

# IT9000 Control Software PV3900 User Manual



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Model: IT-M3900C Series  
Version: V1.0/06,2022

# Notices

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## Manual Part Number



402225

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## Safety Notices

### CAUTION

A CAUTION sign denotes a hazard. It calls attention to an operating procedure or practice that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

### WARNING

A WARNING sign denotes a hazard. It calls attention to an operating procedure or practice that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.



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

## Quality Certification and Assurance

We certify that series instrument meets all the published specifications at time of shipment from the factory.

## Warranty

ITECH warrants that the product will be free from defects in material and workmanship under normal use for a period of one (1) year from the date of delivery (except those described in the Limitation of Warranty below).

For warranty service or repair, the product must be returned to a service center designated by ITECH.
















- The product returned to ITECH for warranty service must be shipped PRE-PAID. And ITECH will pay for return of the product to customer.
- If the product is returned to ITECH for warranty service from overseas, all the freights, duties and other taxes shall be on the account of customer.

## Limitation of Warranty

This Warranty will be rendered invalid in case of the following:

- Damage caused by circuit installed by customer or using customer own products or accessories;
- Modified or repaired by customer without authorization;
- Damage caused by circuit installed by customer or not operating our products under designated environment;
- The product model or serial number is altered, deleted, removed or made illegible by customer;
- Damaged as a result of accidents, including but not limited to lightning, moisture, fire, improper use or negligence.

## Safety Symbols

|   |   |   |                    |
|---|---|---|--------------------|
|    | Direct current  |    | ON ( power)        |
|    | Alternating current   |   | OFF ( power)       |
|    | Both direct and alternating current   |   | Power-on state     |
|    | Chassis (earth ground) symbol.  |   | Power-off state    |
|    | Earth ( ground) terminal  |   | Reference terminal |
|   | Caution   |  | Positive terminal  |
|  | Warning ( refer to this manual for specific Warning or Caution information) |  | Negative terminal  |
|  | A chassis terminal  | -   | -                  |

## Safety Precautions

The following safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or specific warnings elsewhere in this manual will constitute a default under safety standards of design, manufacture and intended use of the instrument. ITECH assumes no liability for the customer's failure to comply with these precautions.

**WARNING**

- Do not use the instrument if it is damaged. Before operation, check the casing to see whether it cracks. Do not operate the instrument in the presence of inflammable gasses, vapors or dusts.
  - The instrument is provided with a power cord during delivery and should be connected to a socket with a protective earth terminal, a junction box or a three-phase distribution box. Before operation, be sure that the instrument is well grounded.
  - Please always use the provided cable to connect the instrument.
  - Check all marks on the instrument before connecting the instrument to power supply.
  - Ensure the voltage fluctuation of mains supply is less than 10% of the working voltage range in order to reduce risks of fire and electric shock.
  - Do not install alternative parts on the instrument or perform any unauthorized modification.
  - Do not use the instrument if the detachable cover is removed or loosen.
  - To prevent the possibility of accidental injuries, be sure to use the power adapter supplied by the manufacturer only.
  - We do not accept responsibility for any direct or indirect financial damage or loss of profit that might occur when using the instrument.
  - This instrument is used for industrial purposes, do not apply this product to IT power supply system.
  - Never use the instrument with a life-support system or any other equipment subject to safety requirements.
-

**WARNING**

- **SHOCK HAZARD Ground the Instrument.** This product is provided with a protective earth terminal. To minimize shock hazard, the instrument must be connected to the AC mains through a grounded power cable, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet or distribution box. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in injury or death.
  - **Before applying power, verify that all safety precautions are taken.** All connections must be made with the instrument turned off, and must be performed by qualified personnel who are aware of the hazards involved. Improper actions can cause fatal injury as well as equipment damage.
  - **SHOCK HAZARD, LETHAL VOLTAGES** This product can output the dangerous voltage that can cause personal injury, and the operator must always be protected from electric shock. Ensure that the output electrodes are either insulated or covered using the safety covers provided, so that no accidental contact with lethal voltages can occur.
  - **Never touch cables or connections immediately after turning off the instrument.** Verify that there is no dangerous voltage on the electrodes or sense terminals before touching them.
  - **After using the device, turn off the power switch of the device before unplugging the power cord or disassembling the terminals.** Do not touch the cable or the terminal immediately. Depending on the model, the dangerous voltage at the plug or terminal is maintained for 10 seconds after the device is switched off. Make sure that there is no dangerous voltage before touching them.
- 

**CAUTION**

- **Failure to use the instrument as directed by the manufacturer may render its protective features void.**
  - **Always clean the casing with a dry cloth. Do not clean the internals.**
  - **Make sure the vent hole is always unblocked.**
- 

## Environmental Conditions





The instrument is designed for indoor use and an area with low condensation. The table below shows the general environmental requirements for the instrument.

| Environmental Conditions | Requirements                 |
|--------------------------|------------------------------|
| Operating temperature    | 0°C ~ 40°C                   |
| Operating humidity       | 20% ~ 80%( non-condensation) |
| Storage temperature      | -10°C ~ 70 °C                |
| Altitude                 | Operating up to 2,000 meters |
| Installation category    | II                           |
| Pollution degree         | Pollution degree 2           |

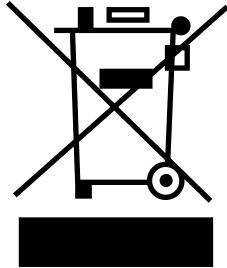

**Note**

In order to ensure the accuracy of measurement, it is recommended to operate the instrument half an hour after start-up.

## Regulation Tag

|   |   |
|---|---|
|  | The CE tag shows that the product complies with the provisions of all relevant European laws (if the year is shown, it indicates that the year when the design is approved).  |
|  | The UKCA tag shows that the product complies with the provisions of all relevant United Kingdom laws (if the year is shown, it indicates that the year when the design is approved).  |
|  | This instrument complies with the WEEE directive (2002/96/EC) tag requirements. This attached product tag shows that the electrical/electronic product cannot be discarded in household waste.  |
|  | This symbol indicates that no danger will happen or toxic substances will not leak or cause damage in normal use within the specified period. The service life of the product is 10 years. The product can be used safely within the environmental protection period; otherwise, the product should be put into the recycling system. |

## Waste Electrical and Electronic Equipment (WEEE) Directive



Waste electrical and electronic equipment (WEEE) directive, 2002/96/EC

The product complies with tag requirements of the WEEE directive (2002/96/EC). This tag indicates that the electronic equipment cannot be disposed of as ordinary household waste. Product Category

According to the equipment classification in Annex I of the WEEE directive, this instrument belongs to the "Monitoring" product.

If you want to return the unnecessary instrument, please contact the nearest sales office of ITECH.



## Compliance Information

Complies with the essential requirements of the following applicable European Directives, and carries the CE marking accordingly:

- Electromagnetic Compatibility (EMC) Directive 2014/30/EU
- Low-Voltage Directive (Safety) 2014/35/EU

Conforms with the following product standards:

### EMC Standard

IEC 61326-1:2012/ EN 61326-1:2013 <sup>123</sup>

#### Reference Standards

CISPR 11:2015+A1:2016 Ed 6.1

IEC 61000-3-2: 2018 RLV

IEC 61000-3-3: 2013+A1:2017

IEC 61000-4-2:2008

IEC 61000-4-3 2006+A1:2007+A2:2010/ EN 61000-4-3 A1:2008+A2:2010

IEC 61000-4-4:2012

IEC 61000-4-5:2014+A1:2017

IEC 61000-4-6:2013+cor1:2015

IEC 61000-4-11:2004+A1:2017

1. The product is intended for use in non-residential/non-domestic environments. Use of the product in residential/domestic environments may cause electromagnetic interference.
2. Connection of the instrument to a test object may produce radiations beyond the specified limit.
3. Use high-performance shielded interface cable to ensure conformity with the EMC standards listed above.

### Safety Standard

IEC 61010-1:2010+A1:2016

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# 1 Brief Introduction

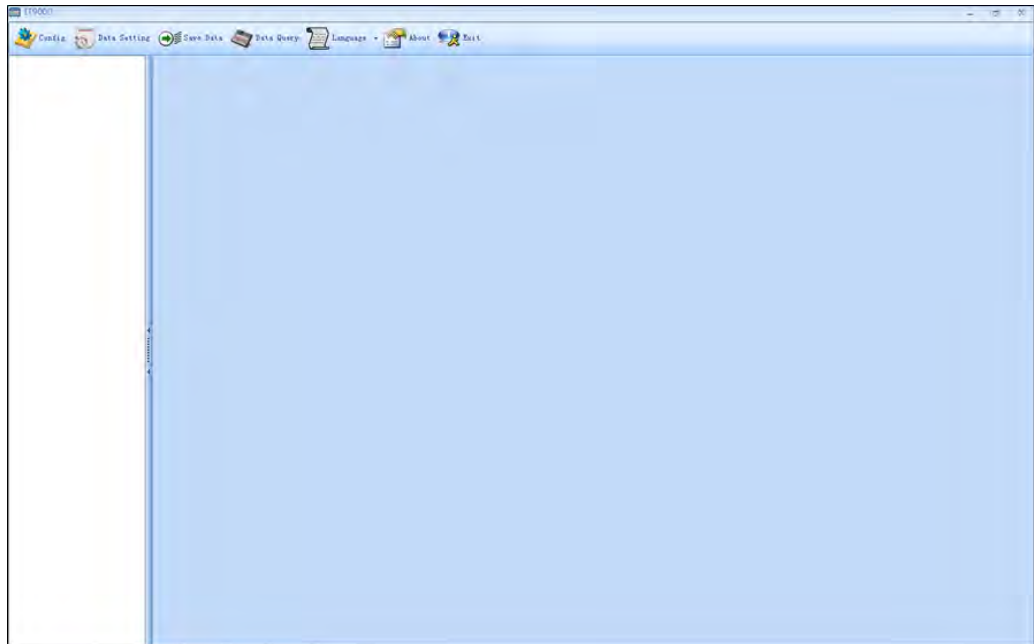
- ◆ Software Introduction
- ◆ IT9000 Interface Introduction

## 1.1 Software Introduction

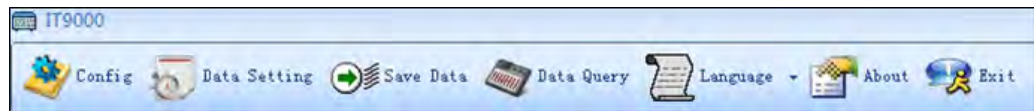
IT9000-PV3900 is a kind of easy-to-use and practicable control software designed by Itech Electronic Co., Ltd. It is applicable to Itech IT-M3900B, IT-M3900C, IT-M3900D, IT-M3800 Series products. With this software, you can take all operations for power supply front panel via computer control and enjoy great convenience in remote control. This software supports RS232, USB, GPIB and Ethernet communication interface.

## 1.2 IT9000 Interface Introduction

After run IT9000, the software will initialize, in about 2 seconds, the English interface will appear. After modifying the language to Chinese Simplified, the below interface is displayed:



The interface is described as follows:



- **Config**  
Configuration function, to configure hardware information for control power supply device of IT9000 software control, including power supply device alias, device interface and interface parameter, and to configure sub-devices (e.g., channels) for each device.
- **Data Setting**  
Data setting, mainly to select numeric field to be saved, device alias and save interval before data saving.
- **Save Data**  
Data saving, mainly to save present test data. Before data saving, please set data at first.
- **Data Query**  
Data query, to open the data file saved before.
- **Language**  
To select software language version, including Simplified Chinese, Chinese-traditional and English.
- **About**  
To list related information of software, including Company website.
- **Exit**  
To exit IT9000 software.

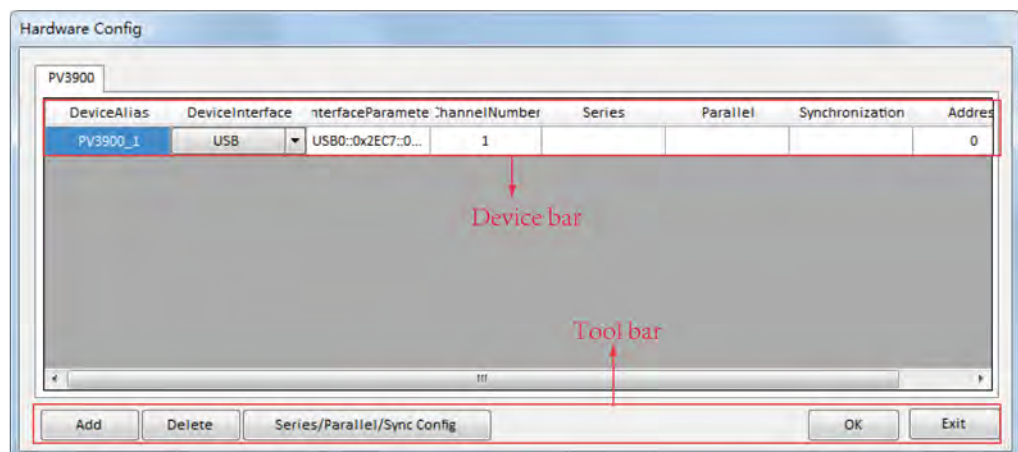
# 2 Basic Operation

- ◆ Hardware Configuration
- ◆ Data Setting and Saving
- ◆ Data Query

## 2.1 Hardware Configuration

### 2.1.1 Function Introduction

The hardware configuration interface of IT9000 software is as shown below.



- The “Device bar” includes settings for device alias, device interface, interface parameter and channel number:
  - Device Alias: the alias of a device, used to distinguish devices of same model.
  - Device Interface: drop-down options include RS232, GPIB, USB and Ethernet.
  - Interface Parameter: the interface parameter corresponding to device interface.
  - Channel Number: to set the channel number of sub-device.
  - Series: to display series configuration name in series connection of devices.
  - Parallel: to display parallel configuration name in parallel connection of devices.

- Synchronization: to display synchronization configuration name in synchronization of devices.
- Address: to set instrument communication address (used for devices with frame format protocol).
- Main toolbar functions:
  - Add: to add hardware device.
  - Delete: to delete specific device.
  - Series/Parallel/sync Config
  - OK: to confirm hardware configuration information.

## 2.1.2 Configuring Hardware

When the user needs to connect the instrument to PC to realize computer control, the user needs to add the instrument to the software interface firstly. Take USB communication as an example. The following introduce how to configure hardware.



For more information on the communication interface, please refer to the product's User Manual.

### Precondition

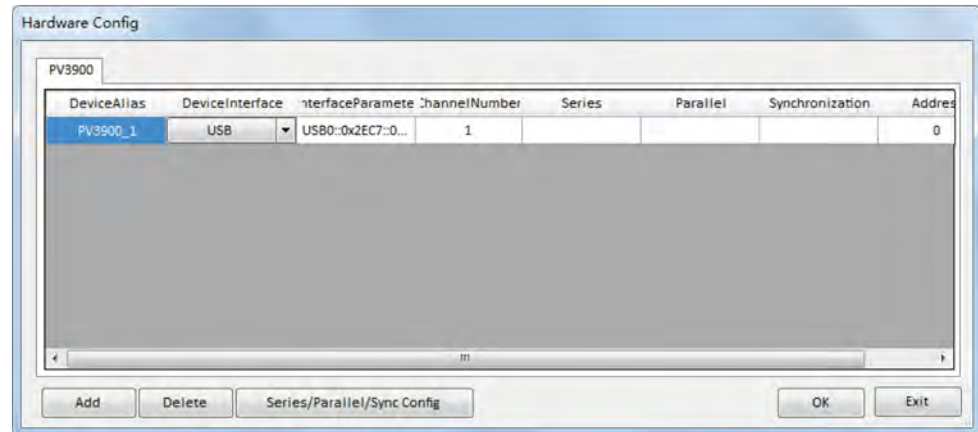
1. Before configuring hardware, you need to check whether the device communication method is consistent with the realistic application or not.
 

If they are inconsistent, you need to modify the communication mode on the front panel of the instrument. The detailed modification method is as follows:

  - a. Turn on the device.
  - b. Press **[Shift]+[P-set]**(System) to enter the system menu on the device front panel.
  - c. Press the up / down key or rotate the knob to select **I/O** and press **[Enter]**.
  - d. Press the right / left key or rotate the knob to select USB.
  - e. Press **[Enter]** to confirm the modification.
2. Connect the instrument and PC by USB cable.

## Operation steps

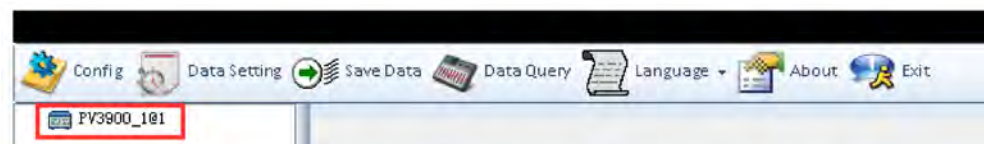
1. Run IT9000 software and click “Configure” icon.
2. Click “Add” button in the Configuration Interface and display the currently added hardware device information and default parameter of device in the “Device bar” at top. As shown below.



To change default parameter of hardware device (e.g., device interface, interface parameter and channel number), you may click the parameter for change.

- Device Alias: double click to edit device alias.
  - Device Interface: to select from the drop-down box.
  - Interface Parameter: double click to configure in the Configure Dialog. For details, refer to [2.1.3 Configuring Interface of Device](#).
  - Channel Number: set the channel number of sub-device. The channel number is changeable.
3. Click “OK” to save the configuration information of current hardware device.

At this time, the device name (device alias @ channel number) will be displayed at top left of the interface. To pop up the Control Interface, you need to double click the Device Name.



## 2.1.3 Configuring Interface of Device

IT9000 software is installed in PC and interacts with matching hardware devices via different communication interfaces. This software supports interfaces like

USB, RS232, GPIB and Ethernet interface. When configuring the hardware device, configure different interface types based on actual needs and set corresponding interface parameters for different interfaces.

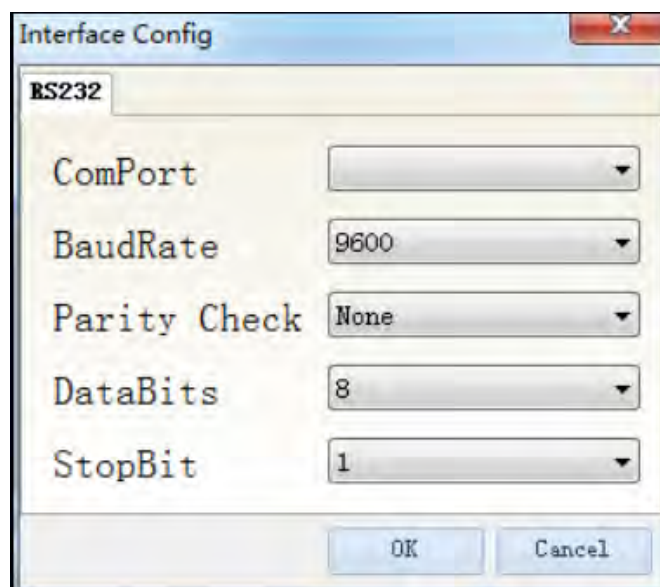
The IT-M3900 series comes standard with three communication interfaces: USB, LAN and CAN, and supports two optional interfaces: GPIB and RS-232. For GPIB and RS-232, before configuring, you need to confirm that the corresponding communication card has been inserted into the rear panel of the instrument.

## Operation steps

1. Select the device interface corresponding to the hardware device to be edited from the Hardware Configuration Interface, and select the interface type from the drop-down list.



2. After selecting the device interface, double click corresponding "Interface Parameter" column. The system will pop up "Interface Configuration" window.
  - RS232 Interface Parameter Configuration

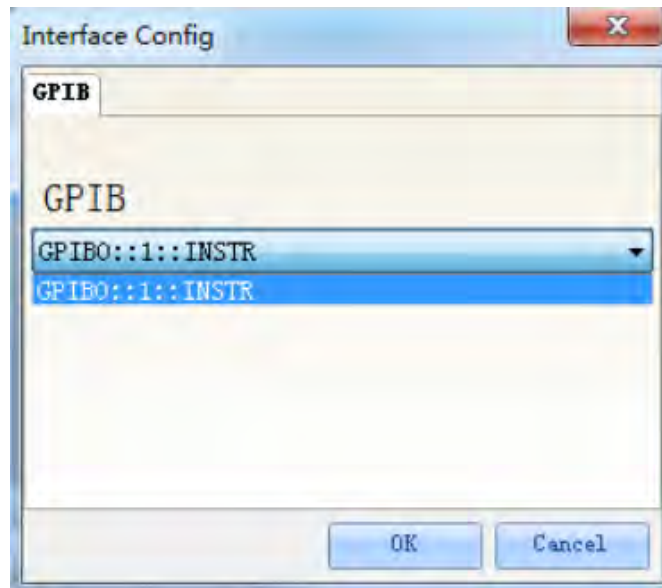




Serial interface: to select serial interface, i.e., the serial interface number occupied by RS232 communication cable interface.

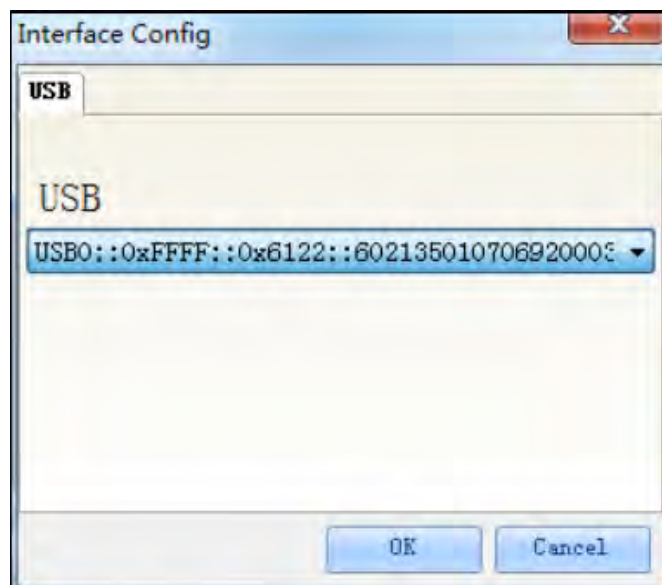
Baud rate, parity check bit, data bits and stop bit must be configured consistently with those in System menu setup.

- GPIB Interface Parameter Configuration



During GPIB communication of device, the address setting range is: 1-30.

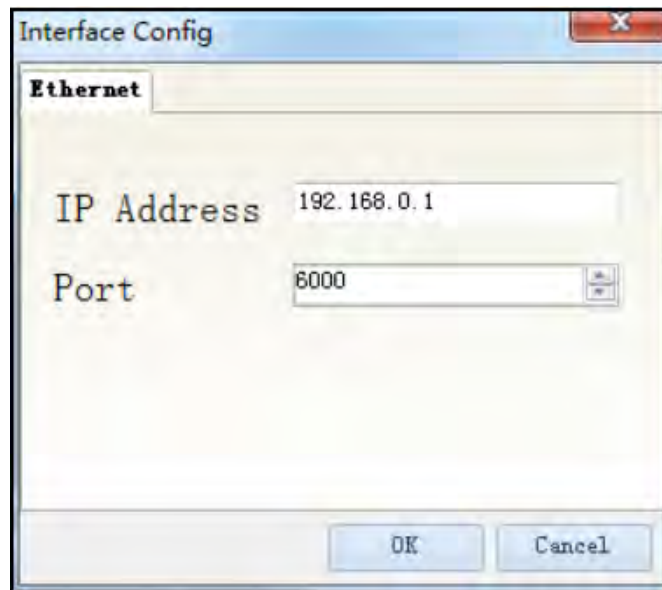
- USB Interface Parameter Configuration



- LAN Interface Parameter Configuration

If LAN interface is used for communication, both computers and device are connected via HUB (or, the device and computer are directly

connected via cross network cable). The computer and device IP setting should be in a same network segment.



IP address: When using the LAN interface for communication, both the computer and the instrument are connected through the HUB (or the instrument and the computer are directly connected through the standard network cable), and the IP settings of the computer and the instrument must be consistent and need to be on the same network segment.

Port number: Consistent with the instrument's SocketPort value.

3. After interface parameter configuration, click "OK". Finish interface parameter configuration.

## 2.1.4 Series, Parallel and Synchronization Configuration

This configuration is used when several devices or several channels are connected. Setting types include series, parallel and synchronization.

This series of power supplies only supports parallel functions, and the parallel function does not need to be configured in the "Series / Parallel / Synchronous Configuration". The relevant instructions for paralleling are as follows:

- Before the software configuration, you must first confirm that the parallel connection between the instruments (same model) and the master / slave configurations are completed. For details, please refer to the product's User Manual.
- You only need to connect the master to the PC. In the "Hardware Configuration" interface, you only need to add the master, no need to add the slave device.

- The parallel function in the software interface enables: Take the parallel between two IT-M3906C-500-36 as an example, the settable range of the current setting value (Is), current upper limit (I+), current lower limit (I-) in the software control interface is from -72 to 72A. Other functions (such as ARB) are the interaction between the PC and the master.

That is, the parallelization realizes the expansion of output current and output power. You still control one instrument (master) in the software interface, but the output capability is doubled compared to the single unit.

## Operation steps

In the following, taking two single units in parallel as an example, the steps of parallel connection are as follows:

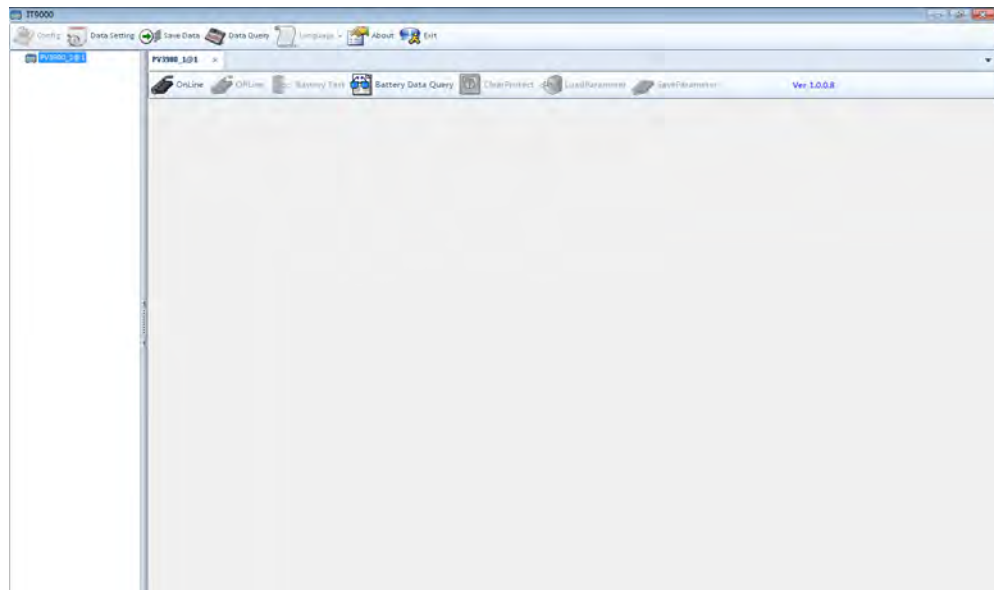
1. Connect the cables between the two single units, and configure the master-slave configuration.  
For details, see the User Manual.
2. Select the communication method of the master unit and connect the master unit to the PC using the communication cable.
3. In the Hardware Configuration interface, add the master device.

## 2.2 Data Setting and Saving

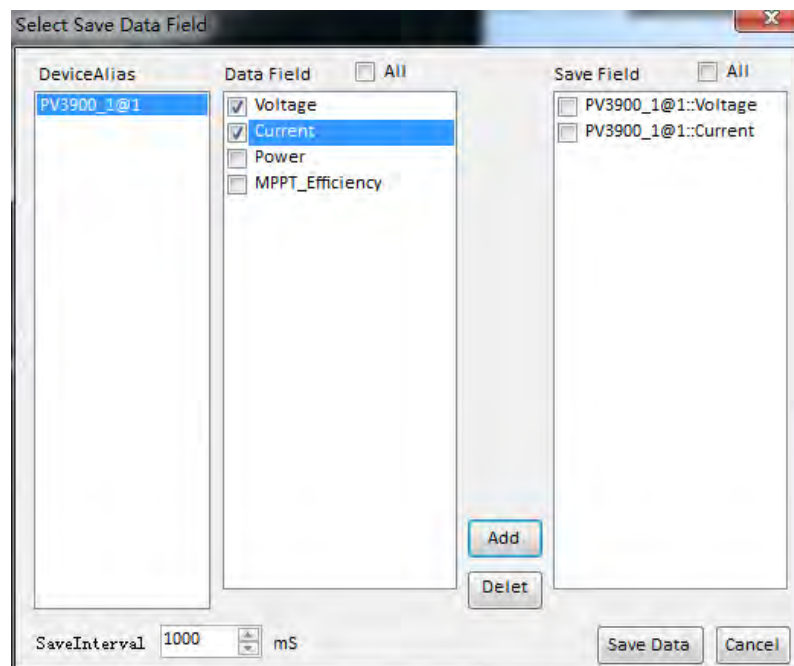
IT9000 can save test data. Before data saving, select the data field to be saved. Select the device alias for saving and the save interval.

### Operation step

1. After device hardware configuration is finished, double click the device name (device alias @ channel number) displayed at top left of the interface. At this time, Device Control Interface will be displayed. As shown below.



2. Click “Data Setting” icon to enter the Data Setting Interface.
3. Click the alias of the device requiring data saving.
4. In “Data Field” bar, check the box at front of Data Field (Voltage, Current, Power), and click “Add” button to enter the “Save Field” bar.



You may also click the Field Name in the Save Field bar. Click “Delete” button to delete the saved field.

5. Set “Save Interval”.
6. Click “Save Data” button to save data setting.
7. In the Control Interface, click “Save Data” icon to appear the interface as shown below. You need to input Save File Name.



- Click “OK” button in the figure above to start data save.

Then, the icon will change to Stop Save, and “Data Setting” and “Data Query” will be grayed out.

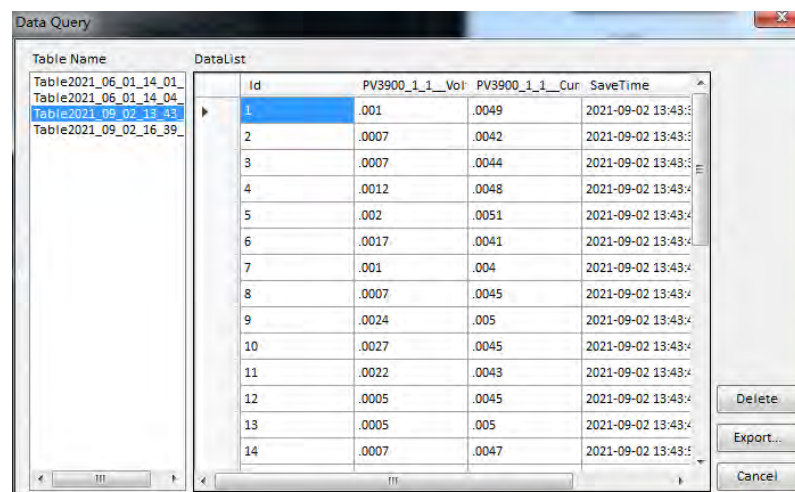
Click Stop Save to stop saving.

## 2.3 Data Query

IT9000 software provides query function for measured data. You can query measured data at different periods of time and export and save these measured data.

### Operation steps

- Click Data Query icon to enter the Data Query Interface.
- In Data Query Interface, select and click the “Table Name” of data saving, and the test data will be displayed in the data list. As shown below.



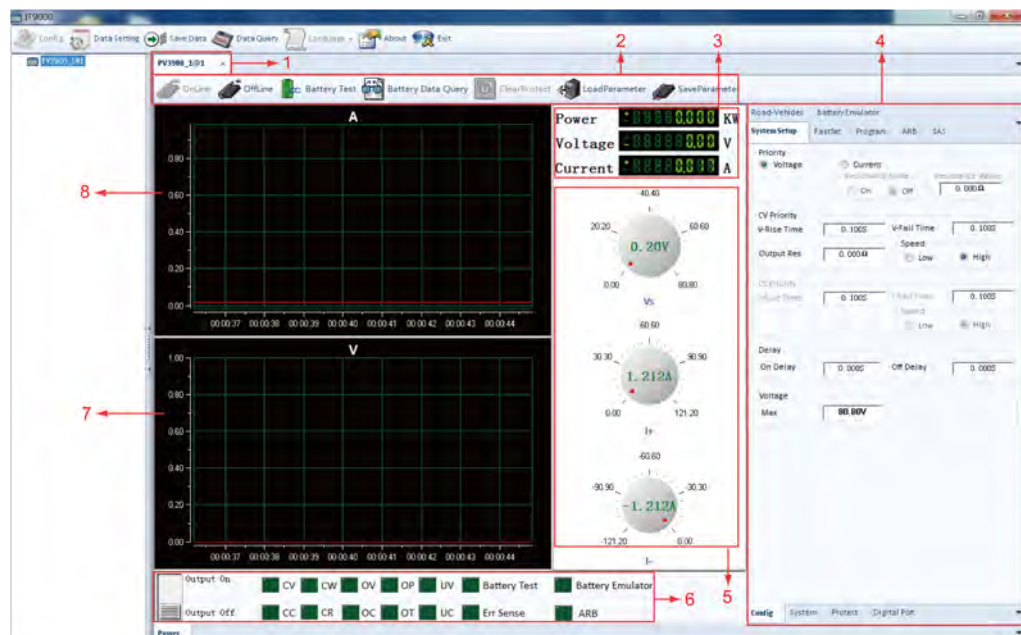
- Delete: to delete the data in current data list.
- Export: Click Export to export the data in current data list to EXCEL table. Saving path is optional.
- Cancel: to exit the Data Query Interface.

# 3 PV3900 Control Interface

- ◆ Introduction of Control Interface
- ◆ Simulated Pulsating Knob
- ◆ SystemSetup
- ◆ FastSet
- ◆ Program
- ◆ ARB
- ◆ Battery Test
- ◆ Battery Emulator
- ◆ Road-Vehicles
- ◆ SAS
- ◆ Curve Zoom In and Translation

## 3.1 Introduction of Control Interface

The PV3900 Control Interface of IT9000 software (after clicking "Online") is as shown below.



1. Tab bar, to switch the display of Control Interfaces of different devices.
2. Toolbar, main functions include:

**Online:** remote control, to set the instrument to Remote Control mode.

**Offline:** local switch, to return the instrument back to Local Mode from Remote Mode.

**Battery Data Query:** query the test data saved when the Battery Test function and Battery Emulator function are running.

**Clear Protect:** to clear instrument protection status.

**Load Parameter:** to recall the parameter settings stored in a file suffixed with .3900, including the parameters in the program, and scan interface.

**Save Parameter:** to save the parameters in the program, and scan interface to a file with a .3900 suffix for users to quickly and easily use.

3. The real-time display value of voltage, current, and power, that is, the Meter value.
4. SystemSetup, FastSet, Program, ARB, and other function configuration interfaces.
5. Pulsating knob for voltage, current.
  - **CV priority:** (default mode) Used to set the voltage setting value (Vs), current upper limit (I+), current lower limit (I-)
  - **CC priority:** Used to set the current setting value (Is), voltage upper limit (Vh), voltage lower limit (Vl)



#### Note

Different types of instruments display different setting ranges, please refer to the actual display.

6. Display instrument status
  - Output status: On/ Off.
  - Working status: CV priority (CV), CC priority (CC), constant power(CW), constant resistance(CR), ARB waveform output status (ARB), battery test status (Battery Test), battery simulation status (Battery Emulator)
  - Protection status: overvoltage (OV), over power (OP), undervoltage (UV), output electrode reverse (RVS), over temperature (OT), over current (OC), undercurrent (UC), protection state (PS), Sense protection(Err Sense).
7. Voltage curve graph
8. Current curve graph

## 3.2 Simulated Pulsating Knob

You can set the voltage and current values by simulating the pulsation knob, but the pulsation knob is not very precise. For precise settings, you can use the Hot-key in FastSet. For details, see [3.4.1 HotKey](#).

The usage of the pulsation knob is described as follows:

1. Move the mouse to the pulsation knob.
2. Click the knob and drag the mouse: turn the mouse clockwise to increase the value and counterclockwise to decrease the value.
3. Release the left mouse button or move the mouse arrow away from the pulsation knob to complete the setup.

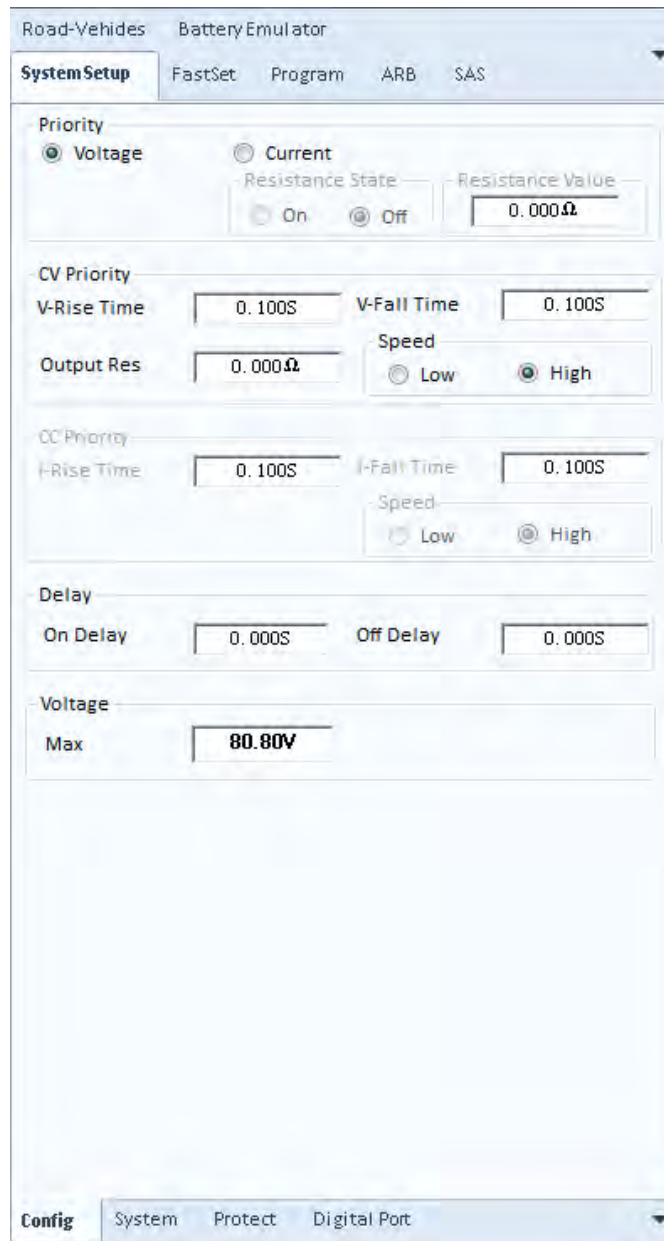
## 3.3 SystemSetup

The system settings include four sub-pages: Config, System, Protect, and Digital Port. The parameter settings for each page are described below.

### 3.3.1 Config

The parameters on this page correspond to the parameter settings in the **[Shift]+[V-set](Config)** menu on the front panel of the instrument, as shown in the figure below.





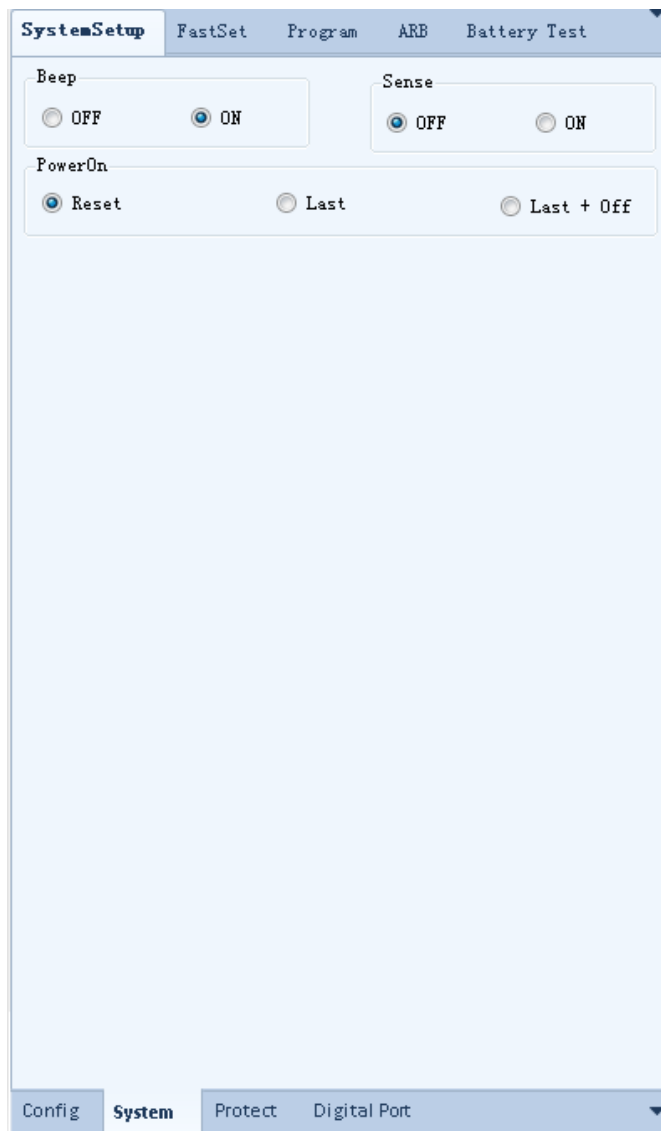
The parameters are detailed as follows:

|          |   |                                     |
|----------|---|-------------------------------------|
| Priority | CC/CV priority selection. The settings here are directly related to the parameter settings in FastSet, Program, ARB. For example, if "Voltage" is selected, it will be displayed as <b>Vs</b> in FastSet; if "Current" is selected, it will be displayed as <b>Is</b> in FastSet. |                                     |
|          | Voltage   | Constant voltage loop priority mode |
|          | Current   | Constant current loop priority mode |
|          |   | Resistance State: on/off.           |

|             |  |   |
|-------------|--|---|
|             |  | Resistance Value: Set the CR function in sink mode. This parameter needs to be set only when priority mode is selected as CC. |
| CV Priority | CV priority related parameter settings       |   |
|             | V-Rise Time                                  | The time interval at which the voltage rises from the present value to the set value.   |
|             | V-Fall Time                                  | The time interval at which the voltage drops from the present value to the set value.   |
|             | Output Res                                   | Set the internal resistance of the power supply.  |
|             | Speed  | CV loop response speed setting: high speed / low speed  |
| CC Priority | CC priority related parameter settings       |   |
|             | I-Rise Time                                  | The time interval at which the current rises from the present value to the set value.   |
|             | I-Fall Time                                  | The time interval at which the current drops from the present value to the set value.   |
|             | Speed  | CC loop response speed setting: high speed / low speed  |
| Delay       | Delay in when the output is turned on or off |   |
|             | On Delay                                     | Set the delay time to turn on the output.   |
|             | Off Delay                                    | Set the delay time to turn off the output.  |

### 3.3.2 System

The parameters on this page correspond to some parameter settings in the **[Shift]+[P-set](System)** menu on the front panel of the instrument, as shown in the figure below.



The parameters are detailed as follows:

|       |                               |                              |
|-------|-------------------------------|------------------------------|
| Beep  | Set the beeper state.         |                              |
|       | On                            | Turn the beeper on.          |
|       | Off                           | Turn the beeper off.         |
| Sense | Set the sense function state. |                              |
|       | Off                           | Turn the sense function off. |
|       | On                            | Turn the sense function on.  |
| Sense | Set the sense function state. |                              |
|       | Off                           | Turn the sense function off. |
|       | On                            | Turn the sense function on.  |

|         |   |   |
|---------|---|---|
| PowerOn | Set the parameter settings and <b>[On/Off]</b> status when the instrument is powered on. See the product's User Manual for details. |   |
|         | Reset   | When the instrument is powered on, the instrument will initialize some settings and <b>[On/Off]</b> state.  |
|         | Last  | When the instrument is powered on, the instrument will remain the same settings and <b>[On/Off]</b> state as last time you turned off the instrument.             |
|         | Last+Off  | When the instrument is powered on, the instrument will remain the same settings as last time you turned off the instrument, but the <b>[On/Off]</b> is OFF state. |

### 3.3.3 Protect

The parameters on this page correspond to the parameters in the **[Shift]+[Recall](Protect)** menu, as shown below.

SystemSetup
FastSet
Program
ARB
Battery Test

**OVP**

OFF
  ON
 Level 
 Delay

**OCP**

OFF
  ON
 Level 
 Delay

**OPF**

OFF
  ON
 Level 
 Delay

**UVF**

OFF
  ON
 Warm-Up

Level 
 Delay

**UCF**

OFF
  ON
 Warm-Up

Level 
 Delay

Config
System
Protect
Digital Port

The parameters are detailed as follows:

|     |                        |                                  |
|-----|------------------------|----------------------------------|
| OVP | Overvoltage protection |                                  |
|     | Off                    | Turn the OVP function off. (Def) |
|     | On                     | Turn the OVP function on.        |
|     | Level                  | OVP limit                        |
|     | Delay                  | Protection delay time            |
| OCP | Overcurrent protection |                                  |
|     | Off                    | Turn the OCP function off. (Def) |
|     | On                     | Turn the OCP function on.        |
|     | Level                  | OCP limit                        |
|     | Delay                  | Protection delay time            |

|     |                         |                                  |   |
|-----|-------------------------|----------------------------------|---|
| OPP | Overpower protection    |                                  |   |
|     | Off                     | Turn the OPP function off. (Def) |   |
|     | On                      | Turn the OPP function on.        |   |
|     |                         | Level                            | OPP limit   |
|     |                         | Delay                            | Protection delay time   |
| UCP | Undercurrent protection |                                  |   |
|     | Off                     | Turn the UCP function off. (Def) |   |
|     | On                      | Turn the UCP function on.        |   |
|     |                         | Warm-up                          | Indicates the instrument warm-up time. This time is set to prevent the instrument from triggering protection when the current is rising. Because this transient condition should not be considered as an undercurrent fault and there is no need to trigger protection. |
|     |                         | Level                            | UCP limit   |
|     |                         | Delay                            | Protection delay time   |
| UVP | Undervoltage protection |                                  |   |
|     | Off                     | Turn the UVP function off. (Def) |   |
|     | On                      | Turn the UVP function on.        |   |
|     |                         | Warm-up                          | Indicates the instrument warm-up time. This time is set to prevent the instrument from triggering protection when the voltage is rising. Because this transient condition should not be considered as an undervoltage fault and   |

|  |  |       |   |
|--|--|-------|---|
|  |  |       | there is no need to trigger protection. |
|  |  | Level | UVP limit                               |
|  |  | Delay | Protection delay time                   |

### 3.3.4 Digital Port

The parameters on this page correspond to the parameter settings of the digital I/O function in the **[Shift]+[P-set]**(System) menu on the front panel of the instrument, as shown in the figure below.



The general parameters of the 7 pins are described as follows:

|                     |  |  |   |
|---------------------|--|--|---|
| Not-Invert / Invert | Used to control whether the digital signal of the present pin is inverted. |  |   |
|                     | Not-Invert   | No   |   |
|                     | Invert   | Yes  |   |
| Input / Output      | Used to control the direction of the digital signal.                       |  |   |
|                     | Input  | Indicates that the instrument can detect the level status of the external input. By default (i.e., the pin is not connected), it is detected as high; if the corresponding pin is configured as "Invert", it is detected as low. |   |
|                     | Output   | Indicates that the digital signal is output from the present pin.  |   |
|                     |  | False  | By default ( <b>Not-Invert</b> ), the output digital signal is 0 (i.e. high level), and in the case of <b>Invert</b> , the output is low level. |
|                     |  | True   | By default ( <b>Not-Invert</b> ), the output digital signal is 1 (i.e. low level), and in the case of <b>Invert</b> , the output is high level. |
|                     |  | PWM  | Digital signal of PWM.  |
|                     |  | Frequency  | Frequency of PWM  |
|                     |  | Duty   | Duty cycle  |

The function-related parameters unique to each of the 7 pins are as follows:



|                |  |   |  |
|----------------|--|---|--|
| Ps-Fault-Clear | This default function means that when the instrument generates protection, the protection state can be cleared via this pin.   |   |  |
| Ps             | This default function means the output level from pin 2, which displays that whether the instrument is under protection or not. Under normal conditions (Not under protection), and when pin 2 is under default setting ( <b>Not-Invert</b> ), pin 2 outputs high level; when the instrument is under protection, pin 2 outputs low level. |   |  |
| Off-Status     | This default function indicates the existing <b>[On/Off]</b> state of the instrument. When it is set to ( <b>Not-Invert</b> ), the <b>[On/Off]</b> is turned off, and pin 3 outputs high level; the <b>[On/Off]</b> is turned on, and pin 3 outputs low level.   |   |  |
| IO-4.Trig(In)  | This default function means that pin 4 of the P-IO performs bi-direction control over the instrument's trigger function.   |   |  |
|                | Trig-Out   | Indicates that when the instrument generates a signal (which triggers the Meter function, Data Recording function and List function runs for a limited time), pin 4 will output a pulse signal. |  |
|                | Trig-In  | Indicates that the instrument will trigger the running of one of the functions below after receiving the external pulse signal.   |  |
|                |  | Meter   | Triggers the running of Meter function.          |
|                |  | Dlog  | Triggers the running of data recording function. |
|                |  | List  | Triggers the running of List files.              |
| Inhibit        | This default function means that pin 5 of the P-IO controls the operation of the instrument.   |   |  |

|          |        |   |
|----------|--------|---|
|          | Living | Select Living, and the instrument will be operated in the mode of Living.   |
|          | Latch  | Select Latch, and the instrument will be operated in the mode of Latch.   |
| Sync-On  |        | This default function means that pin 6 performs bi-directional and synchronous control over the turn-on of <b>[On/Off]</b> .  |
| Sync-Off |        | This default function means that pin 7 performs bi-directional and synchronous control over the turn-off of <b>[On/Off]</b> . |


**Note**

For more information about digital I/O functions, please refer to the product's User Manual.

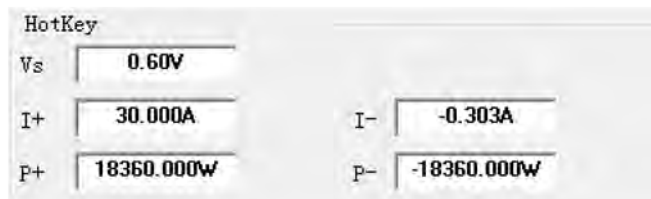
## 3.4 FastSet

The FastSet page contains two functions: hotkey, scan. Their function descriptions are described below.

### 3.4.1 HotKey

You can set the voltage, current value and other parameters more accurately in the "HotKey".

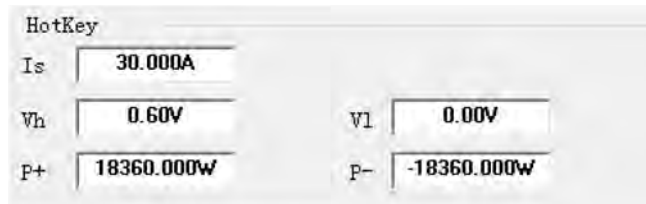
**CV priority:** Support for quickly setting the parameters as shown in the figure below.



| Parameter | Description           |
|-----------|-----------------------|
| Vs        | Voltage setting value |
| I+        | Current upper limit   |

| Parameter | Description         |
|-----------|---------------------|
| I-        | Current lower limit |
| P+        | Power upper limit   |
| P-        | Power lower limit   |

**CC priority:** Support for quickly setting the parameters as shown in the figure below.



HotKey

Is

Vh  Vl

P+  P-

| Parameter | Description           |
|-----------|-----------------------|
| Is        | Current setting value |
| Vh        | Voltage upper limit   |
| Vl        | Voltage lower limit   |
| P+        | Power upper limit     |
| P-        | Power lower limit     |

## Operation steps

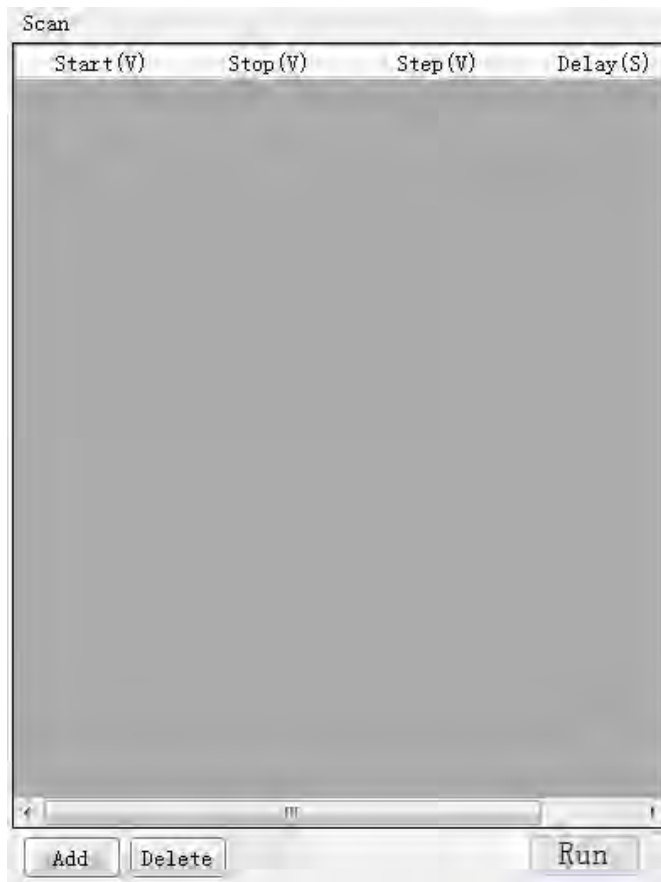
The setting method of these parameters is the same, the operation steps are as follows:

1. Double-click the text box after the parameter name to enter the parameter value.
2. Press Enter or click "Set" to confirm the changes.

## 3.4.2 Scan

The scanning function means that the instrument can output or input voltage and current values according to the step value set by the user.

**CV priority:** Support for setting the parameters as shown below.



**CC priority:** Support for setting the parameters as shown below.



| Parameter | Description  |
|-----------|--|
| Start     | The starting value of the <b>Vs / Is</b> curve indicates that the instrument is outputting voltage or current from this value.             |
| Stop      | The end value of the <b>Vs / Is</b> curve indicates that the instrument output voltage or current reaches this value and stops outputting. |
| Step      | Step value of <b>Vs/Is</b> .   |
| Delay     | The duration of the output voltage/current.  |

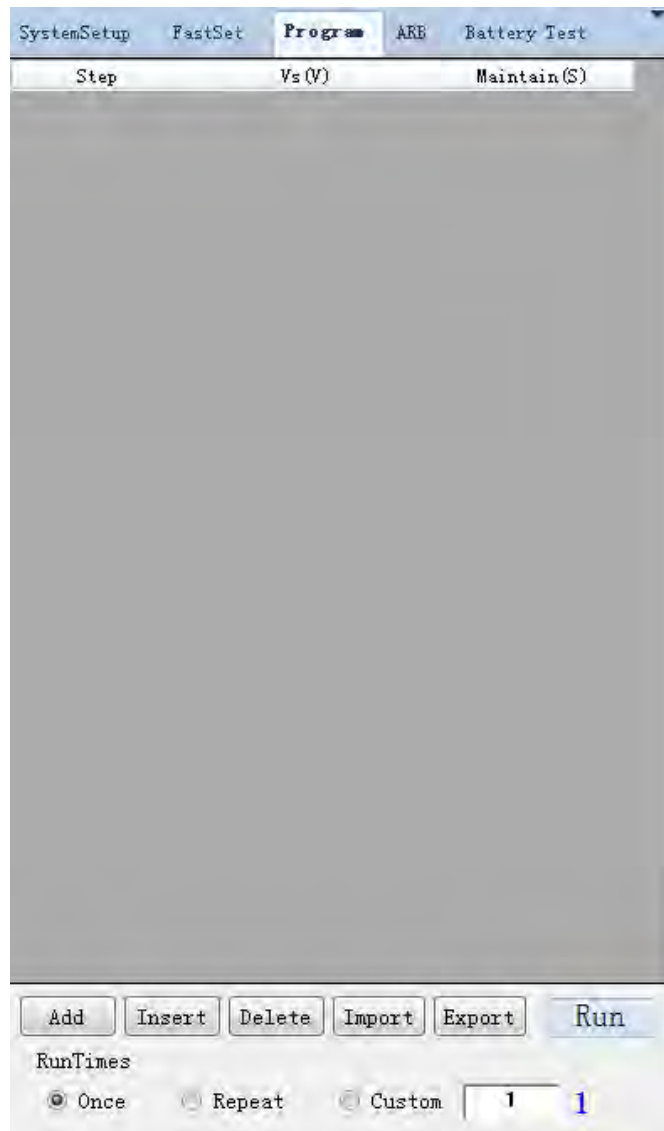
### Operation steps

1. Click "Add" button and add a group of scan data in the scan edit area.
2. Double click the value corresponding to scan data (Start, Stop, Step, Delay).
3. Press the Enter key to confirm the setting.
4. Click "Run" button to execute scan operation.  
Click Delete to delete a selected scan record.

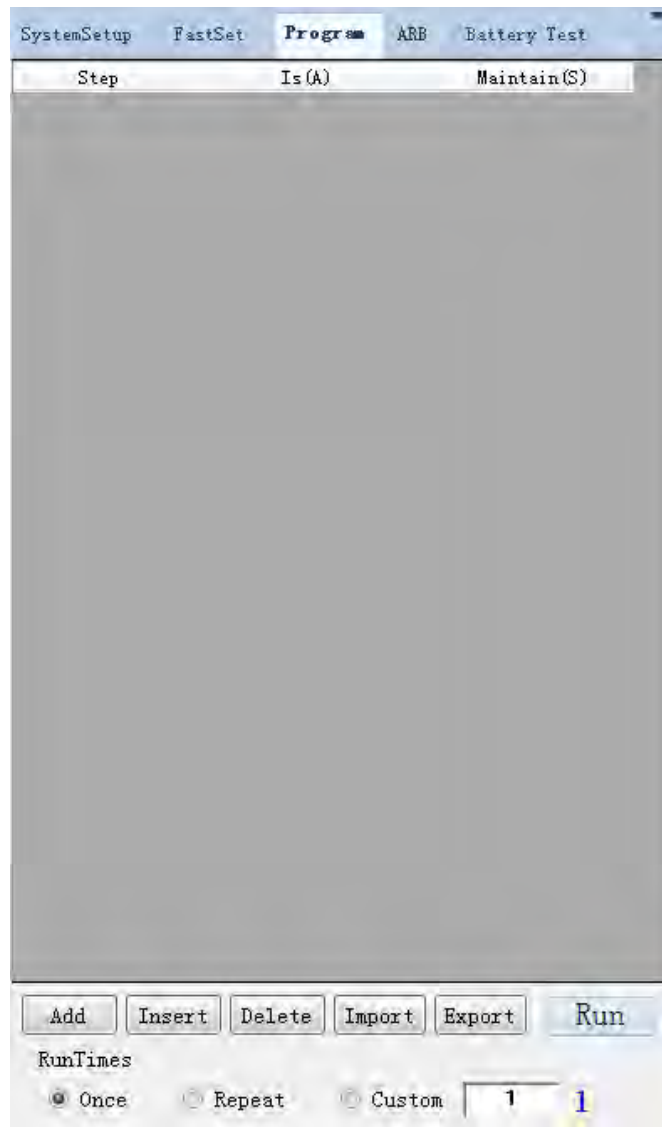
## 3.5 Program

The user can use the program function to edit a test program consisting of multiple steps.

**CV priority:** Support for setting the parameters as shown below.



**CC priority:** Support for setting the parameters as shown below.



| Parameter | Description                                    |
|-----------|--|
| Step      | Step number, no need to set here.              |
| Vs/Is     | Voltage/current setting value.                 |
| Maintain  | The execution time of the present step.        |
| RunTimes  | The number of executions of this program file. |

- **Add:** Add a step. Click this button to add 1 step.
- **Insert:** Insert a step. Click this button to insert 1 step before present step.
- **Delete:** Delete a step. Click this button to delete present step.
- **Import:** Import external Program files.
- **Export:** Export Program file being edited.

- **Run:** Run the present Program file.

### Edit the Program file

1. Go to the **SystemSetup > Config** page and select CV or CC Priority.
2. Click the **Program** tab to enter the quick programming page.
3. At the bottom of Program page, click “Add” button to add the first step of program.
4. Double click the value corresponding to program step and set them to required values.

### Import Program file from externals

IT9000 software supports import function of program files. The user can finish the editing of Program file in Excel and import it into the software. This function simplifies the Program file edit and facilitates user operation. Detailed operation steps are as below:

1. Create a new Excel document on local PC and name it List 1.
2. Open the Excel document and save it as in “other formats” i.e. “(\*.csv)”.
3. Open the **List 1.csv** document and edit. Set every step of the Program and corresponding parameters (Vs/Is and Maintain).



#### Note

You can also “Export” a **.csv** file template and edit based on this template.

4. Close the document when editing is complete.
5. Click “Import” button.
6. Select and open **List 1.csv** file to finish the file import.

### Run the Program file

1. Follow the steps above to edit Program file.
2. Set Run Times, including Once, Repeat or Custom (user-defined repeats).
3. Click **Run** to run program file.

Click **Stop** to stop operation.

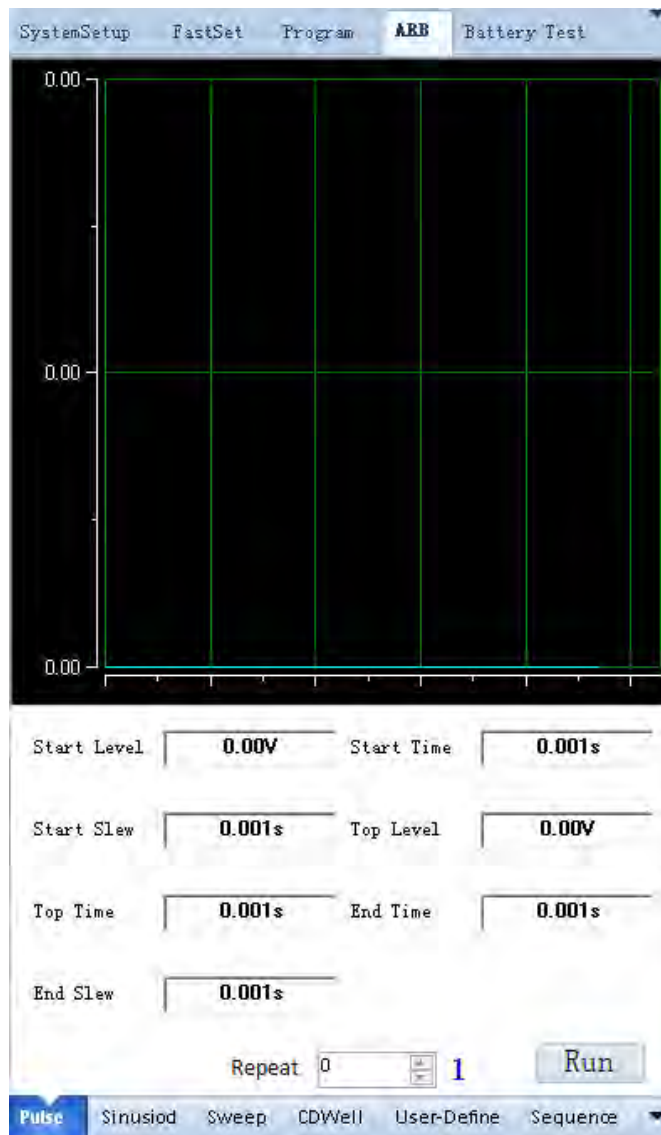


## 3.6 ARB

ARB functions include: Pulse, Sinusoid, Sweep, CDWell, User-Define, Sequence.

### 3.6.1 Pulse

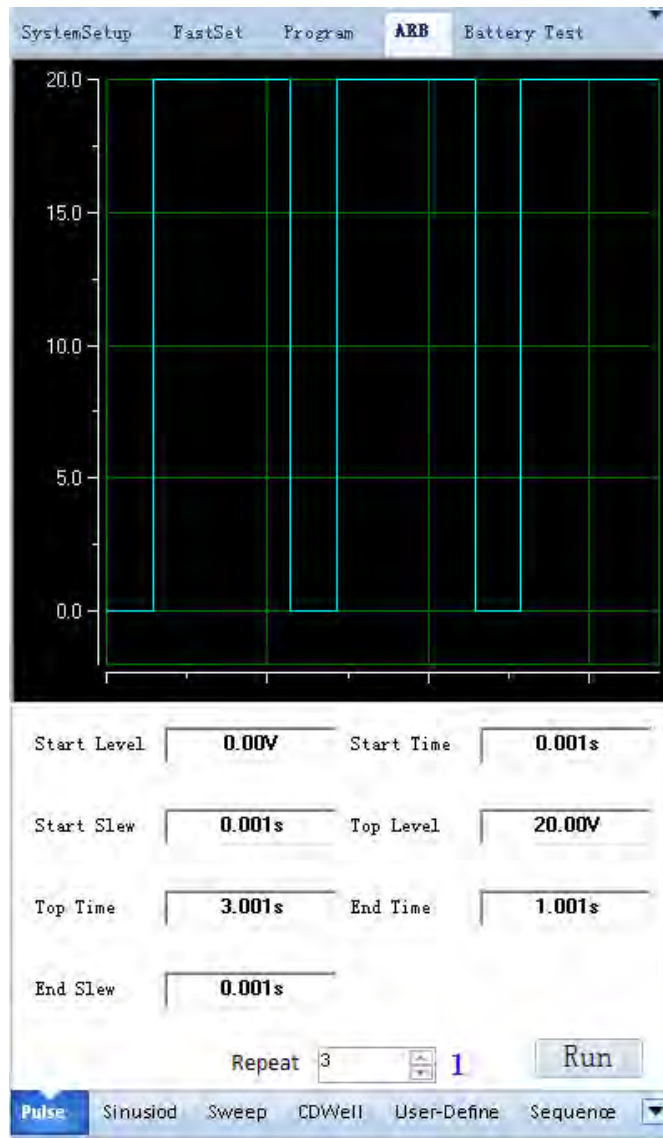
The interface of this function is shown below.



The upper part of the interface is the waveform design drawing displayed in real time when editing the waveform parameters; the parameter setting of the waveform at the bottom of the interface is introduced as follows.

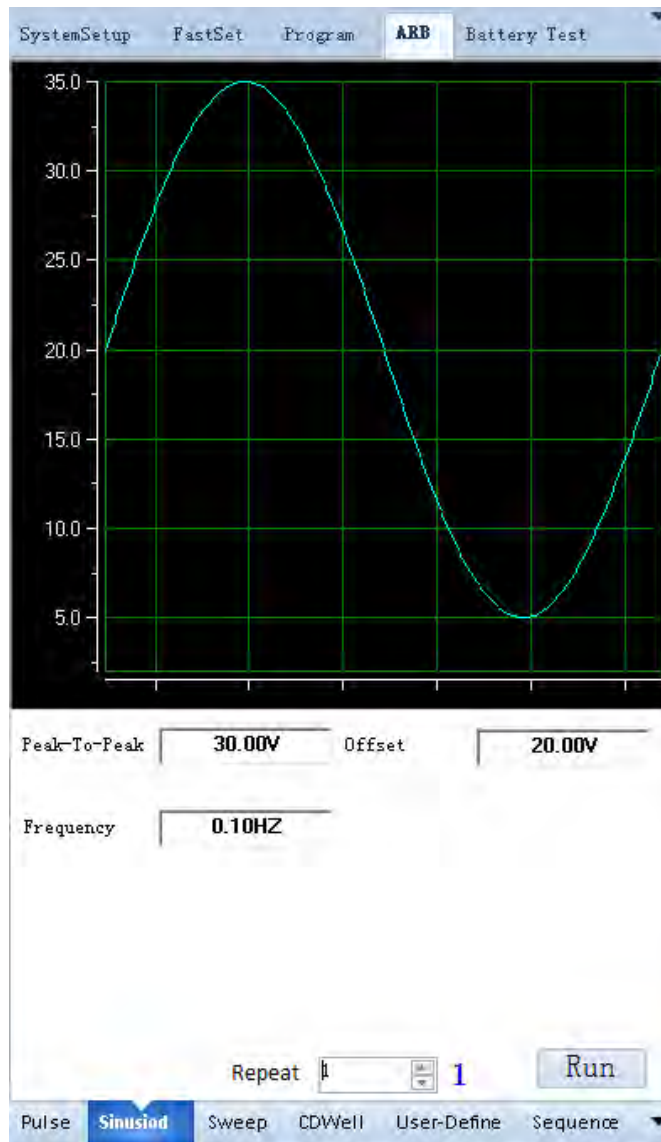
| Parameter   | Description   |
|-------------|---|
| Start Level | The low voltage/current value of the pulse waveform.<br>The unit of this parameter (V/A) varies with the CV/CC priority selection on the Config page.   |
| Start Time  | The delay time before the pulse waveform starts to output.  |
| Start Slew  | The rising slope of the start voltage/current.  |
| Top Level   | The high voltage/current value of the pulse waveform.<br>The unit of this parameter (V/A) varies with the CV/CC priority selection on the Config page.  |
| Top Time    | The duration of the high voltage/current.   |
| End Time    | The duration of the low voltage/current.  |
| End Slew    | The falling slope of the high voltage/current.  |
| Repeat      | The number of repetitions of the pulse waveform.<br>The default 0 means that after the user clicks "Run", the waveform will be output repeatedly until the user clicks "Stop" to stop the output. |

The following figure shows an example of parameter setting. The actual output waveform is subject to the one shown in the connected oscilloscope.



### 3.6.2 Sinusoid

The interface of this function is shown below.



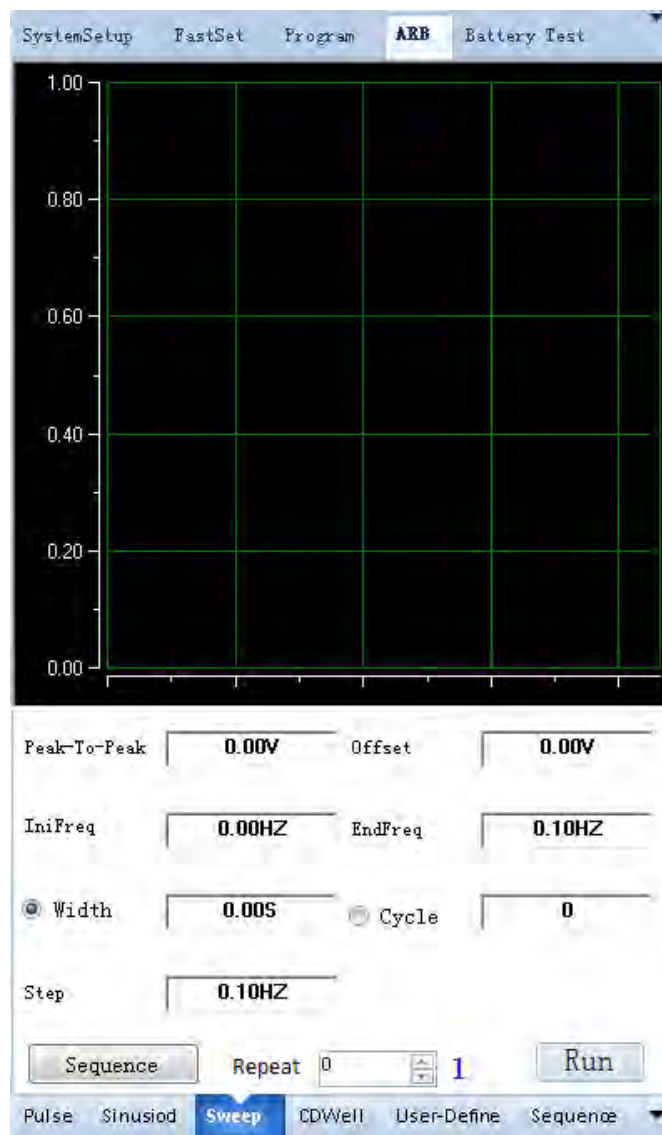
The upper part of the interface is the waveform design drawing displayed in real time when editing the waveform parameters; the parameter setting of the waveform at the bottom of the interface is introduced as follows.

| Parameter    | Description  |
|--------------|--|
| Peak-To-Peak | The peak-to-peak value of a sine wave.<br>The unit of this parameter (V/A) varies with the CV/CC priority selection on the Config page.    |
| Offset       | The value of the sine wave offset upward.<br>The unit of this parameter (V/A) varies with the CV/CC priority selection on the Config page. |

| Parameter | Description   |
|-----------|---|
| Frequency | The frequency of the sine wave, which is the reciprocal of the waveform duration (one cycle).   |
| Repeat    | The number of repetitions of the sine waveform. The default 0 means that after the user clicks "Run", the waveform will be output repeatedly until the user clicks "Stop" to stop the output. |

### 3.6.3 Sweep

The interface of this function is shown below.



The upper part of the interface is the waveform design drawing displayed in real time when editing the waveform parameters; the parameter setting of the waveform at the bottom of the interface is introduced as follows.

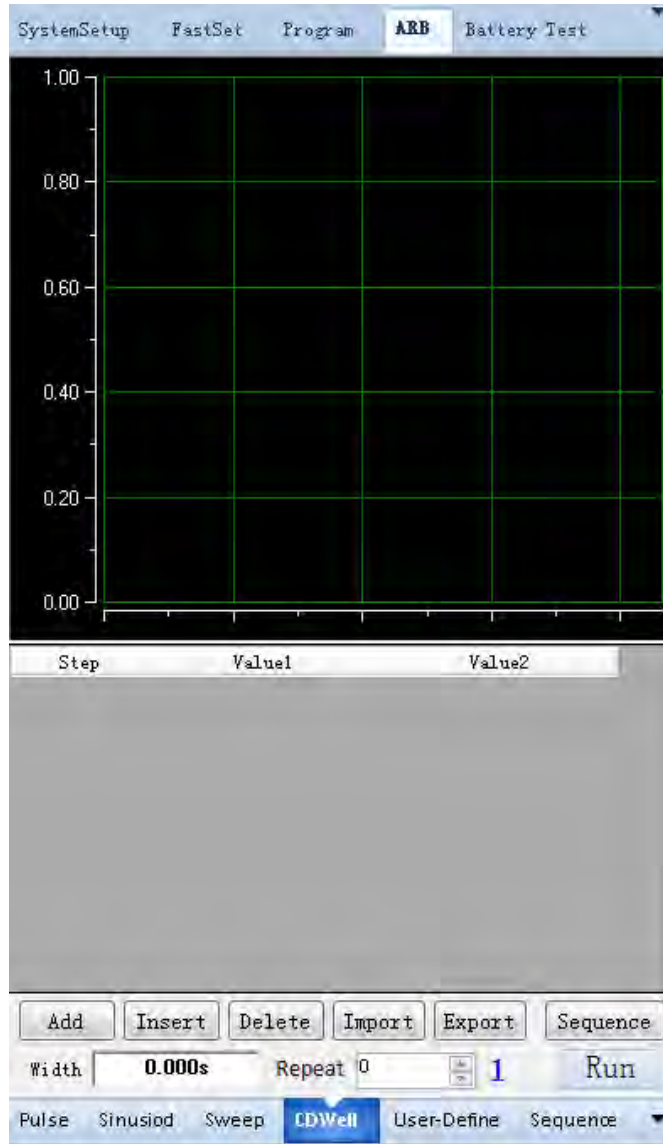
| Parameter     | Description   |
|---------------|---|
| Peak-To-Peak  | The peak-to-peak value of the sweep wave.<br>The unit of this parameter (V/A) varies with the CV/CC priority selection on the Config page.  |
| Offset        | The value of the sweep wave offset upward.<br>The unit of this parameter (V/A) varies with the CV/CC priority selection on the Config page.   |
| IniFreq       | The starting frequency of the sweep wave.   |
| EndFreq       | The cutoff frequency of the sweep wave.   |
| Step          | The stepping frequency of the sweep wave.   |
| Width / Cycle | Choose one of the following to set: <ul style="list-style-type: none"> <li>Width: The execution time width of each frequency point of the sweep wave.</li> <li>Cycle: The number of repetitions of each frequency point of the sweep wave.</li> </ul> |
| Repeat        | The number of repetitions of the sweep waveform. The default 0 means that after the user clicks "Run", the waveform will be output repeatedly until the user clicks "Stop" to stop the output.  |

#### Button introduction

- **Sequence:** Click this button to add the present sweep wave to the Sequence page. Can be added repeatedly.
- **Run:** Run to output the currently edited waveform.

### 3.6.4 CDWell

The interface of this function is shown below.



The upper part of the interface is the waveform design drawing displayed in real time when editing the waveform parameters; the parameter setting of the waveform at the bottom of the interface is introduced as follows.

| Parameter | Description  |
|-----------|--|
| Step      | The number of the voltage/current point in the CDWell waveform. No settings are required here.   |
| Value 1   | In the first step, it represents the first voltage/current point in the CDWell waveform. In the second step, it represents the third point, and so on.   |
| Value 2   | In the first step, it represents the second voltage/current point in the CDWell waveform. In the second step, it represents the fourth point, and so on. |

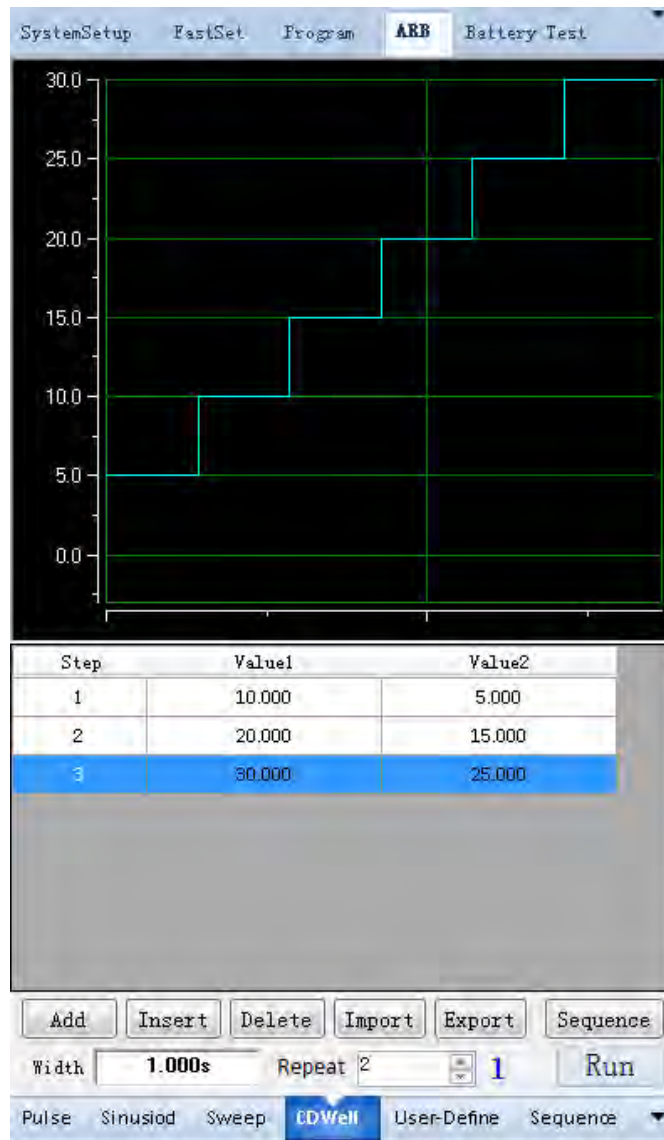
| Parameter | Description   |
|-----------|---|
| Width     | The duration of each voltage/current point in the CDWell waveform.  |
| Repeat    | The number of repetitions of the CDWell waveform. The default 0 means that after the user clicks "Run", the waveform will be output repeatedly until the user clicks "Stop" to stop the output. |

### Button introduction

- **Add:** Add a step.
- **Insert:** Insert a step before the currently selected step.
- **Delete:** Delete the currently selected step.
- **Import:** Import the edited CDWell waveform file (.csv format) from the outside.
- **Export:** Export the currently edited CDWell waveform to a file in .csv format.
- **Sequence:** Click this button to add the present CDWell wave to the Sequence page. Can be added repeatedly.
- **Run:** Run to output the currently edited waveform.

The following figure shows an example of parameter setting. The actual output waveform is subject to the one shown in the connected oscilloscope.



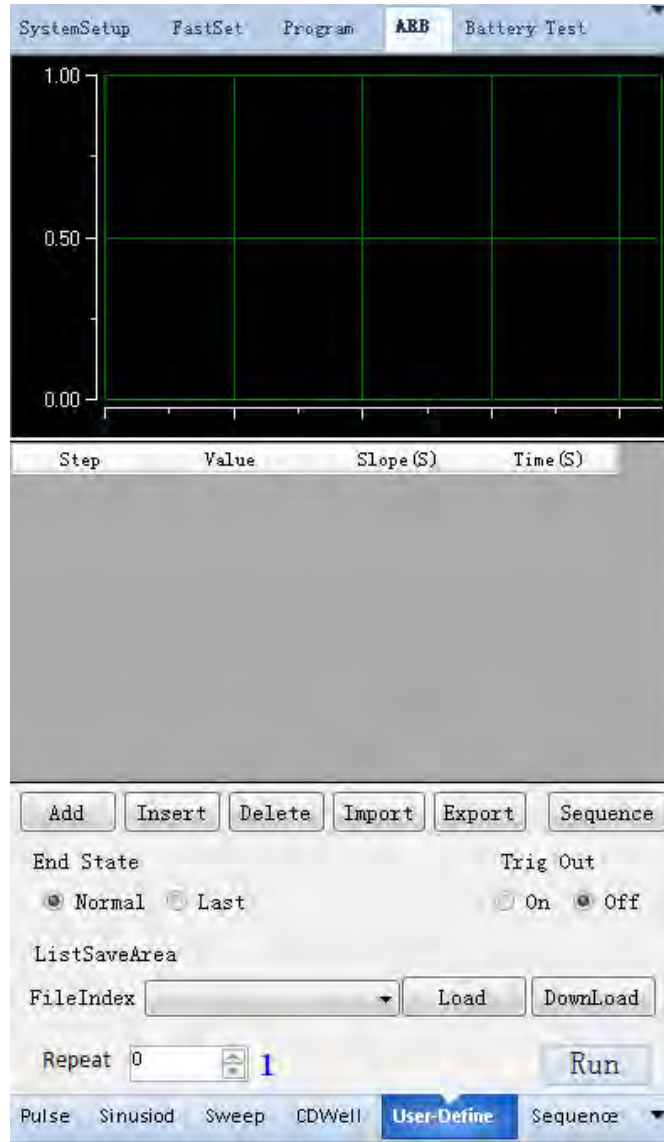


### Note

The steps for editing, importing, exporting, and running the waveform are the same as those on the Program page, and are not repeated here.

## 3.6.5 User-Defined

The interface of this function is shown below.



The upper part of the interface is the waveform design drawing displayed in real time when editing the waveform parameters; the parameter setting of the waveform at the bottom of the interface is introduced as follows.

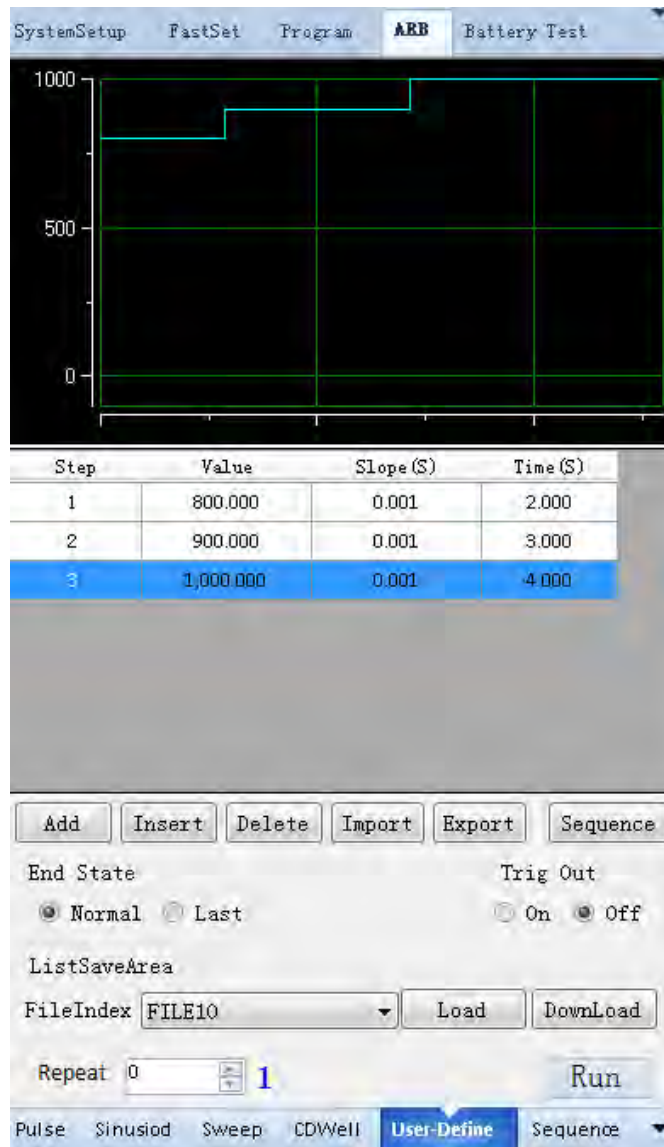
| Parameter | Description  |
|-----------|--|
| Step      | The number of the voltage/current point in the user-defined waveform. No settings are required here. |
| Value     | The set value of the voltage/current point.  |
| Slope     | The slope of the rise or fall from the previous voltage/current point to the currently set point.    |
| Time      | The duration of the currently set voltage/current point.   |

| Parameter | Description  |
|-----------|--|
| End State | Indicates the working status of the instrument after the user-defined waveform output ends: <ul style="list-style-type: none"> <li>• Normal: Returns to the state before the waveform was output.</li> <li>• Last: Stays in the state of the last voltage/current point of the user-defined waveform.</li> </ul> |
| Trig Out  | Used to control whether the trigger signal is output after the user-defined waveform runs: <ul style="list-style-type: none"> <li>• On: There is a trigger signal output.</li> <li>• Off: No trigger signal output.</li> </ul>   |
| FileIndex | Select the name of the user-defined waveform file.   |
| Repeat    | The number of repetitions of the User-Defined waveform. The default 0 means that after the user clicks "Run", the waveform will be output repeatedly until the user clicks "Stop" to stop the output.  |

### Button introduction

- **Add:** Add a step.
- **Insert:** Insert a step before the currently selected step.
- **Delete:** Delete the currently selected step.
- **Import:** Import the edited User-Defined waveform file (.csv format) from the outside.
- **Export:** Export the currently edited User-Defined waveform to a file in .csv format.
- **Sequence:** Click this button to add the present User-Defined wave to the Sequence page. Can be added repeatedly.
- **Load:** Recall the user-defined waveform file which is saved in the instrument to the software interface.
- **Download:** Save the user-defined waveform file currently edited in the software interface to the inside of the instrument.
- **Run:** Run to output the currently edited waveform.

The following figure shows an example of parameter setting. The actual output waveform is subject to the one shown in the connected oscilloscope.



The steps for editing, importing, exporting, and running the waveform are the same as those on the Program page, and are not repeated here.

## Edit the User-define waveform

The following takes the CV priority mode as an example to introduce the steps of waveform editing:

1. Go to the **SystemSetup > Config** page and select CV Priority.
2. Click Add to add a step record.
3. Set the relevant parameters of this voltage point.
4. Add other voltage point data in the same way.
5. Set parameters such as "End State", "Trig Out", and "Repeat".

## Load / Download

- **Load**

1. Click the drop-down list after **FileIndex** to select the waveform file saved inside the instrument.

The file name here corresponds to the file name saved in the "Function > LIST" menu of the instrument.

2. Click **Load**.

If the file exists inside the instrument, the software prompts "Load Complete" and reads the data; otherwise it prompts "Load failed".

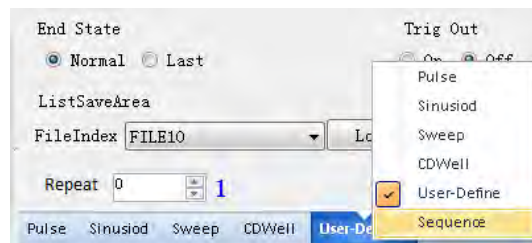
- **Download**

1. Edit the parameters of the User-define waveform.
2. Click the drop-down list after **FileIndex** to select the file name.
3. Click **Download**.

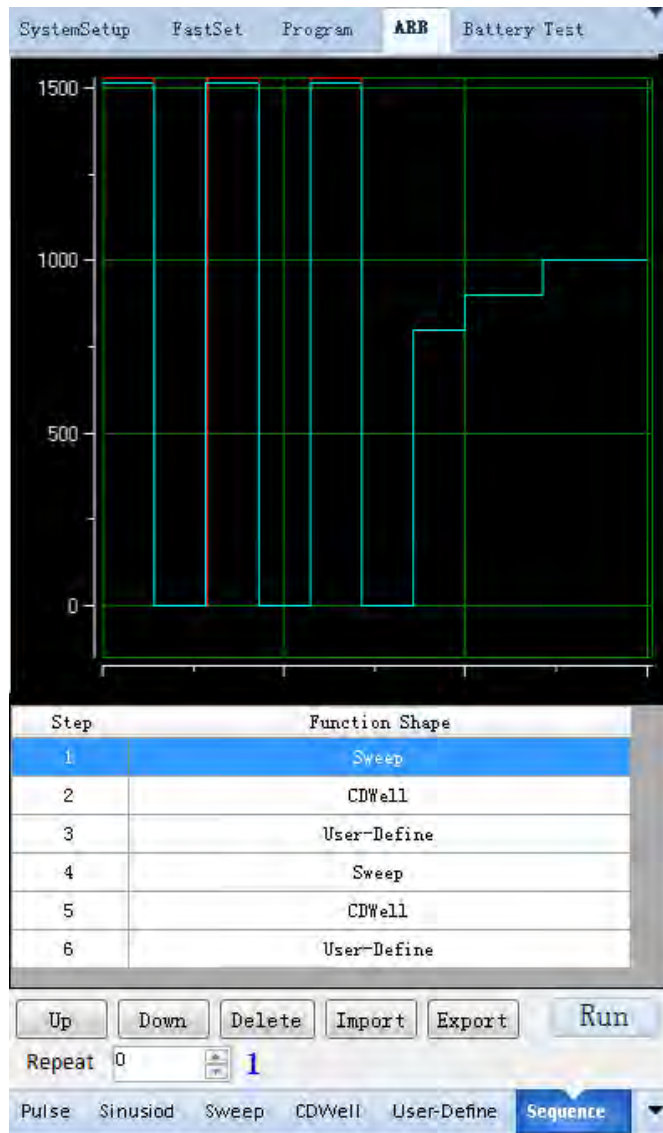
The software interface prompts "Download completed".

## 3.6.6 Sequence

A sequence is a combined waveform of any combination of three types of waveforms: Sweep, CDWell, and User-Defined. You need to open the Sequence tab in the location shown below.



The interface of this function is shown below.



The upper part of the interface is the combined waveform of the superimposed display (click “Sequence” in the “Sweep”, “CDWell”, “User-defined” page); the lower part of the interface displays and sets the order of the waveforms, as described below.

| Parameter      | Description   |
|----------------|---|
| Step           | Waveform number. No settings are required here.   |
| Function Shape | Display of waveform types. No settings are required here.   |
| Repeat         | The number of repetitions of the combined waveform. The default 0 means that after the user clicks "Run", the waveform will be output repeatedly until the user clicks "Stop" to stop the output. |

### Button introduction

- **Up:** Forward the currently selected waveform.
- **Down:** Backward the currently selected waveform.
- **Delete:** Delete the currently selected waveform.
- **Import:** Import the edited combined waveform file (.seq format) from the outside.

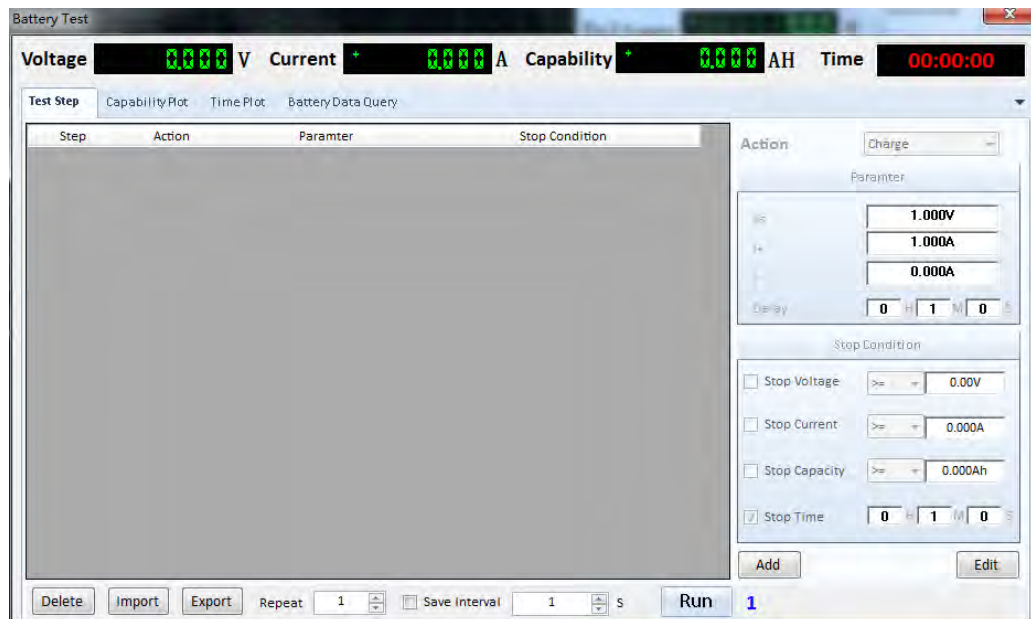


You can also "Export" a .seq file template and edit based on this template.

- **Export:** Export the currently edited combined waveform to a file in .seq format.
- **Run:** Run to output the currently edited combined waveform.

## 3.7 Battery Test

The interface of this function is shown below.



The parameters of the battery charge/discharge test are described below.

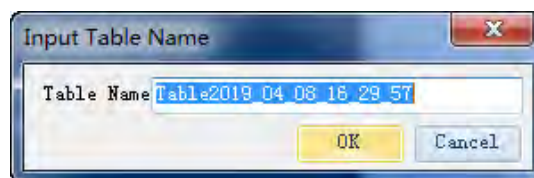
| Parameter | Description                                       |
|-----------|---|
| Voltage   | The display of the charging /discharging voltage. |
| Current   | The display of the charging /discharging current. |

| Parameter       | Description   |
|-----------------|---|
| Capability      | The display of the charging /discharging capability.                                |
| Time            | The display of the charging /discharging test duration.                             |
| Test Step       | Set up charge/discharge test steps.   |
| Action          | Battery charging /discharging test function and delay options.                      |
| Parameter       |   |
| Vs              | The voltage value of the battery charge/discharge test.                             |
| I+              | The current value of the battery charge test.                                       |
| I-              | The current value of the battery discharge test.                                    |
| Delay           | The time for the single step test.  |
| Stop Condition  |   |
| Stop Voltage    | Stop the test when the battery voltage is the set value.                            |
| Stop Current    | Stop the test when the battery current is the set value.                            |
| Stop Capability | Stop the test when the capacity reaches the set value.                              |
| Stop Time       | Stop the test when the test duration reaches the set value.                         |
| Add/Save        | Add a step. Click this button to add 1 step. /Save the edited step.                 |
| Edit/Cancel     | Edit a step. Click this button to edit the selected step. /Cancel the editing step. |
| Delete          | Delete a step. Click this button to delete present step.                            |
| Import          | Import external test files.   |
| Export          | Export test file being edited.  |
| Repeat          | The number of executions of this test file.   |



| Parameter          | Description   |
|--------------------|---|
| Save Interval      | The time interval for saving battery charge/discharge test data.  |
| Capability Plot    | Voltage and current are on the ordinate, and capacity is the waveform display diagram on the abscissa.      |
| Time Plot          | Voltage, current and capacity are the waveform display diagrams with the ordinate and time as the abscissa. |
| Battery Data Query | Query the test data saved when the Battery Test function is running.  |

**Run:** Start running the battery charge/discharge test. After clicking “Run”, the interface prompts as shown below.



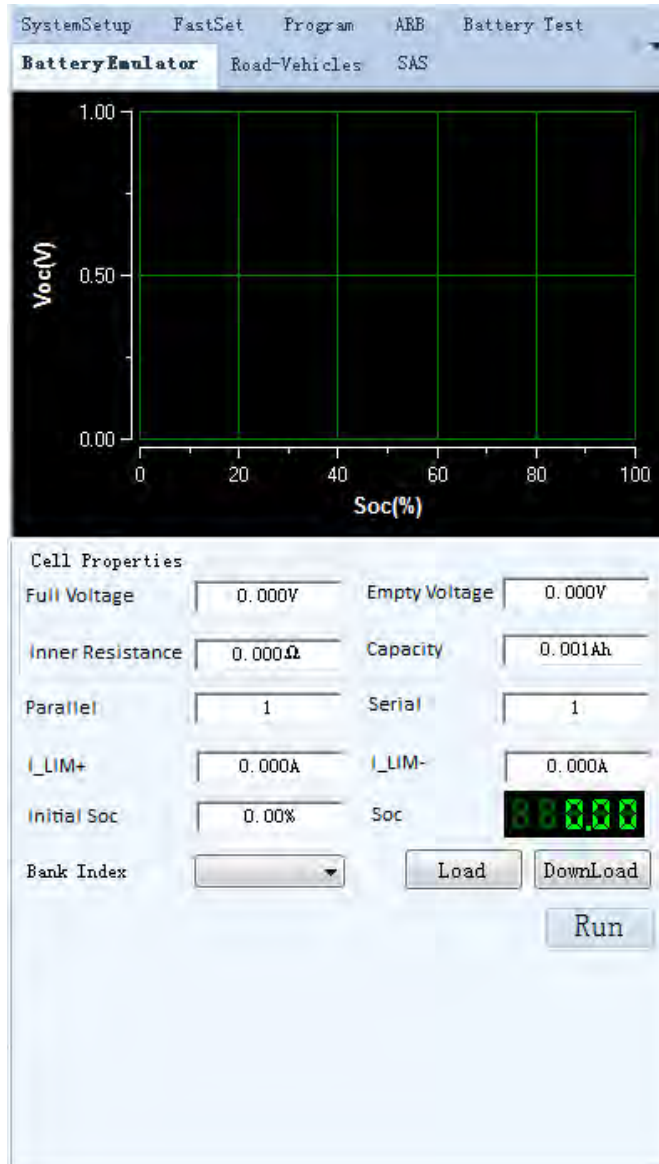
Click "OK" to start the battery charge/discharge test and save the test data in the data sheet.

### WARNING

**Before running the battery test function, make sure the wiring is correct. The Sense terminals (VS + and VS-) on the rear panel of the instrument must also be connected to the positive and negative poles of the DUT.**

## 3.8 Battery Emulator

The interface of this function is shown below.



The upper part of the interface is the battery simulation waveform diagram displayed in real time. The abscissa is the battery capacity, the ordinate is the battery voltage; the lower part of the interface is the parameters of the battery simulation function, as described below.

| Parameter        | Description  |
|------------------|--|
| Full Voltage     | Simulates the voltage value when the cell battery is fully charged.      |
| Empty Voltage    | Simulates the voltage value when the cell battery is in the empty state. |
| Inner Resistance | Simulates the internal resistance of a cell battery.                     |
| Capacity         | Simulates the capacity of a cell battery.                                |
| Parallel         | Set the number of parallel connected batteries.                          |

| Parameter   | Description  |
|-------------|--|
| Serial      | Set the number of batteries in series.   |
| I_LIM+      | Positive current limit value, which simulates the maximum discharge current of the battery pack.   |
| I_LIM-      | Negative current limit value, which simulates the maximum charge current of the battery pack.  |
| Initial Soc | Set the initial state of charge (SOC) of the battery. 0~100% corresponds to the voltage range from no-load voltage to full-load voltage. |
| Bank Index  | Select the name of the battery simulation test file.   |

#### Button introduction

- **Load:** Recall the battery simulation test file which is saved in the instrument to the software interface.
- **Download:** Save the battery simulation test file currently edited in the software interface to the inside of the instrument.
- **Run:** Run the currently edited battery simulation test file.

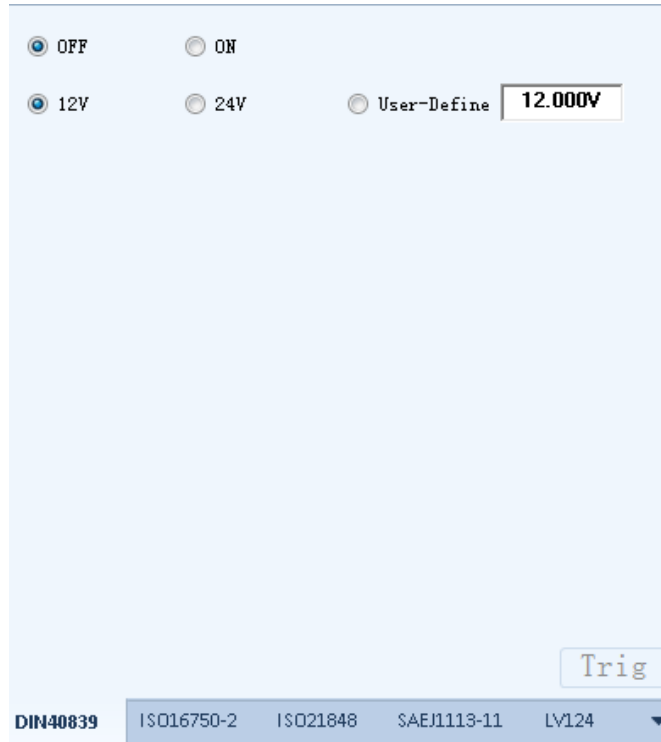
## 3.9 Road-Vehicles

This instrument has built-in car waveforms of the following standards/protocols:

- DIN40839
- ISO16750-2
- ISO21848
- SAEJ1113-11
- LV124
- LV123
- LV148
- ISO21780

### 3.9.1 DIN40839

The interface of this function is shown below.



Select stimulating wave for analog vehicle start. In corresponding editing bar, select On or Off. Or set the startup voltage level of curve (12V or 24V). The user can self define the value from 8V to 32V as required.

**Trig:** After starting the wave, Trigger key takes effect. Click Trigger key to execute this wave.

### 3.9.2 ISO16750-2

The interface of this function is shown below.

**Short-Drop**

OFF   
  ON   
  12V   
  24V

**Reset-Test**

OFF   
  ON   
 Ulow

**Starting-Profile**

OFF   
  ON   
  12V   
  24V

Rate Range

DIN40839   
 ISO16750-2   
 ISO21848   
 SAEJ1113-11   
 LV124

The standard/protocol contains the following waveforms. According to your choice, which waveform you need to edit and test currently, click the radio button below the waveform and select “ON”.

- Short-Drop
- Reset-Test
- Starting-Profile
- Load-Dump

The waveform parameters are described below.

|                  |   |  |
|------------------|---|--|
| Short-Drop       | Automotive short-time voltage drop waveform                         |  |
|                  | 12V   | Select the 12V automotive short-time voltage drop waveform |
|                  | 24V   | Select the 24V automotive short-time voltage drop waveform |
| Reset-Test       | This test is applicable to equipment with reset function.           |  |
|                  | Ulow  | The minimum supply voltage Ulow                            |
| Starting-Profile | This test verifies the behavior of a DUT during and after cranking. |  |
|                  | 12V/24V   | Select the 12V/24V test system.                            |

|           |                 |   |  |
|-----------|-----------------|---|--|
|           | Rate Range      | Select the voltage/duration of 12V/24V starting profile corresponding to Level 1/2/3/4. |  |
| Load-Dump | Load dump curve |   |  |
|           | Test A          | Select centralized load dump unsuppression  |  |
|           |                 | 12V/24V   | Select the 12V/24V test system.        |
|           |                 | Pulse width   | Pulse width of 12V/24V voltage system  |
|           |                 | Peak voltage  | Peak voltage of 12V/24V voltage system |
|           | Test B          | Select centralized load dump suppression  |  |
|           |                 | 12V/24V   | Select the 12V/24V test system.        |
|           |                 | Pulse width   | Pulse width of 12V/24V voltage system  |
|           |                 | Peak voltage  | Peak voltage of 12V/24V voltage system |
|           |                 | Clamping voltage  | Clamping voltage of 24V voltage system |

**Trig:** After starting the wave, Trigger key takes effect. Click Trigger key to execute this wave.

### 3.9.3 ISO21848

The interface of this function is shown below.



The screenshot shows a control interface with the following elements:

- Umax, dyn:** Radio buttons for OFF (selected) and ON.
- Momentary-Drop:** Radio buttons for OFF (selected) and ON.
- Reset:** Radio buttons for OFF (selected) and ON.
- Start:** Radio buttons for OFF (selected) and ON.
- Ulow:** A text input field containing the value "0.000V".
- Trig:** A button located at the bottom right of the main control area.
- Standard Selection:** A bar at the bottom with radio buttons for DIN40839, ISO16750-2, **ISO21848** (selected), SAEJ1113-11, and LV124.

The standard/protocol contains the following waveforms. According to your choice, which waveform you need to edit and test currently, click the radio button below the waveform and select "ON".

- $U_{max,dyn}$
- Moment-Drop
- Reset

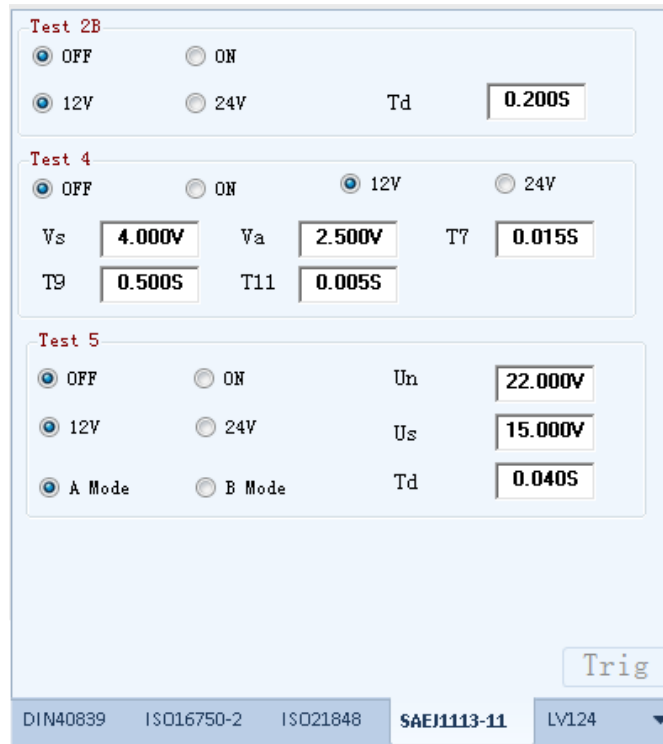
If you select this waveform, you also need to set the "Ulow".

- Start

**Trig:** After starting the wave, Trigger key takes effect. Click Trigger key to execute this wave.

### 3.9.4 SAEJ1113-11

The interface of this function is shown below.



The standard/protocol contains the following waveforms. According to your choice, which waveform you need to edit and test currently, click the radio button below the waveform and select “ON”.

- **Test 2B:** Transient from DC motors acting as generators after ignition switch OFF
- **Test 4:** Starter motor engagement disturbance pulse
- **Test 5:** Load dump waveform

The waveform parameters are described below.

|         |   |  |
|---------|---|--|
| Test 2B | Transient from DC motors acting as generators after ignition switch OFF |  |
|         | 12V/24V   | Select the 12V/24V voltage system          |
|         | Pulse width   | Test pulse width                           |
| Test 4  | Starter motor engagement disturbance pulse                              |  |
|         | 12V/24V   | Select the 12V/24V voltage system          |
|         | Vs/Va/T7/T9/T11   | See the product's User Manual for details. |
| Test 5  | Load dump waveform  |  |
|         | Test A  | Select centralized load dump unsuppression |



|  |        |  |  |
|--|--------|--|--|
|  |        | 12V/24V                                  | Select the 12V/24V voltage system      |
|  |        | Pulse width                              | Pulse width of 12V/24V voltage system  |
|  |        | Peak voltage                             | Peak voltage of 12V/24V voltage system |
|  | Test B | Select centralized load dump suppression |  |
|  |        | 12V/24V                                  | Select the 12V/24V voltage system      |
|  |        | Pulse width                              | Pulse width of 12V/24V voltage system  |
|  |        | Peak voltage                             | Peak voltage of 12V/24V voltage system |
|  |        | Clamping voltage                         | Clamping voltage of 24V voltage system |

**Trig:** After starting the wave, Trigger key takes effect. Click Trigger key to execute this wave.

### 3.9.5 LV124

The interface of this function is shown below.



The screenshot shows a control interface with the following elements:

- E02, E04, E05:** Each has an OFF (selected) and ON radio button.
- E07:** OFF (selected) and ON radio buttons. Input fields: Ubmax (0.000V), Ubmin (0.000V), Time (0.000S).
- E08:** OFF (selected) and ON radio buttons. Input fields: Ubmax (0.000V), Ubmin (0.000V), Time (0.000S).
- E09:** OFF (selected) and ON radio buttons. Input field: Ubmin (6.000V).
- E11:** OFF (selected) and ON radio buttons. Two groups of radio buttons: 'Start Mode' (Cold-Start selected, Warm-Start) and 'Cold-Start' (Normal selected, Server).
- E12:** OFF (selected) and ON radio buttons. Input field: U (0.000V).
- Trig:** A button located at the bottom right of the waveform configuration area.
- Standards:** A dropdown menu at the bottom left showing options: DIN40839, ISO16750-2, ISO21848, SAEJ1113-11, and LV124 (selected).

The standard/protocol contains the following waveforms. According to your choice, which waveform you need to edit and test currently, click the radio button below the waveform and select “ON”.

- **E02:** Transient overvoltage test waveform
- **E04:** Jump start test waveform
- **E05:** Load dump test waveform
- **E07:** Slow decrease and increase of the supply voltage test waveform
- **E08:** Slow decrease, quick increase of the supply voltage test waveform
- **E09:** Reset behavior test waveform
- **E11:** Start pulses
- **E12:** Voltage curve with intelligent generator control

The waveform parameters are described below.

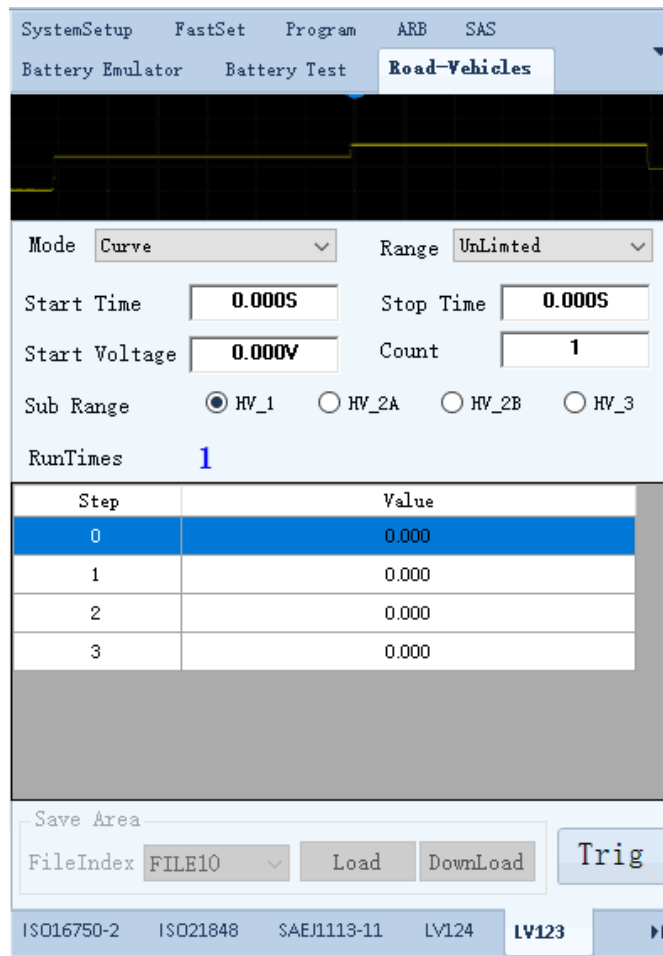
|      |  |                               |
|------|--|-------------------------------|
| E-07 | Slow decrease and increase of the supply voltage test waveform |                               |
|      | Ubmax  | Start voltage                 |
|      | Ubmin  | Holding voltage               |
|      | Time   | Voltage holding time at Ubmin |

|      |   |  |                             |
|------|---|--|-----------------------------|
| E-08 | Slow decrease, quick increase of the supply voltage test waveform |  |                             |
|      | Ubmax   | Start voltage                                  |                             |
|      | Ubmin   | Holding voltage                                |                             |
|      | Time  | Voltage holding time at Ubmin                  |                             |
| E-09 | Reset behavior test waveform                                      |  |                             |
|      | Ubmin   | Holding voltage                                |                             |
| E-11 | Start pulses  |  |                             |
|      | Cold-Start  | Cold start                                     |                             |
|      |   | Normal   | Standard experimental pulse |
|      |   | Server   | Enhanced experimental pulse |
|      | Warm-Start  | Warm start                                     |                             |
| E-12 | Voltage curve with intelligent generator control                  |  |                             |
|      | U   | Voltage drop between DUT and battery terminals |                             |

**Trig:** After starting the wave, Trigger key takes effect. Click Trigger key to execute this wave.

### 3.9.6 LV123

The interface of this function is shown below.



SystemSetup FastSet Program ARB SAS

Battery Emulator Battery Test **Road-Vehicles**

Mode **Curve** Range **Unlimited**

Start Time **0.000S** Stop Time **0.000S**

Start Voltage **0.000V** Count **1**

Sub Range  HV\_1  HV\_2A  HV\_2B  HV\_3

RunTimes **1**

| Step | Value |
|------|-------|
| 0    | 0.000 |
| 1    | 0.000 |
| 2    | 0.000 |
| 3    | 0.000 |

Save Area

FileIndex **FILE10** Load DownLoad Trig

ISO16750-2 ISO21848 SAEJ1113-11 LV124 **LV123**

The waveform parameters are described below.

|       |   |   |
|-------|---|---|
| Mode  | Choose to recall the standard or user-defined LV123 waveform. |   |
|       | Curve   | Choose to recall the standard LV123 waveform. |
|       | User-defined  | Select the user-defined LV123 waveform.       |
| Range | Select the waveform type                                      |   |

|               |   |  |
|---------------|---|--|
|               | Unlimited   | Range of unlimited operating capability      |
|               | Upper-limited   | Range of upper limited operating capability  |
|               | Lower-limited   | Range of lower limited operating capability  |
|               | Highly-limited  | Range of highly limited operating capability |
| Start Time    | Duration of the initial voltage output by the instrument before performing the LV123 regulatory waveform test. The range is 0 to 999.999S.  |  |
| Stop Time     | Duration of the end voltage output by the instrument after performing the LV123 regulatory waveform test. The range is 0 to 999.999S.   |  |
| Start Voltage | Set the initial output voltage of the instrument before the LV123 regulation waveform test. At the same time, this value is also the end voltage after the regulatory waveform test is completed.   |  |
| Count         | Set the number of test repetitions, ranging from 1 to 65535.  |  |
| Sub Range     | Select the subtype of the waveform, including: HV_1, HV_2A, HV_2B, HV_3. The output voltage and duration are different for different subtypes. For the voltage and duration defined by the standard LV123 regulations, please refer to the user manual. |  |
| Step/Value    | Voltage range and voltage value of user-defined LV123 waveform.   |  |

- **FileIndex:** Select the saved file name.
- **Load:** Read the LV123 waveform file saved in the instrument into the software interface.
- **Download:** Save the LV123 waveform file edited in the software interface into the instrument.
- **Trig:** After starting the wave, Trigger key takes effect. Click Trigger key to execute this wave.

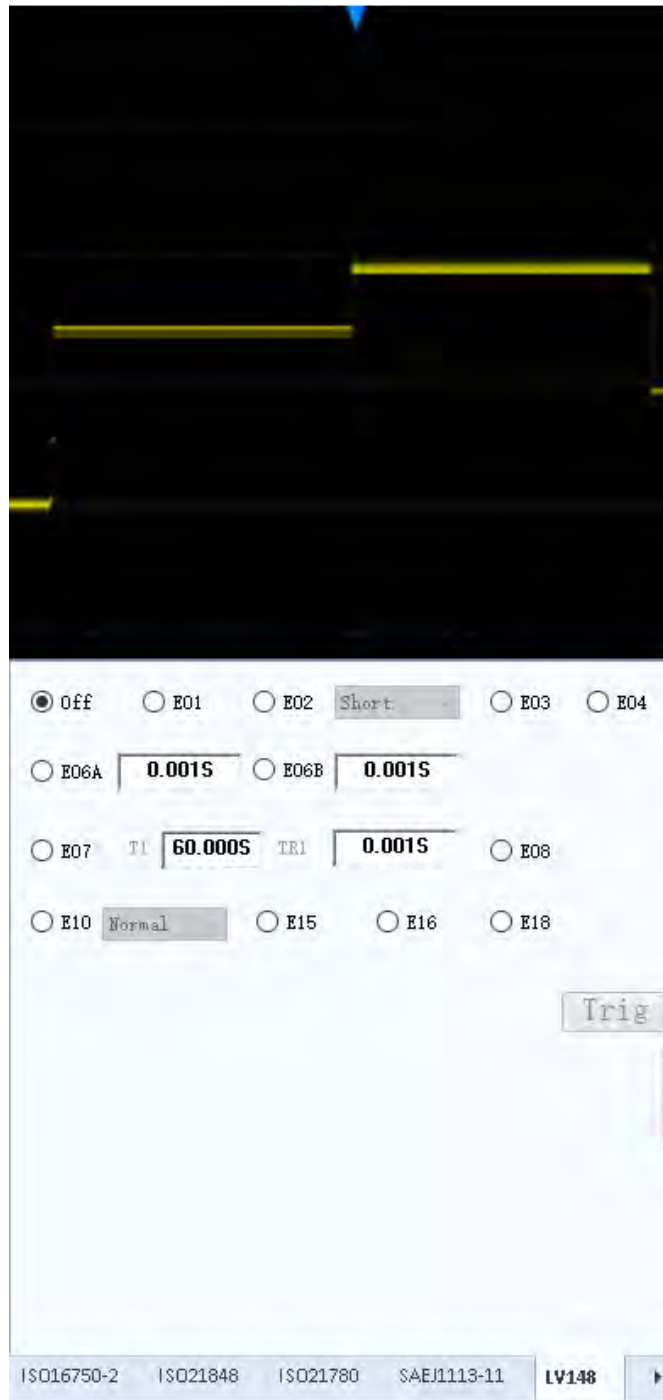
## How to Use

- Choose to recall the standard LV123 waveform.

1. Select the **Mode** as **Curve**, and select the type (take **Unlimited** as an example).
  2. Set **Start Voltage**, **Start Time**, **Stop Time** and **Count**.
  3. Select the **Sub Range**.
  4. Click the **Trig**.
- Select the user-defined LV123 waveform.
    1. Select the **Mode** as **User-defined**, and select the type (take **Unlimited** as an example).
    2. Set **Start Voltage**, **Start Time**, **Stop Time** and **Count**.
    3. Customize the voltage value corresponding to different intervals.
    4. Click the **Trig**.
  - Select the LV123 waveform file saved in the instrument to trigger directly.
    1. Select the **Mode** as **Curve** or **User-defined**.
    2. Select a file name.
    3. Click the **Load**.
    4. Click the **Trig**.

### 3.9.7 LV148

The interface of this function is shown below.



The waveform parameters are described below.

|  |   |
|--|---|
| Off: Do not enable the LV148 waveform. |   |
| E-01                                   | Long-term overvoltages<br>The component's resistance to long-term overvoltage is tested. A generator control fault during driving operation is simulated. |
| E-02                                   | Transient overvoltages  |

|       |   |                             |
|-------|---|-----------------------------|
|       | Transient overvoltages may occur in the electric system due to the switching off of loads and due to short accelerator tip-ins. These overvoltages are simulated by means of this test.   |                             |
|       | Short   | Short time mode (3 times)   |
|       | Endurance   | Endurance mode (1000 times) |
| E-03  | Transient undervoltages<br>Transient undervoltages in the electric system may occur due to switching on of loads. These undervoltages are simulated by means of this test.  |                             |
| E-04  | Jumpstart / recuperation<br>Jump starting of the vehicle is simulated. The maximum test voltage results from commercial vehicle systems and their elevated electric system voltages.  |                             |
| E-06A | Slow decrease and increase of the supply voltage (without energy storage )<br>The slow decrease and increase of the supply voltage is simulated as it occurs during the slow discharging and charging procedure of the vehicle battery.   |                             |
|       | T1 Holding Time   | Holding time                |
| E-06B | Slow decrease and increase of the supply voltage (with energy storage – Part 1 )<br>Checks will slow the supply voltage decrease to the energy storage protection voltage, followed by energy storage disconnection.  |                             |
|       | T1 Holding Time   | Holding time                |
| E-07  | Slow decrease, fast increase in the supply voltage<br>This test simulates the slow decrease of the vehicle system voltage to the energy storage protection voltage followed by shutdown to 0V and the sudden reconnect the system voltage by a charged or new energy storage battery. |                             |
|       | T1 Holding Time   | Holding time                |
|       | T1 Rising Time  | Rising time                 |
| E-08  | Reset behavior  |                             |

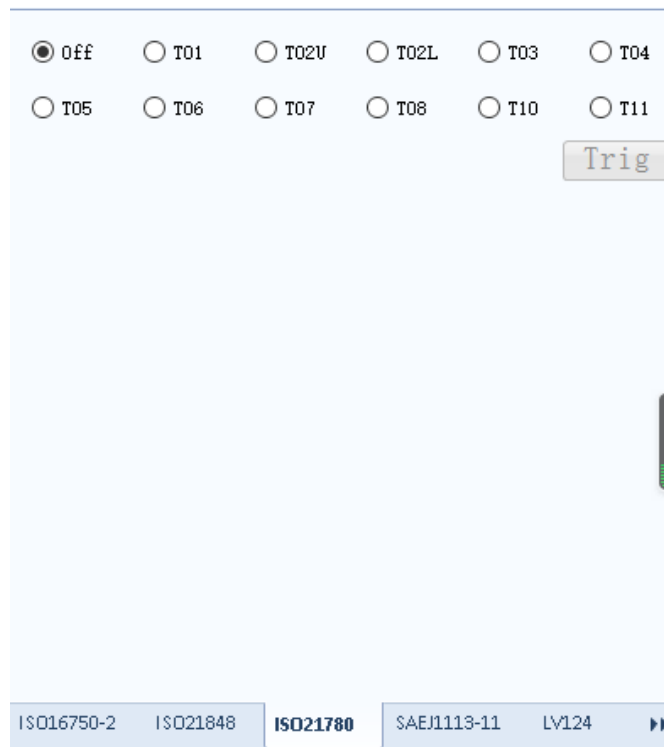


|      |   |                             |
|------|---|-----------------------------|
|      | The reset behavior of a component in its environment is simulated and tested. Test boundary conditions (e.g., assembly, terminal, system) must be described in detail. During operation, an arbitrary sequence of repeated switching-on/off procedures occurs; this must not lead to an undefined behavior of the component. The reset behavior is represented by a voltage variance and a time variance. Two different test sequences are required to simulate different switch-off times. A component must always undergo both sequences. |                             |
| E-10 | Start impulses<br>During a <b>cold start</b> (motor start), the energy storage battery voltage decreases for a short, then increases again. The warm start is not considered, because the operating range is maintained.  |                             |
|      | Normal  | Standard experimental pulse |
|      | Severe  | Enhanced experimental pulse |
| E-15 | Operation in the range without function restriction<br>The operating behavior at the range limits is checked.   |                             |
| E-16 | Operation in the upper range with function limitation<br>The operating behavior with change and at the range limits is checked.   |                             |
| E-18 | Overvoltage range<br>The test is to show the load cut-off during storage charging and check the changes of the operating behavior into the overvoltage range.   |                             |

**Trig:** After starting the wave, Trigger key takes effect. Click Trigger key to execute this wave.

### 3.9.8 ISO21780

The interface of this function is shown below.



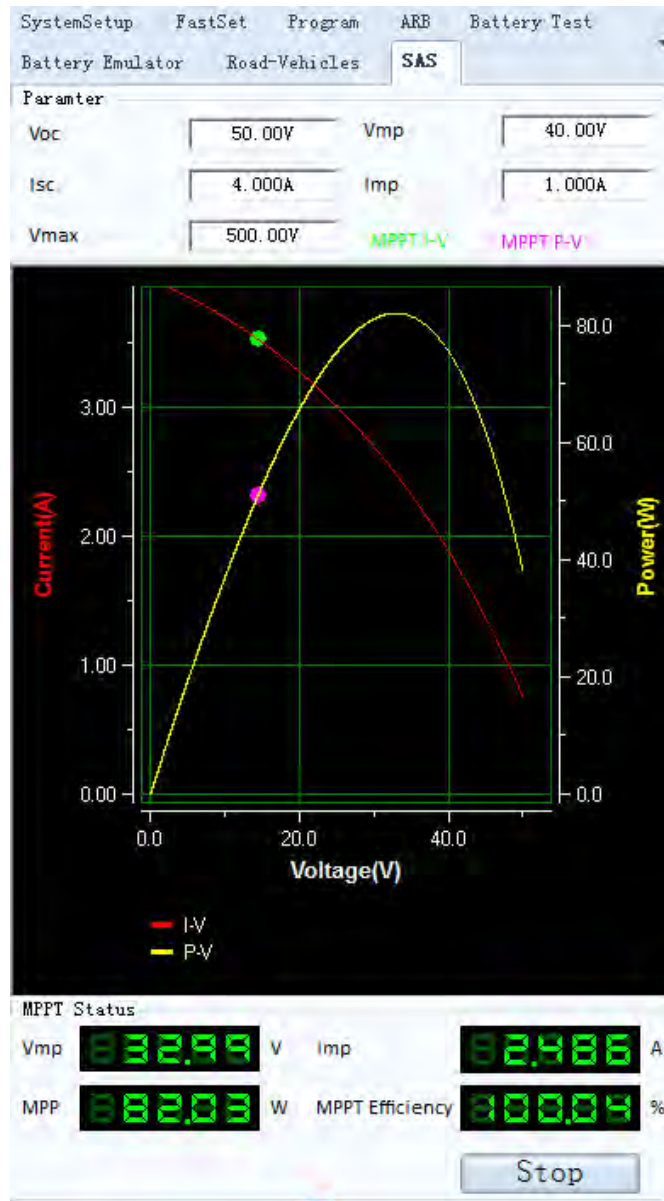
The parameters are introduced as follows (for detailed waveform output, please refer to the user manual):

|      |   |
|------|---|
| Off: | Do not enable the ISO21780 waveform.                                    |
| T01  | nominal voltage range   |
| T02U | Upper Range: upper transitory voltage range                             |
| T02L | Lower Range: lower transitory voltage range                             |
| T03  | short term overvoltage  |
| T04  | supply component load dump control test                                 |
| T05  | starting profile  |
| T06  | long term overvoltage   |
| T07  | overvoltage with consumer components which may supply electrical energy |
| T08  | decrease and increase of supply voltage                                 |
| T10  | reinitialisation  |
| T11  | discontinuities in supply voltage                                       |

**Trig:** After starting the wave, Trigger key takes effect. Click Trigger key to execute this wave.

## 3.10 SAS

The interface of this function is shown below.



The upper part of the interface is the parameter setting of the user-defined PV simulation curve (static). The middle part of the interface is the MPPT graph displayed in real time, the abscissa is voltage, and the ordinate is current or power. The lower part of the interface is the MPPT status parameter, as described below.

| Parameter | Description                          |
|-----------|--------------------------------------|
| Voc       | Set the open-circuit voltage value.  |
| Vmp       | Set the maximum power voltage value. |
| Isc       | Set the short-circuit current value. |

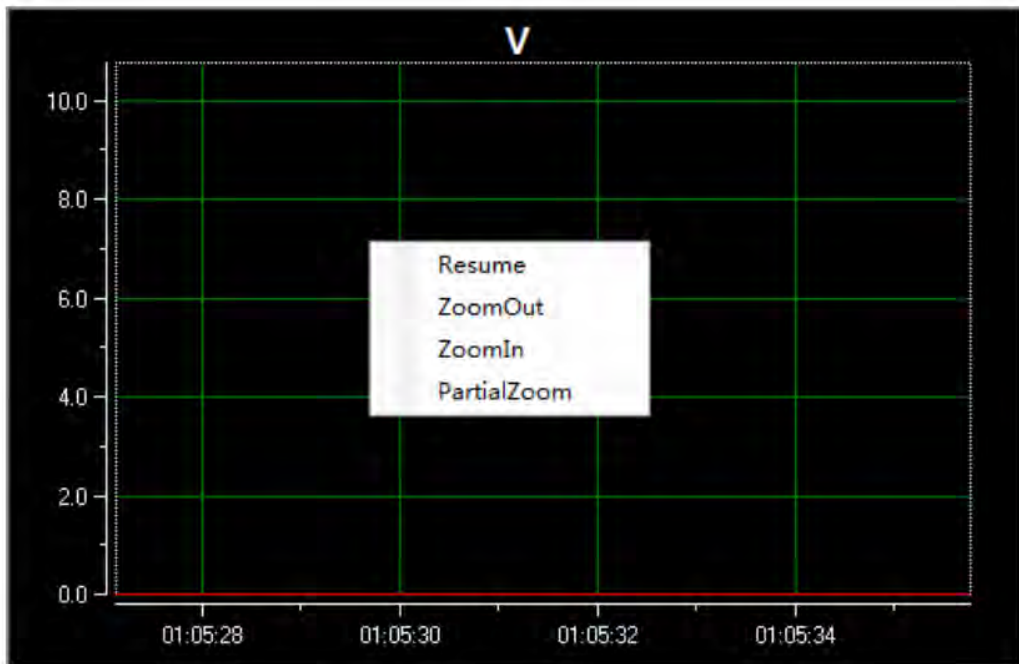
|                    |   |
|--------------------|---|
| Imp                | Set the maximum power current value.  |
| Vmax               | Used to limit the maximum value of the output voltage. Even if the output voltage is set in the PV curve, the output is still limited by the settings here. |
| <b>MPPT Status</b> | <b>Description</b>  |
| Vmp                | The voltage value of the tracked maximum power point.   |
| Imp                | The current value of the tracked maximum power point.   |
| MPP                | The maximum power point.  |
| MPPT Efficiency    | The actual output power of the tracking point divided by the modeled power, i.e. the value of <b>MPP/(Vmp*Imp)</b> .  |

#### Button introduction

**Run/Stop:** Run or stop running the edited PV simulation curve (static).

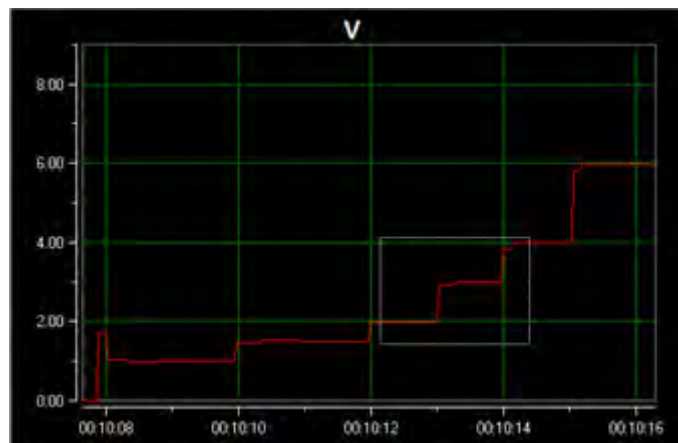
## 3.11 Curve Zoom In and Translation

In the IT9000 software, voltage and current curve graphs have such functions as Resume, Zoom Out, Zoom In and Partial Zoom. Right click any one at the curve graph, as shown below.

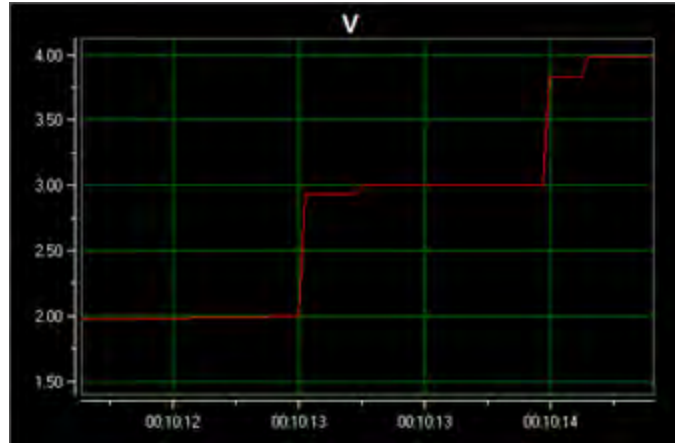


### Curve zoom in

1. Right click the curve graph and select "Partial Zoom". At the bottom of cursor will display a small rectangle box.
2. Move the cursor of small rectangle box to pull out a bigger rectangle box to define the location which you need enlarge the partial wave.



3. Release the mouse left key and the image will be promptly zoomed in.

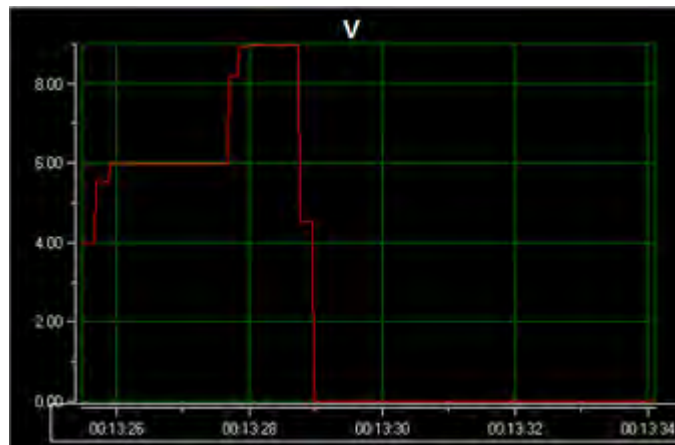


4. To resume dynamic records, right click the curve graph and choose "Resume".

### Translation view

1. Move the cursor shape to any position of the horizontal coordinate axis (Time Axis) and the mouse will change to be a hand.
2. Hold down the mouse left key to move the mouse. When moving left, you will see the curve after the present time; when moving right, you will see the curve before present time.

Similarly, you can translate the voltage/current coordinate to view curve.



3. To resume dynamic records, right click the curve graph and choose "Resume".

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