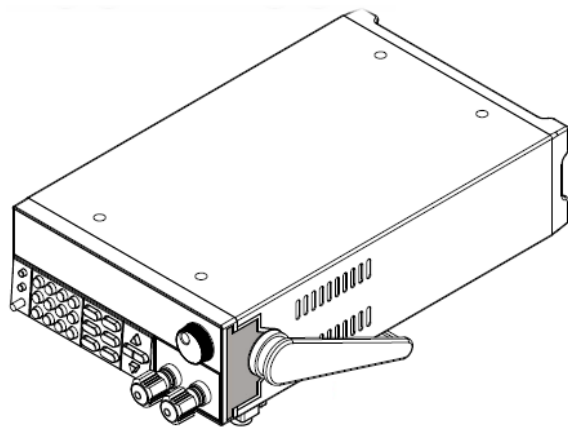# ITECH

Programmable DC Electronic Load

IT8912E User's Manual

Model: IT8912E

Version: V2.0

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Itech Electronic, Co., Ltd.

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Safety Statement

CAUTION

"Caution" signs indicate danger. It is required to pay attention to the contents of these signs during implementation of operations.

The damage to the product or loss of important data may be caused in case of improper operation steps or failure to follow operation steps. Do not continue to implement any improper operation indicated in "Caution" signs when the specified conditions are not fully understood or these conditions are not satisfied.

WARNING

"Warning" indicates danger. It is required to pay attention to the contents of these signs during implementation of operation steps. Personal casualties may be caused in case of improper operation steps or failure to follow these operation steps. Do not continue to implement any improper operation indicated in "Warning" signs when the specified conditions are not fully understood or these conditions are not satisfied.

NOTE

"Instructions" indicates operation instructions. It is required to refer to the contents of these signs during operation steps. These signs are used for providing tips or supplementary information for operators.

Certification and Quality Assurance

IT8912E electronic load completely reaches nominal technical indicators in the manual.

Warranty service

ITECH Company will provide one-year warranty services for the product materials and manufacturing (excluding the following limitations).

When warranty service or repair is needed, please send the product to the service unit specified by ITECH Company.

- When the product is sent to ITECH Company for warranty service, the customer must pay the one-way freight to the maintenance department of ITECH, and ITECH will be responsible for return freight.
- If the product is sent to ITECH for warranty service from other countries, the customer will be responsible for all the freight, duties and other taxes.

Limitation of Warranty

Warranty service does not apply to the damage caused in the following circumstances:

- Damage resulting from customer-wired circuits or customer-supplied parts or accessories;
- Product which has been modified or repaired by the customer;
- Damage caused by the circuit installed by the customer or damage caused by operation of the product in non-specified environment;
- The product model or serial number is altered, deleted, removed or made illegible by customer;
- Damage caused by accidents, including but not limited to lightning, water, fire, abuse or negligence.

Safety signs

⎓	DC power	I	ON (with the power switched on)
∼	AC power	○	OFF (with the power supply switched off)
≈	Both DC and AC power supply	⊓	Power supply switching-on status
⏚	Protective grounding terminal	⊓	Power supply switching-off status
⏚	Grounding terminal	±	Reference terminal
⚡	Danger sign	+	Positive terminal
⚠	Warning sign (refer to specific "Warning" or "Caution" information in the manual)	−	Negative terminal
⏚	Ground wire connection end sign	-	-

Safety Precautions

General safety precautions below must be followed in each phase of instrument operation. In case of failure to follow these precautions or specific warnings in other parts of the manual, violation against the safety standards related to the design, manufacture and purpose of the instrument will occur. If the user does not follow these precautions, ITECH will bear no responsibility arising there from.

WARNING

- To prevent burnout, be sure to check whether the AC voltage setting of electronic load is consistent to the supply voltage before start-up!
- Do not use the instrument if it is damaged. Before operation, check the casing to see whether it cracks. Do not operate the instrument in the presence of inflammable gasses, vapors or dusts.
- The electronic load is provided with a three-core power line during delivery and should be connected to a three-core junction box. Before operation, be sure that the electronic load is well grounded.
- Make sure to use the power cord supplied by ITECH.
- Observe all tags on the equipment before connection.
- Use electric wires of appropriate load. All loading wires should be capable of bearing maximum short-circuit current of electronic load without overheating. If there are multiple electronic loads, each pair of the power cord must be capable of bearing the full-loaded rated short-circuit output current
- 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 equipment when the removable cover is dismantled or loose.
- Please use the power adapter supplied by the manufacturer to avoid accidental injury.
- 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.
- Do not use the equipment on the life support system or other equipment with safety requirements.

CAUTION

- If the equipment is not used in the manner specified by the manufacturer, its protection may be damaged.
- Always use dry cloth to clean the equipment housing. Do not clean the inside of the instrument.
- Do not block the air vent of the equipment.

Environmental conditions

The instrument can only be used indoors or in low condensation areas. The following table shows general environmental requirements for this instrument.

Environmental conditions	Requirement

Operating temperature	0°C to 40°C
Operating humidity	20% to 80% (non condensing)
Storage temperature	-20°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).
[crossed-out wheeled bin symbol]	This instrument complies with the WEEE directive (2002/96/EC) tag requirements. This attached product tag shows that the electrical/electronic product cannot be discarded in household waste.
[10 within circle with arrows]	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

[crossed-out wheeled bin symbol] Waste electrical and electronic equipment (WEEE) directive, 2002/96/EC
The product complies with tag requirements of the WEEE directive (2002/96/EC). This tag indicates that the electronic equipment cannot be disposed of as ordinary household waste.
Product Category
According to the equipment classification in Annex I of the WEEE directive, this instrument belongs to the "Monitoring" product.
If you want to return the unnecessary instrument, please contact the nearest sales office of ITECH.

Compliance Information

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

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

Conforms with the following product standards:

EMC Standard

IEC 61326-1:2012/ EN 61326-1:2013 [1][2][3]
Reference Standards
CISPR 11:2009+A1:2010/ EN 55011:2009+A1:2010 (Group 1, Class A)
IEC 61000-4-2:2008/ EN 61000-4-2:2009
IEC 61000-4-3:2006+A1:2007+A2:2010/ EN 61000-4-3:2006+A1:2008+A2:2010
IEC 61000-4-4:2004+A1:2010/ EN 61000-4-4:2004+A1:2010
IEC 61000-4-5:2005/ EN 61000-4-5:2006
IEC 61000-4-6:2008/ EN 61000-4-6:2009
IEC 61000-4-11:2004/ EN 61000-4-11:2004

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/ EN 61010-1:2010

Content

Chapter1 Acceptance and Installation

1.1 Confirm package contents

Open the package and check the articles within package box before operation. In case of any non-conformity, missing or appearance wearing, please contact ITECH immediately.

The package box should comprise:

Device name	Quantity	Model	Remarks
Electronic load	1	IT8912E	-
Power line	1	IT-E171/IT-E172/IT-E173/IT-E174	The User may select different power lines based on local outlet specification. For detailed specifications, refer to 1.7 Installation of Power Line.
USB communication line	1	-	-
Factory alignment report	1	-	Test report before delivery.

📖 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.

IT8912E electrical load has optional fittings for individual sales. Detailed descriptions of each fitting are as shown below:

Device name	Model	Fitting description
Installation fitting for mounting instrument to rack	IT-E151/ IT-E151A	When the user is to install the instrument to a special rack, use this fitting.

1.2 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 size of the electronic load is shown as below.
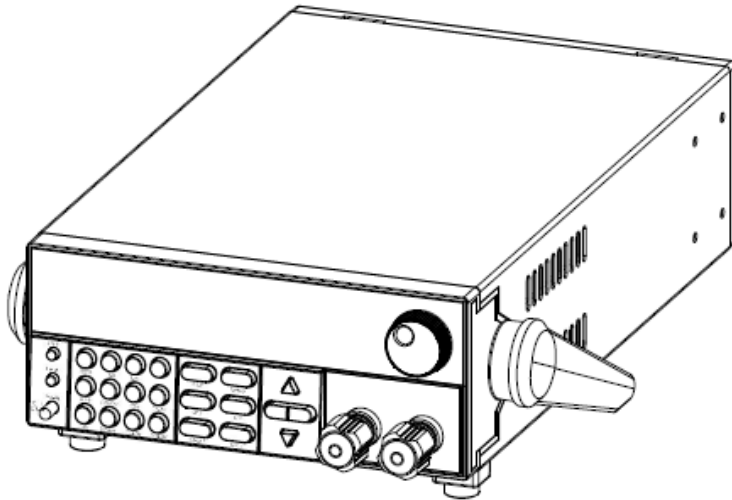
Detailed dimensional drawings
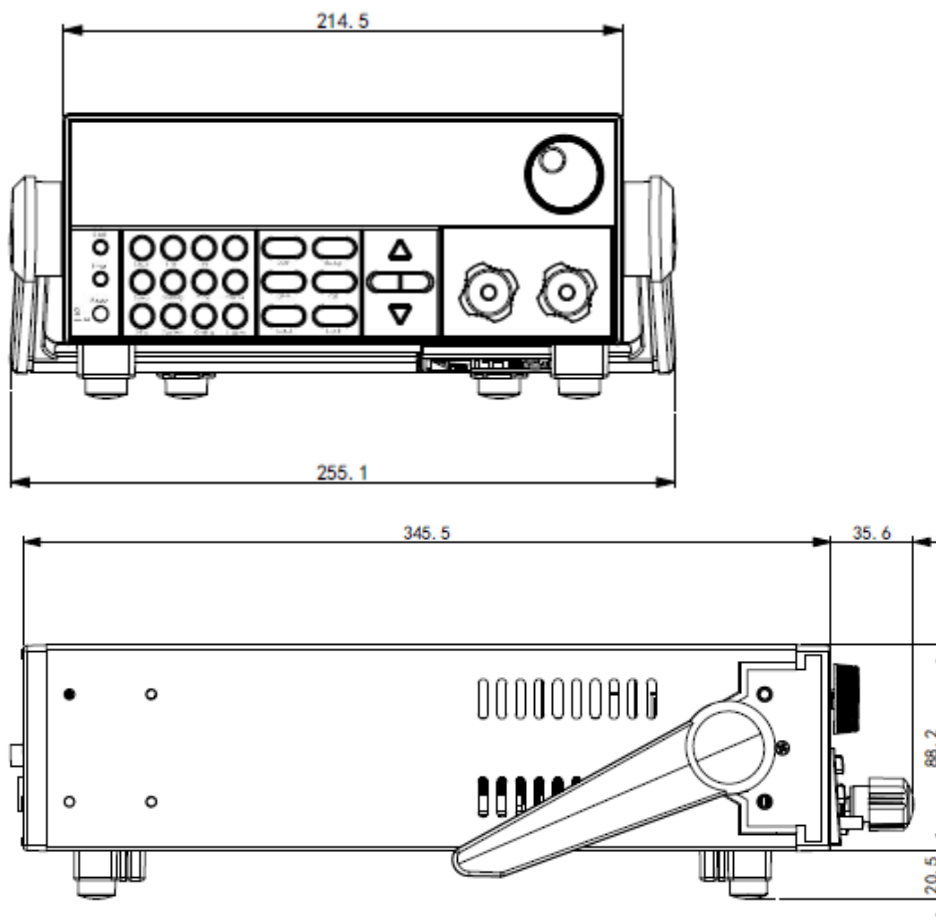
1.3 Adjustment of load handle

IT8912E load is equipped with a handle for user to easily carry and place it.

The load handle can be adjusted based on the three methods shown below. When adjusting the handle, gently pull the handle towards two sides and then rotate the handle. Each position has corresponding locker for fixing.
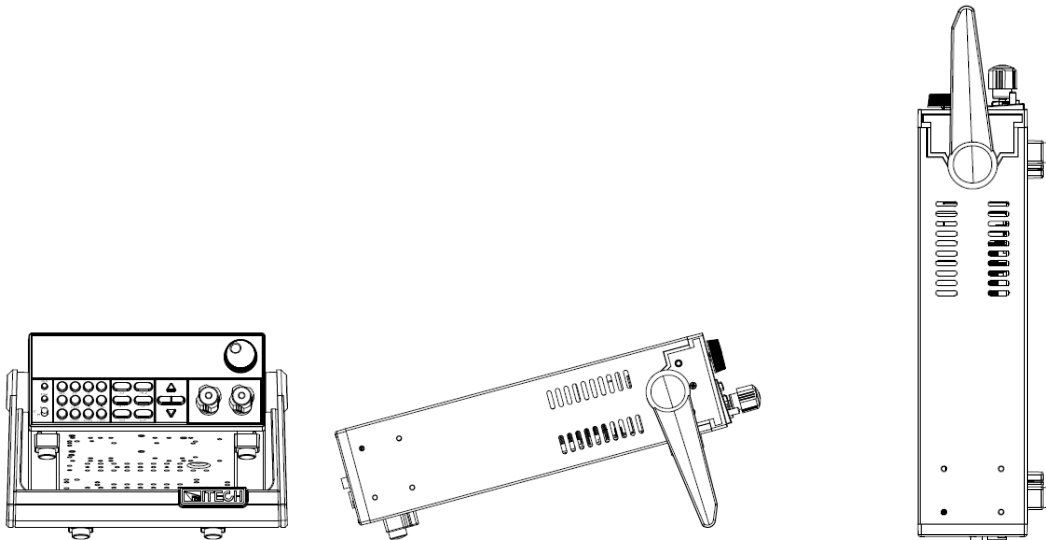
1.4 Disassembly of load handle

Please disassemble the load handle before installing equipment on the support.

Disassembly steps:

1. Adjust the handle to the position as shown in the figure below.
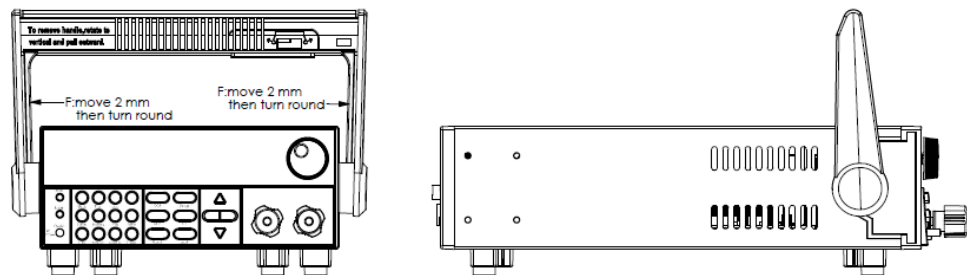
📖 NOTE

To easily disassemble handle, align the locking mouth and locking device, which is between the handle and the instrument.

2. Align the locking mouth, and pull out the handle towards two sides.

📖 NOTE

Do not use too much force and mind your hands during disassembly of load handle.

1.5 Rackmount Installation

This instrument can be installed on standard 19-inch rack. ITECH provides user with IT-E151/IT-E151A rack, as an optional mount kit. The detailed operation, please refer to the User Manual of your mount kit.

1.6 Installation of power line

Connect power line of standard accessories and ensure that the electronic load is under normal power supply.

Please select appropriate power lines appropriate to local voltage based on the specifications of power lines below. If purchased model fails to meet local voltage requirements, please contact distributor or factory for change.
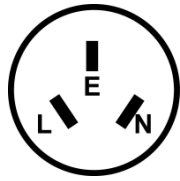
China	America, Canada, Japan	Europe	Britain
IT-171	IT-E172	IT-E173	IT-E174
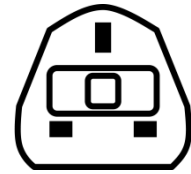
1.7 Connecting Test Lines (Optional)

Test lines are not standard accessories of the instrument. Please select optional red and black test lines for individual sales based on the maximum current value. For specifications of test lines and maximum current values, refer to "**Specifications of Red and Black Test Lines**" in "**Appendix**".

> **WARNING**
>
> ● **Before connecting test lines, be sure to switch off the power supply of the test loop in order to avoid electric shock.**
> ● **To avoid electrical shock, before testing, please make sure the rating values of the testing lines, and do not measure the current that 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.**

Test line connection is given below taking local measurement as example. For details of local and remote measurements, refer to "**Functions of Rear Panel Terminal**".

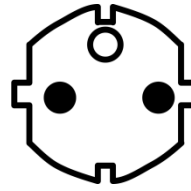1. Before connecting the test lines, be sure that the instrument Power is in Off position.

2. Unscrew 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.

3. Directly connect the other end of the red and black lines to the DUT terminal.

Chapter2 Quick Start

This chapter will introduce power-on check steps of IT8912E to ensure normal start-up and usage under initialization status of the load. Besides, to facilitate usage, this part also displays the functions of front board, rear board and keyboard keys as well as display functions of VFD (Vacuum Fluorescent Display) to a quick view of load appearance, structure and key usage functions before operation.

2.1 Brief Introduction

IT8912E is a single-input programmable DC electronic load. Built in with RS232 and USB communication interfaces, this series of programmable DC electronic load provides a multi-purpose solution to meet different design and test requirements.

This Series delivers special functions and advantages at international level, including:

- High-visibility vacuum fluorescent display (VFD)
- CC dynamic mode: up to 20KHz
- Voltage measurement dissolution rate: up to 10 mV Current 0.01 mA (10 uA)
- Voltage and current measurement speed: up to 50 KHz
- CC、CV+CC、CR、CW and CR-LED operating modes
- Unique CR-LED mode for PWM-LED driver test
- Ipp/Imax Measure function for LED driver pulsating current and inrush current test.
- Easy programmable parameter setting, applicable for simulating LED lights with different characteristics
- Adjustable frequency, duty cycle, PWM dimming output
- Pressure drop at compensation line in remote measure
- OCP test, OPP test
- Battery test function、Auto test function、Short-circuit function、Dynamic test function
- Memory capacity: 100 groups
- Portable and robust enclosure equipped with skid resistant foot stand
- Intelligent fan control
- Rotary coding switch for easy and quick operation
- Built-in Buzzer, for warning
- Outage backup memory
- Built-in USB and RS232 interface with VISA/USBTMC/SCPI protocol support

Model	Voltage	Current	Power
IT8912E(G)	500V	15A	300W

📖 NOTE

IT8912E(G) is the model with built-in GPIB, the function is the same as standard model, please check with ITECH for availability.

2.2 Front panel Introduction
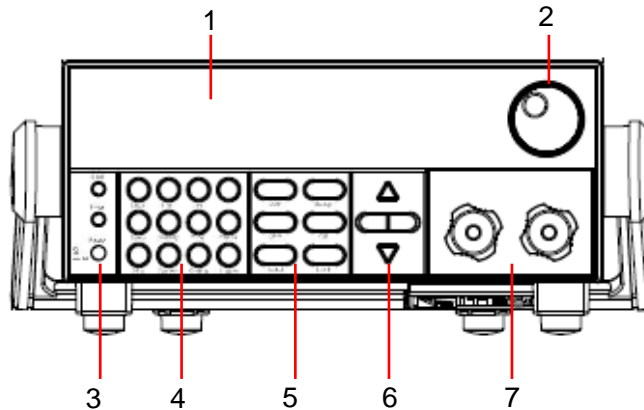
① VFD display

② Rotray knob

③ Shift composite key and Local key,Power switch

④ Numeric key:set parameter,achieve the menu's function by key combination

⑤ Function key:set the operation mode;Control the input state:on/off

⑥ direction key:to toggle the menu items,move the cursor location

⑦ input terminal

2.3 Introduction of keyboard

Keys at IT8912E key area are shown below.

Detailed description of keys:

keys	Name and functions
(Shift)	This key is used to enter other menus and functions.
(Local)	Press this key to switch the electronic load to local mode when in remote sense mode.
(Power)	Power on or shut down the electronic load.
0～9	0-9 are numeric keys.In combination with Shift compound key,

keys	Name and functions
	enable marking at bottom of each key.
(•)	Dot.
(ESC)	Esc key, to exit at any working status.
CC	To select constant current mode and set current input value.
CV	To select constant voltage mode and set voltage input value.
CR-LED	To select CR-LED function.
CW	To select constant power mode and set constant power input value.
Enter	Confirm current setting or operations.
on/off	To control input status of load: on/off.
△	Up key, to select menu items during menu operation.
▽	Down key, to select menu items during menu operation.
◀▶	Left/Right key, to adjust the cursor to the specified location to set the value.

2.4 Fast function key

A combination of front board keys and Shift composition keys in IT8912E can realize functions marked at key bottom. For details, see table below.

keys	Name and functions
●+①(Short)	To start or end short circuit test.
●+②(Tran)	To set dynamic operation parameters.
●+③(List)	To set list operation function.
●+④(Save)	To save existing setting load parameter values, e.g., voltage, current and power.
●+⑤(Battery)	To operate battery test function.
●+⑥(Prog)	To operate auto test function.
●+⑦(Info)	To display model, version number and serial number of electronic load.
●+⑧(System)	To set system menu.
●+⑨(Config)	To configure system menu.
●+⓪(Pause)	To pause operation during automatic test.
●+ (•)(Trigger)	Trigger key, to start up triggering functions.
●+ CC (OCP)	To operate OCP test function.
●+ CV (Setup)	To set specific parameters of constant voltage, constant current, constant resistance and constant power.
●+ CW (OPP)	To operate OPP test function.
●+ CR-LED (CR)	To select constant resistance mode and set resistance input value.
●+ Enter (Recall)	To select stored load parameter values, e.g., voltage, current and power setting values.

● + on/off (Lock)	To operate Keyboard locking function.

2.5 Function description of VFD status indicators

OFF	The load is off	Error	The load has error
CC	The load is under constant current mode	Trig	The load is waiting for triggering signal
CV	The load is under constant voltage mode	Sense	The load is under remote sense input mode
CR	The load is under constant resistance mode	Prot	The load is under software overcurrent protection status
CW	The load is under constant power mode	Rear	Start external analog quantity function
Rmt	The load is under remote operation mode	Auto	Start automatic voltage range
Addr	Send command under remote operation	*	Start keyboard locking function
SRQ	Serial request query	Shift	Shift key is pressed

2.6 Rear panel Introduction
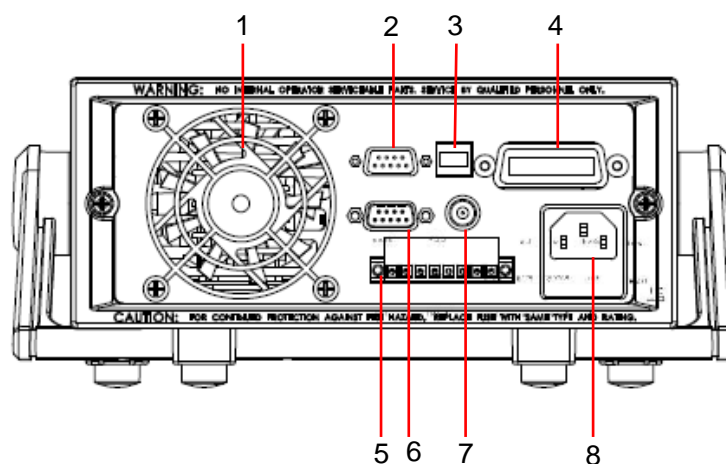
① Heat radiating window

② RS232 communication interface

③ USB communication interface

④ GPIB communication interface(Only for IT8912E(G))

⑤ Remote sense,external trigger,external analog control terminal (0-10V),PWM output terminal

⑥ External signal control terminal

⑦ I-monitor terminal

⑧ AC power input socket

2.7 Power-on selftest

A successful selftest indicates that the purchased load product meets delivery standards and is available for normal usage.

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

WARNING

- IT8912E electronic load supports 110V or 220V AC input methods. Before powering on, be sure to check that the AC input switch status matches with the supply voltage. Otherwise, it may damage the electronic load.
- Be sure to connect the main power socket to the power outlet of protective grounding. Do not use terminal board without protective grounding. Before operation, be sure that the electronic load is well grounded.
- To avoid burning out, pay attention to marks of positive and negative polarities before wiring.

Selftest steps

Normal selftest procedures:

1. Correctly connect the power line. Press **Power** key to start up.The VFD screen of electronic load displays software version number "**BOIS Ver 1.10**".

2. After approximately 1s, the system is under selftest and the VFD display shows "**System Selftest….**"

3. After selftest, the VFD display information below.

   0.0000V   0.000A

   0.00W   CC=0.000A

   Information description:

   - The first line displays actual input voltage and current values.

   - The second line displays setting values of actual power value and current (voltage, power and resistance).

4. Press ⬤(Shift)+7(Info), the electronic load VFD screen displays related information of the product. Press △ ▽ key to switch display of product model, product serial number and software version number.

   IT89XX   Ver--1.XX-1.XX

   SN1:XXXXXXXXXXXXX

Exception handling

If the electronic load cannot start normally, please check and take measures by reference to steps below.

1. Check whether the power line is correctly connected and confirm whether the electronic load is powered.

Correct wiring of power line => 2

Incorrect wiring of power line => Re-connect the power line and check whether the exception is removed.

2. Check whether the power in On. Power key is under � On status.

Yes => 3

No => Please check the **Power** key to start power and check whether the exception is removed.

3. Check whether set power voltage of electronic load is larger than the power supply voltage. If set power voltage is 220 V and the supply voltage is 110 V, the electronic load cannot start.

4. Check whether the fuse of electronic fuse is burned out.

    If yes, change fuse. Detailed steps:

1）Pull out power line and take out the fuse box at power line jack with a small screw driver. As shown below.

2）If the fuse is fused, please change fuse of same specification based on machine model. See the table blow for matching information of fuse and machine model.

Product	Fuse specification(220VAC)	Fuse specification(110VAC)
IT8912E	2.5AT	1.25AT

3）After replacement, install the fuse box back to original position, as shown below.
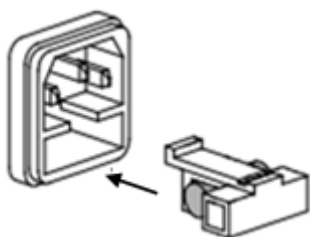
Chapter3 Function and Features

This Chapter will give a detailed description of functions and features of the electronic load. It is divided into the following parts:

- Switching of local/remote operation modes
- Constant-status operation mode
- Input control function
- Keyboard locking function
- Short circuit operation function
- Save/Recall function
- System setting function
- Triggering function
- List function
- Test function
- CR-LED function
- Measurement of voltage rise time
- VON function
- Protective function
- Remote compensation function
- Current monitoring function

3.1 Switching of local/remote operation modes

The electronic load is provided with local and remote operation modes. These two modes can be switched through communication commands. At initialization, the electronic load is defaulted under local operation mode.

- Local operation mode: for operating related functions through keys on the electronic load machine.
- Remote operation mode: for operating related functions of the electronic load on PC through a connection between the electronic load and PC. Under remote operation mode, except **[Local]** key, other keys on the board are disabled. The **[Local]** key can be used for switching to local operation mode.

3.2 Constant-status operation mode

The electronic mode can work under the 4 constant-state operation modes:

- Constant current operation mode (CC)
- Constant voltage operation mode (CV)
- Constant resistance operation mode (CR)
- Constant power operation mode (CW)

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 Fig. 3-1.
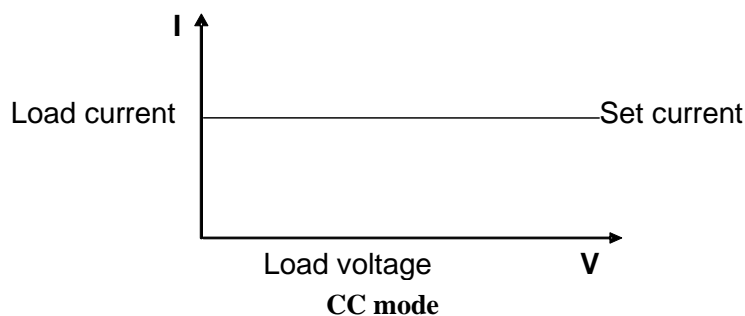
CC mode

Fig. 3-1 Voltage-Current Relation Schema under CC Mode

Under CC mode, the electronic load provides three ways to set constant current.

● Rotate adjusting knob to set constant current value.

● Use numeric keys to input current value and press **[Enter]** key to confirm set constant current value.

● Use ◀️▶ moving cursor and press △ ▽ to adjust values at corresponding positions.

Operation steps

1. Press **[CC]** key and **[Shift]** +**[CV]** to enter parameter setting screen.

   Constant   Current

   Range=0.000A

2. Set maximum working current value and press **[Enter]** for confirmation.

   Constant   Current
   Range =1.000A   ▼

3. Set maximum voltage value and press **[Enter]** key.
   Constant   Current

   High=500V   ▼

4. Set minimum voltage value and press **[Enter]** key.
   Constant   Current

   Low=0.1V   ▼

5. Set high and low rate and press **[Enter]** key.
   Constant   Current
   High-Rate   Low-Rate   ▼

6. Set ascending slope and press **[Enter]** key.
   Constant   Current
   Rise up=0.001A/uS   ▼

7. Set descending slope and press **[Enter]** key.
   Constant   Current
   Rise down=0.001A/uS

8. Complete parameter setting.
   10.0000V   0.0000A
   0.00W   CC=1.000A

NOTE

When the set current is within small range, current display resolution will be improved.

3.2.2 Constant voltage operation mode (CV)

Under CV mode of IT8900, you can set limit current (Limit). When the set limit current is higher than the input current, the electronic load will work under constant voltage; when the set limit current is lower than the input current, the electronic current will be loaded with set limit current and the voltage is input voltage. As shown in Fig. 3-2.
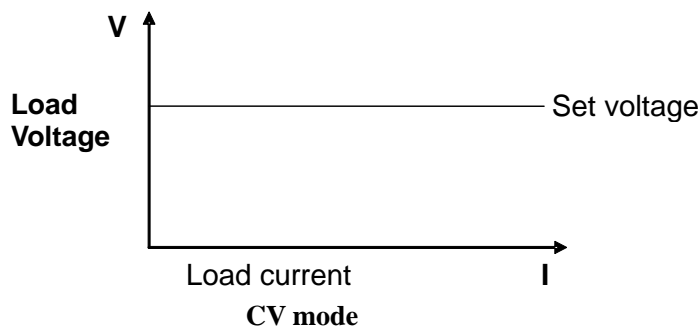
Fig. 3-2 Voltage-Current Relation Schema under CV Mode

Under CV mode, the electronic load provides three ways to modify constant voltage.

● Rotate adjusting knob to set constant voltage value.

● Use numeric keys to input voltage value and press **[Enter]** key to confirm set constant voltage value.

● Use ◀▶ moving cursor and press △ ▽ to adjust values at corresponding positions.

Operation steps

Set voltage range.

1. Press **[CV]** key and **[Shift] +[CV]** to enter parameter setting screen.
Constant   Voltage
Range=500.00V

2. Set maximum working voltage value and press **[Enter]** for confirmation.
Constant   Voltage

Range=500.00V

3. Set maximum current value and press **[Enter]** key.
Constant   Voltage
▲High=15.000A   ▼

4. Set minimum current value and press **[Enter]** key.
Constant   Voltage
▲Low=0.0000A   ▼

5. Set high and low rate and press **[Enter]** key.
Constant   Voltage
▲High-Rate   Low-Rate
6. Complete parameter setting.

10.0000V   0.0000A
0.00W   CV=2.33V

📖 NOTE

When the set current is within small range, voltage display resolution will be improved.

3.2.3 Constant resistance operation mode (CR)

Under CR mode, the electronic load is equivalent to a constant resistance (as shown below) and will give linear change of current with input voltage change. As shown in Fig. 3-3.
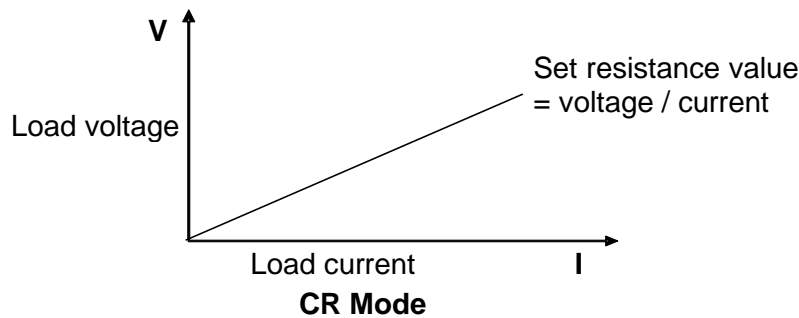
Fig. 3-3 Voltage-Current Relation Schema under CR Mode

Under CR mode, the electronic load provides three ways to modify constant resistance.

● Rotate adjusting knob to set constant resistance value.
● Use numeric keys to input resistance value and press [Enter] key to confirm set constant resistance value.
● Use ◀▶ moving cursor and press △ ▽ to adjust values at corresponding positions.

Operation steps

1. Press **[Shift] +[CR-LED]** (CR) key and **[Shift] + [CV]** to enter parameter setting screen.
   Constant   Resistance
   Range=7500.0Ω

2. Select voltage range and click **Enter** for confirmation.
   Constant   Resistance
   High-Volt   Low-Volt   ▼

3. Set maximum working resistance value and press **[Enter]** for confirmation.
   Constant   Resistance
   High=130.0V

4. Set minimum voltage value and press **[Enter]** key.

   Constant   Resistance
   Low=0.000V

5. Complete parameter setting.
   10.0000V   0.0000A
   0.00W   CC=2.000Ω

3.2.4 Constant power operation mode (CW)

Under CW mode, the electronic load will consume a constant power, as shown below. If input voltage rises, the input current decreases and power P (= V * I)

will maintain at setting power. As shown in Fig. 3-4.
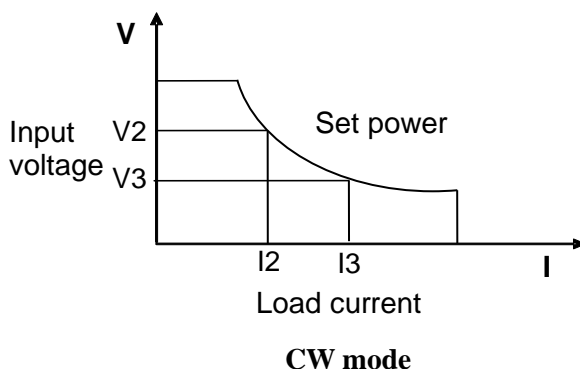
CW mode

Fig. 3-4 Voltage-Current Relation Schema under CW Mode

Under CW mode, the electronic load provides three ways to modify constant power.

● Rotate adjusting knob to set constant power value.

● Use numeric keys to input power value and press **[Enter]** key to confirm set constant power value.

● Use ◀▶ moving cursor and press △ ▽ to adjust values at corresponding positions.

Operation steps

1. Press **[CW]** key and **[Shift]** +**[CV]** to enter parameter setting screen.

   Constant   Power
   Range=300.00W

2. Set maximum working power value and press **[Enter]** for confirmation.

   Constant   Power
   Range =1.00W   ▼

3. Set maximum voltage value and press **[Enter]** key.
   Constant   Power
   ▲High=130.00V   ▼

4. Set minimum voltage value and press **[Enter]** key.
   Constant   Power
   ▲Low=0.000V

5. Complete parameter setting.
   10.0000V   0.0000A
   0.00W   CW=1.00W

3.3 Input control function

Control input switch of the electronic load by pressing **[On/Off]** key on the front board. If **[On/Off]** lamp is lighted, the input is on; and if **[On/Off]** lamp is unlighted, the VFD Off is On and the input is off. When the electronic load is on, the VFD working status indicator is OFF.

3.4 Keyboard locking function

Press the composite key ● (Shift)+ on/off (Lock) to lock the instrument board key, and the VFD displays *. Under other function statuses, except on/off key

and ●(Shift)+⑦(Info), other keys are disabled. Press this composite key to cancel locking.

3.5 Short-circuit analog function

The load can analog a short circuited circuit at input terminal. Test whether the protection function of DUT is operable when the DUT output terminal is short circuited. Press ● (Shift) + ① (Short) at the front panel of electronic load to switch the short circuit status. When the short circuit does not affect current set value, when ● (Shift) + ① (Short) is pressed again, the electronic load will return to original set status.Actual current value consumed by load at short circuit depends on the existing working mode of load and current range. Under CC, CP and CR modes, maximum short-circuit current is 110% of current range. Under CV mode, short circuit current is equivalent to that constant voltage value of load is 0 V.

3.6 Configuration save function

The electronic load can save some commonly-used parameters in 100-group NVM for convenient and fast usage. Saving parameters comprise working mode, voltage, current, etc. The **[Shift]** + 4 (Save) keys can be used for saving parameters. The **[Shift]** + **[Enter]** (Recall) key is for quick invoking.

Memory function

During RECALL, please recall saved parameters in combination with the Memory function in the system menu. To recall saved data, please combine the Group option in Memory function under system menu.

Save is divided into GROUP0～GROUP9
● Group0: recall parameters in Group 1-10;
● Group1: recall parameters in Group 11-20;
● Group2-Group9 will be in the same manner;

📖 NOTE

Recall 1,2,3,4,5,6,7,8,9,0 correspond to recall of Groups 1-10. Similarly, Group2-Group9 will be in the same manner.

Operation steps

If the operator needs to save configured parameter values for direct recall in follow-up operation, refer to the steps below:

E.g., power supply 6V and 3A. The electronic load works under constant current (CC) 1A. Save "CC 1A" in register 9 for recall.

● SAVE：

1. Set parameters and press **[Shift]**+ 4 keys to save data. Press 9 key (to select in which group the data is to be saved).
   5.8949V   0.99994A
   5.89W   SAVE 9

2. Press **[Enter]** key.
   5.8949V   0.99994A
   5.89W   cc=1.000A

● RECALL

Press **[Shift]** + **[Enter]** key and press **9** (to select from which group the data is recalled).

5.8949V   0.99994A

5.89W   cc=1.000A

3.7 System menu function (System)

Press [Shift] + 8 to enter system menu setting.

Initialize	INITIALIZE SYSTEM?	Initialize system menu
	NO	Keep existing configurations
	YES	Recover all configurations to factory set values
Power-ON	POWER-ON PARAMENT	Set power-on parameters
	RST(default)	Set the input status of load at powering on as "status as delivered"
	SAV0	Set the input status of load at powering on as SAVE 0 value
Buzzer	BUZZER STATE	Set the buzzer status
	On(default)	Set the buzzer as ON status.
	Off	Set the buzzer as OFF status.
Knob	LOAD ON KNOB MODE	Set the pulse knob
	Update(default)	Real-time update
	Old	No update (Recover to original value at ON/OFF)
Trigger	TRIGGER SOURCE	Set triggering mode
	Manual（Def）	Manual trigger
	External	External signal trigger mode
	Hold	Trig: IMM valid
	Bus	GPIB bus trigger mode
	Timer	Timer trigger mode
Memory	MEMORY	Save/recall setting parameters to specified storage location
	Group=（0-9）	0 group:means 1-10 storage location；1 group：means 11-20 storage location, et cetera
Displ	DISPLAY ON TIMER	Screen displays loading time
	On	Start function
	Off（default）	Stop function
Communication	COMMUNICATION	Select the interface for communication with a computer
	After interface entry, press the Arrow Key to select RS232 configuration	4800, 8, N non parity check, 1, NONE
		9600 O even parity check CTS/RTS
		19200 E odd parity check XON/XOFF
		38400
		57600
		115200
	USBTMC	Select the USB communication interface.
	GPIB	Address（0-31）
Protocol	PROTOCOL	Communication protocol selection
	SCPI（Default）	SCPI protocol
	Extend-Table	Expand SCPI protocol for compatibility of other machines

3.8 Configuration menu function (Config)

Press **[Shift]** + 9 to enter menu configuration (CONFIG MENU).

Von	VOLTAGE ON		Start judgment voltage of load
	Living	Von living state	
	Point= 2V		Set Von point
	Latch	Von latch state	
	Point= 2V		Set Von point
Protect	PROTECT MENU		
	Max-P	Set hardware power protection	
	MAX POWER		
	Point=300.00W		Set hardware protective power value
	A-Limit	Set software current protection	
	CURRENT LIMIT		
	On		Start function
	Point=15A		Set software current protective value
	Delay= 3S		Set software current protective delay
	Off		Stop function
	P- Limit	Set software power protection	
	POWER LIMIT		
	Point=300W		Set software power protective value
	Delay= 3S		Set software power protective delay
	Time	Set loaded timer	
	ON-TIMER		
	On		Enable timer function
	Delay=10S		Setup timing,max value is 60000s
	Off		Disable timer function
Measure	MEASURE MENU		
	TimeV1	Measure voltage rise/drop time	
	TIMER VOLTAGE1		Set starting voltage value
	Point=0.000V		
	TimeV2	Measure voltage rise/drop time	
	TIMER VOLTAGE2		Set stopping voltage value
	Point=120.00V		
	FILTER	Smoothing function	
	Average Count=2^(2~16)		Set of average count
Remote-Sense	REMOTE SENSE STATE	Remote sense function	
	On	Enable remote sense function	
	Off	Disable remote sense function	
Ext-Program	EXTNAL PROGRAM	External analog control function	
	On	Turn on external analog control function(0-10V)	
	Off	Turn off external analog control function(0-10V)	

3.9 Trigger function

Trigger function is necessary to operate dynamic pulse output and list output. There are five triggering methods to trigger the tested instrument.

Optional triggering sources of triggering function of electronic load comprise:

- Key ((Shift)+ (Trigger)) trigger: when key trigger is valid, press (Shift)+ (Trigger) key and the load will trigger an operation.
- External trigger signal (TTL): TRIG on the rear board is the triggering input terminal. When external trigger signal method is effective, after applying a low pulse (> 10 us), the load will trigger an operation. When external trigger is selected, the positive and negative terminals of TRIG will generate trigger signals and low pulse is effective. An input corresponding to each trigger can be used to change set value (voltage, current, resistance, etc).

You can stir between the set values under dynamic trigger mode or generate pulse under dynamic pulse mode.

● Timing trigger: when the timing trigger is valid, the load will automatically trigger an operation at intervals.

● Bus trigger: when the bus trigger is valid, after the load receives a trigger command (5AH) , the load will trigger an operation.

● Trigger holding: when trigger holding is valid, only when the load receives trigger command (9DH), the load will trigger an operation.

Select the triggering sources as follows:

Operation steps

1. Press **[Shift]** + 8 (system) to enter system menu setting screen.

   POWER-ON BUZZER

2. Press ◀▶ to move to the Trigger and press **[Enter]** to enter trigger source selection screen.

   SOURCE MANUAL

3. Press ◀▶ to select trigger method and press **[Enter]** to complete setting.

   MANUAL：Manual trigger

   EXTERNAL：external signal trigger

   BUS：BUS command trigger

   HOLD：special command trigger

   Timer：timing trigger

4. Press **[Esc]** to exit setting. The system displays original values under different modes.

3.10 List operation

LIST mode provides an accurate, fast and low-cost way to complete any complicated current change mode, which enables synchronization of internal or external signals in multiple quasi-bit load precision tests.

When different trigger sources are selected, the LIST function will form a variety of complex sequences by editing step value, pulse width and slope of each step to meet complicated test requirements. LIST parameters comprise designation of input list file, input step count (2-84 steps at maximum), step time (0.00005s – 3600s) as well as setting value and slope of each step. The list file can be stored in non-volatile RAM available for a quick output in case of usage. The user can edit 7 groups of list files at maximum.

If the load operation mode is at List operation, the load will start List operation when it receives a trigger signal and will stop when it complete or when it receives another trigger signal.
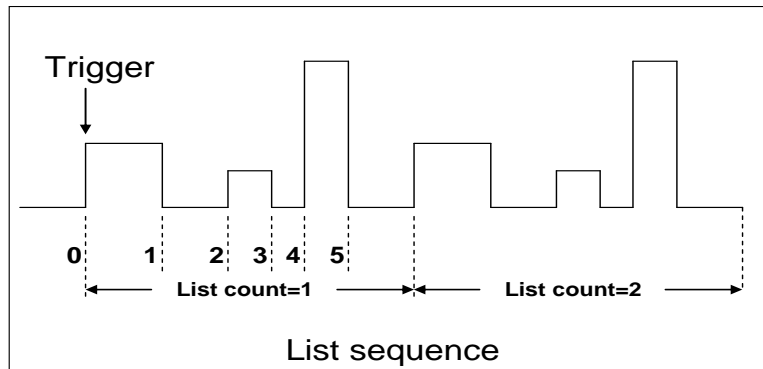
You can press the keys on the front panel of the electronic load to edit the sequence operation files, and trigger this sequence operation. Or you may directly recall existing sequence operation files to trigger the sequence operation.For example, when the DUT output voltage is 10V and the output current is 3A, after editing the sequence operation files under Constant Current (CC) mode, the steps for triggering sequence operation are as follows:

Operation steps

1. Press **[Shift]** + 3 keys.
   LIST
   On   Recall   Edit

2. Operate ◀▶ key and move to Edit. Press **[Enter]** key.
   EDIT   LIST
   High-Rate   Low-Rate

3. Operate ◀▶ key and move to the High-Rate and press **[Enter]** key.
   EDIT   LIST
   Current Range=3A

4. Edit number of steps. Press 2 key to edit two steps. Press **[Enter]** key.
   EDIT   LIST
   File Step=2（2-84）

5. Edit current value in step 1 and press **[Enter]** key.
   EDIT   LIST
   Step 001   Level=1A

6. Edit slope in step 1 and press **[Enter]** key.
   EDIT   LIST
   Step 001   Rate=0.1A/uS

7. Edit time in step 1 and press **[Enter]** key.
   EDIT   LIST
   Step 001   Width=5S

8. Edit current value in step 2 and press **[Enter]** key.
   EDIT   LIST
   Step 002   Level=2A

9. Edit slope in step 2 and press **[Enter]** key.
   EDIT   LIST
   Step 002   Rate=0.1A/uS

10. Edit time in step 2 and press **[Enter]** key.
    EDIT   LIST
    Step 002   Width=5S

11. Edit repeat count and press **[Enter]** key.

EDIT LIST
Reapeat Count=3

12. Save all edited files and press **[Enter]** key.

EDIT LIST
Save List File=1（1-7）

13. Operate ◀▮▶ key and move to On. Press **[Enter]** key (The Trig lamp that indicates VFD screen status   is on). Press **[ESC]** key to exit setting.

LIST
On   Recall   Edit

14. Press **[On/Off]** key to open input and press **[Shift]** + ⊙ key (Trigger key). List operation running

15. Press **[CC]/ [CV]/ [CR]/ [CW]** key or any composite function key to exit List test function.

For direct recall of existing List files and triggering of List operation, refer to steps below:

Operation steps

1. Press **[Shift]** +3 keys and ensure that ON lamp flicks. If not, press **[Enter]** before operation. Press ◀▮▶ key to select Recall. And press **[Enter]** for confirmation.
LIST
On   Recall   Edit

2. Select edited files and press **[Enter]** for confirmation.
Recall List File=1

3. Operate ◀▮▶ key and move to On. Press **[Enter]** key (The Trig lamp that indicates VFD screen status is on). Press **[ESC]** key to exit setting.
LIST
On   Recall   Edit

4. Press **[On/Off]** key to open input and press **[Shift]** + ⊙ key (Trigger key) List operation.

3.11 Dynamic test function

Through dynamic test operation, the electronic load can be switched between two setting parameters based on setting rules. This function can be used to test dynamic performances of power supply. For dynamic test operation, press **[Shift]** + 2 key on the front board to enter the dynamic test menu. Before test, firstly, set parameters related to dynamic test operation, including dynamic test mode, A value, B value, pulse width time, frequency, duty ratio, etc. Under CC mode, current ascending and descending slopes should be set for dynamic test.

The dynamic test mode can be divided into continuous mode, pulse mode and toggle mode.

3.11.1 Continuous mode

Under continuous mode, after enabling dynamic test operation, the load will be switched continuously between A value and B value.
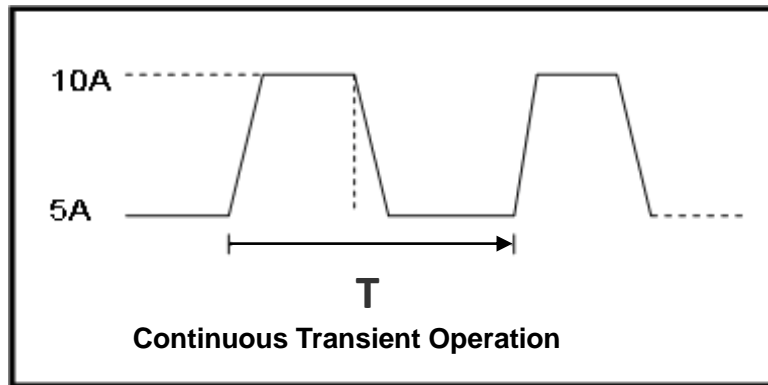
Continuous Transient Operation

Taking CC mode as example (operations under other modes are similar), when output voltage and current of the tested instrument are 10 V and 3 A respectively, the load current will switch from 1 A and 2 A. Set the dynamic test parameters and perform the test as follows:

1. Press **[Shift]** + 2 keys.
   TRANSITION
   On   Off

2. Operate ◀▶ key and move to On. Press **[Enter]** key and select Continuous. Press **[Enter]** key (The Trig lamp that indicates VFD screen status is on)
   TRANSITION
   Continuous   Pulse   Toggle

3. Operate ◀▶ key and select high range and low range. Move to the High-Rate and press **[Enter]** key.
   TRANSITION
   High-Rate   Low-Rate

4. Set ascending slope and press **[Enter]** key.
   TRANSITION
   Rise up=5.000A/uS

5. Set descending slope and press **[Enter]** key.
   TRANSITION
   Rise down=5.000A/uS

6. Set A value and press **[Enter]** key.
   TRANSITION
   Level A=1A

7. Set B value and press **[Enter]** key.
   TRANSITION
   Level B=2A

8. Set frequency value and press **[Enter]** key.
   TRANSITION
   Frequnce=50Hz（0.01-25000Hz）

9. Set duty ratio and press **[Enter]** key.
   TRANSITION
   Duty=98%（0.1%-99.9%）

10. Start dynamic test and operate ◀▶ key. Move to On and press **[Enter]** key.
    TRANSITION

    On   Off

11. Enter the dynamic test mode.
    10.0000V   0.0000A
    0.00W   0 TRAN

12. Press **[On/Off]** key to open input and press **[Shift]** + ⊙ (Triggering key)

    The load will continuously switch between A and B value. Time of operations is shown at bottom right.

13. Press **[CC]**/ **[CV]**/ **[CR]**/ **[CW]** key or any composite function key to exit dynamic test function. Repeat Steps 1-12 to continue parameter setting and operation of dynamic test.

3.11.2 Pulse mode

Under pulse mode, after enabling dynamic test operation, the load will switch to B value after receipt of a trigger signal and switch back to A value after maintaining B for pulse width time.
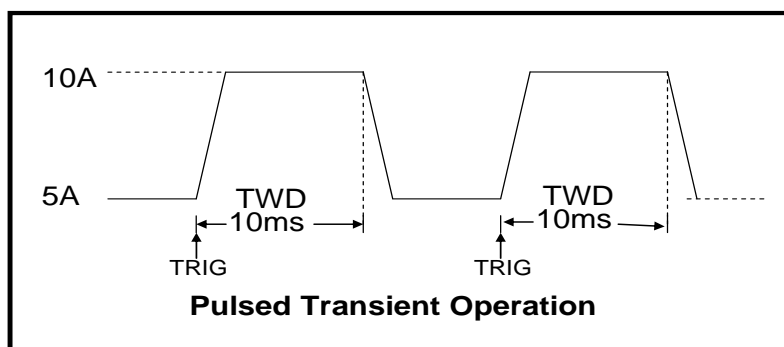
Pulsed Transient Operation

Taking CC mode as example (operations under other modes are similar), when output voltage and current of the tested instrument are 10 V and 3 A respectively, the load current will switch from 1 A and 2 A. Set the dynamic test parameters and perform the test as follows:

1. Press **[Shift]** + 2 keys.
   TRANSITION
   On   Off

2. Operate ◀▐▶ key and move to On. Press **[Enter]** key and select Pulse. Press **[Enter]** key (The Trig lamp that indicates VFD screen status is on)
   TRANSITION
   Continuous   Pulse   Toggle

3. Operate ◀▐▶ key and select high range and low range. Move to the High-Rate and press **[Enter]** key.
   TRANSITION
   High-Rate   Low-Rate

4. Set ascending slope and press **[Enter]** key.
   TRANSITION
   Rise up=30.000A/uS

5. Set descending slope and press **[Enter]** key.
   TRANSITION
   Rise down=30.000A/uS

6. Set A value and press **[Enter]** key.
   TRANSITION
   Level A=1A

7. Set B value and press **[Enter]** key.
   TRANSITION
   Level B=2A

8. Set time width and press **[Enter]** key.
   TRANSITION
   Pulse Width=5S（ 0.00002-3600S）

9. Start dynamic test and operate ◀▶ key. Move to On and press **[Enter]** key.
   TRANSITION
   On   Off

10. Enter the dynamic test mode.
    10.0000V   0.0000A
    0.00W   0 TRAN

11. Press **[On/Off]** key to open input and press **[Shift]** + ⊙key (Triggering key)
    The load will switch after receipt of every trigger signal. The load will continuously switch between A and B value. Times of operations is shown at bottom right.

12. Press **[CC]/ [CV]/ [CR]/ [CW]** key or any composite function key to exit dynamic test function. Repeat Steps 1-11 to continue parameter setting and operation of dynamic test.

3.11.3 Toggle mode

Under toggle mode, after enabling dynamic test operation, the load will switch one time between A value and B value after receipt of every trigger signal.
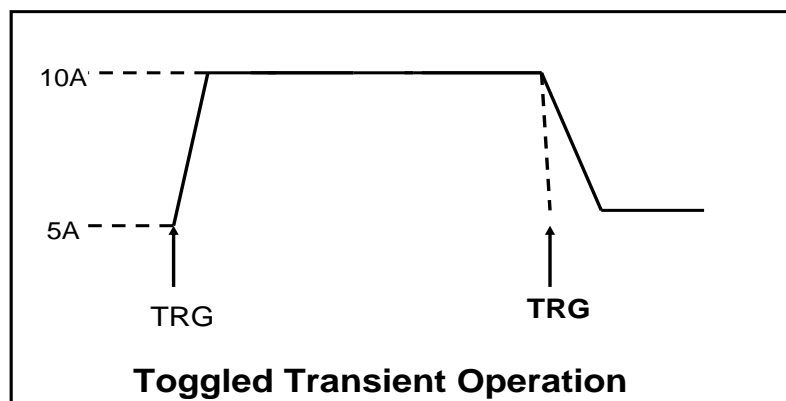
Toggled Transient Operation

Taking CC mode as example (operations under other modes are similar), when output voltage and current of the tested instrument are 10 V and 3 A respectively, the load current will switch between 1 A and 2 A. Set the dynamic test parameters and perform the test as follows:

1. Press **[Shift]** + 2 keys.
   TRANSITION
   On   Off

2. Operate ◀▶ key and move it to On. Press **[Enter]** key and move the cursor to Toggle. And press **[Enter]** key (The Trig lamp on VFD screen status is on)
   TRANSITION
   Continuous   Pulse   Toggle

3. Operate ◀▶ key and select high range and low range. Move to the High-Rate and press **[Enter]** key.
   TRANSITION
   High-Rate   Low-Rate

4. Set ascending slope and press **[Enter]** key.
   TRANSITION

Rise up=30.000A/uS

5. Set descending slope and press **[Enter]** key.
TRANSITION
Rise down=30.000A/uS

6. Set A value and press **[Enter]** key.
TRANSITION
Level A=1A

7. Set B value and press **[Enter]** key.
TRANSITION
Level B=2A

8. Start dynamic test and operate ◀▊▶ key. Move to On and press **[Enter]** key.
TRANSITION
On   Off

9. Enter the dynamic test mode.
10.0000V   0.0000A
0.00W   0 TRAN

10. Press **[On/Off]** key to open input and press **[Shift]** + ⊙ key (Triggering key)

The load will switch after receipt of every trigger signal. The load will switch between A and B value for one time. Times of operations is shown at bottom right.

11. Press **[CC]/ [CV]/ [CR]/ [CW]** key or any composite function key to exit dynamic test function. Repeat Steps 1-10 to continue parameter setting and operation of dynamic test.

3.12 OCP test function

The IT8912E electronic load is provided with overcurrent protection test function (OCP). Under OCP test mode, when input voltage reached Von value, delay for a while for the electronic load to latch. Ascend value by step value at regular interval. At the same time, check the load input voltage and judge whether it is higher than standard voltage value. If higher, it indicates that OCP does not occur. Repeat current stepping operation till the load operates to the cutoff current; if lower, it indicates that OCP does occur. Check whether the existing current value is within target scope again. If yes, PASS the test.

Press **[Shift] + [CC]** (OCP) keys to enter OCP test function setting screen.

OCP TEST	Run	OCP TEST	
			Operate OCP test documents
	Recall	OCP TEST	
		Recall OCP File=1	Recall OCP test documents (1-5)
	Edit	OCP TEST	
		1：Voltage on level=0.000V	Set Von voltage value
		2：Voltage on Delay=0.00S	Set Von voltage delay time
		3：Current Range=0.000A	Set working current range
		4：Start Current=0.000A	Set initial current value
		5：Step Current=0.000A	Set step current value
		6：Step Delay=0.00S	Set step delay time
		7：End Current=0.000A	Set cutoff current value
		8：OCP Voltage=0.000V	Set OCP voltage value
		9：Max Trip Current=0.000A	Set overcurrent range

		(maximum value)
	10：Min Trip Current=0.000A	Set overcurrent range (minimum value)
	Save OCP File=1（1-5）	Save OCP test documents

Operating steps:

1. Press **[Shift]** + ⊙ key to start OCP test. If within range, PASS the test and the board will display as follows:

```
9.9973V        0.0005A
0.01W    5.100A    PASS        STOP
```

If not, there is FAULT and the board will display as follows:

```
9.9973V          0.0005A
0.01W    5.100A    FAULT    STOP
```

End test. Press [ESC] to return to setting screen. Press [ESC] again to exit.

📖 NOTE

If the set OCP voltage value is higher than the power voltage value, the OCP will fail to operate and the board will display as follows:

```
9.9990V          0.0009A
0.01W    0.100A    FAULT    STOP
```

3.13 OPP test function

1. Press **[Shift]** + **[CW]** keys to enter OPP test function setting screen:

OPP TEST	Run	OPP TEST		
			Operate OPP test documents	
	Recall	OPP TEST		
		Recall OPP File=1	Recall OPP test file（1-5）	
	Edit	OPP TEST		
		1：Voltage on level=0.000V	Set Von voltage value	
		2：Voltage on Delay=0.00S	Set Von voltage delay time	
		3：Current Range=0.000A	Set current range	
		4：Start Power=0.000W	Set initial power value	
		5：Step Power=0.000W	Set step power value	
		6：Step Delay=0.00S	Set step delay time	
		7：End Power=0.000W	Set cutoff power value	
		8：OPP Voltage=0.000V	Set OPP voltage value	
		9：Max Trip Power =0.000W	Set overpower range (maximum value)	
		10：Min Trip Power =0.000W	Set overpower range (minimum value)	
		Save OPP File=1（1-5）	Save OPP test documents	

2. Press **[Shift]** + ⊙ key to start OPP test.
   when input voltage reaches Von value, delay for a while for the electronic load to latch. Ascend value by step value at regular interval. At the same time, check the load input voltage and judge whether it is higher than standard voltage value. If higher, it indicates that OPP does not occur. Repeat power stepping operation till the load operates to the cutoff power; if lower, it indicates that OPP does occur. Check whether the existing power value is within target scope again. If yes, PASS the test. and the board will display as follows:

```
9.996V              0.0007A
0.01W     49.10W    PASS    STOP
```

If not, there is FAULT and the board will display as follows:

```
9.996V              0.0007A
0.01W     48.6W     FAULT    STOP
```

End test. Press **[ESC]** to return to setting screen. Press **[ESC]** again to exit.

📖 NOTE

If the set OPP voltage value is higher than the power voltage value, the OPP will fail to operate and the board will display as follows:

```
9.996V              0.0007A
0.01W     0.1W      FAULT     STOP
```

3.14 Battery discharge test function

In the IT8912E electronic load, constant current mode is applied for discharge test with programmatic setting of stop voltage/capacity/discharging time If stop voltage is set as the stop condition, the system determines whether the battery is about to reach the set threshold value or unsafe status when the battery voltage is low, and if yes, an automatic stop will be activated. During test, the operator can observe voltage, discharging time and discharged capacity of battery. Battery discharge test is a necessary step before battery replacement for it can reflect reliability and remaining life of battery.

Press **[Shift]** + 5 keys to enter function testing screen of battery discharge test.

STOP CONDITION	Voltage	STOP Condition	
		Stop Voltage=0.000V	Set stop voltage
	Capability	STOP Condition	
		Stop Capability=0.000Ah	Set battery stop capacity
	Timer	STOP Condition	
		Stop Timer=0S	Set discharge time

Operation method:

1. Press **[On/Off]** key to cut off load input status. Connect the battery to be tested. Under CC mode, press **[Shift]** + 5 keys to enter battery discharge function menu and select one of the three methods for test based on actual requirements.

2. Set discharge stopping conditions:

- Type I: Press **[Shift]** + 5 keys and select Capability. Press **[Enter]** key and the VFD displays Stop Capability =Ah. Set battery stop capacity. Press **[Enter]** key. When set battery capacity is reached, the load input status will automatically be OFF.

- Type II: Press **[Shift]** + 5 keys and select Voltage. Press **[Enter]** key and the VFD displays Stop Voltage=V. Set stop voltage and press **[Enter]** key to start discharge test. When the battery voltage drops to stop voltage, the load input status will automatically be OFF.

- Type III: Press **[Shift]** + 5 key and select Timer. Press **[Enter]** key and the VFD displays Stop Timer=S (Max. 99999S). Set discharge time. When the set stop time is reached, the load input status will automatically be OFF.

3. Press **[Shift]** + ⊙ key to start test. The board will display discharge voltage, current discharge time and discharged capacity (AH).

4. Press **[ESC]** key to exit battery capacity test mode in any three methods.

3.15 CR-LED test function

IT8912E electronic load adds diode break-over voltage setting under traditional CR mode. Only when the voltage across the electronic load is higher than the diode break-over voltage, the electronic load will work. This is the completely true simulation of the working principle of the diode. So IT8912E electronic load can simulate the real LED test ripple current.

PWM dimming is to use the pluse width modulation technology to control the LED driver luminance.

IT8900 LED mode is used for LED lamp dimming.User can control PWM(PWM+,PWM-) terminal output via adjusting the frequency and duty ratio setup in menu.

Operating steps:

1. Press CR-LED key.
   0.000V   0.00000A
   0.00W   V_o=200.00V

2. Press ⬤ (Shift)+ CV to enter CR-LED setup.

3. Select voltage range,press Enter to confirm.
   Led   Mode
   High-Volt   Low- Volt ▼

4. Set the upper current limit,press Enter to confirm
   Led   Mode
   ▲High=15.500A   ▼

5. Set the lower current limit,press Enter to confirm
   Led   Mode
   ▲Low=0.1000A   ▼

6. Set LED driver working voltage,press Enter to confirm
   Led   Mode
   ▲Volt=200V   ▼

7. Set LED driver working current,press Enter to confirm

Led   Mode
▲Curr=3.000A   ▼

8. Set coeff of LED driver,press `Enter` to confirm
Led   Mode
▲Coef=0.150   ▼

9. Set PWM frequency,press `Enter` to confirm
Led   Mode
▲Freq= 100Hz   ▼

10. Set PWM duty ratio,press `Enter` to confirm
Led   Mode
▲Duty=0.500   ▼

11. Finish all settings.
0.000V   0.00000A
0.00W   Vo=200.00V

📖   NOTE

Press upper key can help user return to last step operation.

After setting, you can press (Shift) +4 (Save) to save, so that you can press (Shift) + Enter (Recall) to call.

Set LED mode value

- Vo：constant working voltage For LED constant source loaded with LED lamp;

- I_o：output current of LED constant current source;

- V_f：break-over voltage of diode (string);

- R_d：LED impedance value;
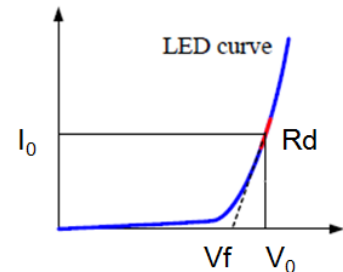
Get the equation below through the above four parameters and V-I characteristic curve of LED:

$$\frac{V_o - V_f}{R_d} = I_o \Leftrightarrow \frac{V_o - V_f}{I_o} = R_d \Leftrightarrow \frac{V_o\left(1 - \dfrac{V_f}{V_o}\right)}{I_o} = R_d \Leftrightarrow \left(1 - \frac{V_f}{V_o}\right) = \frac{R_d}{\left(\dfrac{V_o}{I_o}\right)} = \frac{R_d}{R_{DC}}$$

Define $Coeff = \dfrac{R_d}{R_{DC}}$

$$\Rightarrow R_d = \frac{V_o}{I_o} \times Coeff \Rightarrow V_f = V_o \times (1 - Coeff)$$

Coeff means the proportion of Rd voltage in the loop. This parameter is convenient when the user analogs the same type of LED while the number of series is different.

Note: The specification range of each parameter is as shown below:

CR-LED mode	range	Uo-L				Uo-H			
	Option	Uo	Io	Coef	Rd	Uo	Io	Coef	Rd
	range	0.1~100V	0~15A	0.01~1	0.08~30 Ω	0.1~500V	0~3A	0.01~1	1.8~1600 Ω

The relationship among Vo, Io, Rd and Coeff shall be subject to the equation:

$$R_d = \frac{V_o}{I_o} \times Coeff$$

. Actual set values of Vo, Io and Coeff are affected by their

specification ranges and dynamic range of equations of $V_o = \dfrac{R_d}{I_o} \times C\text{oeff}$,

$I_o = \dfrac{V_o}{R_d} \times C\text{oeff}$ and $C\text{oeff} = \dfrac{I_o}{V_o} \times R_d$. For example, select range to Vo-L and complete setting of Vo and Io. When Io/Vo equals to 1, the set value of Coeff is affected by both Coeff specification rang and Rd range. Actual set value ranges from 0.08 to 1. The user cannot set any value between 0.01 and 0.08.

3.16 Measurement rise time For voltage

The IT8912E electronic load is provided with special voltage rise/drop time measurement function. This function gives a simple analog of voltage rise/drop speed of oscilloscope test power.

Operation methods:

1. **Set initial voltage and final voltage**

   a) Press **[Shift]** +9 keys to enter configuration menu. Press Right key. Select "Measure" and press **[Enter]** key.

   b) Press ◀▶ to select "TimeV1". Press **[Enter]** key. Press numeric keys to set initial voltage value and press **[Enter]** key.

   c) Press ◀▶ to select "TimeV2". Press **[Enter]** key. Press numeric keys to set final voltage value and press **[Enter]** key.

   d) Press **[ESC]** to exit setting.

2. **Start timer function**

   a) Press **[Shift]** +8 keys to enter system menu. Press Right key till "Displ" flicks and press **[Enter]** key.

   b) Press ◀▶ key to select "On". Start timer function and press **[Enter]** key.

   c) Press **[ESC]** to exit setting.

3. VFD second line will display time 0.0000S between power value and set value.

```
OFF CC
0.0001V          0.0002A
0.00W    0.0000S  CC=0.000A
```

4. **Measurement of rise time**

5. Connect DC power to be tested to the input terminal of the electronic load. The power is set with a value that is higher than the set final voltage value. Keep power output in OFF status.

6. Set a constant current value on the load and open the load input.

7. Open power output.

8. The electronic load timer starts timing. After ending, time will keep stable, which is rise time of voltage.

9. Close the power output. The electronic load VFD will display voltage drop time.

3.17 VON function

When testing some power products with slow voltage rise speed, if the electronic load input is opened before power, 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.

Press [Shift] + 9 keys to enter configuration menu. Set voltage value in Voltage on under configuration menu to control on/off status of electronic load. Based on Von value load and unload, the load has two modes: Living and Latch. When Living is selected, it indicates that the work load point is in living status; when Latch is selected, it indicates that the work load point is in latch load status.

📖 NOTE

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 without authorization to prevent unnecessary trouble from failure of loading.

If the instrument cannot 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 VON LIVING 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.
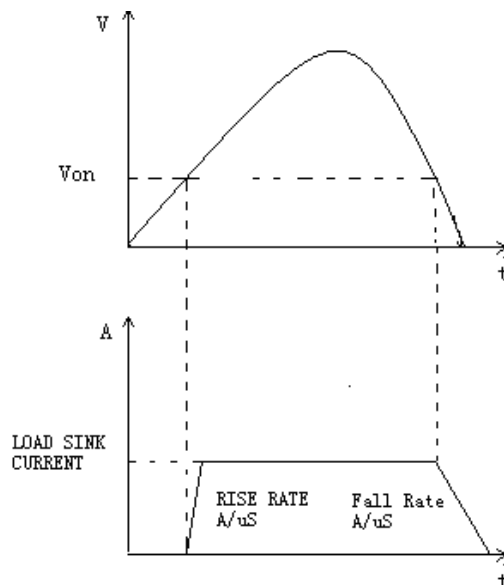
Load working range when VON LIVING is started

● When VON LATCH 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.
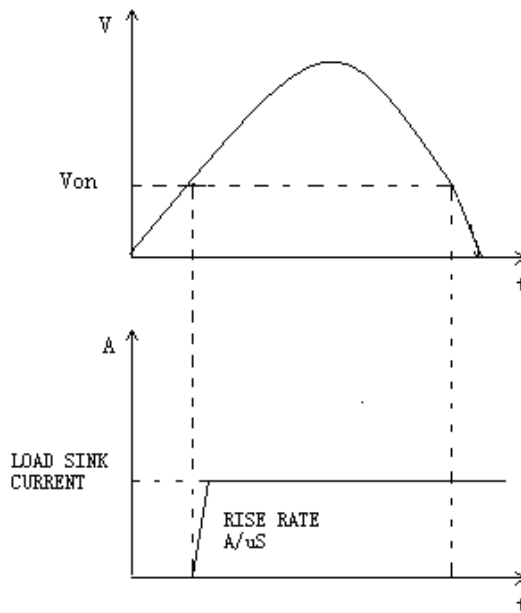
Load working range when VON LATCH is started

3.18 Protective function

The load is provided with following protective functions: overvoltage protection (OVP), overcurrent protection (OCP), overpower protection (OPP), overtemperature protection (OTP) and input reverse polarity protection (LRV/RRV).

If any one of the above protections is enabled, the load will have corresponding actions. Press any key on the front board to reset protection functions. For example, in case of overtemperature protection, the load will give alarm and the input will automatically switch to OFF status. The load VFD will display OTP.

3.18.1 Overvoltage protection (OVP)

The load will be immediately OFF and the buzzer will sound if the overvoltage circuit is triggered. OV and PWM bits of the status register will be set and OVP will be displayed on the screen of the load till resetting. In case of overvoltage protection, the VF pin of the 8-pin connector on rear board of the load outputs TTL high level and the PWM pin can be used for controlling output status of the power to be tested.

Clear overvoltage protection status

Inspect whether voltage of object under test is within load rated voltage or set protection voltage range. If not, disconnect the object. Press any key on load front board (or send command to PROTection:CLEar), the load front board (OVP) word will get cleared and the load will exit OVP protection status.

3.18.2 Overcurrent protection (OCP)

The electronic load is provided with two kinds of overcurrent protections: hardware overcurrent protection and software overcurrent protection.

- Hardware overcurrent protection: maximum load current of the electronic load is limited within about 110% of the existing current range by hardware. When the hardware triggers overcurrent protection, OC bit of the status register will be set; when such protection is removed, the OC bit will be reset. The On/Off status of load will not be changed by the hardware

overcurrent protection.

- Software overcurrent protection: the user can set load software overcurrent protection value following steps: press **[Shift]** + 9 key >Protect> A-limit (set as ON). I point is set as OCP current value and A delay set as pre-alarm delay time. When software overcurrent protection function is on, if the loading current value exceeds delay of such overcurrent protection set value, the load will automatically be OFF and the VFD will display OCP. At the same time, OC and PS bits of the status register will be set and keep till reset.

Clear overcurrent protection status

Inspect whether current of object under test is within load rated current or set protection current range. If not, disconnect the object. Press any key on load front board (or send command to PROTection:CLEar), the load front board (OCP) word will get cleared and the load will exit OCP protection status.

3.18.3 Overpower protection (OPP)

The electronic load is provided with two kinds of overpower protections: hardware overpower protection and software overpower protection.

- Hardware overpower protection: the user can set load hardware overpower protection. Load overpower will be limited to existing power value. The On/Off status of load will not be changed by the hardware overpower protection.

- Software overpower protection: the user can set load software overpower protection value following steps: press **[Shift]** + 9 key >Protect > P- Limit > Point set OPP power value. Delay is set as pre-alarm delay time. If the loading power value exceeds delay of such overpower protection set value, the load will automatically be OFF and the VFD will display OPP. At the same time, OP and PS bits of the status register will be set and keep till reset.

Clear overpower protection status

Inspect whether power of object under test is within load rated power or set protection power range. If not, disconnect the object. Press any key on load front board (or send command to PROTection:CLEar), the load front board (OPP) word will get cleared and the load will exit OPP protection status.

3.18.4 Overtemperature protection (OTP)

When internal power device of load is higher than about 85 °C, the load is under temperature protection. At this time, the load will automatically be OFF and VFD will display OTP. At the same time, OT and PS bits of the status register will be set and keep till reset.

Clear overtemperature protection

When load temperature is decreased to protection point, press any key on load front board (or send command to PROTection:CLEar), the load front board (OTP) word will get cleared and the load will exit OTP protection status.

3.19 Functions of the terminals at the rear panel

3.19.1 Remote sense compensation functions

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: SENSE (+) and SENSE (-) 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.

Operation steps of remote sense measurement:

1. Press **[Shift]** +9 keys to enter menu. Operate ◀▮▶ key and select Remote-Sense. Press **[Enter]** key.
2. Select ON and start Sense function. Set load in remote sense measurement mode.
3. Remote sense measurement is connected. Refer to figure below for detailed wiring.
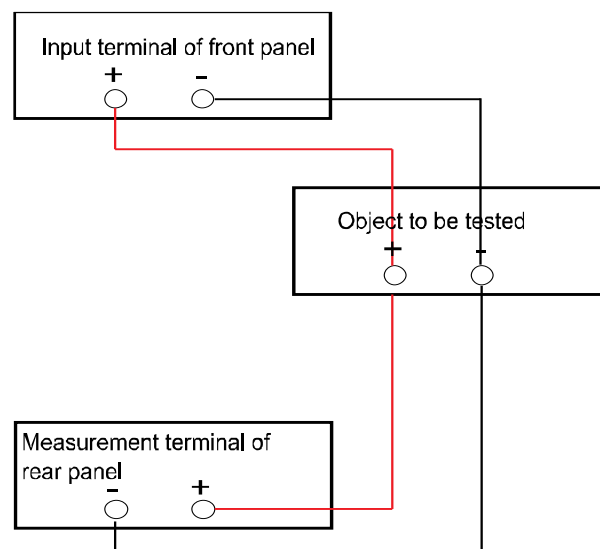
3.19.2 External trigger function

When rear board triggering mode is selected, firstly, set the trigger source as External and the triggering signal is input from the rear board TRIG terminal.

Press **[Shift]** + 8 keys to enter system menu. Click Right key till Trigger appears and flicks. Press **[Enter]** to entry and press ◀▮▶ to select External. Press **[Enter]** for confirmation. Press **[ESC]** to exit the menu.

When external trigger is selected, the positive and negative TRIG terminals will generate trigger signal and the low pulse is valid.

Input corresponding to one trigger can be used for triggering dynamic test, LIST test and auto test.

3.19.3 External analog quantity test

Loading voltage or current of the electronic load can be controlled by EXT PRG (positive and negative) analog quantity terminals on rear board. Connect 0-10V adjustable voltage at the EXT PRG terminal to analog input from 0- full range so as to adjust input voltage and current of load (10V corresponds to voltage or current of load at full range).

3.19.4 Voltage fault indication

When load is under overvoltage protection or terminal reverse polarity

protection, PWM pin voltage fault indication terminal outputs high level.

3.19.5 Current monitoring (I Monitor)

The 0-10V analog quantity output signal of current monitoring output terminal represents input current to which the terminal belongs from 0 to full range. An external voltmeter or oscilloscope can be connected to display input current change.

3.20 Auto test function

The IT8912E electronic load delivers strong auto test functions, which can analog several tests. A total of 10 groups of test files can be edited, and each group test file has 10 steps. Therefore, a maximum of 100 steps can be edited and saved in EEPROM.

📖 NOTE

In the following editing procedures, "Y indicates selected status. To cancel selected status, press numeric key of corresponding step again.

Operation steps

1. Press **[Shift]** + 6 keys.
   PROGRAM
   Run   Recall   Edit

2. Operate ◀▶ key and move to Edit. Press **[Enter]** key to enter editing test files
   EDIT   PROGRAM
   Active Sequence=0987654321

3. Press numeric key to select test step and press **[Enter]** key. Active Sequence= 09876543YY (indicating that 1/2 step has been selected).
   EDIT   PROGRAM
   Active Sequence=09876543YY

4. Select whether pause is necessary for these two steps. If step 2 is to be paused, press 2 key. If not, directly press **[Enter]** key.
   EDIT   PROGRAM
   Pause Sequence=□□□□□□□□Y1

5. Select whether short-circuit test is necessary for these two steps. If step 1 is to be tested, press 1 key. If not, directly press **[Enter]** key.
   EDIT   PROGRAM
   Short Sequence=□□□□□□□□2Y

6. Set loading time of step 1. If 2S is required, directly press 2 key on the board. Press **[Enter]** key.
   EDIT   PROGRAM
   SEQ01 On Time=2S

7. Set unloading time of step 1. If 2S is required, directly press 2 key. Press **[Enter]** key.
   EDIT   PROGRAM
   SEQ01 Off Time=2S

8. Set test delay time of step 1. If 1S is required, directly press 1 key. Press **[Enter]** key. Tpf is delay time before measurement.
   EDIT   PROGRAM
   SEQ01 P/F Delay Time=1S

9. Set loading time of step 2. If 2S is required, directly press 2 key. Press **[Enter]** key.
   EDIT   PROGRAM
   SEQ02 On Time=2S

10. Set unloading time of step 2. If 2S is required, directly press 2 key. Press **[Enter]** key.
    EDIT   PROGRAM
    SEQ02 Off Time=2S

11. Set test delay time of step 2. If 1S is required, directly press 1 key. Press **[Enter]** key. Tpf is delay time before measurement.

    EDIT   PROGRAM
    SEQ02 P/F Delay Time=1S
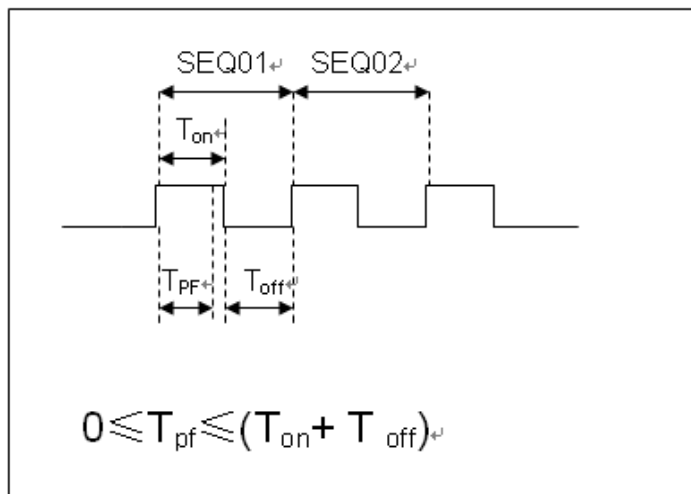
Tpf is delay time before measurement.

12. Set conditions for stop test. COMPLETE means to stop after finished all tests and FAILURE means to stop in case of test error. Press **[Enter]** key.
    PROGRAM
    Complete-Stop   Failure-Stop

13. Determine whether to link to next group of test file. If it is to link to second group, press 2 key. 0 means not to link to other test files. Press **[Enter]** key.
    PROGRAM
    Chain Program File=0(0-10）

Correspondence Table of Auto test files and step parameter saving.

Program 1 Sequence	1	2	3	4	5	6	7	8	9	10
Save Group	1	2	3	4	5	6	7	8	9	10
Program 2 Sequence	1	2	3	4	5	6	7	8	9	10
Save Group	11	12	13	14	15	16	17	18	19	20
⋮										
⋮										
Program 10 Sequence	1	2	3	4	5	6	7	8	9	10
Save Group	91	92	93	94	95	96	97	98	99	100

14. Save the programmed files in EEPROM. A total of 10 groups of files can be saved. If it is to save edited files in group 1, press 1 key. Press **[Enter]** key.

    PROGRAM
    Save Program File=1（1-10）

15. Press **[ESC]** key to exit editing menu.

The above steps only set entire framework of auto tests. Additional setting is required for specific parameters in each step. This design will facilitate modification of parameters in a single step.

16. Select desired working mode and set working parameters. Press **[Shift]** + **[CV]** to enter parameter setting.
    10.0000V   0.0000A
    0.00W   CC=1.000A

17. It is assumed that step 1 edits CC mode as follows: current: 2A, maximum voltage value: 10V, and minimum voltage value: 2V; and step 2 edits CV mode as follows: voltage: 3V, maximum current value: 5A, and minimum current value: 0A. After parameter setting in each step, press **[ESC]** to exit setting menu. Press **[Shift]** + 4 key for saving. **Settings at each step should be independently saved. Refer to the Correspondence Table for saving position.**

18. It is necessary to recall test files for running after editing auto test files.

Recall test file for running

To recall edited test files from EEPROM quickly after re-energizing instrument, refer to the method below.

1. Press **[Shift]** + 6 keys.
   PROGRAM
   Run   Recall   Edit

2. Operate ◀▶ key, select Recall and press **[Enter]** key.
   RECALL PROGRAM
   Recall Program File=1

3. Operate ◀▶ key, select Run and press **[Enter]** key.
   PROGRAM
   Run   Recall   Edit

4. Display auto test file 1.
   PRG01 STOP

5. Press **[Shift]** + ⊙ key.

   Operate auto test file 1. Press **[Shift]** + 0 key to pause auto test. Press ▽ key for next step.

Chapter4 Technical Specification

4.1 Specification

Model					IT8912E				
Rated value (0~40 ℃)	Input voltage				0~500V				
	Input current				0~3A		0~15A		
	Input power				300W				
	Min-op-V				0.72V/3A		3.6V/15A		
	Temperature factor				≤100ppm/℃				
CV mode	range				0.1~500V				
	resolution				10mV				
	accuracy				±(0.05%+0.05%FS)				
CC mode	range				0~3A		0~15A		
	resolution				0.1mA		1mA		
	accuracy				±(0.05%+**0.1%FS**)		±(0.05%+0.05%FS)		
CR-LED mode	range				Uo-L		Uo-H		
	Option	Uo	Io	Coef	Rd	Uo	Io	coef	Rd
	range	0.1~100V	0~15A	0.01~1	0.08~30Ω	0.1~500V	0~3A	0.01~1	1.8~1600Ω
CR mode *1	range				**0.3Ω**~300Ω【0~100V/0~15A】		8Ω~7.5KΩ【0~500V/0~3A】		
	resolution				16bit				
	accuracy				0.2% +0.01S ***2**		0.2% +0.001S ***3**		
CP mode *4	range				300W				
	resolution				10mW				
	accuracy				0.2%+0.2%FS				
Dynamic mode									
Dynamic mode					CC mode				
	T1＆T2				20uS~3600S /Res:1 uS				
	accuracy				5 uS±100ppm				
	Increasing/decreasing slope *5				0.0001~0.3A/uS		0.001~1.5A/uS		
	Minimum rise time *6				≒10uS		≒10uS		
PWM dimming output									
Output voltage					10V				
Frequency range					20Hz~2KHz				
Duty cycle					10%~100%				
Measurement range									
Readback voltage	range				0~500V				
	resolution				10 mV				
	accuracy				±(0.025%+0.025%FS)				
Readback current	range				0~3A		0~15A		
	resolution				0.01mA		0.1mA		
	accuracy				±(0.05%+0.05%FS)				
Readback power	range				300W				
	resolution				10mW				
	accuracy				±(0.2%+0.2%FS)				

Protection range		
OPP	≒310W	
OCP	≒3.3A	≒16.5A
OVP	≒530V	
OTP	≒85℃	
specification		
Short circuit	current（CC）| ≒3.3A	≒16.5A
	voltage（CV）| 0V	0V
	resistance（CR）| ≒240mΩ	
Input impedence	≒500KΩ	
External analog monitoring		
I-Monitor	0~10V	
Corresponding current	0~15A	
Ac power supply		
voltage	110V	220V
frequency	50/60Hz	
Apparent power	Max: 50VA	
Fuse specification	T2.5A	T1.25A
dimension W*H*D (mm)	214.5mm*88.2mm*354.6mm	
Weight (net)	5Kg	
Storage temperature	-20℃~70℃	

*1 The voltage/current input is no less than 10%FS (FS indicates the full scope).

*2 Range of current readback value: (1/(1/R+(1/R)*0.2%+0.01),1/(1/R-(1/R)*0.2%-0.01)

    a) When voltage input value is less than 10%FS: 0.2%+0.1/Vin (s);

    b) When current input value is less than 10%FS, the load current precision is: ±(0.2%xVin/Rsetting+3mA);

*3 Range of resistance readback value: (1/(1/R+(1/R)*0.2%+0.001),1/(1/R-(1/R)*0.2%-0.001)

    a) When voltage input value is less than 10%FS: 0.2%+0.05/Vin (s);

    b) When current input value is less than 10%FS, the load current precision is: ±（0.2%xVin/Rsetting+10mA）;

*4 The voltage/current input is no less than10%FS

*5 Increasing/decreasing slope: 10%~90% increasing slope of current when the current is from 0 to maximum current.

*6 Minimum rise time: 10%-90% current rise time

*The above specifications may be subject to change without prior notice.

4.2 Supplementary parameters

Memory capacity:100 groups

Suggested calibration frequency：1time/year

Input levels of AC power supply (which can be selected through the switch at load bottom)

Option Opt.1: 220V ±10%　50Hz/60Hz

Option Opt.2: 110V ±10%   50Hz/60Hz

Cooling method: Fan cool

Chapter5 References of Load Communication Interfaces

IT8912E electronic load is provided with two communication interfaces to communicate with a computer for selection, including S232 and USB.

5.1 RS232 interface

Connect E-load and computer by cable of COM ends (DB9). Composite key **[Shift]** + numeric key 8 on front board can be used to enter system menu for activation.

In RS-232 interface, all SCPI commands can be used for programming. If RS-232 interface is selected, in accordance with internal connection of data terminal equipment (DTE) and data communication equipment (DCE) as defined in EIA RS-232, the load is connected to another DTE (e.g., PC COM interface) with direct-connected Modem cable.

> 📖 NOTE
>
> IT8912E has two COM ports at the rear panel: The 9-hole COM port connectors at top are the RS232 communication ports; and the 9-pin COM ports at bottom are the external signal control interfaces.
>
> RS-232 setting in procedure should be consistent with that in system menu of front board. Press composite key **[Shift]** + numeric key 8 to change (if necessary). Send a ^C or ^X character string to the load to pause data transmission. It will clear any uncompleted operation and waive any uncompleted output.

RS-232 data format

RS-232 data is a 10-bit word having a start bit and a stop bit. Start bit and stop bit are not editable. However, next odd or even item can be selected by front board **[Shift]** + numeric key 8 (System). The odd and even items are saved in NVM.

Baud rate

Through front board **[Shift]** + numeric key 8 (System), the user may select one Baud rate saved in NVM: 4800/9600/19200/38400/57600/115200

RS-232 Connection

Use RS-232 cable with DB-9 interface because the RS-232 serial port can be connected controller (e.g. PC) serial port. Do not use modulating cable of air-conditioner.

If your computer is provided with a RS-232 interface with DB-25 plug, a cable and a adapter with DB-25 plug (one end) and DB-9 plug (the other end) are required (not the modulating cable of the air-conditioner).
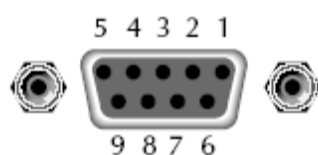
RS232 Pins of Plug

Base pin number	Description
1	No conjunction
2	TXD, data transmission
3	RXD, data receiving

4	No conjunction
5	GND, grounding
6	No conjunction
7	CTS, clear to send
8	RTS, request to send
9	No conjunction

RS-232 Troubleshooting:

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

- Please check the parameters setting

  PC and power supply must have the same configuration in the following items: baudrate, parity bit,data bit and flow control.Please note that power supply has been configured with a start bit and stop bit(the two values are fixed).

- Check the cable

  Ensure you have used the correct communication cable.Please pay attention that some cable may not have a correct internal wiring even it is with a appropriate DB9 interface.
  The RS232 communication cable should have been connected to a correct serial port of the PC.

Communication Setup

Please ensure the PC and the load have the same configuration in the following items.

baudrate：9600(4800、9600、19200、38400、57600、115200)。You could enter the system menu to set the baudrate.

Data bit：8

Stop bit：1

Parity bit：(none,even,odd)

EVEN   8 data bits have even parity

ODD   8 data bits have odd parity

NONE   8 data bits have no parity

Native machine address: (0 ~31, factory default is 0)

Parity=None	Start Bit	8 Data Bits	Stop Bit

5.2 USB Interface

Connect the load and the computer using a cable with two USB interfaces (each end). All functions of the load can be programmed via USB.

The functions of load USB488 interface are as follows:

- The interface is 488.2 USB488 Interface.
- The interface receives requests of REN_CONTROL, GO_TO_LOCAL and LOCAL_LOCKOUT.

- The interface receives the command MsgID=TRIGGER USBTMC and conveys the TRIGGER command to the functional layer.

The functions of load USB488 device are as follows:

- Capable to read all common SCPI commands.
- SR1 enabled.
- RL1 enabled.
- DT1 enabled.

5.3 GPIB interface (Only for IT8912E(G))

Firstly, connect load GPIB interface and computer GPIB card through IEEE488 bus and ensure sufficient contact. Tighten them with screws. Set address. Load address range: 0-31. Press **[Shift]** + numeric key 8 (System) to enter system menu functions. Press Left/Right key to find Communication. Select GPIB and set address. Input address and press **[Enter]** for confirmation. The load works by setting GPIB address on front board. GPIB address is saved in NVM.

Appendix

Specifications of Red and Black Test Lines

ITECH provides you with optional red and black test lines, which individual sales and you can select for test. For specifications of ITECH test lines and maximum current values, refer to the table below.

Model	Specification	Cross section	Length
IT-E301/10A	10A	-	1m
IT-E301/30A	30A	$6mm^2$	1.2m
IT-E301/30A	30A	$6mm^2$	2m
IT-E301/60A	60A	$20mm^2$	1.5m
IT-E301/120A	120A	$50mm^2$	2m
IT-E301/240A	240A	$70mm^2$	1m
IT-E301/240A	240A	$70mm^2$	2m
IT-E301/360A	360A	$95mm^2$	2m

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

AWG	10	12	14	16	18	20	22	24	26	28
The Maximum current value(A)	40	25	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.

Contact Us

Thanks for purchasing ITECH products. In case of any doubts, please contact us as follows:
1. Visit ITECH website: www.itechate.com.
2. Select the most convenient contact method for further information.