IT9000 Control Software

PV6000 User Manual

ITECH

Notices

Manual Part Number

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402225

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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.

Note

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.**

<div style="background:red;color:white;padding:4px;">WARNING</div>

- **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.**

<div style="background:#c8822a;color:white;padding:4px;">CAUTION</div>

- **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.**
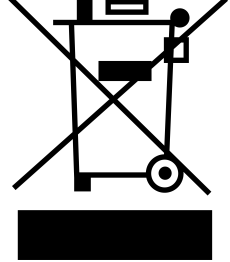
Environmental Conditions

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

$\mathsf{C}\,\mathsf{E}$	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).
(crossed-out wheeled bin symbol)	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.
(recycle symbol with 10)	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
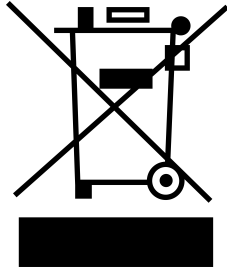
Waste electrical and electronic equipment (WEEE) directive, 2002/96/EC The product complies with tag requirements of the WEEE directive (2002/96/EC). This tag indicates that the electronic equipment cannot be disposed of as ordinary household waste. Product Category
According to the equipment classification 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 [1][2][3]

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

Content

1 Brief Introduction

♦ Software Introduction
♦ IT9000 Interface Introduction

1.1 Software Introduction

IT9000-PV6000 is a kind of easy-to-use and practicable control software designed by Itech Electronic Co., Ltd. It is applicable to Itech IT6000B, IT6000C, IT6000D, IT8000 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:
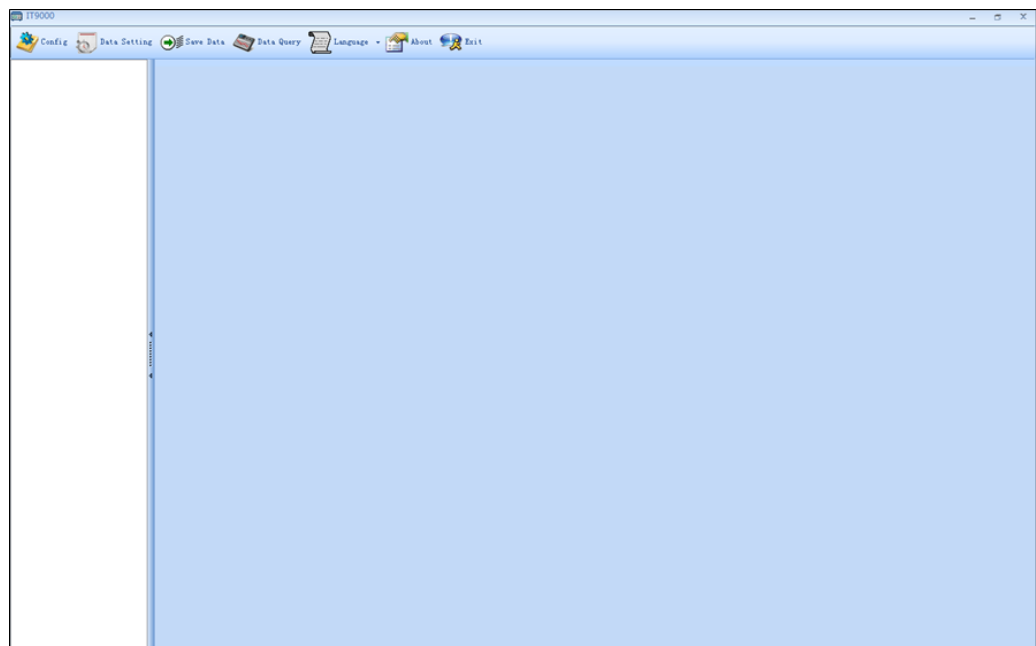
The interface is described as follows:

- **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.
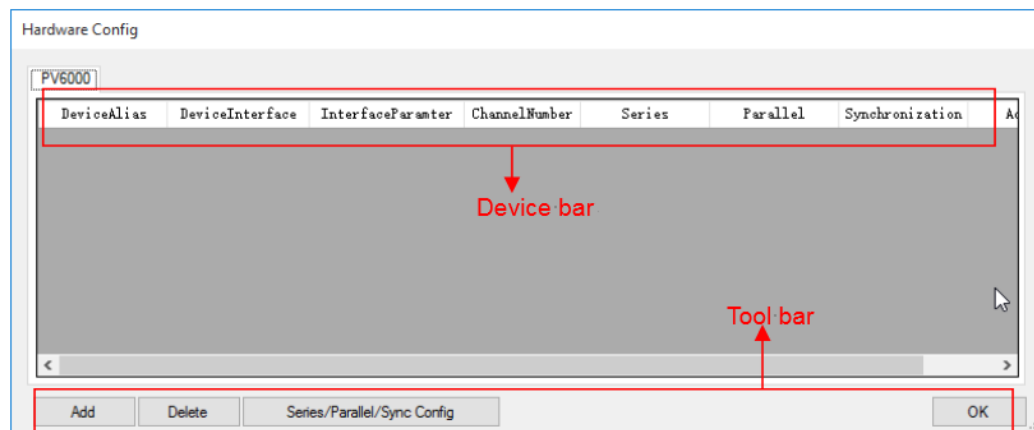
- The "Device bar" includes settings for device alias, device interface, interface parameter and channel number:

  – 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 (TMC) communication as an example. The following introduce how to configure hardware.

📖 **Note**

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 > TMC).

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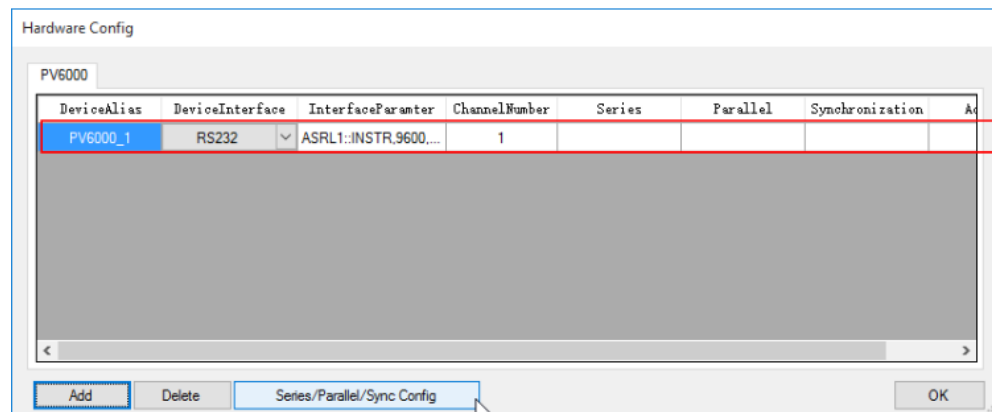
To change default parameter of hardware device (e.g., device interface, interface parameter and channel number), you may click the parameter for change.

- 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.
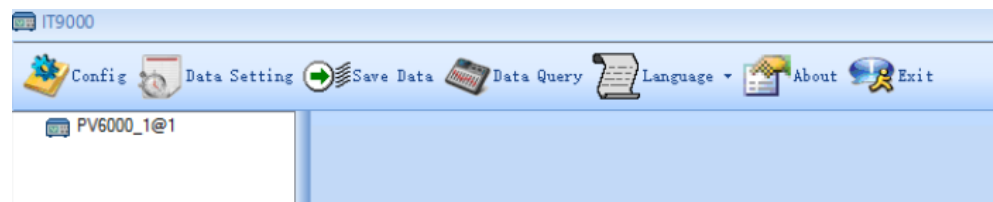
2.1.3 Configuring Interface of Device

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 IT6000 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.
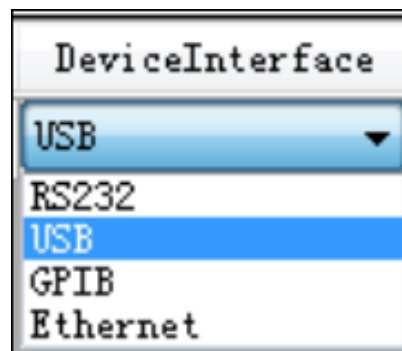
2. After selecting the device interface, double click corresponding "Interface Parameter" column. The system will pop up "Interface Configuration" window.

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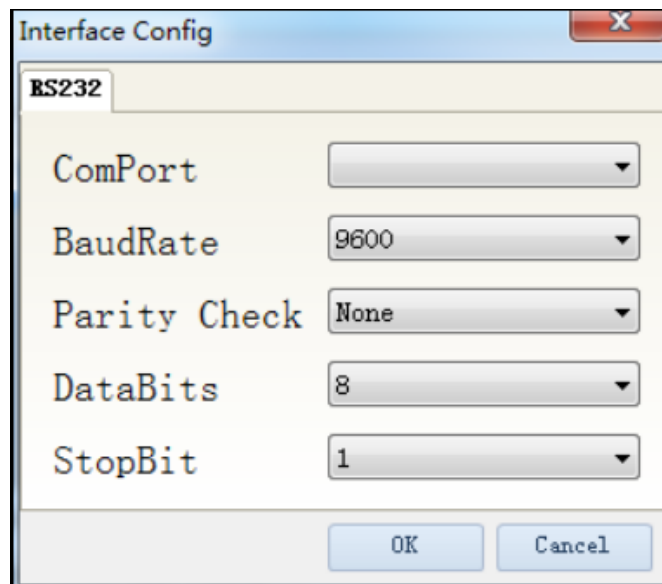
Serial interface: to select serial interface, i.e., the serial interface number occupied by RS232 communication cable interface.

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

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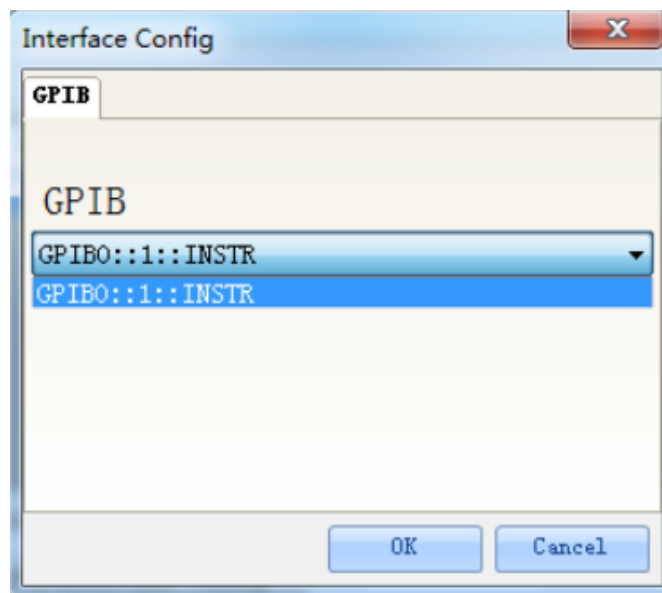
During GPIB communication of device, the address setting range is: 1-30.

- USB Interface Parameter Configuration
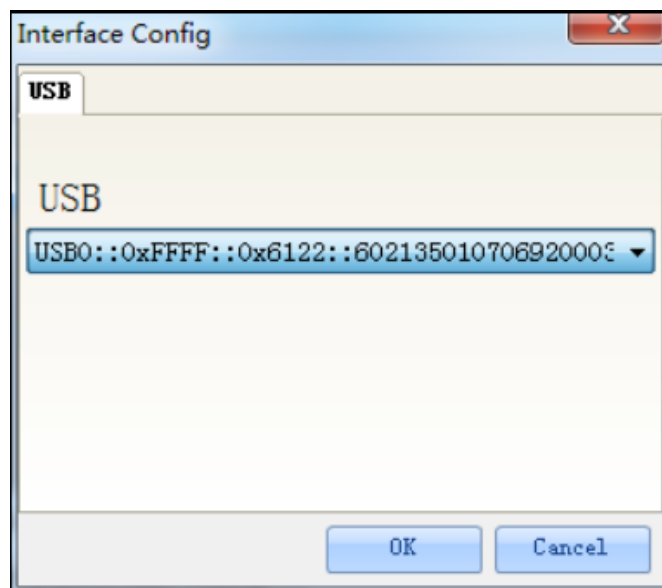
- LAN Interface Parameter Configuration

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.
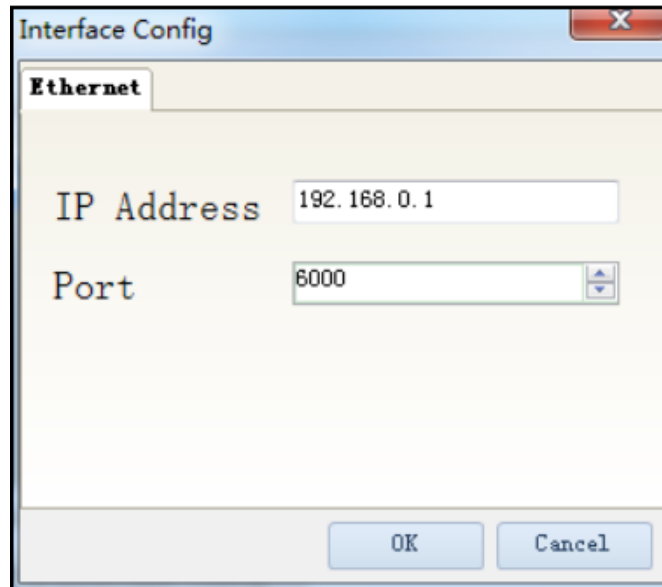
IP address: When using the LAN interface for communication, both the computer and the instrument are connected through the HUB (or the instrument and the computer are directly connected through the standard network cable), and the IP settings of the computer and the instrument must be consistent and 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 IT6018C-500-30 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 –60 to 60A. 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.
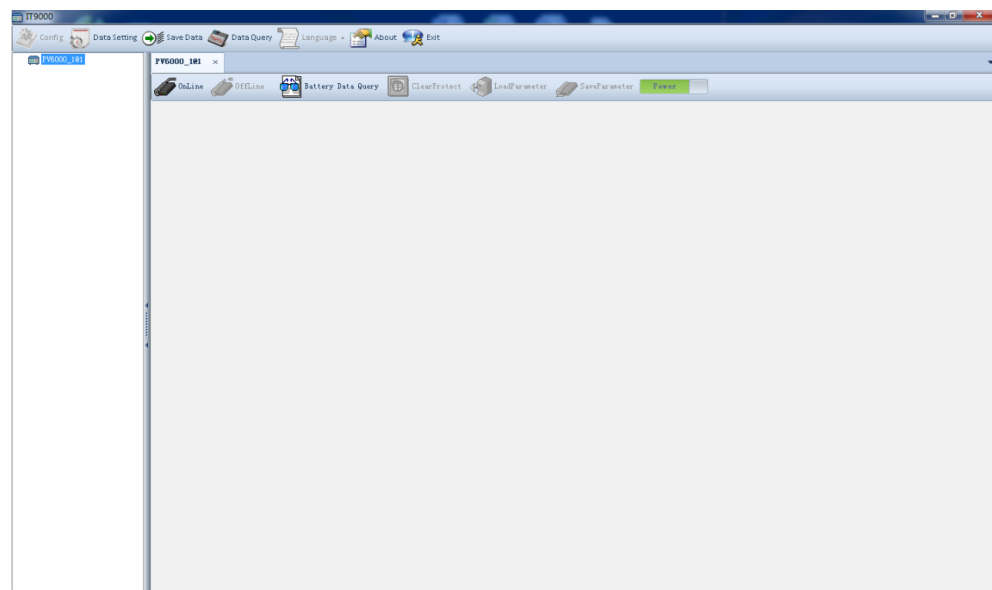
2. Click "Data Setting" icon to enter the Data Setting Interface.

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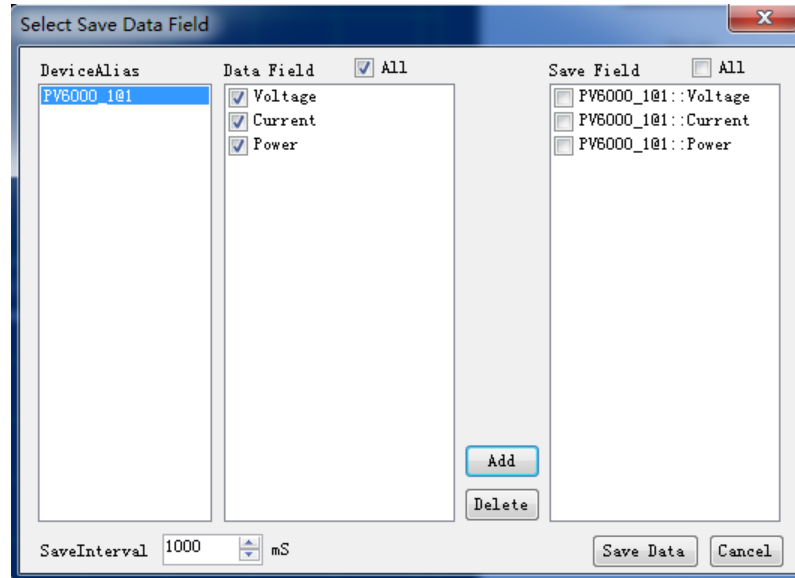
You may also click the Field Name in the Save Field bar. Click "Delete" button to delete the saved field.

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.

8. 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

1. Click Data Query icon to enter the Data Query Interface.

2. 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.
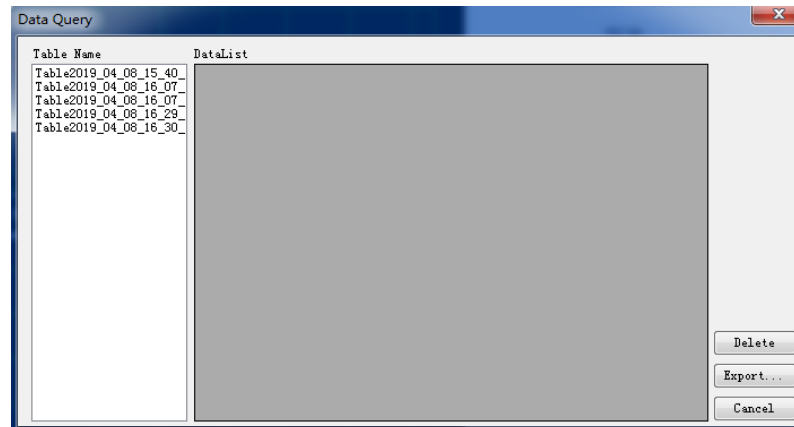
- Delete: to delete the data in current data list.

- 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 PV6000 Control Interface

3.1 Introduction of Control Interface

The PV6000 Control Interface of IT9000 software (after clicking "Online") is as shown below.
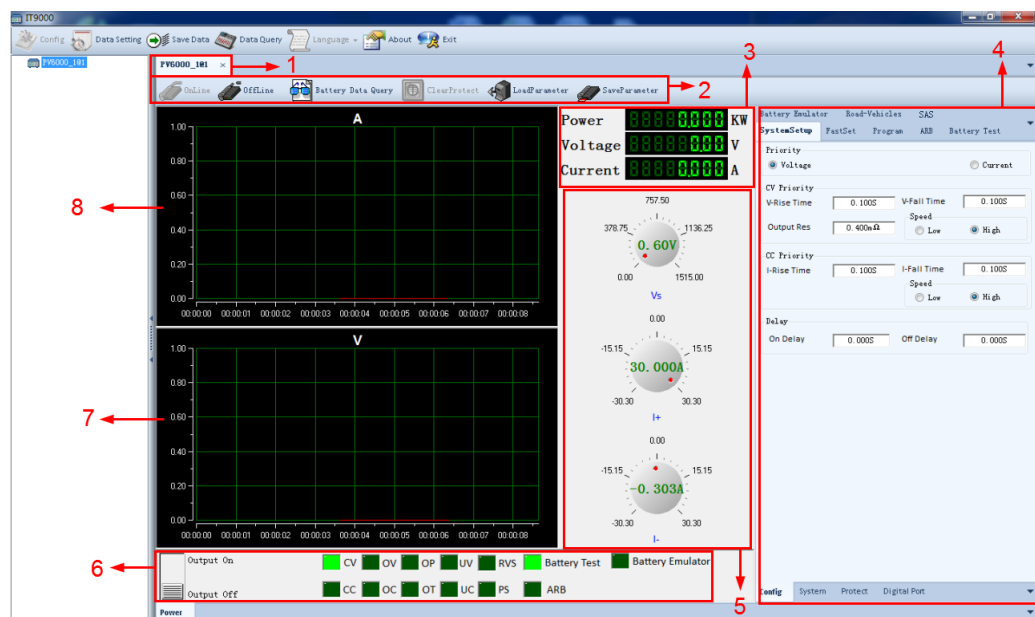
1. Tab bar, to switch the display of Control Interfaces of different devices.

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 is running.

Clear Protect: to clear instrument protection status.

Load Parameter: to recall the parameter settings stored in a file suffixed with .6000, including the parameters in the program, scan, and ARB interface.

Save Parameter: to save the parameters in the program, scan and ARB interface to a file with a .6000 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), 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)

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 Hotkey 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.
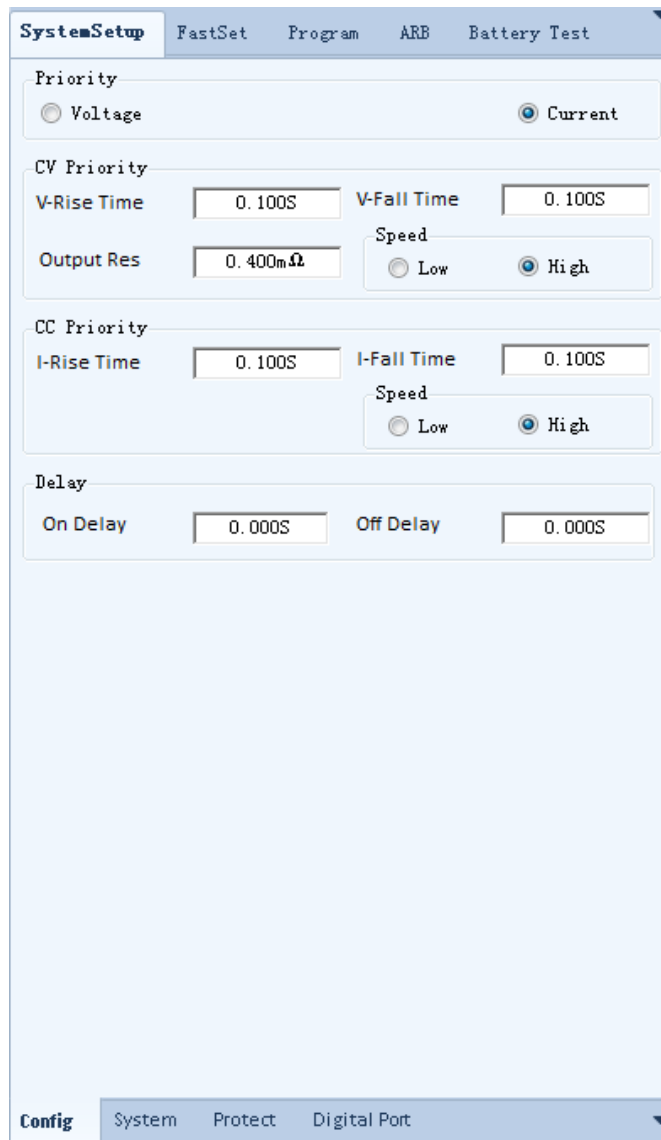
3.3 SystemSetup

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 **Vs** in FastSet; if "Current" is selected, it will be displayed as **Is** in FastSet.	
	Voltage	Constant voltage loop priority mode
	Current	Constant current loop priority mode
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.
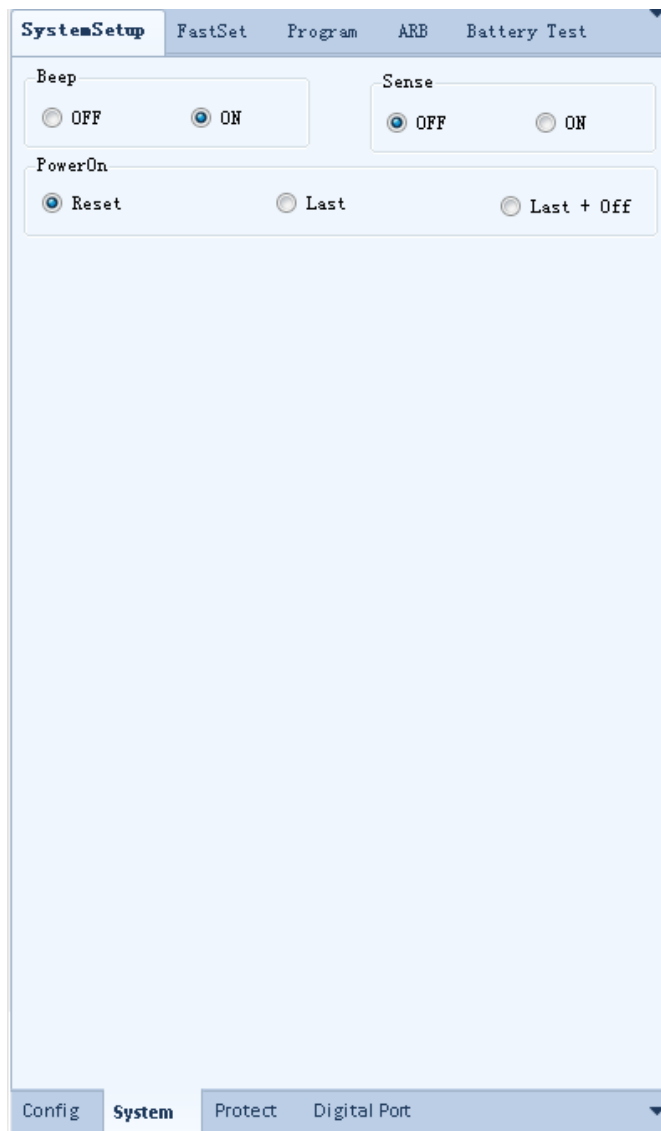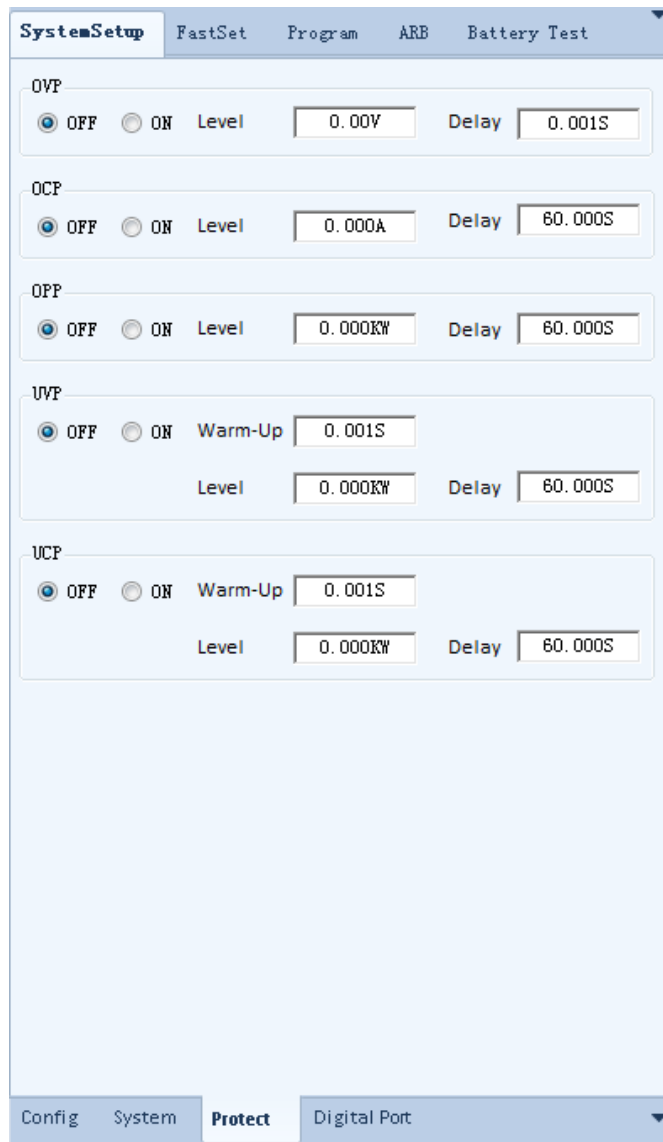
The parameters are detailed as follows:

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 **[On/Off]** 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 **[On/Off]** state.
	Last	When the instrument is powered on, the instrument will remain the same settings and **[On/Off]** 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 **[On/Off]** 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.

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 (**Not-Invert**), the output digital signal is 0 (i.e. high level), and in the case of **Invert**, the output is low level.	
		True	By default (**Not-Invert**), the output digital signal is 1 (i.e. low level), and in the case of **Invert**, 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 (**Not-Invert**), pin 2 outputs high level; when the instrument is under protection, pin 2 outputs low level.		
Off-Status	This default function indicates the existing **[On/Off]** state of the instrument. When it is set to (**Not-Invert**), the **[On/Off]** is turned off, and pin 3 outputs high level; the**[On/Off]** is turned on, and pin 3 outputs low level.		
Ext-Trig	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 for running), 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 **[On/Off]**.
Sync-Off		This default function means that pin 7 performs bi-directional and synchronous control over the turn-off of **[On/Off]**.

📖 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".

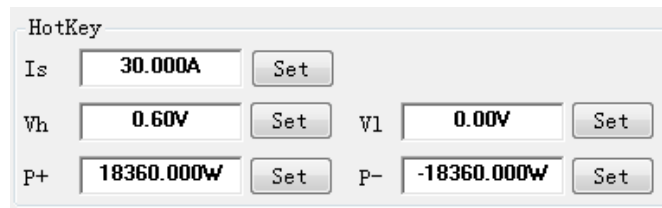**CV priority:** Support for quickly setting the parameters as shown in the figure below.

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.

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 **Vs** / **Is** curve indicates that the instrument is outputting voltage or current from this value.
Stop	The end value of the **Vs** / **Is** curve indicates that the instrument output voltage or current reaches this value and stops outputting.
Step	Step value of **Vs**/**Is**.
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.

SystemSetup	FastSet	Program	ARB	Battery Test	▼
Step		Vs (V)		Maintain (S)	

Add   Insert   Delete   Import   Export   Run

RunTimes
● Once   ○ Repeat   ○ Custom   [1]   1

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.
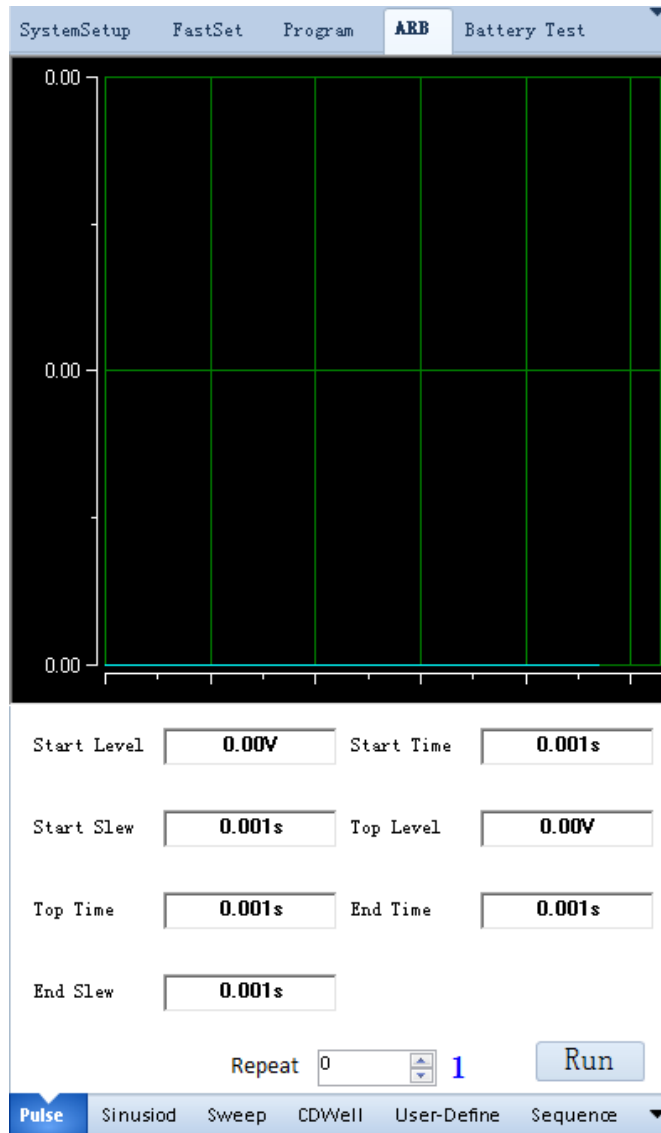
   Click **Stop** to stop operation.

3.6 ARB

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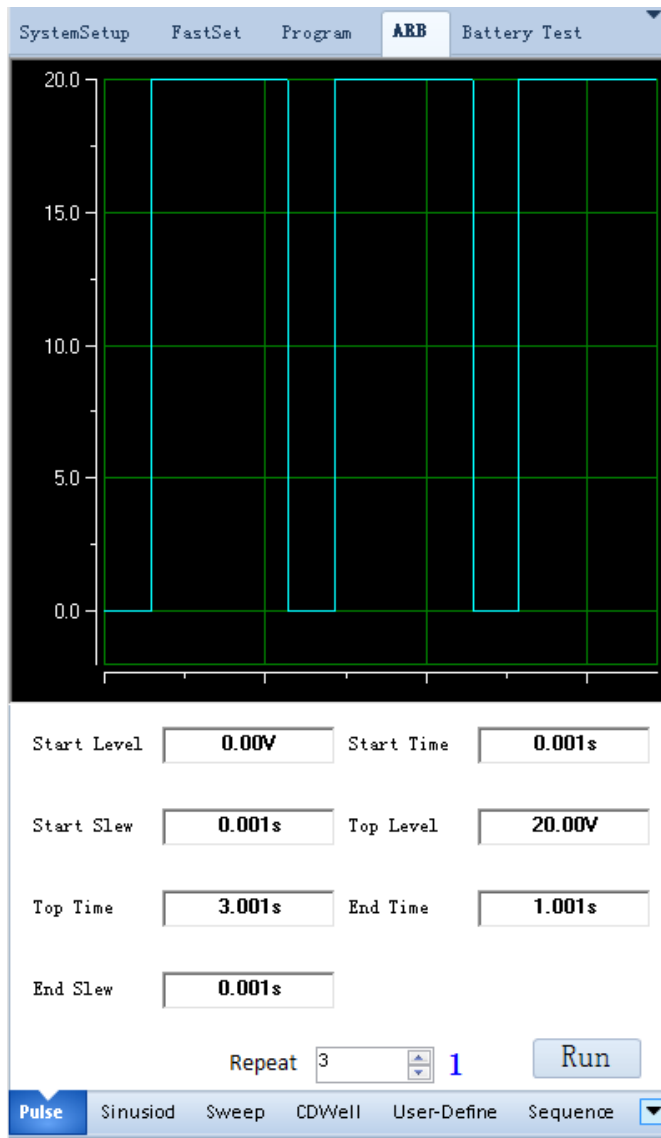
3.6.1 Pulse

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. 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. 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. 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.
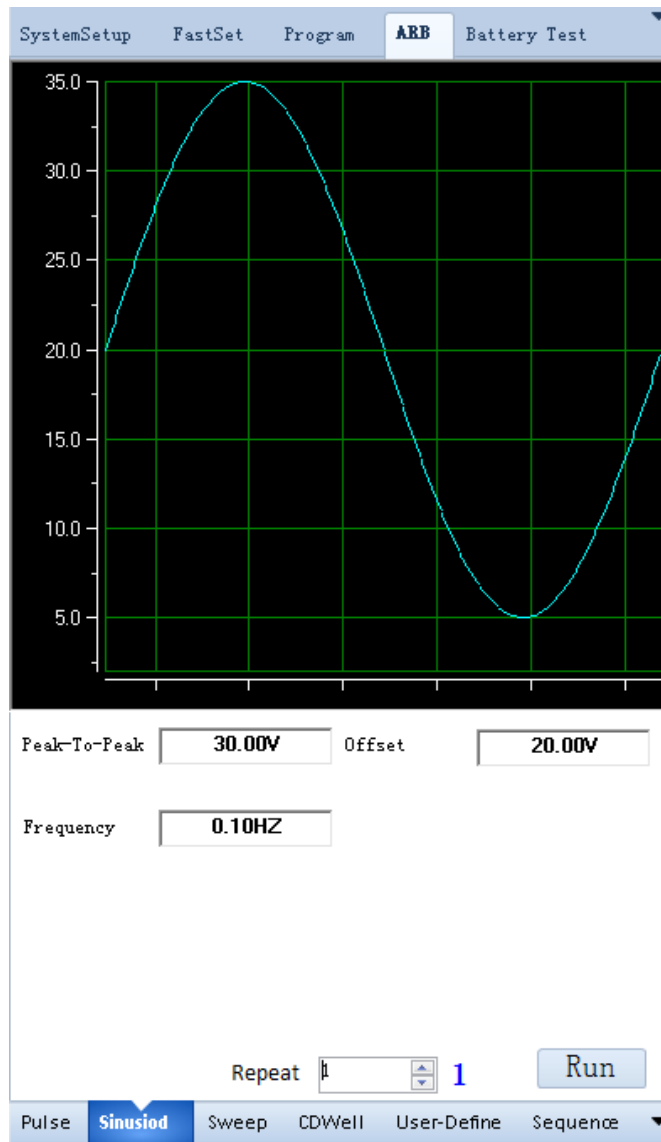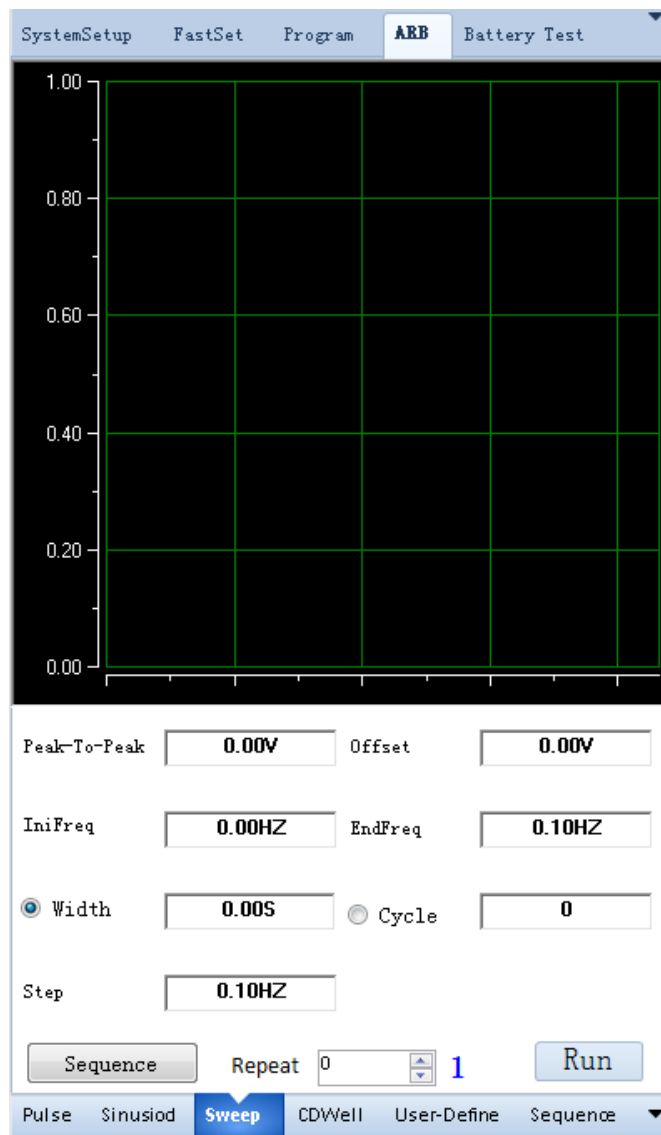
Parameter	Description
Peak-To-Peak	The peak-to-peak value of a sine wave. The unit of this parameter (V/A) varies with the CV/CC priority selection on the Config page.
Offset	The value of the sine wave offset upward. The unit of this parameter (V/A) varies with the CV/CC priority selection on the Config 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.
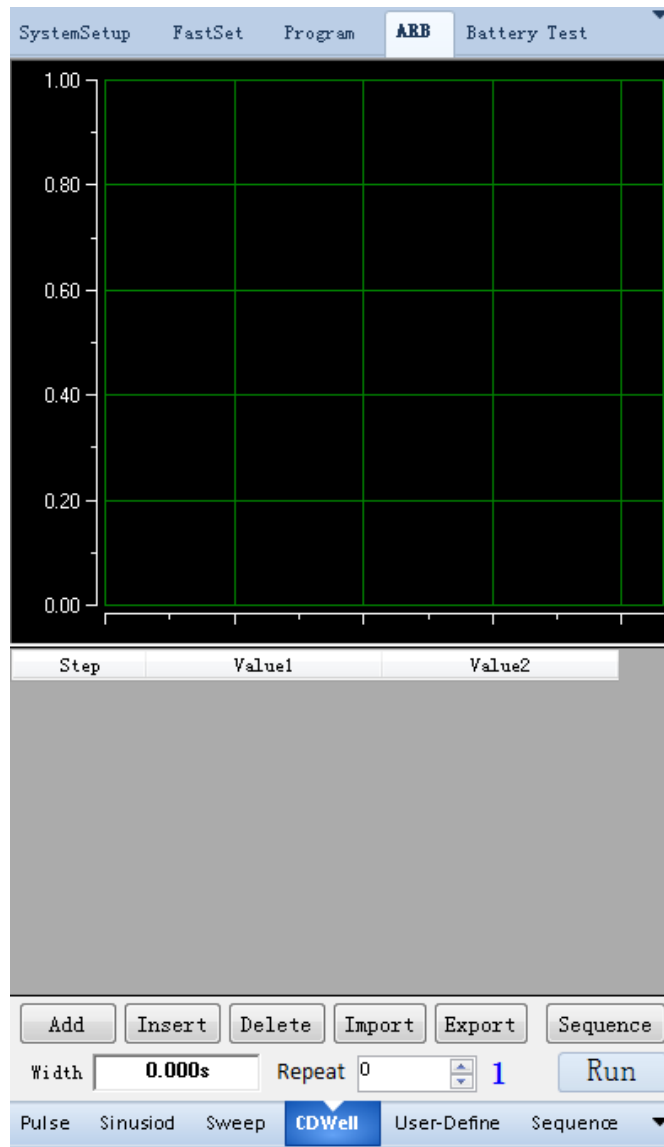
Parameter	Description
Peak-To-Peak	The peak-to-peak value of the sweep wave. The unit of this parameter (V/A) varies with the CV/CC priority selection on the Config page.
Offset	The value of the sweep wave offset upward. The unit of this parameter (V/A) varies with the CV/CC priority selection on the 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: • Width: The execution time width of each frequency point of the sweep wave. • Cycle: The number of repetitions of each frequency point of the sweep wave.
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 second voltage/current point in the CDWell waveform. In the second step, it represents the fourth point, and so on.
Value 2	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.

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.
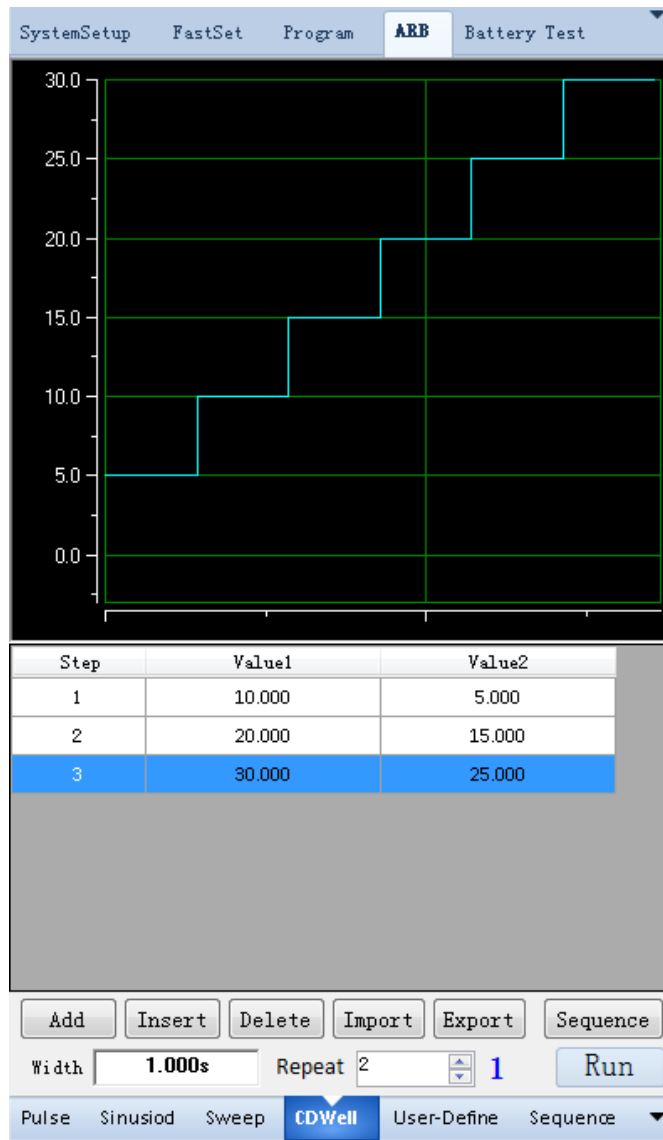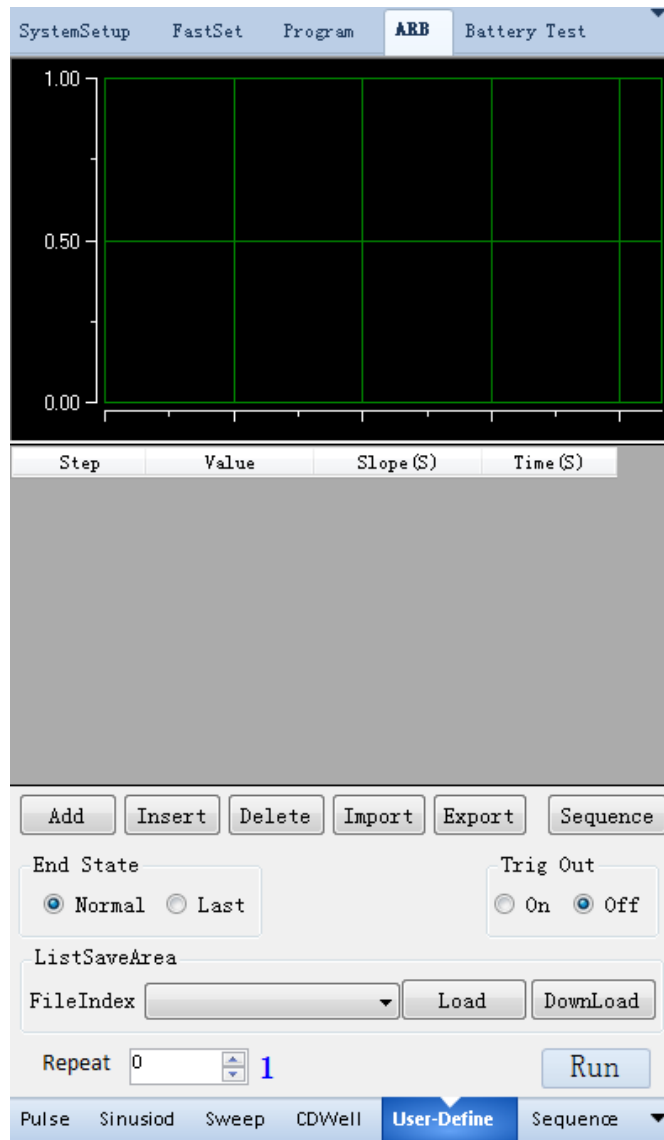
⬚Note

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: • Normal: Returns to the state before the waveform was output. • Last: Stays in the state of the last voltage/current point of the user-defined waveform.
Trig Out	Used to control whether the synchronous trigger (i.e. trigger user-defined waveform output) in the parallel state is turned on: • On: Yes • Off: No
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.
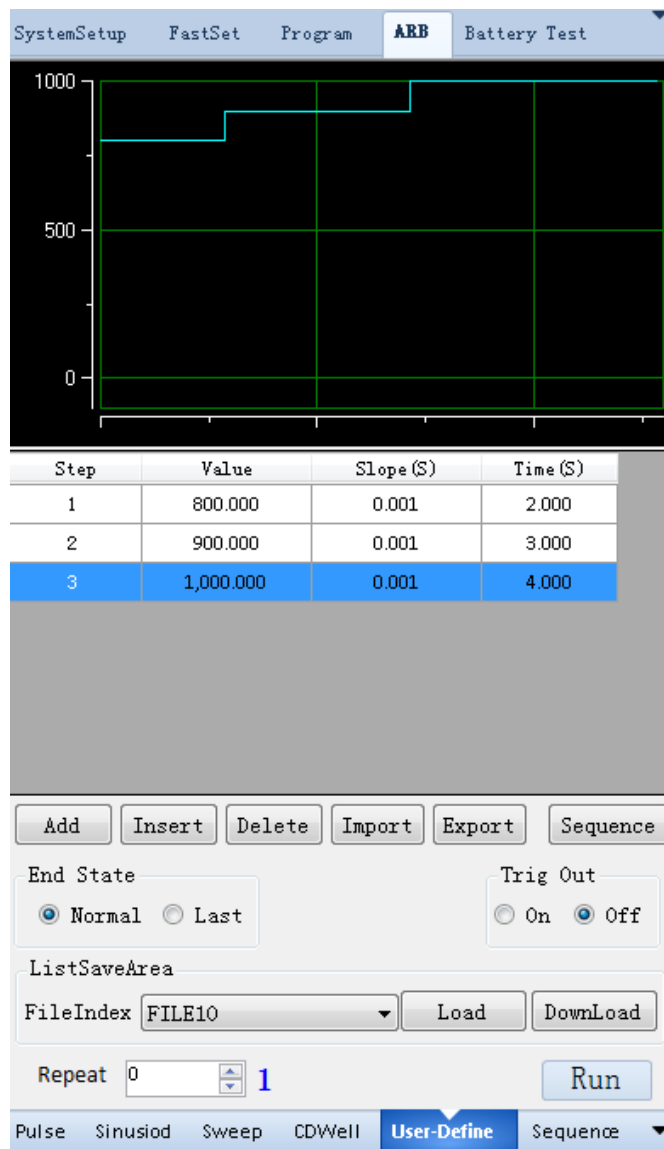
⌒📖 Note

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

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.
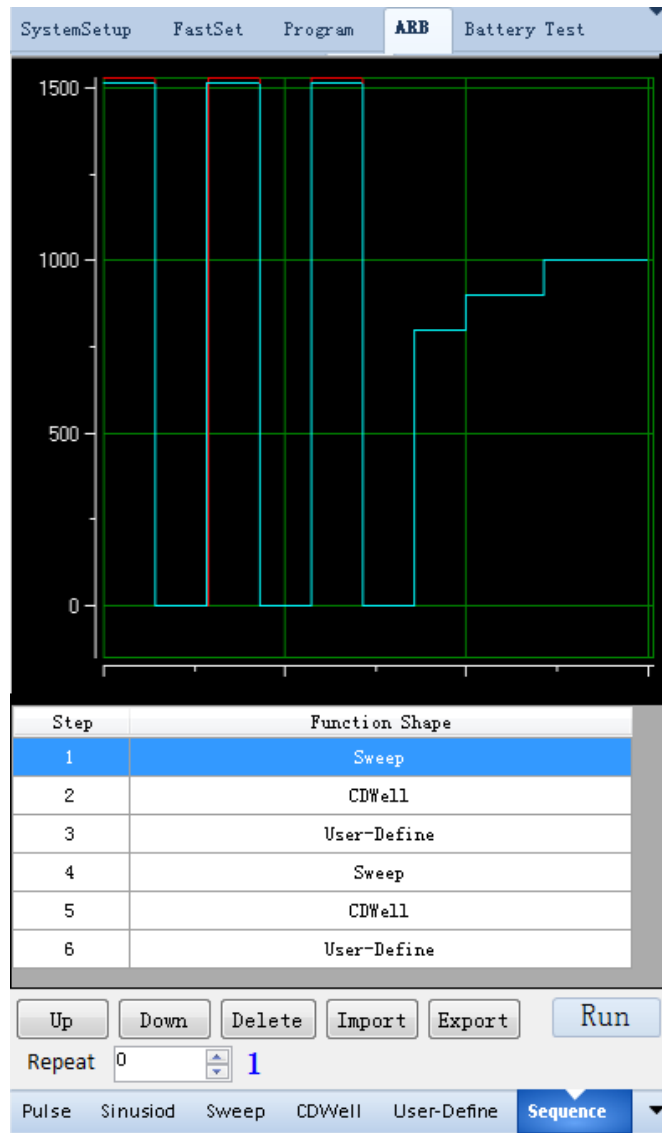
  3. Click **Download**.

     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.
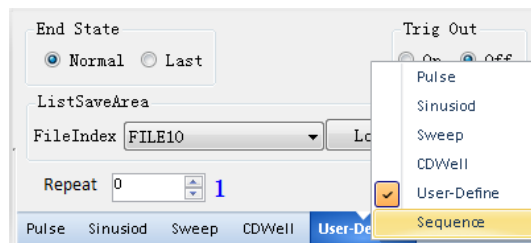
The interface of this function is shown below.

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.

- **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

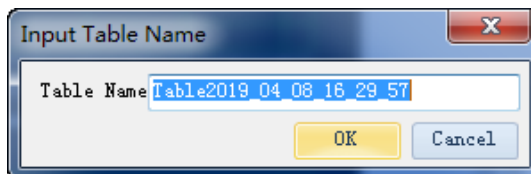The interface of this function is shown below.
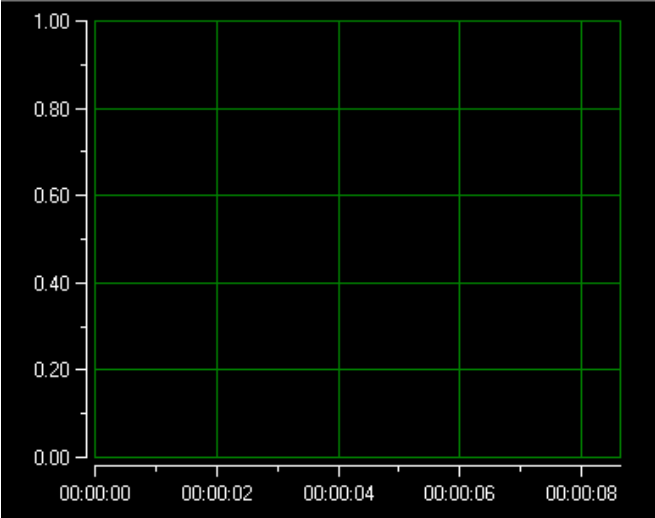
The parameters of the battery charge/discharge test are described below.

Parameter	Description
Charge/Discharge	Battery charging /discharging test function options.
Charge/Discharge Time	The display of the charging /discharging test duration. Corresponds to the abscissa of the waveform display area below.
Charge/Discharge Capability	The display of the charging /discharging capability. Corresponds to the ordinate of the waveform display area below.
Stop Voltage	Stop the test when the battery voltage is the set value.

Parameter	Description
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.
Work Voltage	The voltage value of the battery charge/discharge test.
Work Current	The current value of the battery charge/discharge test.
Save Interval	The time interval for saving battery charge/discharge test data.

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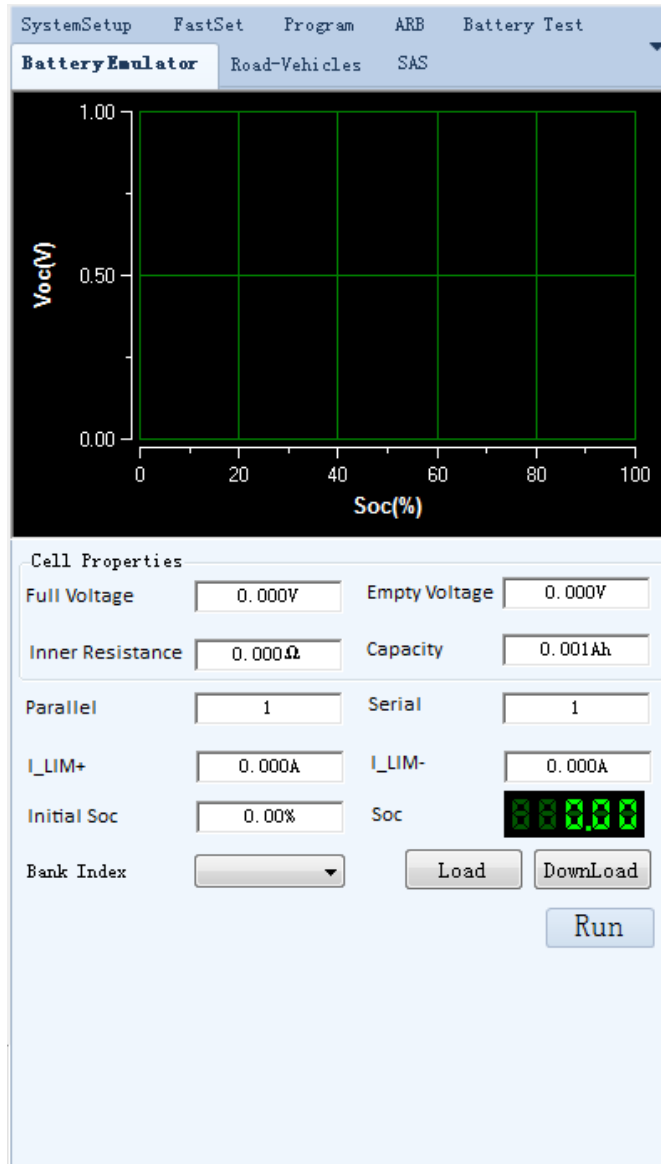
The upper part of the interface is the battery simulation waveform diagram displayed in real time. The abscissa is the battery capacity, the ordinate is the battery voltage; the lower part of the interface is the parameters of the battery simulation function, as described below.

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.

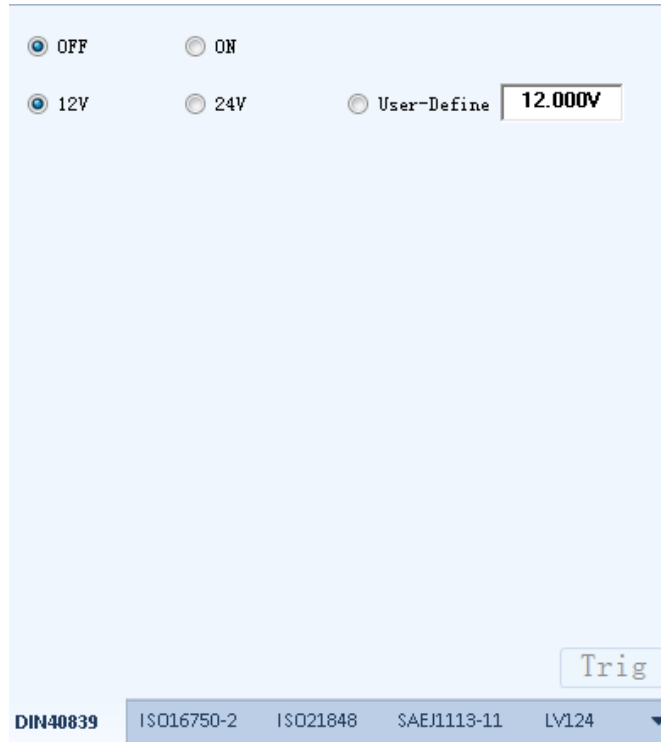- **Run:** Run the currently edited battery simulation test file.

3.9 Road-Vehicles

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

- DIN40839
- ISO16750-2
- ISO21848
- SAEJ1113–11
- LV124
- LV123

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.

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 (Ulow≤80V)
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 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".

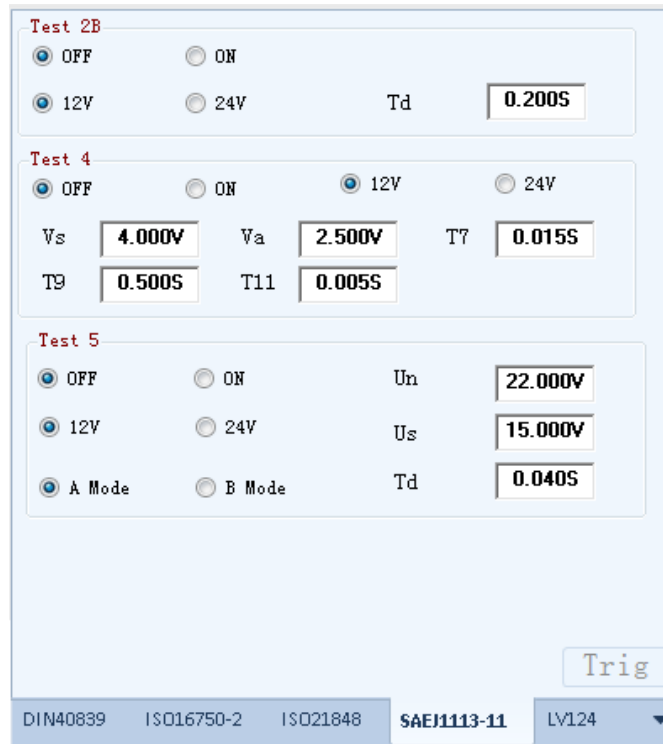- $U_{max,dyn}$
- Moment-Drop
- Reset

  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 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
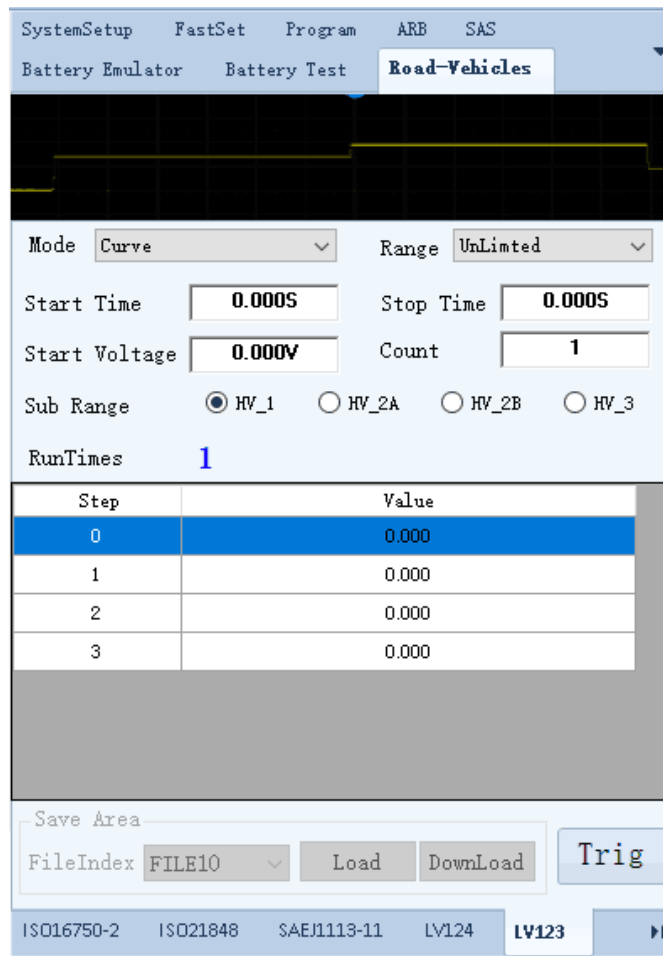
The waveform parameters are described below.

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.

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. The actual number of test executions = count * 3.
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. Select the **Sub Range**.

  4. Customize the voltage value corresponding to different intervals.

  5. 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**.

3.10 SAS

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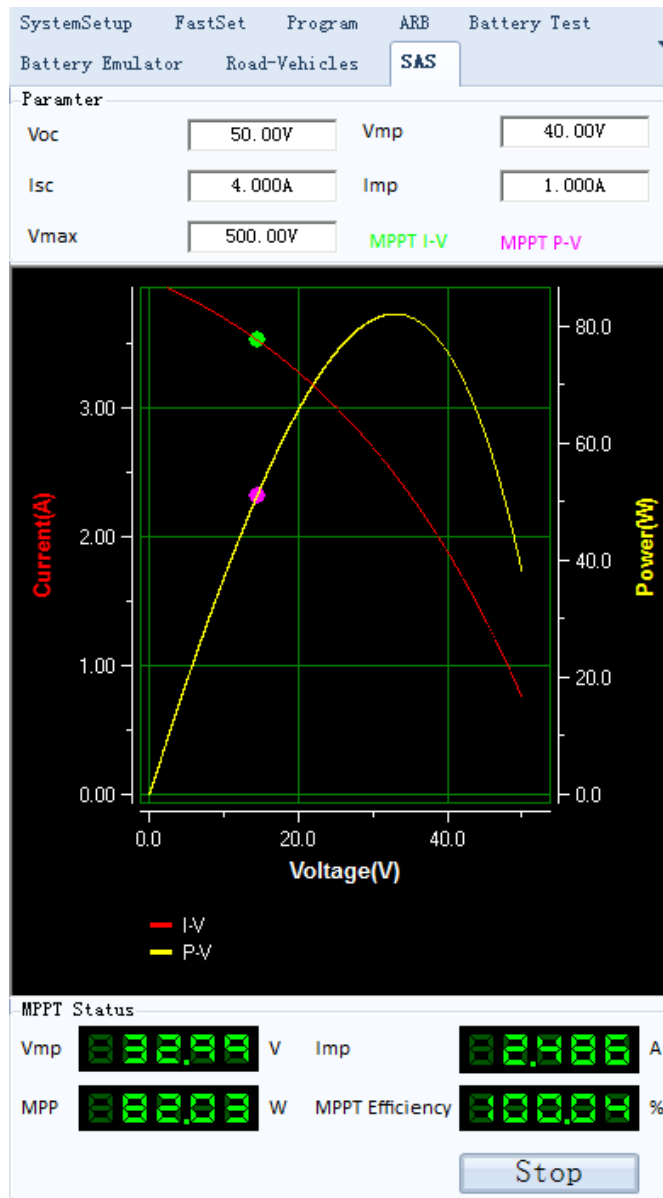
The upper part of the interface is the parameter setting of the user-defined PV simulation curve (static). The middle part of the interface is the MPPT graph displayed in real time, the abscissa is voltage, and the ordinate is current or power. The lower part of the interface is the MPPT status parameter,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

MPPT Status	Description
	PV curve, the output is still limited by the settings here.
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 **MPP/(Vmp*Imp)**.

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.
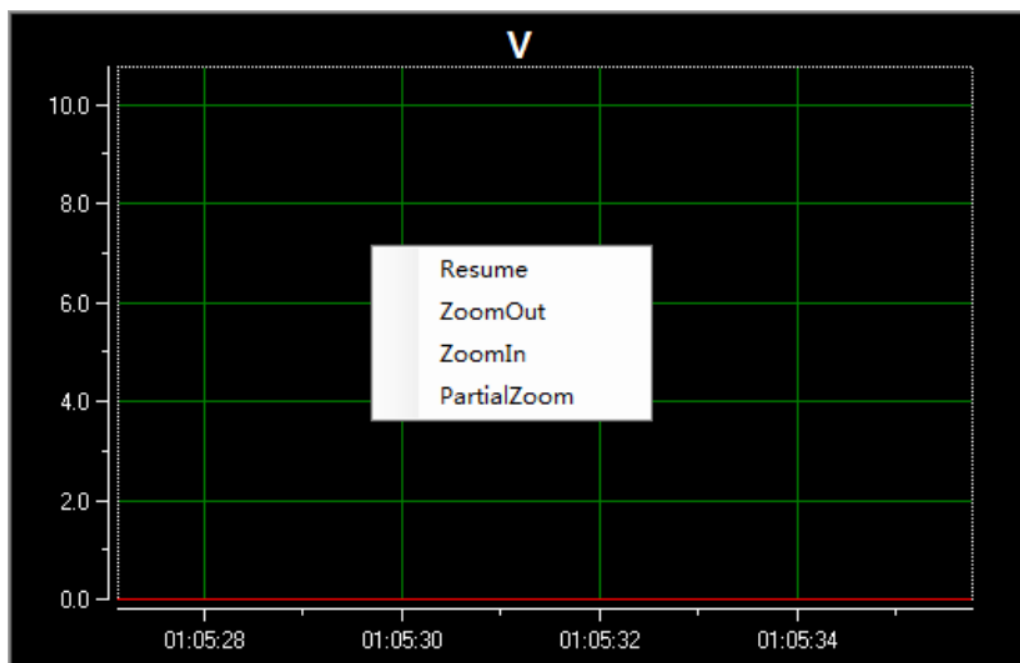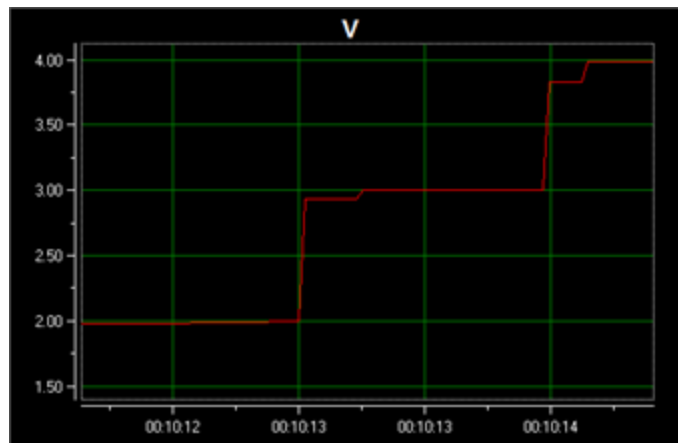
Curve zoom in

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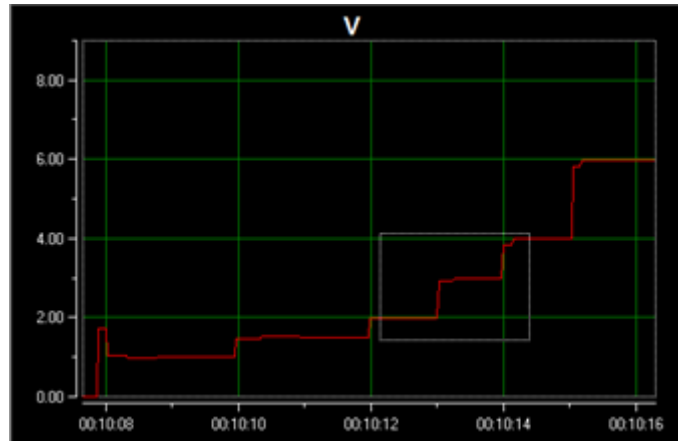
3. Release the mouse left key and the image will be promptly zoomed in.
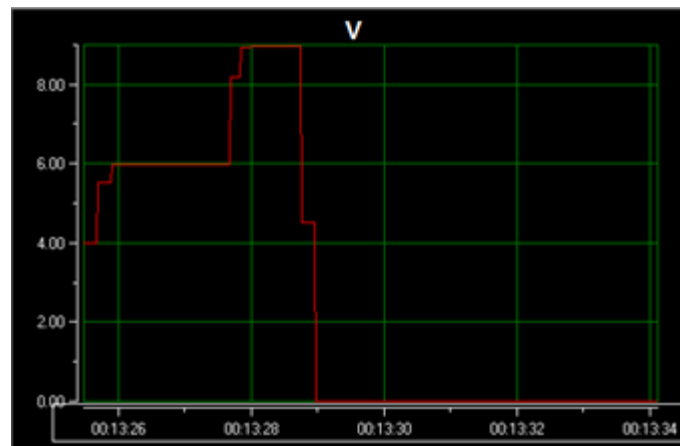

4. To resume dynamic records, right click the curve graph and choose "Resume".

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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2. Select the most convenient contact method, for further information.