User's Manual

DC Programmable Electronic Load

Model IT8500plus series

IT8511+/IT8512+/IT8512B+/IT8512C+
/IT8513C+/IT8514B+/IT8514C+/IT8516C+

Ver1.1 /MAR, 2013/ IT8500+

Warranty Information

Certification

We certify that this product met its published specifications at time of shipment from the factory.

Warranty

This hardware product is warranted against defects in material and workmanship for a period of ONE year from date of delivery. During the warranty period our company will either repair or replace products which prove to be defective. Our company does not warranty that the operation for the software firmware or hardware shall be uninterrupted or error free.

For warranty service, with the exception of warranty options, this product must be returned to a service facility designated by our company. Customer shall prepay shipping charges (and shall pay all duty and taxes) for products returned to our place for warranty service. Our company shall pay for return of products to Customer.

Limitation of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by the Customer, Customer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation and maintenance.

Assistance

The above statements apply only to the standard product warranty. Warranty options product maintenance agreements and customer assistance agreements are also available.

Safety Summary

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument .We assumes no liability for the customer’s failure to comply with these requirements.

Environmental Conditions

This instrument is intended for indoor use in a pollution degree 2 environment. It is designed to operate at a maximum relative humidity of 80%. Refer to the specifications tables for the AC mains voltage requirements and ambient operating temperature range.

Before Applying Power

Verify that all safety precautions are taken. Note the instrument's external markings described under "Safety Symbols".

Ground the Instrument

This product is a Safety Class 1 instrument (provided with a protective earth terminal). To minimize shock hazard, the instrument chassis and cover must be connected to an

electrical ground. The instrument must be connected to the AC power through a grounded power cable, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet. Note: Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of fumes or flammable gases.

KEEP AWAY FROM LIVE CIRCUITS

Operating person must not remove instrument covers except as instructed in this Guide for installing or removing electronic load modules. Component replacement and internal adjustments must be made only by qualified service personnel. Do not replace components with the power cable connected. Under certain conditions dangerous voltages may exist even with the power cable removed. To avoid injuries always disconnect power, discharge circuits and capacitors, and remove external voltage sources before touching components.

DO NOT SERVICE OR ADJUST ALONE

Do not try to perform internal service or adjustment unless another person capable of rendering first aid resuscitation is present.

Safety Symbols


Direct current


Alternating current


Both direct and alternating current


Protective earth (ground) terminal


Caution (refer to accompanying documents)

WARNING

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

CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

NOTE

We suggest you operate the instrucment after half an hour warm machine operation to ensure the accuracy.

The content of this manual is subject to change without notice.

Introduction

IT8500plus series DC electronic loads are single channel programmable electronic load which can provide multiple solutions according to the requirements of your design and test. This series have international advanced functions and features.

- Highlight VFD display
- Dynamic mode: Up to 10KHZ;
- Measurement resolution: 0.1mV,0.1mA
- Measurement speed: up to 40KHZ
- Four operation mode:CV(Constant Voltage),CC,CR,CW
- Rotary knob, making the operation more convenient
- Remote Sense function
- Battery test function
- Memory capacity to save/recall setting parameters: 100 registers
- Short circuit function
- Intelligent fans
- Build-in Buzzer as alarm signal
- Power off memory function

Operational accessory:
IT8511+/IT8512+/IT8512B+/IT8512C+/ IT8513C+ optional accessory:
IT-E121(RS232)，IT-E122(USB)，IT-E123(RS485)
IT-E151(Rack mount kit)
IT8514B+/IT8514C+/IT8516C+ optional accessory:
No, the models equipped with RS232/USB interface.

Model	Voltage	Current	Power	Communication interface
IT8511+	120V	30A	150W	COM
IT8512+	120V	30A	300W	COM
IT8512B+	500V	15A	300W	COM
IT8512C+	120V	60A	300W	COM
IT8513C+	120V	120A	600W	COM
IT8514B+	500V	60A	1500W	USB/RS232
IT8514C+	120V	240A	1500W	USB/RS232
IT8516C+	120V	240A	3000W	USB/RS232

Chapter1 Inspection and Installation

1.1 Inspection

Make sure that you have received the following compontents in the table below (one instrucment for example).If anything has been lost, please contact with your franchiser.

Item	Part Number	Description
One power cord	IT-E171	You can choose different power cord according to your region.
	IT-E172	
	IT-E173	
	IT-E174	
One user's manual		Installation,operation,self-test information
One test report		Calibration report

1.2 Cleaning

Do not clean any internal parts of the electronic loads casually.If you need to clean the outside cover, please use a dry cloth or moistish cloth to wipe.

Caution: Cut the power off before cleaning.

1.3 Installation

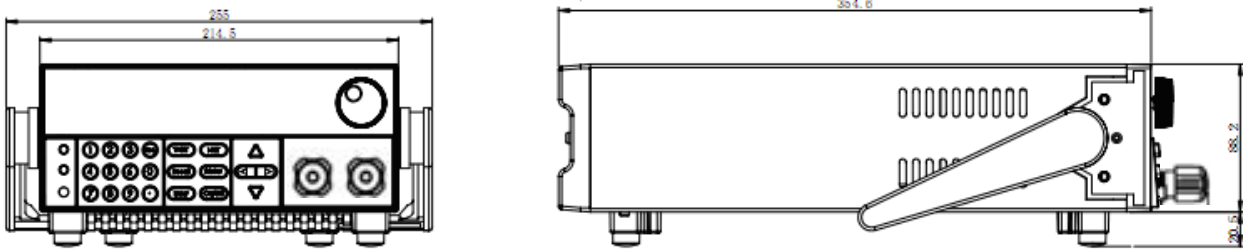
The following outside drawing has marked the dimension information.The instrucment should be fixed in a ventilation and reasonable size of space.

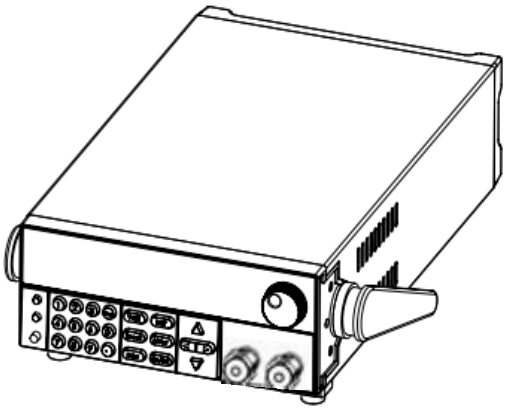
1.3.1 Mounting Dimensions

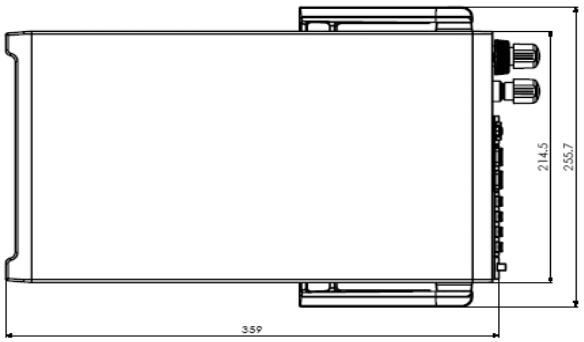
IT8511+/IT8512+/IT8512B+/IT8512C+ Dimension：

214.5 mmW x 88.2mm H x 354.6mm D

Refer to the following dimension drawing:



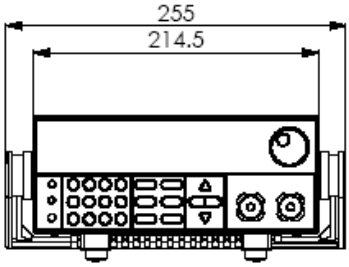


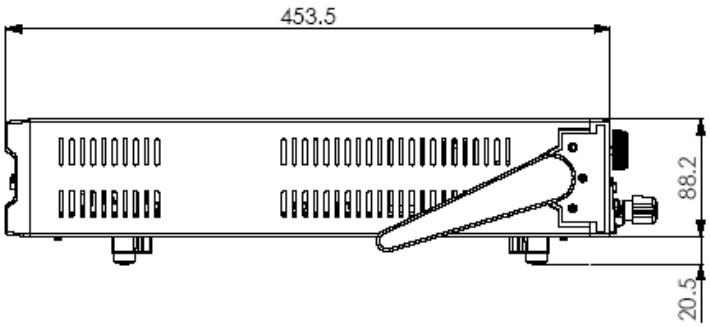


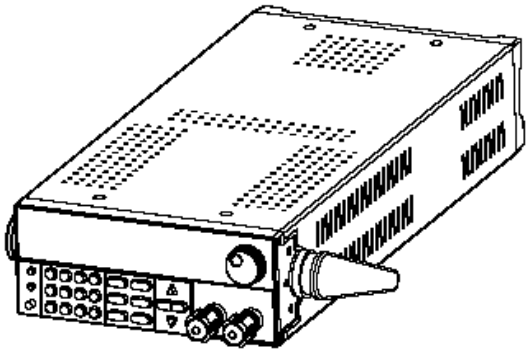
unit: minimeter（mm）

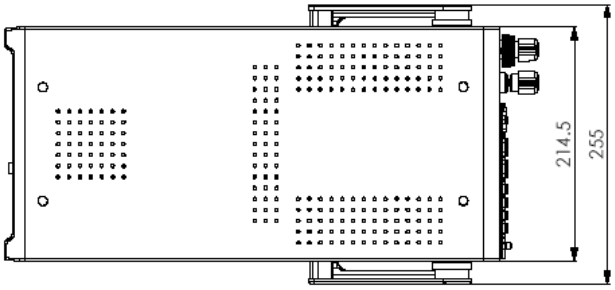
IT8513C+ Dimension:

214.5 mmW x 88.2mm H x 453.5mm D





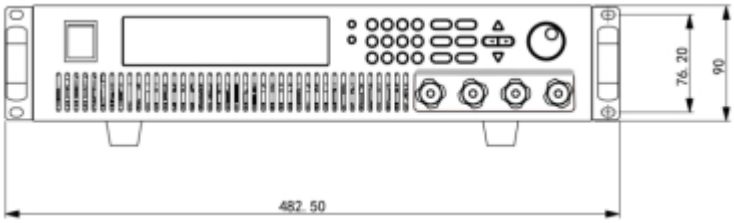


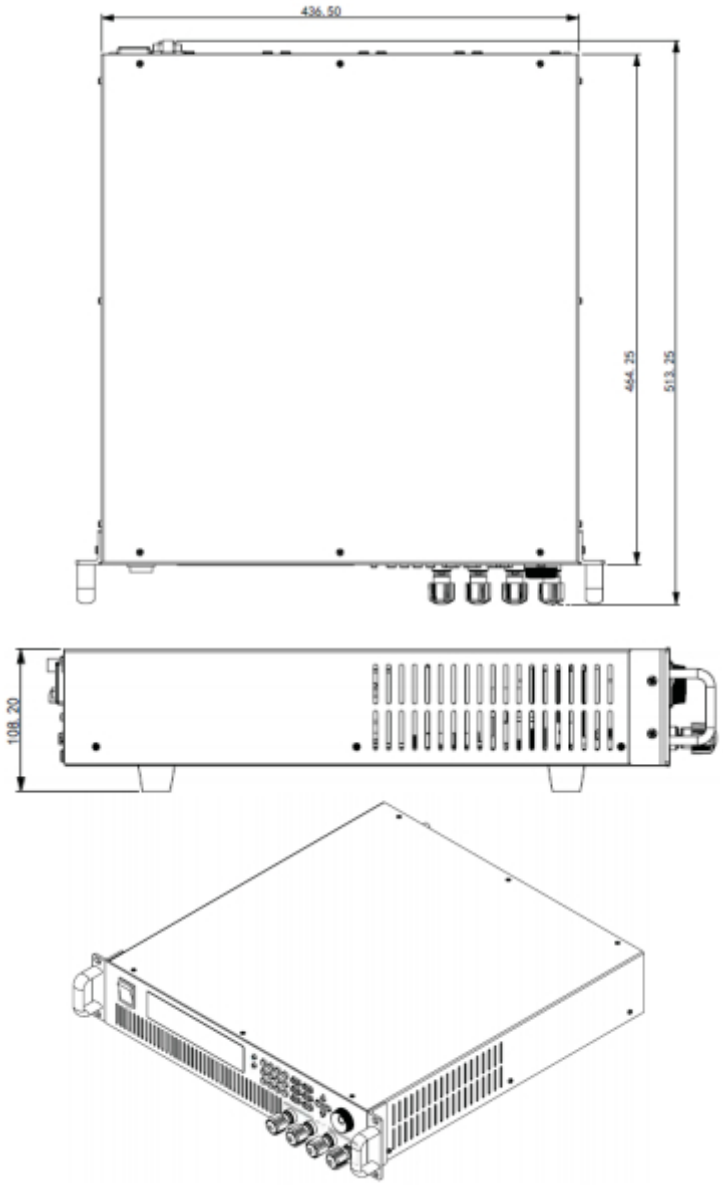


unit: minimeter（mm）

IT8514B+/IT8514C+ Dimension:

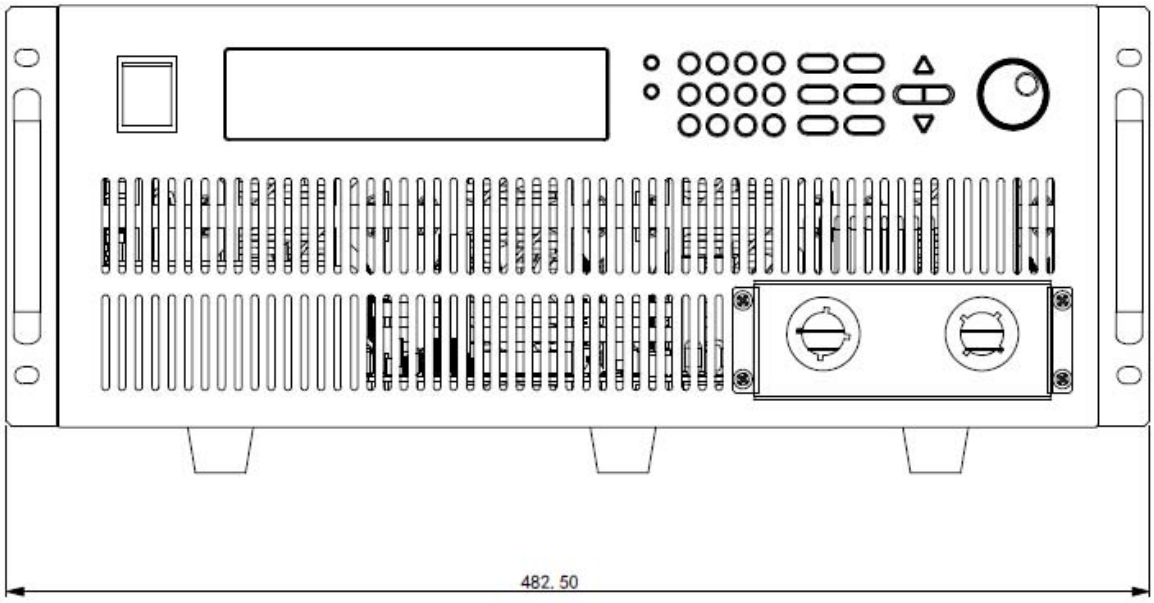
436.5 mmW x 88.2mm H x 463.5mm D

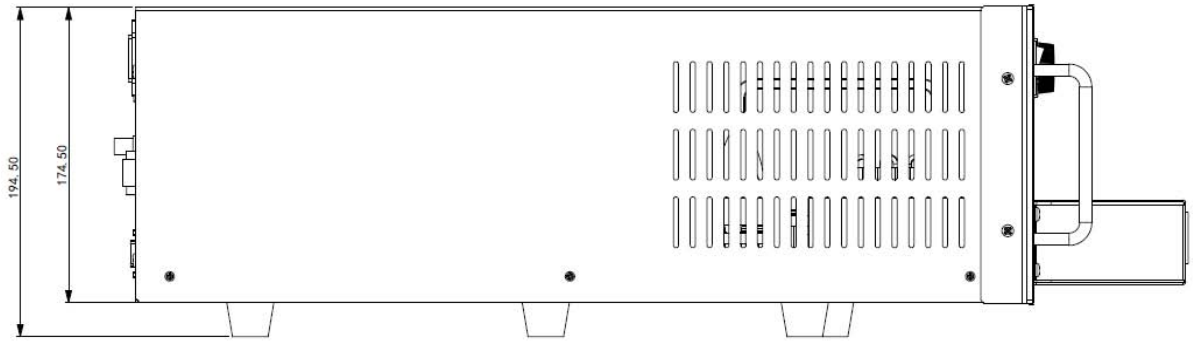


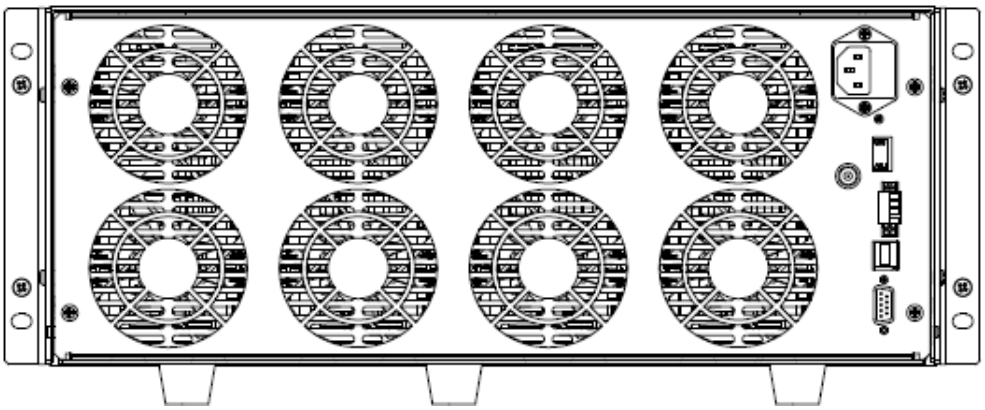


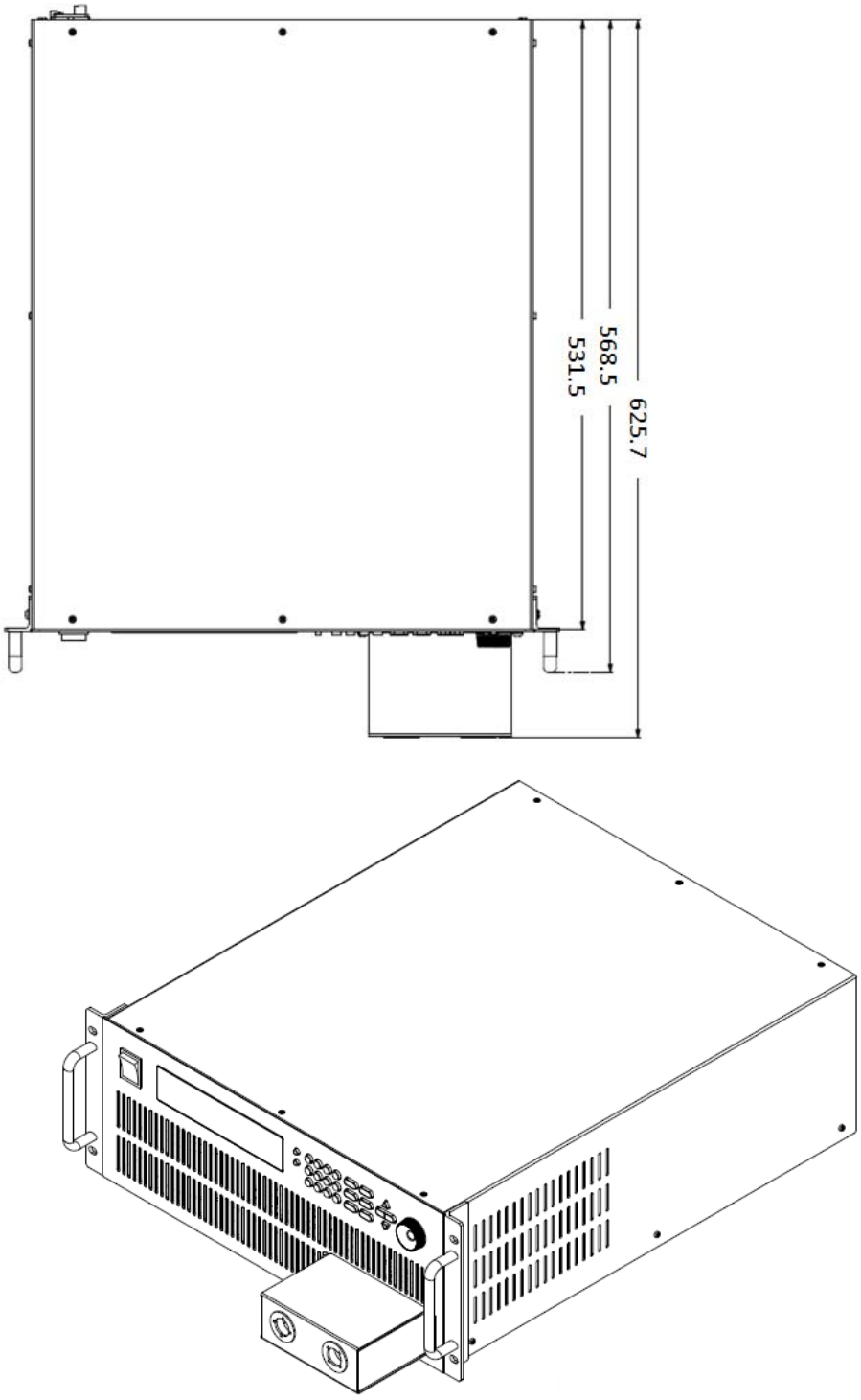
unit: minimeter（mm）

IT8516C+ Dimension:
482.5 mmW x 174.5mm H x 531.5mm D





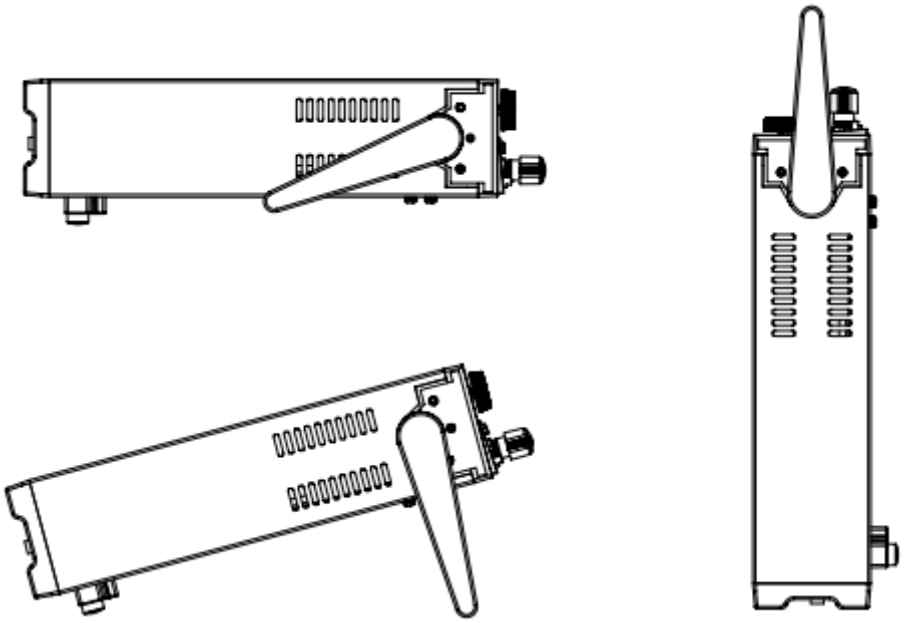




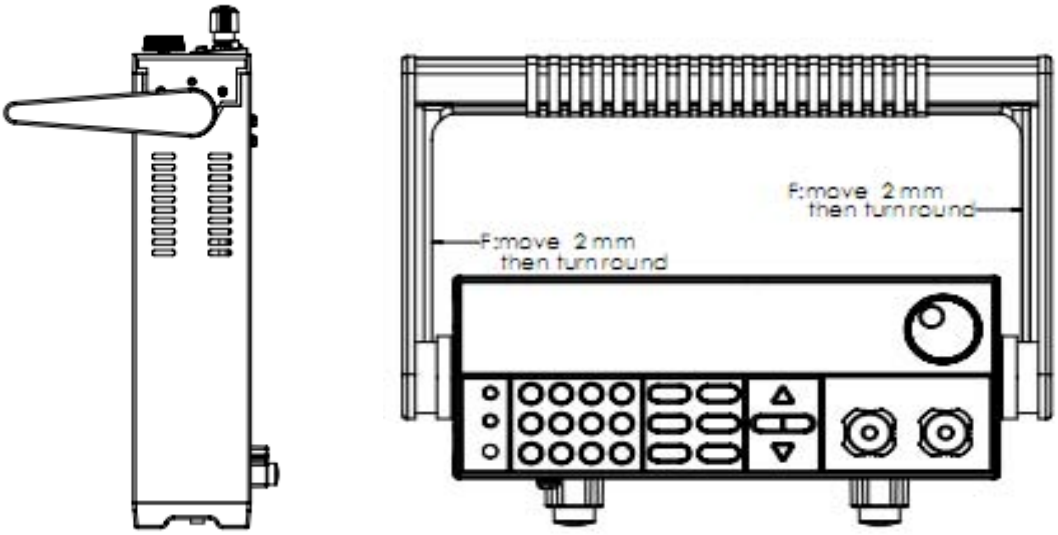
unit: minimeter（mm）

1.3.2 Adjustment of handle

Model IT8511+/IT8512+/IT8512B+/IT8512C+/IT8513C+ has handle. The following pictures demonstrate various ways to use the handle. Please use proper strength to adjust the handle to enable it in a favorable location.



The handle may be removed if desired. The way to remove the handle:
Move the handle to depart it from the load's side by 2mm and then rotate the handle to the position as below pictures, remove it.

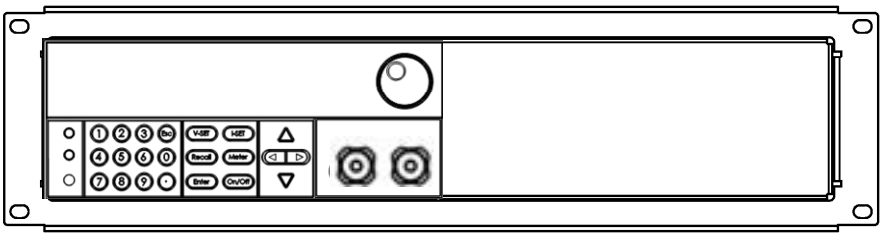


1.3.3 Rack mounting

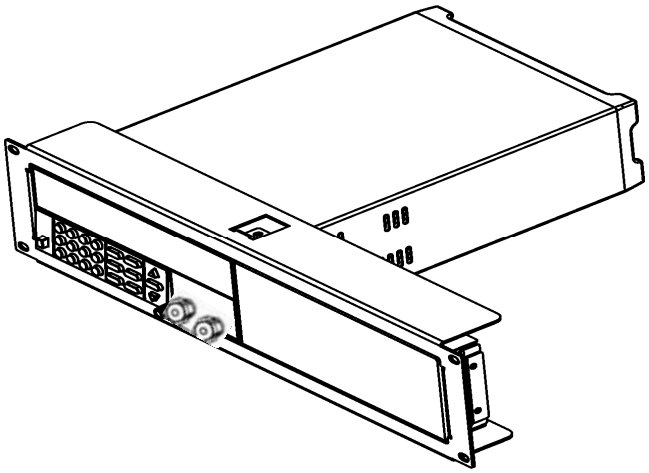
Model IT8511+/IT8512+/IT8512B+/IT8512C+/IT8513C+can be mounted into a standard 19-inch rack. Rack mount kits are available as Option IT-E151. The electronic load can be mounted in a standard 19-inch rack panel or enclosures using an Option IT-E15C1 rack mount kit. A rack mount kit for joining two half-rack units is also available by using Option IT-E151.

Before you install IT-E151, you should first remove the handle as described in 1.3.2
Then tear the tags on both sides.

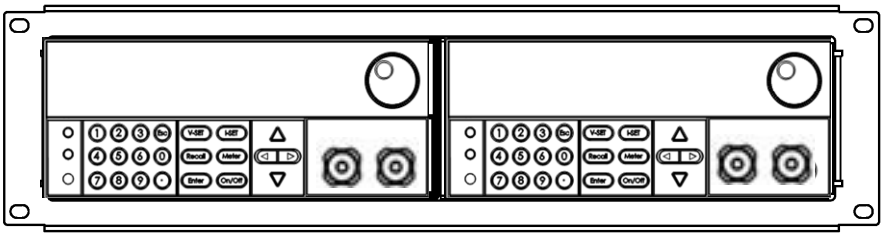
Rack Installation:



Elevation for Installation one electronic load in a standard 19-inch rack



Side elevation for Installation one electronic load in a standard 19-inch rack



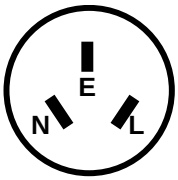
Elevation for Installation two electronic loads in a standard 19-inch rack

Caution: Be careful not to grip your fingers due to too much strength when you take off the handle.

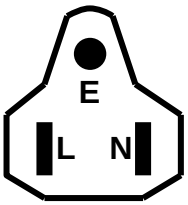
1.4 Input connections

Power Cord

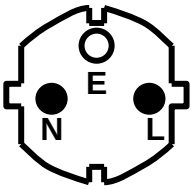
Connect the power cord to the IEC 320 connector on the rear of the unit. If the wrong power cord was shipped with your unit, contact your nearest Agent to obtain the correct cord. See the following figure for the part number and ordering options.



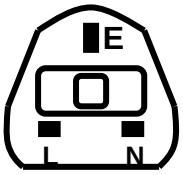
China
IT-E171



United States/Canada
IT-E172



Europe
IT-E173



United Kingdom
IT-E174

Chapter2 Quick Starts

2.1 Power-on selftest

2.1.1 Introduction

A successful test process indicates that the instrucment meets the factory specifications and can be operated well.

2.1.2 Selftest steps

Power cord should be connected correctly.Following is the detailed selftest steps.

Procedure	VFD display	Explanations
About 1S later	**System Selftest….**	System self check
About 1S later	**0.0000V 0.0000A** **0.00W CC=0.000A** **OFF CC Auto**	VFD: The first line display actual voltage and current value The second line display the actual power value and the setting current/voltage/power/resistance value The third line display the input state/operation mode
Press (Shift)+7	**IT85XX Ver—1.XX** **SN1:XXXXXXXXXXXXX** **SN2: XXXXX**	Display products information.You can press direction buttons to examine product's model/SN/software version

It may display following prompts when selftest fail.

1. "Eeprom Fail" means EEPROM is not functional.
2. "Eeprom data lost" means parameters of power-on have been lost.Reset them by pressing (Shift)+4(save)+0
3. "Cal data lost" means calibration date have been lost.
4. "Eeprom Data lost"means the system settings are lost, reset them in system menu.

If you experience these error messages, the instrument should be returned to ITECH for service.

WARNING: The electronic load is shipped from factory with a power cord that has a plug appropriate for your location. Your electronic load is equipped with 3-wire grounding type power cord; the third conductor being ground. The electronic load is grounded only when the power-line cord is plugged into an appropriate receptacle. Do not operate your power supply without adequate cabinet ground connection.

2.1.3 Instrument won't turn on

If the instrument won't turn on, please check as follows.

1) Check whether the power cord is connected well.

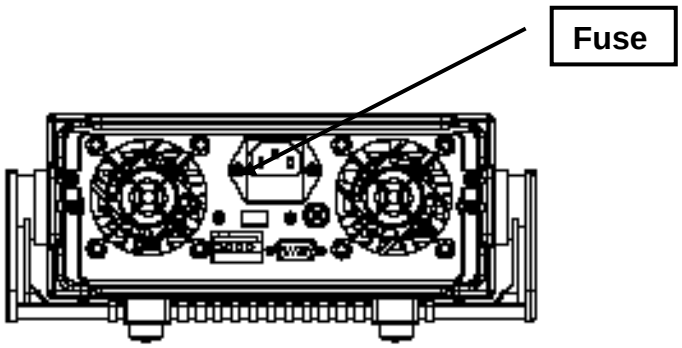
Please ensure the power cord is plugged into the back of the instrument, the other end of the cord is plugged into a live AC power outlet and the power is on.

2) Check the power-line voltage setting.
The line voltage is set to the proper value for your country(110VAC or 220VAC) when the electronic load is shipped from facory. Change the line voltage setting if it's not correct.

3) Check whether the fuse is ok.
If the instrument still won't turn on, remove the power cord from the instrument. Open the fuse container on the rear panel and check the fuse for continuity.Please refer 4) to take down the fuse.
If the fuse is an open circuit, replace it with the proper fuse indicated in the following table.

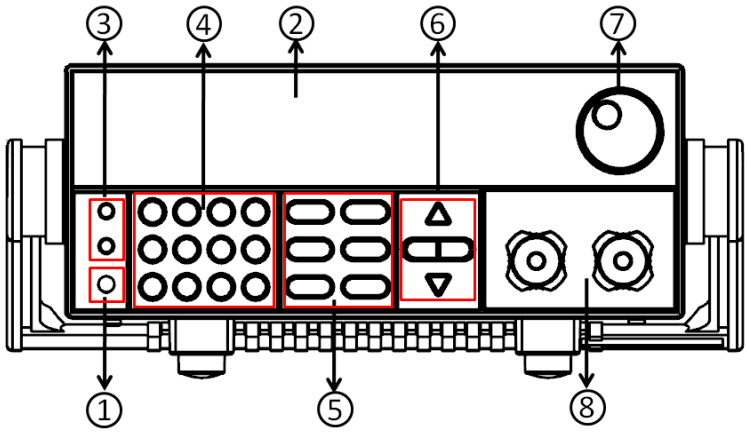
Model	Fuse specification for 220 V AC operation	Fuse specification for 110 VAC operation
IT8511+	T0.5A 250V	T1.25A 250V
IT8512+	T0.5A 250V	T1.25A 250V
IT8512B+	T0.5A 250V	T1.25A 250V
IT8512C+	T0.5A 250V	T1.25A 250V
IT8513C+	T1.25A 250V	T2.5A 250V
IT8514B+	T1.25A 250V	T2.5A 250V
IT8514C+	T1.25A 250V	T2.5A 250V
IT8516C+	T2.5A 250V	T5A 250V

4) The method of replacing fuse
Use a flat-bladed screwdriver to open the small plastic cover under the AC input connector on the rear panel of the load , then you can see the fuse. Please use the matching fuse.（figure showing the fuse location）

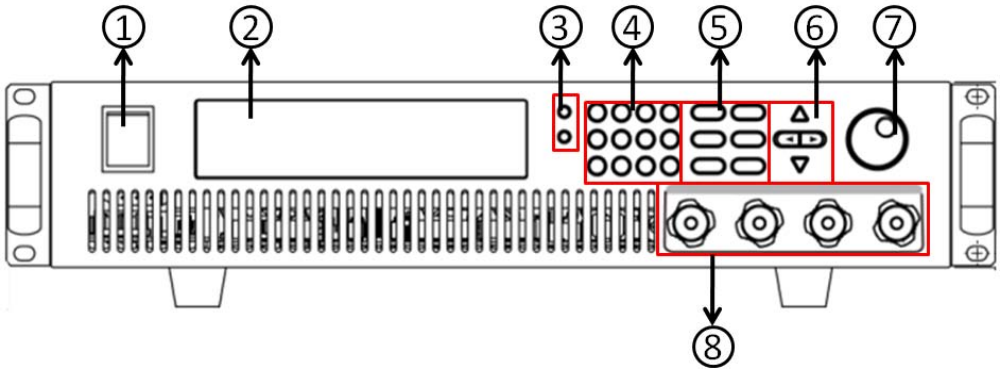


2.2 Front pannel introduction

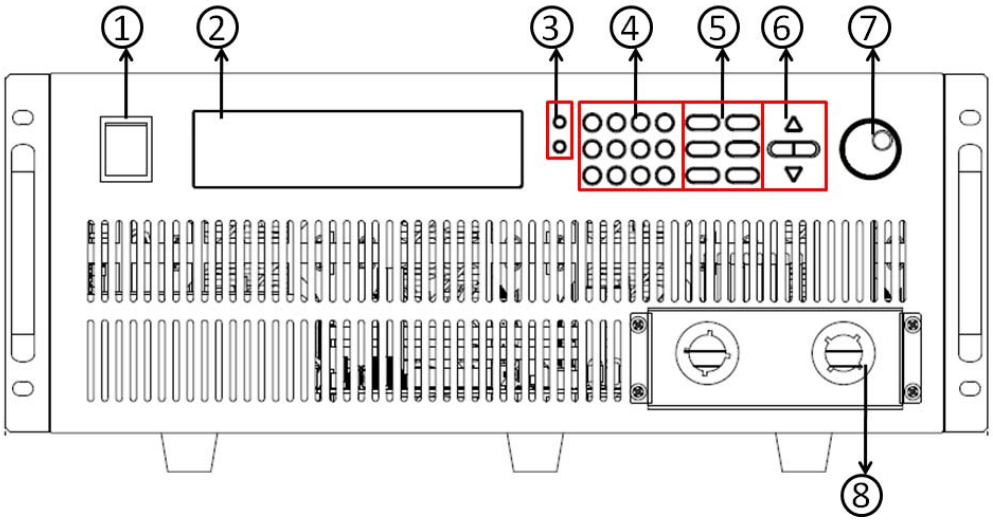
Front panle of IT8511+/IT8512+/IT8512B+/IT8512C+/IT8513C+



Front panel of IT8514B+/IT8514C+



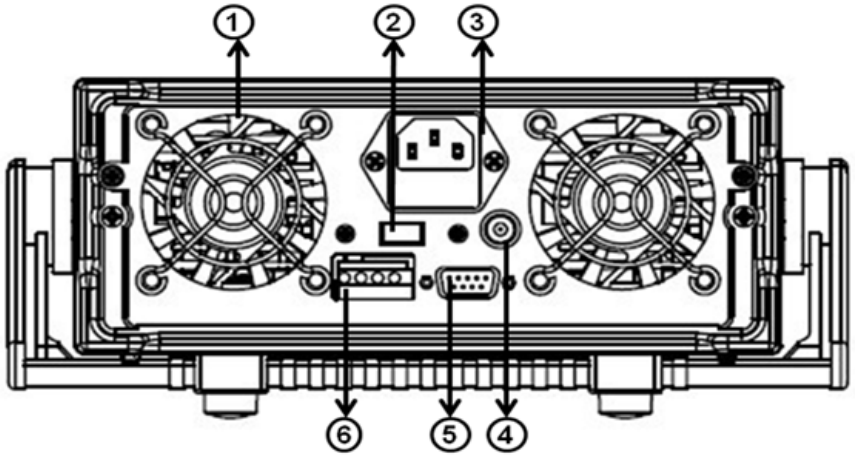
Front panel of IT8516C+



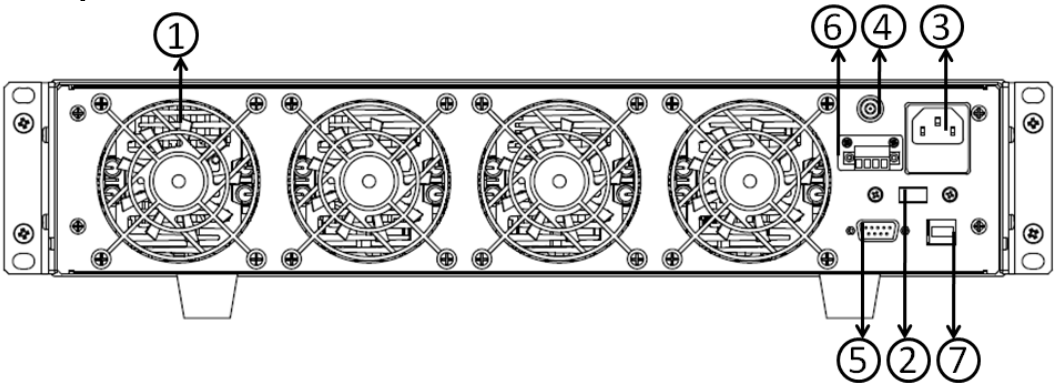
① Power switch
② VFD display
③ Composite key and Local key
④ Number key:
Set the parameters value
Achieve the menu's function by key combination
⑤ Function key:
Set the operation mode
Control the input state: On/Off
⑥ Direction function
⑦ Rotary knob
⑧ Input terminal

2.3 Rear Pannel Introduction

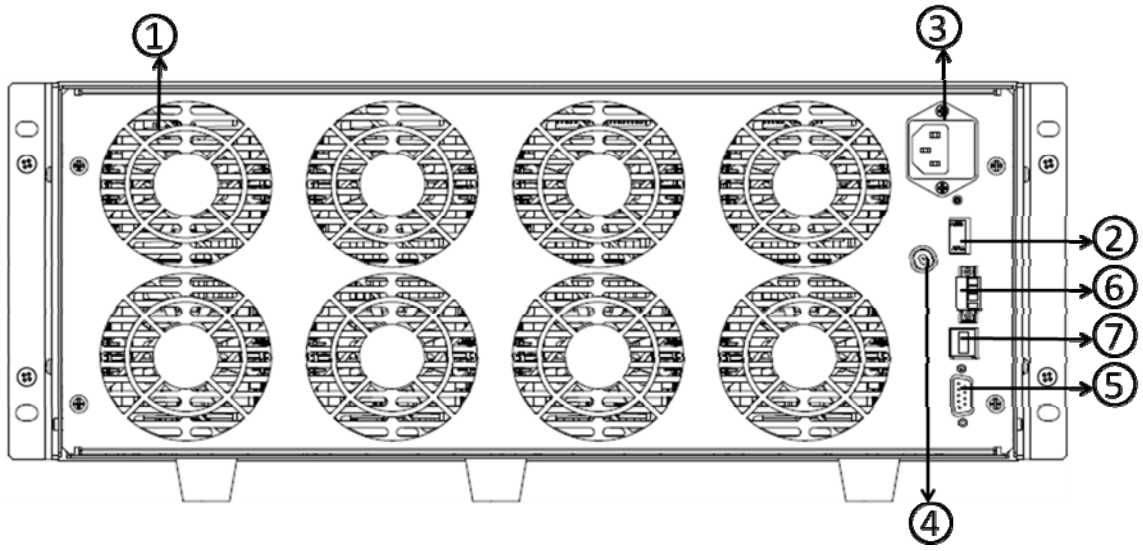
Rear panel of IT8511+/IT8512+/IT8512B+/IT8512C+/IT8513C+



Rear panel of IT8514B+/IT8514C+



Rear panel of IT8516C+

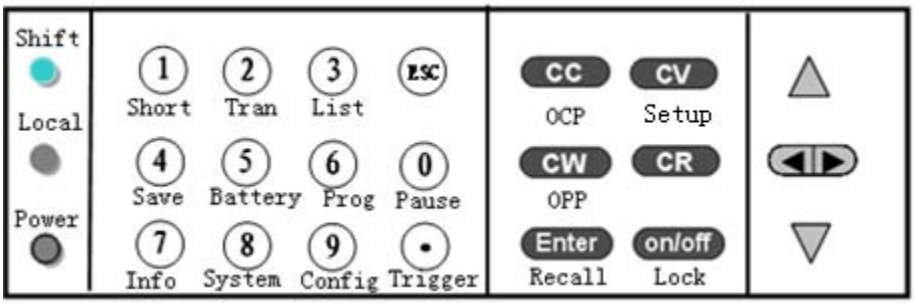


① Fan
② Power swith (110V/220V)
③ Power input socket
④ I-monitor
⑤ DB9 COM interface/RS232 interface（IT8514B+/IT8514C+/IT8516C+）
⑥ Remote measurement and external trigger terminals
⑦ USB interface

2.4 VFD Display annunciators

OFF	The load is off.	Error	An error has occurred.
CC	Constant current mode	Trig	Waiting for the trigger signal
CV	Constant voltage mode	Sense	Remote sensing is on.
CR	Constant resistance mode	Prot	OCP function is on.
CW	Constant power mode	Auto	Voltage range automatically seleted function is open
Rmt	Instrument is in the remote state.	Lock	The keyboard is locked.
Timer	LOAN ON is on.	Shift	Shift button has been pressed.

2.5 Front panel keys



(Blue-green)	Shift button is a composite key.
(Gray)	Local button is used to switch local and remote mode.

(Gray-white)	Power on button
0 ~ 9	Enter the digits 0 to 9.
•	Decimal point
ESC	The escape key
CC	Choose constant current mode.
CV	Choose constant voltage mode.
CR	Choose constant resistance mode.
CW	Choose constant power mode.
Enter	Enter the selected value or setting.
on/off	Turns DC Load ON or OFF (OFF is high impedance state).
△	Scroll up key
▽	Scroll down key
◀▶	Scroll left and right key

2.6 Combination keys

Press (Shift) button first and then other keys to achieve all kinds functions in the following table.

+1(Short)	Turn short circuit on or off.
+2(Tran)	Start or stop transient condition.
+3(List)	Set LIST operation parameters.
+4(Save)	Store the DC Load state in non-volatile memory.
+5(Battery)	Turn on or off battery testing function.
+6(Prog)	Enter auto tese function.
+7(Info)	Display product's Model/SN/Version.
+8(System)	System menu setting
+9(Config)	Configure menu setting
+0(Pause)	Press this button if you need a pause when runing an auto test file.
+•(Trigger)	Cause an immediate trigger.
+CC(OCP)	Enter OCP test function.
+CV(Setup)	Set detailed parameters in CC/CV/CW/CRmode.
+CW(OPP)	Enter OPP test function.
+Enter(Recall)	Recall the DC Load state from non-volatile memory.
+On/Off(Lock)	Key lock function

Chapter3 Specifications

3.1 Specifications

Model		IT8511+		IT8512+	
Rated value (0 ~ 40 ℃)	Input voltage	0~120V		0~120V	
	Input current	0~3A	0~30A	0~3A	0~30A
	Input power	150 W		300W	
	Minimum operation voltage	0.14V at 3A	1.4V at 30A	0.12V at 3A	1.2V at 30A
CV mode	range	0~18V	0~120V	0~18V	0~120V
	resolution	1mV	10mV	1mV	10mV
	accuracy	±(0.05%+0.02%FS)	±(0.05%+0.025% FS)	±(0.05%+0.02%FS)	±(0.05%+0.025%FS)
CC mode	range	0~3A	0~30A	0~3A	0~30A
	resolution	0.1mA	1mA	0.1mA	1mA
	accuracy	±(0.05%+0.05%FS)	±(0.05%+0.05%F S)	±(0.05%+0.05%FS)	±(0.05%+0.05%FS)
CR mode	range	0.05Ω~10Ω	10Ω~7.5KΩ	0.05Ω~10Ω	10Ω~7.5KΩ
	resolution	16bit		16bit	
	accuracy	0.01%+0.08S	0.01%+0.0008S	0.01%+0.08S	0.01%+0.0008S
CW mode	range	150W		300W	
	resolution	10mW		10mW	
	accuracy	0.1%+0.1%FS		0.1%+0.1%FS	
Dynamic mode					
Dynamic mode		CC mode		CC mode	
	T1＆T2	50uS~3600S /Res:1 uS		50uS~3600S /Res:1 uS	
	accuracy	1uS+100ppm		1uS+100ppm	
	Rising/ decending slope	0.0001~0.3A/uS	0.001~1.5A/uS	0.0001~0.3A/uS	0.001~1.5A/uS
Measuring range					
Readback voltage	range	0~18V	0~120V	0~18V	0~120V
	resolution	0.1mV	1mV	0.1mV	1mV
	accuracy	±(0.025%+0.025%FS)	±(0.025%+0.025 %FS)	±(0.025%+0.025% FS)	±(0.025%+0.025%FS)
Readback current	range	0~3A	0~30A	0~3A	0~30A
	resolution	0.1mA	1mA	0.1mA	1mA
	accuracy	±(0.05%+0.05%FS)		±(0.05%+0.05%FS)	
Readback power	range	150W		300W	
	resolution	10mW		10mW	
	accuracy	±(0.1%+0.1%FS)		±(0.1%+0.1%FS)	
Protection range					
OPP		≒160W		≒320W	
OCP		≒3.3A	≒33A	≒3.3A	≒33A
OVP		≒125V		≒125V	
OTP		≒85℃		≒85℃	
Specification					

Short	current(CC)	≒3.3/3A	≒33/30A	≒3.3/3A	≒33/30A
	voltage(CV)	0V	0V	0V	0V
	resistance(CR)	≒45mΩ	≒45mΩ	≒40mΩ	≒40mΩ
Input impendance	150KΩ			150KΩ	
Dimension	214.5mm*88.2mm*354.6mm			214.5mm*88.2mm*354.6mm	

Model		**IT8512B+**		**IT8512C+**	
Rated value (0 ~ 40 ℃)	Input voltage	0~500V		0~120V	
	Input current	0~3A	0~30A	0~6A	060A
	Input power	300W		300W	
	Minimum operation voltage	0.6V at 3A	3V at 15A	0.25V at 6A	2.5V at 60A
CV mode	range	0~50V	0~500V	0~18V	0~120V
	resolution	1mV	10mV	1mV	10mV
	accuracy	±(0.05%+0.02%FS)	±(0.05%+0.025%FS)	±(0.05%+0.02%FS)	±(0.05%+0.025%FS)
CC mode	range	0~3A	0~15A	0~6A	0~60A
	resolution	0.1mA	1mA	0.1mA	1mA
	accuracy	±(0.05%+0.05%FS)	±(0.05%+0.05%FS)	±(0.05%+0.05%FS)	±(0.05%+0.05%FS)
CR mode	range	0.3Ω~10Ω	10Ω~7.5KΩ	0.3Ω~10Ω	10Ω~7.5KΩ
	resolution	16bit		16bit	
	accuracy	0.01%+0.08S	0.01%+0.0008S	0.01%+0.08S	0.01%+0.0008S
CW mode	range	300W		300W	
	resolution	10mW		10mW	
	accuracy	0.1%+0.1%FS		0.1%+0.1%FS	
Dynamic mode					
Dynamic mode		CC mode		CC mode	
	T1＆T2	50uS~3600S /Res:1 uS		50uS~3600S /Res:1 uS	
	accuracy	5uS+100ppm		5uS+100ppm	
	Rising/ decending slope	0.0001~0.3A/uS	0.001~0.8A/uS	0.0001~0.3A/uS	0.001~1.2A/uS
Measuring range					
Readback voltage	range	0~50V	0~500V	0~18V	0~120V
	resolution	1mV	10mV	1mV	10mV
	accuracy	±(0.025%+0.025%FS)	±(0.025%+0.025%FS)	±(0.025%+0.025%FS)	±(0.025%+0.025%FS)
Readback current	range	0~3A	0~15A	0~6A	0~60A
	resolution	0.1mA	1mA	0.1mA	1mA
	accuracy	±(0.05%+0.05%FS)		±(0.05%+0.05%FS)	
Readback power	range	300W		300W	
	resolution	10mW		10mW	
	accuracy	±(0.1%+0.1%FS)		±(0.1%+0.1%FS)	
Protection range					
OPP	≒320W			≒320W	

OCP		≒3.3A	≒16A	≒6.5A	≒65A
OVP		≒530V		≒125V	
OTP		≒85℃		≒85℃	
Specification					
Short	current(CC)	≒3.3/3A	≒16/15A	≒6.5/6A	≒65/60A
	voltage(CV)	0V	0V	0V	0V
	resistance(CR)	≒180mΩ	≒180mΩ	≒40mΩ	≒40mΩ
Input impendance		150KΩ		150KΩ	
Dimension		214.5mm*88.2mm*354.6mm		214.5mm*88.2mm*354.6mm	

Model		**IT8513C+**		**IT8514C+**	
Rated value (0 ~ 40 ℃)	Input voltage	0~120V		0~120V	
	Input current	0~12A	0~120A	0~24A	0~240A
	Input power	600 W		1500W	
	Minimum operation voltage	0.2V at 12A	2V at 120A	0.25V at 24A	2.5V at 240A
CV mode	range	0~18V	0~120V	0~18V	0~120V
	resolution	1mV	10mV	1mV	10mV
	accuracy	±(0.05%+0.02%FS)	±(0.05%+0.025%FS)	±(0.05%+0.02%FS)	±(0.05%+0.025%FS)
CC mode	range	0~12A	0~120A	0~24A	0~240A
	resolution	1mA	10mA	1mA	10mA
	accuracy	±(0.05%+0.05%FS)		±(0.1%+0.1%FS)	
CR mode	range	0.05Ω~10Ω	10Ω~7.5KΩ	0.05Ω~10Ω	10Ω~7.5KΩ
	resolution	16bit		16bit	
	accuracy	0.01%+0.08S *2	0.01%+0.0008S	0.02%+0.08S *2	0.02%+0.0008S
CW mode	range	600W		1500W	
	resolution	10mW		10mW	
	accuracy	±(0.2%+0.2%FS)		±(0.2%+0.2%FS)	
Dynamic mode					
CC mode					
T1＆T2		100uS~3600S /Res:1 uS		100uS~3600S /Res:1 uS	
accuracy		10uS±100ppm		10uS±100ppm	
Rising/ decending slope		0.001~0.2A/uS	0.01~1.6A/uS	0.001~0.3A/uS	0.01~3.2A/uS
T1＆T2		≒60uS	≒60uS	≒60uS	≒60uS
Measuring range					
Readback voltage	range	0~18V	0~120V	0~18V	0~120V
	resolution	0.1 mV	1mV	0.1 mV	1mV
	accuracy	±(0.025%+0.025%FS)			
Readback current	range	0~12A	0~120A	0~24A	0~240A
	resolution	1mA	10mA	1mA	10mA
	accuracy	±(0.05%+0.05%FS)		±(0.05%+0.05%FS)	
Readback power	range	600W		1500W	
	resolution	10mW		10mW	
	accuracy	±(0.2%+0.2%FS)		±(0.2%+0.2%FS)	
Protection range					
OPP		≒620W		≒1550W	
OCP		≒13A	≒130A	≒26.7A	≒267A

OVP	≒125V			≒125V	
OTP	≒95℃			≒85℃	
Specification					
Short	current(CC)	≒13/12A	≒130/120A	≒26.7/24A	≒267/240A
	voltage(CV)	0V	0V	0V	0V
	resistance(CR)	≒15mΩ	≒15mΩ	≒8mΩ	≒8mΩ
Input impendance	150KΩ			150KΩ	
Dimension	214.5mm*88.2mm*453.5mm			436.5mm*88.2mm*463.5mm	

Model		**IT8514B+**		**IT8516C+**	
Rated value (0 ~ 40 ℃)	Input voltage	0~500V		0~120V	
	Input current	0~6A	0~60A	0~24A	0~240A
	Input power	1500 W		3000W	
	Minimum operation voltage	0.25V at 6A	2.5V at 60A	0.15V at 24A	1.5V at 240A
CV mode	range	0~50V	0~500V	0~18V	0~120V
	resolution	1mV	10mV	1mV	10mV
	accuracy	±(0.05%+0.02%FS)	±(0.05%+0.025%FS)	±(0.05%+0.02%FS)	±(0.05%+0.025%FS)
CC mode	range	0~6A	0~60A	0~24A	0~240A
	resolution	1mA	10mA	1mA	10mA
	accuracy	±(0.05%+0.05%FS)		±(0.1%+0.1%FS)	
CR mode	range	0.05Ω~10Ω	10Ω~7.5KΩ	0.05Ω~10Ω	10Ω~7.5KΩ
	resolution	16bit		16bit	
	accuracy	0.02%+0.08S *2	0.02%+0.0008S	0.02%+0.08S *2	0.02%+0.0008S
CW mode	range	1500W		3000W	
	resolution	10mW		10mW	
	accuracy	±（0.2%+0.2%FS）		±（0.2%+0.2%FS）	
Dynamic mode					
CC mode					
T1＆T2		100uS~3600S /Res:1 uS		120uS~3600S /Res:1 uS	
accuracy		10uS±100ppm		10uS±100ppm	
Rising/ decending slope		0.001~0.15A/uS	0.01~0.8A/uS	0.001~0.3A/uS	0.01~2.8A/uS
T1＆T2		≒60uS	≒60uS	≒70uS	≒70uS
Measuring range					
Readback voltage	range	0~50V	0~500V	0~18V	0~120V
	resolution	0.1 mV	1mV	0.1 mV	1mV
	accuracy	±(0.025%+0.025%FS)			
Readback current	range	0~6A	0~60A	0~24A	0~240A
	resolution	1mA	10mA	1mA	10mA
	accuracy	±(0.05%+0.05%FS)		±(0.1%+0.1%FS)	
Readback power	range	1500W		3000W	
	resolution	10mW		10mW	
	accuracy	±(0.2%+0.2%FS)		±(0.2%+0.2%FS)	
Protection range					
OPP	≒1550W			≒3050W	
OCP	≒6.7A		≒67A	≒26A	≒260A
OVP	≒530V			≒125V	

OTP	≒85℃			≒85℃	
Specification					
Short	current(CC)	≒6.7/6A	≒67/60A	≒26/24A	≒260/240A
	voltage(CV)	0V	0V	0V	0V
	resistance(CR)	≒30mΩ	≒30mΩ	≒5mΩ	≒5mΩ
Input impendance	150KΩ			150KΩ	
Dimension	436.5mm*88.2mm*463.5mm			436.5mm*176mm*463.5mm	

3.2 Supplementary characteristics

Memory capacity: 100 registeres

Suggested calibration frequency: Once a year

AC input level(A transfer switch is selectable on the rear panel)
Option Opt.1: 220V ±10% 50Hz/60Hz
Option Opt.2: 110V ±10% 50Hz/60Hz

Cooling type
Intelligent fans

Fans working principle:
Fans running speed is determined by radiator temperature.When temperature reaches 40℃,fans start to work and intelligently adjust its speed with temperature variation.
Operation temperature
0 to 40 °C
Storage temperature
-20 to 70 °C

Using condition
Suitable for indoor use.Allowable maximum humidity is 80%, without condensation.

Chapter4 Functions and Characteristics

This chapter elaborates on the functions and characteristics of electronic loads.Contents following sections:

- Local mode/Remote mode
- Operation mode(CC/CV/CR/CW)
- On/Off control
- Four trigger function
- Transient mode
- List mode
- Save/Recall
- VON function
- OCP test
- OPP test
- Battery test funtion
- Full protection function,OCP,OVP,OTP,OPP,Reverse voltage
- Safe-lock function
- Terminals function at the rear panel

4.1 Local mode/Remote mode

There are two types of control modes for IT8500+ series products:**Local mode and Remote mode.**

In remote mode, you can operate the electronic loads through PC via communication cable(optional). While After power on electronic loads, it defaults in local mode and all buttons are avaiable in this mode.In remote control mode, the keys on the front pannel can not work except local key.Customers could through Local key to switch the control mode.

4.2 Operation Mode

There are four operation modes of IT8500+ series products:

1: Constant current mode (CC)
2: Constant voltage mode (CV)
3: Constant resistance mode (CR)
4: Constant power mode(CW)

4.2.1 Constant current mode (CC)

In constant current mode, the DC load will comsume a constant current, regardless of the voltage at its terminals.

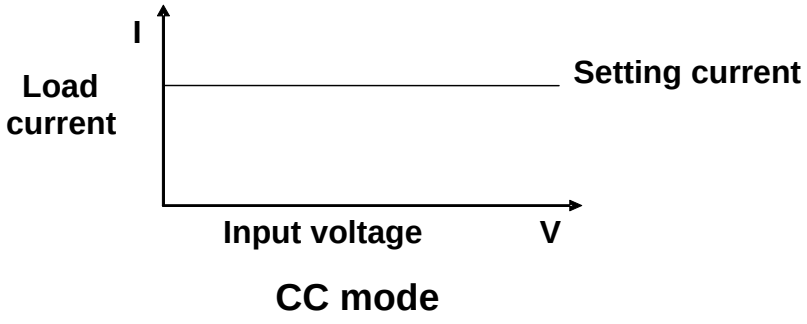
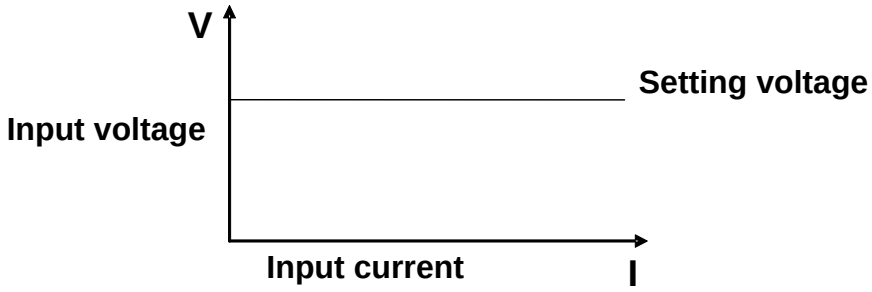


Diagram 4-1 I-V curve in CC mode

4.2.2 Constant voltage mode (CV)

In constant voltage mode, the DC load will cause a constant voltage to appear at its terminals.

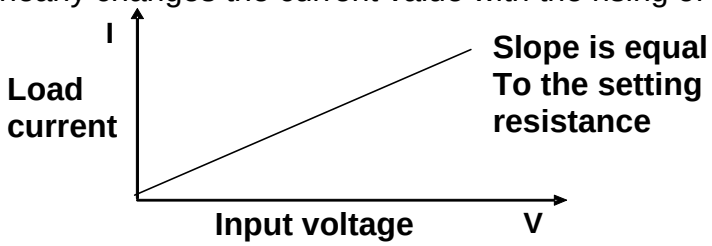


CV mode

Diagram 4-2 I-V curve in CV mode

4.2.3 Constant resistance mode (CR)

In constant resistance mode, the DC load will behave as a fixed resistance value.As shown below,the load linearly changes the current value with the rising of input voltage.

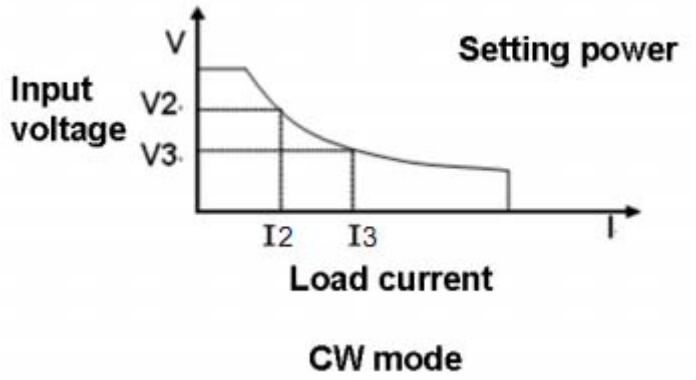


CR mode

Diagram 4-3 I-V curve in CR mode

4.2.4 Constant power mode (CW)

In constant power mode,the DC load will cause a constant power to be dissipated in the load.As shown below,the load current is decreasing with the rising of input voltage,while power always maintain the setting value.



CW mode

Diagram 4-4 I-V curve in CP mode

4.3 Input On/Off control

4.3.1 On/Off operation

On/Off button on the front panel is used to manually toggle the instrument between its set mode and an infinite impedance state, i.e control input on and off. On/Off button lighted indicates the load input is on, meanwhile the OFF indicator will disappear.

4.3.2 Short

Short circuit simulation and short circuit current measuremen:you may press (Shift)+ 1(short) botton to emulate a short state.It can be used to check whether the tested instrument's short protection is avaiable.

In short mode,the DC load will draw maximum current from the DC supply in any of the four operation modes(CC,CV,CW or CR).In CC,CV,or CR mode,you may press (Shift)+1(short) to stop short.The DC load will return to its previous operation.However,in CW mode,the short current will continue to be drawn.To stop the short,you must press the On/Off key after you press (Shift)+1(short).

When emulating a Short in CC, CW or CR mode, the maximum allowable short current is equal to the 110% of current range.

4.4 System menu (System)

Press (Shift)+ 8(System)to enter the system menu.

POWER-ON	POWER-ON	Power on state of instrument
	RST(default)	Do not remember state in SAVE 0.Customer can save a often used data in SAVE 0 to recall when power on the DC load next time.
	SAV0	Remember state in SAVE 0
BUZZER	BUZZER	
	ON(default)	Enable audible beep when key is pressed
	OFF	No sound when key is pressed
KNOB	KNOB	
	UPDATE(default)	The value modified with knob during operation will be saved after load is off.For example; the DC load is set to 1A by press CC and turned on the input.Then increase the setting value to 2A with knob.When customer turn off load and trun on again, the setting value changes to 2A.
	OLD	As explained above, after the DC load is turned on again,the setting value is 1A instead of 2A changed with knob.
TRIGGER	SOURCE	Set trigger mode
	MANUAL(Def)	Triggered from the (Shift)+ (Trigger) key
	EXTERNAL	Triggered from a TTL high signal at the trigger connector on rear panel
	BUS	Triggered from a serial bus command 5AH

	HOLD	Receving a command 9DH
MEMORY	MEMORY	Recall the prestored datas
	GROUP= 0	**0:**indicates1-10 group; **1**:indicates 11-20group, by parity of reasoning
DISPLAY	DISP-TIMER	Timer function
	ON	Enable timer function
	OFF(default)	Disable timer function
RS-232	RS-232	
	4800_8N 1	Baudrate 4800, data bit 8, none parity, stop bit 1
	9600_8N 1	Baudrate 9600, data bit 8, none parity, stop bit 1
	19200_8N 1	Baudrate 19200, data bit 8, none parity, stop bit 1
	38400_8N 1	Baudrate 38400, data bit 8, none parity, stop bit 1
ADDRESS	ADDRESS= 0	Set the instrument's address(0~31)
RUNMODE	RUN	Runing mode at power on
	NORMAL	Normal mode
	BATTERY	Default in battery test mode at power on
	PROG_TEST	Default in autotest mode at power on
	OCP_TEST	Default in OCP test mode at power on
	OPP_TEST	Default in OPP test mode at power on
DEFAULT	DEFAULT	
	NO	Do not return instrument to factory default settings.
	YES	Retrun instrument to factory default settings

4.5 Config menu (Config)

Press (Shift)+9(Config) to enter the menus.

PROTECT	Max-P	Set hardware power protection
	MAX POWER=150.00W	Set hardware OPP value
	A-LIMIT	Set software current protecting state
	A-LIMIT	
	ON	Enable software over current protection function
	A-LIM POIN=30.000A	Set the software OCP level
	A-LIM DELAY=3S	Set the OCP delay time
	OFF	Disable the software OCP funtion
	P- LIMIT	Set software power protecting state.
	P-LIM POIN=150.00W	Set the software OPP level.

	P-LIM DELAY=3S	Set the OPP delay time.
	TIMER	Set load on timer
	LOAD-TIMER	
	ON	Enable load-on timer
	LOAD-TIMER=10.0S	Set the load on time(0.1S~9999.9S)
	OFF	Disable load on timer
MEASURE	V-RANGE	Voltage auto-rangefuntion
	V-RANGE	
	ON	Enable voltage auto range function
	OFF	Disable voltage auto range function
	FILTER	Set the filter parameter
	FILTER COUNT = 2^14	Filter count set, range 2~16
	TIME-V1	
	TIME-VOLT1=0.000V	Set the start time, to measure the voltage rise/fall time.
	TIME-V2	
	TIME-VOLT2=120.00V	Set the end time, to measure the voltage rise/fall time
CR-LED	CR-LED	Imitate LED (in CR mode)
	ON	Open the function(in CR mode,press shift+CV to set Vd value)
	OFF	Disenable the function
SENSE	REM- SENSE	Remote sense function
	ON	Enable remote sense function
	OFF	Disable remote sense function
VON	VON	Set the load's VON point
	LIVING	VON point living state
	VON POINT = 0.10V	Set the VON value
	LATCH	VON point latch state, ON /OFF
	VON POINT = 0.10V	Set the VON value
RESET	RESET	Reset the config menu
	NO	Do not reset
	YES	Reset

4.6 Trigger function

4.6.1 Trigger operation

Triggering is used with the transient operation; list operation and test function.There are four types of triggers you can use for IT8500+ products.

4.6.2 Trigger source

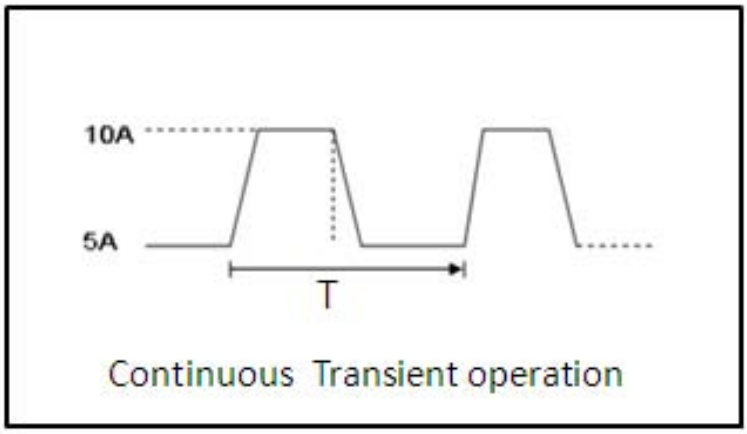
Manual: An immediate trigger is created by pressing (Shift)+ (Trigger) on the front panel.
External(TTL signal): An external trigger is a TTL low signal applied to the trigger connection on the rear panel.This TTl signal must last for more than 10us.
Bus: The instrument will be triggered if command 5AH is sent via the communication interface.
Hold: The instrument will be triggered if command 9DH is sent via the communication interface.

4.7 Transient function

The transient test allows switching between two different load values.A common application is to test the dynamic characteristics of DC source.
There are three different types of transient operation: **continuous, pulse, toggled.**

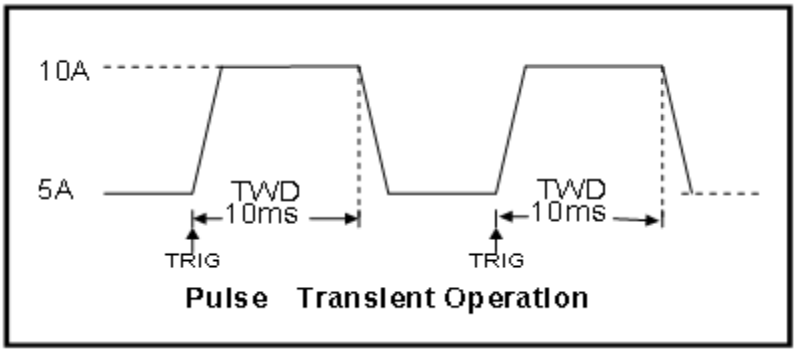
4.7.1 Continuous mode

In continuous transient operation, the load iscontinuously switched between two load values.An example is shown in the following figure:



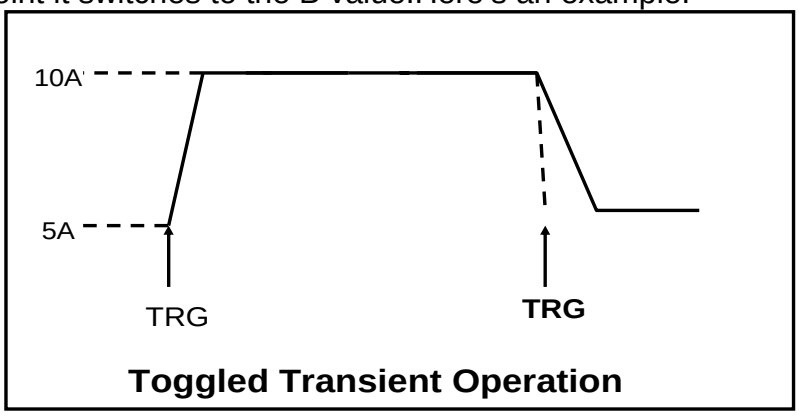
4.7.2 Pulse mode

In pulse operatrion,the load operates at the A value that has been entered until a trigger is received.At the trigger,the load switches to the B value and stays at that level for the B timing value.Then the load switches back to the A value and stays there until another trigger is received.



4.7.3 Toggled mode

In toggled transient operation,the load starts at the stored parameters for the mode.When a trigger is received,the load switches to B value.When another trigger is received,the load switches to the A level.It stays at the A value until another trigger is received,at which point it switches to the B value.Here's an example:

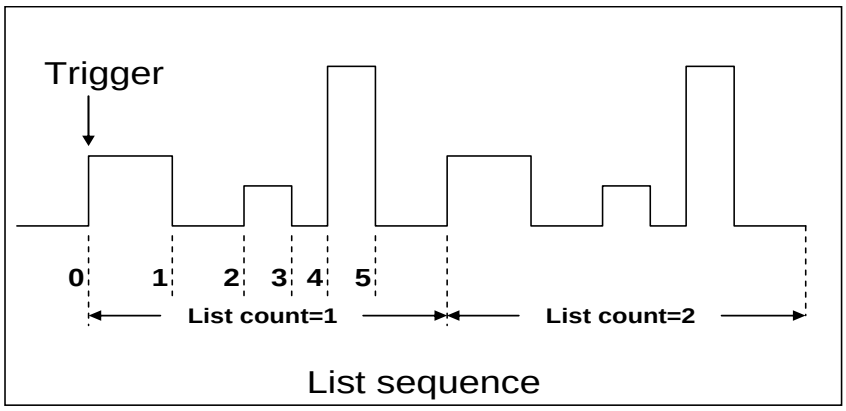


Toggled Transient Operation

4.8 LIST operation

List mode allows you to generate a complex current sequence. Moreover, the mode change can be synchronized with an internal or external signal, to accomplish dynamic and precise test A list file includes following parameters: **file name, step counts (range 2-84), time width of single step(0.00005s~3600s),step value and slope**.The edited list file can be saved in nonvolatile memory, can be recalled easily.The DC load provides 7 nonvolatile registers to save list files for recall later.

In list mode,the DC load start to run the list file once receiving a trigger signal, continue to run once receiving another trigger signal.To illustrate the use of a list,we'll create a list that runs the following constant current profile on a power supply:



List sequence

4.9 Saving and recalling settings

We can save some often-used parameters in the non volatile memory, including working mode, voltage/current value and so on.IT8500plus series provide 100 non-volatile registers.

They are divided into 10 Memory groups: Group0-9.You can set it in the system menu.Group0 means you can save and recall parameters in 0-10 registers. Group1

means you can save and recall parameters in 11-20 registers. Group2-Group9 can be concluded in the same manner.

Save and Recall operation:

For example: the instrucment works in CC mode, setting value is 1A,
Memory Group is 6. Save “CC 1A” in the 61th register and then recall.

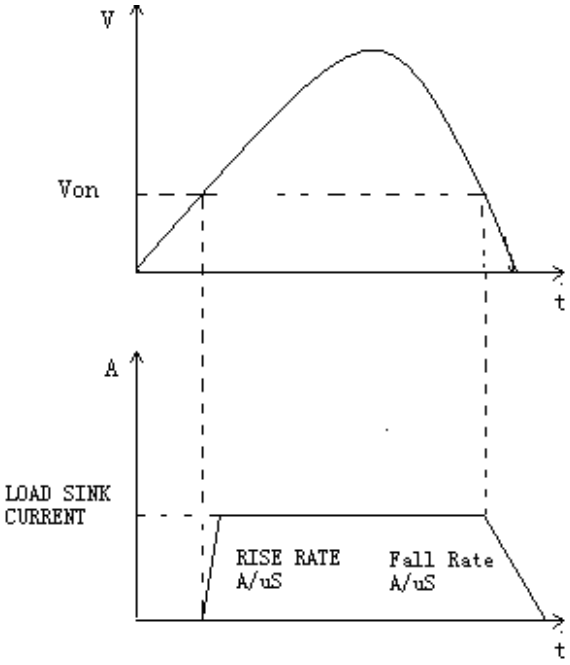
Operation	VFD Display
SAVE	
1. Set the parameters ok. To save the instrument's settings to a register, press (Shift)+4(Save). Enter number 6 and 1.	5.8949V 0.99994A 5.89W SAVE 61
2、Then press Enter . The setting is saved.	5.8949V 0.99994A 5.89W cc=1.000A
RECALL	
1. To recall the instrument's settings from a register, press (Shift)+ Enter(Recall).	5.8949V 0.99994A 5.89W cc=1.000A
2、Enter 1.Then the setting is recalled.	5.8949V 0.99994A 5.89W cc=1.000A

Note: Saving operation will overwrite any values previously saved in that register. Recalling operation will light the Enter . You should press ESC to escape the recalling state before setting other parameters.

4.10 VON function

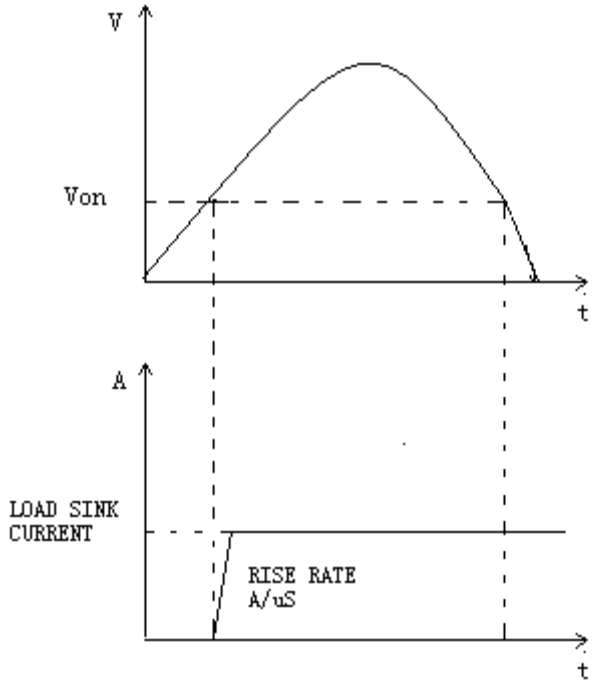
The DC load can be set to only turn on if the voltage is above a set value(VON set) under configure menu by pressing (Shift)**+9.**There are two types of VON function:**Living** and **Latch**.The following will have detailed description for the two types.

Note: VON set is used to ensure an electronic system under test will not have power applied unless the supply voltage is above a certain value.If you have no such testing request, do not set this value arbitrarily.If your instrument can not work normally, for example, set CC=1A, after turn on the input while the current is still 0A instead of setting value 1A, then you should check VON set firstly.If VON set is not 0V, then please modify to 0V.



VON LIVING MODE

In Living mode, when power is applied to the DC load, the voltage must rise above VON setting before the load draws current from the source.If the voltge below VON setting on the load's terminals, the load will turn off input.



VON LATCH MODE

In Latch mode,as before,the load will turn on only when the voltage exceed VON setting,but once on,it will now stay on,even if the voltage drops to zero.

4.11 OCP operation

OCP test process: After input voltage reaches VON point,the DC load start to draw a current from the source after a delay time.The current value will increase by a certain step size at regular intervals.Simultaneously,the DC load will judge whether the input voltage is lower than OCP voltage you've set.If it is,then the present current value will be compared to see if it is in the current range you've set,in this range,the OCP test will Pass or fail.On the contrary,the DC load will continue to increase drawing current and compare the voltage.

To start an OCP test,press (Shift)+ (Trigger).

Press (Shift)+CC(OCP) to enter OCP operation.

EDIT	OCP TEST	
	1.VON LEVEL=0.000V	Set Voltage threshold
	2.VON DELAY=0.00S	After delay certain time,the DC load starts to draw current.
	3.RANGE=3.000A	Set current range
	4.START=0.1000A	Set start current
	5.STEP=0.1000A	Set step current
	6.STEP DEL=0.20S	Set delay time of each step
	7.END=2.0000A	Set end current
	8.OCP VOLT=2.000V	Set OVP value
	9.MAX TRIP =1.5000A	Upper limit of OCP value
	10.MIN TRIP=0.9000A	Lower limit of OCP value
	SAVE OCP FILE=1	Save OCP test file (1-10)

Set the power on mode to be OCP test mode:

Operation	Display on front pannel
1.Press (shift)+8(system) enter into sysmtem menu	0.0000V 0.000A POWER-ON BUZZER
2.Press right key,select RUNMODE and confirm with Enter button	0.0000V 0.000A RUN <NORMAL
3.Press direction key to select OCP_TEST,Press Enter to confirm.	0.0000V 0.000A RUN <OCP_TEST
4,Press Esc button to quit the set.	0.0000V 0.000A STOP 0.000A

After above steps,press (Trigger) button to run ocp test file.

Recall OCP file:

Press shift+ Enter button to select programe file,the panel displays "CALL OCP FILE= 1.Enter the file name(1-10),press Enter button to confirm.

According to the following steps to escape OCP mode:press (shift)+8(system)------"RUNMODE"-----"Enter"-------select "NORMAL"mode----"Enter".

4.12 OPP operation

OPP test process:When the input voltage has reached VON point, power will begin to work after a delay time.The power value will increase by a step size at regular intervals.Simultaneously,the DC load will judge wether the input voltage is lower than OPP voltage(you need to set).If it is,then the present current value will be compared to see if it is in the current range you've set,in this range,the OPP test will Pass or fail.On the contrary,the power will continue to increase within the cut-off current range.And then compare OPP voltage with input voltage too.

To start a OPP test, press (Shift)+ (Trigger).

Press (Shift)+CW(OPP) to enter OPP test operation.

OPP TEST	RUN	OPP TEST	
		STOP	Run OPP test file
	CALL	OPP TEST	
		Recall OPP File=1	Recall OPP test file(range file1-file10)
	EDIT	OPP TEST	
		1.VON LEVEL=0.000V	Set Voltage on value
		2.VON DELAY=0.01S	Set Voltage on delay time
		3.RANGE=5A	Set working current range
		4.START =0.1W	Set start power value
		5.STEP =1W	Set step power value
		6.STEP DEL=1S	Set step delay time
		7.END =12W	Set cut-off power value
		8.OPP VOLT=7V	Set OPP value
		9.MAX TRIP =6.5W	Upper limit of OPP value
		10.MIN TRIP =5.6W	Lower limit of OPP value
		SAVE OPP FILE=1	Save OPP test file

Set the power on mode to be OPP test mode

Operation	Display on front pannel
1.Press (shift)+8(system) enter into sysmtem menu	0.0000V 0.000A POWER-ON BUZZER
2.Press right key,select RUNMODE and confirm with Enter button	0.0000V 0.000A RUN <NORMAL
3.Press direction key to select OCP_TEST,Press Enter to confirm.	0.0000V 0.000A RUN <OPP_TEST
4,Press Esc button to quit the set.	0.0000V 0.000A STOP 0.000A

After above steps,press (Trigger) button to run OPP test file.

Recall OPP file

Press shift+ Enter button to select programe file,the panel displays "CALL OPP FILE= 1.Enter the file name(1-10),press Enter button to confirm.

According to the following steps to escape OPP mode:press (shift)+8(system)------“RUNMODE”-----“Enter”-------select “NORMAL”mode----“Enter”.

4.13 Battery test

IT8500plus series products test the battery capability in CC/CW/CR mode.
The test mode should be set first, and then the discharge stop conditions. There are three discharge stop conditions to be set for IT8500 plus series products. When user only need to do battery testing in one or two stop conditions, the other conditions should be set to the specified value (STOP VOLT:0V;STOP CAP:999.999AH;STOP TIMER:99999S). When the system checks the discharging time or battery voltage or capacity is equal to the setting stop value or under an insecurity state, the battery test will stop, and the E-Load will turn off. The battery voltage, discharge current, discharge time and discharged capability are displayed on the VFD while testing.

Take CC mode for example, the operations are as below:

Voltage-threshold cut off

Step	Operation	Display
1	Press (Shift)+5(Battery),set current range	0.0000V 0.000A RANGE = 0.00A
2	Set discharge current,for example 2A	CURRENT = 2.000A
3	Set the stop voltage,for example 2V, then press Enter to confirm.	STOP VOLT=2V
4	Set the stop capability to maximum 999.999AH, press Enter to confirm.	STOP CAP=999.999AH
5	Set the stop timer to maximum 99999S, press Enter to confirm.	STOP TIMER=99999S
6	Save the battery test to specified file	0.0000V 0.000A SAVE BATT FILE 1(1-10)
6	Press Enter to confirm	0.0000V 0.000A 0.00W I = 2.00A Off cc

(2)Capacity-threshold cut off

Step	Operation	Display
1	Press (Shift)+5(Battery),set current range	0.0000V 0.000A RANGE = 0.00A
2	Set discharge current,for example 2A	CURRENT = 2.000A
3	Set the stop voltage to 0V, then press Enter to confirm.	STOP VOLT=0V
4	Set the stop capability, for example,7AH,then press Enter to confirm.	STOP CAP=7AH
5	Set the stop timer to maximum 99999S, press Enter to confirm.	STOP TIMER=99999S
6	Save the battery test to specified file	0.0000V 0.000A SAVE BATT FILE 1(1-10)
7	Press Enter to confirm	0.0000V 0.000A 0.00W I = 2.00A Off cc

(3)Time-out cut off

Step	Operation	Display
1	Press (Shift)+5(Battery),set current range	0.0000V 0.000A RANGE = 0.00A
2	Set discharge current,for example 2A	CURRENT = 2.000A
3	Set the stop voltage to 0V, then press Enter to confirm.	STOP VOLT=0V
4	Set the stop capability to maximum 999.999AH, press Enter to confirm.	STOP CAP=999.999AH
5	Set the stop timer, for example, 3800S, press Enter to confirm.	STOP TIMER=3800S
6	Save the battery test to specified file	0.0000V 0.000A SAVE BATT FILE 1(1-10)
7	Press Enter to confirm	0.0000V 0.000A 0.00W I = 2.00A Off cc

(4) Any of the three conditions cut off

Step	Operation	Display
1	Press (Shift)+5(Battery),set current range	0.0000V 0.000A RANGE = 0.00A
2	Set discharge current,for example 2A	CURRENT = 2.000A
3	Set the stop voltage as needed,for example,2V,then press Enter to confirm.	STOP VOLT=2V
4	Set the stop capbility as needed,for example,7AH,then press Enter to confirm.	STOP CAP=7AH
5	Set the stop timer as needed,for example,3800S,then press Enter to confirm.	STOP TIMER=3800S
6	Save the battery test to specified file	0.0000V 0.000A SAVE BATT FILE 1(1-10)
7	Press Enter to confirm	0.0000V 0.000A 0.00W I = 2.00A Off cc

(5)go into battery test mode

Operation	Display on front pannel
1.Press (shift)+8(system) enter into sysmtem menu	0.0000V 0.000A POWER-ON BUZZER
2.Press right key,select RUNMODE and confirm with Enter button	0.0000V 0.000A RUN <NORMAL
3.Press direction key to select OCP_TEST,Press Enter to confirm.	0.0000V 0.000A RUN <BATTERY
4,Press Esc button to quit menu set	0.0000V 0.000A 0S 0.000AH

(6)Start battery test

Press (trigger) to provide a signal to start battery test.The discharing process will be auto terminated when stop conditions are reached.

(7)Recall battery file

Press shift+ Enter button to select programe file,the panel displays “RECALL BATTERY 1.Enter the file name(1-10),press Enter button to confirm.

(8)Pannel locked in case of error operations

Press (shift)+ on/off(Lock) button to lock the panel.In this mode,only (shift) and on/off button is enabled.

According to the following steps to escape OPP mode:

Press (shift)+8(system)---“RUNMODE”---“Eneter”----select “NORMAL” mode---“Enter”

4.14 Protection features

DC load protection features include: OVP, OCP,OPP,OTP,reverse voltageprotection(LRV/RRV)。

4.14.1 Over Voltage Protection (OVP)

If input voltage exceeds the voltage limit set by the user, the DC load will turn the input OFF and the buzzer will sound. The display will show **OVP.**

Operations to clear the OVP state

Disconnect the instrument under test. Press any key on the front panel, the **OVP** on the VFD will disappear, then the DC load exits OVP protection state.

4.14.2 Over Current Protection (OCP)

The DC load includes both hardware and software over current protection features.

Hardware OCP: maximum input current of the DC load will be limited at about 110% of the current range, once the hardware OCP is activated, the status register’s OC bit will be set; when the hardware OCP is removed, the status register’s OC bit will be reset. Hardware over current protection won’t change the DC load’s On/Off state.

Software OCP: users can set the DC load’s software OCP value, steps:

(Shift)+9 >**Protect**>**Alimit** set ON, Apoint set OCP current value, Adelay set delay time before alarm. When the software OCP function is actived, the DC load will automatically turn off, VFD displays **OCP**.

Operations to clear the OCP state

Disconnect the instrument under test. Press any key on the front panel, the **OCP** displayed on the VFD will disappear, the DC load exits OCP protection state.

4.14.3 Over Power Protection (OPP)

The DC load includes both hardware and software OPP features.

Hardware OPP: the DC load allows user to set a power protection limit in hardware which will limit the power in the range you set when the OPP occur. The hardware OPP protection will not change the ON/OFF state of the the DC load.

Software OPP: users can set the DC load’s software OPP value, steps: (Shift)+ 9 >**Protect>P-LIMIT>P-LIM POIN** set OPP power value, **P-LIM DELAY** set alarm delay.

If the the DC load's power value reach OPP limit and after the delay time, the DC load will automatically turned off, VFD will display **OPP**.

Operations to clear the OPP state
Disconnect the instrument under test. Press any key on the front panel, the **OPP** displayed on the VFD will disappear, the DC load exits OPP protection state.

4.14.4 Over Temperature Protection (OTP)

If internal temperature exceeds safety limits(85℃ ;185 °F), the Over temperature circuitry will be activated. The DC Load will turn off the input, the buzzer will sound, and the display will show **OTP**.

Operations to clear the OTP state
When the DC load temperature drops to the protecting point, press any key on the front panel, the **OTP** displayed on the front panel will disappear, the DC load exits OTP protection state.

4.14.5 Reverse voltage protection (LRV)

This feature protects the DC load in case the DC input terminals are connected to a power source with reversed polarity. If a reverse voltage condition is detected, the buzzer will sound and **LRV**/**RRV** will be displayed on the VFD.

Operations to clear the reverse voltage state
Check whether the connection is reversed; if so disconnect the power source.

4.15 Key Lock Function

Press (Shift)+On/Off(Lock)key to lock the front panel keys,VFD will display a **Lock** label.In this state,setting values can not be modified,woriking mode can not be changed.Press (Shift)+ On/Off(Lock)again will disable this function.

4.16 The terminals on the rear panel

4.16.1 Remote sensing

Remote sensing is used to counteract the effect of lead resistance. For example, if you connect a power supply to the DC Load, the voltage at the power supply's terminals will not be the same as the voltage at the DC Load's terminals if there is a current flowing because of the finite resistance from the wires. Using remote sensing, you can sense the voltage at the power supply's terminals, effectively removing the effect of the voltage drop in the connection wire.
When using remote sensing, the power displayed by the instrument includes both the power dissipated inside the instrument and the power dissipated in the leads from the power supply to the DC Load's input terminals.

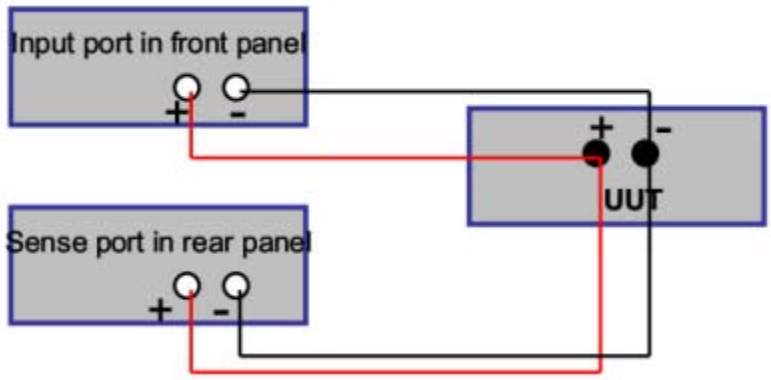
Steps t**o enable remote sensing in the menu:**

（1） Press (Shift)+ 9 key into the menu
（2） VFD displays **>**CONFIG**, press Enter** key to confirm
（3） Press to choose**>** SENSE**, press Enter** key to confirm

（4） Press ◀▶ to choose>ON, press **Enter** key to confirm, then remote sense function has been set,and VFD display Sense indicator.

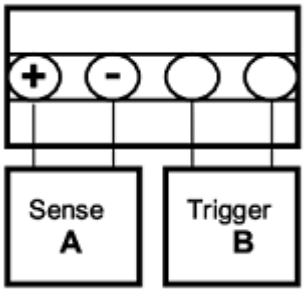
Remote Sensing: SENSE (+) and **SENSE (–)** are the remote sensing inputs**.** By eliminating the effect of the inevitable voltage drop in the DC load leads, remote sensing provides greater accuracy by allowing the DC load to regulate directly at the source's output terminals.

Wiring diagram for remote sensing:



4.16.2 External Triggering

EXTERNAL:An external trigger is a TTL low signal applied to the Trigger connection on the back panel. This TTL signal must last for more than 5 ms. A trigger applied to this input can be used to change settings (voltage, current , resistance), toggle between settings in transient-toggle mode, or generate a pulse in pulse mode.



Operation to select the trigger source as external:

(Shift)+ 8(system)to enter the menu，use ◀▶ to select TRIGGER,press Enter,and then select EXTERNAL.Press ESC to exit the menu.

4.16.3 Current monitoring (I Monitor)

Current monitoring terminal will output 0-10V analog signal to corresponding to 0 to full range of input current. You can connect an external voltmeter or an oscilloscope to display the input current's changing.

Chapter 5 Basic Operation

5.1 Operation mode

5.1.1 Constant current operation

(Set the current from 0 to the current limit)

There are three ways to set the current value:

1. In CC mode, rotate Rotary knob.
2. In CC mode, input value through number keys directly，press **Enter** to confirm.
3. In CC mode, move the cursor to change the step value by pressing the ◀▮▶, and then adjust the current by pressing the △ ▽.

To set current range, follow the steps:

Step	Operation	VFD display
1	Press CC, and then (Shift)+CV(Setup).	RANGE=30.000A
2	Set the current range，press **Enter** to confirm	RANGE =10.000A
3	Press Esc to escape.	HIGH=120.00V

Note: when you set the current range to low range(within 3A)，the resolution of current will rise.

5.1.2 Constant voltage operation

(Set the voltage from 0.1V to the setting voltage limit)

There are three ways to change the voltage:

1. In CV mode, rotate Rotary knob.
2. In CV mode,input value through number key boards directly，press **Enter** to confirm
3. In CV mode, move the stepping cursor by pressing ◀▮▶, and then adjust the voltage by pressing △ ▽.

To set voltage range, follow the steps:

Steps	Operation	VFD display
1	Press CV, then (Shift)+CV.	RANGE=120.00V
2	Set the voltage range, press **Enter** to confirm	RANGE=10.00V
3	Press Esc to escape.	HIGH=30.000A

Note: When you set the voltage range to low range，the resolution of voltage will rise.

5.1.3 Constant power operation

(Set a value from 0 to upper limit of power)

There are three ways to set the power value:
1. In CW mode, rotate Rotary konb.
2.In CW mode, input value through number key boards directly，press **Enter** to confirm
3. In CW mode, move the stepping cursor by pressing , and then adjust the power by pressing △ ▽.

To set power range, follow the steps:

Steps	Operation	VFD display
1	Press CW, then (Shift)+CV.	RANGE=150.00W
2	Set the power range，press **Enter** to confirm	RANGE =100.00W
3	Press Esc to escape.	HIGH=120.00V

5.1.4 Constant resistance operation

(Allowed setting range is 0.05Ω to 7500Ω)

There are three ways to set the resistance value:
1. In CR mode, rotate Rotary knob.
2.In CR mode, input value through number key boards directly，press **Enter** to confirm
3. In CR mode, move the stepping cursor by pressing , and then adjust the resistance by pressing △ ▽.

To set resistance range, follow the steps:

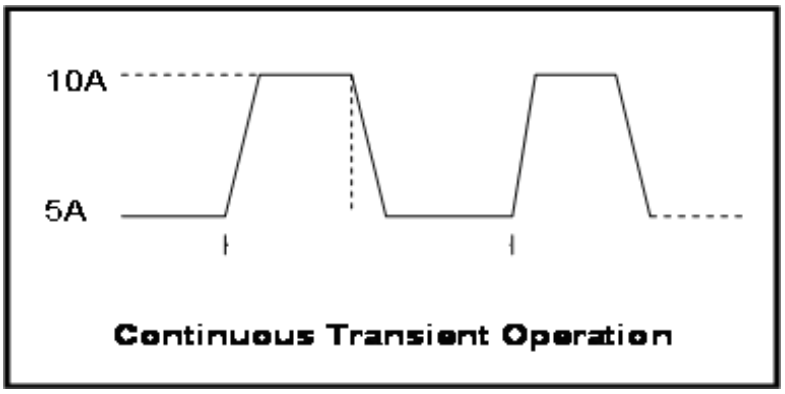
Steps	Operation	VFD display
1	Press CR, then (Shift)+CV(Setup).	RANGE=7500.0Ω
2	Set the resistance range，press **Enter** to confirm	RANGE =2000Ω
3	Press Esc to escape.	HIGH=120.0V

5.2 Transient test operation

Transient operation enables the DC load to periodically switch between two levels.
To edit a transient test file, related parameters need to be set: A level, B level, time width (only in pulse mode), frequency, duty and running mode (Continuous/Pulse/Toggled). If in CC dynamic mode, user can set current rising and falling slope additionally.

Following is an example to illustrate the three transient operations.

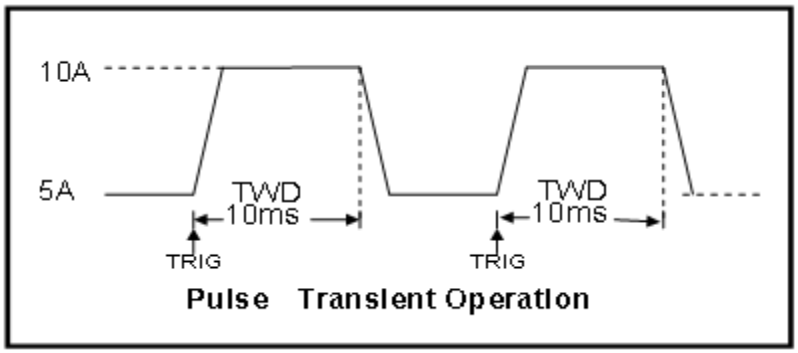
5.2.1 Continuous transient operation



Press (Shift)+ 2(Tran) to enter the transient operation setup menu:

Steps	Operation	VFD display
1	Press (Shift)+ 2(Tran), move key to select **ON.**, press **Enter** to confirm.	TRAN ON OFF
2	Preess to select transient operation mode as CONTINUOUS (the indicator lamp Trig will be lighted)	MODE CONTINUOUS >
3	Set the rising slope,press **Enter** to confirm	UP=1A/uS
4	Set the descending slope,press **Enter** to confirm	DOWN=2/uS
5	Set level **A**,press **Enter** to confirm	LEVEL A=5A
6	Set level **B**,press **Enter** to confirm	LEVEL B=10A
7	Set the frequency,press **Enter** to confirm	FREQUNCE=50HZ(0.01-10000HZ)
8	Set the dutyfactor,press **Enter** to confirm	DUTY=98%(%0.1-99.9%)
9	Open the transient test function, mentain on the “on”selection, press **Enter** to confirm.	TRAN ON OFF
10	Then the VFD will display TRAN and Trig	10.0000V 0.0000A 0.00W TRAN. 0 Trig
11	Turn on the load, press (Shift)+(Trigger) to trigger	
12	Press anyone of CC/CV/CW/CR button can quit the transient test,if you want to continue the test again, please repeat 1-11 steps	

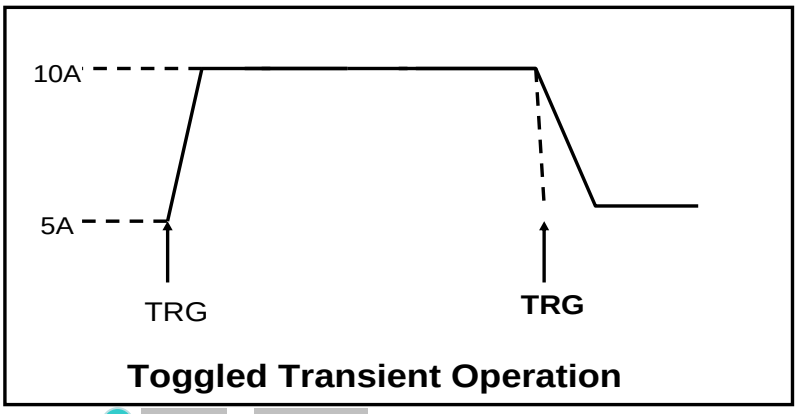
5.2.2 Pulse transient operation



Press (Shift)+ 2(Tran) enter the transient operation setup menu:

Steps	Operation	VFD display
1	Press (Shift)+ 2(Tran), move key to select **ON** , press **Enter** to confirm.	**TRAN ON OFF**
2	Preess to select transient operation mode as **PULSE**(the indicator lamp Trig will be lighted)	**MODE CONTINUOUS >**
3	Set the rising slope, press **Enter** to confirm	**UP=1A/US**
4	Set the descending slope,press **Enter** to confirm	**DOWN=2A/US**
5	Set level A,press **Enter** to confirm	**Level A=5.000A**
6	Set level B,press **Enter** to confirm	**Level B=10.000A**
7	Set the time width,press **Enter** to confirm	**WIDTH=5S(0.00005-3600S)**
8	Open the transient test function, mentain on the “on”selection , press **Enter** to confirm	**TRAN ON OFF**
9	Then the VFD will display **TRAN** and Trig	**10.0000V 0.0000A 0.00W TRAN. 0 Trig**
10	Turn on the load, press (Shift)+(Trigger) to trigger	
11	Press anyone of CC/CV/CW/CR button will quit the transient test,if you want to continue the test again,please repeat 1-10 steps.	

5.2.3 Toggle transient operation



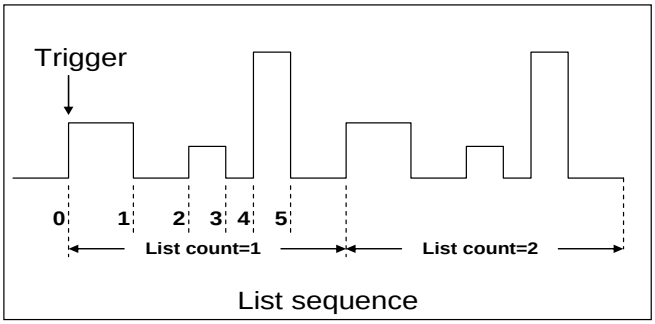
Toggled Transient Operation

Press (Shift)+ 2(Tran) to enter the transient operation setup menu

Steps	Operation	VFD display
1	Press (Shift)+ 2(Tran), move key to select **on** , press **Enter** to confirm.	**TRAN On Off**
2	Set transient operation mode as **TOGGLE**(the indicator lamp Trig will be lighted)	**MODE CONTINUOUS >**
3	Set the rising slope, press **Enter** to confirm.	**UP=1A/US**
4	Set the descending slope,press **Enter** to confirm	**DOWN=2A/US**
5	Set level A, press **Enter** to confirm	**LEVEL A=5A**
6	Set level B, press **Enter** to confirm	**LEVEL B=10A**
7	Open the transient test function, function,press **Enter** to confirm	**TRAN ON OFF**
8	Then the VFD will display **TRAN** and Trig	**10.0000V 0.0000A 0.00W TRAN. 0 Trig**
9	Turn on the load, press (Shift)+ (Trigger) to trigger	
10	Press anyone of CC/CV/CW/CR button will quit the transient test,if you want to continue the test again,please repeat 1-9 steps.	

5.3 List operation

Before run a list file,you should edit the list file firstly and save it in a non-volatile memory.The following examples will help you understand the function well.In the example, the output voltage and current are 10V and 3A,and the DC load is in CC mode.



Steps	Operation	VFD display
1	Press (Shift)+3(List), make sure the ON is flashing,if not,press Enter to select ON,then press key to select EDIT,press **Enter** to confirm.	LIST ON CALL EDIT
2	Set the current range.	LIST RANGE=3A
3	Set list step count by number keys, and press **Enter** to confirm.	LIST STEP=2(2-84)
4	Set the first step's current, press Enter to confirm.	STEP 01 =1A
5	Set the first step's rise slope, press **Enter** to confirm.	STEP 01 =0.1A/US
6	Set the first step's time, such as 5S. Press **Enter** to confirm.	STEP 01 =5S
7	Set the second step's current, such as 1A, press **Enter** to confirm.	STEP 01 =2A
8	Set the second step's rise slope, such as 1A/uS press **Enter** to confirm.	STEP 01 =0.1A/US
9	Set the second step's time, such as 5S. Press **Enter** to confirm.	STEP 01 =5S
10	Set repeat times, press **Enter** to confirm.	REAPEAT =3
11	Select the position to save file, such as 1, press **Enter** to confirm.	SAVE LIST =1(1-7)
12	Press to select ON, press **Enter** to confirm (the Trig indicator will be light now),press Esc .	LIST ON CALL EDIT
13	Turn on the DC load, press (Shift)+(Trigger) to trigger.	
14	Press any function ksys if you want to quit list mode	

If you want to run a list file you've saved, please recall it first.The steps is:

Steps	Operation	VFD display
1	Press (Shift)+3(List), make sure the ON is flashing,if not,press Enter to select ON,then press to select CALL,press Enter to confirm.	LIST ON CALL EDIT
2	Select the list file.Press Enter to confirm.	RECALL LIST =1
3		LIST ON CALL EDIT

5.4 Test files

Test files are a generalization of lists—they let you generate a sequence of tests using different modes, mode parameters, and durations. They are useful for executing a set of tests on a device, then displaying whether the tests passed or failed. We will illustrate how to use test files by a short example.
You can edit up to 10 groups of testing files, each file has 10 steps, it can edit up to 100 steps which can be saved in EEPROM (address).

Suppose we have a small AC to DC power supply (a "wall-wart") and we want to set up an acceptance test for a number of these devices. Our test will consist of two steps:
1. Set the DC load to constant current mode to draw the rated current of 1.2A from the device. The output voltage of the device at the rated current must be between 4.4V and 4.6V.
2. Set the DC load to constant voltage 3V. The output current of the device is between 2A and 3A.
3. When the device operates into a short, the supplied current must be larger than 3.0 A.

Steps	Operation	VFD display
1	Press (Shift)+ 6(Prog),	ACTIVE =0987654321
2	Press 1 ,2 and 3, Press Enter to confirm.	ACTIVE =0987654YYY
3	Select the step that needs to pause during the test. When it is paused,press can continue the test.	PAUSE =NNNNNNN32Y
4	Step 3 short circuit testing, press 3. And press Enter to confirm.	SHORT =NNNNNNNY21
5	Set Ton for the first step, if you want to load on 2S, press 2, and then press Enter to confirm. Ton range 0~60S	SEQ01 ON =2S
6	Set Toff for the first step, if you want to load off 2S, press	SEQ01 OFF =2S

	2, then press **Enter** to confirm Toff range 0~60S	
7	Set testing delay time, range 0~60S e.g. 1S, press 1.	SEQ01 P/F =1S
8	Set Ton for the second step, if you want to load 2S, press 2, then press **Enter** to confirm	SEQ02 ON =2S
9	Set Toff of the second step, if you need 2S, press 2, and then press **Enter** to confirm.	SEQ02 OFF =2S
10	Set testing delay time of the second step, e.g. 1S, press 1.	SEQ02 P/F =1S
11	Set Ton for the third step, if you want to load on 3S, press 3, then press **Enter** to confirm	SEQ03 ON =3S
12	Set Toff of the third step, if you need 2S, press 2, then press **Enter** to confirm.	SEQ03 OFF =2S
13	Set testing delay time of the third step, e.g. 2S, press 2.	SEQ03 P/F =2S
14	set start voltage.Please refer to “function of auto start voltage”.	AUTO START=0.000V
15	Set stop condition	STOP COMP FAILURE

Function of Auto start voltage:

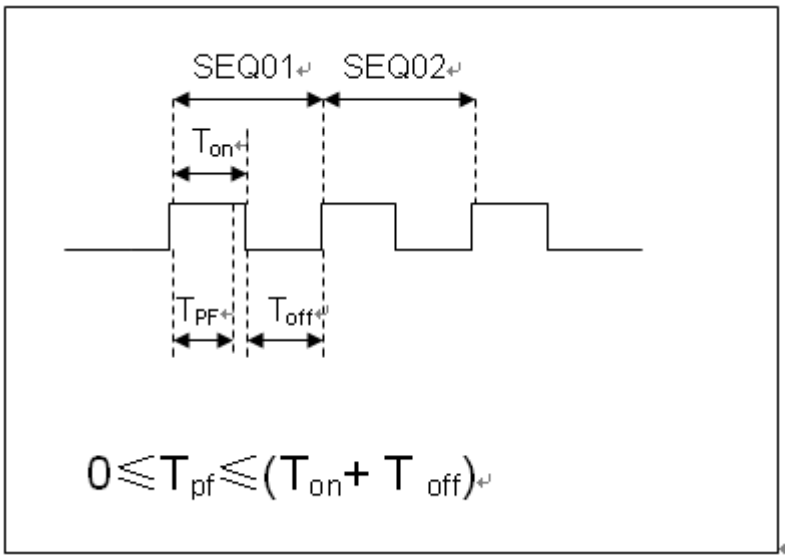
(1) Auto start=0V.

Auto test file start to run when receive a trigger signal by pressing shift+trigger or providing a external trigger signal.

(2) Auto start is not equal to 0V(Take 2V as an example)

In this condition,user only need to connect the charger to input termianls of E-load.The unit can auto start to run test file when detect a rising edge from 0-2V.Auto start voltage is not suggested to be a big value.2V is suitable.

Ton, Toff and Tpf (P/F) relation:



Tpf is the delay time for a step

15	Set stop conditions: **COMP** means stop test when all the steps are completed, **FAILURE** means stop test when the testing fails. Press **Enter** key to confirm.	STOP COMP FAILURE
16	Select the test file to link if you'd like to. The linked file must be saved before. 0 stands for not linking to other files. Press **Enter** key to confirm.	CHAIN PROGRAM =0(0-10)

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

17	Save the edited files in EEPROM, you can save up to 10 groups of files, e.g please press 1 to save the edited file in group 1, and then press **Enter** to confirm.	SAVE PROGRAM =1(1-10)
18	Select a operation mode and then press (Shift)+CV to set related parameters	10.0000V 0.0000A 0.00W CC=1.000A
19	Edit the three steps of the test file, details refer to below procedure. After all the steps are set , Press ESC to exit setup, and then press (Shift)+ 4 to save.	
	You need to recall the test file before runing it	

Set the steps of a test file in the example

CC mode, 1.2A, voltage range 4.4V~4.6V

Step	Operation	VFD display
1	Press CC button，and then (Shift)+CV(Setup) to enter the setting interface	RANGE=30.000A CC
2	Set the current range，press	RANGE =1.2A

	Enter to confirm	**CC**
3	set the upper limit of voltage, press **Enter** to confirm	**HIGH=4.6V CC**
4	Set the lower limit of voltage, press **Enter** to confirm	**LOW=4.4V CC**
5	Set the rise speed of current, press **Enter** to confirm	**UP=1A/uS CC**
6	Set the fall speed of current, press **Enter** to confirm	**DOWN=1A/uS CC**
7	Finish the setup	**10.0000V 0.000A 0.00W CC=0.000A**

CV mode, 3V, current range 2A~3A

Steps	Operation	VFD display
1	Press CV button，press (Shift)+CV to set related parameters	**RANGE=120.00V**
2	Set the voltage range，press **Enter** to confirm	**RANGE=3.00V**
3	set the upper limit of current,press **Enter** to confirm	**HIGH=3A**
4	Set the lower limit of current,press **Enter** to confirm	**LOW=2A**
5	Finish the setup	**10.0000V 0.000A 0.00W CV=10V**

The CW and CR is set as the same way:

CW mode

Steps	Operation	VFD display
1	Press CW button，press (Shift)+CV to set related parameters	**RANGE=150.00W**
2	Set the power range，press **Enter** to confirm	**RANGE =1.00W**
3	Set the upper limit of voltage,press **Enter** to confirm	**HIGH=120.00V**
4	Set the lower limit of voltage,press **Enter** to confirm	**LOW=0.000V**
5	Finish the setup	**10.0000V 0.000A 0.00W CW=1.00W**

CR mode

Steps	Operation	VFD display
1	Press CR button，press (Shift)+CV(Setup) to set related parameters	**RANGE=7500.0Ω**
2	Set the resistance range，press **Enter** to confirm	**RANGE =2Ω**
3	set the upper limit of voltage,press **Enter** to confirm	**HIGH=120.0V**
4	Set the lower limit of voltage,press **Enter** to confirm	**LOW=0.000V**
5	Finish the setup	**10.0000V 0.000A 0.00W CR=2.000Ω**

Go into autotest mode

Operation	Display on front pannel
1.Press (shift)+8(system) enter into sysmtem menu	0.0000V 0.000A POWER-ON BUZZER
2.Press right key,select RUNMODE and confirm with Enter button	0.0000V 0.000A RUN <NORMAL
3.Press direction key to select OCP_TEST,Press Enter to confirm.	0.0000V 0.000A RUN <PROG_TEST
4,Press Esc button to quit menu set	0.0000V 0.000A P01

According to the following steps to escape OPP mode:

Press (shift)+8(system)---“RUNMODE”---“Eneter”----select “NORMAL” mode---“Enter”

(6)Start auto test file

Press (trigger) to provide a signal to start auto test file.The discharing process will be auto terminated when stop conditions are reached.

(7)Recall test file

Press shift+ Enter button to select programe file,the panel displays “RECALL PROGRAM= 1.Enter the file name(1-10),press Enter button to confirm.

If you need a pause, please press (Shift)+0(pause).Press can continue the test.

Chapter6 Communication interfaces

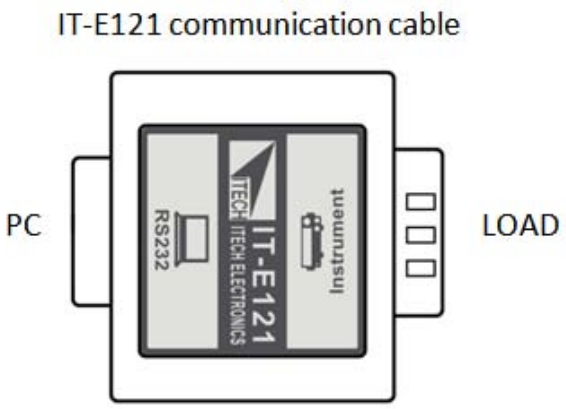
DB9 in the rear panel of the DC load could connect with RS-232 through on TTL connector. The following description may help you to know how to control the output of the DC load through PC.

WARNING: Don't connect the DC load's DB9 connector to a standard RS232 instrument; doing so may damage the instrument.

6.1Communication modules intruduction

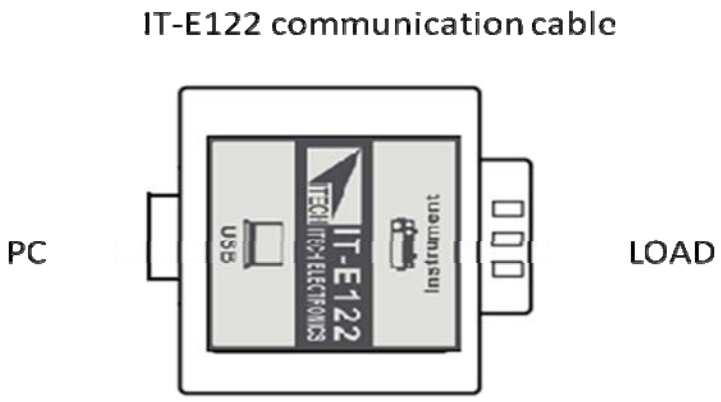
IT-E121 communication module

The DB9 interface connector on the rear panel of the DC load is TTL voltage level; you can use the communication module IT-E121 and an a standard RS232 extension cable to connect the DB9 interface connector of the DC load and the RS-232 interface connector of computer for the communication.



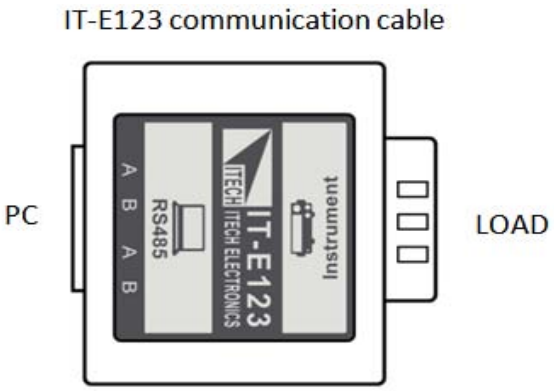
IT-E122 communication module

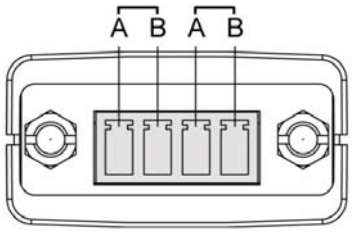
The DB9 interface connector on the rear panel of the DC load is TTL voltage level; IT-E122 has a USB interface on one end,you can use IT-E122 and an a standard USB extension cable to connect the DB9 interface connector of the DC load and the USB interface connector of computer for the communication.



IT-E123 communication module

The DB9 interface connector on the rear panel of the DC load is TTL voltage level;
The interface on both side port of IT-E123 are DB9 interface and RS485 interface, you can use the communication module IT-E123 and an a standard RS485-RS232 conversion cable to connect the DB9 interface connector of the DC load and the RS-232 interface connector of computer for the communication.





RS485 pins

6.2 Communication with PC

Before using the remote operation mode, please make sure that the baud rate and communication address in the DC load are the same as in the computer software, otherwise, the communication will fail, you can change the baud rate and communication address from the front panel or from computer.

Commnunication settings

In order for the computer to communicate with the DC load, both must be set to the same RS-232 settings. These communication settings are:

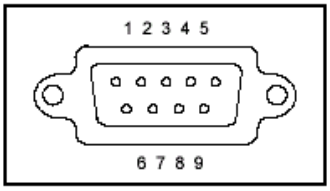
1. Address: the range is from 0 to 31, default setting is 0
2. Baud rate: 4800,9600,19200 and 38400 are selectable, default setting is 9600.

Refer to chaptor 1.7.

3. Data bit: 8 bit
4. Stop bit: 1
5. Parity: None,Even, Odd, default is None, refer to chaptor1.7.

Parity=None	Start Bit	8 Data Bits	Stop Bit

DB9 serial port



Support process

If you have a problem, follow these steps:

1 Check the documentation that come with the product

2 Visit the ITECH online service Web site is www.itechate.com ,ITECH is avaliable to all ITECH customers. It is the fastest source for up-to-date product information and expert assistance and includes the following features:

Fast access to email AE

Software and driver updates for the product

Call ITECH support line 4006-025-000