appear.



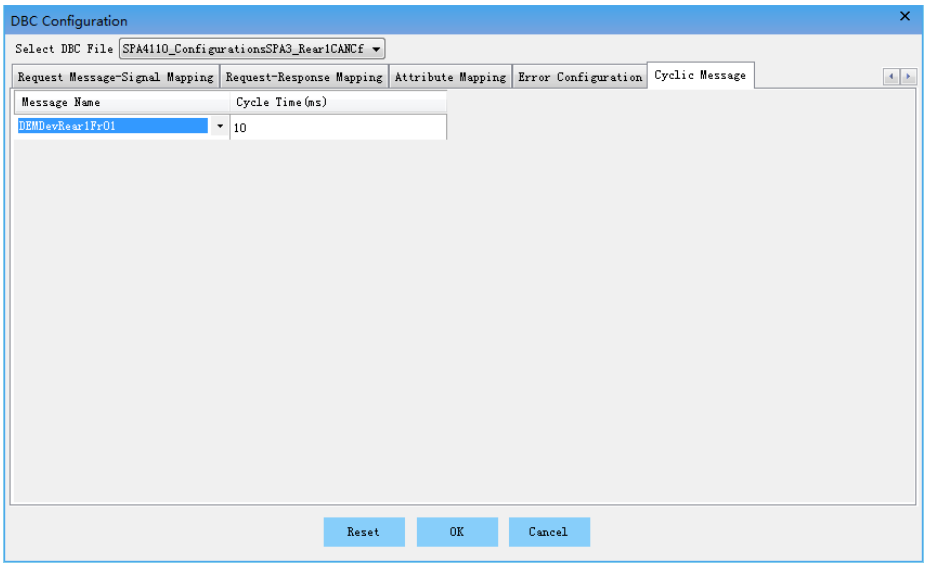
- Configure “Error Configuration”: define the fault message information in this system.



Click “Add”, and select the name of message to be added. By default, the system will tick all message signals. The user can select specific message signal as the fault message information based on requirements. The system will stop test after receiving the fault message.

Select the message signal, and click “Delete” to delete the message information.

- Configure “Cyclic Message”. If the user wants to modify the message cycle time, the user can directly define the message recycle time in this tab. After the configuration is completed, the message cycle will be subject to this configuration.



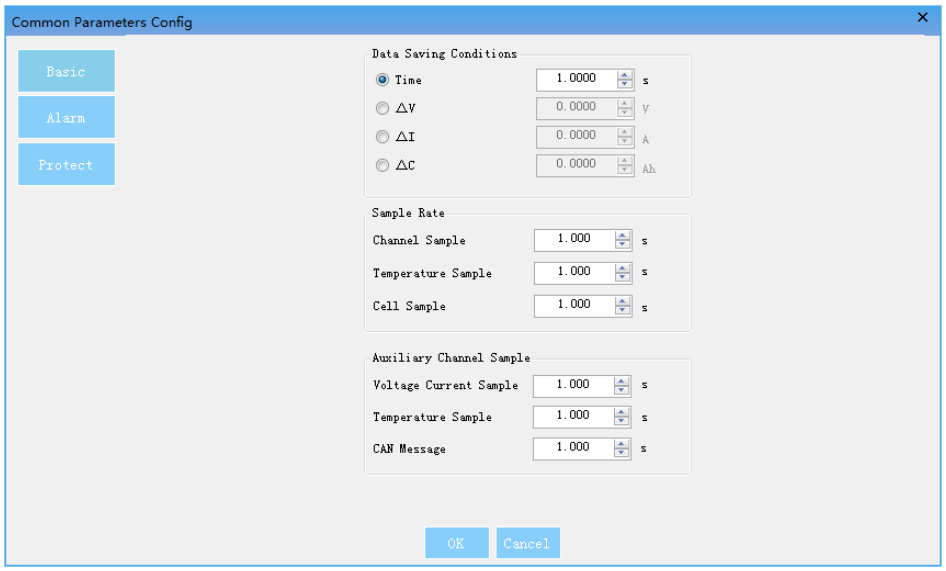
Right click the blank and select “Add”, select the required message name in the drop-down list to set the recycle interval time.

Select the message signal, and right click “Delete” to delete this message information.

- After the above information is set, click OK on the DBC Configuration interface.

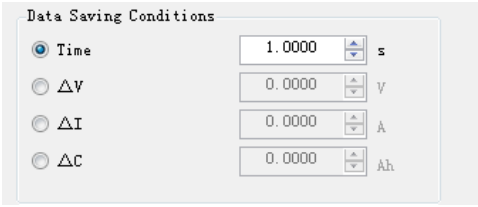
Common Parameters Config

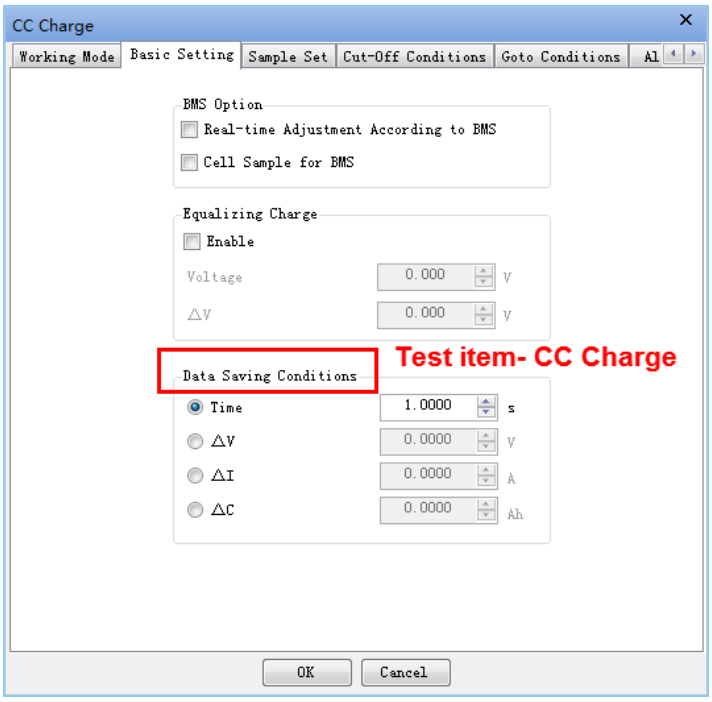
- “Basic”



Select one of the time, voltage difference, current difference, and capacity difference, and set the condition value for trigger data saving. When the condition is met, the system will automatically save the test data.

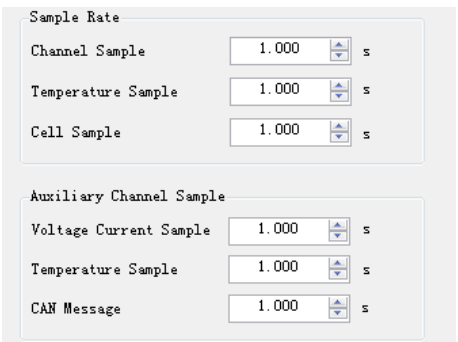
The setting here is the same as the "Data Saving Conditions" function tab in each test item "Basic Setting", here is the unified setting (after applying to the sequence). You can also set each test item separately, and the priority in the test item is higher.

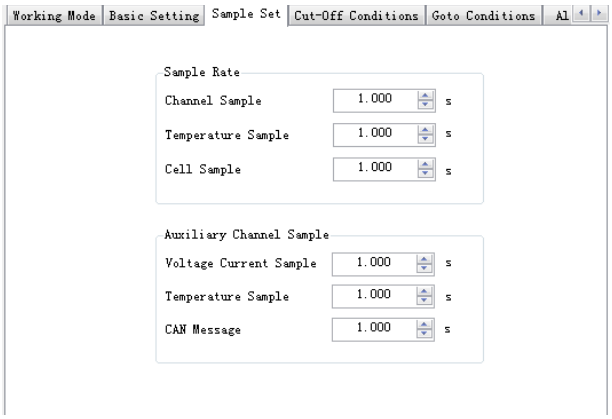




Parameters	Description
Time	Time interval for saving data, indicating that data is saved every X seconds, wherein, X is a setting value
ΔV	Compare sampling voltage values. When difference between them meets setting value, the data is saved.
ΔI	Compare sampling current values. When difference between them meets setting value, the data is saved.
ΔC	Compare sampling capacity values. When difference between them meets setting value, the data is saved.

The setting here is the same as the "Sample Set" function tab in each test item, here is the unified setting (after applying to the sequence). You can also set each test item separately, and the priority in the test item is higher.



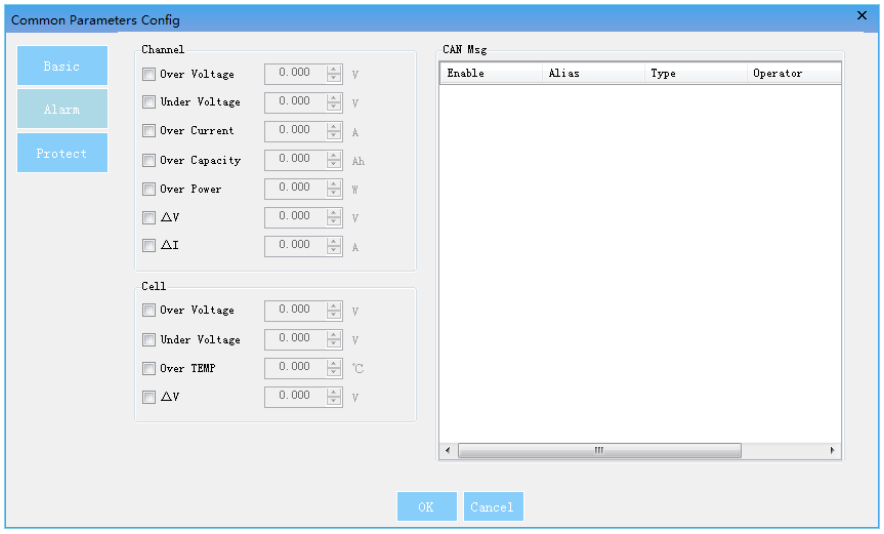


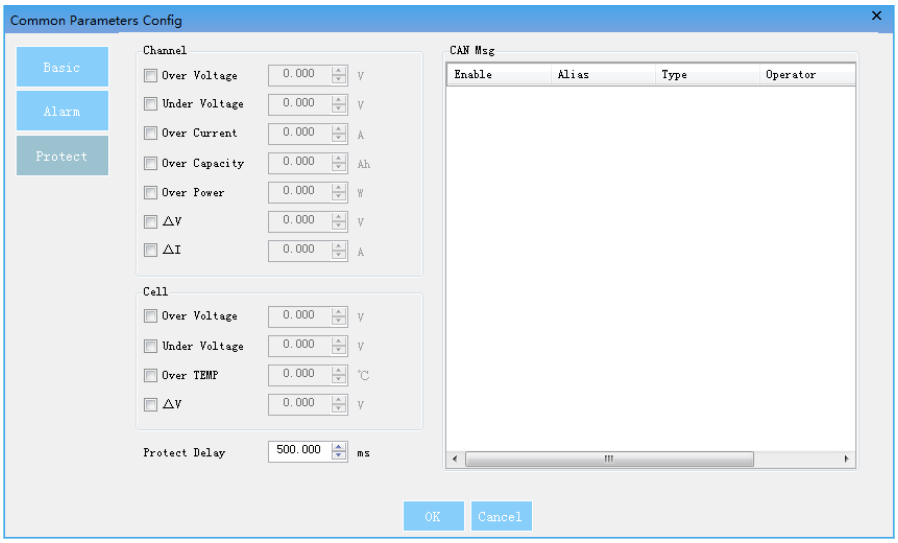
Parameters	Description
Channel Sample Rate	Channel Sample Rate
Temperature Sample Rate	Temperature Sample Rate
Cell Sample Rate	Cell Sample Rate
Voltage Current Sample	Auxiliary Channel Sample
Temperature Sample	
CAN Message	

- Alarm/Protection

The parameter settings for the alarm and protection functions are basically the same. The system determines whether an alarm or protection is generated based on the trigger condition and the set value. The difference is that after the alarm is triggered, the alarm information is generated, but the test process is not interrupted (for example, the output of the power supply device will not be turned off); after the protection is triggered, the test will be stopped (for example, the output of the power supply device is turned off).

The setting here is the same as the "Alarm"/"Protection" function tab in each test item, here is the unified setting (after applying to the sequence). You can also set each test item separately, and the priority in the test item is higher.





Parameters	Description
Channel Over Voltage	If channel voltage is higher than voltage setting value, the system gives alarm/protection.
Channel Under Voltage	If channel voltage is lower than voltage setting value, the system gives alarm/protection.
Channel Over Current	If channel current is higher than current setting value, the system gives alarm/protection.
Channel Over Capacity	If channel capacity is higher than capacity setting value, the system gives alarm/protection.
Over Power	If channel power is higher than power setting value, the system gives alarm/protection.
Channel ΔV	If channel voltage fluctuation higher than voltage setting value, the system gives alarm/protection.
Channel ΔI	If channel current fluctuation higher than current setting value, the system gives alarm/protection.
Cell Over Voltage	If DUT voltage is higher than voltage setting value, the system gives alarm/protection.
Cell Under Voltage	If DUT voltage is lower than voltage setting value, the system gives alarm/protection.
Cell Over Temperature	If DUT temperature is higher than temperature setting value, the system gives alarm/protection.
Cell ΔV	Compare sampling voltage value and highest voltage value during test. When difference between them meets setting value, the system gives alarm/protection.
Protect Delay	Delay time of system protect

2.2.7 Saving Test Program

After test program configuration is completed, the user can click “Save” or “Save As” in the Tool column to save the configured test program or save it as another file name. If the existing test program is a newly-created test program, the user needs to input the test program file name at the time of saving.

2.3 Introduction of Test Items

The test sequences in the test program are formed by different test work steps based on sequence. Each work step is a step. The user needs to edit values for each step based on test requirements. Detailed description will be given below for parameters and editing methods of all test work steps in this system.

For the steps related to the battery charge and discharge test, the parameter settings of the "Basic Setting", "Cut-off Conditions", "Alarm", and "Protection" tabs are identical. The following is a general introduction to the setting methods of these types of parameters.

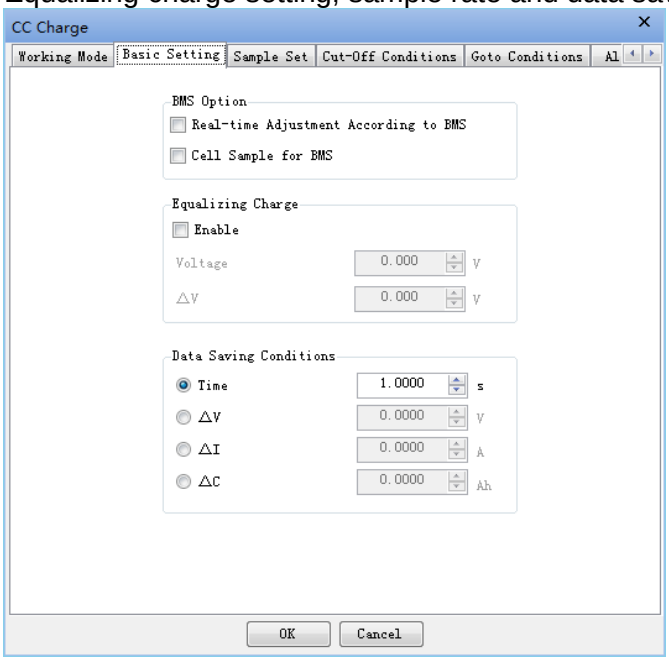
Attention: The test item involves the setting parameters of charging and discharging current values, which need to be distinguished, charging current shall be set to positive value and discharging current shall be set to negative value.

- **Pulse mode:** When charging and discharging test items include pulse mode, in addition to supporting the editing mode of the test item interface, it also supports importing Excel.

  When selecting "Excel Import", the newly created template parameters are introduced as follows:

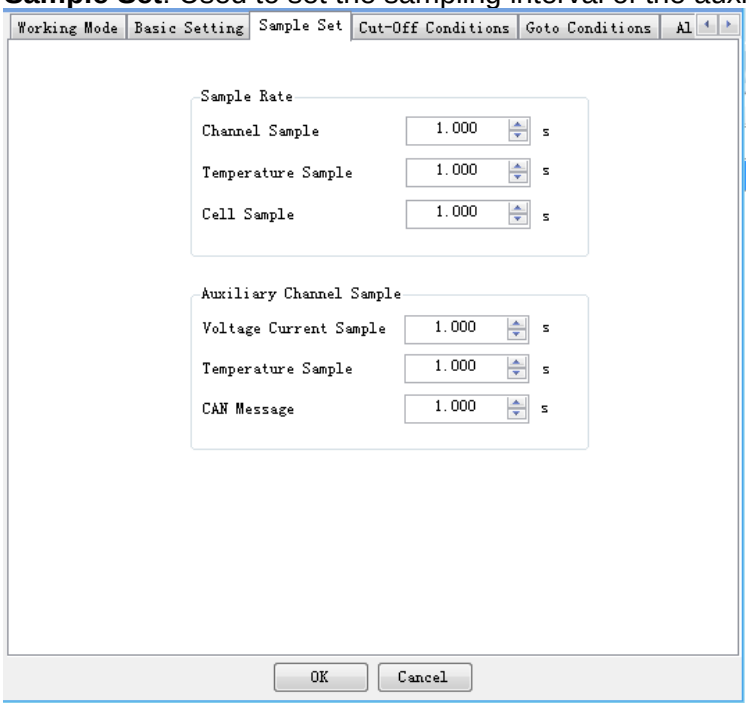
Parameter	Description
Sub Wave Count	The number of wave files, keep the default settings, no need to modify.
Waveform1 Type	Waveform type, keep the default setting, no need to modify.
Step Count	The total number of steps. The number set here must be consistent with the number of Value rows below.
Mode	The working mode of the device (CC/CV/CP), keep the default setting, no need to modify.
LIMIT+(V)	The maximum value of output voltage, that is, the set value of **Vh**, represents the rated voltage value of battery charging.
LIMIT-(V)	The minimum value of the output voltage, that is, the set value of **Vl**, represents the cut-off voltage value for battery discharge.
Repeat	The number of repetitions of List, setting range: 1~65535.
value(A) / value(W)	The current value or power value of a single step. **Note: The charging current/power is set to a positive value, and the discharging current/power is set to a negative value.**
Slew Rate(s)	The slope of a single step.
Pulse(s)	The pulse width of a single step.

- **Basic Setting**: configuring the basic settings for work step, include Equalizing charge setting, sample rate and data saving conditions.



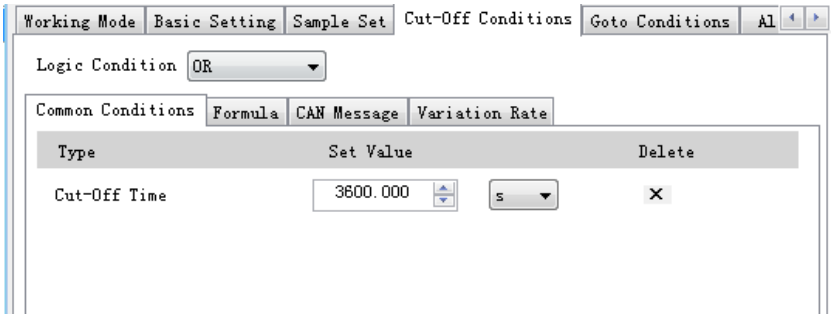
Item	Parameter	Description
BMS Option	Real-time Adjustment According to BMS	Tick it off in the box indicates the BMS system adjusts the charging/discharging voltage value or current value in real time.
	Cell Sample for BMS	Whether the voltage of the battery chip is read by the BMS system. If this item is selected, it is read from the BMS system, otherwise it is read from the IT5102.
Equalizing Charge	Enable	Indicates whether the charge equalization function is enabled during the charge test. If this option is checked, the charge equalization function is enabled.
	Voltage	Indicates the voltage value when the charge equalization function is performed.
	ΔV	Indicates the difference between the maximum voltage and the minimum voltage of the battery in the circuit during the charge test.
Save the Data Condition	Time	Time interval for saving data, indicating that data is saved every X seconds, wherein, X is a setting value
	ΔV	Compare sampling voltage values. When difference between them meets setting value, the data is saved.
	ΔI	Compare sampling current values. When difference between them meets setting value, the data is saved.
	ΔC	Compare sampling capacity values. When difference between them meets setting value, the data is saved.

- **Sample Set**: Used to set the sampling interval of the auxiliary channel.



Item	Parameter	Description
Sample Rate	Channel Sample	Sampling rate of the channel
	Temperature Sample	Temperature sampling rate
	Cell Sample	Sampling rate of cell
Auxiliary Channel Sample	Voltage Current Sample	Auxiliary channel voltage and current sampling interval
	Temperature Sample	Temperature sampling interval of auxiliary channel
	CAN Message	CAN message sampling interval

- **Cut-off Conditions**: configure the cut-off conditions for work step, right click in blank and add the condition.

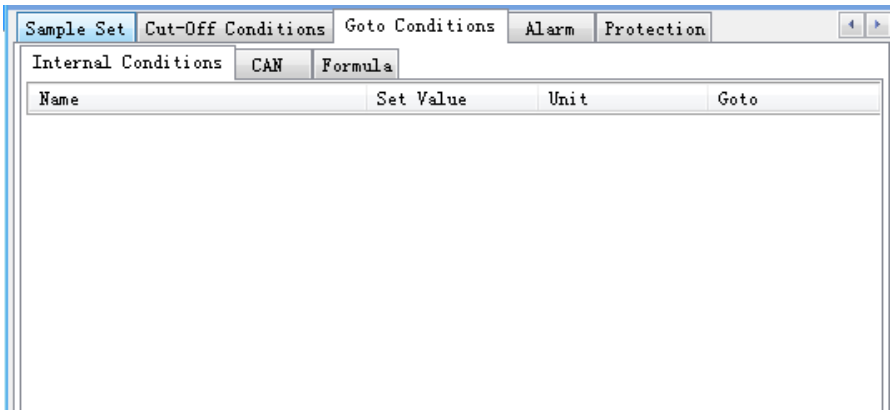


Note: Right-click on the blank space under the "Common Conditions", "Formula", "CAN Message", "Variation Rate" tabs and select "Add" to select the parameter settings for adding multiple cut-off conditions. The parameters displayed by different test items may be different. The following table covers all the descriptions of the cut-off condition parameters.

Item	Parameter	Description
Logic Condition	AND	Indicates that there is “AND” relationship between several cut-off conditions.
	OR	Indicates that there is “OR” relationship between several cut-off conditions.
Common Conditions	Cut-Off Time	The test is stopped when the cut-off time meets the setting value.
	Cut-Off Voltage	The test is stopped when the voltage meets the setting value. **Sampling from IT6000 channel**
	Cut-Off Current	The test is stopped when the current meets the setting value. **Sampling from IT6000 channel**
	Cut-Off Capacity	The test is stopped when the capacity meets the setting value. **Sampling from IT6000 channel**
	Cut-Off Energy	The test is stopped when the energy meets the setting value. **Sampling from IT6000 channel**
	Over Power	The test is stopped when the over power meetings the setting value. **Sampling from IT6000 channel**
	Voltage Fluctuation	The test is stopped when the voltage fluctuation meets the setting value. **Sampling from IT6000 channel**
	Current Fluctuation	The test is stopped when the current fluctuation meets the setting value. **Sampling from IT6000 channel**
	Cell Voltage	The test is stopped when the cell voltage meets the setting value. **Sampling from BMS or data recorder**
	Cell Temperature	The test is stopped when the cell temperature meets the setting value. **Sampling from BMS or data recorder**
	Cell ΔV	Compare the existing sampling voltage value with the maximum voltage value during the test process. The test is stopped when the difference of compared voltages meets the setting value. **Sampling from BMS or data recorder**
Formula	Name	The name of selected formula, which is defined in the “Tool” menu.
	Operator	The operator to be followed by the formula
	Set Value	The setting value of cut-off conditions. The test is stopped when the formula after calculation meets the setting value.
CAN Message	Message	The message name in the selected CAN message
	Operator	The operator to be followed in the CAN message
	Set Value	The setting value of cut-off conditions. The test is stopped when the CAN message after calculation meets the setting value.
Variation Rate	ΔTime	Set time range
	ΔVoltage	The test is stopped when the voltage change rate within the set time meets the setting value.

Item	Parameter	Description
	ΔEnergy	The test is stopped when the energy change rate within the set time meets the setting value.
	ΔCapacity	The test is stopped when the capacity change rate within the set time meets the setting value.
	ΔTemperature	The test is stopped when the temperature change rate within the set time meets the setting value.

- **Goto Conditions**: Indicates the relationship of going to the next step when the jump conditions are met. You can choose which step to jump to according to the set jump conditions.

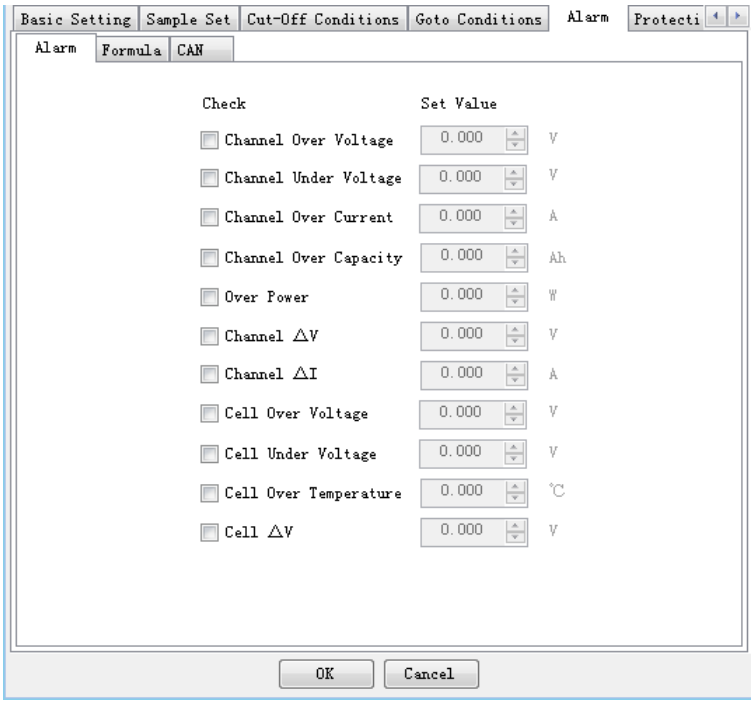


Right-click in an empty area and select "Add" to add a Goto Condition.

Item	Parameter	Description
Internal Conditions	Name	Internal condition name. Not editable.
	Set Value	Set the value of the Goto condition, that is, jump to the specified test item when the measurement reaches this value.
	Unit	The unit corresponding to the set value of the Goto condition.
	Goto	When this condition is met, it is used to specify which test item to jump to for execution.
CAN	Message	The message name in the CAN message.
	Operator	The operator to be followed in the CAN message
	Set Value	The set value of the Goto condition. When the CAN message meets the set value after operation, it will jump to the specified test item for execution.
	Goto	When this condition is met, it is used to specify which test item to jump to for execution.
Formula	Name	The name of the expression, which is defined in the **Tool** menu.
	Operator	The operator to be followed by the formula
	Set Value	The set value of the Goto condition. When the expression matches the set value after operation, it will jump to the specified test item for execution.

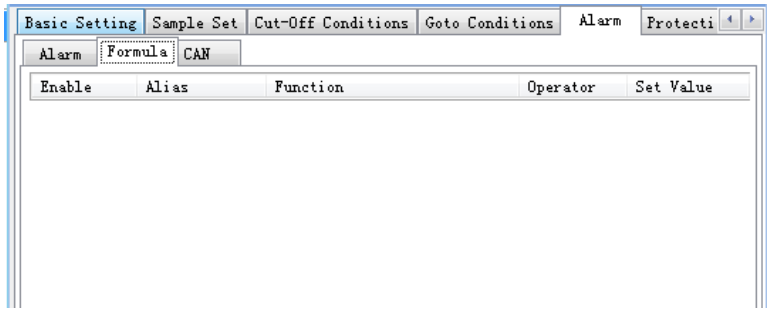
Item	Parameter	Description
	Goto	When this condition is met, it is used to specify which test item to jump to for execution.

- **Alarm**: configure the alarm conditions. The user can directly select the general alarm items, and set condition values. The user can right click the Formula tab to select Add. When the formula after calculation meets the setting value, an alarm is generated.

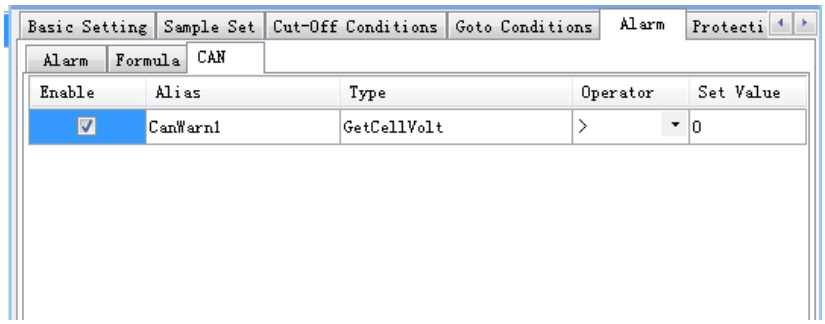


Alarm	Description
Channel Over Voltage	If channel voltage is higher than voltage setting value, the system gives alarm information.
Channel Under Voltage	If channel voltage is lower than voltage setting value, the system gives alarm information.
Channel Over Current	If channel current is higher than current setting value, the system gives alarm information.
Channel Over Capacity	If channel capacity is higher than capacity setting value, the system gives alarm information.
Over Power	If channel power is higher than power setting value, the system gives alarm information.
Channel ΔV	If channel voltage fluctuation higher than voltage setting value, the system gives alarm information.
Channel ΔI	If channel current fluctuation higher than current setting value, the system gives alarm information.
Cell Over Voltage	If DUT voltage is higher than voltage setting value, the system gives alarm information. When **Cell Sample for BMS** is selected, the corresponding message **getcellvolt**

Alarm	Description
Cell Under Voltage	If DUT voltage is lower than voltage setting value, the system gives alarm information. When **Cell Sample for BMS** is selected, the corresponding message **getcellvolt**
Cell Over Temperature	If DUT temperature is higher than temperature setting value, the system gives alarm information. When **Cell Sample for BMS** is selected, the corresponding message **getcelltemp**
Cell ΔV	Compare sampling voltage value and highest voltage value during test. When difference between them meets setting value, the system gives alarm information. When **Cell Sample for BMS** is selected, the corresponding message **getcellvolt**

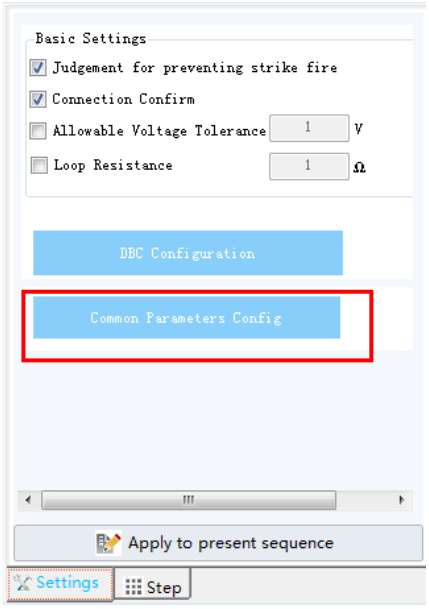


Formula	Description
Enable	Choose whether to enable the formula (the expression is defined in the "Tools" menu)
Alias	Alias of formula
Function	The name of the formula
Operator	The operator that the formula must follow
Set Value	The set value of the alarm condition. When the formula meets the set value after calculation, an alarm will be generated

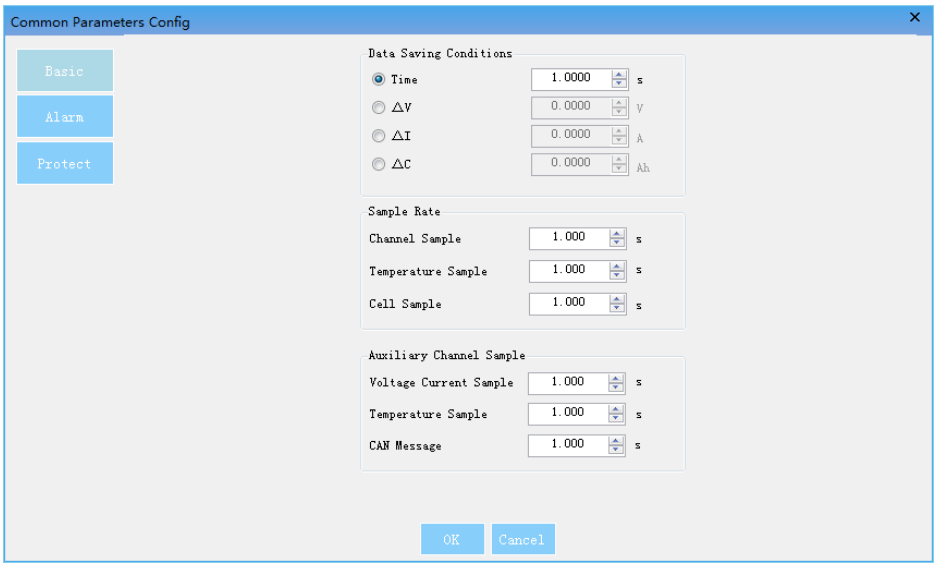


The setting method of CAN message trigger alarm:

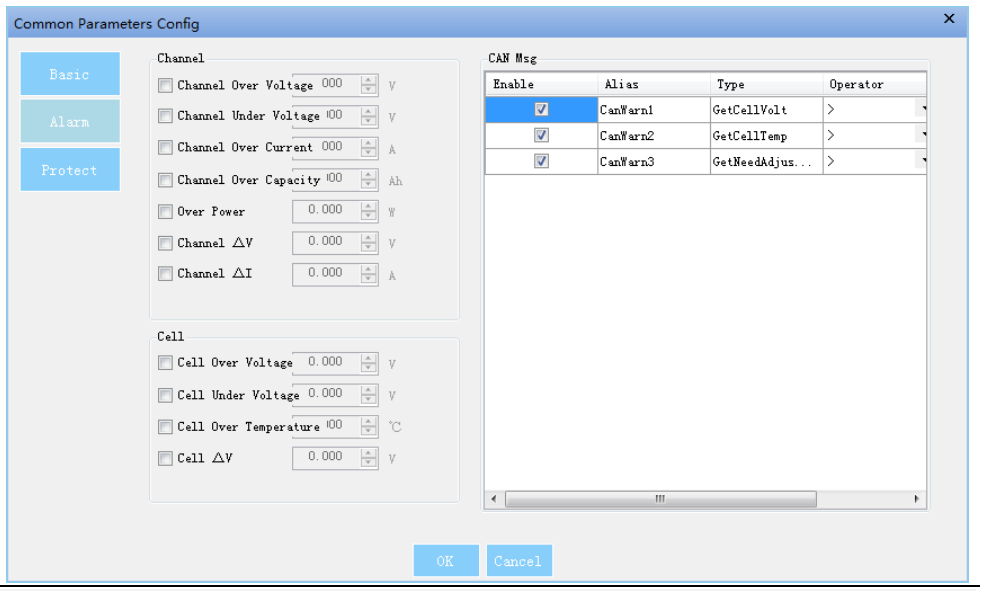
1. Click the "Common Parameters Config" button on the right side of the interface.



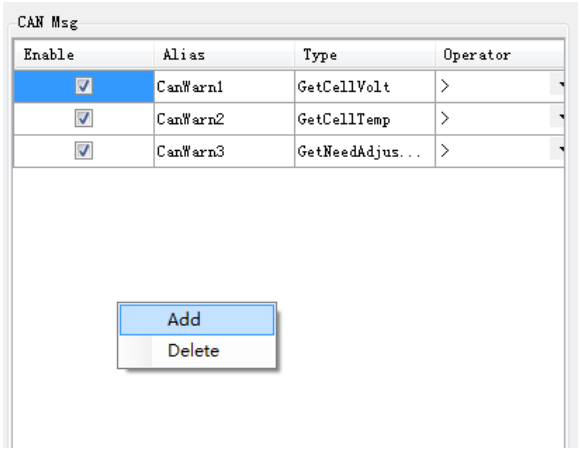
2. Select "Basic", "Alarm" or "Protect" in the opened interface.



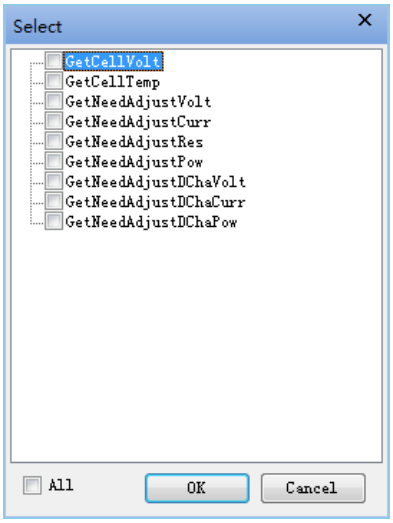
Take "Alarm" as an example, the interface displays as follows:



3. Right-click in the blank area on the right to add the alarm settings of the CAN message.

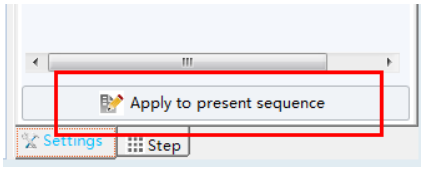


4. Select the message name and click "OK".



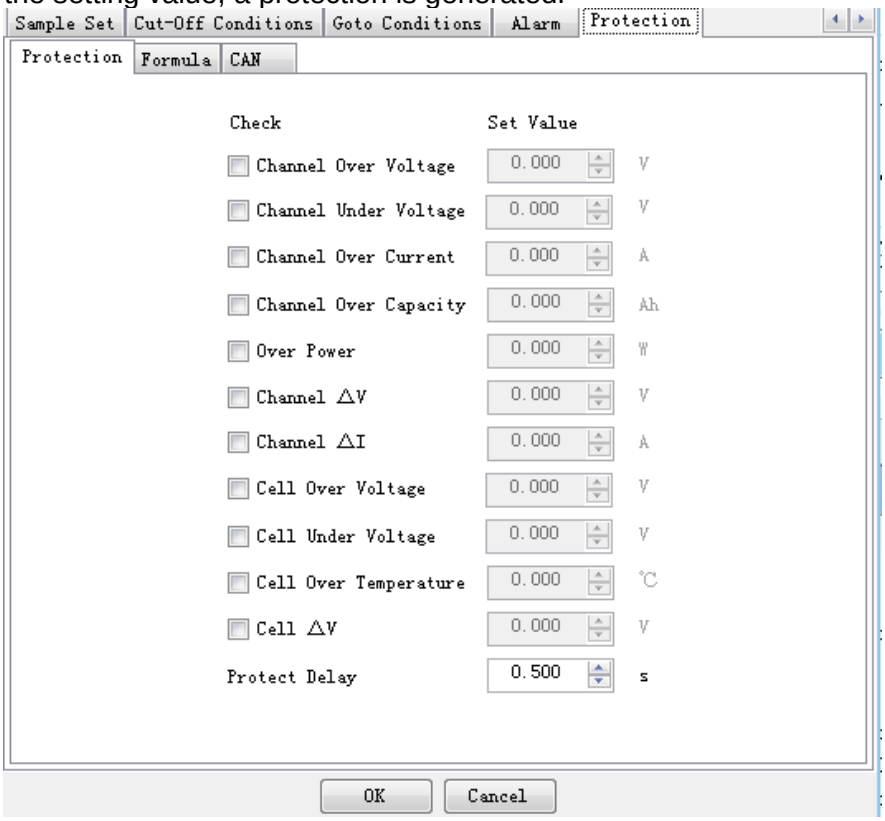
5. Set the "Alias", "Operator" and other parameters, and set the alarm trigger conditions.

6. After setting is complete, click "Apply to present sequence" and click "OK".



7. At this time, open the "Alarm" in the test item, and you can see the newly added CAN message options.

- **Protection**: set the protection conditions. The user can directly select the general protection items, and set condition values. The user can right click the Formula tab to select Add. When the formula after calculation meets the setting value, a protection is generated.



Protection	Description
Channel Over Voltage	If channel voltage is higher than voltage setting value, the system gives protect information.
Channel Under Voltage	If channel voltage is lower than voltage setting value, the system gives protect information.
Channel Over Current	If channel current is higher than current setting value, the system gives protect information.
Channel Over Capacity	If channel capacity is higher than capacity setting value, the system gives protect information.
Over Power	If channel power is higher than power setting value, the system gives protect information.
Channel ΔV	If channel voltage fluctuation higher than voltage setting value, the system gives protect information.
Channel ΔI	If channel current fluctuation higher than current setting value, the system gives protect information.
Cell Over Voltage	If DUT voltage is higher than voltage setting value, the system gives protect information. When **Cell Sample for BMS** is selected, the corresponding message **getcellvolt**
Cell Under Voltage	If DUT voltage is lower than voltage setting value, the system gives protect information. When **Cell Sample for BMS** is selected, the corresponding message **getcellvolt**

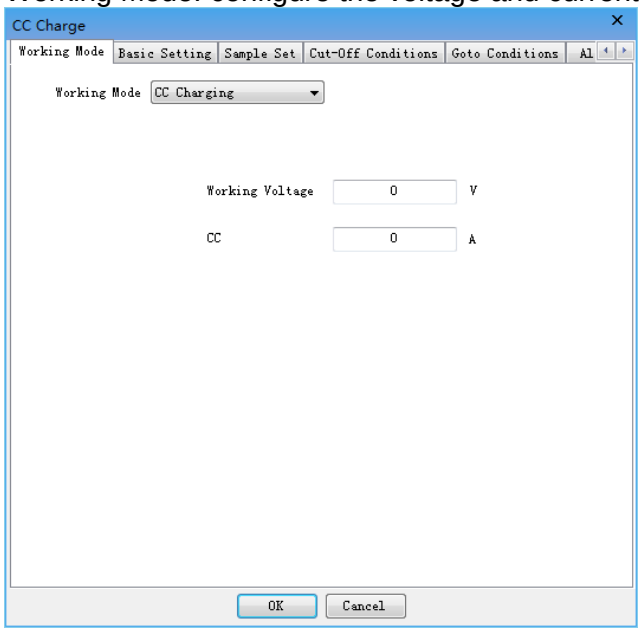
Protection	Description
Cell Over Temperature	If DUT temperature is higher than temperature setting value, the system gives protect information. When **Cell Sample for BMS** is selected, the corresponding message **getcelltemp**
Cell ΔV	Compare sampling voltage value and highest voltage value during test. When difference between them meets setting value, the system gives protect information. When **Cell Sample for BMS** is selected, the corresponding message **getcellvolt**
Protect Delay	Delay time of system protect

Note: Formula and CAN are the same setting method with Alarm tab.

2.3.1 CC Charge Test

Parameter Description:

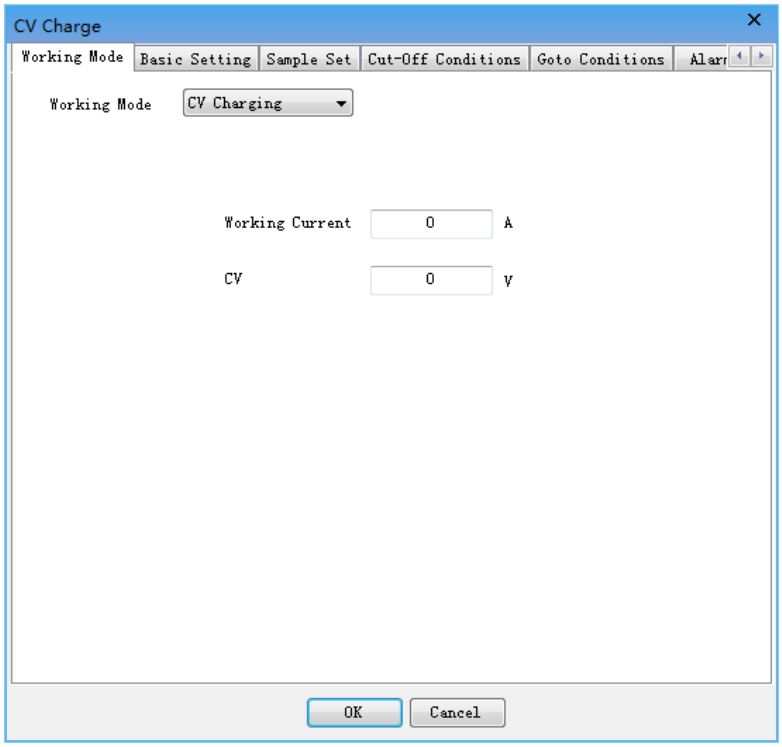
Working Mode: configure the voltage and current value



Item	Parameter	Description
CC Charging	CC	The current value in CC charging mode
	Working Voltage	The voltage limit value in CC charging mode
Pulse Charging	Pulse Edit / Import Excel File	Choose one of the two options. When you select “Pulse Edit”, you need to customize the following parameters; when “Import Excel File” is selected, “New” an Excel template, edit parameters, and import into the interface.
	Cycle Number	Number of loops performed in existing list.
	Charging Voltage	Voltage value of the single step in the list.
	Current	Current value of the single step in the list.
	Pulse	Pulse width of the single step in the list.
	Slew Rate	Single step rise/fall time during pulse charging.

Item	Parameter	Description
	Add	Add a single step.
	Insert	Insert a single step in existing step.
	Delete	Delete selected single step.
	Clear	Clear all steps in the list.
RAMP Charging	Working Voltage	Ramp charging voltage value
	Starting Current	Starting current value of ramp charging
	Cut-off Current	Cut-off current value of ramp charging
	Rise Time	Ramp charging time

2.3.2 CV Charge Test

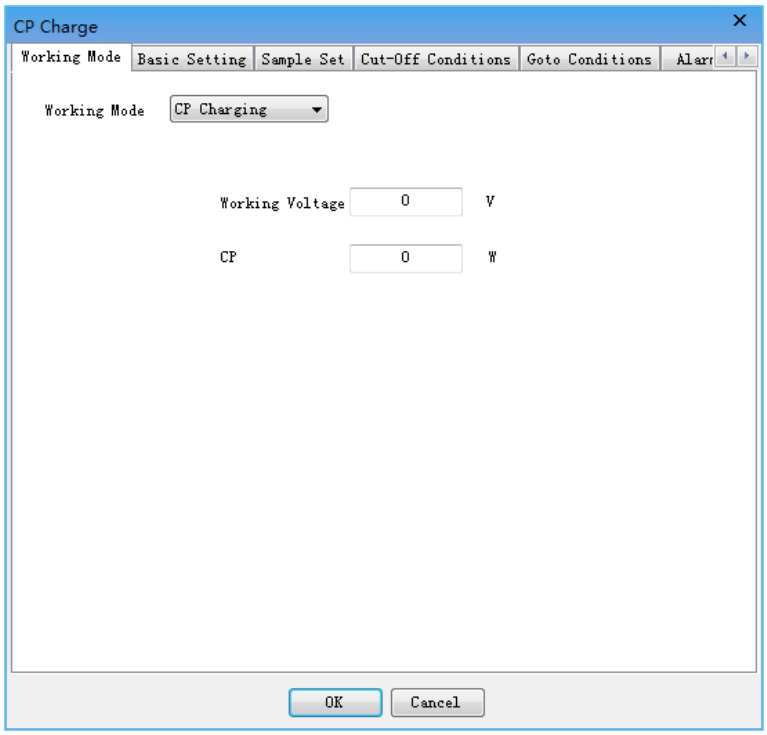


Parameter Description:

Item	Parameter	Description
CV Charging	Working Current	The current limit value in CV charging mode
	CV	The voltage value in CV charging mode
Pulse Charging	Pulse Edit / Import Excel File	Choose one of the two options. When you select “Pulse Edit”, you need to customize the following parameters; when “Import Excel File” is selected, “New” an Excel template, edit parameters, and import into the interface.
	Cycle Number	Number of loops performed in existing list.
	Charging Voltage	Voltage value of the single step in the list.
	Current	Current value of the single step in the list.
	Pulse	Pulse width of the single step in the list.

Item	Parameter	Description
	Slew Rate	Single step rise/fall time during pulse charging.
	Add	Add a single step.
	Insert	Insert a single step in existing step.
	Delete	Delete selected single step.
	Clear	Clear all steps in the list.
RAMP Charging	Working Voltage	Ramp charging voltage value
	Starting Current	Starting current value of ramp charging
	Cut-off Current	Cut-off current value of ramp charging
	Rise Time	Ramp charging time

2.3.3 CP Charge Test

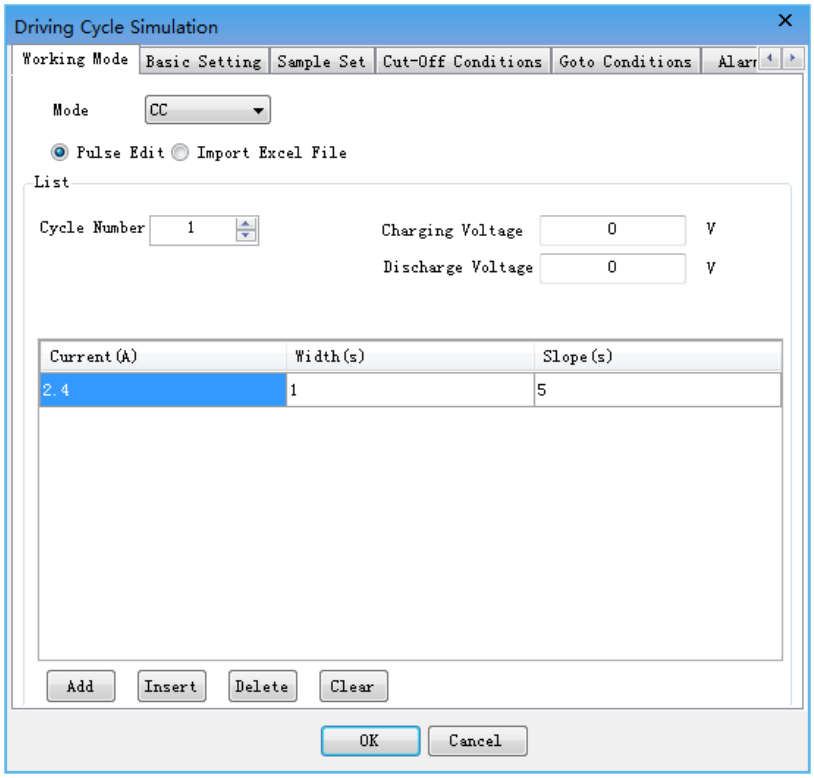


Parameter Description:

Item	Parameter	Description
CP Charging	CP	The power value in CP charging mode
	Working Voltage	The voltage limit value in CP charging mode
Pulse Charging	Pulse Edit / Import Excel File	Choose one of the two options. When you select “Pulse Edit”, you need to customize the following parameters; when “Import Excel File” is selected, “New” an Excel template, edit parameters, and import into the interface.
	Cycle Number	Number of loops performed in existing list.
	Charging Voltage	Voltage value of the single step in the list.
	Power	Power value of the single step in the list.

Item	Parameter	Description
	Pulse	Pulse width of the single step in the list.
	Slew Rate	Single step rise/fall time during pulse charging.
	Add	Add a single step.
	Insert	Insert a single step in existing step.
	Delete	Delete selected single step.
	Clear	Clear all steps in the list.

2.3.4 Driving Cycle Simulation

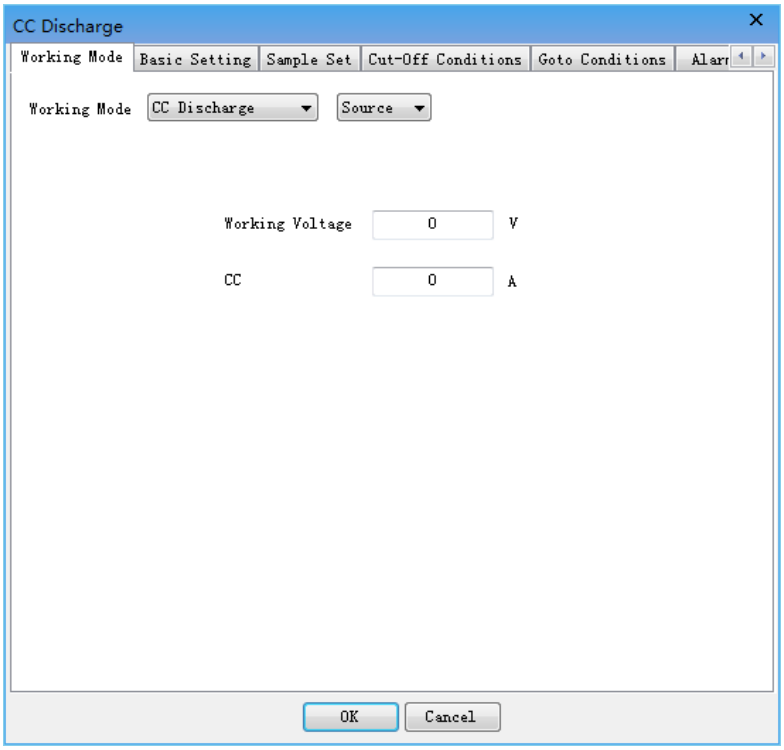


Parameter Description:

Item	Parameter	Description
CC	Pulse Edit / Import Excel File	Choose one of the two options. When you select “Pulse Edit”, you need to customize the following parameters; when “Import Excel File” is selected, “New” an Excel template, edit parameters, and import into the interface.
	Cycle Number	Number of loops performed in existing list.
	Charging Voltage	Charging voltage value during vehicle road condition simulation test
	Discharge Voltage	Discharge voltage value during vehicle road condition simulation test
	Current	Charging or discharge current value of the single step in the list.
	Width	Time width of the single step in the list.
	Slope	Current rise or fall time of the single step in the list.

Item	Parameter	Description
CP	Pulse Edit / Import Excel File	Choose one of the two options. When you select “Pulse Edit”, you need to customize the following parameters; when “Import Excel File” is selected, “New” an Excel template, edit parameters, and import into the interface.
	Cycle Number	Number of loops performed in existing list.
	Charging Voltage	Charging voltage value during vehicle road condition simulation test
	Discharge Voltage	Discharge voltage value during vehicle road condition simulation test
	Power	Charging or discharge power value of the single step in the list.
	Width	Time width of the single step in the list.
	Slope	Power rise or fall time of the single step in the list.

2.3.5 CC Discharge Test

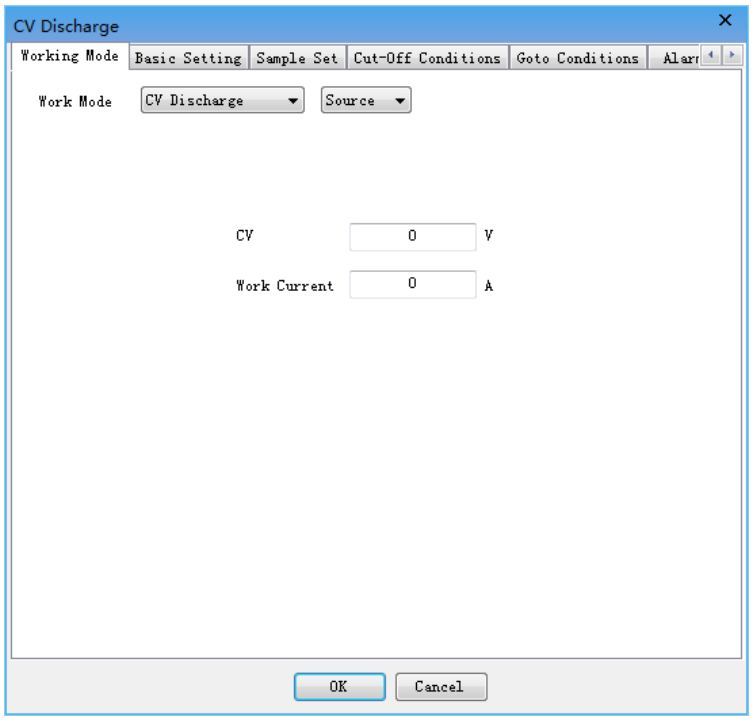


Parameter Description:

Item	Parameter	Description
CC Discharge	CC	The current value in CC discharge mode
	Working Voltage	The voltage limit value in CC discharge mode
Source/Load	Source: Use the sink mode of IT6000C series to discharge. Load: Use the Load mode of IT6000B series to discharge.	

Item	Parameter	Description
Pulse Discharge	Pulse Edit / Import Excel File	Choose one of the two options. When you select “Pulse Edit”, you need to customize the following parameters; when “Import Excel File” is selected, “New” an Excel template, edit parameters, and import into the interface.
	Cycle Number	Number of loops performed in existing list.
	Discharge Voltage	Voltage value of the single step in the list.
	Current	Current value of the single step in the list.
	Pulse	Pulse width of the single step in the list.
	Slew Rate	Single step rise/fall time during pulse discharge.
	Add	Add a single step.
	Insert	Insert a single step in existing step.
	Delete	Delete selected single step.
	Clear	Clear all steps in the list.
RAMP Discharge	Working Voltage	Ramp discharge voltage value
	Starting Current	Starting current value of ramp discharge
	Cut-off Current	Cut-off current value of ramp discharge
	Fall Time	Ramp discharge time

2.3.6 CV Discharge Test

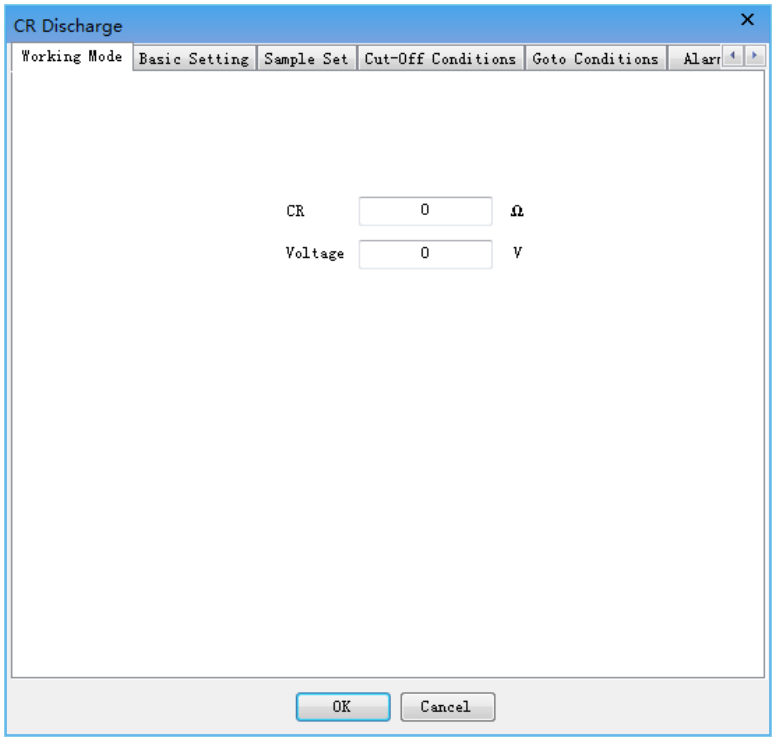


Parameter Description:

Item	Parameter	Description
CV Discharge	CV	The voltage value in CV discharge mode
	Work Current	The current limit value in CV discharge mode

Item	Parameter	Description
Source/Load	Source: Use the sink mode of IT6000C series to discharge. Load: Use the Load mode of IT6000B series to discharge.	
Pulse Discharge	Pulse Edit / Import Excel File	Choose one of the two options. When you select “Pulse Edit”, you need to customize the following parameters; when “Import Excel File” is selected, “New” an Excel template, edit parameters, and import into the interface.
	Cycle Number	Number of loops performed in existing list.
	Discharge Voltage	Voltage value of the single step in the list.
	Current	Current value of the single step in the list.
	Pulse	Pulse width of the single step in the list.
	Slew Rate	Single step rise/fall time during pulse discharge.
	Add	Add a single step.
	Insert	Insert a single step in existing step.
	Delete	Delete selected single step.
	Clear	Clear all steps in the list.
RAMP Discharge	Working Voltage	Ramp discharge voltage value
	Starting Current	Starting current value of ramp discharge
	Cut-off Current	Cut-off current value of ramp discharge
	Fall Time	Ramp discharge time

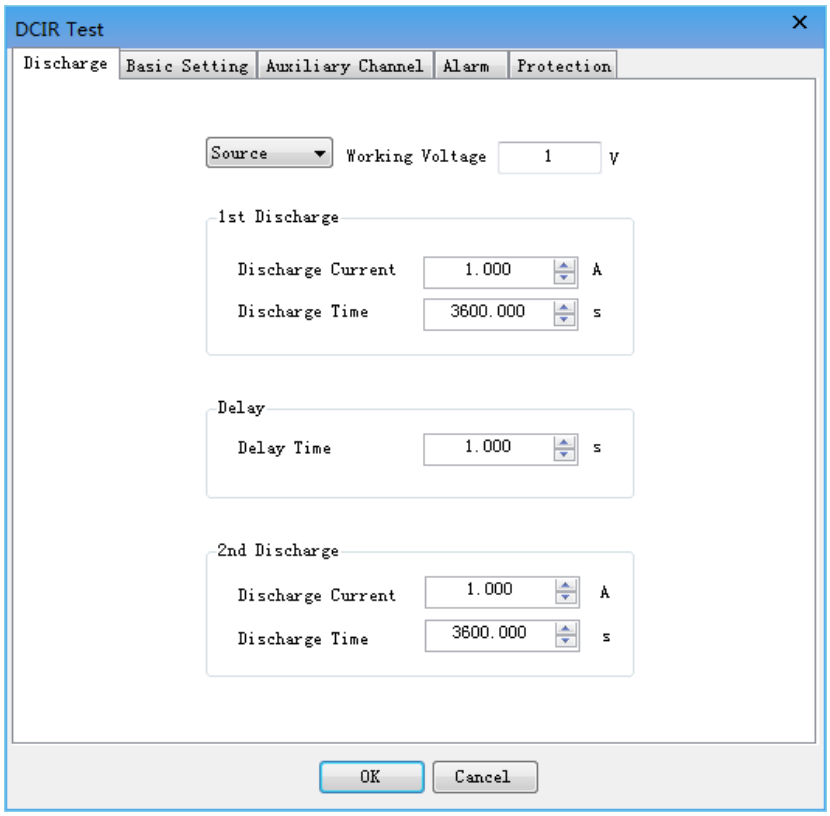
2.3.7 CR Discharge Test



Parameter Description:

Item	Parameter	Description
CR Discharge	CR	The resistance value in CR discharge mode
	Voltage	The voltage limit value in CR discharge mode

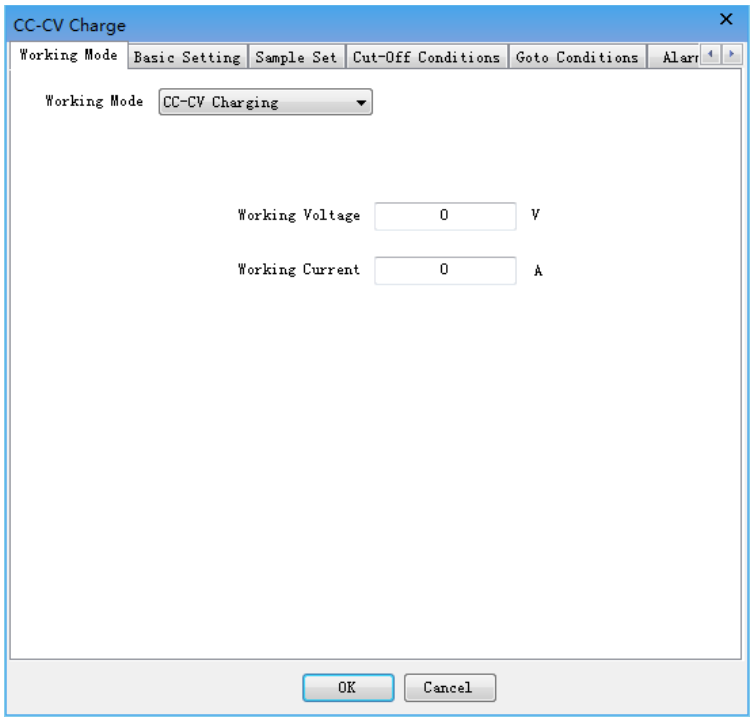
2.3.8 DCIR Test



Parameter Description:

Item	Parameter	Description
Source/Load	Source: Use the sink mode of IT6000C series to discharge. Load: Use the Load mode of IT6000B series to discharge.	
Work Voltage	Work Voltage	The voltage limit value in DCIR Test mode
1st Discharge	Discharge Current	Discharge current setting for the first discharge
	Discharge Time	Discharge time setting for the first discharge
Delay	Delay Time	The time the battery stops discharging after the first discharge.
2nd Voltage	Discharge Current	Discharge current setting for the second discharge
	Discharge Time	Discharge time setting for the second discharge

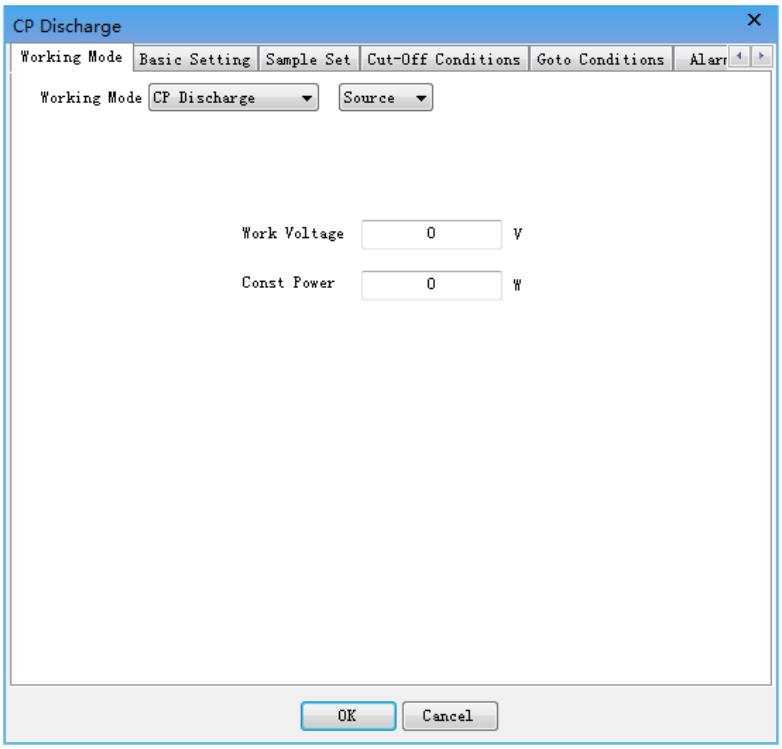
2.3.9 CC-CV Charge Test



Parameter Description:

Item	Parameter	Description
CC-CV Charging	Working Voltage	Voltage value at constant voltage charging
	Working Current	Current value at constant current charging
Pulse Charging	Pulse Edit / Import Excel File	Choose one of the two options. When you select “Pulse Edit”, you need to customize the following parameters; when “Import Excel File” is selected, “New” an Excel template, edit parameters, and import into the interface.
	Cycle Number	Number of loops performed in existing list.
	Charging Voltage	Voltage value of the single step in the list.
	Current	Current value of the single step in the list.
	Pulse	Pulse width of the single step in the list.
	Slew Rate	Single step rise/fall time during pulse charging.

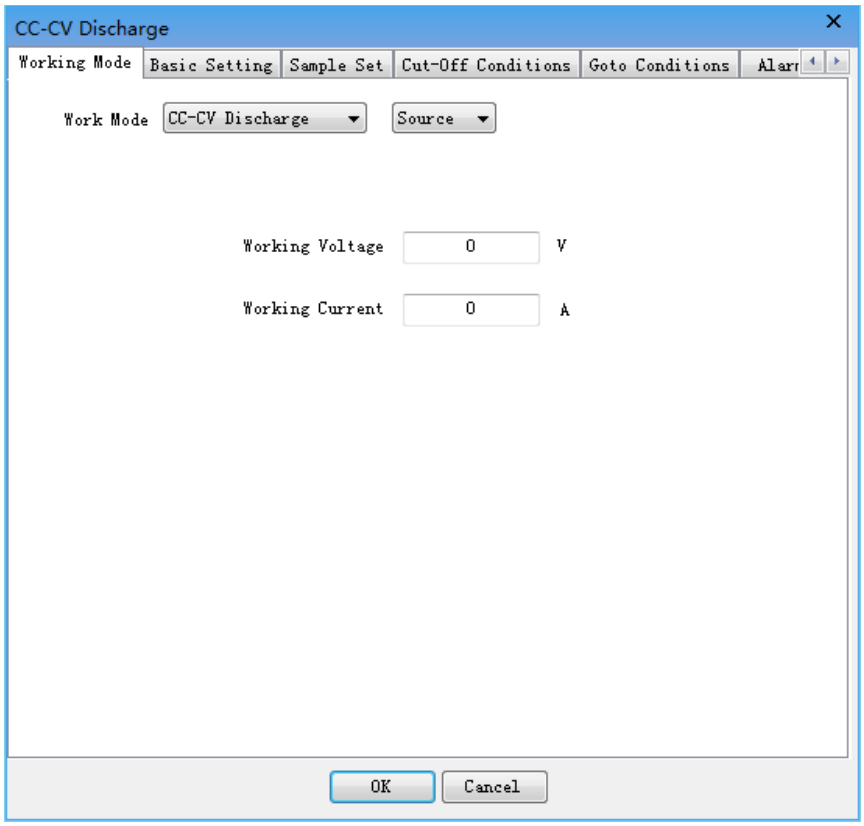
2.3.10 CP Discharge Test



Parameter Description:

Item	Parameter	Description
CP Discharge	CP	The power value in CP discharging mode
	Work Voltage	The voltage limit in CP discharging mode
Source/Load	Source: Use the sink mode of IT6000C series to discharge. Load: Use the Load mode of IT6000B series to discharge.	
Pulse Discharge	Pulse Edit / Import Excel File	Choose one of the two options. When you select “Pulse Edit”, you need to customize the following parameters; when “Import Excel File” is selected, “New” an Excel template, edit parameters, and import into the interface.
	Cycle Number	Number of loops performed in existing list.
	Discharge Voltage	Voltage value of the single step in the list.
	Power	Power value of the single step in the list.
	Pulse	Pulse width of the single step in the list.
	Slew Rate	Single step rise/fall time during pulse discharge.
	Add	Add a single step.
	Insert	Insert a single step in existing step.
	Delete	Delete selected single step.
	Clear	Clear all steps in the list.

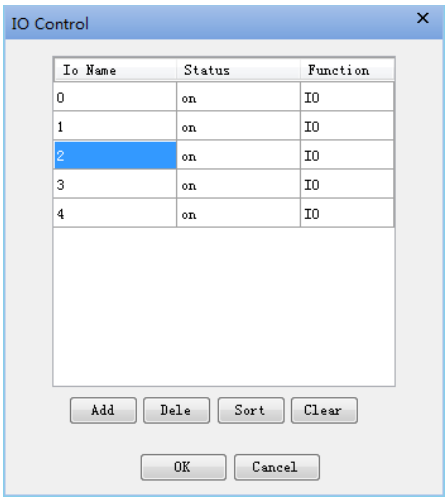
2.3.11 CC-CV Discharge Test



Parameter Description:

Item	Parameter	Description
CC-CV Discharge	Working Voltage	Voltage value at constant voltage discharge
	Working Current	Current value at constant current discharge
Source/Load	Source: Use the sink mode of IT6000C series to discharge. Load: Use the Load mode of IT6000B series to discharge.	
Pulse Discharge	Pulse Edit / Import Excel File	Choose one of the two options. When you select “Pulse Edit”, you need to customize the following parameters; when “Import Excel File” is selected, “New” an Excel template, edit parameters, and import into the interface.
	Cycle Number	Number of loops performed in existing list.
	Discharge Voltage	Voltage value of the single step in the list.
	Current	Current value of the single step in the list.
	Pulse	Pulse width of the single step in the list.
	Slew Rate	Single step rise/fall time during pulse discharge.

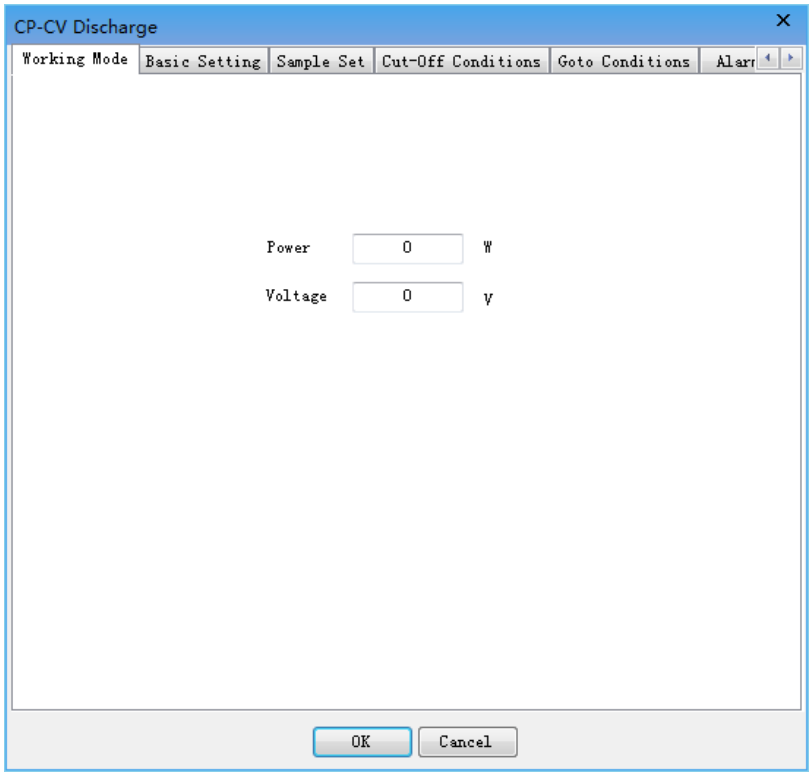
2.3.12 IO Control



Corresponds to the functions of each pin of the digital I/O interface (P-IO) of the IT6000 series instruments.

Parameter	Description
IO Name	Indicates the number of the digital I/O pin.
Status	Turns the function of the corresponding pin on or off. **Off** represents closed IO pin, **on** represents disconnected IO pin.
Function	Select the existing pin function.
Add	Add a pin configuration.
Delete	Remove the selected pin configuration.
Sort	Reorder the pin numbers.
Clear	Clear all pin configurations.

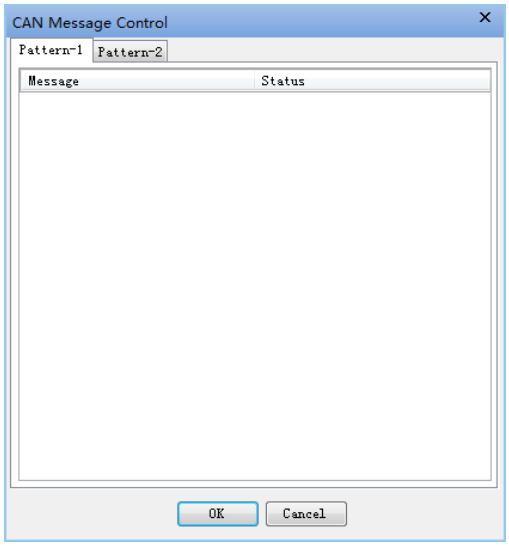
2.3.13 CP-CV Discharge Test

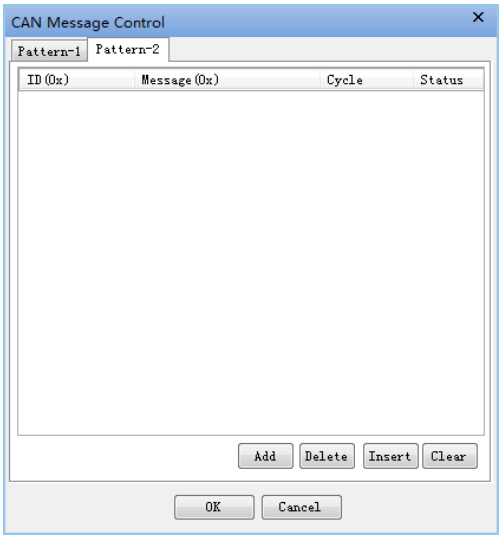


Parameter Description:

Parameter	Description
Voltage	Voltage value at constant voltage discharge
Power	Power value at constant power discharge

2.3.14 CAN Message Control

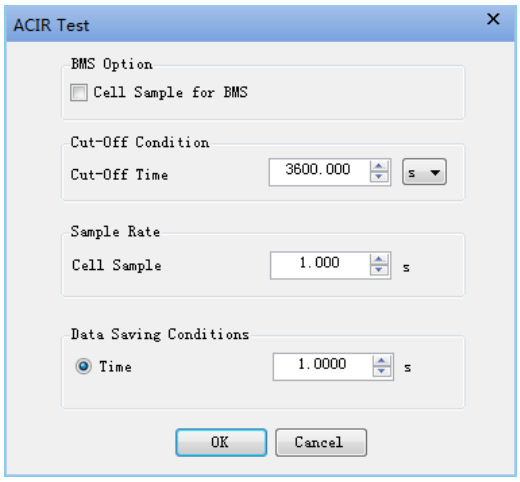




Parameter Description:

Parameter	Description
Add	Right-click in the blank space and select Add to add a message.
Message	The message to be sent.
Status	Message sent status
ID (0x)	Node ID
Message (0x)	Message content
Cycle	Number of times the message is sent cyclically
Status	Message sent status

2.3.15 ACIR Test

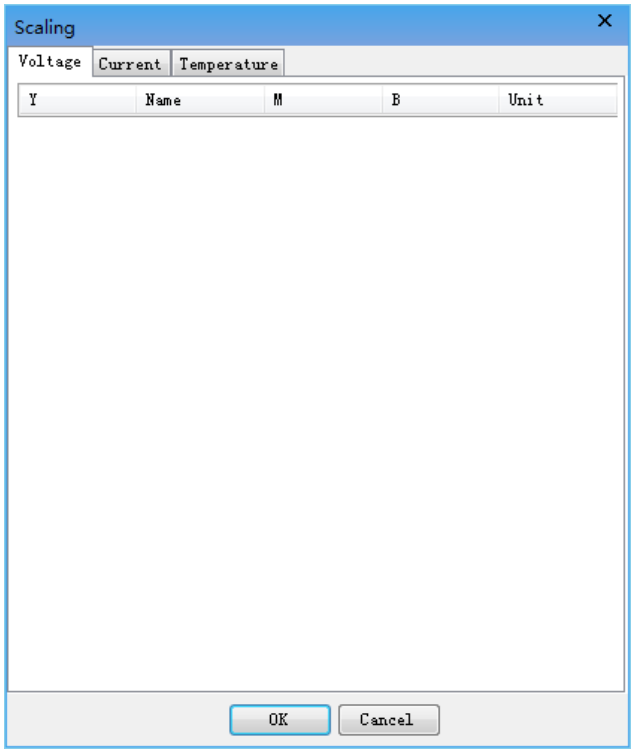


Parameter Description:

Item	Parameter	Description
BMS Option	Cell Sample for BMS	Whether the voltage of the battery chip is read by the BMS system. If this item is selected, it is read from the BMS system, otherwise it is read from the IT5102.
Cut-Off Condition	Cut-Off Time	Test cutoff time
Sample Rate	Cell Sample	Cell sample rate
Data Saving Conditions	Time	Time interval for saving data, indicating that data is saved every X seconds, wherein, X is a setting value

2.3.16 Scaling (Applicable to 34980)

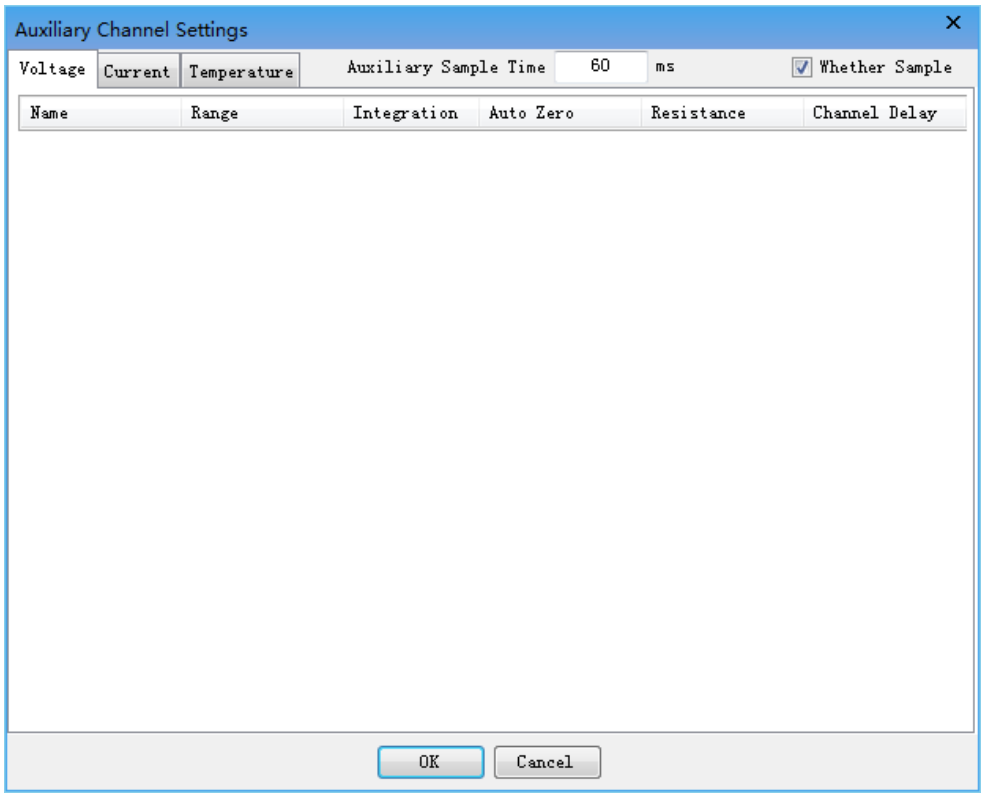
Note: If the hardware is configured with 34980 and the test item needs to be set, please place the test item at the first step of the test sequence and let the data acquisition instrument start up first.



Item	Parameter	Description
Voltage / Current / Temperature	Y	Editable items. The data collected by the auxiliary channel is calculated by Mx+B.
	Name	Non-editable items. The channel name of the data acquisition instrument (34980) whose type is "Auxiliary Channel Voltage/Current/Temperature" defined on the "<Step 3>" page.
	M	Editable items. Set the gain factor.
	B	Editable items. Set the offset value.
	Unit	Editable items. Set the unit of the collected data.

2.3.17 Auxiliary Channel Settings (Applicable to 34980)

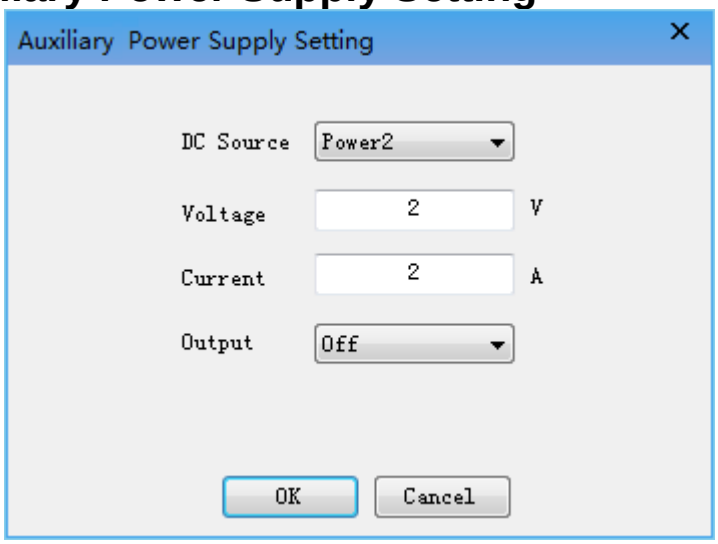
Note: If the hardware is configured with 34980 and the test item needs to be set, please place the test item at the first step of the test sequence and let the data acquisition instrument start up first.



Item	Parameter	Description
Voltage	Name	Non-editable items. The channel name of the data logger (34980) whose type is "Auxiliary Voltage" defined on the "<Step3>" page.
	Range	Editable items. Select the range of a single channel of the data logger.

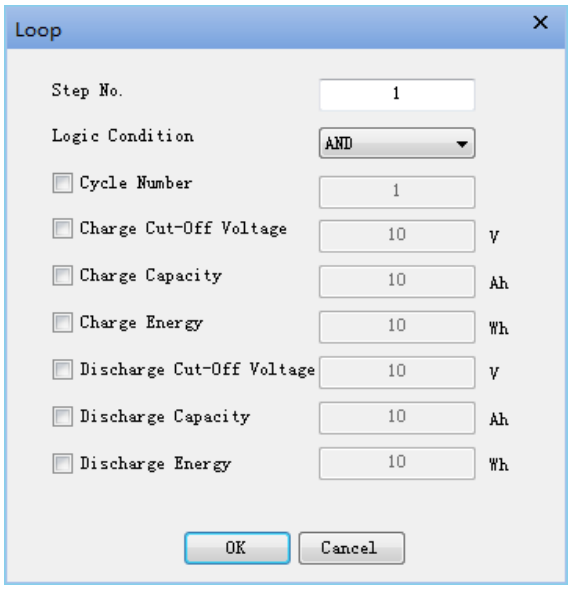
Item	Parameter	Description
	Integration	Editable items. ● NPLC: Number of power frequency cycles ● TIME: User-defined measurement sampling period.
	Auto Zero	Editable items. Indicates whether to automatically calibrate zero.
	Resistance	Editable items. Configure the input resistance.
	Channel Delay	Editable items. Configure the channel delay time.
Current	Name	Non-editable items. The channel name of the data logger (34980) whose type is "Auxiliary Current" defined on the "<Step3>" page.
	Range	Editable items. Select the range of a single channel of the data logger.
	Integration	Editable items. ● NPLC: Number of power frequency cycles ● TIME: User-defined measurement sampling period.
	Auto Zero	Editable items. Indicates whether to automatically calibrate zero.
	Resistance	Editable items. Configure the input resistance.
	Channel Delay	Editable items. Configure the channel delay time.
Temperature	Name	Non-editable items. The channel name of the data logger (34980) whose type is "Auxiliary Temperature" defined on the "<Step3>" page.
	Probe Type	Select "Thermocouple" from the drop-down menu, and set the thermocouple type, thermocouple check, reference junction source, and temperature value (FIXED only) in the pop-up dialog box.
	Integration	Editable items. ● NPLC: Number of power frequency cycles ● TIME: User-defined measurement sampling period.
	Auto Zero	Editable items. Indicates whether to automatically calibrate zero.
	Unit	Editable items. Configure the temperature unit.
	Channel Delay	Editable items. Configure the channel delay time.
Auxiliary Sample Time	Set the delay time for the software to read the data collected by the auxiliary channel, here is the delay time of each channel.	
Whether Sample	Whether to enable auxiliary channel sampling. If it is not checked, the auxiliary channel will not sample.	
Add	Right-click and select "Add" to add a new channel set.	
Delete	Right-click and select "Delete" to delete a channel set.	

2.3.18 Auxiliary Power Supply Setting



Parameter	Description
DC Source	Editable items. The channel name of the auxiliary source whose type is "DC Power Supply" defined on the "<Step 3>" page.
Voltage	The output voltage value of the auxiliary DC power supply.
Current	The output current limit value of the auxiliary DC power supply.
Output	The output switch of the auxiliary DC power supply.

2.3.19 Loop



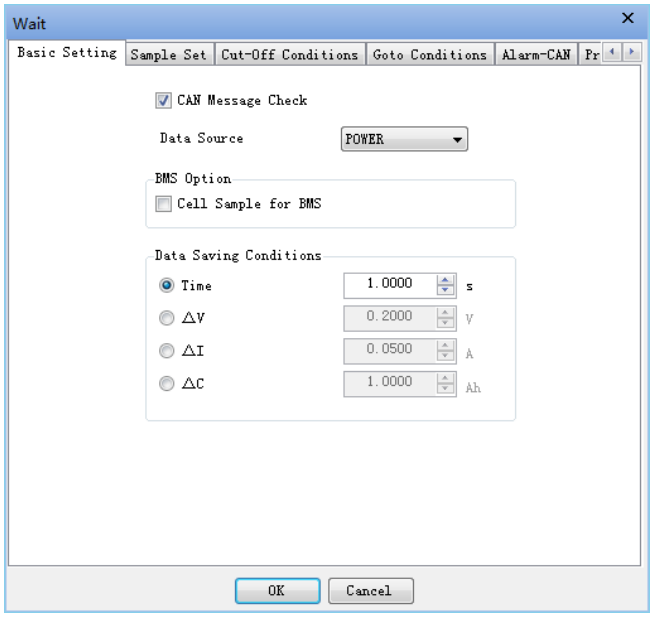
Parameter Description:

Item	Description

Item	Description
Step No.	Work step number for beginning cycle
Logic Condition	The relationship between Cut-off conditions
Cycle Number	Number of loops performed by the work step
Charge Cut-off Voltage	The loop is stopped when the charging voltage meets the setting value.
Charge Capacity	The loop is stopped when the charging capacity meets the setting value.
Charge Energy	The loop is stopped when the charging energy meets the setting value.
Discharge Cut-off Voltage	The loop is stopped when the discharging voltage meets the setting value.
Discharge Capacity	The loop is stopped when the discharging capacity meets the setting value.
Discharge Energy	The loop is stopped when the discharging energy meets the setting value.

2.3.20 Wait

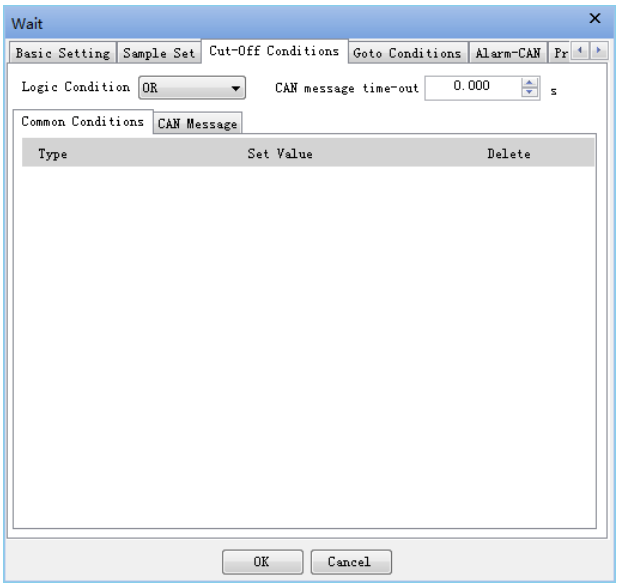
Basic Setting:



Item	Parameter	Description
-	Data Source	Select the data source
BMS Option	Cell Sample for BMS	Whether the voltage of the battery chip is read by the BMS system. If this item is selected, it is read from the BMS system, otherwise it is read from the IT5102.
Sample Rate	Channel Sample	Channel sample rate
	Temperature Sample	Temperature sample rate
	Cell Sample	Cell sample rate
Data Saving Conditions	Time	Time interval for saving data, indicating that data is saved every X seconds, wherein, X is a setting value

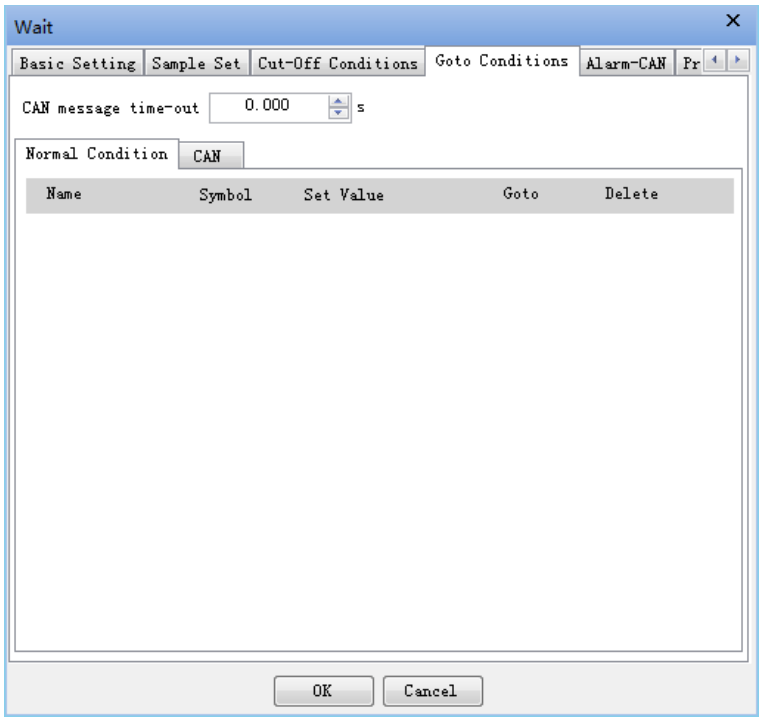
Item	Parameter	Description
	ΔV	Compare sampling voltage values. When difference between them meets setting value, the data is saved.
	ΔI	Compare sampling current values. When difference between them meets setting value, the data is saved.
	ΔC	Compare sampling capacity values. When difference between them meets setting value, the data is saved.

Cut-Off Conditions:



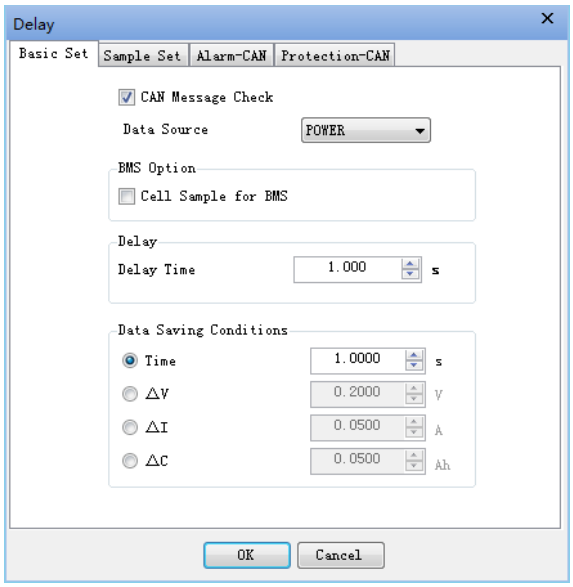
Item	Parameter	Description
Logic Condition	AND	Indicates that there is “AND” relationship between several cut-off conditions.
	OR	Indicates that there is “OR” relationship between several cut-off conditions.
Common Conditions	Cut-Off Voltage	The test is stopped when the voltage meets the setting value.
CAN Message	Message	The message name in the selected CAN message
	Operator	The operator to be followed in the CAN message
	Set Value	The setting value of cut-off conditions. The Wait step is stopped and continues to the next step when the CAN message after calculation meets the setting value. Otherwise, the test will stop and the system will prompt that the CAN message does not meet the conditions.
CAN message time-out	The time when the CAN message is sent or responded to timeout. Once timed out, the test stops.	

Goto Conditions:



Item	Parameter	Description
Normal Condition	Voltage	Indicates the voltage of the cell battery.
	Symbol	Indicates the judgment symbol.
	Set Value	Indicates the judgment voltage of the cell battery.
	Goto	Indicates which step to jump to. When the collected cell voltage meets the set value condition, a jump is performed.
CAN Message	Message	The message name in the selected CAN message
	Operator	The operator to be followed in the CAN message
	Set Value	The setting value of Goto conditions. The test step will jump to the next step when the CAN message after calculation meets the setting value. Otherwise, the test will stop and the system will prompt that the CAN message does not meet the conditions.
	Goto	Indicates which step to jump to.
CAN message time-out	The time when the CAN message is sent or responded to timeout. Once timed out, the test stops.	

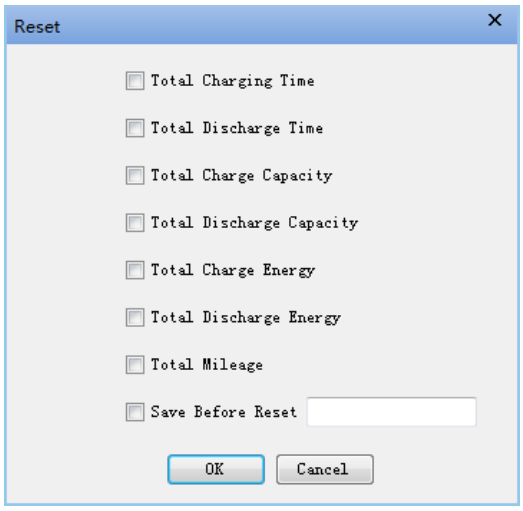
2.3.21 Delay



Parameter Description:

Item	Parameter	Description
-	Data Source	Select the data source
BMS Option	Cell Sample for BMS	Whether the voltage of the battery chip is read by the BMS system. If this item is selected, it is read from the BMS system, otherwise it is read from the IT5102.
Delay	Delay Time	Delay Time of Battery
Data Saving Conditions	Time	Time interval for saving data, indicating that data is saved every X seconds, wherein, X is a setting value
	ΔV	Compare sampling voltage values. When difference between them meets setting value, the data is saved.
	ΔI	Compare sampling current values. When difference between them meets setting value, the data is saved.
	ΔC	Compare sampling capacity values. When difference between them meets setting value, the data is saved.

2.3.22 Reset



Parameter Description:

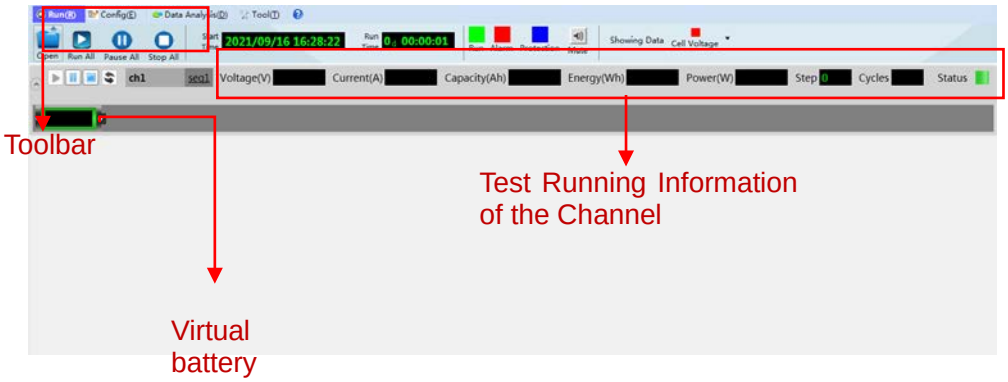
Parameter	Description
Total Charging Time	Reset the total charge test time.
Total Discharge Time	Reset the total discharge test time.
Total Charge Capacity	Reset the total charge capacity.
Total Charge Energy	Reset the total charge energy.
Total Discharge Capacity	Reset the total discharge capacity.
Total Discharge Energy	Reset the total discharge energy.
Total Mileage	Reset the total test mileage.
Save Before Reset	Perform data saving before resetting.

Chapter3 Test Run

After test configuration, ITS5300 test system starts test for battery. The test running module is provided with such functions as running test steps and test process observation.

3.1 Interface Introduction

Click “Test Run” module in the main interface, which is shown below.



- Main functions of toolbar:
  - Open: open configured test files.
  - Run All: run test files. When the user clicks this key for running, all channel tests in the test files will be run. If a single channel test is to be performed, select running key corresponding to the channel.
  - Pause All: pause test files in running.
  - Stop All: stop test files in running.
- Start Time: time for opening the test file.
- Run Time: time for executing the test file.
- Run: Green indicates that existing test is running normally.
- Alarm: Red indicates that existing test appears alarm. The user can set voice prompt for alarm status.
- Protection: Blue indicates that protection occurs during existing test. The user can set voice prompt for protection status.
- Mute: close the voice prompt.
- Voltage/Resistance/Temperature: when different parameter buttons are selected, the virtual battery displays voltage/resistance/temperature respectively.
- Virtual battery: unfold detailed information of this channel, and all battery status under this channel will be displayed. Each cell displays existing voltage, resistance or temperature value. When the user clicks the battery, the battery name, voltage, resistance and temperature values will be displayed.
- Running information of channel test: Display detailed running information of this channel, including voltage, current, capacity, work step, cycle count and running status.

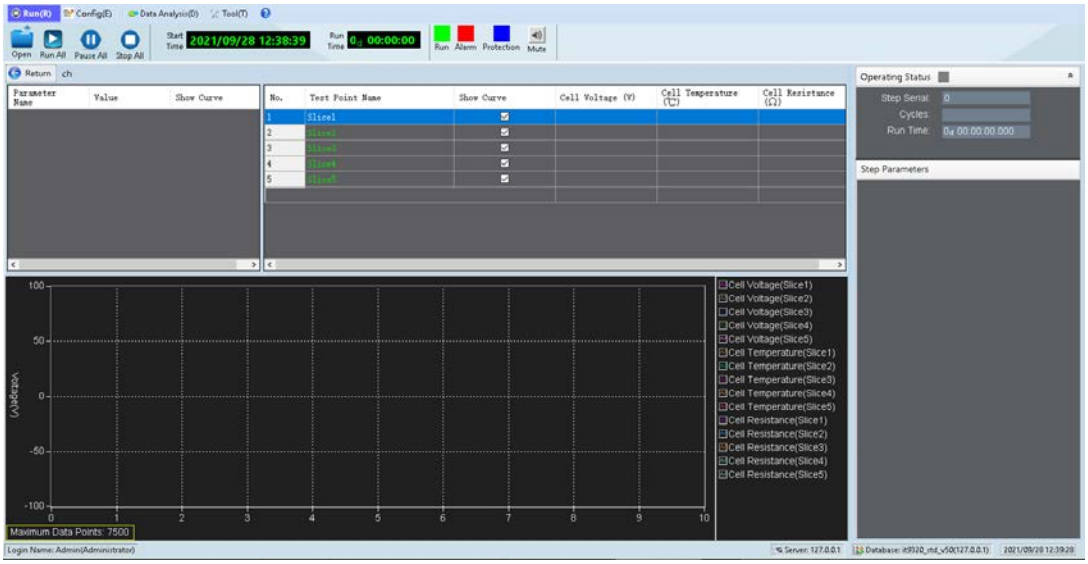
3.2 Running Test Program

Running sequences of the test program are related to the sequence of the user's selection of test items. Run test items based on such sequence. Run the configured test programs in the 2.2 configuration test program as an example, detailed running steps are as shown below.

1. Click “Open” to open edited test file.
2. Click “OK”, and the file starts loading.
3. Based on test item to be selected, click “Run All” to run edited test files, and the test program stops test based on stopping conditions.

3.3 View Channels

The user can check detailed information of channel test by clicking the channel name in the running interface. Click Return at the top left corner to return to the Running Interface of Test Programs.



In the above figure, the voltage, current, power, capacity, and energy parameters in the upper left corner area (**Parameter Name, Value, Show Curve**) are those of the IT6000 series instrument and will always be displayed in this area. Other parameters will only be displayed when checked and the test item is controlled to the device.

For example, the thermostat and water-cooling equipment are externally connected equipment. If the system is not configured, they will not be displayed.

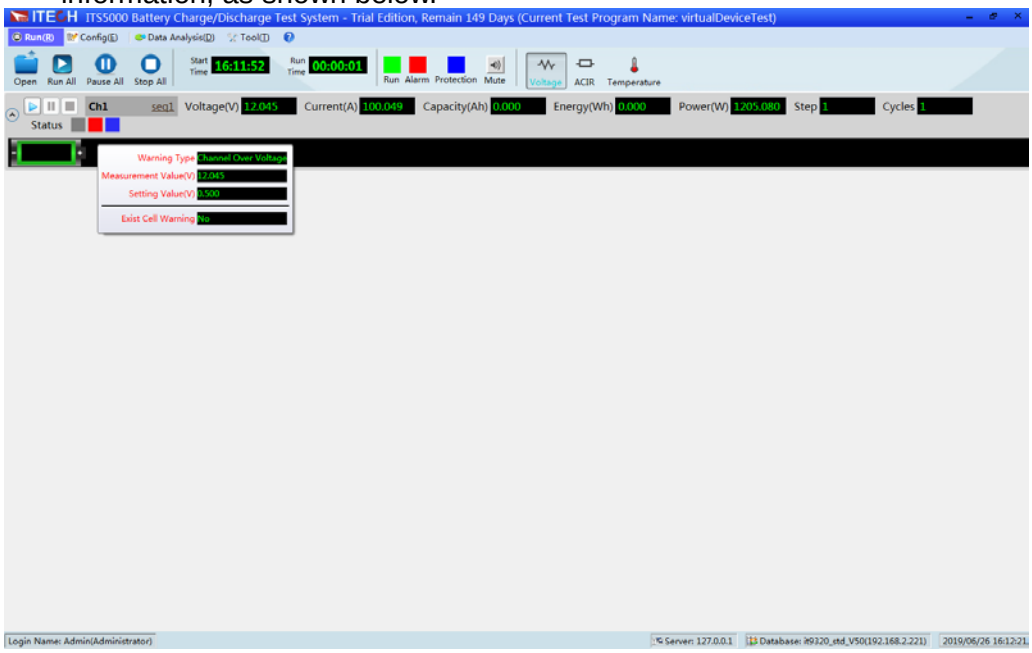
- The main window area in the middle displays the test point name, cell voltage, cell temperature and other information.
- The left window area displays the battery voltage, capacity, water cooling/thermostat equipment (if configured) parameters, etc.
- The right window displays the running status, including the step parameters and running information of the test program.
- The lower window displays the battery cell test curve, and the user can click the button in the upper right corner to select the display voltage,

current and capacity or multiple selections as needed.

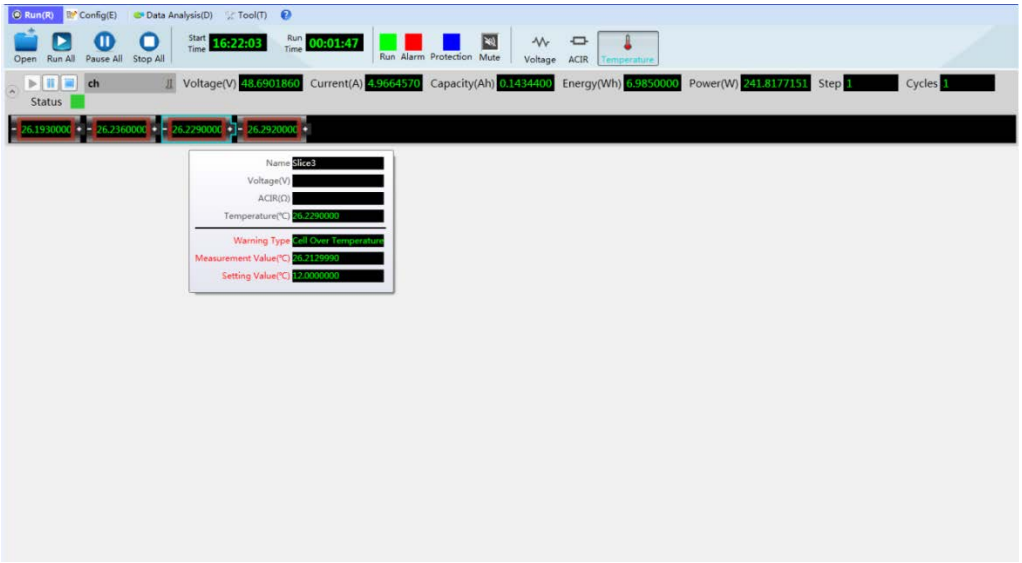
3.4 View Alarm Information

During test, if alarm conditions are configured, when circumstances meeting the alarm conditions appear, the system will automatically report an alarm.

- When channel alarm information is generated, the mouse points to the channel and the running status red marker displays the channel alarm information, as shown below.



- When cell alarm information is generated, the battery cell turns red. The mouse points to the cell, and the cell alarm information is displayed, as shown below.

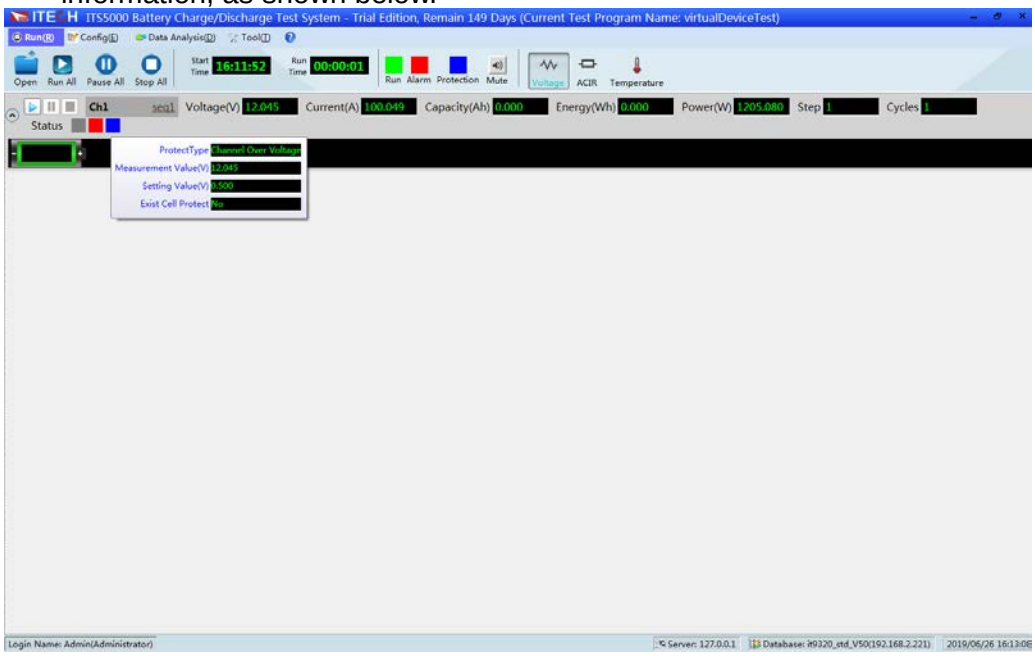


3.5 View Protection Information

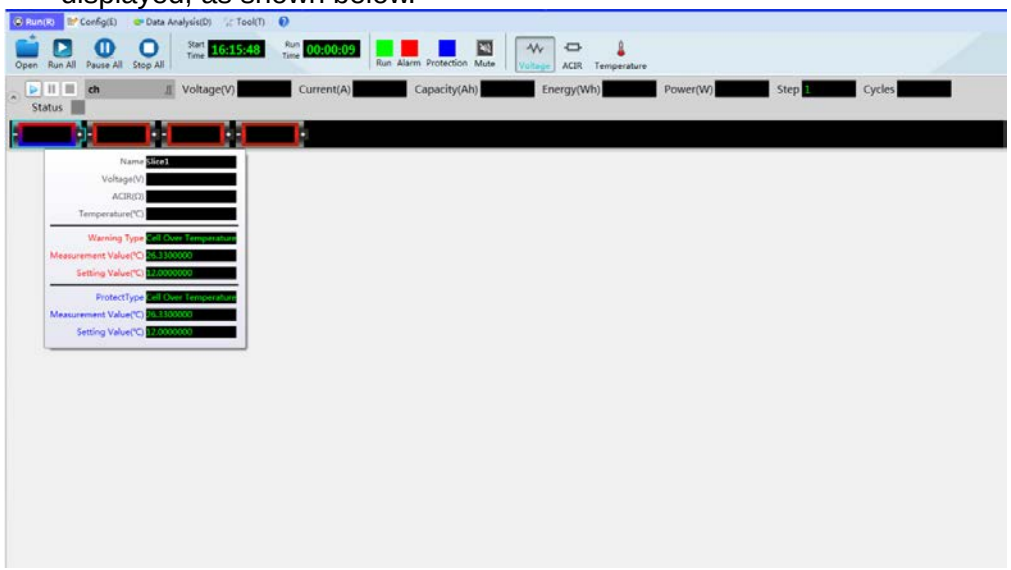
During test, if protection conditions are configured, when circumstances

meeting the protection conditions appear, the system will automatically report protection and stop test.

- When channel protection information is generated, the mouse points to the channel and the running status blue marker displays the channel protection information, as shown below.



- When cell protection information is generated, the battery cell turns blue. The mouse points to the cell, and the cell protection information is displayed, as shown below.



Note

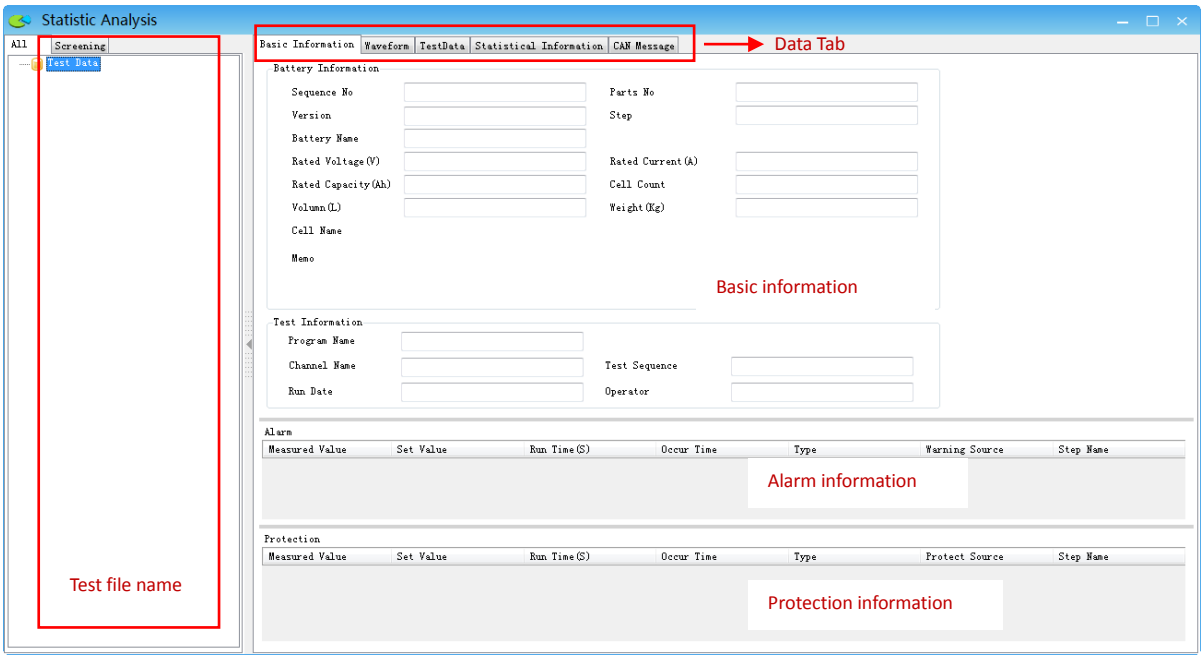
When the channel generates protection and alarm information simultaneously, the Status column appears red marker and blue marker at the same time. When the cell generates protection and alarm information at the same time, the cell box turns into half red and half blue. The mouse points to the battery cell, and the battery cell protection and alarm information are displayed.

Chapter4 Data Analysis

This chapter introduces statistic analysis, integrated query, CAN message query, test data manager and template manager function after finishing executing the test program.

4.1 Statistic Analysis

After test is completed, the user can query statistics of the test results. Click “Data Analysis” on the main test interface, and select “Statistic Analysis” to enter the Statistic Analysis interface of test results. The user can analyze and check results as required.



- All: display all test file name, user can select the test data according to test file name.
- Screening: the screening condition of test file, user can setup the condition to screening data.
- Basic Information: View the basic information of the selected test data, including battery information, test channel information, charge and discharge statistics, alarm and protection information.
- Waveform: Show detailed test curve information.
- Test Data: Users can customize the query conditions, filter the required test information, and export it as an Excel file.
- Statistical Information: Accumulated data information for performing battery charge and discharge tests, including statistical information such as charge energy, discharge energy, charge capacity, discharge capacity, and total mileage.
- CAN Message: Display the test value contained in the parsed CAN message.

4.1.1 Basic Information

Select a test data file, the basic information page displays the following parts:

- Battery information: the battery parameter information set in Step 1 of the program configuration.
- Test information: channel, sequence name and other information in the program configuration.
- Alarm: Alarm information generated during the test.
- Protection: Protection information generated during the test.

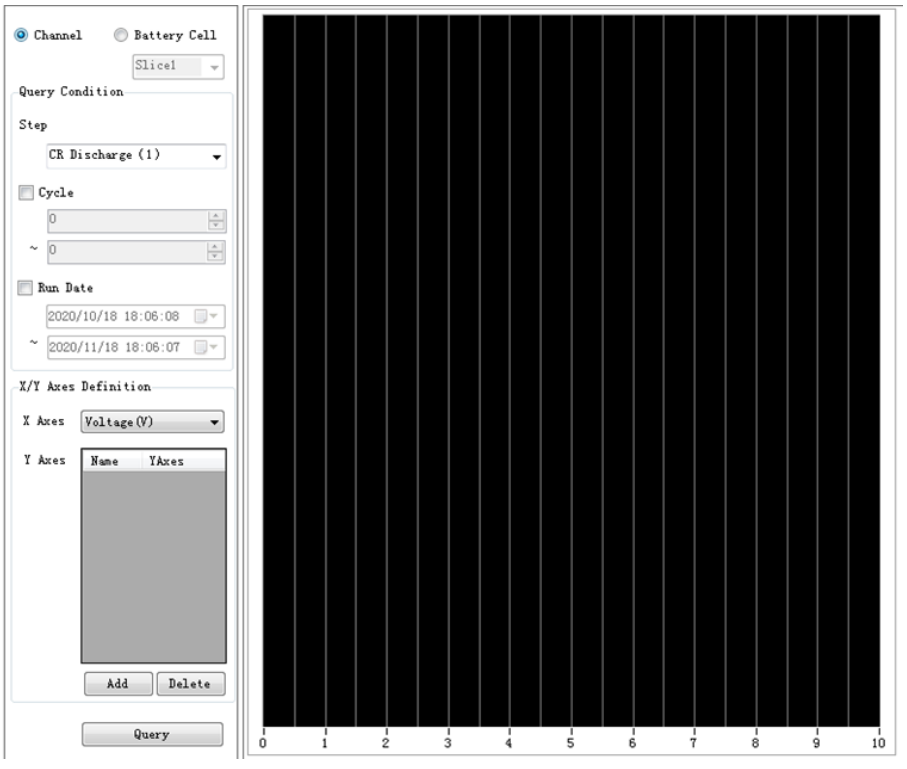
Alarm and protection information supports exporting data to Excel files (right-click in the table interface and select "Export"), which is convenient for users to perform statistics and analysis.

Note

The "Run time" in the alarm and protection information indicates the time point when the alarm or protection occurred, which can help users quickly locate and analyze.

4.1.2 Waveform

Select "Waveform" on the "Statistical Analysis" page, the display interface is as follows:

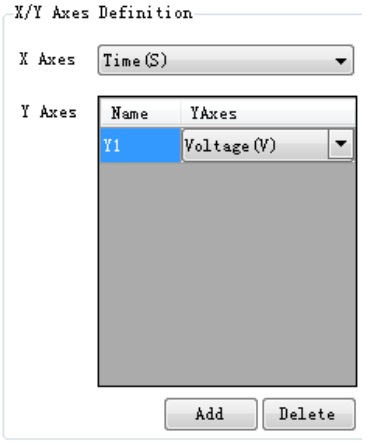


First select a test data file, and then set the following parameters:

- Channel/Battery Cell: Users can choose to view the test waveform of the channel or cell battery.

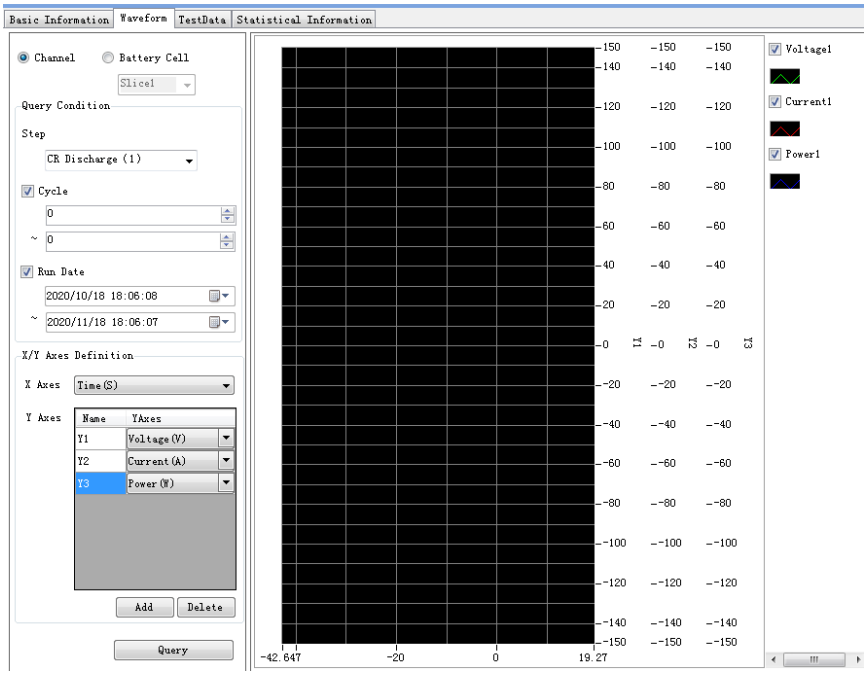
- Query Condition: The user can filter some waveforms for viewing according to the test step, cycle (that is, the number of cycles executed by the step), and test time.
- X/Y Axis Definition: users can customize the type of test data represented by the coordinate axis.

  For example, choose X axis as time and Y axis as voltage, as shown in the figure below.

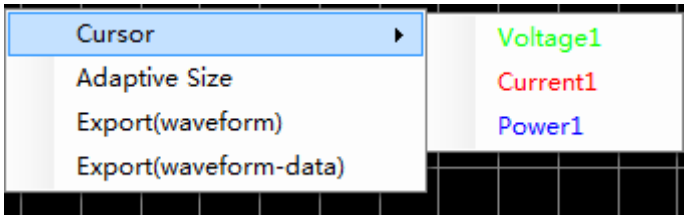


  Click "Add" to set multiple waveforms indicated by the Y axis; you can also select a Y axis and click "Delete".

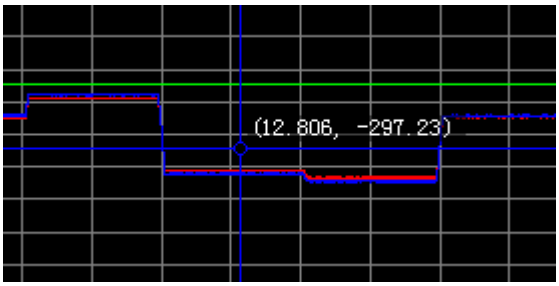
- Query: After setting the query conditions and defining the X/Y axis, click the "Query" button to display the eligible waveforms, as shown in the figure below.



Right-click on the waveform interface to display the following functions:



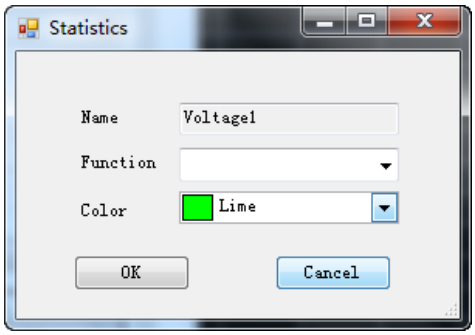
- Cursor: select and display a certain coordinate information of a certain waveform (such as "power"), as shown in the figure below.



- Adaptive Size: adjust the waveform interface to an appropriate size, allowing users to see the complete waveform.
- Export (waveform): Export the waveform interface as a picture.
- Export (waveform-data): Export the waveform data to an Excel file.

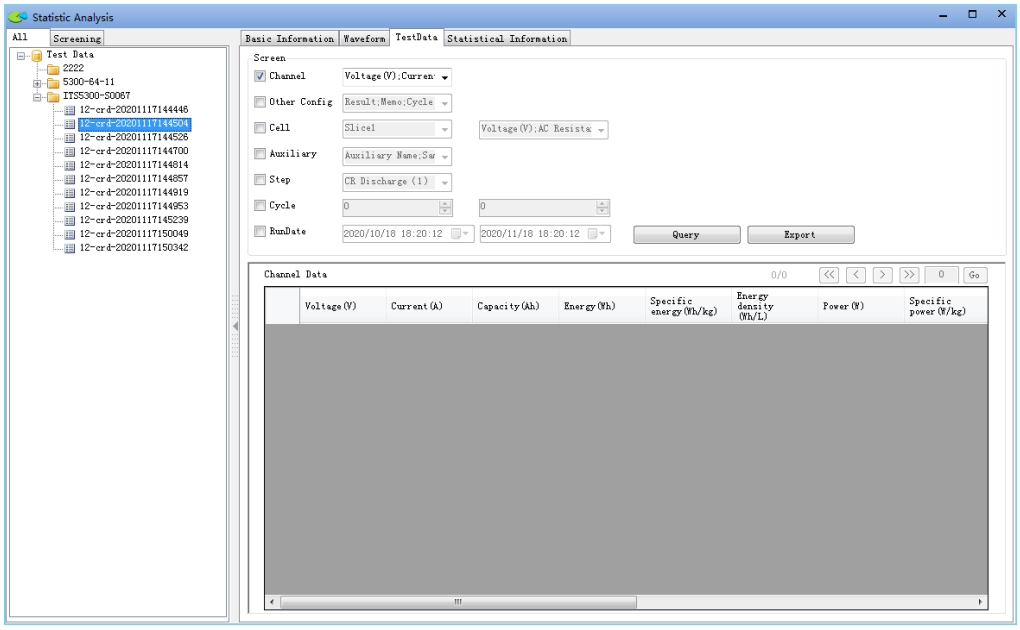
- Adjust Curve

  The user can tick the existing curve name off at the right of the interface, and select to display or not to display the curve. The user can also click the Curve icon to adjust the curve. The user can change the color and operation method of the curve, as shown below.

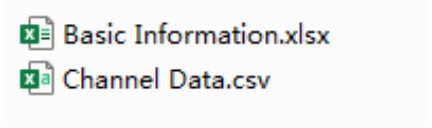


4.1.3 Test Data

The user can select “Test Data” in the Data tab, and view detailed test data of the existing file.



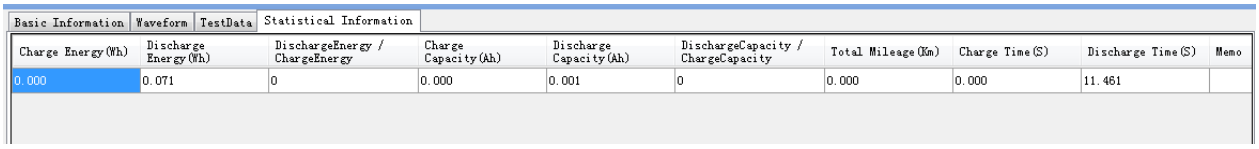
- Screen: Set the filter conditions for test data query.
- Query: After setting the filter conditions, click "Query" to display the test data that meets the conditions.
- Export: Export the "Basic Information" and "Channel Data" of the selected test data file as an Excel file as shown below.



- Channel data: the test data of the selected channel.

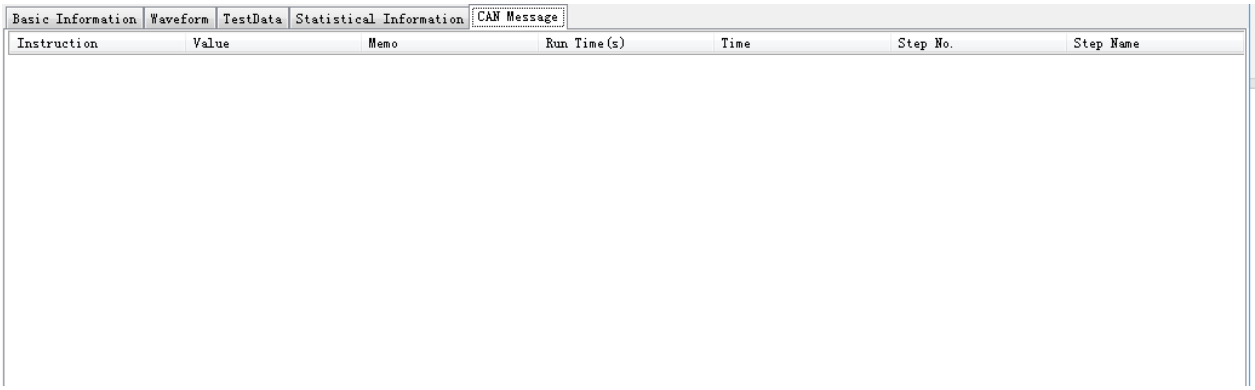
4.1.4 Statistical Information

Accumulated data information for performing battery charge and discharge tests, including statistical information such as charge energy, discharge energy, charge capacity, discharge capacity, and total mileage.



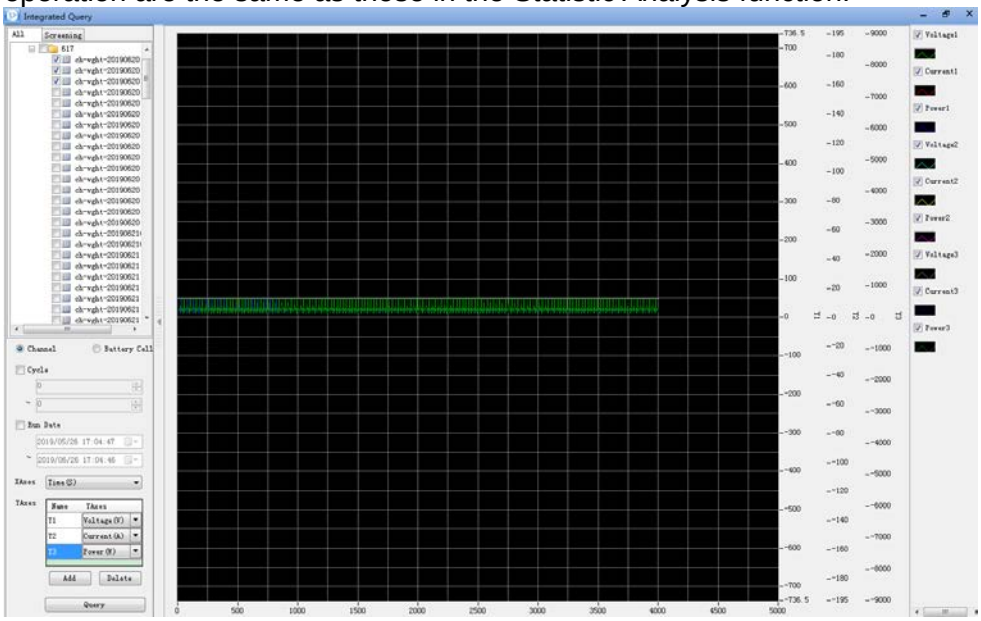
4.1.5 CAN Message

The parsed value of CAN message is displayed on this interface. Different from the function of the **4.3 CAN Message Query** chapter, the interface function of the 4.3 chapter is the query of the original message.



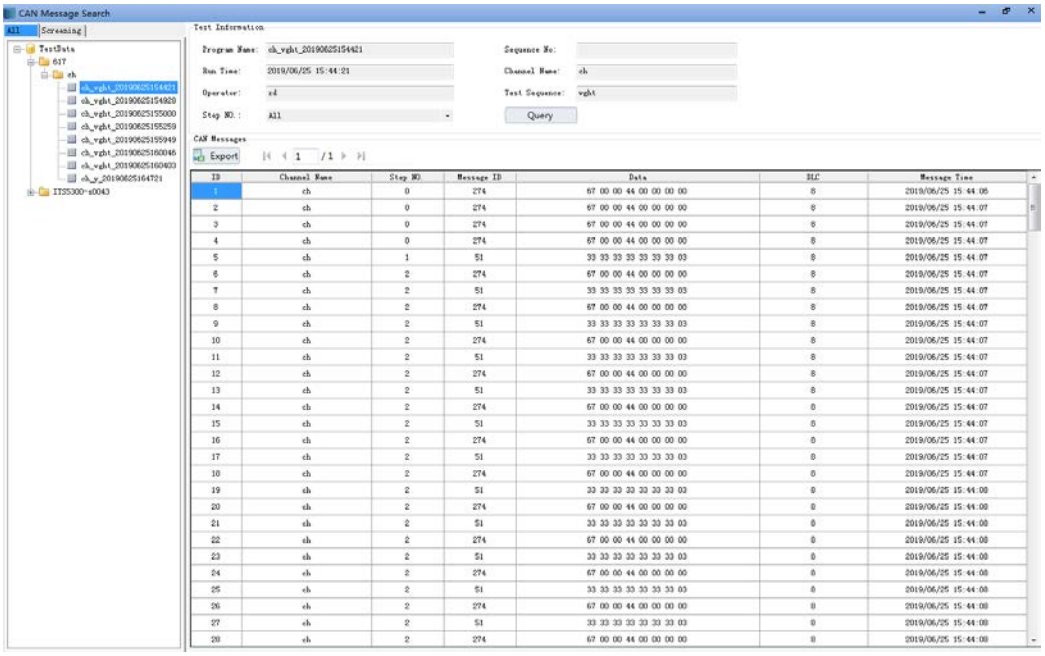
4.2 Integrated Query

The running data of several test programs or different running file data of a same test program can be viewed, which can be used to compare data curves as required. The screening conditions and curve adjustment operation are the same as those in the Statistic Analysis function.



4.3 CAN Message Query

During test, it is necessary to establish CAN communication with the DUT. On the main test interface, click “Data Analysis -> CAN Message Query” to enter the CAN Message Query interface. The user can view the content of all CAN messages received by the system.

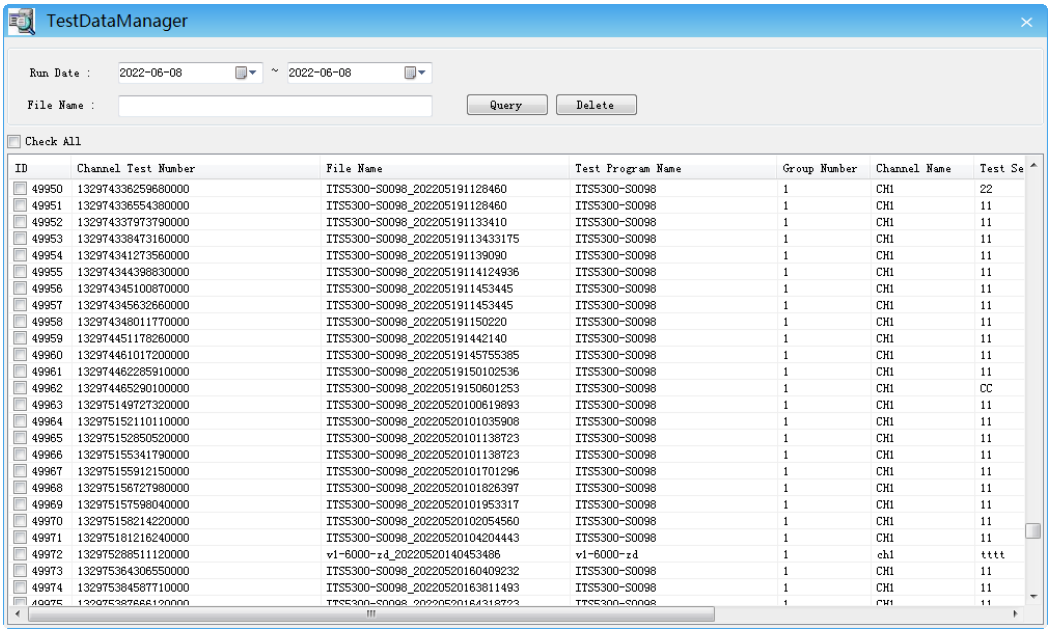


On the CAN Message Query interface, the user can directly click the test program file name for viewing or click the “Screen” for viewing based on screening conditions.

If it is necessary to export the CAN message, click “Export” to export the existing CAN message records to the Excel for saving.

4.4 Test Data Manager

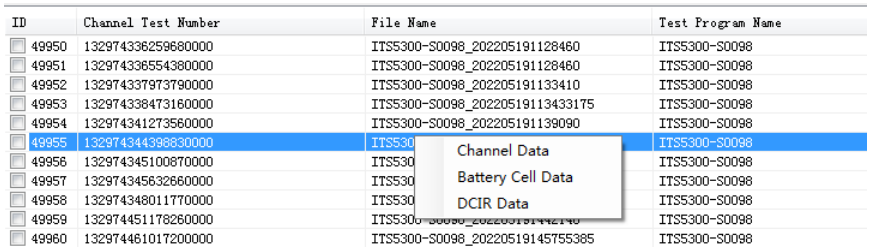
The user can check and delete data generated by all test tasks, and select required data based on test date or test name for checking or deletion.



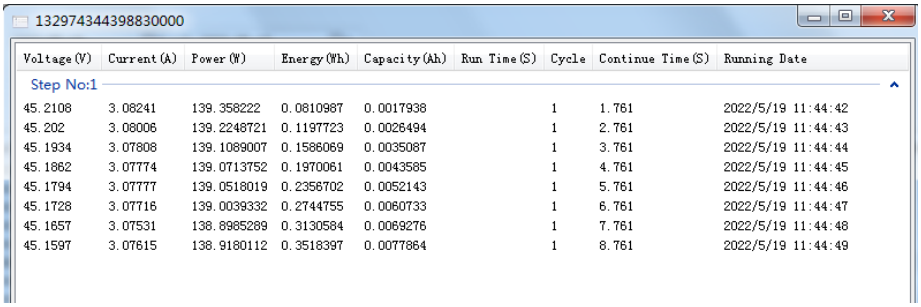
- Run Date: Filter test data based on the set date range.
- File Name: Test data file name. The user can enter the keyword of the file name (such as the test date 20190610) to filter the test data.

- Query: Query the test data that meets the conditions according to the "Run Date" and "File Name".
- Delete: Check the box before a test data record or select "Check All" to delete the test data.

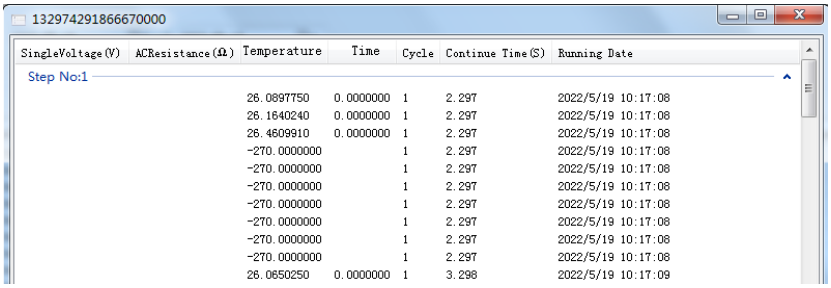
Right-click a test data record and the following menu appears:



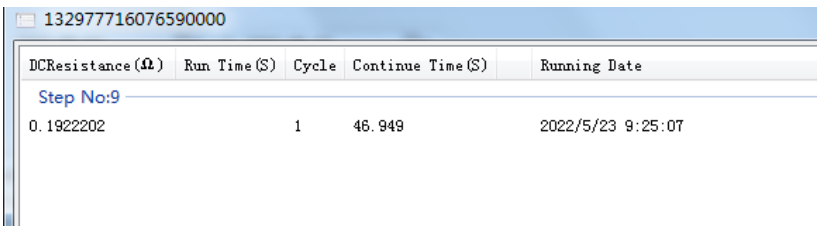
- Channel Data: Displays the test data of a specific test channel.



- Battery Cell Data: Display the test data of the cell.



- DCIR Data: Displays the test data of DC internal resistance.



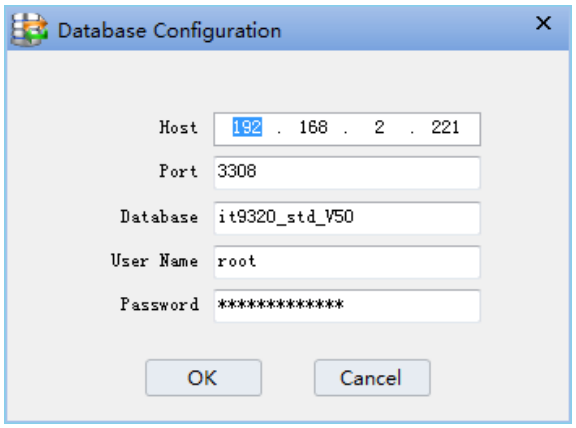
Chapter5 Tool

This chapter introduces system tool function, including database configuration, server settings, user manager and system log query.

5.1 Database Configuration

All test data of ITS5300 test system are saved in the database. During test system installation, the database has been installed and configured. For future change of database configuration, the user can select Tool > DataBase Configuration on the main interface of ITS5300 system.

Input the database information in the following DataBase Configuration window.



Filling information shall be consistent with the information configured during database creation. For detailed description of database creation, refer to the *DB info.txt* file in Installation package path.

5.2 Server Settings

ITS5300 Test System is divided into Client and Server. At the Client, the user can run test and check test results. At the Server, the user can process all tasks and data, and manage communication and connection between the system and the instrument.

The user can install Client and Server programs on the same PC or on different PCs. The Client program installation environment shall be convenient for operation, and the Server program installation environment shall be stable and convenient for connection with hardware devices.

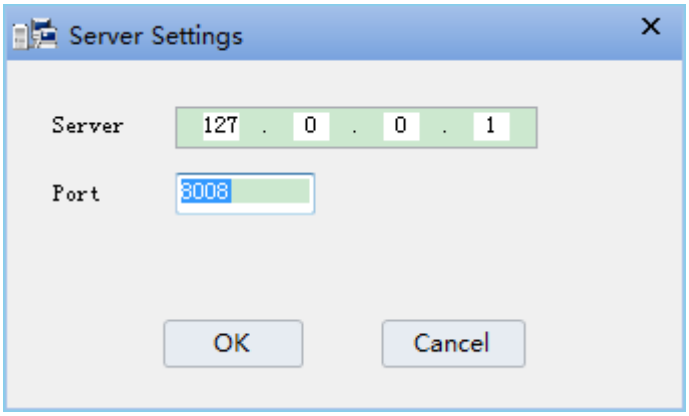
During running of ITS5300 test system, it is necessary to run the Server program and the Client program simultaneously. All user operations shall be performed in the Client programs. Before logging in the Client programs, it is necessary to configure Client program address and ensure successful connection.

When the connection information of Server program changes, the user can change the information with the Server configuration function under the tool module.

The detailed operations are shown as follows.

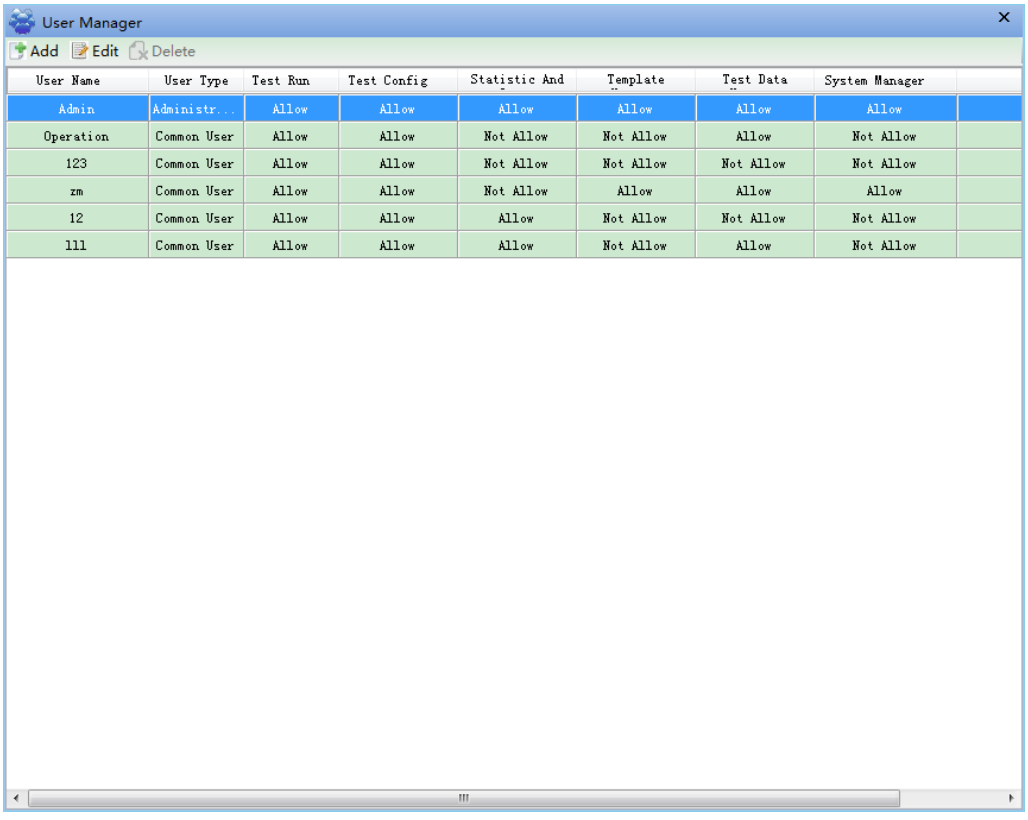
1. Select Tool> Server Settings on the main interface.
2. Input the server address and port number to connect on the Server

Settings.



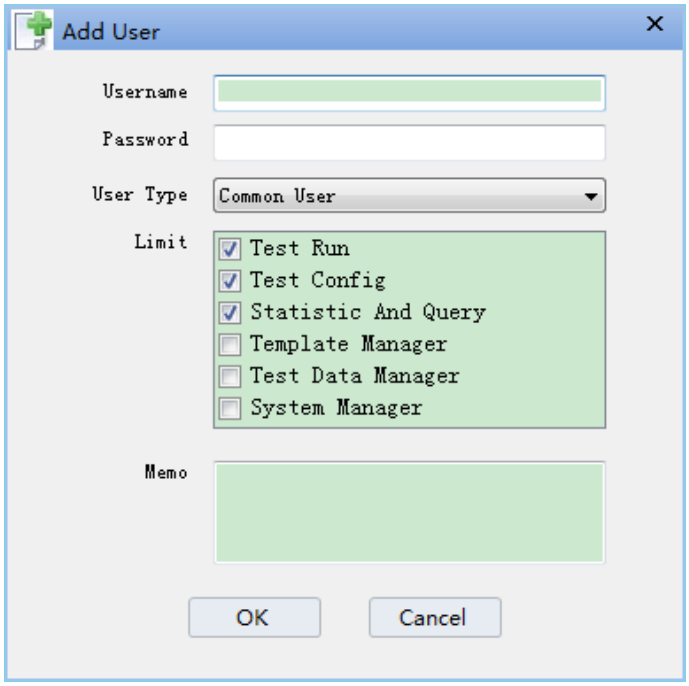
5.3 User Manager

In initial login of ITS5300 battery testing system, user name and password are Admin/123, and the user type is Administrator. After login, the user can add the user information and user permissions in the User Management module. Main page is as shown below.



Add User

1. Select Tool> User Manager on the main interface.
2. Click “Add” on the user manager interface.
3. Set the username, password, user type and user permissions.

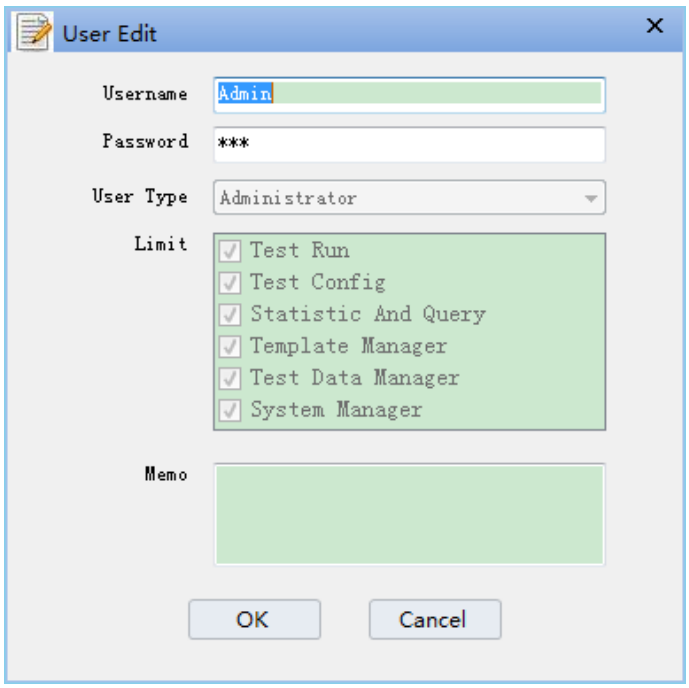


4. Click “OK”, and the system prompts “Add user successful”.

Edit User

1. Select Tool> User Manager on the main interface.
2. Select the user information to edit and click “Edit”.

   You can also double-click the user information to edit.
3. Edit the username, password and relevant limit information on the User Edit interface.



4. Click “OK” and the system prompts “Save successful”.

Delete User

1. Select Tool> User Manager on the main interface.
2. Select one user data record, and click “Delete”.

   The system prompts to confirm deletion.
3. Click “OK”.

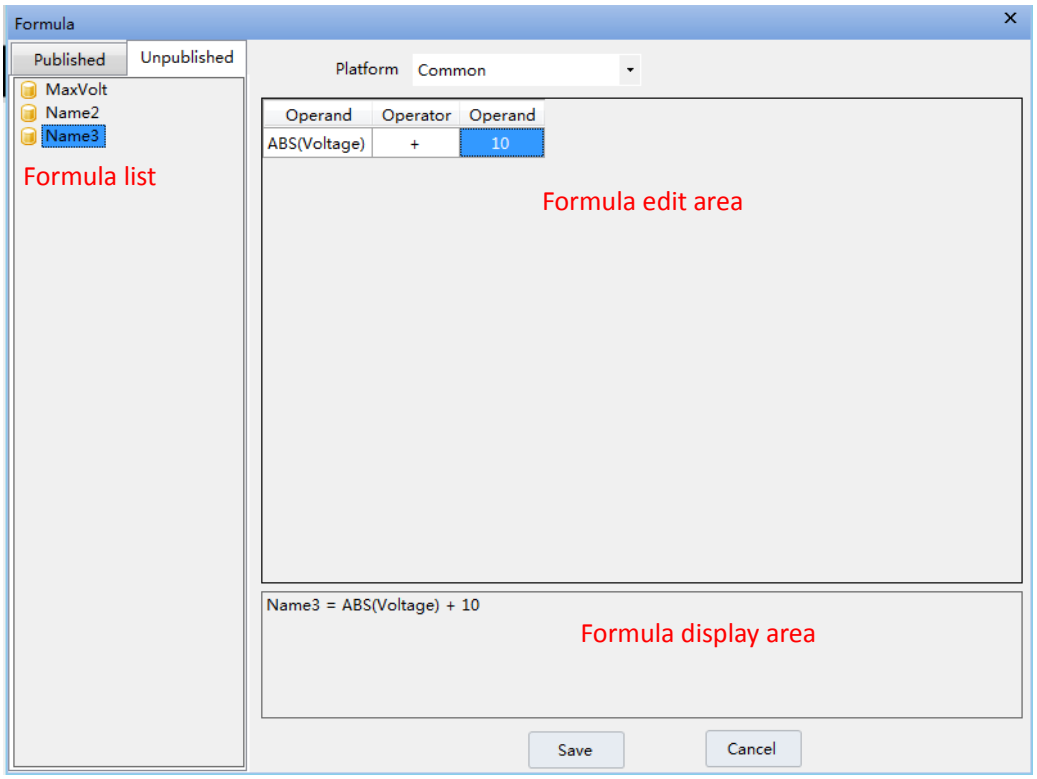
   The system deletes the selected user.

5.4 Manage Formula

The user can create a formula in this menu. After successful creation, the formula will serve as a condition in the cut-off conditions, alarm conditions and protection conditions for selection. The test is stopped or alarm and protection are generated when the formula after calculation meets the setting value.

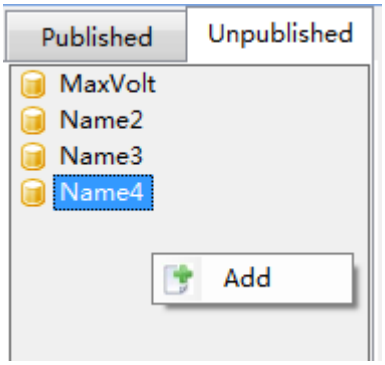
Right click the left formula list to create the formula name, and right click the Formula Edit area to add operand and operator, and edit the required formula. The Formula Edit Area at the bottom will display the formula in real time based on the edited formula.

The user can manage related configurations of the formula based on the existing platform.



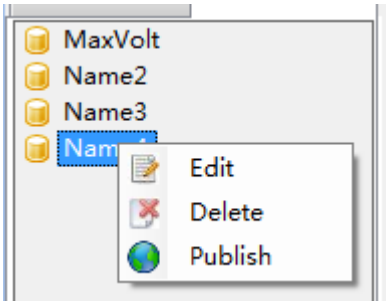
Formula configuration steps are as follows:

1. Select the “Unpublished” tab, and right click in blank and select “Add”.

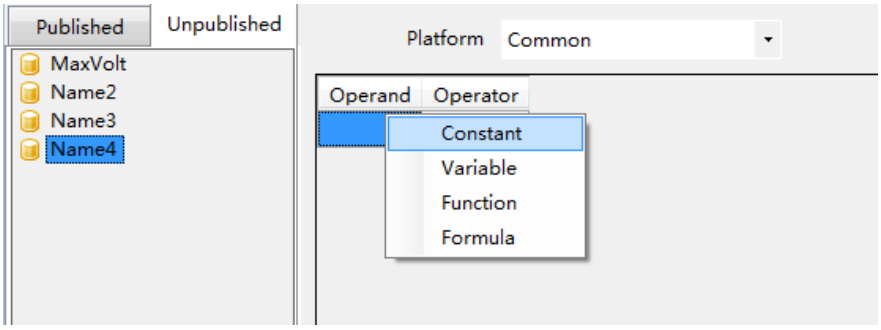


2. Set the formula name, and click Enter for confirmation.

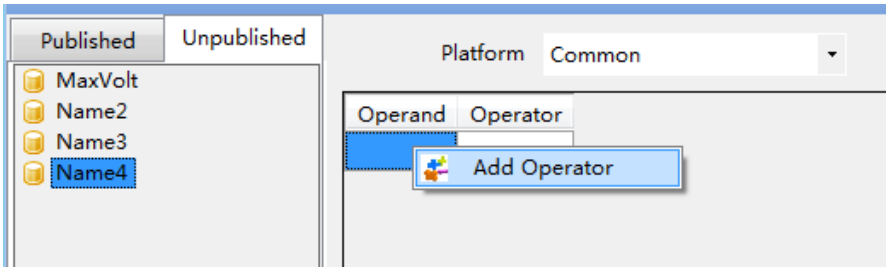
   After the formula is successfully added, right click the formula and you can re-edit the formula name, delete the formula or publish the formula.



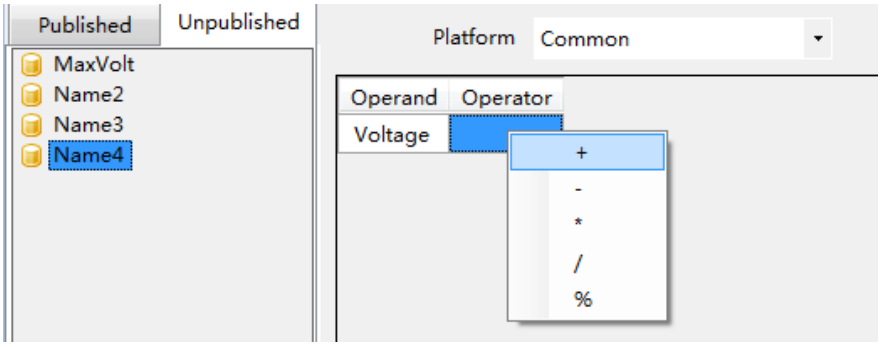
3. In the right Formula Edit Area, double click the box under “Operate” to set the property.



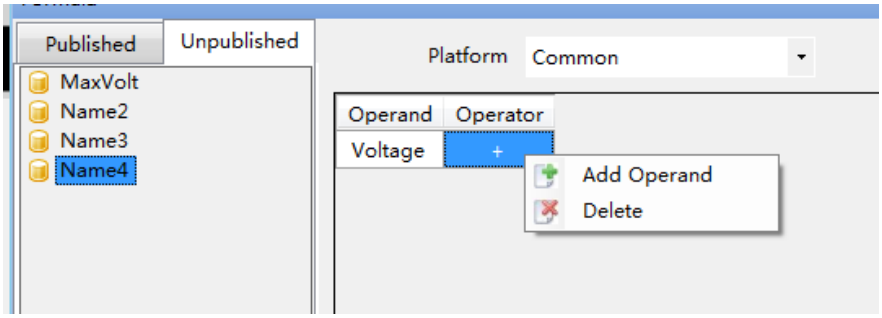
4. Right click the box under the “Operate” and select to add operator.



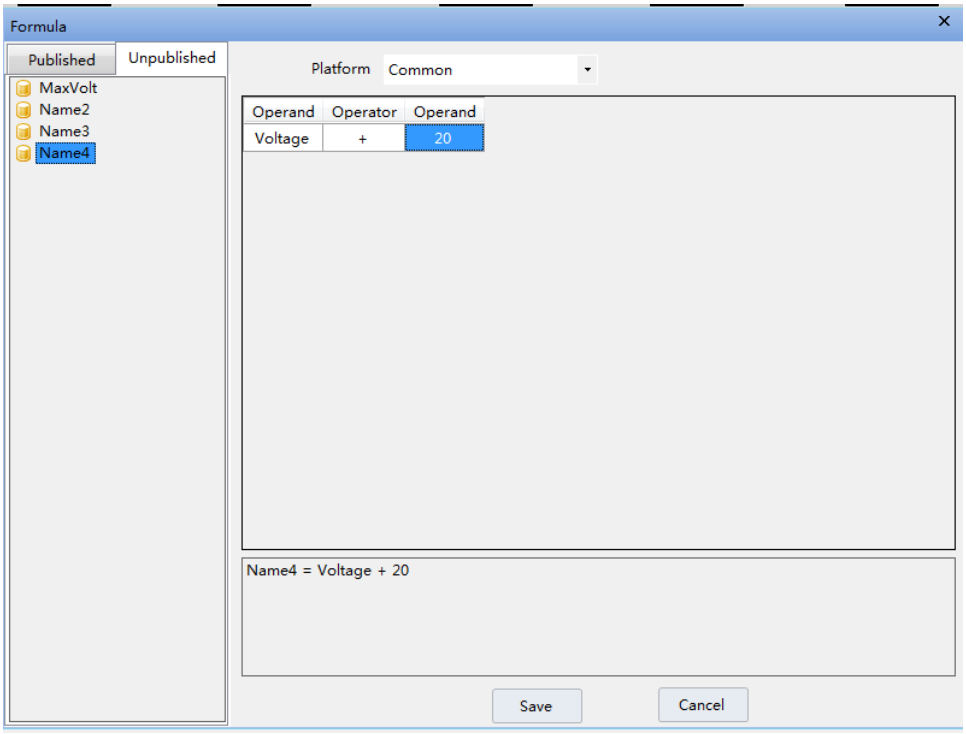
5. Double click the box under the “Operator” and select the operator, as shown below.



6. Right click the box under the “Operator” and select to add the operand.



7. After formula configuration is completed, click “Save”.



5.5 System Log

The user can view the system login information in latest 2 months and clear all login information on this interface.

5.6 Setting Data Accuracy

In this interface, the user can select the interface data accuracy or report data accuracy, and set the number of data digits after the decimal point for the data displayed in the interface and that during data analysis.

5.7 Language

The user can switch software interface language according to the requirement. Select the desired language in Tool> Language setting. The change will take effect after restarting the system client.

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