Programmable DC Electronic Load

IT8100A/E Series User Manual

Model: IT8100A/E Series
Version: V1.1/3,2026

Notices

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.

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).

Note

Visit https://www.itechate.com/en/support/register.html to complete product registration by filling out the necessary information to extend the warranty to two (2) years.

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. Inspect the enclosure for cracks before operation. Do not operate the instrument in the presence of flammable gases, vapors, or dust.**
- **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 loosened.**
- **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 input the dangerous voltage that can cause personal injury, and the operator must always be protected from electric shock. Ensure that the input 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	30% to 90% (non-condensing)
Storage temperature	-10°C to 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

CE	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).
UKCA	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 / EN 61326-1 [1][2][3]

Reference Standards

CISPR 11, Class A

IEC 61000-3-2

IEC 61000-3-3

IEC 61000-4-2

IEC 61000-4-3

IEC 61000-4-4

IEC 61000-4-5

IEC 61000-4-6

IEC 61000-4-11

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

Note

This section provides general and universal terms. For more detailed information on the *Declaration of Conformity*, please contact ITECH personnel.

Content

1 Quick Reference

This chapter describes the power-on inspection procedures to ensure proper startup and initial operation of the instrument. It also provides an overview of the front panel, rear panel, keypad, and display functions.

1.1 Brief Introduction

The IT8100A/E series represents a new generation of graphical programmable electronic loads. An advanced touchscreen and intuitive graphical interface enable fast parameter configuration and easy waveform editing, significantly enhancing usability and efficiency.

Designed for ultra-high power density, the IT8100A/E delivers up to 7.2 kW in a compact 3U chassis (150 V model) and can scale to 1.8 MW through fiber-optic master-slave paralleling, meeting demanding high-voltage and high-current testing requirements.

Available in 60V, 150 V, 600 V, and 1200 V ranges, with standalone power from 2 kW to 86.4 kW, the series features high-speed current slew rates and versatile operating modes-including dynamic, sequence, and advanced loading functions-ensuring outstanding performance in applications such as AI server power supplies, power modules, fuel cells, EV charging station, Solar Array and power electronics.

It provides a powerful and reliable solution for R&D, validation, and production testing.

- Touchscreen display with Meter / Scope / Recorder modes
- Three-range V/I design for full precision coverage
- High dynamic current slew rate up to 150 A/μs per unit
- Minimum Operating Voltage: 0.24 V @ 2400 A
- Minimum sampling interval in Scope mode: 2μs
- Basic load modes: CC / CV / CP / CR /CE

- Combined load modes: CC+CR / CR+CV / CC+CV / CP+CV / CC+CR+CV +CP
- Advanced Load Modes： CC sine/CC Pulse/Table mode *1
- Transient frequency up to 50kHz
- LIST / OCP / OPP / Battery discharge / Short-circuit modes
- User-defined waveform function for simulating complex load profiles
- 1.5× short-time overloading capability
- 4× transient overloading capability *1
- Built-in Sequence & Sweep modes
- Built-in EIS analysis with direct Bode and Nyquist plot generation *1
- Built-in 5½-digit DVM terminals *1

*1. Only IT8100A have.

1.2 Model and Options

Models

Table 1–1 60V

Models	Specifications	Height
IT8102E-60-800	60V/800A/2kW	3U
IT8104E-60-1600	60V/1600A/4kW	3U
IT8106E-60-2400	60V/2400A/6kW	3U

Table 1–2 150V

Models	Specifications	Height
IT8102E-150-200	150V/200A/2.5kW	3U
IT8105E-150-400	150V/400A/5kW	3U
IT8107A/E-150-600	150V/600A/7.2kW	3U
IT8110A/E-150-800	150V/800A/10kW	6U
IT8114A/E-150-1200	150V/1200A/14.4kW	6U
IT8121A/E-150-1800	150V/1800A/21.6kW	15U
IT8128A/E-150-2400	150V/2400A/28.8kW	15U

Models	Specifications	Height
IT8136A/E-150-3000	150V/3000A/36kW	15U
IT8143A/E-150-3600	150V/3600A/43.2kW	27U
IT8150A/E-150-4200	150V/4200A/50.4kW	27U
IT8157A/E-150-4800	150V/4800A/57.6kW	27U
IT8164A/E-150-5400	150V/5400A/64.8kW	27U
IT8172A/E-150-6000	150V/6000A/72kW	37U
IT8179A/E-150-6600	150V/6600A/79.2kW	37U
IT8186A/E-150-7200	150V/7200A/86.4kW	37U

Table 1–3 600V

Model	Specifications	Height
IT8102E-600-140	600V/140A/2kW	3U
IT8104E-600-280	600V/280A/4kW	3U
IT8106A/E-600-420	600V/420A/6kW	3U
IT8108A/E-600-560	600V/560A/8kW	6U
IT8112A/E-600-840	600V/840A/12kW	6U
IT8118A/E-600-1260	600V/1260A/18kW	15U
IT8124A/E-600-1680	600V/1680A/24kW	15U
IT8130A/E-600-2100	600V/2100A/30kW	15U
IT8136A/E-600-2520	600V/2520A/36kW	27U
IT8142A/E-600-2940	600V/2940A/42kW	27U
IT8148A/E-600-3360	600V/3360A/48kW	27U
IT8154A/E-600-3780	600V/3780A/54kW	27U
IT8160A/E-600-4200	600V/4200A/60kW	37U
IT8166A/E-600-4620	600V/4620A/66kW	37U
IT8172A/E-600-5040	600V/5040A/72kW	37U

Table 1–4 1200V

Model	Specifications	Height
IT8102E-1200-80	1200V/80A/2kW	3U
IT8104E-1200-160	1200V/160A/4kW	3U
IT8106A/E-1200-240	1200V/240A/6kW	3U
IT8108A/E-1200-320	1200V/320A/8kW	6U
IT8112A/E-1200-480	1200V/480A/12kW	6U
IT8118A/E-1200-720	1200V/720A/18kW	15U
IT8124A/E-1200-960	1200V/960A/24kW	15U
IT8130A/E-1200-1200	1200V/1200A/30kW	15U
IT8136A/E-1200-1440	1200V/1440A/36kW	27U
IT8142A/E-1200-1680	1200V/1680A/42kW	27U
IT8148A/E-1200-1920	1200V/1920A/48kW	27U
IT8154A/E-1200-2160	1200V/2160A/54kW	27U
IT8160A/E-1200-2400	1200V/2400A/60kW	37U
IT8166A/E-1200-2640	1200V/2640A/66kW	37U
IT8172A/E-1200-2880	1200V/2880A/72kW	37U

Optional accessories

The following optional accessories from ITECH are sold separately. Users need to purchase separately.

Device Name	Model	Description
GPIB communi-cation interface	IT-E176	When the user needs to use GPIB interface to enable remote operation, this option is the right choice.
RS232+Analog	IT-E177	Interface card that includes RS-232 commu-nication interface and external analog. When the user needs to use RS-232 or external analog interface to enable remote operation, this option is the right choice.

Device Name	Model	Description
Fiber optic modules and cables	IT-E168	Used for parallel connection between the units in a cabinet, including one fiber module and two fiber cables, with lengths of 1.5 meters and 0.3 meters. The fiber optic module and cable are the necessary accessories for the parallel connection. Different numbers of fiber optic modules and cables are used in different numbers of parallels.
Fiber optic modules and cables	IT-E169	Used for parallel connection between cabinets, including one fiber module and one 2.5m fiber cable. The fiber optic module and cable are the necessary accessories for the parallel connection. Different numbers of fiber optic modules and cables are used in different numbers of parallels.

1.3 Front Panel Overview

- The schematic diagram of the front panel for the 3U 60V models in this series is shown below.

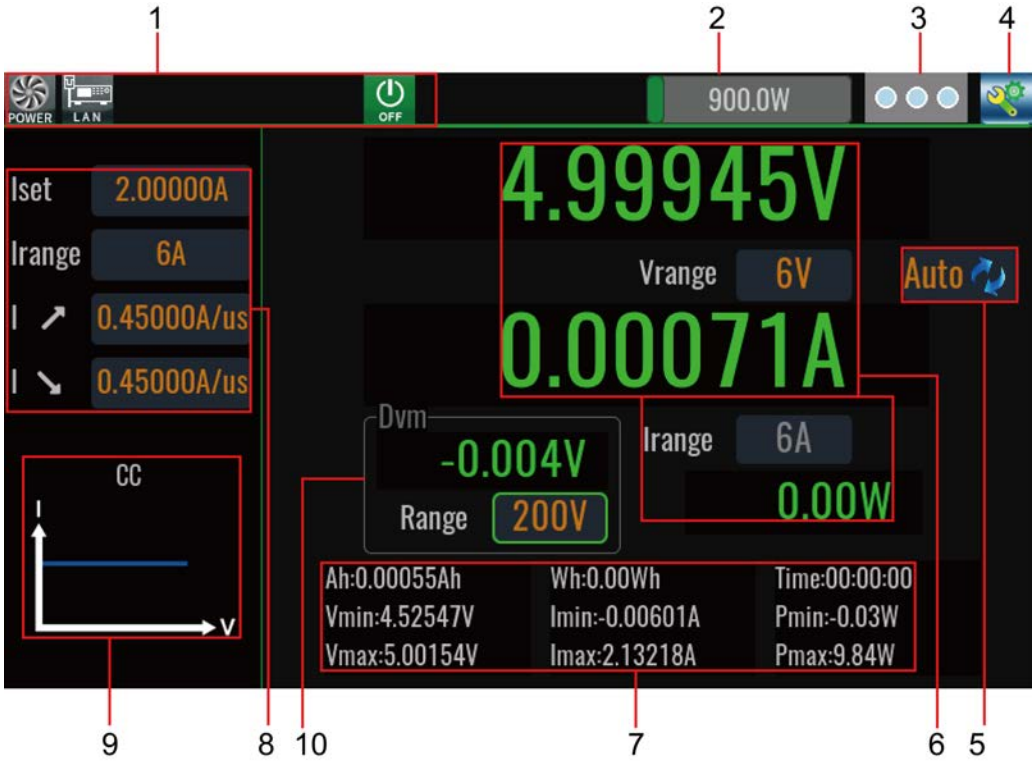
1. Power Switch
2. USB interface /Print/View/Menu
3. LCD touch screen
4. Vent hole
5. Function keys and combination keys.
6. Numeric keys and combination keys.
7. Up, down, left, and right cursor movement keys and the Enter key.
8. Knob
9. Remote sense terminals and input terminals.

- The schematic diagram of the front panel for the 3U 150V/600V/1200V models in this series is shown below.

1. Power Switch
2. USB interface /Print/View/Menu
3. LCD touch screen
4. Vent hole
5. Function keys and combination keys.
6. Numeric keys and combination keys.
7. Up, down, left, and right cursor movement keys and the Enter key.
8. Knob

1.3.1 Display Screen

This series of electronic loads features a touch-control display screen, allowing users to press or swipe directly on the screen for selection and switching. The detailed introduction of the Meter interface is as follows.



No.	Name	Description
1	Status display area	Displays information about the current input status of the instrument.
2	Config	Navigates to the Config interface.
3	Head button	After clicking the Head button, a function window will pop up below the button, containing the "Trig", "Prot Clear", "On/Off", and "Menu" buttons.
4	Power display icon	Displays the maximum available power value currently.
5	Measurement trigger mode (Auto/Manual)	• Continue & Measure (Auto): Automatically and continuously refreshes the Meter value. • Manual Trigger Mode (Manual): Manual triggering is required, and the trigger signal of the Trig button must be received before refreshing the Meter value.
6	Main measurement value display area	Real-time display of measured values for voltage, current, and power, as well as voltage and current range information.
7	Measured value display area	The measured values are displayed in real time.
8	Setting value editing area	The setting parameters of the current operation mode.
9	Operation mode	Displays the current operation mode of the instrument.
10	DVM display area	Displays the voltage reading and range.

Introduction to Interface Status Icon

The interface of this series of loads will display the following status icons. All the status icons and their descriptions are listed in the table below.

Icon	Description	Icon	Description
	The load is off.		Maximum available power.
	Config configuration menu.		Load voltage measurement is in remote sense input mode.
	The load is under constant current mode.		The load is under constant power mode.
	The load is under constant voltage mode.		The load is under constant resistance mode.
	CC Pulse function is enabled.		The load is under remote operation mode.
	Battery function is running.		Recorder function is turned on.
	Transient function is waiting for trigger.		Sweep function is waiting for trigger.
	Transient is running.		Sweep is running.
	Transient run completed.		Sweep run completed.
	OCP/OPP/Pulse is waiting for trigger.		OCP/OPP/Pulse is running.
	ARB function is waiting for trigger. ARB waveform types include List, CDARB, and Sequence.		ARB is running. ARB waveform types include List, CDARB, and Sequence.
	The instrument recognizes that the USB flash drive is inserted.		ARB run completed.
	Inlet overheat alarm (>51 ° C)		Short function is enabled.
	Input is disabled. (Inhibit Latching)		Fiber-optic communication fault.
	Over current protection.		Over voltage protection.

Icon	Description	Icon	Description
	Over power protection.		Under voltage protection.
	Current oscillation protection.		Input voltage exceeds 105% of the rated value.
	Over temperature protection. (Transistor)		Over temperature protection. (Module)
	Sense fault protection is active.		Instruction watchdog exception warning.
	Parallel fault indication.		Multi-master fault indication.
	Input is disabled. (Inhibit Live)		Power limitation warning.
	Low voltage, not loaded.		Analog function is enabled.
	Ethernet connection normal.		Device calibration modes.
	Enters Fan Boost Mode when power exceeds the rated limit.		Communication command error.
	Key operation is locked.	-	-

1.3.2 Keyboard Introduction

The keyboard introduction of this series loads is shown as follows.

Table 1–5 Keys Description

Keys	Description
Power Switch	Turn on or off the power switch of the instrument.
[Print]	Used for saving screen images.
[View]	Interface display switch key. ☐ • In Normal working mode, use this key to switch between the Meter interface, Scope interface, and Recorder interface. • In non-Normal working mode, use this key to switch between the function interface, Scope interface, and Recorder interface.
[Menu]	Menu function key.
[Set]	Parameter setting key.
[Config]	Enter the Config menu. Used to set the configuration parameters.
[Transient]	Enter transient test interface.
[Trig]	Manually trigger function key.
[Sweep]	Enter sweep test interface.
[Func]	Enter function test interface.
[On/Off]	Load input on/off key.
[Shift]	Used in combination with other keys to access the functions labeled above the keys.
[Esc]	Press this key to cancel the present entry or exit the present menu. When the instrument enters a protection state, press the **[Esc]** key to clear it.
[0]-[9]	Number key. Enter the number directly.
+/–	Positive and negative signs.
.	Decimal point.
[Enter]	Operation confirmation key.
	The up and down navigation keys are used to scroll page up and down to view menu items.

Keys	Description
	The left and right navigation keys are used to adjust the cursor to the specified position or scrolls pages to view menu items.
Knob	• Turn the knob to adjust the voltage or current value, or turn the page to display the menu item. Turn clockwise to increase the set value and counterclockwise to decrease the set value; after entering the menu interface, turn the knob to turn the page to display the menu items. • Press the knob. Equivalent to the **[Enter]** key.

Composite key **[Shift]**, combined with other keys to realize functions marked above keys. Firstly, press **[Shift]** and the shift key will be lighted, and then press the function key, the detailed functions are listed as follows.

Table 1–6 Composite keys Description

Keys	Description
[Shift]+[Set](System)	Enter the system menu. Used to set the system parameters.
[Shift]+[Config] (Protect)	Enter the protection menu. Used to set the protection parameters.
[Shift]+[Transient] (Short)	Short circuit function key.
[Shift]+[Sweep](List)	Enter the list test interface.
[Shift]+[Func](Func-Set)	Enter the function selection interface. In this interface, the user can click to select the function corresponding to the Func key, including Discharge, CD Arb, OCP OPP or Sequence.
[Shift]+[1](log)	Enter the Log query interface.
[Shift]+[2](lock)	Turn the keyboard lock on or off.
[Shift]+[3](local)	Switch remote control mode to local control mode.
[Shift]+[4](Save)	Enter the save interface.

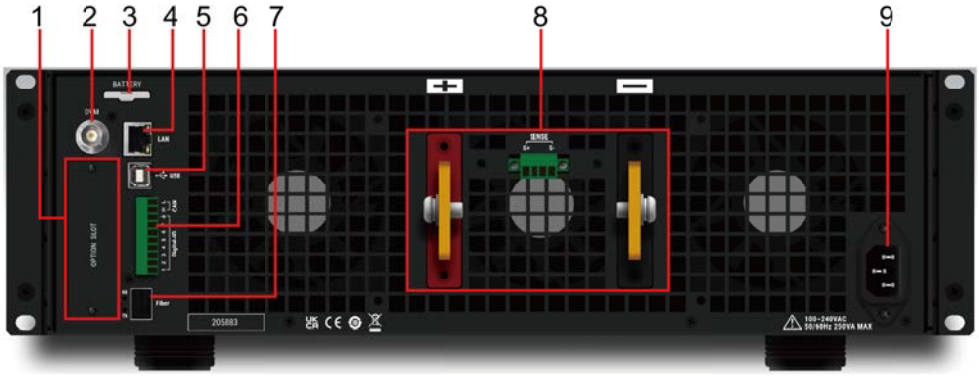
Keys	Description
[Shift]+[5](Recall)	Enter the recall interface.
[Shift]+[6](Hold)	When you need to keep the present meter status, you can press the keys. Then the present meter status display and will be kept no matter whether input is running.

1.4 Rear Panel Overview

- The schematic diagram of the rear panel for the 3U 60V models in this series is shown below.

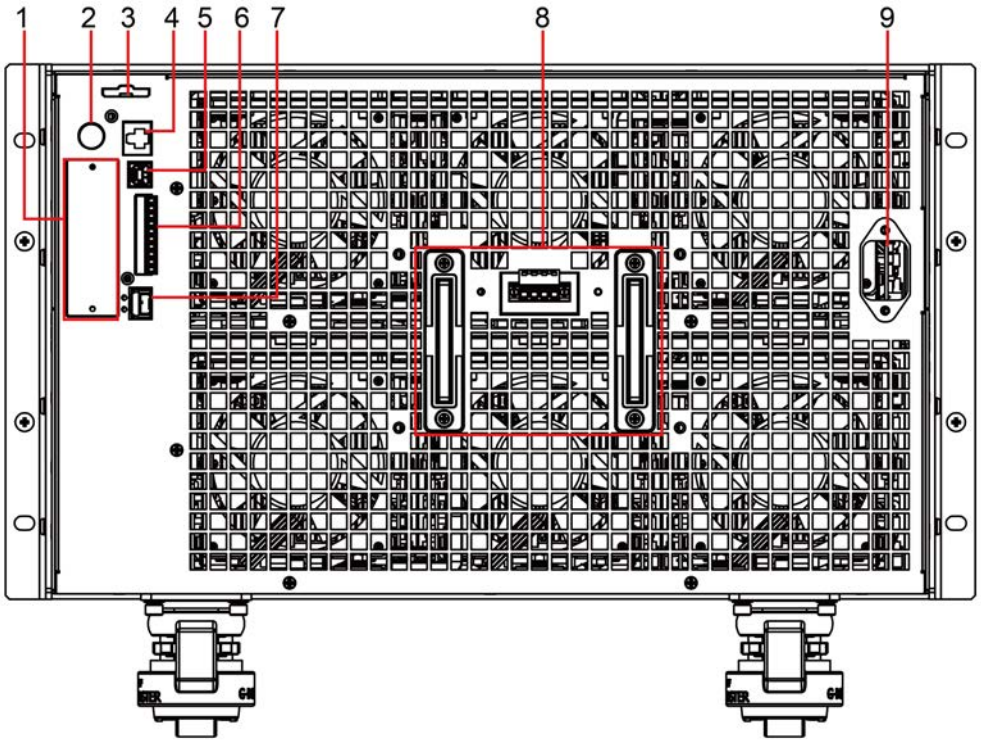
1. Optional interface expansion slot. If no interface is selected, a plastic plug is inserted by default. Available interfaces include: GPIB, RS232.
2. DVM input terminal. (Only for IT8100A series)
3. Battery: The RTC battery supports user-removable replacement.
4. LAN communication interface.
5. USB communication interface.
6. Digital I/O interface and CAN communication interface.
7. Fiber optic socket interface, used for communication between instruments in parallel operation.
8. AC power input socket.

- The schematic diagram of the rear panel for the 3U 150V/600V/1200V models in this series is shown below.



1. Optional interface expansion slot. If no interface is selected, a plastic plug is inserted by default. Available interfaces include: GPIB, RS232.
2. DVM input terminal. (Only for IT8100A series)
3. Battery: The RTC battery supports user-removable replacement.
4. LAN communication interface.
5. USB communication interface.
6. Digital I/O interface and CAN communication interface.
7. Fiber optic socket interface, used for communication between instruments in parallel operation.
8. Remote sense terminals and input terminals.
9. AC power input socket.

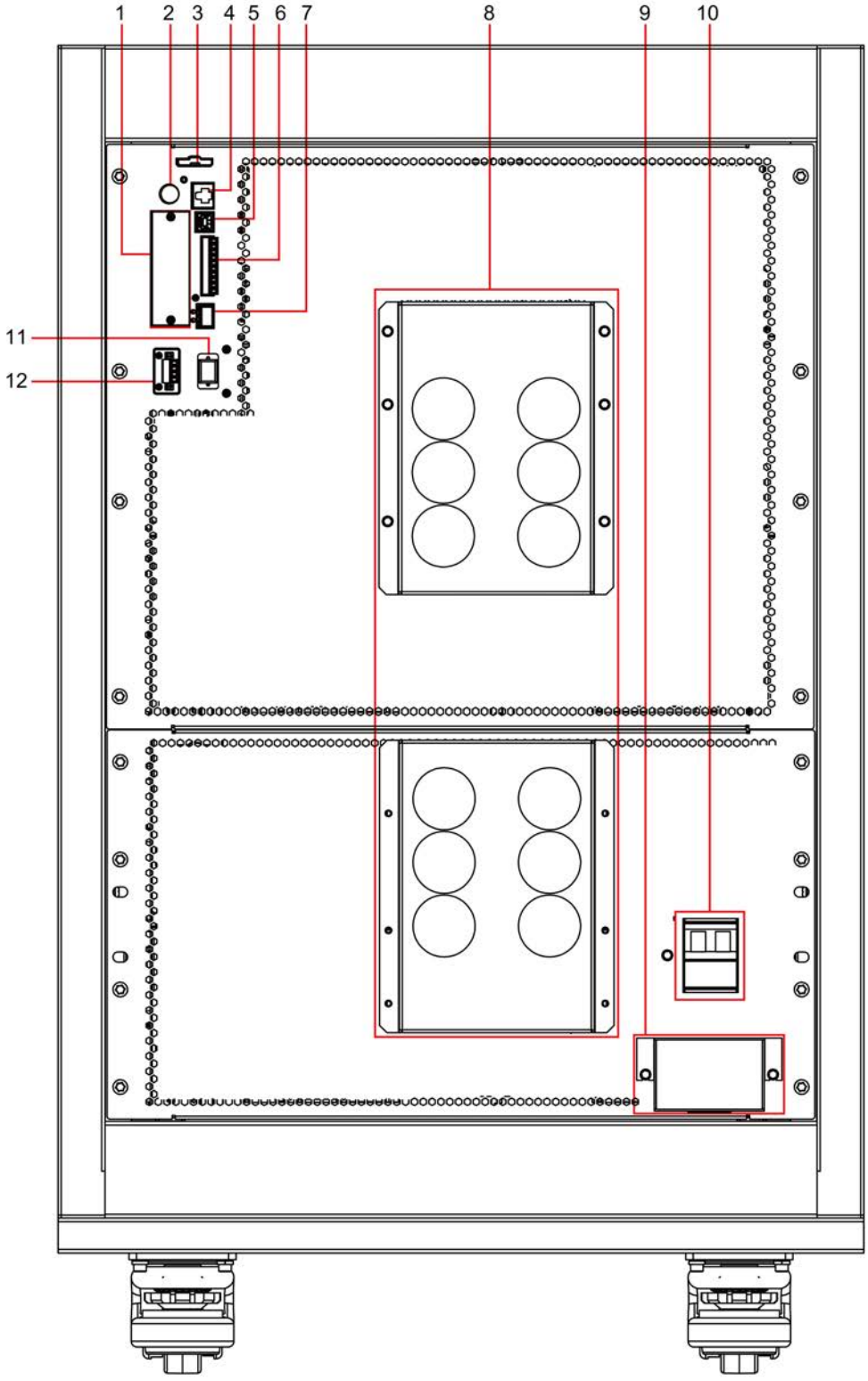
- Schematic Diagram of Rear Panel of this series (6U) electronic load.



1. Optional interface expansion slot. If no interface is selected, a plastic plug is inserted by default. Available interfaces include: GPIB, RS232.
2. DVM input terminal. (Only for IT8100A series)

3. Battery: The RTC battery supports user-removable replacement.
4. LAN communication interface.
5. USB communication interface.
6. Digital I/O interface and CAN communication interface.
7. Fiber optic socket interface, used for communication between instruments in parallel operation.
8. Remote sense terminals and input terminals.
9. AC power input socket.

- The rear panel diagram of this series of loads (15U) is shown below. The 27U and 37U models are similar, with the only difference being the overall dimensions.



1. Optional interface expansion slot. If no interface is selected, a plastic plug is inserted by default. Available interfaces include: GPIB, RS232.
2. DVM input terminal. (Only for IT8100A series)
3. Battery: The RTC battery supports user-removable replacement.
4. LAN communication interface.
5. USB communication interface.

6. Digital I/O interface and CAN communication interface.
7. Fiber optic socket interface, used for communication between instruments in parallel operation.
8. Remote sense terminals and input terminals.

   The 15U model is equipped with two sets of DC terminals (positive and negative input terminals), the 27U model is equipped with three sets, and the 37U model is equipped with four sets. When connecting the device under test (DUT), all terminals must be connected correspondingly to the DC terminals of the DUT.
9. AC power input terminal.
10. AC power switch.
11. External control interface P_CTRL.
12. Inner ring fiber optic communication interface.

    For 15U / 27U/ 37U models, the F-TX and F-RX ports of the inner ring fiber optic communication interface are factory-connected with a fiber-optic cable. Except in primary-extension parallel mode, please ensure that this fiber connection remains in place for all other modes; otherwise, the instrument will fail to start properly.

1.5 Powering On the Instrument

Before operation, please confirm that you have fully understood the safety instructions.

Precautions

To prevent electric shock and damage to the instrument, please observe the following precautions.

WARNING

- **Before connecting power cord, be sure to confirm that the power voltage matches with the supply voltage.**
- **Before connecting power cord, be sure to switch off the instrument. Verify that there is no dangerous voltage on the terminals before touching them.**
- **To avoid fire or electric shock, make sure to use the power cord supplied by ITECH.**
- **Be sure to connect the main power socket to the power outlet with protective grounding. Do not use terminal board without protective grounding.**
- **Do not use an extended power cord without protective grounding, otherwise the protection function will fail.**
- **If you notice strange sounds, unusual odors, fire, or smoke around or from inside the instrument, flip the POWER switch to the (O) side to turn the instrument off, or remove the power cord plug from the outlet. The detachable power cord may be used as an emergency disconnecting device. Removing the power cord will disconnect AC input power to the unit.**

Power Switch Introduction

User can adjust the power switch directly to turn on or turn off the instrument.

The status of Power switch is as follows.

On Off On Off

If the instrument is the cabinet type, the rear panel of the cabinet provides a master power switch. The relationships between the device status and switch status are listed in the following table.

Master switch status	Desperate switch status	Device status
On	On	On
On	Off	Off
Off	On	Off
Off	Off	Off

Turning the POWER Switch On

Check that the power cord is connected properly.

Flip the POWER switch to the (|) position to turn on the instrument. The front panel display will illuminate within a few seconds. Once powered on, the instrument will automatically perform a self-test to ensure proper operation.

If a self-test error occurs, an error message will be displayed in the front panel. Press the [Esc] button to try to clear the current fault status. The user can also restart the instrument to try to clear the fault status. Wait until the power is turned off and then start again. If the problem still cannot be solved after restarting, please contact the ITECH engineer.

Turning the POWER Switch Off

Flip the POWER switch to the (O) position to turn the instrument off. When it is turned off, the instrument interface will prompt “Please wait for the device power down.”, and the instrument will store the setting information before shutdown in the group 1 nonvolatile memory.

After you turn the POWER switch off, wait at least 10 seconds after the fan stops before you turn the POWER switch back on. Turning the instrument on too soon after you turn it off can cause damage to the inrush current limiter circuit, as well as reduce the life of components such as the POWER switch and the internal input fuses.

2 Inspection and Installation

2.1 Unpacking and Transportation

Unpacking

For cabinet products, they are packaged in wooden boxes at the factory. After you receive them, please refer to the unpacking instructions provided with the box for disassembly; for products packaged in cartons, please use appropriate tools for unpacking.

Recommended: Retain the original packaging materials for future transport or return shipment to the manufacturer for service.

Transportation

If you need to transport non-cabinet products, you must pay attention to the following to ensure the safety of equipment and personnel.

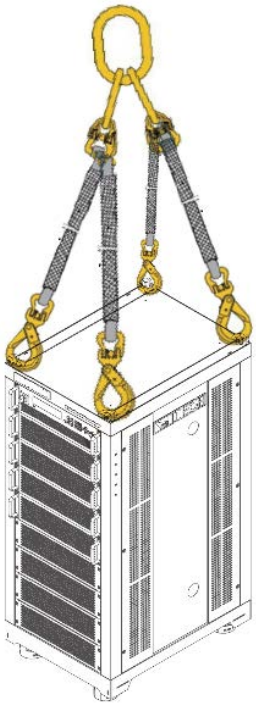
CAUTION

- **Before moving, make sure that the cabinet or stand where the equipment will be placed has been fixed and meets the load-bearing conditions to avoid tilting and collapsing, causing personnel to be injured, and equipment broken.**
- **Due to the weight of the product, transport by hand should be avoided where possible. If unavoidable, carry it with two people and holding the product shell and not external parts (such as handles, electrodes, knobs, etc.).**
- **When carrying, be prepared to bear the weight to avoid sprains or being crushed by heavy objects.**
- **Use suitable safety clothing, especially safety shoes, when carrying the equipment, as due to its weight a fall can have serious consequences.**

After unpacking the cabinet product, if you need to move it to other places, you must pay attention to the following matters to ensure the safety of equipment and personnel.

CAUTION

- **The cabinet product is very heavy. Before moving to another location, confirm whether the ground load is in compliance.**
- **During the process of moving the cabinet, it is recommended that two or more people cooperate and push it slowly and at a constant speed. If you encounter a pit, you need to pay special attention. It is forbidden to push it quickly, otherwise it will easily cause excessive inertia and cause the casters at the bottom of the cabinet to jam and the cabinet to fall.**
- **It is not advisable to push down the slope to prevent the cabinet from falling down due to the shift of the center of gravity. It is recommended to use a forklift or crane to move the cabinet.**
- **ITECH 27U and 37U cabinets are equipped with hoisting rings as standard on the top. It is recommended to use a crane equipped with a four-leg hoisting belt structure for horizontal hoisting and moving, and ensure that the four hoisting belts are the same length to avoid cabinet skew during movement. As shown below.**
- **After moving to the destination, please lock the four casters to secure the cabinet.**
- **The cabinet should be placed on a level ground. It is forbidden to place the cabinet on a sloped ground.**



2.2 Verifying the Shipment

Open the package and verify the contents before use. If any items are missing, damaged, or show signs of shipping damage, contact your distributor or ITECH immediately.

Table 2–1 Package box contents (to a machine as a reference standard)

Device name	Quantity	Model	Remarks
Electronic load	1	IT8100 series	Please refer to 1.2 Model and Options for complete models of this series electronic loads.
Power cord	1	-	Depending on the instrument model. For details, see 2.5 Connecting the Power Cord.
Calibration Report	1	-	Test report before delivery.
USB communication cable	1	-	This accessory is selected when the USB interface is used for starting up remote operation.
LAN communication cable	1	-	This accessory is selected when the LAN interface is used for starting up remote operation.

Note

After confirming that package contents are consistent and correct, please appropriately keep package box and related contents. The package requirements should be met when the instrument is returned to factory for repair.

2.3 Installing the Instrument

2.3.1 Installation Requirements

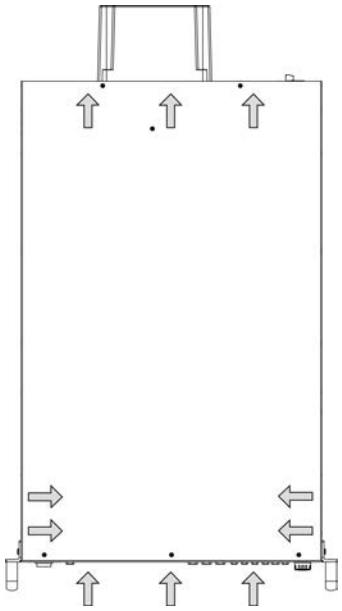
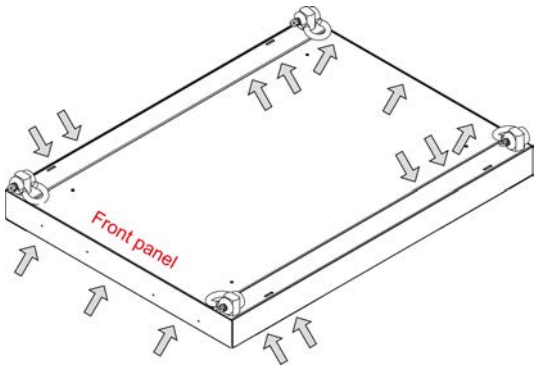
To ensure stable operation of the instrument and meet the needs of heat dissipation and maintenance, sufficient space must be reserved during installation. The specific requirements are as follows.

Space Layout Requirements

- **Front Clearance:** The front of the instrument must remain unobstructed. A minimum clearance of 850 mm should be maintained between the front panel and any wall or large surface to allow for operator access and adequate airflow.
- **Side Clearance:** Both sides of the instrument should remain free of obstructions. A minimum clearance of 850 mm must be maintained between each side panel and any wall or large surface to ensure normal air circulation.
- **Rear Clearance:** The rear of the instrument must also be kept unobstructed. A minimum clearance of 1 m should be maintained between the rear panel and any wall to ensure smooth airflow.

Airflow Requirements

The instrument adopts a front-to-rear airflow design. The airflow direction diagram is shown below.

3U, 6U models	15U, 27U, 37U models
	 Arrow ⇨ indicates the direction of airflow.

During installation, ensure that this airflow path remains unobstructed and that adequate space is reserved around the ventilation openings to maintain correct airflow and ensure stable operation.

- If the instrument is installed in a relatively enclosed space, a dedicated ventilation duct should be provided to prevent heat accumulation that may affect operational stability.
- Ensure that the air entering the intake area is clean and well-circulated. If heat dissipation is insufficient, auxiliary fans may be added to enhance cooling performance.

- It is recommended to install exhaust fans at the air outlet, and use them together with air conditioning or other cooling equipment to form effective airflow between the intake and exhaust sides. This helps improve cooling efficiency and meet the heat dissipation requirements under high-power load conditions.

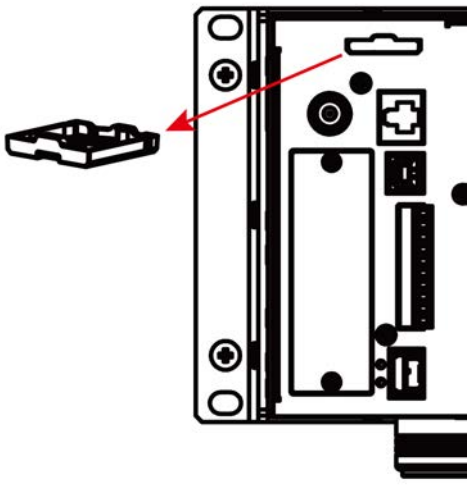
2.3.2 Installing the Battery

The IT8100 Series instruments are equipped with a system time setting and display function. To enable this function, the instrument must be powered by an external battery. Since no battery is included with the instrument at shipment, please purchase and install a compatible battery if you wish to use the time function. Recommended battery specifications are as follows.

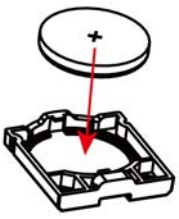
- Nominal voltage: 3 V.
- Open-circuit voltage range: 3.05 V – 3.45 V.
- Dimensions: diameter 19.7 – 20.0 mm, thickness 3.0 – 3.2 mm.
- Recommended model: CR2032.

Installation steps:

1. **Press to eject**: Lightly press the battery compartment to pop it out and remove it.



2. **Install battery**: Insert the battery correctly into the compartment.



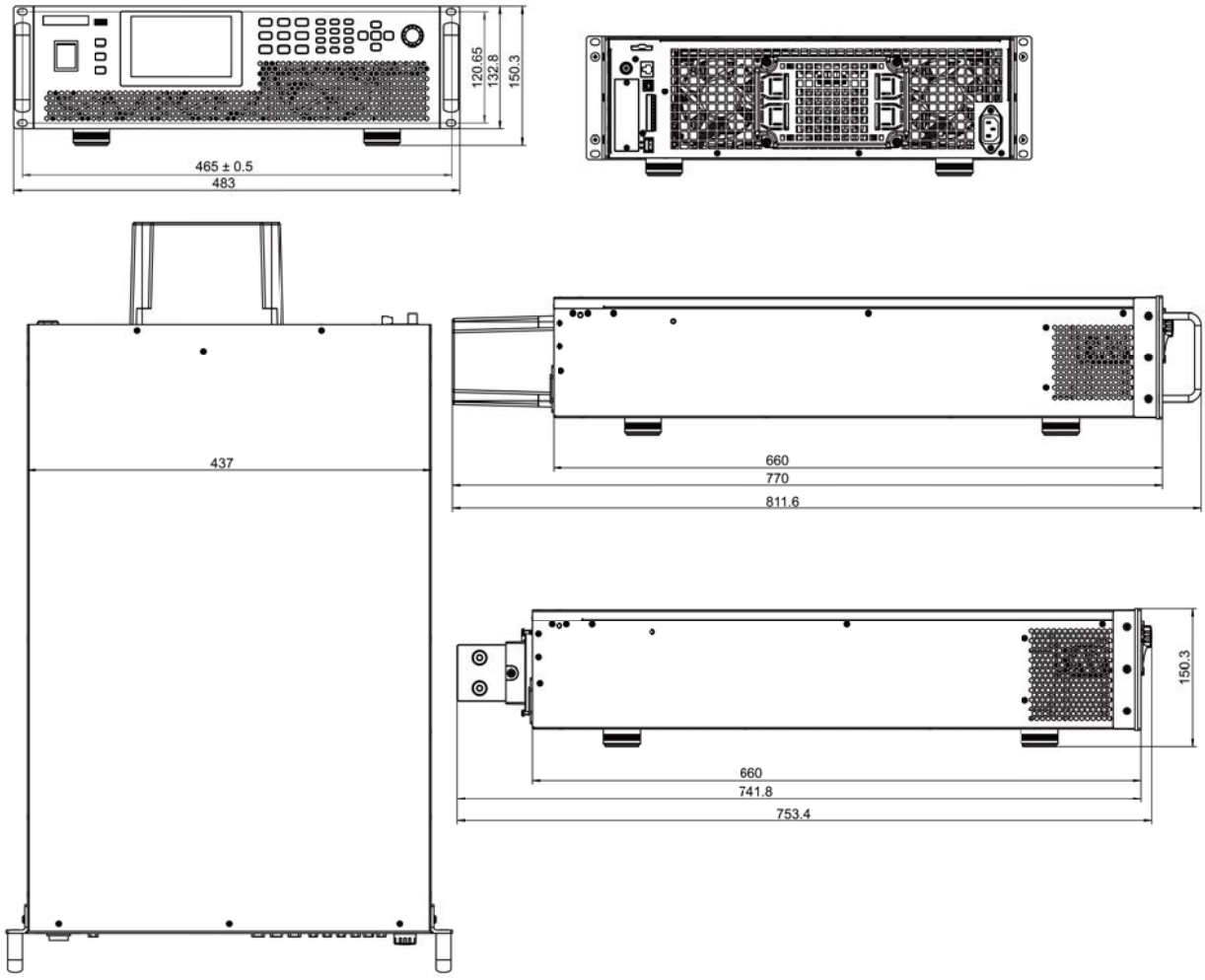
3. **Push back to lock**: Replace the battery compartment onto the instrument's rear panel and push firmly to secure it.

2.4 Instrument Size Introduction

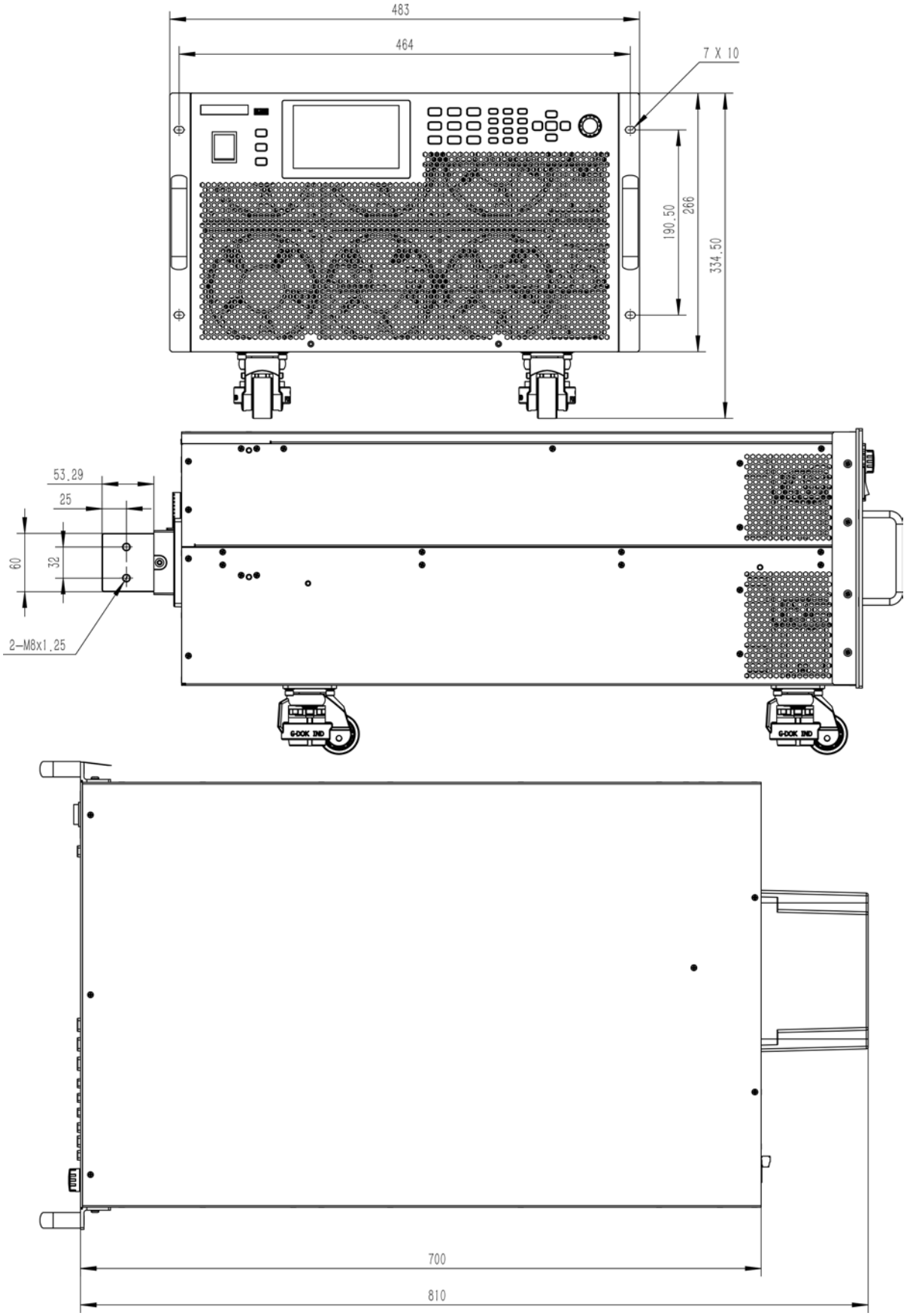
The instrument should be installed at well-ventilated and rational-sized space. Please select appropriate space for installation based on the electronic load size.

The detailed dimension drawings of the IT8100 series are as follows (unit:mm).

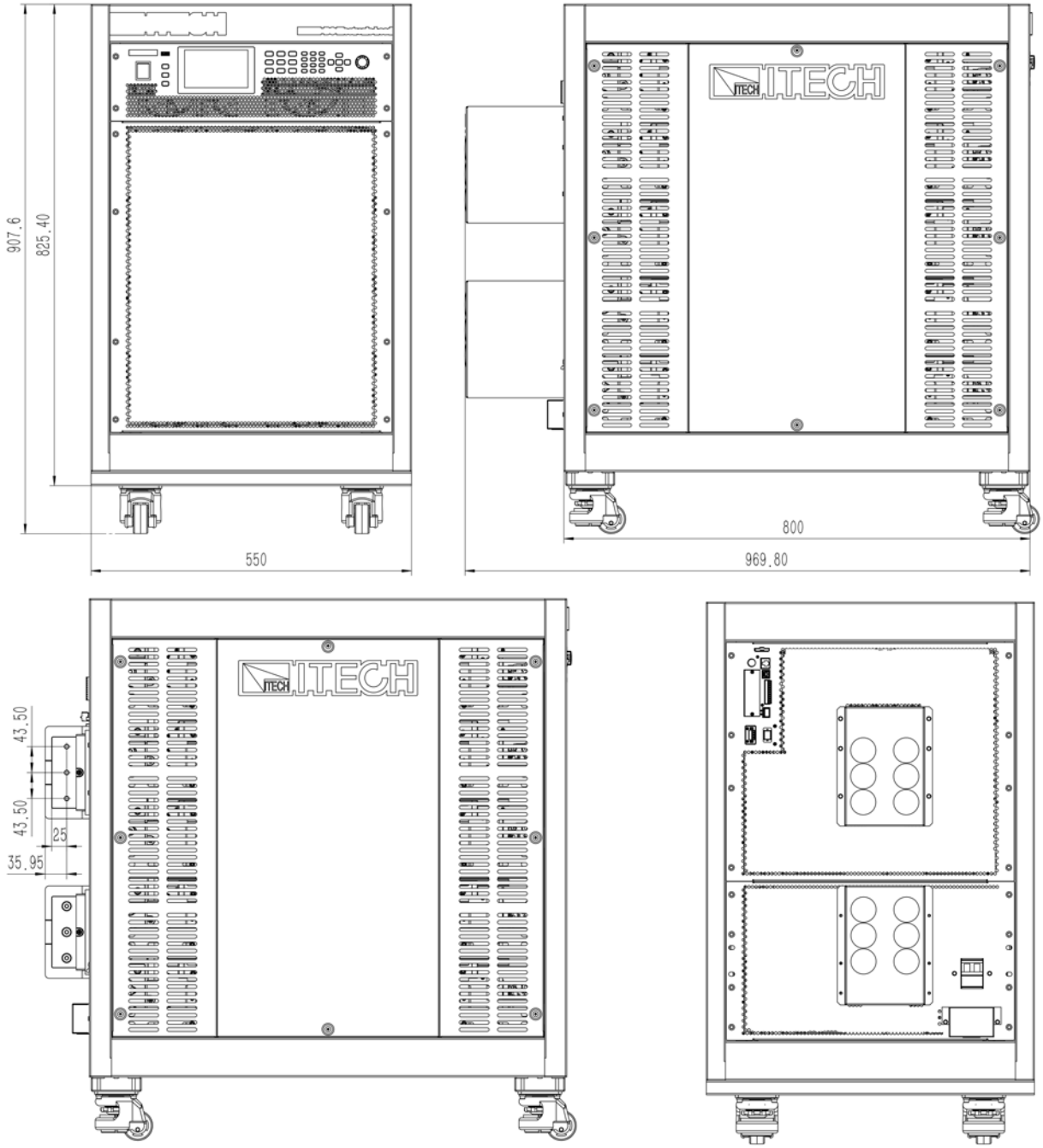
3U Model



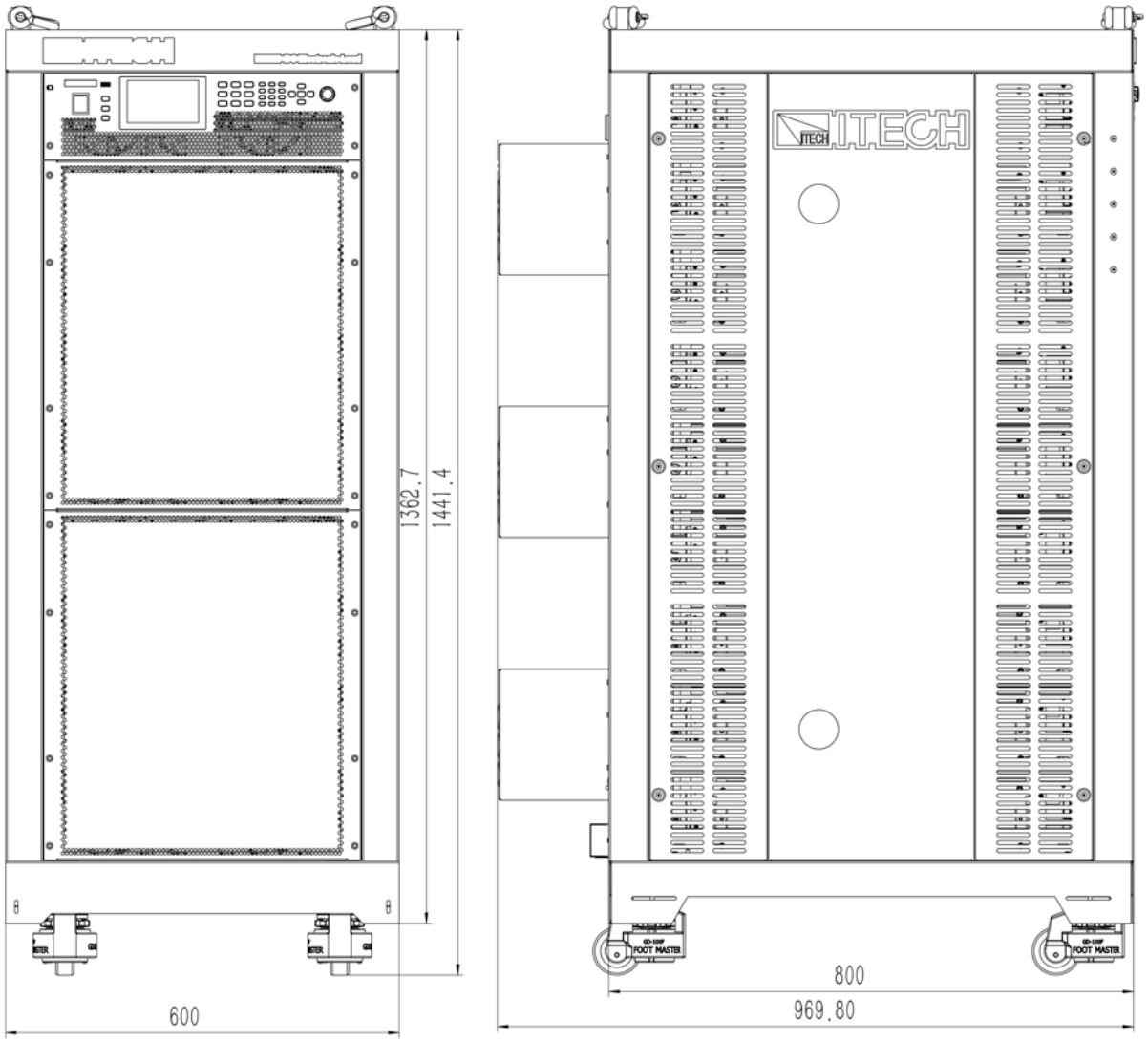
6U Model



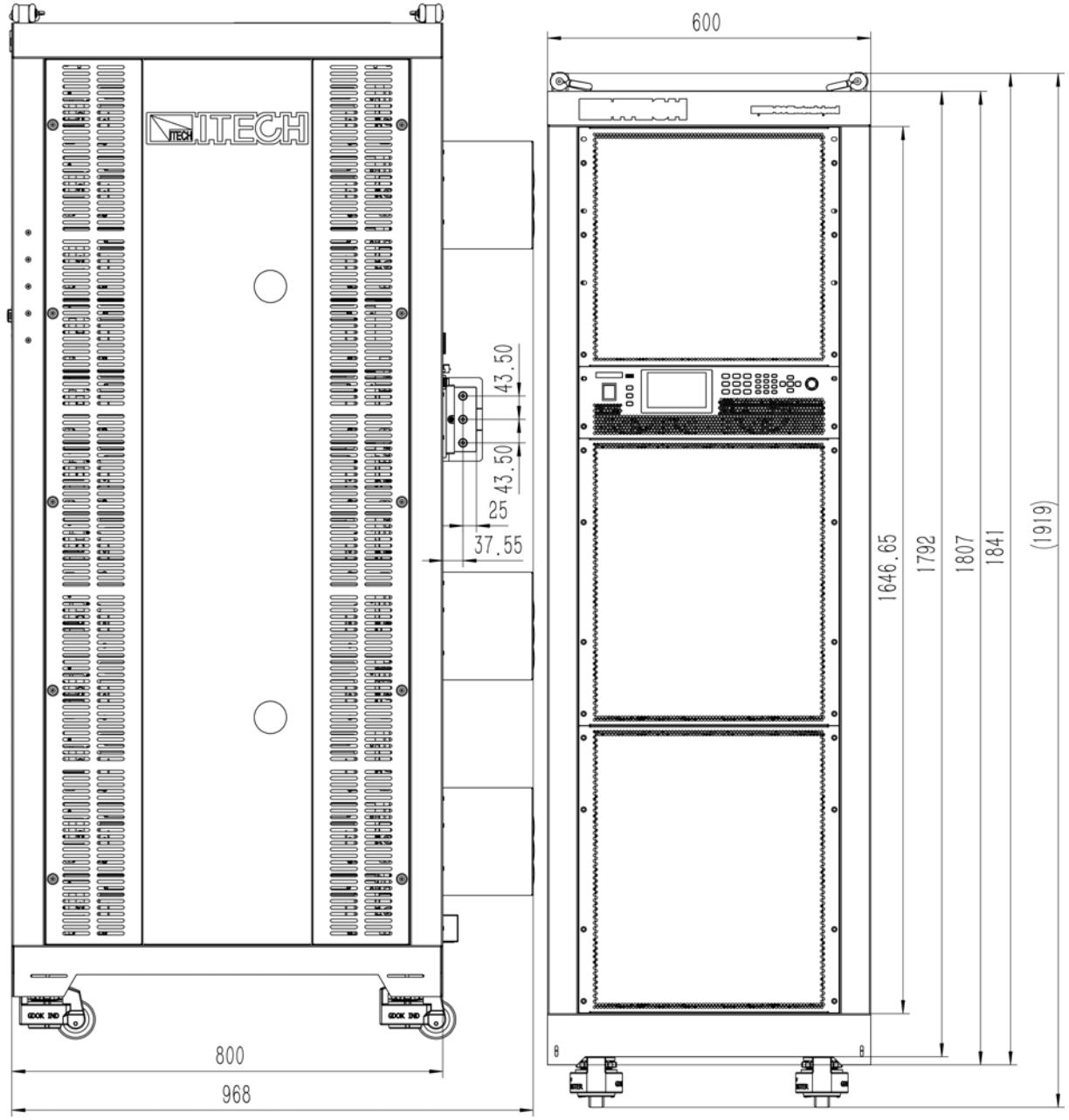
15U Model



27U Model



37U Model



2.5 Connecting the Power Cord

Before Connection

To prevent electric shock or damage to the instrument, observe the following precautions.

WARNING

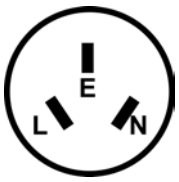
- **To avoid burning out, be sure to confirm that the power voltage matches with the supply voltage.**
- **If the working voltage of the instrument supports 110V or 220V, before connecting the power cord, please confirm the 110V / 220V transfer switch to ensure that the switch of the load matches the supply voltage. Otherwise, the instrument may be damaged.**
- **Please ensure the power switch of the instrument is turned Off.**
- **To avoid burning out and electric shock, please only use the power cord supplied as a standard accessory.**
- **Be sure to connect the main power socket to the power outlet with protective grounding. Do not use terminal board without protective grounding.**
- **To prevent electric shock, the instrument must be connected to a protective earth (PE). Please connect the power cable to the socket with the protective earth terminal.**
- **Do not use an extended power cord without protective grounding, otherwise the protection function will fail.**
- **The instrument must be connected to an AC outlet compatible with the supplied power cord and equipped with a protective earth (PE) connection. If you can not use a suitable AC power cord, do not use the instrument.**

AC power input level

Working voltage for this series electronic load is 100V~240V, AC power input level: 100V~240V 50Hz/60Hz.

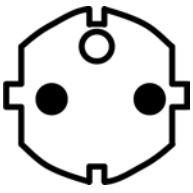
Power Cord Type and Connecting Method

- 3U and 6U models provides the standard power cords as below. Please select appropriate power cords appropriate to local voltage based on the specifications of power cords below. If purchased model fails to meet local voltage requirements, please contact distributor or factory for change.



China
IT-E171

United States &
Canada & Japan
IT-E172

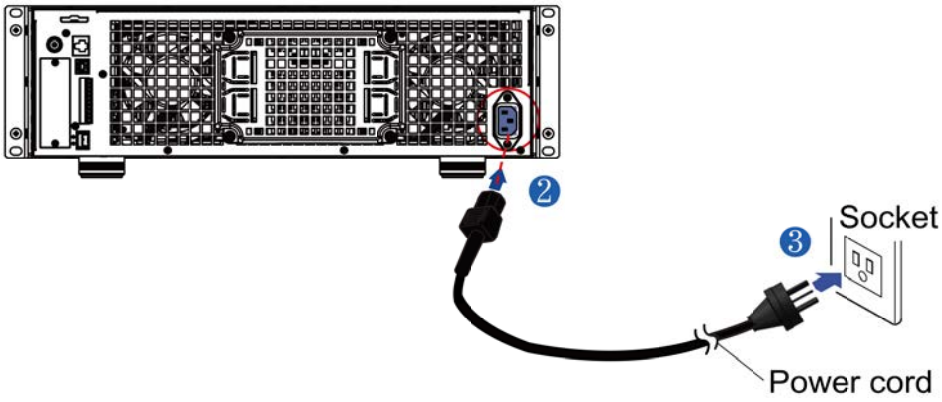


Europe
IT-E173

England
IT-E174

Connecting Method:

1. Please ensure the power switch of the instrument is turned Off.
2. Connect one end of the power cord to the AC input connector on the rear panel of the instrument.
3. Connect the other end of the power cord to the socket configured with protective earth.

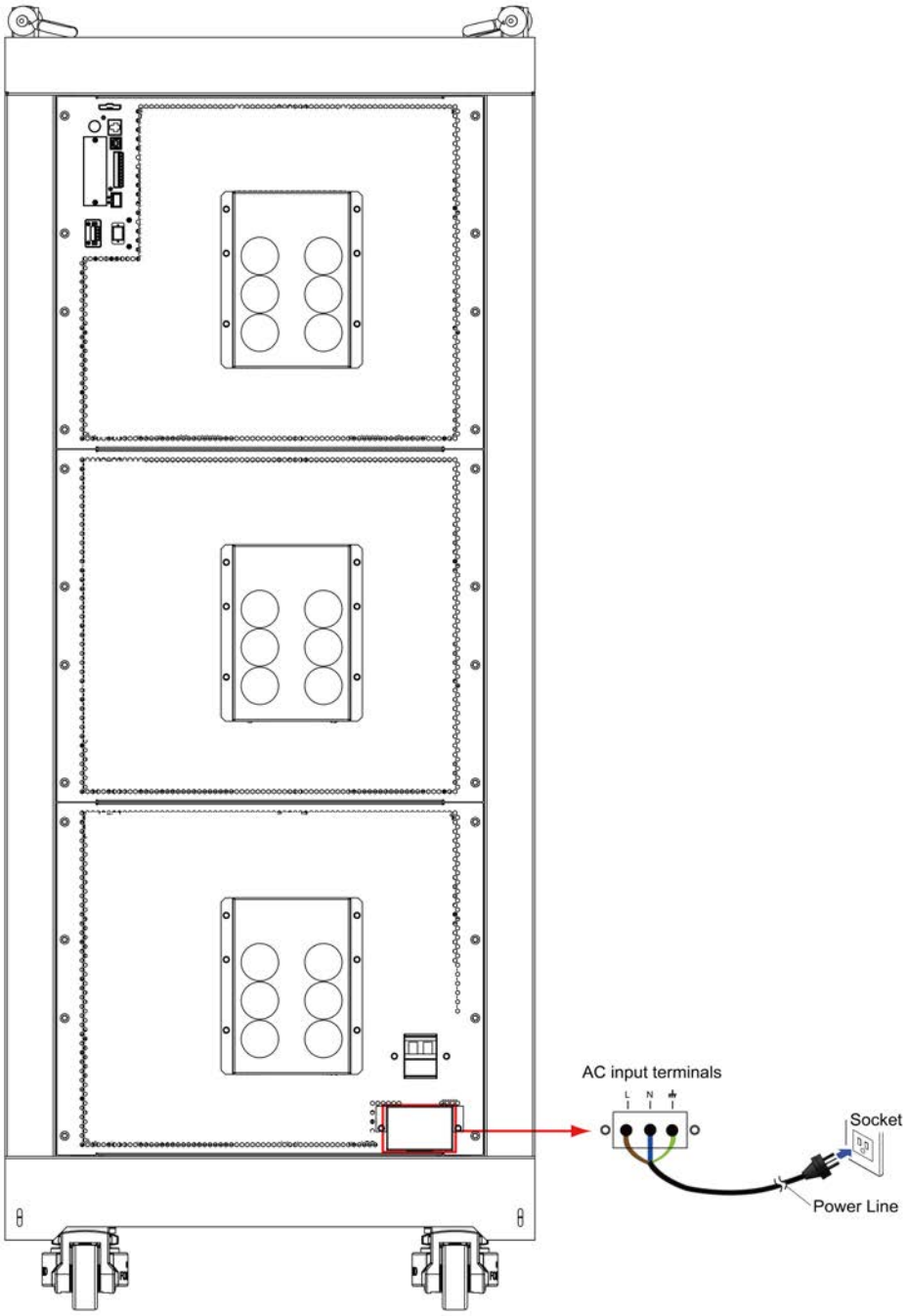


- Other models (15U, 27U and 37U instruments) provides the standard power cords as below.

Connecting Method:

1. Please ensure the power switch of the instrument is turned Off.
2. Remove the protective cover outside the AC input terminal on the rear panel.
3. See the below illustration, connect one end of the AC power cord to the AC input terminal in the rear board of the instrument.

   Connect the conductors to the corresponding terminals of the instrument: line (L), neutral (N), and protective earth (PE). Connect the brown wire to line (L), the blue wire to neutral (N), and the yellow-green wire to protective earth (PE).
4. Mount the protective cover back to its original position.
5. Connect the plug on the other end of the power cord to a grounded AC outlet.



2.6 Connecting the DUT

Before connecting the DUT

To prevent instrument damage and electric shock, observe the following safety precautions.

WARNING

- **Before connecting the DUT, be sure to switch off the power supply of the test loop in order to avoid electric shock.**
- **To avoid electric shock, before testing, please make sure the rating values of the testing lines, and do not measure the current that is higher than the rating value.**
- **Always use test lines provided by ITECH to connect the equipment. If test lines from other factories are used, please check that the test line can withstand maximum current.**
- **When using switch-type devices to directly connect the battery and electronic load, there will be a voltage surge at the moment the switch device is closed. The excessively high voltage surge will damage the electronic load. To avoid loading the load with a high voltage surge, it is recommended to connect a current-limiting resistor in series in the circuit. The method for connecting a series current-limiting resistor is detailed in reference Precautions for connecting batteries.**

Specification

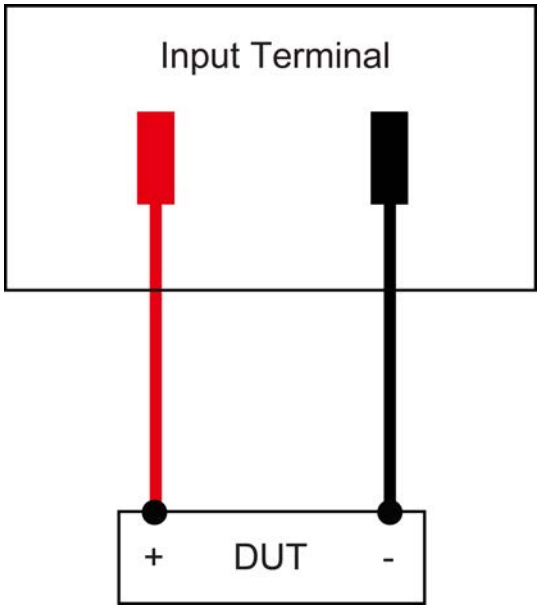
The test lines are not standard accessories for the load in this series. Please select optional red and black low inductance test lines for individual sales based on the maximum current value. For specifications of low inductance test lines and maximum current values, refer to A.1 Specifications of Red and Black Test Lines.

Connecting the DUT (Local sense)

The steps of local sense are as follows:

1. Before connecting the test lines, be sure that the instrument Power is in Off position.
2. Remove the load input terminal cover.
3. Loosen the screws of the input terminals and connect the red and black test lines to the input terminals. Re-tighten the screws.

   When maximum current that one test line can withstand fails to meet the current rated current, use several pieces of red and black test lines. For example, the maximum current is 1,200A, then 4 pieces of 360A red and black lines are required.
4. Install the load input terminal cover.
5. Directly connect the other end of the red and black lines to the DUT terminals.



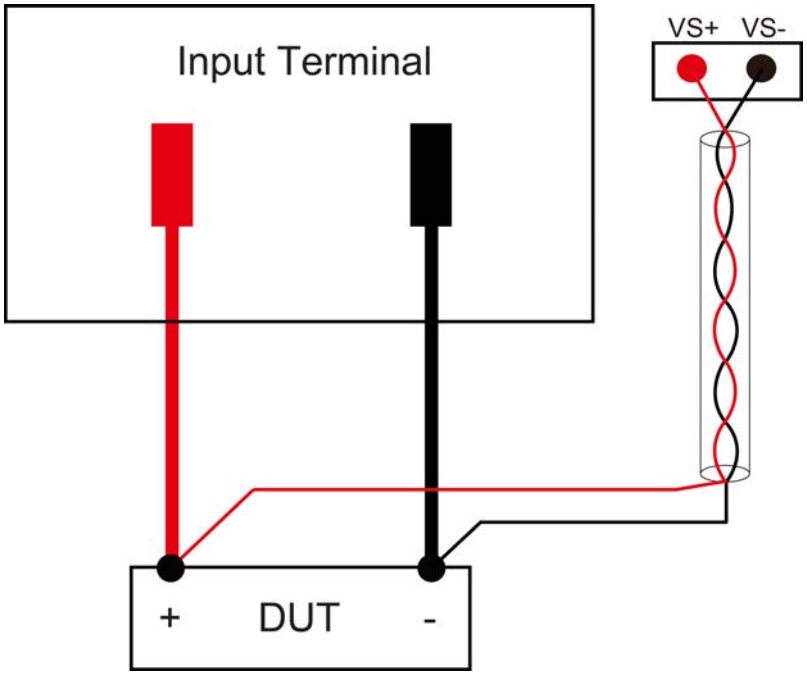
Connecting the DUT (Remote sense)

Under CC, CV, CR or CP mode, if the load consumes large current, a large voltage drop will be detected in connection line between tested instrument and load terminal. To ensure measurement accuracy, a remote sense measurement terminal is provided at load rear board to compensate voltage drop lost in wire.

Remote sense operation: VS+ and VS- are remote input terminals. To avoid voltage drop caused by long input wire of load, the remote sense test allows direct measurement at input terminal source so as to improve measurement accuracy.

The steps of remote sense are as follows:

1. Click **Config** in the **Menu** interface to enter the configuration menu.
2. In the configuration menu, click the **Measure** tab to access the measurement settings page.
3. Scroll up and down on the measurement settings page to find **Remote Sense**.
4. Click the setting located to the right of **Remote Sense**, then select **On** from the dropdown menu to enable the sense function.
5. Click  to exit.
6. Connect the instrument and DUT as shown in the following figure.



Note

Test lines and sense lines should be as short as possible, and sense lines should be twisted together.

2.7 Remote Interface Connection

This series of instruments comes standard with three communication interfaces: USB, LAN, and CAN, and supports two optional interfaces: GPIB and RS-232. You can choose one of them to communicate with your computer.

In the **Menu** interface, click **System** to enter the system menu. In the system menu, select **Communication** to access the communication configuration interface. In this interface, set the communication interface information between the instrument and the computer.

When controlling the instrument via a remote interface, send **SYST:REM** first to switch the instrument to remote mode. Then send SCPI commands that modify settings (for example, setting the input voltage).

2.7.1 USB Interface

The USB interface is located on the rear panel of the instrument. You can connect the instrument to the computer via a cable with a USB interface on both ends (USB A-type connector on one end and USB B-type connector on the other).

Before using the USB interface, you need to select the USB interface type in the system menu. The available options are:

- **Host**: The USB device functions as a peripheral for storage.
- **Device**: The USB device functions as a communication interface for data transfer.

When the USB interface is set to **Device**, you need to select a communication protocol type: VCP or TMC, as described below.

- TMC: USB_TMC type interface, you need to install the NI-VISA driver adapted to the computer operating system version. Please download the driver from the NI official website. After the driver is installed successfully, it will be recognized as the USB device address in the computer device manager.
- VCP: Virtual serial port. The Win7 version of the operating system needs to install the supporting driver. Please download the driver from the ITECH official website or contact the ITECH technical support personnel to obtain it. The operating system of Win10 and above does not need to install the driver. Recognized as a COM port in the computer's device manager.

2.7.2 LAN Interface

When the user connect PC through LAN interface, the following is required to use the LAN interface. The LAN interface complies with the LXI standard.

Connect Interface

Use the following steps to quickly connect your instrument to your LAN and configure it. Two typical LAN interface systems are described below: private LAN and site LAN.

- **Connect to the private LAN**

  A private LAN is a network in which LAN-enabled instruments and computers are directly connected. They are typically small, with no centrally-managed resources. When connected to a computer, a standard network cable can be used to connect directly to the computer via the LAN interface.

- **Connect to the site LAN**

  A site LAN is a local area network in which LAN-enabled instruments and computers are connected to the network through routers, hubs, and/or switches. They are typically large, centrally-managed networks with services such as DHCP and DNS servers. When connected to a computer, a network cable can be used to connect to the router, and the computer is also connected to the router.

Note

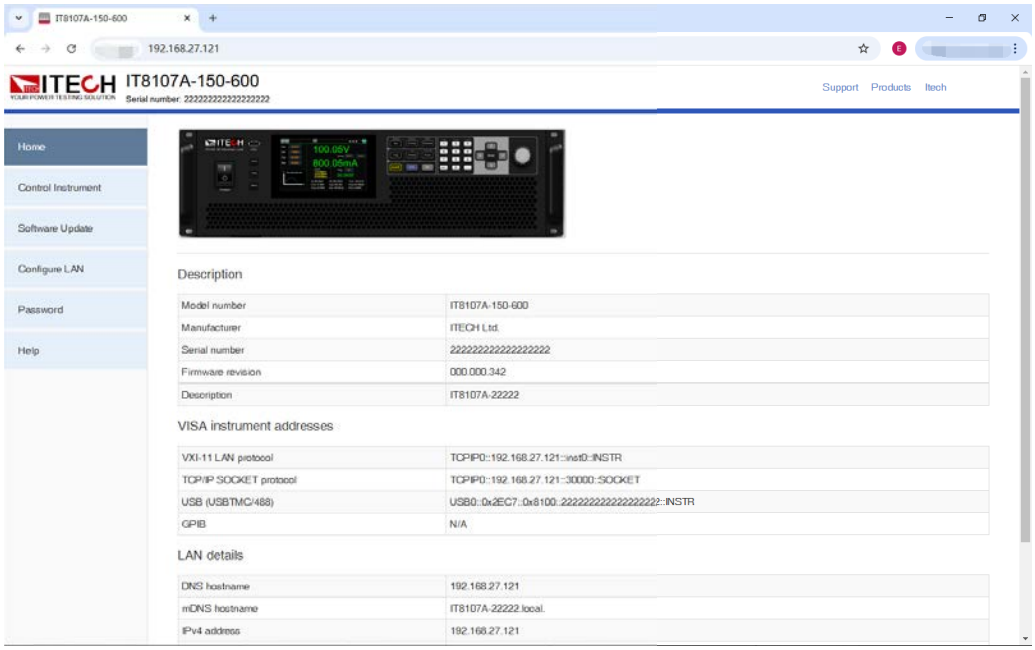
- When using one crossover cable to connect PC directly, the gateway address of the instrument should be consistent with that of the PC, and the IP address should be at the same network segment with the PC's IP address.
- When the instrument and computer are connected to the router, an independent IP address must be assigned for the instrument.

Use Web Function

The instrument provides a built-in web server, allowing you to monitor it directly from your computer's web browser. To use this web server, connect the instrument and the computer via the LAN interface. Then, enter the instrument's IP address in the address bar at the top of the computer's web browser to access front panel control, including LAN configuration parameters.

The address format to be entered in the browser's address bar is: http://192.168.200.100.

192.168.200.100 is the default IP address. If it has been changed by the user, replace this IP with the actual configuration found in the instrument's system menu.



You can select different pages by clicking the buttons shown in the navigation bar on the left side of the window. The detailed descriptions are as follows.

- Home: The main web interface that displays the instrument model, appearance image, and key information including Description, VISA instrument addresses, and LAN details.

- Control Instrument: Enables the Web control to begin controlling the instrument. This page allows you to monitor and control the instrument. The initial login password is iTech.
- Software Update: Performs a system upgrade.

  Click **Click here,** to select the system upgrade installation package (for example, `itech_8100_P.itech`), and then click **Update** performs the upgrade operation. After the upgrade is complete, the instrument needs to be restarted.
- Configure LAN: Reconfigure the LAN parameters.
- Password: Modify the login password for the Control Instrument and Software Update pages to control access to the Web interface.
- Help: Detailed instructions for using the Web features.

2.7.3 CAN Interface

The CAN interface is located on the rear panel of the instrument and is connected to the computer using a CAN communication cable.

Definition of CAN Pins

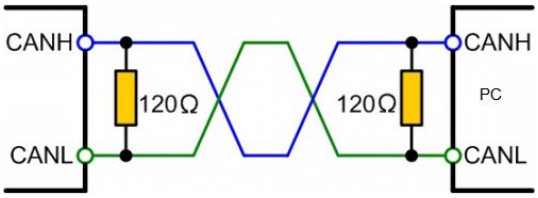
The definition of CAN pins are as follows.

Pins	Description
H	CAN_H
L	CAN_L

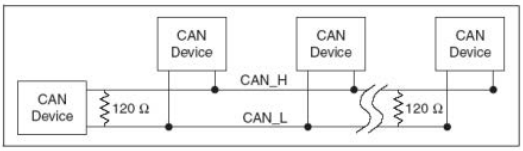
CAN Troubleshooting

If you meet some problems when communicating with PC by CAN interface, please check the following items.

- PC and the instrument must have the same baud rate.
- Ensure you have used the correct communication cable (CAN_H, CAN_L). Please pay attention that some cable may not have a correct internal wiring even it is with an appropriate plug.
- The interface cable is correctly connected (CAN_H to CAN_H, CAN_L to CAN_L).
- If the communication signal is poor or unstable, it is recommended to connect a 120 Ω terminating resistance.
  - The connection diagram of a single device is as below.



– The connection diagram of multiple devices is as below.



Note

When multiple devices are connected, it is recommended to connect the pin 8 (GND) of the P-IO terminal on the rear panel of these devices in parallel, and the communication quality will be improved in the entire CAN network.

2.7.4 GPIB Interface (Optional)

The GPIB (IEEE-488) interface is assembled in the IT-E176 communication board. Use a GPIB cable to connect GPIB interfaces of the instrument and PC. Please ensure that the screws have been screwed down in order to have a full connection.

GPIB Configuration

Each device on the GPIB (IEEE-488) interface must have a unique whole number address between 1 and 30. Your computer's GPIB interface card address must not conflict with any instrument on the interface bus. This setting is nonvolatile; it will not be changed by *RST.

When you purchase the interface accessory and successfully insert it into the corresponding position on the rear panel of the instrument, the menu item for changing the GPIB address appears in the System menu. The specific steps are as follows:

1. Ensure that the instrument's power switch is off, that is, the instrument is in Power Off state.
2. Insert the separately purchased GPIB interface card into the card slot on the rear panel of the instrument.
3. Connect the instrument with the computer via the GPIB cable. After the connection is successful, turn on the power switch of the instrument.
4. Click on **System** in the menu interface to enter the system menu interface.
5. Click the **Communication** tab to enter the communication settings interface.

6. Scroll up and down the communication settings interface to locate the **GPIB Config** menu.

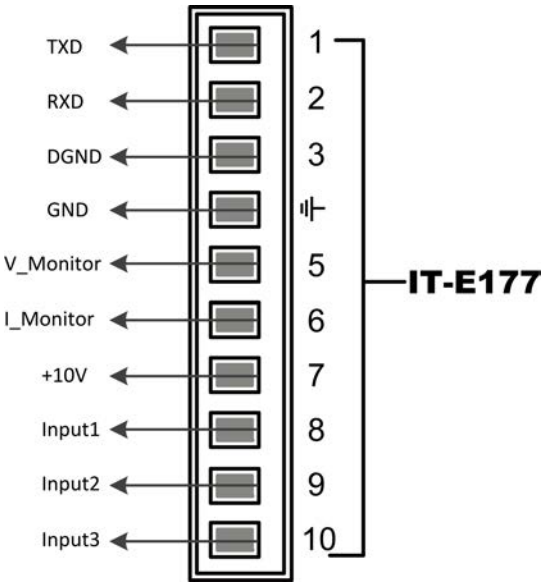
   In the **GPIB Addr** function section, click on the address value. Enter the specific value using the pop-up numeric keypad, and after clicking the **Enter** button, the GPIB address will take effect.

2.7.5 RS232 Interface (Optional)

The RS232 interface shares the same communication card (IT-E177) with the analog function.

Definition of RS232 Pins

The definition of RS232 pins are as follows.



When using the RS232 interface for communication, connect the pin 1, pin 2, and pin 3 of the IT-E177 to the PC. The pin description is as follows:

Pins	Description
1	TXD, transmit data
2	RXD, receive data
3	DGND, ground

RS232 Configuration

When you purchase the interface accessory and successfully insert it into the corresponding position on the rear panel of the instrument, the RS232 menu item will appear in the System menu. The specific steps are as follows:

1. Ensure that the instrument's power switch is off, that is, the instrument is in Power Off state.
2. Insert the separately purchased RS232 interface card into the card slot on the rear panel of the instrument.
3. Connect the instrument to the computer via an RS232 cable. After the connection is successful, turn on the power switch of the instrument.
4. Click on **System** in the menu interface to enter the system menu interface.
5. Click the **Communication** tab to enter the communication settings interface.
6. Scroll up and down the communication settings interface to locate the **RS232 Config** menu.
7. Set the relevant communication parameters in turn.

RS232 Troubleshooting

If you meet some problems when communicating with PC by RS232 interface, please check the following items:

- Check that whether the baud rate of the computer and instrument are the same;
- Make sure the correct cable and adapter are connected. Note that internal wiring may not be correct even if the cable has a suitable plug;
- The cable must be connected to the correct serial ports (COM1, COM2, etc) of PC.

2.8 Parallel Operation

2.8.1 Primary-Secondary Parallel

The IT8100 series electronic load supports multiple instruments to work in parallel mode to provide more power and current input capability. Under the parallel mode, all features are set up from the master unit.

This chapter takes three instruments as an example to describe how to parallelize the single units and how to return from parallel mode to single mode.

Set the Parallel Mode

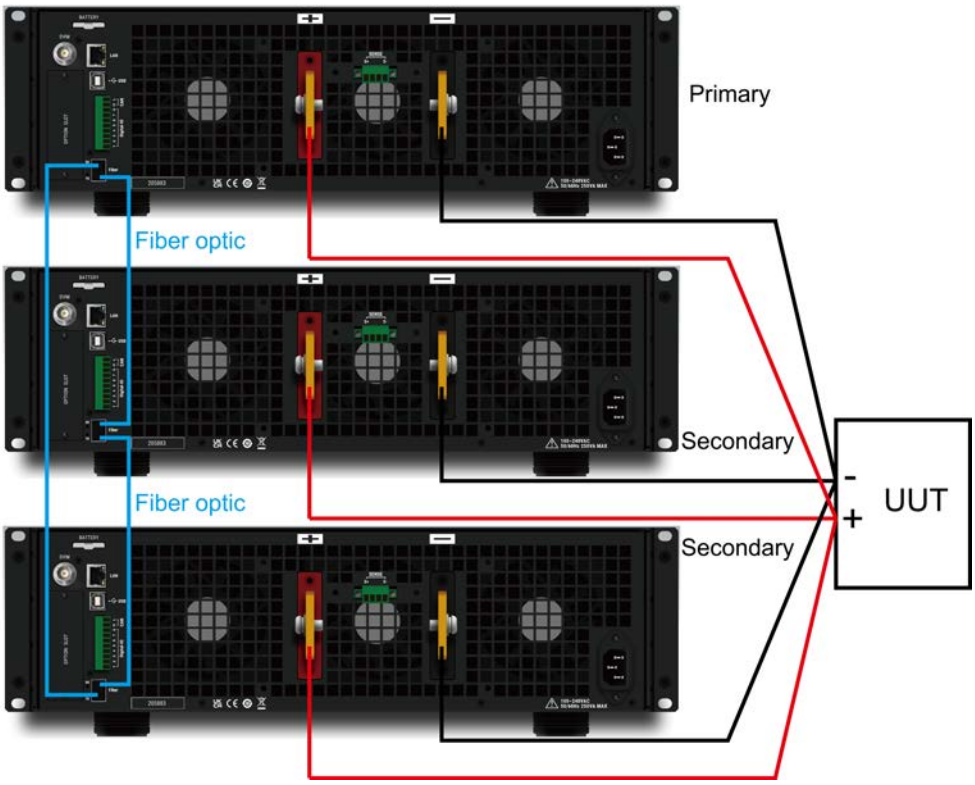
CAUTION

- **Before connecting the fiber optic, you must ensure that each instrument is in single mode (None).**
- **Parallel connection is only supported between instruments/cabinets that meet the following two conditions:**
  1. **The 3U single unit is the same model or the 3U single units in all the cabinets are the same model.**
  2. **The firmware version is the same. (Go to System > Information > Software Version menu to check)**
- **Fiber optic cables cannot be flexed or folded. When the cable is too long and needs to be arranged, gently wrap the cable in a circle and gently tie it.**

WARNING

- **Before connecting the cables, ensure that the instrument power switch is off and the main switch of the AC power input (distribution box) is off.**
- **Before connecting 3 single instruments to the AC distribution box, ensure that the distribution box capacity is sufficient. Refer to the corresponding specifications for the AC input parameters of a single instrument.**

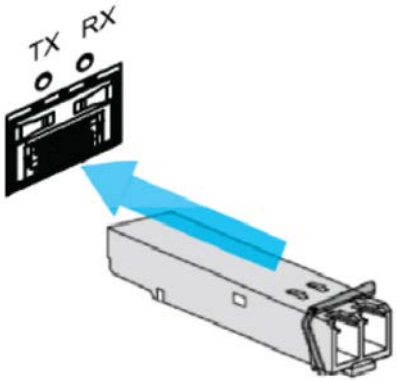
1. Ensure that the power switches of the three units and the main switch of the AC power distribution box are off.
2. Connect the instruments according to the following diagram.



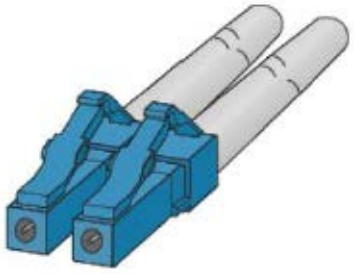
a. Connect the DC input terminals of the three units in parallel and connect them to the DUT.

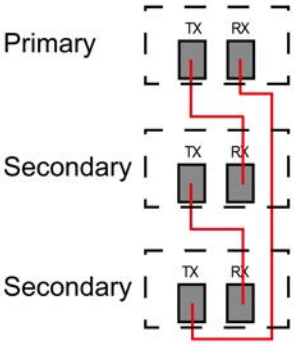
b. Refer to the blue wiring legend in the figure, connect the fiber optic (i.e., the fiber interfaces TX and RX) for fiber-optic communication between the primary and secondaries.

   Insert the fiber optic module into the hole corresponding to TX RX.



   Insert the plug of the fiber optic cable into the fiber optic module and hear a click sound to indicate that it is inserted in place. The fiber optic cable connection schematic is as follows.





3. After connection, configure one electronic load as a primary unit and other electronic loads as secondary units.
   a. Click on **System** in the menu interface to enter the system menu interface.
   b. Scroll up and down the parameter configuration interface to locate the **General -> Parallel** menu.
   c. Set the **Role**, set them to one primary unit and two secondary units. In each group, one instrument must be the primary unit and all other instruments connected in parallel are secondary units. All features are set up from the primary unit.
      - None: Default value, indicates that the instrument is in single mode.
      - Primary: Indicates that the single unit is set to primary in parallel mode.

        Number: Visible only when the instrument role is set to Primary. Indicates the total number of units in the parallel group. Example: with 3 units in parallel, it shows 3.
      - Secondary: Indicates that the instrument is set to the secondary in parallel mode.
      - Ext-Secondary: Set the instrument to extended secondary mode.
   d. Click  to exit.
4. After making the primary-secondary setting, to ensure normal operation, you need to restart the electronic loads.

Revert to single mode

To change Parallel Mode to Single Mode, follow the steps below.

1. Switch three instruments into single mode respectively.
   a. Click on **System** in the menu interface to enter the system menu interface.
   b. Scroll up and down the parameter configuration interface to locate the **General -> Parallel** menu.
   c. Set the **Role**, set them to **None**.
2. Power off the three instruments and turn off the main switch of the AC distribution box.

3. Remove the cables connection of the Fiber optic and input terminals between three units.
4. Power on the three instruments separately. After the instrument is restarted, the screen shows that the instrument is working in single mode.

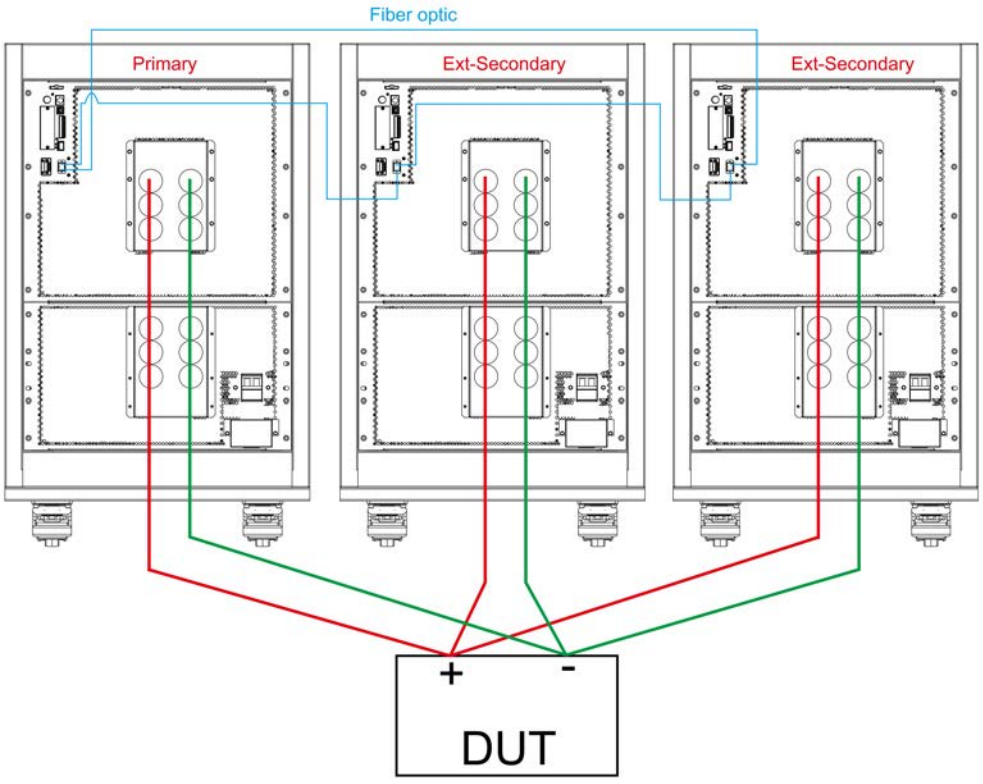
2.8.2 Parallel Extension

This series of cabinet models supports parallel expansion. When the number of units in a primary–secondary parallel set exceeds 18, first create a **unit group**. The group topology can be **Primary + Ext-Secondary** or **Secondary + Ext-Secondary**. Then perform primary–secondary paralleling at the unit-group level with other unit groups or single units. Each unit group supports up to **18** single units, and the system supports up to **18** unit groups in total.

As an example, this section describes how to configure three IT8130E-600-2100 power supplies (15U cabinet type) into a single system using the primary-extension parallel function.

Using three IT8130E-600-2100 units as an example, this section explains how to create a unit group via Primary + Ext-Secondary paralleling. The procedure for Secondary + Ext-Secondary paralleling is identical and is omitted here.

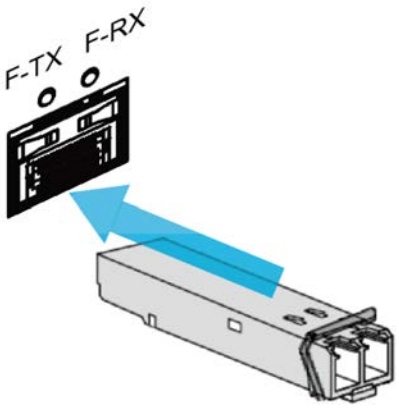
1. Ensure that the power switches of the three cabinets and the main switch of the AC power distribution box are off.
2. Connect the cabinets according to the following diagram.

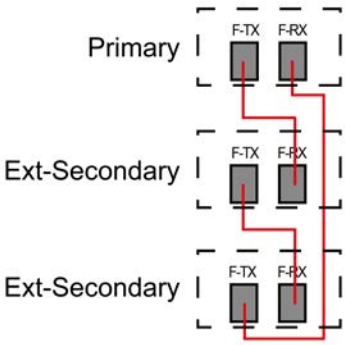


a. Connect the DC input terminals of the three cabinets in parallel and connect them to the DUT.

b. Refer to the blue wiring legend in the figure, connect the fiber optic (i.e., the fiber interfaces F-TX and F-RX) for fiber-optic communication between the Primary and Ext-Secondary units.

Insert the fiber optic module into the hole corresponding to F-TX, F-RX. Insert the plug of the fiber optic cable into the fiber optic module and hear a click sound to indicate that it is inserted in place. The fiber optic cable connection schematic is as follows.

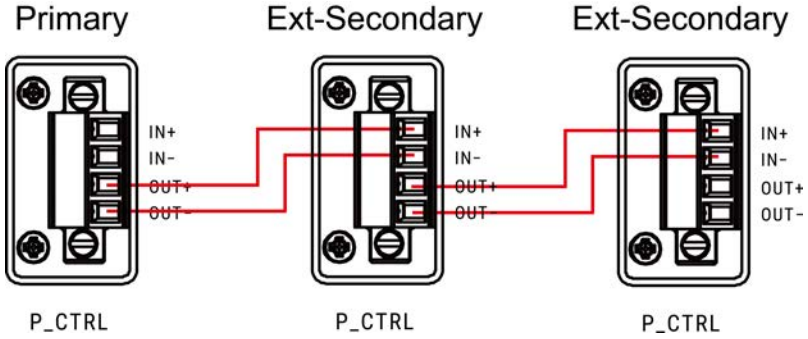




c. Connect the CTRL cables.

The P_CTRL external control interface is used in parallel operation between the Primary and Ext-Secondary units to enable unified power On/Off control of the Ext-Secondary units by the Primary. The power switch of each Ext-Secondary units must remain Off and is synchronized by the Primary.

Daisy-chain connection: connect the Primary's OUT+/OUT- to the IN+/IN- of the second Secondary, then from its OUT+/OUT– to the IN+/IN– of the next Secondary, and so on until the last cabinet.



3. After completing the wiring as shown above, configure one cabinet as the **Primary**, and the other cabinets as **Extended Secondary (Ext-Secondary)**.

a. Click on **System** in the menu interface to enter the system menu interface.

b. Scroll up and down the parameter configuration interface to locate the **General -> Parallel** menu.

c. Set the **Role**, set them to one Primary unit and two Ext-Secondary units. In each group, one instrument must be the Primary unit and all other instruments connected in parallel are Ext-Secondary units. All features are set up from the Primary unit.

- None: Default value, indicates that the instrument is in single mode.

- Primary: Indicates that the single unit is set to Primary in parallel mode.

  Number: Visible only when the instrument role is set to Primary. Indicates the total number of units in the parallel group. Example: with 3 units in parallel, it shows 3.

- Secondary: Indicates that the instrument is set to the Secondary in parallel mode.

- Ext-Secondary: Set the instrument to extended Secondary mode.

d. Click  to exit.

4. After making the primary-extension parallel setting, to ensure normal operation, you need to restart the electronic loads.

3 Programming the Input

3.1 Select the Operation Mode

The IT8100 series electronic load offers 14 operation modes, including CC, CV, CR, CP, CC+CR, CC+CV, CP+CV, CR+CV, Auto, CR LED, CE, CC Pulse, CC Sine, and Table. Among these, CC, CV, CR, and CP are basic operation modes, CC+CR, CC+CV, CP+CV, CR+CV, Auto, CR LED, and CE are complex operation modes, and CC Pulse, CC Sine, and Table are advanced operation modes. **Note that the IT8100E series electronic load does not support advanced operation modes.**

The procedures to select the operation mode are as follows.

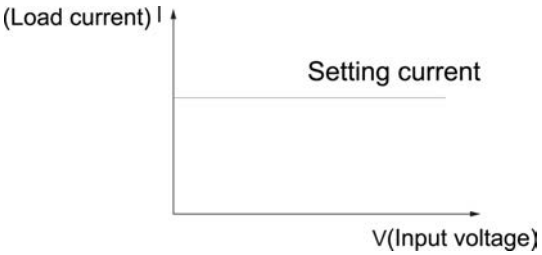
1. Click **Config** in the **Menu** interface to enter the configuration menu.
2. In the configuration menu, click the **Load** tab to access the load settings page.
3. Scroll up and down on the load settings page to find **Const Mode**.
4. Click the parameter to the right of **Const Mode**, select the desired operation mode from the pop-up window, and click **Select** to confirm.
5. Click  to exit.

3.2 Single Operation Mode

When select CC/CV/CP/CR mode, the instrument operating in present mode. This series electronic loads operate in constant voltage, current, resistance, or power modes to satisfy a wide range of test requirements.

3.2.1 Constant Current Operation Mode（CC）

Under CC mode, the electronic load will consume constant current in regardless of whether the input voltage changes or not, as shown in the following figure. The CC mode ensures that the DUT voltage outputs remain stable when the load varies.



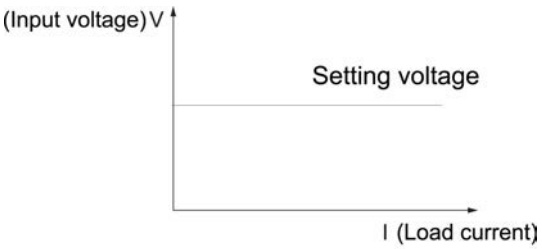
After selecting the CC mode, the following parameters that need to be set will be displayed on the interface.

- I-Set: Set the working current value.
- I-Range: Set current range.

Click the editing area on the right side of the parameter, enter the desired value using the pop-up numeric keypad, and click the **Enter** button to apply the setting.

3.2.2 Constant Voltage Operation Mode（CV）

Under CV mode, the electronic load will consume sufficient current to maintain the input voltage at setting voltage. As shown in the following figure. For battery chargers or charging stations, CV mode can change their output voltage to ensure the precision of the charging current.



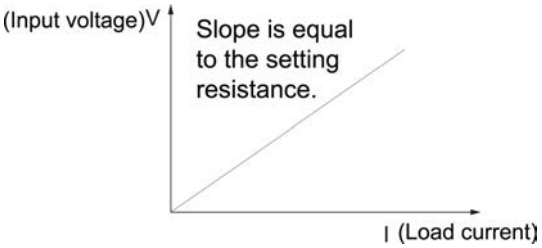
After selecting the CV mode, the following parameters that need to be set will be displayed on the interface.

- V-Set: Set the working voltage value.
- V-Range: Set voltage range.
- I-Limit: Set the current limit value.
- Response Speed: Set the CV loop response speed.

Click the editing area on the right side of the parameter, enter the desired value using the pop-up numeric keypad, and click the **Enter** button to apply the setting.

3.2.3 Constant Resistance Operation Mode（CR）

Under CR mode, the electronic load is equivalent to a constant resistance and will give linear change of current with input voltage change. As shown in following figure. The CR mode ensures that the DUT voltage outputs remain stable when the load varies.



After selecting the CR mode, the following parameters that need to be set will be displayed on the interface.

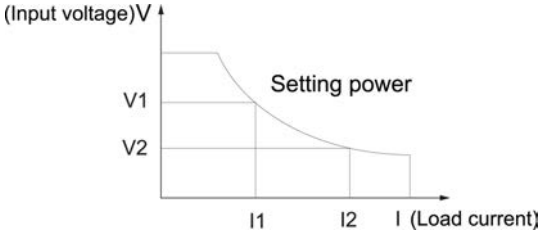
- R-Set: Set the working resistance value.
- R-Range: Set resistance range.
- I-Limit: Set the current limit value.
- Bandwidth Coef: Sets the current bandwidth coefficient for the CR control loops. Increasing the value speeds up the response but may cause instability; decreasing it improves stability but slows down the response.

Click the editing area on the right side of the parameter, enter the desired value using the pop-up numeric keypad, and click the **Enter** button to apply the setting.

3.2.4 Constant Power Operation Mode（CP）

Under CP mode, the electronic load will consume a constant power. If input voltage rises, the input current decreases and power P (= V * I) will maintain at setting power. As shown in the following figure.

When the DUT is a battery, the electronic load changes to simulate device loading behavior. Many battery discharge applications and power consumption profiles can be simulated for analysis, making the CP mode the best choice for simulating electronic device loads.



After selecting the CP mode, the following parameters that need to be set will be displayed on the interface.

- P-Set: Set the working power value.
- I-Range: Set current range.
- I-Limit: Set the current limit value.
- Bandwidth Coef: Sets the current bandwidth coefficient for the CP control loops. Increasing the value speeds up the response but may cause instability; decreasing it improves stability but slows down the response.

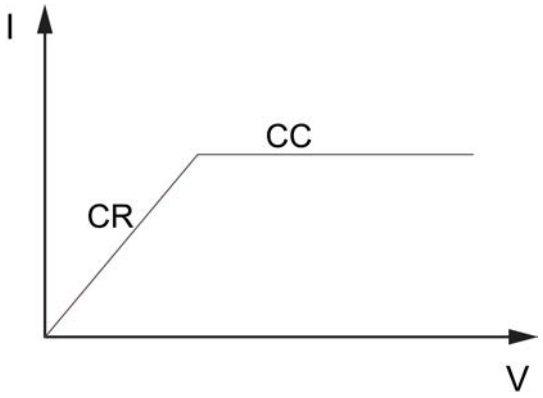
Click the editing area on the right side of the parameter, enter the desired value using the pop-up numeric keypad, and click the **Enter** button to apply the setting.

3.3 Complex Operation Mode

3.3.1 CC+CR Mode

In CC+CR mode, when the input voltage is low, the load operates in constant resistance mode. At this stage, its characteristic is equivalent to a resistor, and the current increases linearly with the voltage. As the voltage continues to rise and reaches the critical point V_{CC} = I-Set * R-Set, the load automatically switches to constant current mode.

The CC+CR mode is commonly used in the testing of voltage limiting, current limiting characteristics, constant voltage accuracy, and constant current accuracy of on-board chargers, which prevents over-current protection of on-board chargers.



After selecting the CC+CR mode, the following parameters that need to be set will be displayed on the interface.

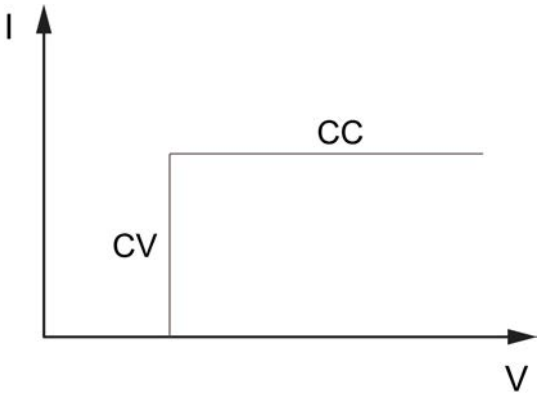
- I-Set: Set the working current value.
- I-Range: Set current range.
- R-Set: Set the working resistance value.
- R-Range: Set resistance range.
- Bandwidth Coef: Sets the current bandwidth coefficient for the CR control loops. Increasing the value speeds up the response but may cause instability; decreasing it improves stability but slows down the response.

Click the editing area on the right side of the parameter, enter the desired value using the pop-up numeric keypad, and click the **Enter** button to apply the setting.

3.3.2 CC+CV Mode

In CC+CV mode, when the measured voltage is higher than the set voltage V-Set, the load operates in constant current mode, sinking the set current I-Set. When the DUT output current is lower than the set value I-Set, the voltage decreases and stabilizes at V-Set, and the load automatically switches to constant voltage mode.

The CC+CV mode can be applied to the load simulation battery and test the charging station or the car charger. When the CV is working, the maximum loading current is limited.



After selecting the CC+CV mode, the following parameters that need to be set will be displayed on the interface.

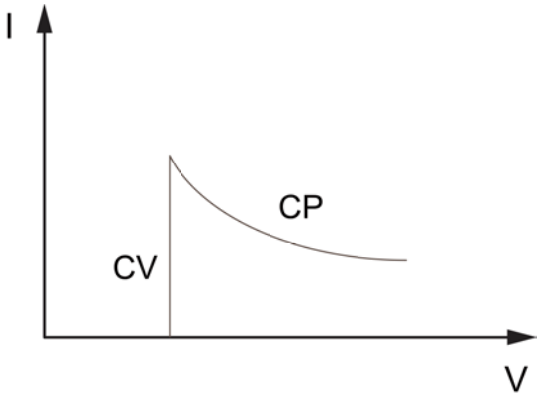
- I-Set: Set the working current value.
- I-Range: Set current range.
- V-Set: Set the working voltage value.
- V-Range: Set voltage range.
- Response Speed: Set the CV loop response speed.

Click the editing area on the right side of the parameter, enter the desired value using the pop-up numeric keypad, and click the **Enter** button to apply the setting.

3.3.3 CP+CV Mode

In CP+CV mode, when the measured voltage is higher than the set voltage V-Set, the load operates in constant power mode, sinking the set power P-Set. When the DUT output power is lower than the set value P-Set, the voltage decreases and stabilizes at V-Set, and the load automatically switches to constant voltage mode.

The CP+CV mode is often used to UPS battery test, simulate the current change when the battery voltage is decaying. It can also be used to simulate the characteristics of the inputs of DC-DC converters and inverters.



After selecting the CP+CV mode, the following parameters that need to be set will be displayed on the interface.

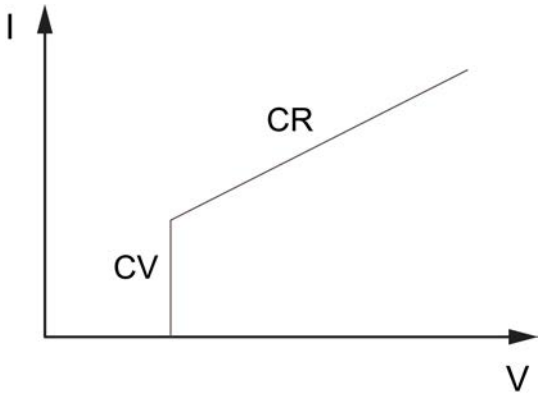
- P-Set: Set the working power value.
- I-Range: Set current range.
- V-Set: Set the working voltage value.
- V-Range: Set voltage range.
- I-Limit: Set the current limit value.
- Response Speed: Set the CV loop response speed.
- Bandwidth Coef: Sets the current bandwidth coefficient for the CP control loops. Increasing the value speeds up the response but may cause instability; decreasing it improves stability but slows down the response.

Click the editing area on the right side of the parameter, enter the desired value using the pop-up numeric keypad, and click the **Enter** button to apply the setting.

3.3.4 CR+CV Mode

In CR+CV mode, when the measured voltage is higher than the set voltage V-Set, the load operates according to the set resistance R-Set, sinking the corresponding current $I_{CR}=V_{Meter}$/R-Set. When the DUT output current is lower than this current I_{CR}, the voltage decreases and stabilizes at V-Set, and the load automatically switches to constant voltage mode.

The CR+CV mode can be applied to the LED simulation and test the LED power supply to get the LED current ripple parameters.



After selecting the CR+CV mode, the following parameters that need to be set will be displayed on the interface.

- R-Set: Set the working resistance value.
- R-Range: Set resistance range.
- V-Set: Set the working voltage value.
- V-Range: Set voltage range.
- I-Limit: Set the current limit value.
- Response Speed: Set the CV loop response speed.
- Bandwidth Coef: Sets the current bandwidth coefficient for the CR control loops. Increasing the value speeds up the response but may cause instability; decreasing it improves stability but slows down the response.

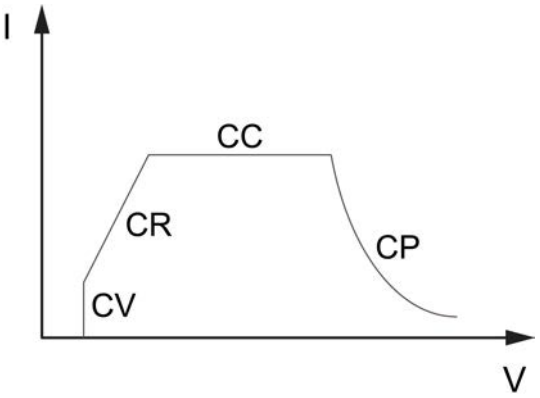
Click the editing area on the right side of the parameter, enter the desired value using the pop-up numeric keypad, and click the **Enter** button to apply the setting.

3.3.5 Auto Mode

In Auto mode, the user must pre-set parameters such as constant voltage, constant resistance, constant current, and constant power. The load will operate in the mode that produces the minimum calculated input current value. Specifically, the input current in CR mode is determined by $I_{CR}=V_{Meter}/R\text{-Set}$, and in CP mode by $I_{CP}=P\text{-Set}/V_{Meter}$, where V_{Meter} is the measured voltage at the load input terminal.

- When the measured voltage exceeds the set voltage V-Set.
  - If I_{CR} > I-Set and I_{CP} > I-Set, the load enters CC mode.
  - If I-Set > I_{CR} and I_{CP} > I_{CR}, the load enters CR mode.
  - If I-Set > I_{CP} and I_{CR} > I_{CP}, the load enters CP mode.
- When the DUT output current is simultaneously lower than I-Set, I_{CR}, and I_{CP}, the output voltage will drop and stabilize at V-Set, and the load will enter CV mode.

Under this mode, the load can automatically switch among CC, CV, CR and CP modes. It is suitable for lithium ion battery charger testing to get a complete V-I charging curve. Moreover, the auto mode can avoid damaging the DUT when the protection circuit is damaged.



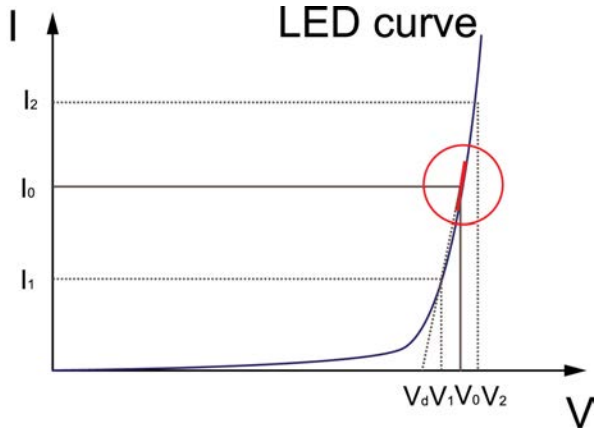
After selecting the Auto mode, the following parameters that need to be set will be displayed on the interface.

- I-Set: Set the working current value.
- I-Range: Set current range.
- V-Set: Set the working voltage value.
- V-Range: Set voltage range.
- R-Set: Set the working resistance value.
- P-Set: Set the working power value.
- Response Speed: Set the CV loop response speed.
- Bandwidth Coef: Sets the current bandwidth coefficient for the CP and CR control loops. Increasing the value speeds up the response but may cause instability; decreasing it improves stability but slows down the response.

Click the editing area on the right side of the parameter, enter the desired value using the pop-up numeric keypad, and click the **Enter** button to apply the setting.

3.3.6 CR-LED test function

The IT8100 series electronic load adds a diode break-over voltage setting based on the traditional CR mode. The electronic load operates only when the applied voltage exceeds the diode break-over voltage, accurately simulating the working principle of an LED. V-I curve of LED is as shown below.



After selecting the CR LED mode, the following parameters that need to be set will be displayed on the interface.

- R-Set: Set the working resistance value.
- R-Range: Set resistance range.
- I-Limit: Set the current limit value.
- V_d: Set the break-over voltage value.
- Bandwidth Coef: Sets the current bandwidth coefficient for the CR control loops. Increasing the value speeds up the response but may cause instability; decreasing it improves stability but slows down the response.

Click the editing area on the right side of the parameter, enter the desired value using the pop-up numeric keypad, and click the **Enter** button to apply the setting.

Calculation method of V_d and R_d

Definition:

- V_o: The constant working voltage when the LED constant current source drives the LED.
- I_o: Output current of LED constant current source.
- V_d: Break-over voltage of diode (string).
- R_d: The operating point impedance of the LED, which is the R-Set value.

According to four parameters above and the V-I curve of LED, you can calculate the value of R_d and V_d .

$$Rd = \frac{V2 - V1}{I2 - I1}$$

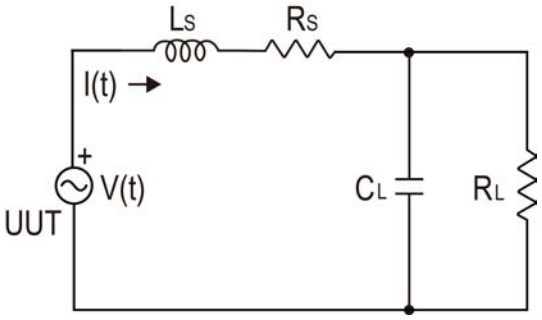
$$Vd = Vo - (Iox\ Rd)$$

Note

The value of V_2, V_1, I_2 and I_1should be close to the static working point of LED as shown in the red circle above.

3.3.7 Circuit Simulation Mode (CE)

In circuit simulation mode, the load will sink current based on the configured RLC parameters. In this mode, the RLC parameters can be programmed by setting the equivalent series resistance Rs, equivalent series inductance Ls, equivalent parallel load capacitance C_L, and equivalent parallel load resistance R_L, enabling precise load simulation.



After selecting the CE mode, the following parameters that need to be set will be displayed on the interface.

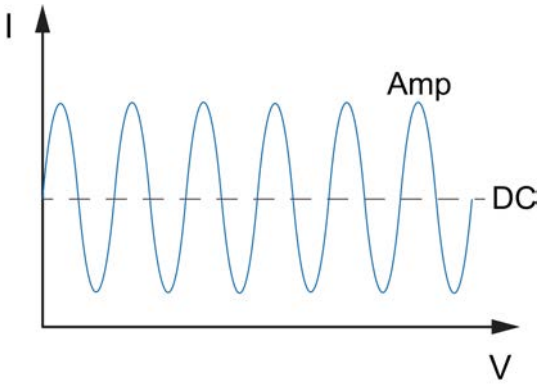
- R-Range: Set resistance range.
- R_L: Set the equivalent parallel load resistance.
- C_L: Set the equivalent parallel load capacitance.
- Ls: Set the equivalent series inductance.
- Rs: Set the equivalent series resistance.
- I-Limit: Set the current limit value.
- Bandwidth Coef: Sets the current bandwidth coefficient for the CP and CR control loops. Increasing the value speeds up the response but may cause instability; decreasing it improves stability but slows down the response.

Click the editing area on the right side of the parameter, enter the desired value using the pop-up numeric keypad, and click the **Enter** button to apply the setting.

3.4 Advanced Operation Mode

3.4.1 CC Sine

The IT8100A series load supports sine wave loading current, allowing the user to set the loading current bias (Iset), the loading sine wave (Iamp), and sine wave frequency. The minimum point of the sine wave must not fall below 0 A.



After selecting the CC Sine mode, the following parameters that need to be set will be displayed on the interface.

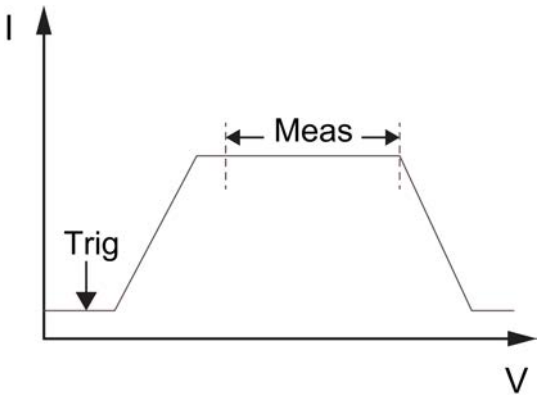
- I-Set: Set the DC load current bias.
- I-Range: Set current range.
- I-Amp: Set the AC peak to peak load sine wave.
- Freq: Set the sine wave frequency, the range is 0.01Hz~20 kHz.

Click the editing area on the right side of the parameter, enter the desired value using the pop-up numeric keypad, and click the **Enter** button to apply the setting.

3.4.2 CC Pulse

The IT8100A series electronic loads support pulse current input. The pulse cycle is composed of the Pulse Width and Pulse Delay settings. During the Pulse Width period, the load inputs the configured pulse peak current, while during the Pulse Delay period, it inputs the configured pulse base current.

In addition, the IT8100A series supports **Instantaneous Overpower Input** in pulse mode, allowing a pulse load up to 4 times the rated power within 1 ms. To ensure instrument safety, the system limits the pulse baseline, maximum pulse width, and minimum pulse delay to prevent damage from prolonged over-power input.



After selecting the CC Pulse mode, the following parameters that need to be set will be displayed on the interface.

- Super Power: Whether to enable the **Instantaneous Overpower Input** function.
- I-Peak: Set the pulse peak current.
- I-Base: Set the pulse base current.
- Width: Set the pulse width time. Setting range: 10μs to 1ms (when Super Power is enabled), 10μs to 100s (when Super Power is disabled).
- Delay: Set the pulse delay time. Setting range: 1ms to 100s (when Super Power is enabled), 10μs to 100s (when Super Power is disabled).
- I-Range: Set current range.
- Priority: Set the priority modes of pulse input.
  - Base Priority Mode: Upon receiving a valid trigger signal, the load first inputs the configured pulse base value. After the pulse delay time elapses, it then inputs the pulse peak value.
  - Peak Priority Mode: Upon receiving a valid trigger signal, the load first inputs the configured pulse peak value. After the pulse width time elapses, it then inputs the pulse base value.

Click the editing area on the right side of the parameter, enter the desired value using the pop-up numeric keypad, and click the **Enter** button to apply the setting.

3.4.3 Table Mode

The IT8100A series electronic loads support Table mode loading, allowing users to precisely define load characteristics by configuring a voltage-current table. In this mode, the load samples the input voltage in real time and dynamically adjusts the loading current according to the predefined V-I curve, enabling accurate simulation of the voltage-current characteristics of nonlinear components such as diodes.

Operation methods

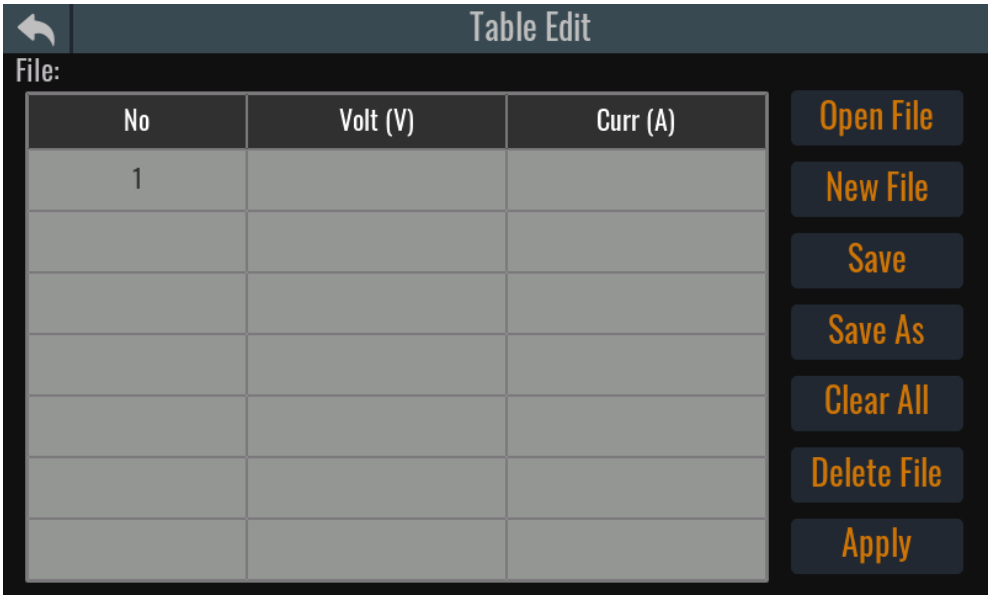
1. Click **Config** in the **Menu** interface to enter the configuration menu.
2. In the configuration menu, click the **Load** tab to access the load settings page.
3. Scroll up and down on the load settings page to find **Const Mode**.
4. Click the parameter to the right of **Const Mode**, select the Table mode from the pop-up window, and click **Select** to confirm.
5. After selecting the Table mode, the following parameters that need to be set will be displayed on the interface.
   - I-Range: Set current range.

- Serial Gain: Sets the current serial gain.
- Parallel Gain: Sets the voltage parallel gain.
- Filter: Set the filter time.

Click the editing area on the right side of the parameter, enter the desired value using the pop-up numeric keypad, and click the **Enter** button to apply the setting.

6. Press **[View]** key to enter the Meter interface.

7. Click the **Edit** button on the interface to enter the Table file edit interface. The parameter description of the List edit interface is as follows.



Parameter	Description
File:	Table file name.
No	Step number of Table.

Parameter	Description
Volt	Voltage value of the current step.
Curr	Current value of the current step.
Open File	Select the Table file to run.
New File	Create a new Table file.
Save	Save the Table file.
Save As	Save the edited Table file under a different file name.
Clear All	Delete all steps.
Delete File	Delete the Table file.
Apply	Apply the Table file.

8. Edit voltage-current data points in the Table file, with up to 1024 points supported.

   Click the Save button to save, and click the Apply button to apply the file.
9. Press **[View]** key to enter the Meter interface.
10. Press **[On/Off]** on the front panel to turn on the load input.

3.5 Set I-Rise / I-Fall Slew

This series of electronic loads allows setting the current rise and fall slew rates to control the speed of current transition from the present value to the target value. The slew rate parameter can be configured via the front panel or remote control, and directly affects the current change speed.

The instrument provides two slew rate types: **Time** (defined by time units) and **Rate** (defined by current slew rate units, A/μs or A/ms). When Rate mode is selected, users can further set the slew rate to either **High** or **Low**.

Operation methods

1. Click on **Config** in the menu interface to enter the configuration menu interface.
2. In the configuration menu, click the **Load** tab to access the load settings page.
3. Scroll up and down on the load settings page to find **Slew Set**.
   a. Click the parameter to the right of **Slew Type**, and select either **Time** or **Rate** from the pop-up window.
   b. When the Slew Type is set to **Rate**, click the parameter to the right of **Slew Rate**, and select either **High** or **Low** from the pop-up window.

c. Click the editing area on the right side of the **I-Rise**, enter the desired value using the pop-up numeric keypad, and click the **Enter** button to apply the setting.

d. Click the editing area on the right side of the **I-Fall**, enter the desired value using the pop-up numeric keypad, and click the **Enter** button to apply the setting.

4. Click  to exit.

3.6 Enable the Input

You can press the **[On/Off]** key on the front panel to control the input status of the instrument. If the **[On/Off]** key light is on, indicates that the input is turned on. The LCD displays the meter value such as voltage, current, power and so on. If the **[On/Off]** key light is off, indicates that the input is turned off. The LCD displays that the instrument state is OFF.

3.7 Short-Circuit Simulation Function

The electronic load can simulate a short circuit at the input. Before using the short-circuit function, the user must first configure the short-circuit function. Only then can it be activated using the front panel short-circuit button or remote control. The setting method is as follows.

1. Click **Config** in the **Menu** interface to enter the configuration menu.
2. In the configuration menu, click the **General** tab to access the general settings page.
3. Scroll up and down on the general settings page to find **Short**.
4. Click the setting located to the right of **State**, and choose either **On** or **Off** from the dropdown menu.
   - On: Turn on the Short key function.
   - Off: Turn off the Short key function.
5. Click  to exit.

After enabling the Short key function, you can press **[Shift] + [Transient]** (Short) on the panel to switch the short circuit state. The operation does not affect the existing settings. Pressing **[Shift] + [Transient]** (Short) again returns the load to its previous setting.

In the short circuit mode, the current value is determined by the operation mode and the current range. Under CC, CP and CR modes, maximum short-circuit current is 101% of the current range. Under CV mode, short-circuit current equals to current when constant voltage is 0 V.

3.8 Von Function

Set voltage value (Level) to control on/off status of electronic load. Based on Von value load and unload, the load has two modes: Latch Off and Latch On. When Latch Off is selected, it indicates that the work load point is in living status; when Latch On is selected, it indicates that the work load point is in latch load status.

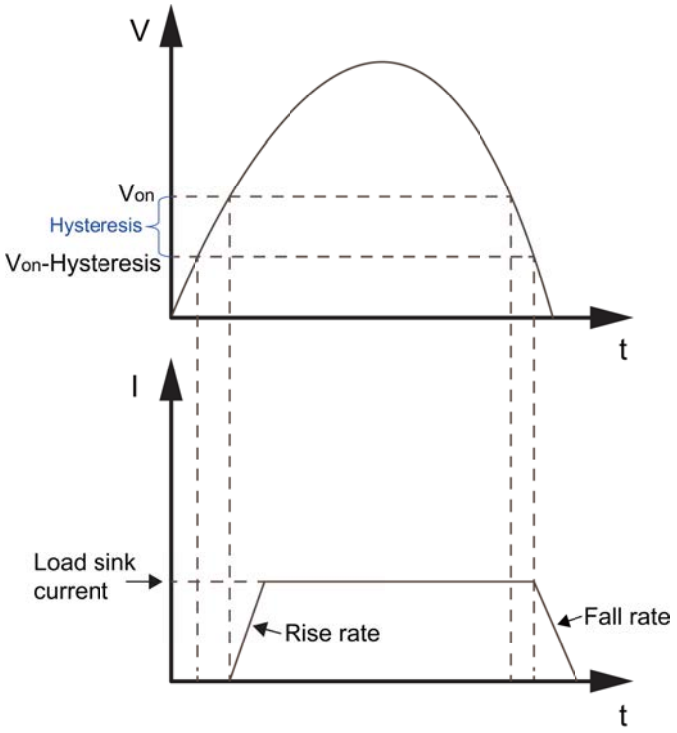
When testing some power products with slow voltage rise speed, if the electronic load input is opened before power on, the power may latch protection. In this way, the user may set Von value. The electronic load only latches when power voltage is higher than this value.

CAUTION

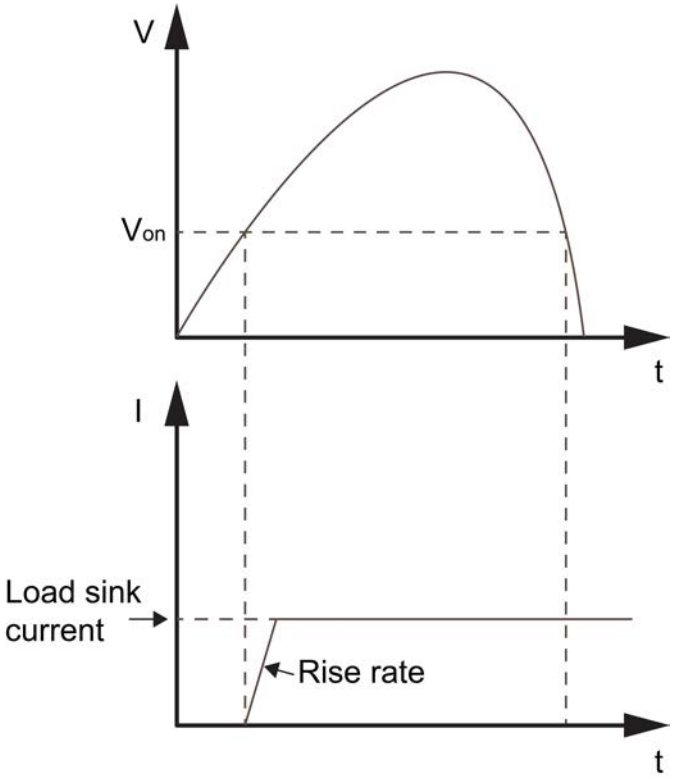
- **Please confirm whether it is necessary to set loading voltage, a step that provides convenience for limiting working voltage value. If not necessary, do not set the loading voltage to prevent unnecessary trouble from failure of loading.**
- **If the instrument can not load, please firstly check whether the Von function is set. If yes, reset the Von value to minimum value (which may be directly set as 0. If minimum voltage value of instrument is not 0, press 0 for confirmation and the menu will automatically set the value as minimum value).**

- When Latch Off function is enabled, the tested power voltage starts rising. When the voltage is higher than the difference between Von Point and Hysteresis, and is lower than Von Point loading voltage, the load will not be loaded; and the load test starts only when the power voltage rises and is higher than Von Point loading voltage.

  After load test, judge whether to continue loading based on the difference between Von Point and Hysteresis; when the power voltage drops but is still higher than the difference between Von Point and Hysteresis, the load is still loaded; only when the power voltage is lower than the difference between Von Point and Hysteresis, the load will unload.



- When Latch On function is started, the load starts load test only when the power voltage rises and is higher than Von Point loading voltage. When the power voltage drops and is lower than Von Point unloading voltage, the load will not unload.



The procedures to set Von function are as follows.

1. Click **Config** in the **Menu** interface to enter the configuration menu.

2. In the configuration menu, click the **General** tab to access the general settings page.
3. Scroll up and down on the general settings page to find **Voltage On**.
4. Click the setting located to the right of **Latch**, and choose either **On** or **Off** from the dropdown menu.
5. Click the editing area on the right side of the **Voltage**, enter the desired value using the pop-up numeric keypad, and click the **Enter** button to apply the setting.
6. Click the editing area on the right side of the **Hysteresis**, enter the desired value using the pop-up numeric keypad, and click the **Enter** button to apply the setting.
7. Click  to exit.

4 Advanced Function

4.1 Battery discharge test function

This series of electronic loads supports a battery discharge test function. Users can set five stop conditions: cutoff voltage, cutoff current, cutoff time, cutoff capacity, and cutoff energy, and the test will end automatically when any one of these conditions is met.

This function is dedicated to controlling test start, stop, and stop determination; it does not set specific load parameters. During discharge, all required load parameters are configured and maintained by the user using any one of Const Mode (set in Config), Dynamic, List, Sweep, or Sequence.

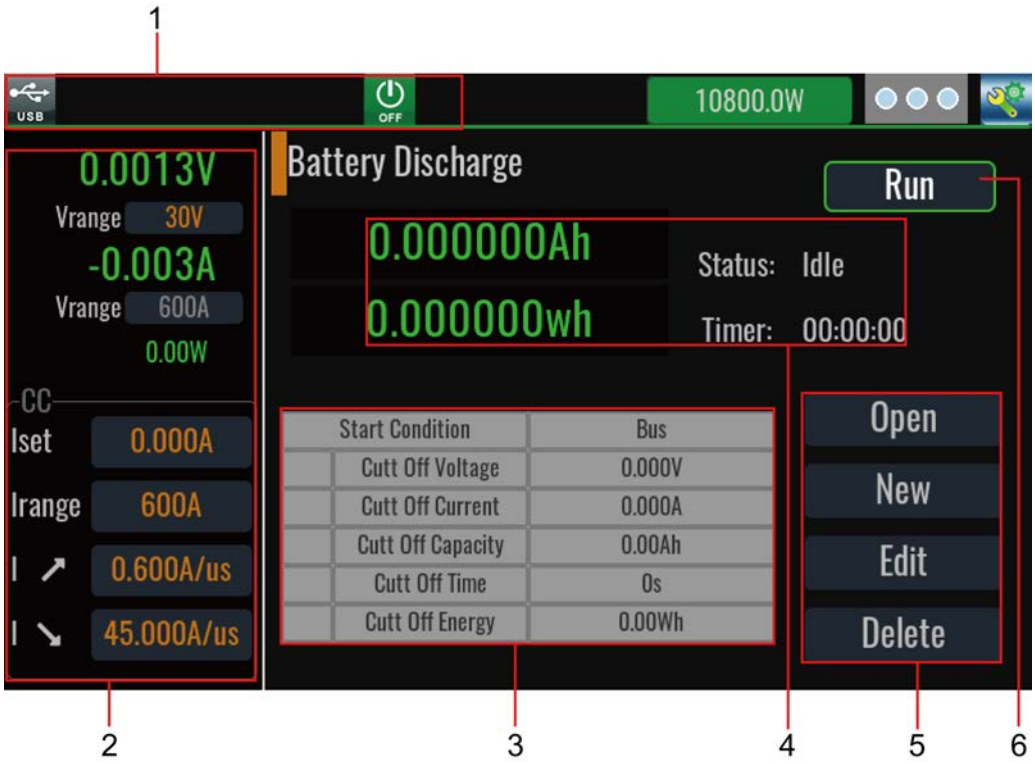
During the test, the load continuously monitors parameters such as battery voltage, discharge time, discharged capacity (Ah), and discharged energy (Wh). This function is suitable for evaluating battery state of health, reliability, and remaining life, providing an important basis for battery maintenance and replacement decisions.

WARNING

- **When using switch-type devices to directly connect the battery and electronic load, there will be a voltage surge at the moment the switch device is closed. The excessively high voltage surge will damage the electronic load. To avoid loading the load with a high voltage surge, it is recommended to connect a current-limiting resistor in series in the circuit. The method for connecting a series current-limiting resistor is detailed in reference Precautions for connecting batteries.**
- **When connecting the DUT (battery/capacitor), do not short-circuit the battery/capacitor.**

Introduction of discharge interface

Click **Discharge** in the Menu interface to enter the battery discharge function page. The functions of this page are introduced as follows.



1. Status display area: Displays information about the current input status of the instrument.
2. Same as Meter interface for parameter setting and measurement value display.
3. Discharge display area: This area mainly displays the edited discharge files.
4. Displays the discharged capacity, discharged energy, discharge status, and discharge time.
5. Discharge edit button. The functions are described as follows.
   - Open: Select the discharge file to run.
   - New: Create a new discharge file.
   - Edit: Edit the discharge file.
   - Delete: Delete the discharge file.
6. Run/Stop: Run/stop the discharge operation.

Edit discharge files

1. Click **Discharge** on the Menu screen to enter the battery discharge function interface.
2. Click the **Edit** button on the interface to enter the discharge file edit interface. The parameter description of the discharge edit interface is as follows.

Parameter	Description
File Name:	Discharge file name.
Operation Condition	
Start Condition	Set the condition that triggers the start of the battery test. • Immediate: Perform a trigger operation immediately. • Manual: Triggered by the [Trig] key. • Bus: Triggered by a command, such as *TRG.
Cut Off Condition	
Voltage	Discharging ends when the voltage is less than or equal to this setting.
Current	Discharging ends when the current is less than or equal to this setting.
Capacity	Discharging ends when the capacity is greater than or equal to this setting.
Time	Discharging ends when the time is greater than or equal to this setting.
Energy	Discharging ends when the energy is greater than or equal to this setting.
Button Description	
Open	Select the discharge file to run.
Save	Save the discharge file.
Save As	Save the edited discharge file under a different file name.
Delete	Delete the discharge file.

3. Set the discharge parameters for the battery and press the **Save** button to save.
4. Click  to return to the discharge main interface. The discharge display area will show the edited discharge file.

Select/Run discharge File

If multiple discharge files have been edited, press **Open** to recall the discharge file for testing. The detailed operation steps are as follows.

1. Discharge parameter setup.
   a. Select an input mode based on the test requirements (e.g., Const Mode, List, Arb Sequence, Dynamic, or Sweep). Complete the corresponding parameter settings, or edit and load a test file as needed.

b. On the main interface of the selected mode, click **Run**. Then start that mode according to the configured trigger method. (For Const Mode, this step can be skipped.)

2. Discharge process control.

a. Click **Discharge** on the Menu screen to enter the battery discharge function interface.

b. Click the **Open** button on the interface, select the saved battery.csv file, and click the **Open** button to confirm the selection.

c. Press **[On/Off]** on the front panel to turn on the load input.

d. Press **Run** on the discharge main interface.

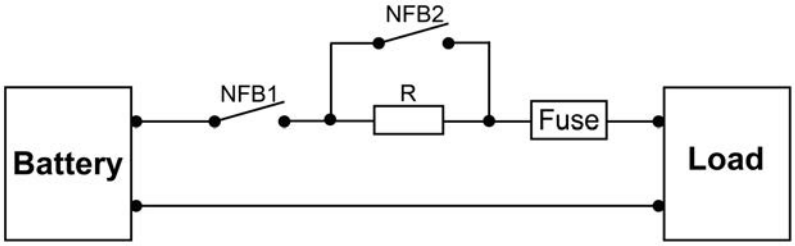
e. Based on the selected trigger method, perform the trigger operation.

Take the manual trigger as an example. Press the **[Trig]** key on the front panel to run the selected discharge file.

f. The test will automatically stop when any preset stop condition is met, or you can click **Stop** at any time to stop manually. (After a manual stop, press the front-panel **[On/Off]** key to turn off the load input.)

Precautions for connecting batteries

When using switch-type devices to directly connect the test object and electronic load, there will be a voltage surge at the moment the switch device is closed. The excessively high voltage surge will damage the electronic load. To avoid equipment damage, it is recommended to use the following wiring method in battery discharge testing to ensure the safe operation of the testing equipment.



Instructions:

- NFB: Non-fused switch, used to cut the circuit in time when the load is aging short circuit inside. The current flow of the non-fused switch must be less than the maximum current flow of the battery.
- R: Current limiting resistor, which is used to prevent the inrush current of the battery from being too high due to the RC of the load port when the NFB1 is sucked in, thus protecting the battery to be tested from damage. It also prevents the parasitic inductance on the test lead from resonating with the RC of the load port at the moment of relay suction, resulting in excessive voltage received at the load end, thus avoiding damage to the electronic load. It is recommended that the resistance value of the current limiting resistor is greater than 100kΩ.
- Fuse: Fuse, when the current abnormally rises to a certain height and heat, it melts itself to cut off the current, protecting the safe operation of the circuit.

The rated current value of the fuse must be 150%~200% of the maximum discharge current of the battery.

Operation instructions:

- Start Discharging

  First, connect the electronic load and the battery according to the diagram. Then, close switch NFB1. After a delay of 5 seconds, close switch NFB2 to begin the battery discharge test.

- Stop Discharging

  First, press the **[On/Off]** key on the load front panel to turn off the load input. Then, disconnect switch NFB2. Finally, disconnect switch NFB1 to stop the battery discharge test.

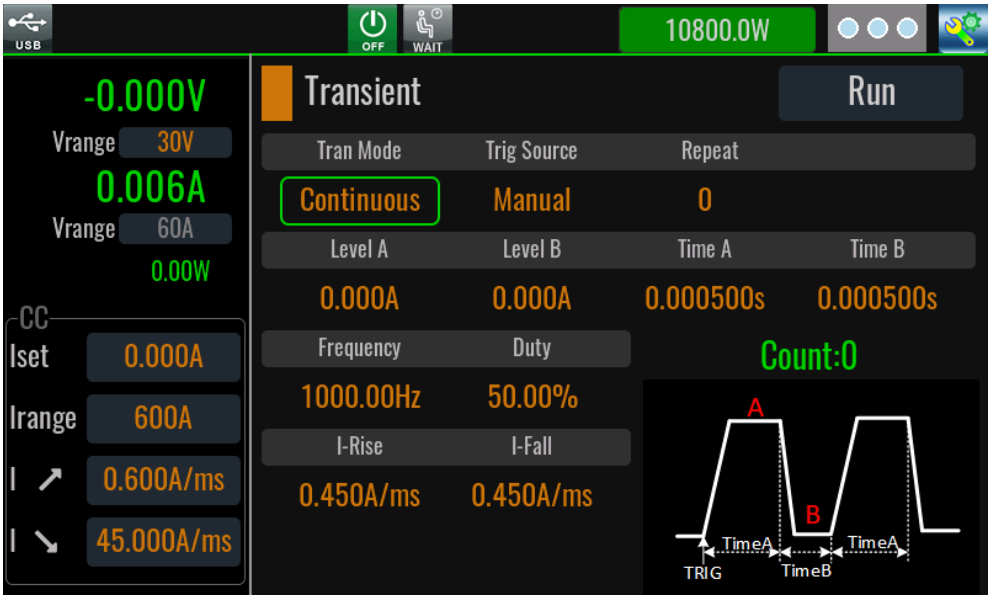
4.2 Transient Test Function

The transient test operation follows set rules to switch the load value of the electronic load between two preset parameters, used to test the transient characteristics of the power supply. The transient testing modes include Continuous Mode, Pulse Mode, and Toggle Mode.

4.2.1 Continuous Mode

In continuous mode, after enabling transient test operation, the load will continuously switch between the A and B values.

1. Please refer to section 3.1 Select the Operation Mode to set the transient operating mode, including CC, CV, CR, and CP modes.
2. Click **Transient** on the Menu screen to enter the transient test interface.
3. Click the parameter below **Tran Mode**, and in the pop-up mode selection box, click **Continuous** to select this mode.



Parameter	Description
Tran Mode	Select mode: Continuous, Pulse, Toggle.
Trig Source	Select the trigger source. • Manual: Triggered by the [Trig] key. • Bus: Triggered by a command, such as *TRG. • Trigger1~3: Triggered by Digital IO1~IO3 pins.
Repeat	Transient repeat count, where 0 represents infinite repetition.
Level A	Transient A value.
Level B	Transient B value.
Time A	Set the loading time for A.
Time B	Set the loading time for B.
Frequency	Set the transient switching frequency.
Duty	Set the duty cycle of the A value.
I-Rise	Set the current rising time.
I-Fall	Set the current falling time.
Count	Display the transient run count.
Run/Stop	Run/Stop the transient operation.

4. Set transient test parameters.
5. Press **[On/Off]** on the front panel to turn on the load input.
6. Press **Run** on the transient interface.
7. Based on the selected trigger method, perform the trigger operation.

Take the manual trigger as an example. Press the **[Trig]** key on the front panel to run a transient operation.

8. Click **Stop** to stop the present running.

4.2.2 Pulse Mode

In pulse mode, after enabling transient test operation, the electronic load defaults to the A value. Upon receiving a trigger signal, the electronic load switches to the B value, maintains it for the B pulse width duration, then automatically returns to the A value and waits for the next trigger signal.

1. Please refer to section 3.1 Select the Operation Mode to set the transient operating mode, including CC, CV, CR, and CP modes.
2. Click **Transient** on the Menu screen to enter the transient test interface.
3. Click the parameter below **Tran Mode**, and in the pop-up mode selection box, click **Pulse** to select this mode.

Parameter	Description
Tran Mode	Select mode: Continuous, Pulse, Toggle.
Trig Source	Select the trigger source. • Manual: Triggered by the [Trig] key. • Bus: Triggered by a command, such as *TRG. • Trigger1~3: Triggered by Digital IO1~IO3 pins.
Level A	Transient A value.
Level B	Transient B value.
Width	Pulse width duration.
I-Rise	Set the current rising time.

Parameter	Description
I-Fall	Set the current falling time.
Run/Stop	Run/Stop the transient operation.

4. Set transient test parameters.
5. Press **[On/Off]** on the front panel to turn on the load input.
6. Press **Run** on the transient interface.
7. Based on the selected trigger method, perform the trigger operation.

   Take the manual trigger as an example. Press the **[Trig]** key on the front panel to run a transient operation.
8. Click **Stop** to stop the present running.

4.2.3 Toggle Mode

In toggle mode, after enabling transient test operation, the electronic load value switches between A value and B value once upon receiving each trigger signal.

1. Please refer to section 3.1 Select the Operation Mode to set the transient operating mode, including CC, CV, CR, and CP modes.
2. Click **Transient** on the Menu screen to enter the transient test interface.
3. Click the parameter below **Tran Mode**, and in the pop-up mode selection box, click **Toggle** to select this mode.

Parameter	Description
Tran Mode	Select mode: Continuous, Pulse, Toggle.
Trig Source	Select the trigger source. • Manual: Triggered by the [Trig] key.

Parameter	Description
	• Bus: Triggered by a command, such as *TRG. • Trigger1~3: Triggered by Digital IO1~IO3 pins.
Level A	Transient A value.
Level B	Transient B value.
I-Rise	Set the current rising time.
I-Fall	Set the current falling time.
Run/Stop	Run/Stop the transient operation.

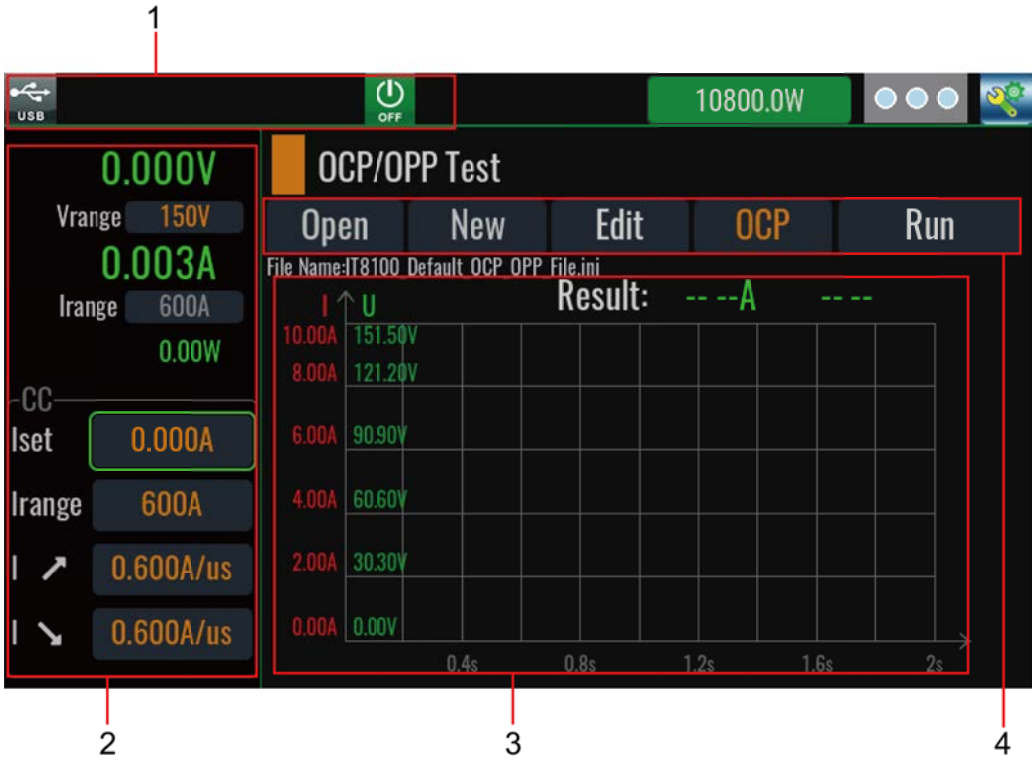
4. Set transient test parameters.
5. Press **[On/Off]** on the front panel to turn on the load input.
6. Press **Run** on the transient interface.
7. Based on the selected trigger method, perform the trigger operation.

   Take the manual trigger as an example. Press the **[Trig]** key on the front panel to run a transient operation.
8. Click **Stop** to stop the present running.

4.3 OCP/OPP Test Function

OCP (or OPP) provides a gradually increasing current (or power) to test whether the output voltage of the DUT drops below the OCP (or OPP) voltage under overload conditions, thereby determining whether its output protection function is operating correctly.

Click **OCP OPP** in the Menu interface to enter the OCP/OPP test page. The functions of this page are introduced as follows.



1. Status display area: Displays information about the current input status of the instrument.
2. Same as Meter interface for parameter setting and measurement value display.
3. Current (or power)/Voltage curve diagram.
4. OCP/OPP edit button. The functions are described as follows.
   - Open: Select the OCP/OPP file to run.
   - New: Create a new OCP/OPP file.
   - Edit: Edit the OCP/OPP file.
   - OCP/OPP: Select OCP or OPP test mode.
   - Run/Stop: Run/stop the OCP/OPP test function.

4.3.1 OCP Test Function

This series of electronic loads features an overcurrent protection (OCP) test function. In OCP test mode, when the input voltage reaches the Von value, a delay is introduced, and the electronic load begins to operate. At regular intervals, the current increases by a set step value, while the input voltage of the load is monitored to determine whether it exceeds the OCP voltage threshold. If the voltage exceeds the threshold, it indicates that OCP has not yet been triggered, and the current stepping operation continues until the cut-off current is reached. If the voltage is lower than the threshold, it indicates that OCP has

been triggered. The current value is then checked to see if it falls within the target range. If it is within the range, the test passes; otherwise, it fails.

Edit OCP files

1. Click **OCP OPP** on the Menu screen to enter the OCP/OPP test interface.
2. Click the **OCP/OPP** button to switch the mode to OCP.
3. Click the **New** button to create a new OCP file.
4. Click the **Edit** button on the interface to enter the OCP/OPP file edit interface. The parameter description of the OCP/OPP edit interface is as follows.

Parameter	Description
File Name:	OCP/OPP file name.
Common Setting	
Auto Start Voltage	Set the start voltage. The load will begin operating only when the input voltage exceeds this value.
Delay	Set the start delay time. The load will only begin to operate once the input voltage exceeds the start voltage and the set delay time has elapsed.
Range	Set the current range.
Parameter Setting	
Start Current	Set the start current.
End Current	Set the end current.
Step	Set the step current.
Step Dwell	Set the step dwell.
Count	Set the step count.
OCP Volt	Set the OCP voltage value. When the DUT output voltage falls below this value, the load will stop operating.
Specification High	Set the OCP high specification value.
Specification Low	Set the OCP low specification value.
Button Description	
Open	Select the OCP/OPP file to run.
Save	Save the OCP/OPP file.
Save As	Save the edited OCP/OPP file under a different file name.
Delete	Delete the OCP/OPP file.

Note

- The OCP low and high specification value should be set between the start current and end current.
- It is recommended to set the start delay time longer than the time required for the source voltage to ramp up to the set value, in order to avoid triggering OCP during the voltage ramp-up and causing the test to end prematurely.

5. Set the OCP test parameters and press the **Save** button to save.
6. Click  to return to the OCP/OPP main interface.

Select/Run OCP File

If multiple OCP files have been edited, press **Open** to recall the OCP file for testing. The detailed operation steps are as follows.

1. Click **OCP OPP** on the Menu screen to enter the OCP/OPP test interface.
2. Click the **Open** button on the interface, select the saved OCP.ini file, and click the **Open** button to confirm the selection.
3. Press **[On/Off]** on the front panel to turn on the load input.
4. Press **Run** on the OCP/OPP main interface.

   When the load input voltage reaches the set Von value, the OCP file will be triggered to run.
5. Click **Stop** to stop the present running.

4.3.2 OPP Test Function

This series of electronic loads features an overpower protection (OPP) test function. In OPP test mode, when the input voltage reaches the Von value, a delay is introduced, and the electronic load begins to operate. At regular intervals, the power increases by a set step value, while the input voltage of the load is monitored to determine whether it exceeds the OPP voltage threshold. If the voltage exceeds the threshold, it indicates that OPP has not yet been triggered, and the power stepping operation continues until the cut-off power is reached. If the voltage is lower than the threshold, it indicates that OPP has been triggered. The power value is then checked to see if it falls within the target range. If it is within the range, the test passes; otherwise, it fails.

Edit OPP files

1. Click **OCP OPP** on the Menu screen to enter the OCP/OPP test interface.
2. Click the **OCP/OPP** button to switch the mode to OPP.
3. Click the **New** button to create a new OPP file.
4. Click the **Edit** button on the interface to enter the OCP/OPP file edit interface. The parameter description of the OCP/OPP edit interface is as follows.

Parameter	Description
File Name:	OCP/OPP file name.
Common Setting	
Auto Start Voltage	Set the start voltage. The load will begin operating only when the input voltage exceeds this value.
Delay	Set the start delay time. The load will only begin to operate once the input voltage exceeds the start voltage and the set delay time has elapsed.
Range	Set the current range.
Parameter Setting	
Start Current	Set the start power.
End Current	Set the end power.
Step	Set the step power.
Step Dwell	Set the step dwell.
Count	Set the step count.
OPP Volt	Set the OPP voltage value. When the DUT output voltage falls below this value, the load will stop operating.
Specification High	Set the OPP high specification value.
Specification Low	Set the OPP low specification value.
Button Description	
Open	Select the OCP/OPP file to run.
Save	Save the OCP/OPP file.
Save As	Save the edited OCP/OPP file under a different file name.
Delete	Delete the OCP/OPP file.

Note

- The OPP low and high specification value should be set between the start power and end power.
- It is recommended to set the start delay time longer than the time required for the source voltage to ramp up to the set value, in order to avoid triggering OPP during the voltage ramp-up and causing the test to end prematurely.

5. Set the OPP test parameters and press the **Save** button to save.
6. Click  to return to the OCP/OPP main interface.

Select/Run OPP File

If multiple OPP files have been edited, press **Open** to recall the OPP file for testing. The detailed operation steps are as follows.

1. Click **OCP OPP** on the Menu screen to enter the OCP/OPP test interface.
2. Click the **Open** button on the interface, select the saved OPP.csv file, and click the **Open** button to confirm the selection.
3. Press **[On/Off]** on the front panel to turn on the load input.
4. Press **Run** on the OCP/OPP main interface.

   When the load input voltage reaches the set Von value, the OPP file will be triggered to run.
5. Click **Stop** to stop the present running.

4.4 Sweep Function

The Sweep function supports various sweep input waveforms, including linear sweep, logarithmic sweep, and user-defined waveforms (List). It not only performs the sweep input but also executes measurements at each sweep step.

Introduction of Sweep interface

Click **Sweep** in the Menu interface to enter the Sweep function page. The functions of this page are introduced as follows.

- Run/Stop: Run/Stop the Sweep operation.
- U-I / I-U / Data List: Display of measurement data types during Sweep function operation.

  - U-I: Current-voltage curve, where the Y-axis represents voltage and the X-axis represents current.
  - I-U: Voltage-current curve (voltammetric characteristic curve), where the Y-axis represents current and the X-axis represents voltage.
  - Data List: The list of measurement data.

- Auto: Automatically adjusts the scale of the curve display on the X and Y axes so that the user can see the complete curve.
- Clear: Clear the history curve, the curve being drawn will not be cleared.
- Setting: Enter Sweep function parameter setting mode.

  If Sweep is running at this time, all settings in the Setting screen will be grayed out and parameter settings cannot be modified.
- 0.000V / 0.000A: Starting value for X and Y coordinate axes (voltage and current).
- 160.000V / 600.000A: Ending value for X and Y coordinate axes (voltage and current).
- Measure: Characteristic parameter display switch, when turned on, it can display the maximum value of voltage, maximum value of current, maximum value of power of the latest curve and the value of voltage and current at this time.
- Cursor: Cursor line. When turned on, there is a red cursor line. This displays the focus value of the red cursor line when it intersects the latest line.
- 

: Sweep / List running status display. The progress bar and percentage at the top of the screen indicate the total number of steps in Sweep / List and how many steps have been run. The Step below indicates the set value of a single step.

Operation methods

1. Click **Sweep** on the Menu screen to enter the Sweep function interface.
2. Click the **Setting** button on the interface to enter the Sweep function setting interface. The parameter description of the Sweep function setting interface is as follows.

Table 4–1 Load Setting

Parameter	Description
General	
Load Mode	Set the load operation mode: CC/CV/CR/CP/CC Pulse.
I-Range/V-Range/ R-Range	Set the sweep range. Supports Fixed range / Best range. • Fixed range: Sweeps the input with a fixed range. • Best: Select a fixed range that covers all sweep values.

Parameter	Description
I-Base	Set the pulse base current.
Super Power	Whether to enable the **Instantaneous Overpower Input** function.
Width	Set the pulse width time.
Delay	Set the pulse delay time.
Slew Set	
Slew Type	Select the slew type. • Time: Describe the slew of the device in terms of time。 • Rate: standard slew, unit is A/μs or A/ms.
Slew Rate	Set the slew rate to high or low. This setting is visible only when the slew type is set to Rate.
I-Rise	Set the current rising time. • When Slew Type is Time, the setting range is 0.000002s~10.00000s. • When Slew Type is Rate, the adjustable range varies depending on the model.
I-Fall	Set the current falling time. • When Slew Type is Time, the setting range is 0.000002s~10.00000s. • When Slew Type is Rate, the adjustable range varies depending on the model.

Table 4–2 Common Setting

Parameter	Description
General	
Mode	Set the Sweep mode. • Linear: Scans from the start to the end in linear incremental steps. • Log: Scans from the start to the end in logarithmic incremental steps. • List: Scans the values defined in the setup list.
End Value	Set the sweep end type. • Last: After sweep has finished running, always input the value of the last step. • Normal: After sweep has finished running, always input the value of the normal mode setting.

Parameter	Description
Cycle Count	Sweep cycle count: 0 represents an infinite loop, with a maximum of 10000 cycles.
Step Set	
Single Step Cycle Count	Set the single-step cycle count.
Step	Sets the sweep step value (incremental step value). Not applicable to Log and List sweep modes. When the sweep mode is Linear, the Points and Step settings conflict with each other. If Points is set, the Step value is automatically generated; if Step is set, the Points value is automatically generated.
Points	Set the number of sweep steps.
Start	Sets the sweep start value.
Stop	Sets the sweep stop value.
When the Sweep mode is set to List, each value in the list must be configured. The relevant parameter descriptions are as follows.	
No	Single-step number.
Amps/Volts/Pow/Ohms	Value per step.
Open File	Open a List file that already exists inside the instrument or is saved on a USB flash drive.
New File	Create a new List file.
Edit File	Edit the List file.
Delete File	Delete the List file.

Table 4–3 Trigger Setting

Parameter	Description
General	
Start Trigger Source	Set the start trigger source. • Manual: Triggered by the [Trig] key. • Bus: Triggered by a command, such as *TRG. • Trigger: Triggered by Digital IO1~IO3 pins. • Voltage: Voltage trigger. When the DC terminals detect that the voltage reaches the trigger voltage setting and is within the upper and lower trigger limits, a trigger is generated.
Start Trigger Delay	Indicates the delay time between receiving the trigger signal and executing the first step.

Parameter	Description
Step Source	Set the step trigger source. • Bus: Triggered by a command, such as *TRG. • Trigger: Triggered by Digital IO1~IO3 pins. • Timer: Timer trigger method.
Trigger Interval Minimum	Set the minimum allowed interval between triggers. This setting needs to be configured when the Step Source is set to **Bus** or **Trigger**.
Period	Set the cycle time for periodic triggering. This setting needs to be configured when the Step Source is set to **Time**.
Output	
Output Trigger Before Step	Trigger signal output switch. • Off: Disables this function. • Trigger: The trigger signal is output through the IO5~IO7 pins before the start of a single step.
Output Trigger After Step	Trigger signal output switch. • Off: Disables this function. • Trigger: The trigger signal is output through the IO5~IO7 pins after the end of a single step.
Output Trigger At Sot	Trigger signal output switch. • Off: Disables this function. • Trigger: The trigger signal is output through the IO5~IO7 pins at the start of the sweep.
Output Trigger At Eot	Trigger signal output switch. • Off: Disables this function. • Trigger: The trigger signal is output through the IO5~IO7 pins at the end of the sweep.

Table 4–4 Graph Setting

Parameter	Description
Line Num	Used to set the number of lines to be displayed (1-20).
Volts Scale	Used to set the voltage display scale.
Volts Invert	Used to set the voltage invert display switch.
Amps Scale	Used to set the current display scale.

Parameter	Description
Amps Invert	Used to set the current reverse display switch.
Export Data	Used for data export.

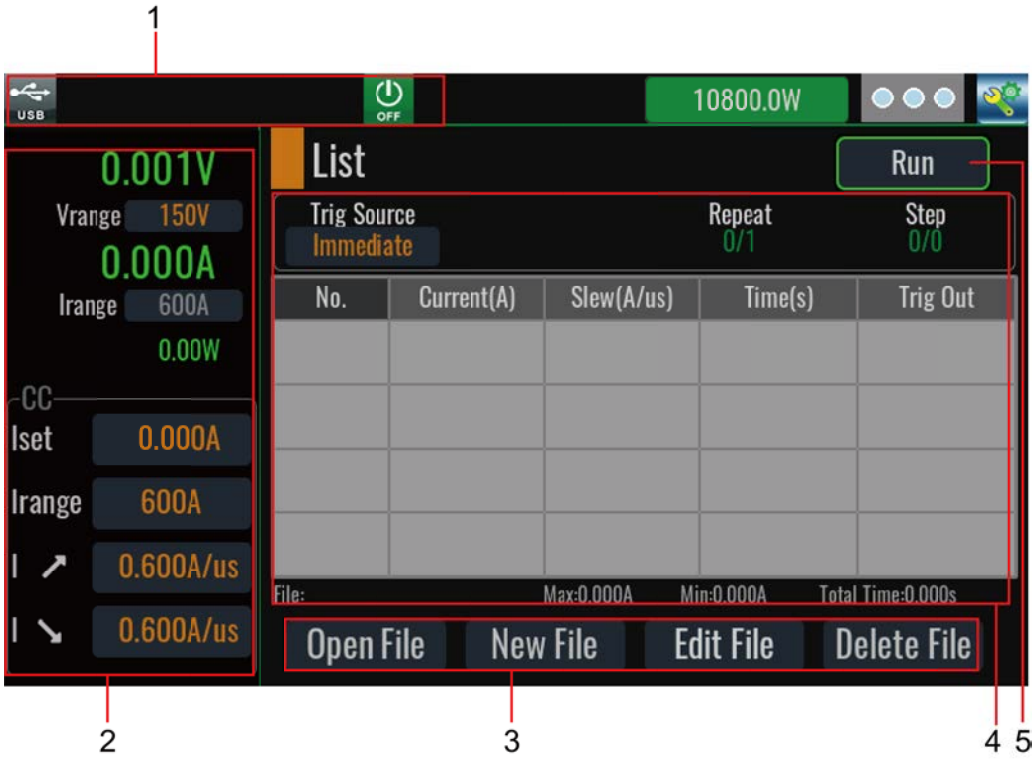
3. After the parameters are set, turn on the **[On/Off]** switch.
4. Press **Run** on the Sweep main interface.
5. Triggers Sweep to run according to the triggering source that has been set.
6. Click **Stop** to stop the present running.

4.5 List Function

Users can edit multi-step test programs through the List function. This feature supports creating up to 1000 List files, with each List file containing up to 9999 test steps. For each step, users can set parameters such as voltage/current/power/resistance, slope, and duration. In addition, users can specify the number of repetitions and the final state for each List file. Once editing is complete, users can select the desired List file and trigger execution according to the preset trigger mode.

Introduction of List interface

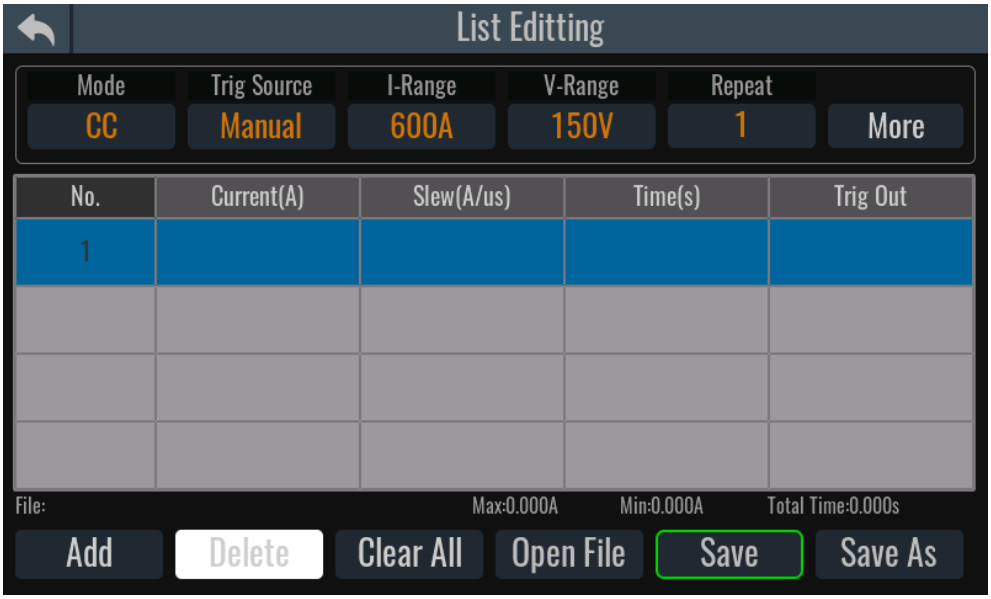
Click **List** in the Menu interface to enter the List function page. The functions of this page are introduced as follows.



1. Status display area: Displays information about the current input status of the instrument.
2. Same as Meter interface for parameter setting and measurement value display.
3. List edit button. The functions are described as follows.
   - Open File: Select the List file to run.
   - New File: Create a new List file.
   - Edit File: Edit the List file.
   - Delete File: Delete the List file.
4. List display area: This area mainly displays the edited List, you can view this list by sliding up and down.
5. Run/Stop: Run/stop the List test function.

Edit List files

1. Click **List** on the Menu screen to enter the List function interface.
2. Click the **Edit File** button on the interface to enter the List file edit interface. The parameter description of the List edit interface is as follows.



Parameter	Description
Edit the attribute parameters of List file.	
Mode	Select the List operating mode: CC, CV, CR, CP.
Trig Source	Select the trigger source. • Manual: Triggered by the [Trig] key. • Bus: Triggered by a command, such as *TRG. • Trigger: Triggered by Digital IO1~IO3 pins.
Repeat	The number of times the List file loops; 0 indicates an infinite loop, and the maximum is 65,535 cycles.
More	Click More to enter the Setting interface and configure additional parameters.
End Value	Set the final waveform, with the following options available. • Normal: Return to normal after operation. • Last: Keep the last waveform output unchanged after operation.
Slew Type	Select the slew type. • Time: Describe the slew of the device in terms of time。 • Rate: standard slew, unit is A/μs or A/ms.
Slew Rate	Set the slew rate to high or low. This setting is visible only when the slew type is set to Rate.
I-Range/R-Range	Set current/resistance range.
V-Range	Set voltage range.

Parameter	Description
PACing	Method of step jumps to next step. Auto: when the time is out, jumps to next step. Trig: receive a trigger signal, jumps to next step.
Trig Out Map	Select the pin for outputting the trigger signal: Trigger1, Trigger2, or Trigger3, corresponding to Digital IO5 to IO7 pins.
Edit the step parameters of List file.	
No.	Step number of list.
Current/Voltage/ Resistance/Power	Voltage/Current/Resistance/Power value of the current step.
Slew	Slew value.
Time	Width time. The range is from 0.00001 to 5000 in seconds.
Trig Out	Step trigger signal output switch. • OFF: Disables this function. • BOS: Outputs a trigger signal before the step starts. • EOS: Outputs a trigger signal after the step ends.
File	List file name.
Button Description	
Insert	Insert steps.
Delete	Delete steps.
Clear All	Delete all steps.
Open	Select the List file to run.
Save	Save the List file.
Save As	Save the edited List file under a different file name.

3. Set the List parameters and press the **Save** button to save.
4. Click  to return to the List main interface. The List display area will show the edited List file.

Select/Run List File

If multiple List files have been edited, press **Open** to recall the List file for testing. The detailed operation steps are as follows.

1. Click **List** on the Menu screen to enter the List function interface.
2. Click the **Open** button on the interface, select the saved List.csv file, and click the **Open** button to confirm the selection.

3. Press **[On/Off]** on the front panel to turn on the load input.
4. Press **Run** on the List main interface.
5. Based on the selected trigger method, perform the trigger operation.

   Take the manual trigger as an example. Press the **[Trig]** key on the front panel to run the selected List file.
6. Click **Stop** to stop the present running.

4.6 CD Arb Function

This series of loads supports the CD Arb function in CC, CR, CP, and CV modes. It allows importing up to one million data points via a CSV file, using voltage, current, power, or resistance as parameters to achieve dynamic load variation. All data points share the same dwell time (configurable, minimum 10 μs), making it suitable for test scenarios that require precise control of load variation timing.

Introduction of CD Arb interface

Click **CD Arb** in the Menu interface to enter the CD Arb function page. The functions of this page are introduced as follows.

1. Status display area: Displays information about the current input status of the instrument.
2. Same as Meter interface for parameter setting and measurement value display.

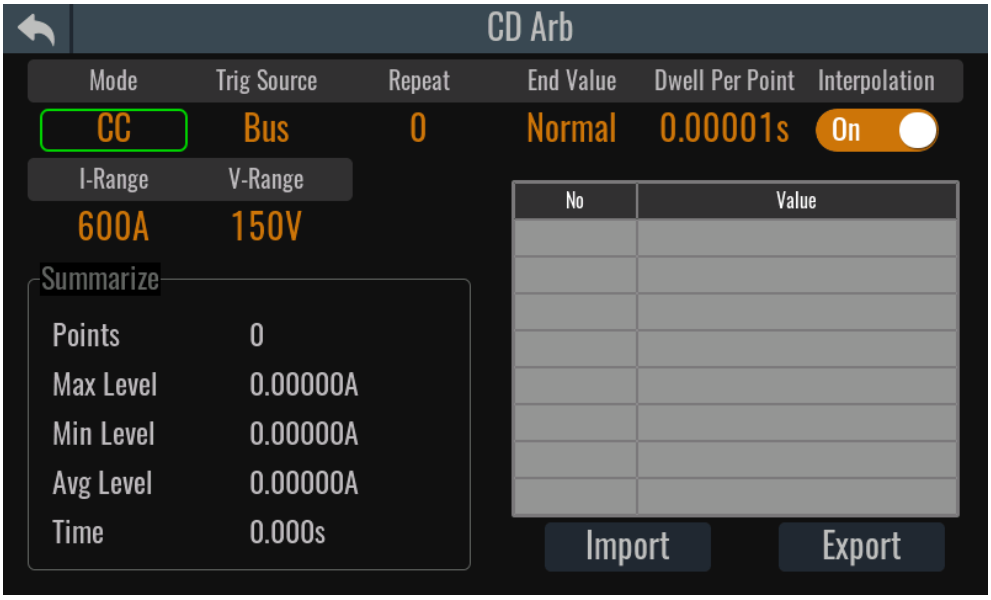
3. Overview of CD Arb file Parameters.
4. Value: The value of the currently running data point.

   Time: A time progress bar that displays the total length of the CD Arb test and how long it has currently been running.
5. Run/Stop: Run/stop the CD Arb operation.

   Edit: Edit the CD Arb file.

Operation methods

1. Click **CD Arb** on the Menu screen to enter the CD Arb function interface.
2. Click the **Edit** button on the interface to enter the CD Arb file edit interface. The parameter description of the CD Arb edit interface is as follows.



Parameter	Description
Mode	Select the List operating mode: CC, CV, CR, CP.
Trig Source	Select the trigger source. • Manual: Triggered by the [Trig] key. • Bus: Triggered by a command, such as *TRG. • Trigger1~3: Triggered by Digital IO1~IO3 pins.
Repeat	The number of times the CD Arb file loops; 0 indicates an infinite loop, and the maximum is 65,535 cycles.
End Value	Set the final waveform, with the following options available. • Normal: Return to normal after operation. • Last: Keep the last waveform output unchanged after operation.
Dwell per Point	The dwell of time that each data point resides. The range is from 0.00001 to 100 in seconds.

Parameter	Description
Interpolation	• On: Inserts linear transitions between adjacent points. • Off: Outputs each point directly based on the configured maximum slew rate.
I-Range/R-Range	Set current/resistance range.
V-Range	Set voltage range.
Summarize	Overview of Data Point Parameters.
Import	Import Data Point Parameters.
Export	Export Data Point Parameters.

3. Click the **Import** button and select import waveform data.
4. Press **[On/Off]** on the front panel to turn on the load input.
5. Press **Run** on the CD Arb main interface.
6. Based on the selected trigger method, perform the trigger operation.

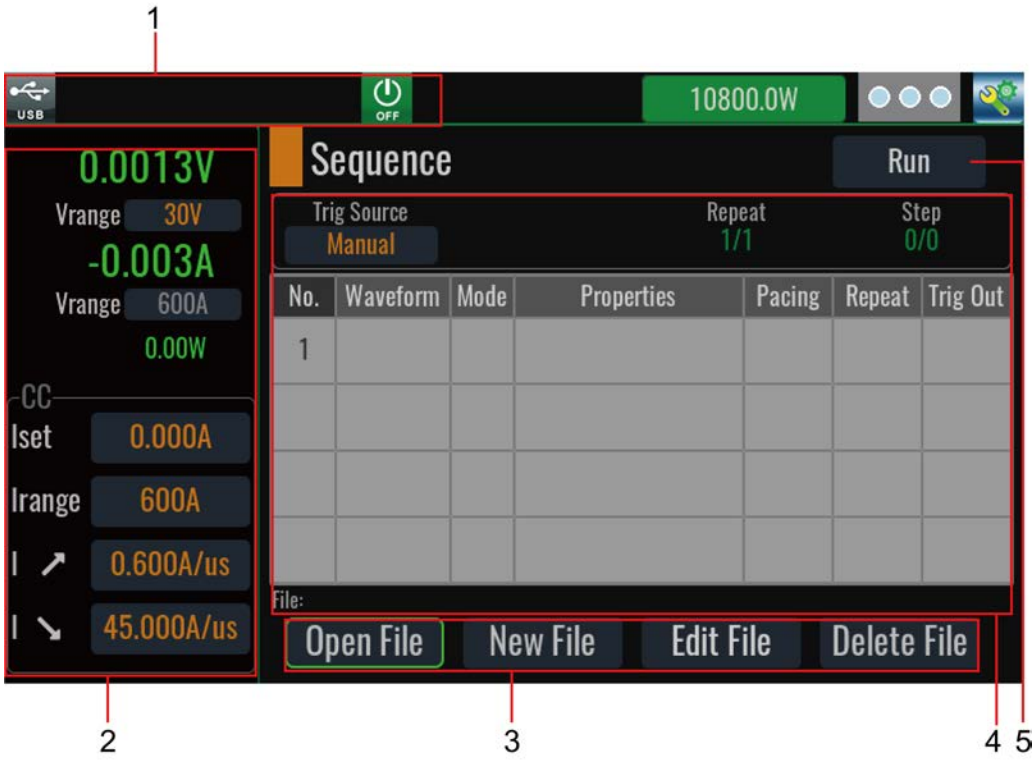
   Take the manual trigger as an example. Press the **[Trig]** key on the front panel to run the selected CD Arb file.
7. Click **Stop** to stop the present running.

4.7 Arb Sequence

An arbitrary waveform sequence allows multiple different ARB waveforms to run sequentially. Supported ARB waveform types include Step, Pulse, Ramp, Trapezoid, Staircase, Exponential, Sine, User Defined, and List. Each ARB waveform can be individually configured with its own repeat count and run mode, while the entire sequence can also be assigned a common repeat count and trigger mode.

Introduction of Sequence interface

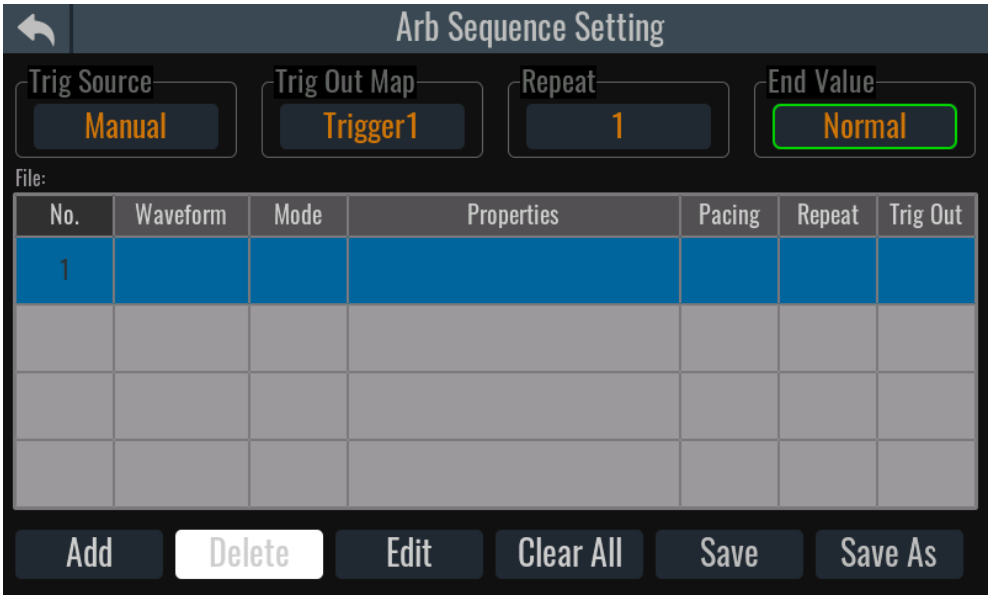
Click **Sequence** in the Menu interface to enter the Sequence function page. The functions of this page are introduced as follows.



1. Status display area: Displays information about the current input status of the instrument.
2. Same as Meter interface for parameter setting and measurement value display.
3. Sequence edit button. The functions are described as follows.
   - Open File: Select the Sequence file to run.
   - New File: Create a new Sequence file.
   - Edit File: Edit the Sequence file.
   - Delete File: Delete the Sequence file.
4. Sequence display area: This area mainly displays the edited Sequence, you can view this Sequence by sliding up and down.
5. Run/Stop: Run/stop the Sequence test function.

Edit Sequence files

1. Click **Sequence** on the Menu screen to enter the Sequence function interface.
2. Click the **Edit File** button on the interface to enter the Sequence file edit interface. The parameter description of the Sequence edit interface is as follows.



Parameter	Description
Edit the attribute parameters of Sequence file.	
Trig Source	Select the trigger source. • Manual: Triggered by the [Trig] key. • Bus: Triggered by a command, such as *TRG. • Trigger: Triggered by Digital IO1~IO3 pins.
Trig Out Map	Select the pin for outputting the trigger signal: Trigger1, Trigger2, or Trigger3, corresponding to Digital IO5 to IO7 pins.
Repeat	The number of times the Sequence file loops; 0 indicates an infinite loop, and the maximum is 65,535 cycles.
End Value	Set the final waveform, with the following options available. • Normal: Return to normal after operation. • Last: Keep the last waveform output unchanged after operation.
Edit the step parameters of Sequence file.	
No.	Step number of Sequence.
Waveform	Arb waveform type: Step, Pulse, Ramp, Trapezoid, Staircase, Exponential, Sine, User defined, List.
Mode	Select the Sequence operating mode: CC, CV, CR, CP.
Properties	ARB waveform properties.
PACing	Method of step jumps to next step. Auto: when the time is out, jumps to next step.

Parameter	Description
	Trig: receive a trigger signal, jumps to next step.
Repeat	Repeat number of Arb waveform.
Trig Out	Step trigger signal output switch. • OFF: Disables this function. • Begin Of Wave: Outputs a trigger signal before the step starts. • End Of Wave: Outputs a trigger signal after the step ends.
File	Sequence file name.
Button Description	
Insert	Insert steps.
Delete	Delete steps.
Edit	Edit the selected ARB curve information.
Clear All	Delete all steps.
Save	Save the Sequence file.
Save As	Save the edited Sequence file under a different file name.

3. Click the **Insert** button to insert an ARB waveform into the sequence, then select it and click the **Edit** button to edit its detailed parameters.

In this interface, you can click **Add** to add a new step, **Delete** to remove the current step, and use the forward and backward arrow keys to select the step to be edited. This makes it easier for users to edit the entire sequence.

The following describes the meaning of the parameters for each type of ARB waveform.

Parameter	Description

Common Parameters	• Mode: Sets the operating mode for current step waveform, options include CC, CV, CR, and CP.
	• Waveform: The waveform type of the current step, including Step, Pulse, Ramp, Trapezoid, Staircase, Exponential, Sine, User defined, and List.
	• Sequ Pacing: Method of step jumps to next step.
	  • Auto: when the time is out, jumps to next step.
	  • Trig: receive a trigger signal, jumps to next step.
	• Repeat: The number of times the current step waveform file loops; 0 indicates an infinite loop, and the maximum is 65,535 cycles.
	• Trig Out: Step trigger signal output switch.
	  • OFF: Disables this function.
	  • Begin of Wave: Outputs a trigger signal before the step starts.
	  • End of Wave: Outputs a trigger signal after the step ends.
	• I-Range/R-Range: Set current/resistance range.
	• V-Range: Set voltage range.
	Convert: Convert the selected waveform type into a user defined waveform. Convenient for users to modify waveform parameters directly based on the present waveform.

Step	• **V0/I0/P0/R0**: Initial amplitude setting before the step starts. • **V1/I1/P1/R1**: Target amplitude setting after the step. • **T0**: Delay time from receiving the trigger signal to the start of the step. • **T1**: Duration for which the output remains at the target amplitude after the step.
Pulse	• **V0/I0/P0/R0**: Baseline amplitude before and after the pulse. • **V1/I1/P1/R1**: Peak amplitude during the pulse. • **T0**: Delay time from receiving the trigger signal to the start of the pulse. • **T1**: Duration of the pulse (pulse width). • **T2**: Duration for which the output remains at the baseline value after the pulse ends.

Parameter	Description
	• **Freq**: Frequency input. This value will automatically adjust T0, T1, and T2.
Ramp	• **V0/I0/P0/R0**: Initial amplitude setting before the ramp starts. • **V1/I1/P1/R1**: Target amplitude setting at the end of the ramp. • **T0**: Delay time from receiving the trigger signal to the start of the ramp. • **T1**: Time for the output to ramp up from the initial to the target amplitude. • **T2**: Duration for which the output remains at the target amplitude after the ramp ends.
Trapezoid	• **V0/I0/P0/R0**: Initial amplitude setting before the waveform starts. • **V1/I1/P1/R1**: Target amplitude setting at the top of the waveform. • **T0**: Delay time from receiving the trigger signal to the start of the rising edge. • **T1**: Time for the output to ramp up from the initial to the target amplitude. • **T2**: Duration for which the output remains at the target amplitude. • **T3**: Time for the output to ramp down from the target to the initial amplitude. • **T4**: Duration for which the output remains at the initial amplitude after the waveform ends.
Staircase	• **V0/I0/P0/R0**: Initial amplitude setting before the staircase starts. • **V1/I1/P1/R1**: Target amplitude setting after the staircase ends. The difference between the initial and target values is evenly distributed across all steps. • **T0**: Delay time from receiving the trigger signal to the start of the staircase. • **T1**: Total time required to complete all step transitions. • **T2**: Duration for which the output remains at the target amplitude after the staircase completes. • **Step**: Total number of steps in the staircase, defining how the amplitude transitions are segmented.

Parameter	Description
Exponential	• **V0/I0/P0/R0**: Initial amplitude setting before the exponential waveform starts. • **V1/I1/P1/R1**: Target amplitude setting after the exponential transition completes. • **T0**: Delay time from receiving the trigger signal to the start of the exponential waveform. • **T1**: Time required for the amplitude to transition from the initial to the target value, following an exponential curve. • **Tc**: Time constant that determines the rate of exponential change. A smaller value means a faster transition; a larger value indicates a slower change.
Sine	• **V1/I1/P1/R1**: Amplitude (peak value) of the sine wave. • **V0/I0/P0/R0**: Offset relative to zero, the offset must not be smaller than the amplitude. • **Freq**: Frequency of the sine wave, in Hertz (Hz).
User defined	**Step Parameters** • No.: Step number of User defined. • Current/Voltage/ Resistance/Power: Voltage/Current/ Resistance/Power value of the current step. • Time: Width time. The range is from 0.00001 to 100 in seconds. **Button Description** • Open File: Select the User defined file to run. • New File: Create a new User defined file. • Delete File: Delete the User defined file. • Save: Save the User defined file. • Save As: Save the edited User defined file under a different file name.
List	Parameter descriptions are the same as those in the 4.5 List Function.

4. After completing the editing, press the  to return to the sequence editing interface.
5. Set the Trig Source, Trig Out Map, Repeat, and End Type parameters, then click the **Save** button.
6. Click  to return to the Sequence main interface. The Sequence display area will show the edited Sequence file.

Select/Run Sequence File

If multiple Sequence files have been edited, press **Open** to recall the Sequence file for testing. The detailed operation steps are as follows.

1. Click **Sequence** on the Menu screen to enter the Sequence function interface.
2. Click the **Open File** button on the interface, select the saved Sequence.csv file, and click the **Open** button to confirm the selection.
3. Press **[On/Off]** on the front panel to turn on the load input.
4. Press **Run** on the Sequence main interface.
5. Based on the selected trigger method, perform the trigger operation.

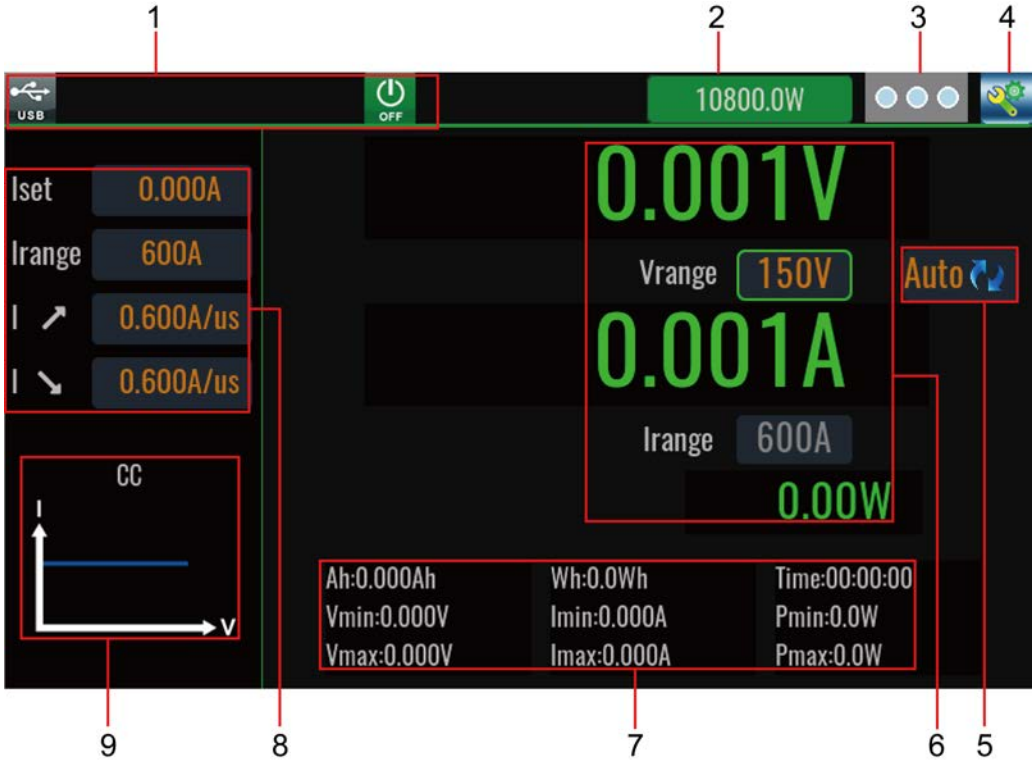
   Take the manual trigger as an example. Press the **[Trig]** key on the front panel to run the selected Sequence file.
6. Click **Stop** to stop the present running.

5 Measurement Functions

This chapter describes the characteristics and operations of the basic metering function of IT8100 series instrument.

5.1 Meter Mode

In the Menu display interface, click **Meter** to enter the metering interface. See the figure below.



No.	Name	Description
1	Status display area	Displays information about the current input status of the instrument.
2	Config	Navigates to the Config interface.

No.	Name	Description
3	Head button	After clicking the Head button, a function window will pop up below the button, containing the "Trig", "Prot Clear", "On/Off", and "Menu" buttons.
4	Power display icon	Displays the maximum available power value currently.
5	Measurement trigger mode (Auto/Manual)	• Continue & Measure (Auto): Automatically and continuously refreshes the Meter value. • Manual Trigger Mode (Manual): Manual triggering is required, and the trigger signal of the Trig button must be received before refreshing the Meter value.
6	Main measurement value display area	Real-time display of measured values for voltage, current, and power, as well as voltage and current range information.
7	Measured value display area	The measured values are displayed in real time.
8	Setting value editing area	The setting parameters of the current operation mode.
9	Operation mode	Displays the current operation mode of the instrument.

5.2 Oscilloscope Function

This series of loads provides a waveform display function based on sampled data. Users can choose to show or hide input voltage and current waveforms, displaying only the necessary signals for easier observation. The waveform display interface includes both vertical and horizontal axes, offering a clear and intuitive view.

When testing high-current waveforms, using traditional current probes often requires multiple probes in parallel, resulting in complicated wiring and difficult installation. With the built-in oscilloscope function of the load, waveform acquisition and display can be completed without additional high-current probes. This simplifies test wiring, improves testing efficiency, and effectively reduces both testing cost and risk.

Introduction of Waveform Display interface

In the Menu display interface, click **Scope** to enter the waveform interface. See the figure below.

The trigger status is described as follows:

Trigger status	Description
Auto	Acquisition is triggered when the trigger condition is met. If no trigger occurs within the preset time, the system will automatically trigger to refresh the waveform.
Roll	When the time base is ≥ 50 ms, the waveform will continuously scroll and update over time.
Arm	The system is acquiring and updating waveform data before the trigger point (filling the pre-trigger buffer), then enters Ready.
Ready	The trigger system is armed and continuously monitors the trigger condition, waiting for a valid trigger event.

Trigger status	Description
Trig'd	A valid trigger event has been detected; the trigger point is determined, and acquisition continues for the post-trigger waveform data.
Stop	When the “Stop” key in the waveform display interface is pressed, the trigger status Stop will be displayed.

Description of keys on the waveform display interface:

- Auto: Automatically adjust the appropriate time base, voltage/current scale, and restore the trigger level and trigger delay to default values.
- Voltage/Current/Time: Adjust voltage/current/time base range.
- Single: Single measurement key: when single measurement is enabled in the Stop status, the stop status is enabled again after one measurement based on the current data updating rate. When single measurement is enabled in the Ready status, the instrument immediately restarts one measurement and then enters the Stop status.
- Run/Stop: press the corresponding soft key to run or stop the waveform status.
- Setting: Advanced configuration options for oscilloscope function.

Parameter	Description
Common Setting	
Trigger source	Set the trigger source. • Load: Load change trigger. It indicates that a trigger signal is generated when the load value of the instrument changes. • Voltage: Voltage trigger. When the DC terminals detect that the voltage reaches the trigger voltage setting value and is within the range of the upper and lower trigger limits, a data recording operation is triggered. • Current: Current trigger. When the DC terminals detect that the current reaches the trigger current setting value and is within the range of the upper and lower trigger limits, a data recording operation is triggered. • Manual: Triggered by the [Trig] key. • Bus: Triggered by a command, such as *TRG. • Trigger1: Triggered by Digital IO1 pins. • Trigger2: Triggered by Digital IO2 pins.

Parameter	Description
Trigger slope	Select trigger edge. • Rise: Rising edge trigger. • Fall: Falling edge trigger. • Both: Triggered by rising and falling edges.
Trigger mode	Auto and Normal can be selected.
Recorder length Max	Set the maximum data length.
Print mode	Set [Print] key to export data • BMP: Press [Print] in the Scope interface to take a screenshot only without exporting data. • BMP&Data: Press [Print] in the Scope interface to take a screenshot and export the raw data at the same time.
Sample mode	Set the sampling mode, with options for Normal or Peak.
Interp Method	Set the interp method, with options for Linear or Discrete.
Export To Udisk	Exports raw data from the Scope run.
Line Setting	
Line1 DC Volt	Choose to display the waveform type as voltage, current or voltage and current. Select On to display the corresponding waveform, and select Off to not display it.
Line2 Current	
Zero Position	Set the zero position.
Coupling Mode	Select the coupling mode (DC or AC), the default frequency for AC coupling is 5 Hz.

Trigger waveform

When the specified trigger conditions are satisfied, the trigger waveform will be displayed. The triggering time is the trigger point, generally on the middle of the screen. When the trigger point is reached, the screen will display the waveform from left to right over time. The user should set the following parameters before using the trigger function.

- Trigger mode

  The trigger mode refers to the condition to update the contents on the screen. It is divided into the Auto mode and Normal mode. In the Auto mode, the displayed waveform will be updated when triggering occurs in the suspension time; otherwise, the displayed waveform will be updated automatically.

In the Normal mode, the displayed waveform will be updated in the case of triggering and not updated in the case of no triggering.

- Trigger source

  The trigger source is used for generating trigger conditions

- Trigger edge

  The edge refers to the change of the signal from low level to high level (rising edge) or from high level to low level (falling edge). The edge used as a trigger condition is referred to as the trigger edge.

- Trigger level

  The trigger level refers to the level which the trigger edge passes through. If the signal of the trigger source passes through the set trigger level according to the specified trigger edge, triggering occurs.

  When "U↑" is selected for editing, you can adjust the trigger level using the knob, number keys, or arrow keys. In this case, the trigger level can be changed by rotating the knob and you can observe trigger level changes on the screen.

Horizontal Control and Vertical Control

- Vertical calibration

  When V/grid or A/grid is selected, you can rotate the knob to set the voltage or current range of each interval.

- Horizontal calibration

  When Time/grid is selected, you can rotate the knob to adjust the horizontal scale (scanning speed). When the horizontal (time/scale) setting is changed by rotating the knob, you can observe the change of time/scale on the screen.

- Trigger delay

  You can adjust the trigger delay using the editing box (knob/directional keys/numeric keys) or by horizontal sliding. The default trigger delay is 0, which positions the trigger point () in the middle of the waveform display area. When the trigger delay value is positive, the trigger point moves to the left; when it is negative, the trigger point moves to the right.

Print data

In the **Setting** menu, users can select the **Print mode** item and select the data logging mode. Data of oscilloscope interface will be recorded to U disk. Print data mode:

- BMP: Press [Print] in the Scope interface to take a screenshot only without exporting data.
- BMP&Data: Press [Print] in the Scope interface to take a screenshot and export the raw data at the same time.

5.3 Recorder Function

The data recording function allows you to observe and record input status data for a long time. On the recorder interface, you can select a maximum of four data curves to be displayed.

In the Menu display interface, click **Recorder** to enter the data recording function interface. See the figure below.

- Run/Stop: Runs or stops data recording.
- Clean: Clear the currently drawn graph (the original data still exists). If Clean is executed during Run, recording will automatically restart.
- Auto: Self-adaptive function. The screen will automatically adjust the drawing height according to the actual measurement data.
- Hold-On/Hold-Off: Pause/Resume data recording or curve plotting.
- Setting: Enter to the advanced menu to set more parameters.

Parameter	Description
Viewing	
Curve 1/2/3/4	Select the curve type under Recorder function, support up to 4 curves simultaneously.
Item	Select the type of curve to plot. Options include: VMax, VMin, IMax, IMin, DVMVMax, DVMVMin.
Mode	Set the display mode of the curve, DC or AC can be selected. • DC mode: The curve scale is displayed centered on 0.

Parameter	Description
	• AC mode: The curve scale takes the lowest value of a waveform as the scale Base value. The corresponding value of the display scale is Base + Div.
Advanced	
Measurement	Aperture: Take time as the unit, set the measurement speed, range: 20μs ~ 100s.
Record	Select the data objects to be recorded. • Voltage: Enable or disable voltage storage. • Current: Enable or disable current storage. • Min/Max: Enable or disable the storage of voltage and current maximum and minimum values.
	Record Mode: Set the mode of data recording, you can choose Always or Once. • When Always is selected, the Point setting item is hidden. By default, the maximum number of sampling points is 1,000,000. Once this limit is reached, the oldest data will always be overwritten. • When selecting Once, you can set the Point item.
	Point: Set the depth of data recording, that is, the number of collected data points. When the Recorder starts running and the collection quantity reaches the set number, it will automatically stop recording. Setting range: 1~1000000.
Trigger Setting	Select the trigger source of the recorder function. • Immediate: Perform a trigger operation immediately. • Manual: Triggered by the [Trig] key. • Bus: Triggered by a command, such as *TRG. • Trigger: Triggered by Digital IO1~IO3 pins. • Voltage: Voltage trigger. When the DC terminals detect that the voltage reaches the trigger voltage setting value and is within the range of the upper and lower trigger limits, a data recording operation is triggered. • Current: Current trigger. When the DC terminals detect that the current reaches the trigger current setting value and is within the range of the upper and lower trigger limits, a data recording operation is triggered. • Oook: Triggered by the [On/Off] key.

Parameter	Description
	Trigger Slope: Select trigger edge. • Positive: Rising edge trigger. • Negative: Falling edge trigger.
	Voltage/Current: Trigger threshold for voltage or current.
Data Storage	File Format: The formats of the files exported to the USB drive: Tdms or Csv formats.
	Export: Select whether to export the acquired data to a USB flash drive.
	Real time: When enabled, data collected while the Recorder is running will be saved in real time to the inserted USB flash drive. If no USB flash drive is inserted, this option is hidden. • Off: Disable real-time export. • On: Enable real-time export.

- Time: The time value of each of the horizontal coordinates, unit is s/Div
- Vernier: Cursor, Used to observe the moment of data appearance.

5.4 Time Measure

The IT8100 series provides measurement of the rise and fall times of voltage and current, with an accuracy of up to 10μs, comparable to high-precision oscilloscopes. It can be applied to measuring the startup, shutdown, and hold time of power modules, as well as fuse blowing time.

Operation methods

1. Connect the input terminals of the electronic load to the output terminals of the DC power supply to ensure proper connection.
2. Set the power supply output parameters: adjust the voltage and current settings to be higher than the maximum load requirement, and ensure the power output remains **Off**.
3. Click **Time Meas** on the Menu screen to enter the time measurement function interface and set the time measurement conditions.

Parameter	Description
Start Event	Select one of the following signals as the start condition for time measurement: Load On, Load Off, >Current, <Current, >Voltage, <Voltage, Trigger1, Trigger2, or Trigger3. If a voltage or current option is selected, you must specify the corresponding voltage or current value.
End Event	Select one of the following signals as the end condition for time measurement: Load On, Load Off, >Current, <Current, >Voltage, <Voltage, Trigger1, Trigger2, or Trigger3. If a voltage or current option is selected, you must specify the corresponding voltage or current value.
Control Mode	Set the control mode to **Always** or **Once**. If **Always** is selected, you must also set the Hold off time, which is the wait time before the next measurement begins.
Run/Stop	Run/stop the time measure operation.
Clear	Clear the time measurement value.
00:00:00 000.00ms	Time measurement value.

4. Turn on the power output.
5. Turn on the electronic load input.
6. Click **Run** on the Time Measure interface to start the time measurement function.

   Once the configured start and end conditions are met, the electronic load automatically measures the time interval between them and displays the result on the measurement interface.

5.5 Impedance Analysis

IT8100A series features a built-in professional Electrochemical Impedance Spectroscopy (EIS) analysis function. Within a frequency range of 0.01 Hz to 20 kHz, it applies multi-frequency AC excitation to accurately measure the impedance characteristics of various active and passive devices (such as fuel cells, inductors, and capacitors) as well as power supply systems.

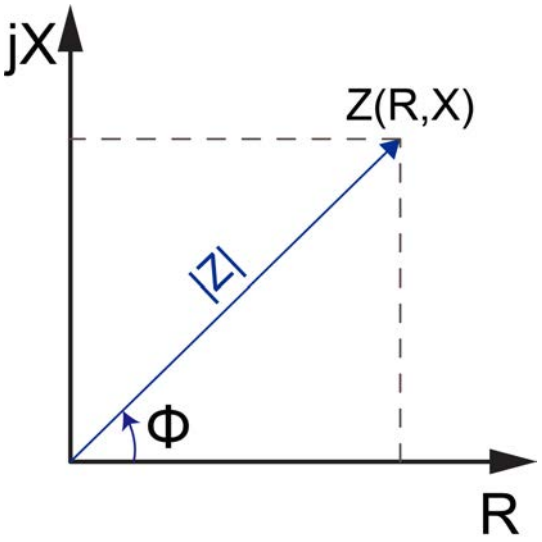
The function captures subtle system responses and presents impedance data intuitively through professional plots such as Bode diagrams and Nyquist plots. It provides a comprehensive solution for device performance evaluation, material property analysis, and system condition diagnostics, making it a powerful tool for electrochemical characteristic research.

5.5.1 Impedance Definition

In practical circuits, resistors, capacitors, and inductors are all non-ideal components and contain inherent parasitic elements. For example, capacitors exhibit equivalent series resistance (ESR) and equivalent series inductance (ESL); inductors have winding capacitance; and resistors include lead inductance. The presence of these parasitic effects may result in unexpected frequency response or additional losses in the circuit. Therefore, practical components must be modeled as **complex impedance** to accurately describe their AC characteristics.

Impedance (Z)

Impedance (Z) is defined as the total opposition that a circuit or device presents to alternating current at a given frequency. It is a complex quantity consisting of a real part and an imaginary part. As illustrated below, in rectangular coordinates impedance can be expressed as the sum of resistance and reactance; in polar coordinates, it can be represented by its magnitude and phase angle. The specific relationships are as follows.



$Z = R + jX = |Z| \angle \Phi$

$$Z = \sqrt{R^2 + X^2}$$

$$\phi = \arctan\left(\frac{|X|}{R}\right)$$

R = Rs

Where:

- Z: Impedance, in ohms (Ω).
- R or Rs: Resistance (real part, commonly expressed as series resistance), in ohms (Ω), representing energy dissipation.
- X: Reactance (imaginary part), in ohms (Ω), representing energy storage; X > 0 indicates inductive behavior, and X < 0 indicates capacitive behavior.
- |Z|: Impedance magnitude, in ohms (Ω), representing the total opposition.
- Φ: Phase of the impedance (in degrees or radians), representing the phase difference between voltage and current.

Reactance (X)

Reactance (X) is the imaginary part of impedance and is used to characterize the ability of circuit elements (such as inductors or capacitors) to store and release energy. Its basic definitions are as follows:

Inductive reactance: $X_L = 2\pi fL$

Capacitive reactance: $X_C = -\frac{1}{2\pi fC}$

Where:

- f: Test frequency [Hz]
- L: Inductance [H]

- C: Capacitance [F]

Component Quality Parameters

In addition to the basic parameters, the quality factor (Q) and dissipation factor (D) are commonly used to evaluate the quality and loss characteristics of components.

$$Q = \frac{1}{D} = \frac{|X|}{R}$$

Where:

- Q: Quality factor, representing the energy storage efficiency of the component.
- D: Dissipation factor, representing the degree of energy loss in the component.

5.5.2 EIS Interface Introduction

EIS Main Interface

In the Menu interface, tap **EIS**to enter the Impedance Analysis (EIS) function interface, as shown in the figure below.

1. Status Bar: Displays the present input status information of the instrument.
2. Same parameter settings and measurement value display as in the Meter interface.
3. Function key area.

- Run/Stop: Start or stop the EIS test.
- Normal: Switch the data analysis mode (Normal/Numeric/Bode Plots/ Nyquist/Table).
- Setting: Enter the EIS settings interface.

4. Test result display area.

   Displays Normal (standard values), Numeric (numerical values), Bode Plots, Nyquist plots, or Table view according to the selected data analysis mode.

5. Progress Bar: Indicates the test progress (0–100%).
6. Parameter Bar: Displays the present AC set values, DC set values, and the test frequency points.

Analysis Modes

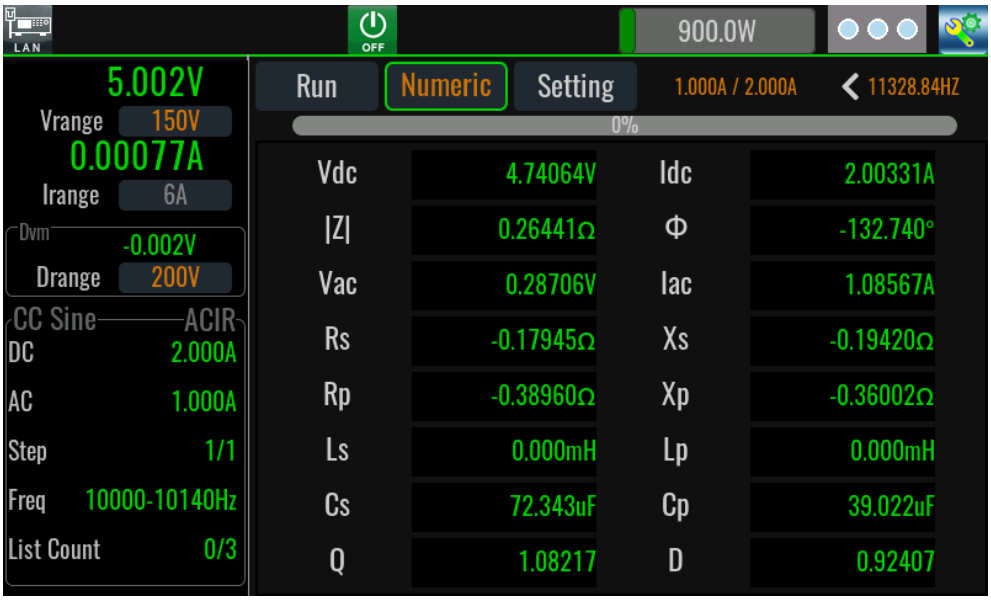
The Impedance Analysis function provides five data display modes, allowing test results to be viewed from different perspectives.

- **Normal**

  In this mode, two primary measured parameters are displayed in large font at the center of the screen (the parameter combination can be selected in **Setting**, including Z–Φ, Rs–X, Cp–D, Rp–Cp, Cs–D, Rs–Cs, Rs–Ls, Lp–D, Rp–Lp, etc.). The bottom area permanently displays the basic measurement values of the DUT (Vac, Iac, Freq, Vdc, Idc). This mode is suitable for debugging or scenarios requiring quick access to key measurement results.

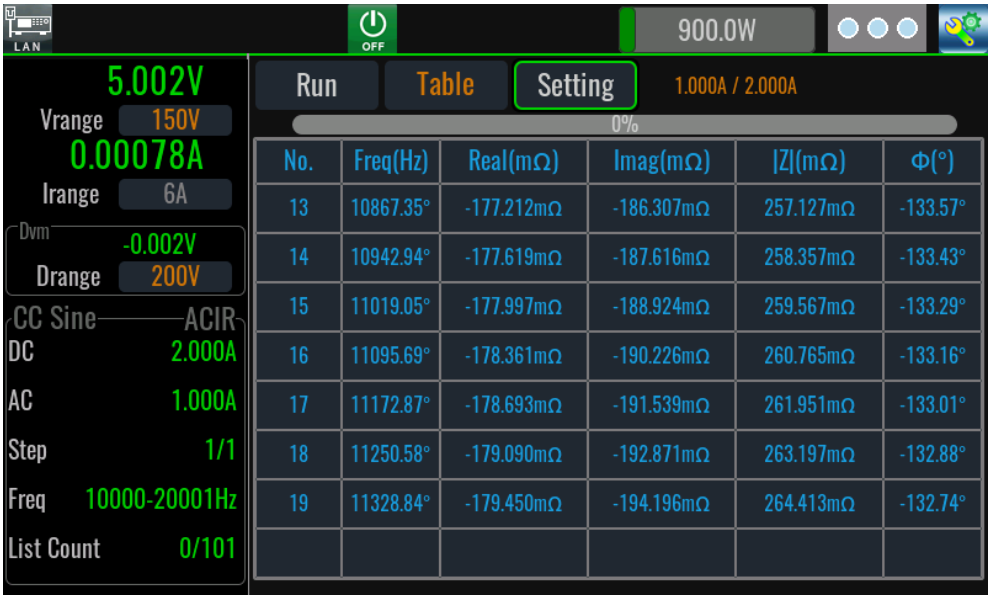
- **Numeric**

  In this mode, all parameters at the current frequency point are displayed in a clear two-column layout, including Vdc, Idc, |Z|, Φ, Vac, Iac, Rs, Rp, Xs, Ls, Cs, Q, and D. During frequency sweep measurements, all parameters update in real time, providing an intuitive view of the relationships among them.



- **Table**

In this mode, complete data for each scanned frequency point is listed in tabular form, including key parameters such as Freq (Hz), Real (mΩ), Imag (mΩ), |Z| (mΩ), and Φ (°). This format allows quick identification of measurement results at specific frequency points.

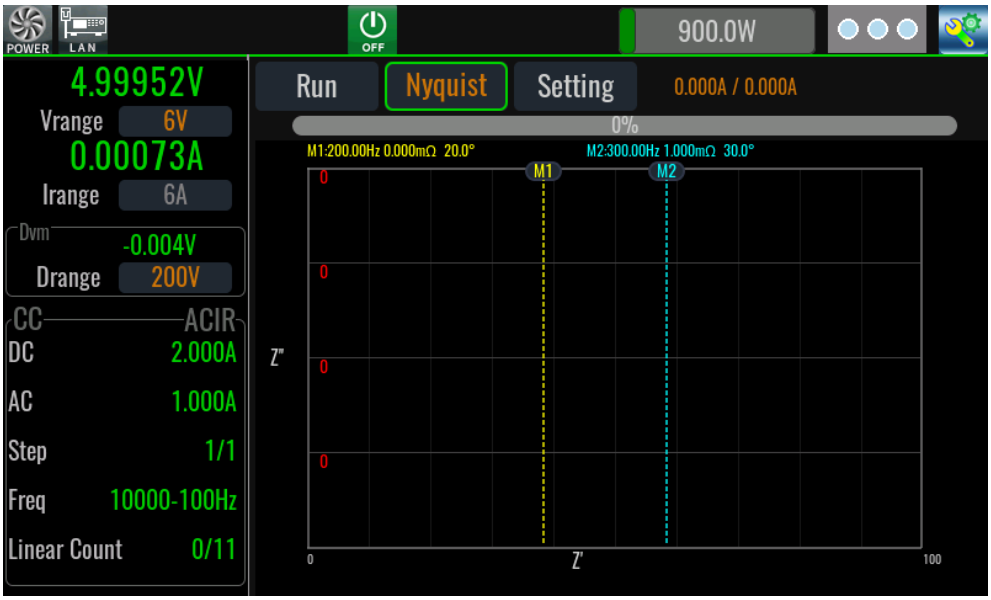


- **Bode Plots**

  In this mode, frequency response characteristics are displayed using a dual Y-axis coordinate system. The horizontal axis represents frequency (Hz); the left vertical axis shows impedance magnitude |Z| (mΩ); and the right vertical axis shows phase (°). After the sweep is completed, |Z|-Freq and Φ-Freq characteristic curves are automatically generated, allowing clear identification of resonance points, cutoff frequencies, and other key features. Two movable cursors (M1 and M2) are provided to display the corresponding frequency, impedance magnitude, and phase values in real time for precise measurement and comparative analysis.

- **Nyquist**

In this mode, impedance characteristics are displayed on a complex-plane coordinate system. The horizontal axis represents the real part of impedance (Z′), and the vertical axis represents the imaginary part (Z″). The Z′-Z″ trajectory illustrates the variation of complex impedance across the entire frequency range, enabling clear observation of arc-shaped features and effective evaluation of equivalent circuit models and polarization behavior. Two movable cursors (M1 and M2) are provided to display the corresponding frequency and Z′/Z″ coordinate values in real time, supporting precise analysis of characteristic points.



EIS Settings Interface

On the EIS main interface, tap the **Setting** button to enter the configuration interface. Here, you can configure the EIS load operating parameters and chart display modes. The configuration can also be saved as a file for convenient future recall.

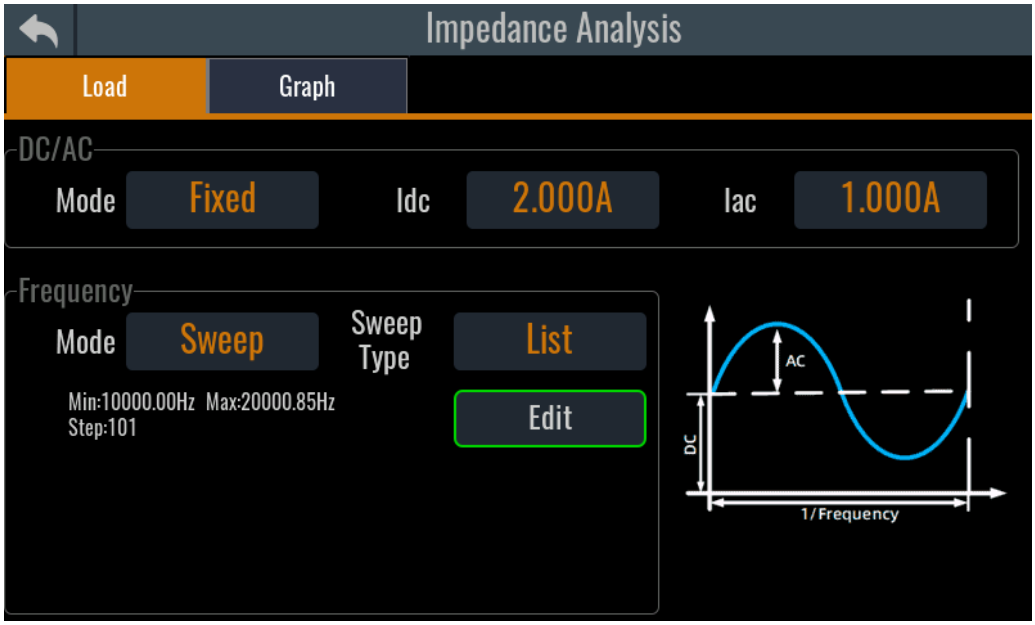


Table 5–1 Load

Parameter	Description
DC/AC	
Mode	Sets the EIS excitation mode, used to select how the test signal is applied. • **Sweep:** Automatically switches Idc/Iac according to the point list to perform EIS measurements at multiple operating points sequentially. • **Fixed:** Keeps Idc/Iac constant according to the present settings and measures only a single operating point.
Edit	Displayed only when Mode = Sweep. Used to edit the Idc/Iac point list data.
Idc (DC Bias Current)	Sets the DC operating current of the load (DC bias value).
Iac (AC Perturbation Current Amplitude)	Sets the amplitude of the small-signal AC current superimposed on Idc (perturbation amplitude).
Frequency	
Mode	Sets the EIS frequency mode. • **Fixed:** Performs impedance measurement at a single specified frequency point. • **Sweep:** Automatically performs frequency sweep measurement within the specified frequency range.
Sweep Type	Displayed only when Frequency Mode = Sweep. Used to select the frequency sweep type. • **Linear:** Frequency increases with a fixed step size. • **Log:** Frequency increases logarithmically. • **List:** Sweeps according to a user-defined frequency point sequence.
Start Frequency	Starting point of the frequency sweep.
Stop Frequency	Ending point of the frequency sweep.
Step Frequency	Displayed only when Sweep Type = Linear. Sets the frequency step size (e.g., 10 Hz). The load generates frequency points according to the specified step.

Parameter	Description
N Freq/dec	Displayed only when Sweep Type = Log. Sets the number of frequency points per decade (e.g., 1 Hz to 10 Hz, 10 Hz to 100 Hz).
Convert to List	Generates a frequency point list based on the present Linear/Log sweep parameters and switches to **List** mode, allowing individual frequency points to be edited.

Table 5–2 Graph

Parameter	Description
Cursors	
Mode	Controls the display and activation status of the measurement cursors. • **Off:** Disable all cursors. • **M1:** Enable cursor M1 only. • **M1, M2:** Enable both M1 and M2 cursors. In Bode or Nyquist plots, cursors are used to precisely locate and read coordinate data at specific points on the curve (such as frequency, impedance magnitude, phase, and real/imaginary components).
Impedance Function	
Function	Selects the impedance parameter combination displayed in the graph. Available options include: Z–Φ, Cp–D, Rp–Cp, Cs–D, Rs–Cs, Rs–Ls, and Rs–X.
Export Data	
Import	Import previously saved measurement data (.csv) to view the corresponding Bode plot and Nyquist plot.
Export	Save the measurement data as a CSV file for later viewing.

5.5.3 Impedance Measurement Configuration

Impedance Measurement

In the Menu interface, click Config -> Z-Φ Measure to enter the impedance measurement configuration page. This interface is dedicated to configuring the parameters related to impedance measurement. Detailed parameter descriptions are as follows.

Impedance Measurement			
	Measurement	Set the measurement timing.	
		Aperture Cycle	Set the sampling cycle for impedance measurement.
		Aperture Time (Min)	Set the minimum sampling time for impedance measurement.
		Delay Cycle	Set the delay cycle for impedance measurement.
		Delay Time (Min)	Set the minimum delay time for impedance measurement.
	DUT Type	Select the actual wiring method. (For detailed introduction, refer to Wiring Method.)	
		Type	Select the corresponding type based on the DUT's connection to the external power source.
			DUT: The DUT is directly connected to the IT8100 load.
			DUTS: The DUT is connected in series with the external power source to the IT8100 load (for scenarios requiring external bias/operating points).
			DUTP: The DUT is connected in parallel with the external power source to the IT8100 load (for scenarios requiring external bias/operating points). After selecting this DUTP type, you need to set the **I Probe Coef** and the **I Probe Precision** coefficient.
	Impedance Function	Selects the impedance parameter combination displayed in the meter interface.	
		Function	
			Z-Φ (Impedance-Phase)
			Cp-D (Parallel Capacitor-Dissipation Factor)
			Rp-Cp (Parallel Resistor-Parallel Capacitor)

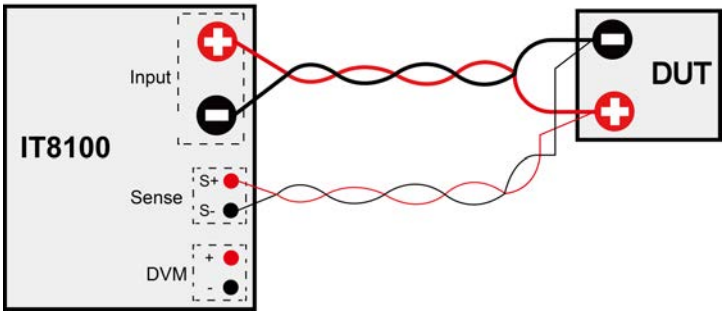
			Cs-D (Series Capacitor-Dissipation Factor)
			Rs-Cs (Series Resistor-Series Capacitor)
			Rs-Ls (Series Resistor-Series Inductor)
			Rs-X (Series Resistor-Reactance)

Wiring Method

This instrument provides three wiring methods: DUT, DUTS, and DUTP, to accommodate different types of devices under test (DUT) and test conditions.

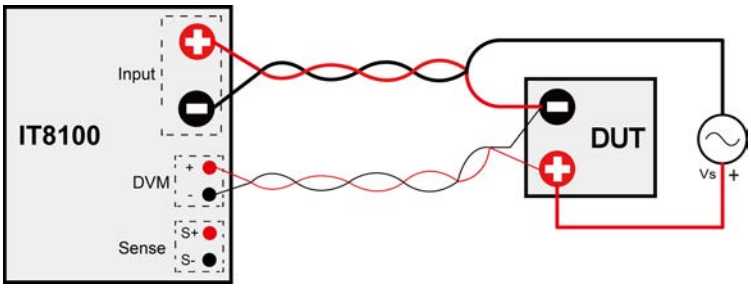
- **DUT (Direct Connection Mode)**

  Suitable for active devices such as batteries, power supplies, and super capacitors. The DUT is directly connected to the IT8100 load, which measures the output impedance characteristics. The wiring diagram is shown below.



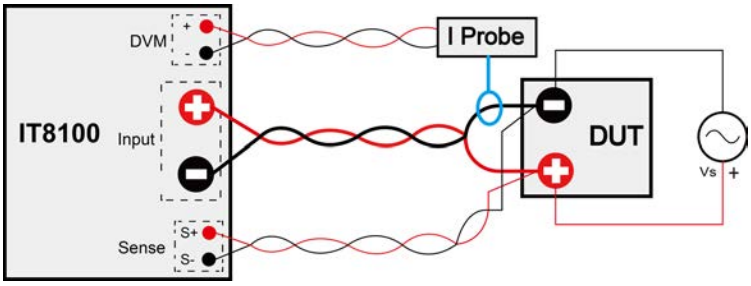
- **DUTS (Series Mode)**

  Suitable for passive components such as capacitors and inductors. An external AC/DC source is required to provide bias and excitation signals, and the IT8100 load measures the impedance characteristics of the DUT under different bias conditions. The wiring diagram is shown below.



- **DUTP (Parallel Mode)**

  Suitable for passive components such as capacitors and inductors. An external AC/DC source is required to provide bias and excitation signals, and the IT8100 load measures the impedance characteristics of the DUT under different bias conditions. The wiring diagram is shown below.



5.5.4 Impedance Zeroing

In the Menu interface, click Config -> Z-Φ Adjust to enter the impedance zeroing page. This page is used to zero the EIS measurement chain, improving the accuracy of subsequent impedance tests.

Z-Φ Adjust			
	Zero Adjust		
		Voltage Range	Select the zeroing voltage range, which should match the range used for subsequent tests. Zeroing can be performed and saved for different ranges.
		Run	Execute the zeroing operation.
		Clear	Clear the current zeroing data.
		Open	Load the previously saved zeroing file.
		Save	After completing zeroing, click **Save** to save the zeroing data to the local device or USB drive.
		Delete	Click **Delete**, select the target zeroing file, and confirm to delete it.
	Frequency		
		Type	Select the frequency change type: linear or logarithmic.
		Status	Displays the zeroing status: Not Zeroed/Zeroing/ Zeroed.
		Start	Zeroing start frequency.
		Stop	Zeroing stop frequency.
		Step	Frequency interval in linear mode (only displayed in linear mode).
		Count/Dec	The number of frequency points per decade (a tenfold frequency range) in logarithmic mode (only displayed in logarithmic mode).

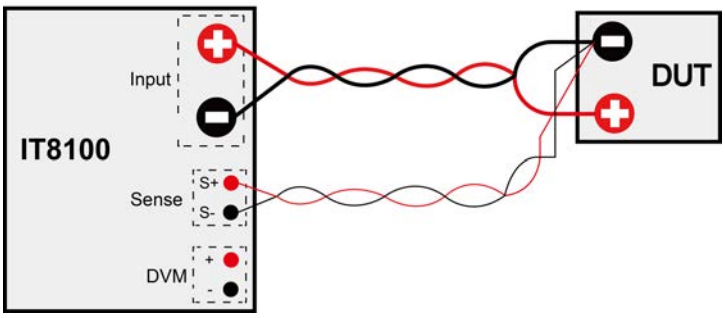
		Count	In linear mode, you can directly set the total number of scan points; in logarithmic mode, the instrument will automatically calculate and display the actual number of points based on "Count/Dec".

Zeroing Operation

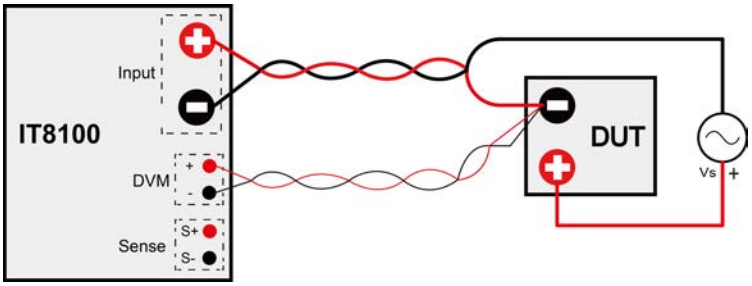
1. **Wiring Preparation and Inspection**

   Complete the zeroing wiring according to the DUT type: For DUT/DUTP modes, short the Sense sampling wire to the negative terminal of the DUT; for DUTS mode, short the DVM wire. The specific wiring methods are shown in the diagrams below.

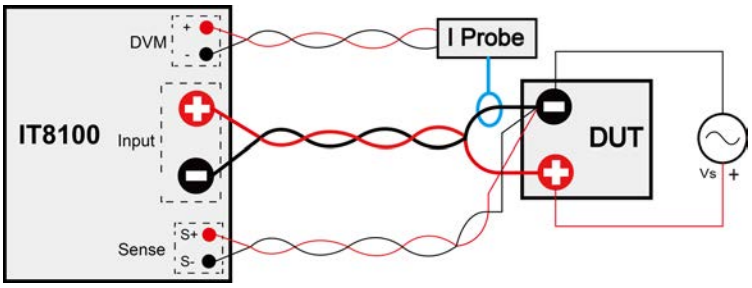
   - DUT (Direct Connection Mode)



   - DUTS (Series Mode)



   - DUTP (Parallel Mode)



2. **Load Mode Setup**

   Refer to 3.1 Select the Operation Mode and set the load to **CC Sine** mode. After selecting this mode, set the following parameters:

   - I-Set: Set the DC load current bias.
   - I-Range: Set current range.

- I-Amp: Set the AC peak to peak load sine wave.

3. **Perform Zeroing**

   a. Enter the impedance zeroing page: **Menu -> Config -> Z-Φ Adjust**.

   b. Select the voltage range: choose the same range as will be used in the subsequent test.

   c. Set the frequency parameters: type (**linear/logarithmic**), start frequency, stop frequency, and corresponding step step/count or count/decades.

   d. Start calibration: click **Run** and wait for the calibration to complete.

   e. Save the calibration file: after calibration is completed, confirm that the status is “Zeroed”, then click **Save**.

6 System Functions

6.1 System Menu Function(System)

In the Menu interface, click **System** to enter the system menu interface. The LCD will then display the available menu options, which can be selected and edited using the arrow keys or touch operation. The specific menu items are as follows.

Table 6–1 General

General	General setting.		
	Key Sound	Set the key sound switch.	
		• On (default): On. • Off: Off.	
	Protect Alarm	The buzzer alarm function when the instrument fails and protection occurs.	
		• On (default): On. • Off: Off.	
	Func-key-set	Set the function assigned to the Func key, including Discharge, CD Arb, OCP OPP or Sequence.	
	Brightness	Set the screen brightness. The setting range is 1~10. Default value: 3.	
	Power-on State	Set the power-on state.	
		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.
	Update by knob	Knob setting will take effect immediately. When set to On, the output value will immediately take effect upon rotating the knob. When set to Off, after adjusting the knob, the output value will only take effect after pressing the Enter key to confirm.	
	Parallel	Set the instruments to parallel operation mode.	
		Role	• None: Set the instrument to single mode, i.e., disable the parallel operation mode. • Primary: Set the instrument to primary mode. • Secondary: Set the instrument to secondary mode. • Ext-Secondary: Set the instrument to extended secondary mode.
		Number	Number of parallel instruments.
	Touch Function	Lock the touch screen function.	
		State	Set the On/Off state.
	Soft Keyboard	Set the soft keyboard.	
		On	Turn on the soft keyboard. The soft keyboard will pop up when the edit box is in editing mode.
		Off	Turn off the soft keyboard.
	Factory Default	Select whether to reset the factory default settings or not.	
		Restore	Confirm to reset operation.
	Language	Set the language of display.	
		English	English
		Chinese	Chinese
	Date	System date: Year/Month/Day.	
	Time	System time: Hour/Minute/Second.	
	Power Unit	Set the power unit: W or kW.	
	Ext-Program	External analog function. (External analog interface is optional.) For detailed introduction of menus and functions, see 6.8 Analogue Function (Optional).	

Table 6–2 Communication

Communica-tion	Set the communication parameters between the instrument and the computer.		
	USB Type	Set the USB type.	
		Device: The USB device is used to communication with PC.	
		Host: The USB device is used to storage disk.	
	USB Device	USB communication interface.	
		VCP	Virtual serial port.
		TMC	USB-TMC protocol.
	CAN Config	Can communication interface.	
		Baudrate	Select the baud rate.
		Can Addr	Set the instrument address to a number.
	GPIB Config	GPIB communication interface. (Only when the IT-E176 interface card is inserted can the settings be updated.)	
		GPIB Addr	Set the communication address.
	RS232 Config	RS232 communication interface. (Only when the IT-E177 interface card is inserted can the settings be updated.)	
		Baudrate	Baud rate.
		Data Bits	Data bit: 5/6/7/8.
		Stop Bits	Stop bit: 1/2.
		Parity Check	Parity bit: N (No parity) / E (Even parity) / O (Odd parity).

Table 6–3 LAN

LAN	LAN communication interface.		
	IP Config	Configure LAN IP information.	
		Mode	• Auto: automatically configure the address of the instrument. • Manual: manually configure the address of the instrument.
		IP Address	Set the IP address.
		Subnet Mask	Set the subnet mask.
		Gateway	Set the gateway address.
		DNS1	Set the preferred address of the DNS server. If it is not involved, there is no need to set it.

		DNS2	Set the DNS server alternate address. If it is not involved, there is no need to set it.
	Socket Config		
		Socket Port	Set the port number.
	DNS Hostname		
		Host Name	Set the DNS host name.
	mDNS Config		
		mDNS	mDNS service state. • On • Off
		Service Name	Set the mDNS service name.

Table 6–4 I/O

I/O		
	Digital IO1 Inhibit	Set Digital I/O. For detailed introduction of menus and functions, see 6.7 Digital I/O Function.
	Digital IO2 Protection Status Cleared	
	Digital IO3 Protection Status	
	Digital IO4 OnOff Status	
	Digital IO5 Short Status And Trigger1	
	Digital IO6 Voltage Fault And Trigger2	
	Digital IO7 Trigger3	

Table 6–5 Preference

Preference	Preference setting.		
	Func-key-set	Set the function assigned to the Func key, including Discharge, CD Arb, OCP OPP or Sequence.	
	Power-on State	Set the power-on state.	
		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.
	Parallel	Set the instruments to parallel operation mode.	
		Role	• None: Set the instrument to single mode, i.e., disable the parallel operation mode. • Primary: Set the instrument to primary mode. • Secondary: Set the instrument to secondary mode. • Ext-Secondary: Set the instrument to extended secondary mode.
		Number	Number of parallel instruments.
	Date	System date: Year/Month/Day.	
	Time	System time: Hour/Minute/Second.	

Table 6–6 Information

Information	View system information.	
	Product Model	Model of the instrument.
	SN	Serial number of the instrument.
	Software Version	Software firmware version number.
	MAC Address	MAC address
	Disp Version	Display board program version.
	Inner Num	Number of inner ring parallel instruments.

6.2 Configuration Menu Function (Config)

Click on **Config** in the menu interface to enter the configuration menu interface. At this interface, user can setup the electronic load input parameters, detailed parameters are shown as follows.

Load	Set load-related parameters.	
	Const Mode	Set the operation mode.

		CC	Constant current single operation mode, see Section 3.2.1 Constant Current Operation Mode (CC) for setup parameter descriptions.
		CV	Constant voltage single operation mode, see Section 3.2.2 Constant Voltage Operation Mode (CV) for setup parameter descriptions.
		CR	Constant resistance single operation mode, see Section 3.2.3 Constant Resistance Operation Mode (CR) for setup parameter descriptions.
		CP	Constant power single operation mode, see Section 3.2.4 Constant Power Operation Mode (CP) for setup parameter descriptions).
		CC+CR	CC+CR complex operation mode, see Section 3.3.1 CC+CR Mode for setup parameter descriptions.
		CC+CV	CC+CV complex operation mode, see Section 3.3.2 CC+CV Mode for setup parameter descriptions.
		CP+CV	CP+CV complex operation mode, see Section 3.3.3 CP+CV Mode for setup parameter descriptions.
		CR+CV	CR+CV complex operation mode, see Section 3.3.4 CR+CV Mode for setup parameter descriptions.
		AUTO	CC+CV+CP+CR complex operation mode, see Section 3.3.5 Auto Mode for setup parameter descriptions.
		CR Led	CR Led mode, see Section 3.3.6 CR-LED test function for setup parameter descriptions.
		CE	Circuit simulation mode, see Section 3.3.7 Circuit Simulation Mode (CE) for setup parameter descriptions.
		CC Pluse	CC Pluse (only available on IT8100A loads; see Section 3.4.2 CC Pulse for setup parameter descriptions).
		CC Sine	CC Sine (only available on IT8100A loads; see Section 3.4.1 CC Sine for setup parameter descriptions).
		Table	Table mode (only available on IT8100A loads; see Section 3.4.3 Table Mode for setup parameter descriptions).

	Slew Set	The following slew set parameters will be dynamically displayed based on the selected Const Mode (for example, these parameters will not be shown in CV mode).	
		Slew Type	Select the slew type.
			Time: Describe the slew of the device in terms of time。
			Rate: standard slew, unit is A/μs or A/ms.
		Slew Rate	Set the slew rate to high or low. This setting is visible only when the slew type is set to Rate.
		I-Rise	Set the current rising time. • When Slew Type is Time, the setting range is 0.000002s~10.00000s. • When Slew Type is Rate, the adjustable range varies depending on the model.
		I-Fall	Set the current falling time. • When Slew Type is Time, the setting range is 0.000002s~10.00000s. • When Slew Type is Rate, the adjustable range varies depending on the model.
Measure	Set measurement-related parameters.		
	Remote Sense	Set the sense measurement function.	
		Off	Turn off the remote measurement function.
		On	Turn on the remote measurement function.
	I-Range	Display the current measurement range.	
	V-Range	Display the voltage measurement range.	
	NPLC	Set the measurement speed in units of PLC (Power Line Cycles, the number of power line cycles per measurement). The setting range is as follows. • 50Hz: 0.0005~100PLC • 60Hz: 0.0006~120PLC	
	Aperture	Take time as the unit, set the measurement speed, range: 10us~2s.	
	Line Frequency	Set the power line cycle.	
	Digital Volt Meter	Set the DVM range and display.	
		Range	Sets the DVM measurement range (e. g., 200 V).
		Dvm View	Display toggle for DVM information (including the reading and range). • ON: Displays the DVM voltage reading and range.

			• OFF: Hides the display.
General	General setting.		
	Power Limit	Set the power limit, up to 1.5 times the rated power. The duration of over-power loading is not fixed; it is dynamically influenced by factors such as the applied voltage, ambient temperature, and the internal temperature of the instrument.	
		Level	Power limit value.
	Voltage On	Set the load's Von voltage. (For detailed description, see 3.8 Von Function.)	
		Latch	Lock the start loading voltage.
			On: When Latch ON, the load will continue to draw current when it reaches Von.
			Off: When Latch Off, the load will stop drawing current if the DUT voltage falls below Von.
		Voltage	Set the Von value.
		Hysteresis	Hysteresis voltage, where Von is maintained as long as the voltage does not drop below this value.
	Short	Short-circuit function setting. Before using the short-circuit function, the user must first configure the short-circuit function. Only then can it be activated using the front panel short-circuit button or remote control. (For detailed description, see 3.7 Short-Circuit Simulation Function.)	
		On	Turn on the Short key function.
		Off	Turn off the Short key function.
	Mode Change	Set the input state when the input mode changes.	
		On	Automatically turn off input when the input mode changes.
		Off	Keep the input state unchanged when the input mode changes.
	Statics Data	Set whether to automatically clear static data.	
		Auto Clear	On: When enabled, static data will be cleared automatically. Off: When disabled, it is not cleared automatically and must be cleared manually.
		Clear	Click Clear to manually clear static data.
Advanced	Advanced setting.		

	Wait Control Measure	Whether to set the measurement wait time. The measurement wait time is defined as the duration for which the measurement channel waits after the load channel starts inputting and before the measurement channel begins measurement. If set to 'On,' the following parameters need to be configured. If set to 'Off,' the wait time is 0.		
		Auto	Automatic wait time On or Off. • If set to On, the Gain parameter needs to be set. See the following formula. Wait time = Gain × initial wait time + Offset The initial wait time is automatically set by the instrument, and cannot be changed. • If set to Off, see the following formula. Wait time = Offset	
			Gain	Gain coefficient, range: 0~100.
		Offset	Offset value, range: 0~1s.	
	Trigger Source	Set the trigger source.		
		Signal	• Auto: Trigger source best suited for the present operating mode is automatically selected by the internal algorithms. • Manual: Triggered by the [Trig] key. • Bus: Triggered by a command, such as *TRG. • Trigger1~3: Triggered by Digital IO1~IO3 pins. Except the Auto option, the other trigger methods support setting the Delay time, range: 0~1000s.	
	Trigger 0utput	Set the output mode of the trigger signal. • Off: No output. • Trigger1~3: Trigger output by Digital IO5~IO7 pins.		
		Sense	Trigger output for measurement mode.	
		Load	Trigger output for load mode.	
Z-Φ Measure	Impedance measurement. (For detailed description, see 5.5.3 Impedance Measurement Configuration.)			
Z-Φ Adjust	Impedance adjust. (For detailed description, see 5.5.4 Impedance Zeroing.)			

Measurement Speed

Measurement speed can be controlled by either NPLC or Aperture. These parameters determine the integration time of the analog-to-digital (AD) converter, thereby affecting measurement accuracy and sampling speed. Line Frequency serves as a reference parameter and influences the NPLC calculation as well as power-line noise suppression.

- **NPLC (Number of Power Line Cycles)**

  NPLC sets the integration time in units of power line cycles. Range: 0.0005–100 PLC under a 50 Hz power grid, and 0.0006–120 PLC under a 60 Hz power grid. The larger the NPLC value, the longer the integration time, which improves voltage and current measurement accuracy and reduces noise; however, the sampling speed will decrease accordingly.

  For example, when the power line frequency is set to 60 Hz, 1 PLC corresponds to an integration time of 1/60 Hz ≈ 16.67 ms.

- **Aperture (Integration Time)**

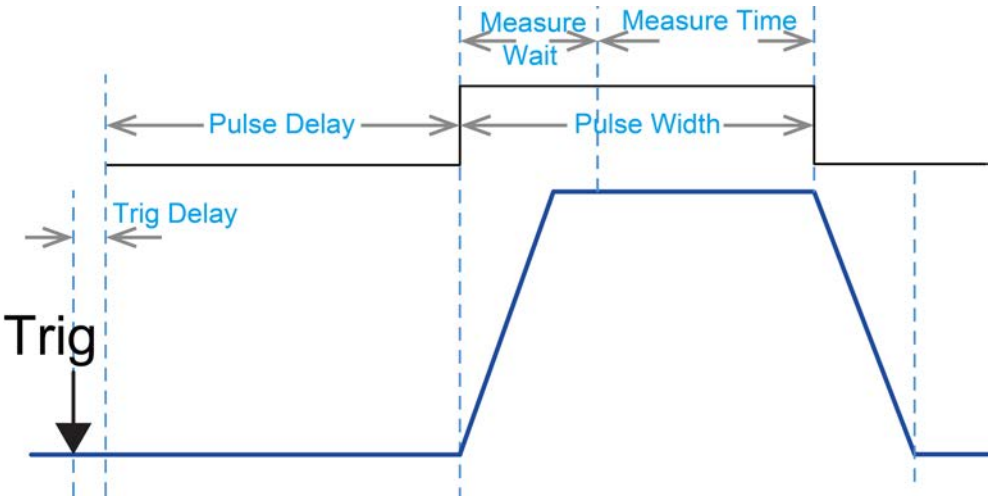
  Aperture directly sets the integration time in units of time, with a range of 10 μs to 2 s. It is commonly used for synchronization with external timing signals or for sampling pulse and short-duration signals.

- **Line Frequency (Power Line Frequency)**

  Line Frequency is used to configure the local mains frequency (50 Hz or 60 Hz) so that the actual integration time corresponding to NPLC can be calculated and power-line interference at the same frequency can be suppressed. If set incorrectly, the integration time may deviate from the expected value, and power-line noise suppression capability may be weakened, thereby affecting overall measurement performance.

Measurement Timing

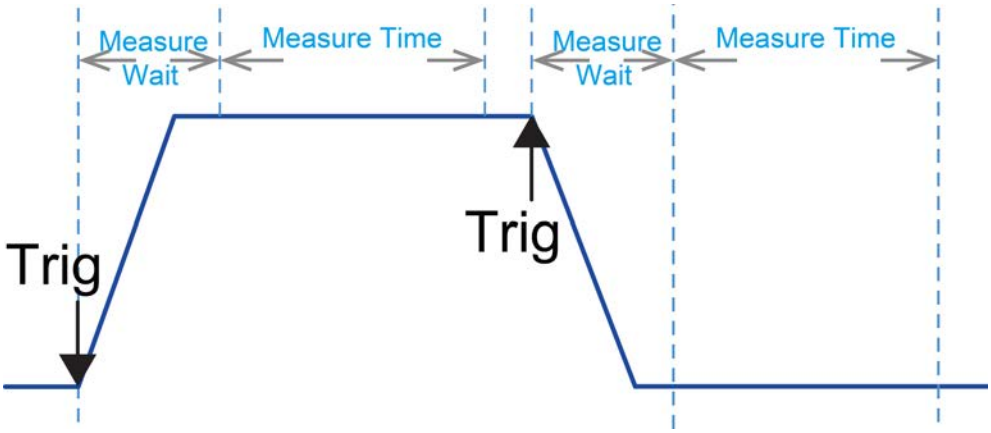
- **Pulse mode timing diagram:**



  – Measure Wait: The delay time between receiving a valid trigger signal and the actual start of measurement.

– Measure Time: The time required to perform the actual measurement, which is determined by the measurement speed configured in the **Config Measure** interface.

- **Normal mode timing diagram:**



6.3 Keyboard Lock Function

You can lock all front panel keys by pressing the composite key **[Shift]+[2]** (Lock) on the instrument's front panel. Once locked, the LCD screen will display the lock icon. In this state, all front panel keys become inoperative. Pressing **[Shift]+[2]**(Lock) again will unlock them.

6.4 Switching Local/Remote Mode

The user can switch from remote mode to local mode by pressing **[Shift] + [3]** (Local) keys.

When the electronic load is powered on, it defaults to local operation mode, where all keys are functional. In remote operation mode, the **[Shift] + [3]**(Local) keys remains available, allowing the measurement interface to be switched via touch, while other panel keys are disabled. Switching from local mode to remote mode can only be controlled via a PC.

Changing the operation mode does not affect the electronic load input parameters.

6.5 Save and Recall Operations

The electronic load supports saving common parameters in 100 groups of non-volatile memory. The saved data includes:

- Current operating mode and input parameters.
- All settings in the Config menu.

Save Operation

The save operation procedures are as follows.

1. Press the composite keys **[Shift]+[4]**(Save) to enter the parameter save interface.
2. Select the storage location. up to 100 position can be select.
3. Press **[Save]** to save the parameters.

   Finished, the saved parameters will be display at the right side of the interface.

Recall Operation

You can recall the parameters you saved in the specified memory location as the setting values.

1. Press the composite keys **[Shift]+[5]**(Recall) to enter the parameter recall interface.
2. Set the storage location.

   Press the direction keys to set the storage location, and then, the saved parameters will be display at the right side of the interface.
3. Press **[Recall]** to recall the parameters.

6.6 Protection Function

In the menu interface, click **Protect** to enter the protection configuration menu page. The menu list and descriptions of the protection functions are shown below.

Over Current Protection	OCP	
	State	Configure over-current protection: On or Off.
	Current	OCP limit.
	Delay	Protection delay time.
Over Power Protection	OPP	
	State	Configure over-power protection: On or Off.
	Power	OPP limit.

	Delay	Protection delay time.
Over Temperature Protection	OTP	
	Mode	Shutdown: Turn off the load input. Limit: Limit the load input power.
Over Voltage Protection	OVP	
	State	Configure over-voltage protection: On or Off.
	Voltage	OVP limit.
	Delay	Protection delay time.
Under Voltage Protection	UVP	
	State	Configure under-voltage protection: On or Off.
	Voltage	UVP limit.
	Delay	Protection delay time.
Load Input Countdown	After the instrument starts loading, it records the total duration of the continuous load. The loading stops immediately when the timing ends.	
	State	Set protection state: On or Off.
	Time	Set the duration of continuous loading.

Protection Delay

You can specify an OCP/OVP/OPP/UVP delay to prevent momentary input settings and status changes from tripping the protection. In most cases these momentary conditions would not be considered an protection fault, and having an OCP/OVP/OPP/UVP condition disable the input when they occur would be a nuisance. Specifying an protection delay (Delay) can ignore these momentary changes during the specified delay period. Once the delay time has expired and the protection limit condition persists, the input will shut down.

Clear the Protection

After the instrument triggers protection and generates a protection message, you need to troubleshoot the possible cause. When the protection is resolved,

the LCD will still prompt the protection information. You can manually clear the protection information record through the following methods.

- Press the **[Esc]** key on the front panel to manually clear the protection status information.
- Configure pin P-IO2 as the Ps-Clear function pin. A pulse signal input to this pin will clear the protection status information.
- Connected to the host computer, the PC sends a PROTection:CLEar command to the instrument to clear the protection status information.

After the protection is cleared, the load will return to its state prior to the protection event. If the instrument was actively loading before the protection occurred, it will automatically resume loading once the protection is cleared. However, if the instrument was manually turned off after the protection was triggered, it must be turned on again to resume loading.

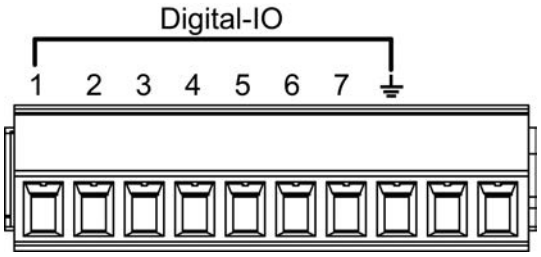
Oscillation Current Protection(OSC)

When the load-on current and the current change frequency exceed a certain limit during the loading process, the current oscillation protection will be triggered. If oscillation current protection is triggered, the load will automatically be off and the status bar will display 

icon. At the same time, OSC and PS bits of the status register will be set and keep till reset.

6.7 Digital I/O Function

This series electronic load supports digital I/O function. The user can realize logic control over high and low level input or output by related configurations in the system menu. The appearance of the terminals are shown below.



6.7.1 Description of Digital I/O pin

A Digital Control Port consisting of seven I/O pins is provided to access various control functions. Each pin is user-configurable.

Description of Digital I/O pin parameter

In the Menu interface, click **System** to enter the system menu interface, then select the I/O tab to configure relevant parameters.

Digital IO-1 Settings	Function setting of pin 1.	
	Function	• Inhibit Ctrl: By default, this function disables load input. • OnOff Ctrl: Indicates that Pin 1 can be used to control the load input state. • Input: Pin 1 receives the level signal from the outside. Status: Indicates the external signal state applied to Pin 1. • Output: Pin 1 sends the digital signal (1, 0) to the outside. Set: Controls Pin 1 to output a digital signal (0 or 1).
	Reverse	On/Off, Select Invert or not under the IO Settings. If setting to ON, it means the valid signal is reversed.
Digital IO-2 Settings	Function setting of pin 2.	
	Function	• PS-Clear: This default function means that when the instrument generates protection, the protection state can be cleared via this pin. • Input: Pin 2 receives the level signal from the outside. Status: Indicates the external signal state applied to Pin 2. • Output: Pin 2 sends the digital signal (1, 0) to the outside. Set: Controls Pin 2 to output a digital signal (0 or 1).
	Reverse	On/Off, Select Invert or not under the IO Settings. If setting to ON, it means the valid signal is reversed.
Digital IO-3 Settings	Function setting of pin 3.	
	Function	• Protect Status: This default function means the output level from pin 3, which displays that whether the instrument is under protection or not. • Input: Pin 3 receives the level signal from the outside. Status: Indicates the external signal state applied to Pin 3. • Output: Pin 3 sends the digital signal (1, 0) to the outside. Set: Controls Pin 3 to output a digital signal (0 or 1).

	Reverse	On/Off, Select Invert or not under the IO Settings. If setting to ON, it means the valid signal is reversed.
Digital IO-4 Settings	Function setting of pin 4.	
	Function	• On-Off Status: This default function indicates the existing [On/Off] state of the instrument. • Input: Pin 4 receives the level signal from the outside. Status: Indicates the external signal state applied to Pin 4. • Output: Pin 4 sends the digital signal (1, 0) to the outside. Set: Controls Pin 4to output a digital signal (0 or 1).
	Reverse	On/Off, Select Invert or not under the IO Settings. If setting to ON, it means the valid signal is reversed.
Digital IO-5 Settings	Function setting of pin 5.	
	Function	• Short Status: The default function item used to indicate the current short-circuit status of the instrument. • Trig-in: Indicates that the instrument will trigger the execution of List and other functions upon receiving an external pulse signal. • Trig-out: Indicates that a pulse signal will be output from Pin 7 when the instrument generates a trigger signal (e.g., during the execution of List and other functions). Pulse Width: Sets the output duration of the trigger pulse signal. Adjustable range: 30 μs to 10 ms. • Input: Pin 5 receives the level signal from the outside. Status: Indicates the external signal state applied to Pin 5. • Output: Pin 5 sends the digital signal (1, 0) to the outside. Set: Controls Pin 5 to output a digital signal (0 or 1).
	Reverse	On/Off, Select Invert or not under the IO Settings. If setting to ON, it means the valid signal is reversed.
Digital IO-6 Settings	Function setting of pin 6.	
	Function	• Voltage Fault: Default function item indicating the instrument's overvoltage status via the output level of Pin 6. • Trig-in: Indicates that the instrument will trigger the execution of List and other functions upon receiving an external pulse signal.

		• Trig-out: Indicates that a pulse signal will be output from Pin 7 when the instrument generates a trigger signal (e.g., during the execution of List and other functions). Pulse Width: Sets the output duration of the trigger pulse signal. Adjustable range: 30 μs to 10 ms. • Input: Pin 6 receives the level signal from the outside. Status: Indicates the external signal state applied to Pin 6. • Output: Pin 6 sends the digital signal (1, 0) to the outside. Set: Controls Pin 6 to output a digital signal (0 or 1).
	Reverse	On/Off, Select Invert or not under the IO Settings. If setting to ON, it means the valid signal is reversed.
Digital IO-7 Settings	Function setting of pin 7.	
	Function	• Trig-in: Indicates that the instrument will trigger the execution of List and other functions upon receiving an external pulse signal. • Trig-out: Indicates that a pulse signal will be output from Pin 7 when the instrument generates a trigger signal (e.g., during the execution of List and other functions). Pulse Width: Sets the output duration of the trigger pulse signal. Adjustable range: 30 μs to 10 ms. • Input: Pin 7 receives the level signal from the outside. Status: Indicates the external signal state applied to Pin 7. • Output: Pin 7 sends the digital signal (1, 0) to the outside. Set: Controls Pin 7 to output a digital signal (0 or 1).
	Reverse	On/Off, Select Invert or not under the IO Settings. If setting to ON, it means the valid signal is reversed.

Signal definition

Digital I/O functions involve input and output levels and pulse signals. The input signal is the control signal provided externally to IT8100, the output signal is the level signal provided externally by IT8100, and the pulse signal is the edge signal switched between high and low levels. The pin signals are defined as follows.

Maximum rated voltage		+/-15V
Maximum voltage leakage current		3mA@+15V; -5mA@-15V
Output	Maximum low-level output voltage	0.41V@5mA; 1.13V@50mA; 2.03V@100mA
	Maximum low-level sink current	100mA
Input	Maximum low-level input voltage	1.9V
	Minimum high-level input voltage	2.9V
	Typical low-level current	500uA@0V (internal 10K pull-up)

Signal Revert

Select Invert or not under the IO Settings menu. If setting to Reverse(Off), it means the default level will be valid. If setting to Reverse(On), it means the valid signal is reversed. For example, the IO-1 pin is inhibit output by default and the high level is valid, when select revert Invert, the low level is valid and the instrument input is disabled.

6.7.2 I/O Control

General Digital I/O Function

- Digital Input

  Each of the seven pins can be configured as digital input only. Pin 8 is the signal common for the digital input pins. When pins 1 to 7 are configured to Input function, an external signal can be Input to this pin, and the instrument can detect the state of the external signal.

- Digital Output

  When pins 1 to 7 are configured for the Output function, they can output a high level (False) or low level (True).

Digital IO-1

IO-1 pin can be set to [Inhibit Ctrl], [OnOff Ctrl], [Input], [Output]

- Pin 1 can be configured as a inhibit input. The Inhibit Input function lets an external input signal control the load input state of the load.

The Inhibit function has two modes: Live and Latching.

- **Inhibit Live**: The load input status responds in real time to the inhibit signal. When the inhibit signal is True, the load input is disabled; when the inhibit signal is False, the load input is automatically restored.
- **Inhibit Latching**: Upon receiving the inhibit signal, the logic latches the input state, causing the load input to be disabled. Even after the inhibit signal is cleared, the load remains disabled.

  To re-enable the load, first remove the external inhibit signal and press **[Esc]** to clear the alarm. If the instrument is still in the ON state (**[On/Off]** key light is on), the load will automatically resume input; otherwise, press the **[On/Off]** key manually to restore load input.
- **Inhibit Off**: The inhibit signal is ignored, and the load input remains enabled at all times, unaffected by the inhibit signal.

- OnOff Ctrl: Controls the load input On/Off. By default, it is high level, and the input is controlled by the **[On/Off]** key. When pin 1 is externally pulled low, the load input is turned on, and the **[On/Off]** key becomes inactive. When pin 1 is pulled high again, the load input is turned off, and **[On/Off]** key control is restored.

Digital IO-2

IO-2 pin can be set to [PS-Clear], [Input], [Output]

The default function is **PS-Clear**. When the device is in a protection state, an external pulse signal can be input through the IO2 pin to perform the protection clear operation, restoring the device to normal working status.

Digital IO-3

IO-3 pin can be set to [Protect Status], [Input], [Output]

The default function is protection state indicator. IO-3 pin will output high or low level based on whether the instrument is under protection or not. Under normal conditions (Not under protection), and when pin 3 is under default setting (Not Invert), pin 3 outputs high level; when the instrument is under protection, pin 3 outputs low level. When pin 3 is set to Invert, the output level is completely opposite.

Digital IO-4

IO-4 pin can be set to [On-Off Status], [Input], [Output]

The default function is to indicate the current input status of the device. Logic level 0 indicates that the instrument is in the On state, while logic level 1 indicates that it is in the Off state.

Digital IO-5

IO-5 pin can be set to [Short Status], [Trig-in], [Trig-out], [Input], [Output]

- The default function is to indicate the short status of the load input terminals: logic level 0 indicates a short circuit at the load input, while logic level 1 indicates normal condition.
- Trig-out: Configure IO-5 as a trigger output and enable the trigger output for the List function. When the List is triggered to run, IO-5 will output a pulse signal.
- Trig-in: The input trigger signal, the pulse signal sent to the IO-5 pin can be used as the trigger source.

  Configure the trigger source of the Oscilloscope function, Data recording, and List function to Trigger1. When the instrument receives an external pulse signal, it will trigger the running of the Oscilloscope function, Data Recording function or List function.

Digital IO-6

IO-6 pin can be set to [Voltage Fault], [Trig-in], [Trig-out], [Input], [Output]

- Voltage Fault: When the load is in overvoltage protection, pin 6 will output a high level signal.
- Trig-out: Configure IO-6 as a trigger output and enable the trigger output for the List function. When the List is triggered to run, IO-6 will output a pulse signal.
- Trig-in: The input trigger signal, the pulse signal sent to the IO-6 pin can be used as the trigger source.

  Configure the trigger source of the Oscilloscope function, Data recording, and List function to Trigger2. When the instrument receives an external pulse signal, it will trigger the running of the Oscilloscope function, Data Recording function or List function.

Digital IO-7

IO-7 pin can be set to [Trig-in], [Trig-out], [Input], [Output]

- Trig-out: Configure IO-7 as a trigger output and enable the trigger output for the List function. When the List is triggered to run, IO-7 will output a pulse signal.
- Trig-in: The input trigger signal, the pulse signal sent to the IO-7 pin can be used as the trigger source.

  Configure the trigger source of the Oscilloscope function, Data recording, and List function to Trigger3. When the instrument receives an external pulse signal, it will trigger the running of the Oscilloscope function, Data Recording function or List function.

6.8 Analogue Function (Optional)

The interface expansion slot provided on the rear panel of the IT8100 series. This function is not standard with the instrument and is optional for users.

When the interface card selected by the user is RS232+Analog interface (IT-E177), the analog interface can realize the external analog function.

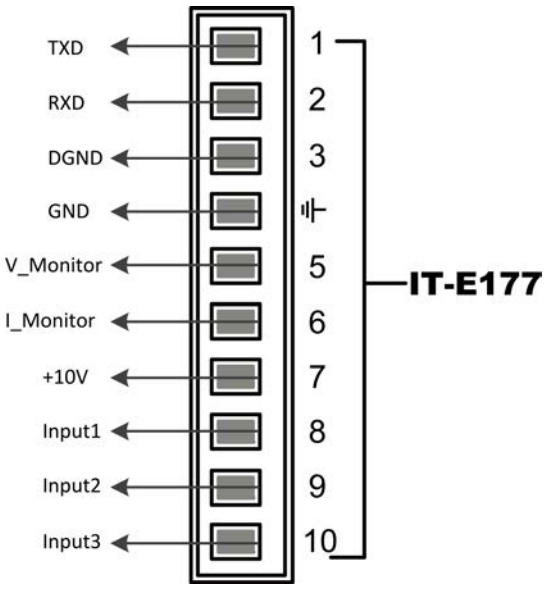
- Remote control of setting values in different modes.
- Remove switching of CC/CV/CR/CP modes.
- Remote monitoring of input voltage/current measurement.

CAUTION

- **Before connecting the hardware device that controls the analog interface, make sure that the hardware device does not output a voltage higher than 20% of the specified value to the pin, otherwise the instrument will be damaged. For example, when setting the voltage or current, the input voltage can't exceed 12V, otherwise the instrument will be damaged.**
- **Safe electrical isolation is set between this analog interface and input electrode. Do not connect any ground wire of the analog interface to the positive and negative terminals of the input interface.**

Analog Card Interface Introduction

The pins description is as below.



Pins	Name	Type	Description
4	GND	Ground	Ground terminal.
5	V_Monitor	Analog out	Voltage monitor signal. This pin generates a voltage of 0 V to 10 V to monitor an input voltage of 0 V to the maximum rated value.
6	I_Monitor	Analog out	Current monitor signal. This pin generates a voltage of 0 V to 10 V to monitor an input current of 0 V to the maximum rated value.
7	+10V	Analog out	The 10V reference voltage output by the instrument can be connected to a resistance subdivision for analog control.
8	Input1	Analog in	Set the input setting value. The analog input range is: -10V to 10V.
9	Input2	Analog in	Set the basic mode of the load. When the input voltage of the pin is ≤ 1V, it is low level. When the input voltage is ≥ 3V, it is high level. Set the load mode with the input voltage and level combination of the Input3:
10	Input3	Analog in	Set the basic mode of the load. When the input voltage of the pin is ≤ 1V, it is low level. When the input voltage is ≥ 3V, it is high level. Set the load mode with the input voltage and level combination of the Input2: For detailed mode definition, refer to Input2 description.

Input2	Input3	Mode
Low	Low	CC
Low	High	CV
High	Low	CR
High	High	CP

Enable/Disable analog control

The user needs to select the corresponding function settings in the System menu. The detailed parameter description is as below.

Ext-Program	External analog function menu.	
	State	Function switch: • On: Turns on the external analog function. • Off: Turns off the external analog function.
	Current Mx	Slope coefficient set by current.
	Current Mb	Offset set by current.
	Voltage Mx	Slope coefficient set by voltage.
	Voltage Mb	Offset set by voltage.
	Resistance Mx	Slope coefficient set by resistance.
	Resistance Mb	Offset set by resistance.
	Power Mx	Slope coefficient set by power.
	Power Mb	Offset set by power.

Analog Conversion Relationship Introduction

In analog control mode, users must define the expected analog value conversion based on actual application needs. The analog output in each mode follows a linear function: y=kx+b. Parameter descriptions are as follows:

- Independent variable x: The actual input voltage value of the external analog channel.
- Slew factor k: Same as Mx in the menu, set by the user.
- Offset b: Same as Mb in the menu, set by the user.
- y: The actual set value of the instrument (voltage, current, resistance, or power).

Taking the CV program setting as an example, the user needs to convert the Mx and Mb values based on the formula below. And set these two values respectively through the front panel keys.

Note

The setting principles of calculation parameters in other modes are the same, so the description will not be repeated.

$$M_x = \frac{(V_{out2} - V_{out1})}{(V_{in2} - V_{in1})}$$

$$M_b = V_{out2} - V_{in2} \times M_x$$

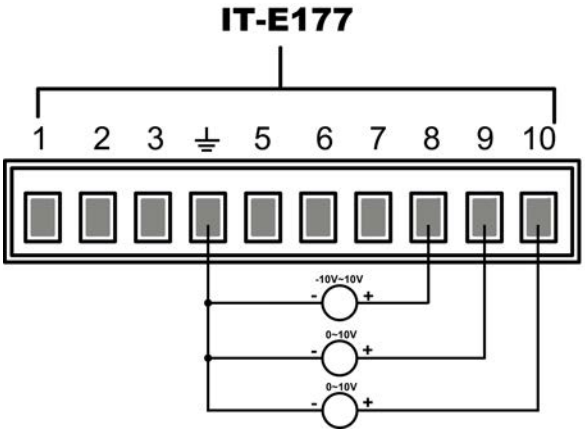
Formula parameter descriptions:

Name	Description
V_{in1}	Indicates the start voltage input to pin 8. The setting range is from -10 to 10.
V_{in2}	Indicates the end voltage input to pin 8. The setting range is from -10 to 10, and $V_{in2} > V_{in1}$.
V_{out1}	The starting value of the input voltage in CV mode.
V_{out2}	The end value of the input voltage in CV mode, and $V_{out2} > V_{out1}$.

Analog Control

The pin connection method and instrument operation method in four basic modes of the load are the same. The voltage control in CV mode is taken as an example below to describe the connection and usage.

1. Refer to the figure below to complete the pin connection.



2. Based on the above formula conversion relationship, calculate the Mx (slope coefficient) and Mb (offset) values of the voltage setting value. The sample data used in this manual is shown in the table below.

Pin input voltage		CV set value	Mx	Mb	Description
8	Vin1 = 0	Vs out1 = 0	15	0	The CV set value (Vs) of the instrument can be controlled from 0 to 150V by applying a voltage between 0V and 10V to pin 8.
	Vin2 = 10	Vs out2 = 150			

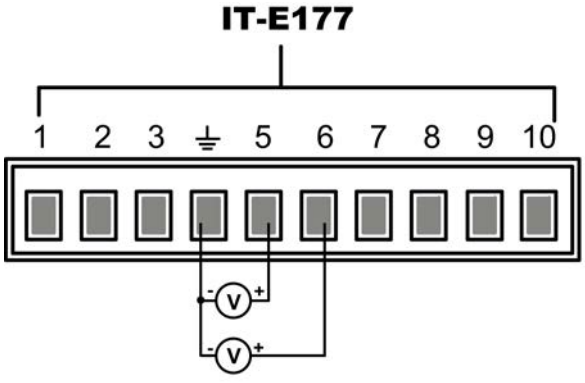
3. Set the Mx and Mb values in CV mode.
   a. Click on **System** in the menu interface to enter the system menu interface.
   b. Scroll up and down the system configuration interface to locate the **Genera->Ext-Program** menu.
   c. Set Voltage Mx and Voltage Mb.

      In the State function section, click the Off button to switch it to On to enable the external analog test function.
4. Input low-level voltage 0V in Pin 9, and input high-level voltage 5V in Pin 10. Switch the existing mode to CV mode. For detailed mode definition, refer to the description of analog card interface.
5. Input 0-10V voltage in Pin 8, and control the setting value of the input voltage of this instrument.

   For example, when the input voltage of Pin 8 is 1V, the setting value of the input voltage of this instrument is 15V; when the input voltage of Pin 8 is 5V, the setting value of the input voltage of this instrument is 75V. The corresponding relationship meets the calculation relationship of y=kx+b.

Voltage Monitoring and Current Monitoring

The analog interface can monitor the existing input voltage and input current. Connect a digital voltmeter between Pin 5 and Pin 6 of the analog interface and ground wire 4. The connection method is as shown below. The voltage reading from 0 to 10V corresponds to the zero to full-scale voltage/current setting of the instrument. The connection diagram is as shown below.



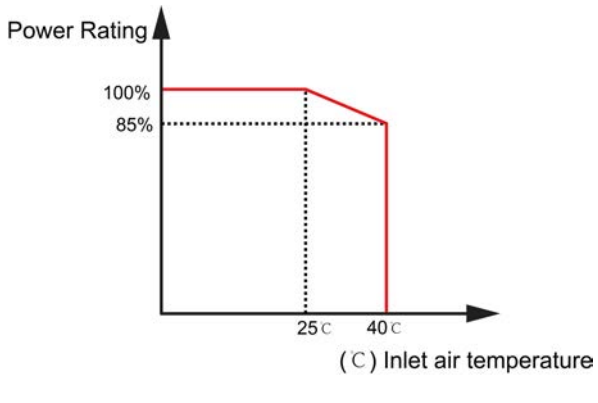
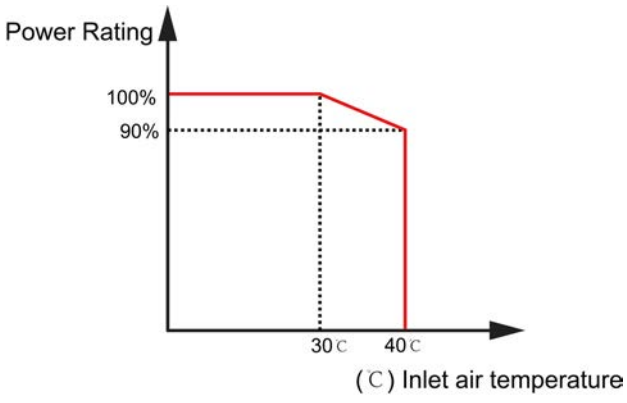
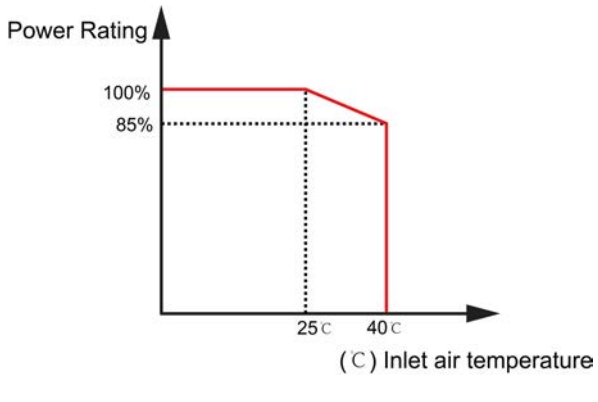
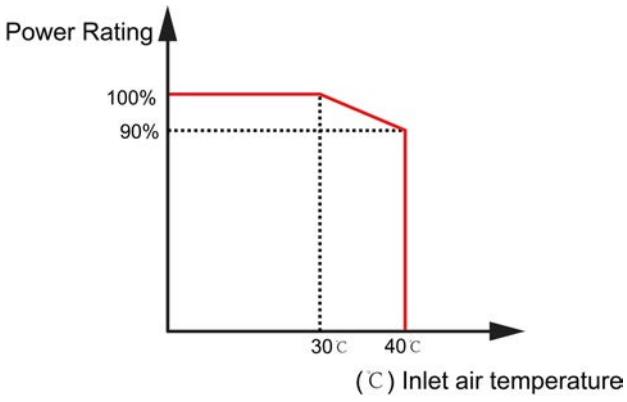
7 Technical Specification

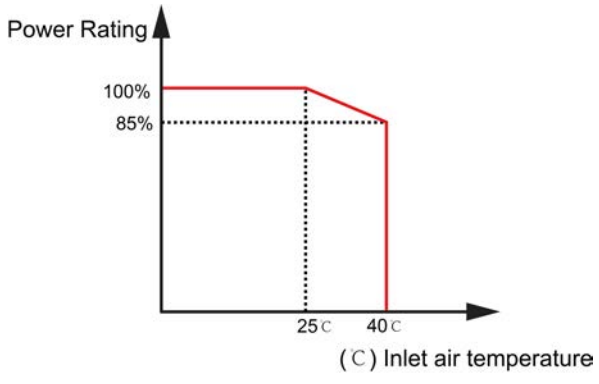
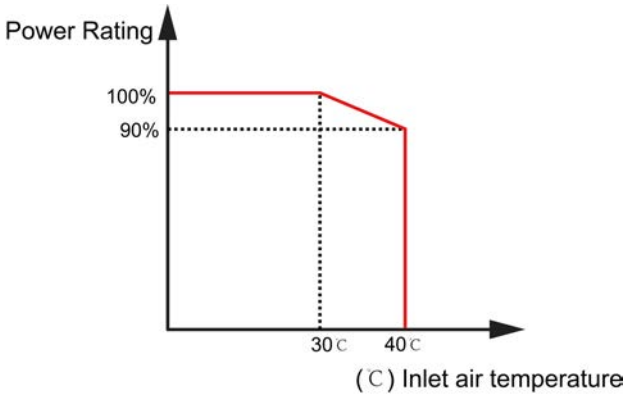
This chapter will introduce the main technical parameters of this load , such as rated voltage/current/power and so on. Besides, we will introduce the working environment and storage temperature.

7.1 Main specifications

7.1.1 Power Derating

The curves indicating relationship between the rated input power and inlet air temperature of IT8100 series load is shown in the following table.

150V (Models 14.4 kW and below)	150V (Models above 14.4 kW)
	
600V (Models 12 kW and below)	**600V (Models above 12 kW)**
	

1200V (Models 12 kW and below)	1200V (Models above 12 kW)
	

Note

- To prevent damaging heat build-up and ensure specified performance, make sure there is adequate ventilation and air flow around the instrument to ensure proper cooling. Do not cover the ventilation holes on the top, sides, or bottom of the instrument.
- To ensure that the IT8100 series load meets the specified specifications and performance, please ensure that the inlet air temperature of the instrument is within the range of 0 to 25°C.

7.1.2 IT8102E-150-200

IT8102E-150-200				
Rated value (25℃)	Voltage	150V		
	Current	200A		
	Power	2.5kW(3.75kW peak)		
	Min. operating voltage	0.5V@200A		
Constant current mode	Range	0~2A	0~20A	0~200A
	Resolution	0.01mA	0.1mA	1mA
	Accuracy *1	0.03%+0.02%F.S.	0.04%+0.02%F.S.	0.04%+0.02%F.S.
Constant voltage mode	Range	0.1~6V	0.1~30V	0.1~150V
	Resolution	0.01mV	0.1mV	1mV
	Accuracy	0.02%+0.01%F.S.	0.02%+0.01%F.S.	0.02%+0.01%F.S.
Constant resistance mode	Range	0.0025~99.9999Ω (200A)	0.025~999.999Ω (20A)	0.25~9999.99Ω (2A)
	Resolution	0.0001Ω	0.001Ω	0.01Ω
	Accuracy	Vin/Rset*0.05%+VF.S/Rset*0.01%+0.05%IF.S.		

IT8102E-150-200				
Constant power Mode	Range *2	0~3.75kW(peak)		
	Resolution	1mW(0~999.999W)		
		10mW(1~3.75kW)		
	Accuracy	0.05% + 0.06% Vrange*Irange		
Dynamic	T1&T2	0.010ms~999.999ms/1.000s~999.999s		
	Resolution	1us/1ms		
	Accuracy	2us+100ppm		
	Slew Rate	0.01mA~0.15A/us	0.1mA~1.5A/us	1mA~15A/us
	Resolution	0.01mA	0.1mA	1mA
	Accuracy	5% + 8us		
	Min. Rise Time *3	8us(Typical)		
Voltage Measurement	Range	0.1~6V	0.1~30V	0.1~150V
	Resolution	0.01mV	0.1mV	1mV
	Accuracy	0.02%+0.01%F.S.		
Current Measurement	Range	0~2A	0~20A	0~200A
	Resolution	0.01mA	0.1mA	1mA
	Accuracy *1	0.03%+0.02%F.S.	0.04%+0.02%F.S.	0.04%+0.02%F.S.
Power Measurement	Range	0~3.75kW(peak)		
	Resolution	1mW(0~999.999W)		
		10mW(1~3.75kW)		
	Accuracy	0.05% + 0.05% Vrange*Irange		
Setup Temper-ature Coeffi-cient (ppm of Set+ppm of Range)/℃	Voltage	Low Range	Medium Range	High Range
		10ppm+5ppm	10ppm+5ppm	10ppm+5ppm
	Current	Low Range	Medium Range	High Range
		30ppm+10ppm	30ppm+10ppm	30ppm+10ppm
Remote Sense Voltage		< 5V		
Input Impedance (Off)		≈161kΩ		
Port Impedance and Capacitance		≈0.5Ω+6.94uF		
Command Response Time		<100us		
Protective Function		OVP, OCP, OPP, UVP, UCP, LRV, OTP		
Standard Interface		USB, LAN, CAN, GPIB（Option）, RS232（Option）		
AC Input	AC input range	100~240VAC/50Hz~60Hz		

IT8102E-150-200		
	Max. VA	≈75VA
	Inrush current	30A
Dimension (HxWxD mm)		132.8 × 437 × 753.4 mm (excluding handles, feet, and protective cover)
		150.3 x 483 x 811.6 mm (overall)
Weight (net)		23.2 kg

*1. Ensure that the load input voltage exceeds the product of the actual load current and the minimum conduction resistance.

*2. The lower current range is 0.3 kW.

*3. Set current > 4% IF.S.

7.2 Additional features

Operating Environment	
Operating conditions	Indoor use, altitude below 2000 m.
Pollution degree	Pollution degree 2
Temperature	0℃ to 40℃
Humidity	30% to 90% (non-condensing)
Storage and Transportation	
Temperature	-10℃ to 70℃
Humidity	10% to 90% (non-condensing)
Safety and Protection	
Protection grade	IP20
Installation category	II
Protection:	
Overvoltage Protection (OVP)	Trigger level ≈ 105% of current range.
Maintenance and Cooling	
Recommended calibration interval	1 year
Cooling method	Fan-cooled

A Appendix

♦ Specifications of Red and Black Test Cables

A.1 Specifications of Red and Black Test Cables

ITECH provides you with optional red and black test cables, which are sold individually and you can select for test. For specifications of ITECH test cables and maximum current values, refer to the table below.

Model	Specification
IT-E30110-AB	1kV/10A/1m*2pcs Alligator clips-Banana plugs
IT-E30110-BB	1kV/10A/1m*2pcs Banana plugs-Banana plugs
IT-E30110-BY	1kV/10A/1m*2pcs Banana plugs-Y-type terminals
IT-E30312-YY	500V/30A/1.2m*2pcs Y-type terminals-Y-type terminals
IT-E30320-YY	500V/30A/2m*2pcs Y-type terminals-Y-type terminals
IT-E30615-OO	500V/60A/1.5m*2pcs Ring terminals-Ring terminals
IT-E31005LIC-OO	600V/100A/0.5m*2pcs Ring terminal low inductance
IT-E31010LIC-OO	600V/100A/1m*2pcs Ring terminal low inductance
IT-E31020LIC-OO	600V/100A/2m*2pcs Ring terminal low inductance
IT-E31040LIC-OO	600V/100A/2m*2pcs Ring terminal low inductance
IT-E31220-OO	500V/120A/2m*2pcs Ring terminals-Ring terminals
IT-E31250-OO	500V/120A/5m*2pcs Ring terminals-Ring terminals
IT-E32410-OO	500V/240A/1m*2pcs Ring terminals-Ring terminals
IT-E32420-OO	500V/240A/2m*2pcs Ring terminals-Ring terminals
IT-E32450-OO	500V/240A/5m*2pcs Ring terminals-Ring terminals
IT-E3301020-OO	3kV/100A/2m*2pcs Ring terminals-Ring terminals
IT-E3301050-OO	3kV/100A/5m*2pcs Ring terminals-Ring terminals
IT-E3302420-OO	3kV/240A/2m*2pcs Ring terminals-Ring terminals

IT-E3302450-OO	3kV/240A/5m*2pcs Ring terminals-Ring terminals
IT-E3303620-OO	3kV/360A/2m*2pcs Ring terminals-Ring terminals
IT-E3304020-OO	3kV/400A/2m*2pcs Ring terminals-Ring terminals
IT-E33620-OO	500V/360A/2m*2pcs Ring terminals-Ring terminals
IT-E33650-OO	500V/360A/5m*2pcs Ring terminals-Ring terminals
IT-E34020-OO	500V/400A/2m*2pcs Ring terminals-Ring terminals
IT-E34520-OO	500V/450A/2m*2pcs Ring terminals-Ring terminals
IT-E35030-OO	500V/360A/3m*2pcs Ring terminals-Ring terminals
IT-E36530-OO	500V/650A/3m*2pcs Ring terminals-Ring terminals

For maximum current of AWG copper wire, refer to table below.

AWG	8	10	12	14	16	18	20	22	24	26	28
The Maxi-mum Current Value (A)	60	40	30	20	13	10	7	5	3.5	2.5	1.7

Note

- AWG (American Wire Gage), it means X wire (marked on the wire). The table above lists current capacity of single wire at working temperature of 30°C. For reference only.
- Along with temperature, you must also consider voltage drop when selecting wire sizes.

  Although the instrument will compensate for the voltage in the wires, it is recommended to minimize the voltage drop as much as possible to prevent excessive power consumption from the instrument and poor dynamic response to load changes. Larger diameter wire sizes will help minimize wire voltage drops. Twisting or bundling wires will help reduce transient voltage drops.

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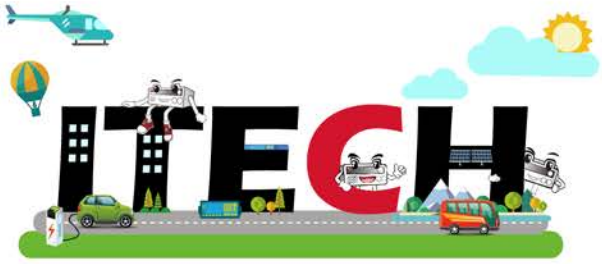

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