

**Rek**<sup>®</sup> Meiruike

instrument

MEIRUIKEINSTRUMENT

Manual  
operation  
instruction

RK8510 series  
dc electronic load  
Operating  
instructions

# Catalogue

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# Chapter 1 Introduction

Welcome to RK8510 series DC electronic load designed by Merrick Company. The electronic load adopts high-performance chips, designed according to high precision, with novel appearance and scientific and rigorous production technology. Compared with similar products, it is more cost-effective.

RK8510 series includes two products, RK8510 and RK8510A. In the following description, unless otherwise specified, the stated contents are applicable to these two products.

The second chapter gives the basic parameters of these two products, which can also be used as the basis for you to choose our products.

Electronic load is widely used in electronic product production lines (such as mobile phone charger, mobile phone battery, electric vehicle battery, switching power supply, linear power supply), scientific research institutions, automotive electronics, aerospace, ships, solar cells, fuel cells and other industries.

**Caution: Do not exceed the maximum test power of RK8510/8510A, otherwise the machine may be damaged.**

## main feature

- ① 2.8-inch TFT true color display, the display is clear and pleasing to the eye.
- ① The circuit parameters are corrected by software, and the adjustable resistor is not used, so the work is stable and reliable.
- ① Over-current, over-voltage, overload, over-temperature, polarity reversal protection.
- ① Intelligent fan system can automatically start or stop and adjust the wind speed according to the temperature change.
- ① Support external trigger input, cooperate with external equipment to complete automatic detection. (only supported by RK8510)
- ① RS232, RS485 communication, MODBUS/SCPI protocol (only supported by RK8510)
- ① Upper computer software support (only supported by RK8510)
- ① Support remote voltage compensation input.
- ① Power supply AC 220V/110V switching use
- ① Support a variety of test functions, as follows:

Four basic load modes: CC, CV, CR and CP.

dynamic test

Battery capacity test

Battery internal resistance test

Short circuit test function

List test

automatic testing

Overcurrent test

## Chapter II Technical Parameters

Parametric model		RK8510A		RK8510	
Rated parameter	power	200W		400W	
	voltage	0-150V		0-150V	
	electric current	0-20A		0-40A	
CV mode	measuring range	0-18V	0-150V	0-18V	0-150V
	resolution ratio	1mV		1mV	
	precision	$\pm(0.05\%+0.025\%FS)$		$\pm(0.05\%+0.025\%FS)$	
CC mode	measuring range	0-2A	0-20A	0-4A	0-40A
	resolution ratio	1mA		1mA	
	precision	$\pm(0.05\% + 0.05\%FS)$		$\pm(0.05\% + 0.05\%FS)$	
CR mode	measuring range	0.05 $\Omega$ ~7.5K $\Omega$		0.05 $\Omega$ 7-5K $\Omega$	
	resolution ratio	1m $\Omega$		1m $\Omega$	
	precision	$\pm(0.1\% + 0.5\%FS)$		$\pm(0.1\% + 0.5\%FS)$	
customer pricing	measuring range	0-200W		0-400W	
	resolution ratio	1mW		1mW	
	precision	$\pm(0.1\% + 0.5\%FS)$		$\pm(0.1\% + 0.5\%FS)$	
Dynamic mode	T1&T2	100 $\mu$ S-99.9999S		100 $\mu$ S-99.9999S	
	precision	\		\	
	slope	0.001~3.000A/us		0.001~3.000A/us	
Voltage readback	measuring range	0-18V	0-150V	0-18V	0-150V
	resolution ratio	1mV、10mV		1mV、10mV	
	precision	$\pm(0.05\% + 0.1\%FS)$		$\pm(0.05\% + 0.1\%FS)$	
Current readback	measuring range	0-2A	0-20A	0-4A	0-40A
	resolution ratio	1mA、10mA		1mA、10mA	
	precision	$\pm(0.05\% + 0.1\%FS)$		$\pm(0.05\% + 0.1\%FS)$	
Power readback	measuring range	0-200W		0-400W	
	resolution ratio	1mW		1mW	
	precision	$\pm(0.1\% + 0.5\%FS)$		$\pm(0.1\% + 0.5\%FS)$	
Power supply input	115V/230V $\pm$ 10%50Hz/60Hz				
protect	Overvoltage (OV)	$\geq$ 152V		$\geq$ 152V	
	Overcurrent (OC)	$\geq$ 21A		$\geq$ 42A	
	Overtemperature (OT)	85 $^{\circ}$ C $\pm$ 5 $^{\circ}$ C		85 $^{\circ}$ C $\pm$ 5 $^{\circ}$ C	

	Overpower (OP)	$\geq 210W$	$\geq 410W$
	AC power supply input fuse 0.5A		
Volume weight	Size (W*D*H)	90×275×185	90×275×185
	Weight (KG)	3.1	3.9

**Note: 1. In the working mode of constant power and constant resistance, it is required that the input voltage and current are more than 10% of the full scale, and then the accuracy can meet the parameters in the table, otherwise it can be beyond the accuracy range.**

**2. The initial value before starting the work shall prevail in judging the voltage level and gear position.**

## Chapter III Commonly Used Terms

Terms used in the specification are explained below.

### ① Power supply to be tested

Electronic load is used to measure various characteristics of DC power supply, such as power supply voltage stability, load capacity, instantaneous change suppression capacity, overload capacity, capacity (battery type) and other indicators. In the following, if the power supply to be tested is mentioned,

Refers to the measured power supply, or "test power supply".

### ② work pattern

There are many working modes of electronic load, and different working modes can complete different measuring functions, such as constant voltage working mode, constant current working mode, battery capacity testing working mode, automatic testing working mode and so on.

Under normal working conditions, the current working mode is displayed in the lower left corner of the screen, with the specific meaning as follows:

Character symbol	Meanings	Character symbol	Meanings
CV	Constant voltage	CR	Constant resistance
CC	Constant current	DY	dynamic test
CP	Constant power	AUT	automatic testing
BAT	Battery capacity test	BIR	Battery internal resistance test
TAB	List test	OC	Overcurrent test

### ③ Normal state and setting state

The normal state and the set state are two relative states. Under normal conditions, the screen displays various data, and displays the detected parameters and setting parameters.

In the normal state, pressing a specific key can enter the setting state. In the setting state, the user is usually prompted to input data to determine a certain operation parameter, or to choose between several options.

### ④ Set value, actual value and calculated value

The set value refers to the operating parameters set by the user, and the actual value refers to the values detected by the instrument. Sometimes these two values are equal, but sometimes they are not. Take the constant current mode as an example, the user sets it as 2A, but the external power supply can only provide 1.5A (maybe the internal resistance of the power supply is large, or the power supply itself has the current limiting function). At this time, 2A is the set value and 1.5A is the actual value.

Calculated values are data obtained by calculation based on actual values, such as power values and resistance values, which are not obtained by direct measurement, but by calculation based on measured voltage and current data.

①Setting parameters (setting values or operating parameters) and parameter saving.

The setting parameter is the setting value in the previous entry. In different contexts, the setting value is sometimes used, and sometimes it is called setting parameter or running parameter.

Setting parameters are specified by users, such as voltage value in constant voltage mode, current value in constant current mode and battery capacity measurement.

The test termination voltage value in the test, etc.

In the process of setting a parameter, if the user presses the "Esc" key, it will return to the normal state without saving the data input by the user. If the data input is completed and the "OK" key is pressed, the device will save the data input by the user, and the data will not be lost after power failure for next use.

#### ④Output state

There are two output states of electronic load, "Stop" and "Run", which are indicated by "gray square" and "red square" in the upper left corner of the screen respectively.

There are many power tubes in the electronic load, which work in one of off, amplification and saturation States. For the power supply to be tested, it is equivalent to a variable load.

The "stop" state means that the power tube is off, and for the power supply to be tested, it means that the load is open (physically, the electronic load and the power supply to be tested are still connected together).

The "running" state indicates that the power tube is working in the amplification or saturation state, and the resistance value of the resistor is reduced, which will consume some power.

#### ④Shift key and shift

In the key area, some of them have a second function, and in the set state, they can be used as ordinary keys.

"Shift" is called the SHIFT key. When the shift key is pressed once, the character "Shift" will be displayed at the position where the output status is displayed in the upper right corner of the screen, and the shift function is effective. If a key with the second function is pressed, the second function of this key will be triggered.

If the "SHIFT" key is pressed again, or a key without the second function is pressed, the "Shift" character on the screen disappears and the shift function fails.

In the following, "Shift+1" means to press the "Shift" key first, and then press the key "1".

#### ④Trigger input

In the "dynamic test" working mode, the user can choose how to start the dynamic test. If continuous is selected, then

The electronic load will automatically switch between the two current settings. If pulse or flip is selected, the electronic load will start with

Low value operation, if there is a trigger event, the electronic load will complete a current change process, and the specific operation can be explained by the parameter "dynamic test" working mode.

There are two input modes for trigger input, one is "Shift+Trigger", and the other is the terminal at the back of the chassis. Two leads are connected at "Trigger" and "+12V". When the user short-circuits these two wires once, the trigger is completed once.

#### ④Trigger output

After the automatic test is completed, or during the automatic test, a trigger signal can be output, which is sent out through the "FAIL" and "PASS" at the rear of the car, and the user can connect an external prompting device to prompt the operator to complete or fail the test.

Please refer to the description of "Automatic Test" working mode for the specific usage of trigger output.



## Chapter IV Quick Start

### Boot self-test

The machine is connected to the 220V/110V power supply, press the power button on the back panel, and the instrument will start. First, it will enter the self-test process, with the following prompts (taking RK8510 as an example, the corresponding model names will be displayed when other instruments are started):

project	VFD display	Release
When powered on	Meiruike electronic	System self-check.
After 1 second.	xxxxxxxVxxxxxxxA xxxxxxxA xxxxxxxWxxxxxxxX	It is displayed as actual input voltage, current, power, setting parameter values and current status.

### If the load cannot be started

The following methods can help solve the problems you may encounter when opening the load.

Z Check whether the 220V/110V power supply is normal, check whether the power cord is intact and whether the power switch is turned on.

Z Check whether the fuse of the load is blown.

Z When using 110V AC power input, please replace the 250V/1A fuse.

If the fuse is burnt out, please replace it with 0.5A/250V or 1A/250V fuse tube. The replacement method of fuse is as follows:

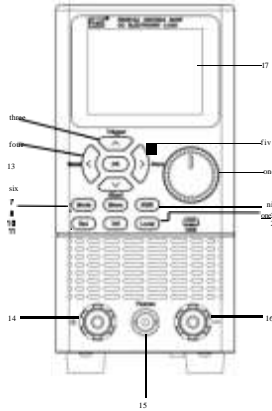
Use a flat screwdriver to pry open the small plastic cover under the power input socket on the back panel of the load, and you can see the safety.

Tube, please use the fuse that meets the above specifications.

If you still can't start the instrument, please contact our after-sales staff. There are no components in the instrument that customers can adjust. Please

Do not repair or modify the instrument by yourself, otherwise, our company will not undertake the warranty obligation and any responsibility arising therefrom.

## Introduction of front panel



### 1. Pulse knob

Used to adjust the parameter size.

### 2.USB interface

Used for system upgrade or other reserved functions.

### 3. Arrow keys

Used to select the test mode (CC/CV/CR/CP/LIST/AUTO, etc.), or adjust the cursor position in the menu, or change the preset size. 4.← Arrow keys.

Used to select the test mode (CC/CV/CR/CP/LIST/AUTO, etc.) or adjust the cursor position in the menu 5.→ arrow keys.

Used to select the test mode (CC/CV/CR/CP/LIST/AUTO, etc.) or adjust the cursor position in the menu.

Used to select the test mode (CC/CV/CR/CP/LIST/AUTO, etc.), or adjust the cursor position in the menu, or change the preset value 7.Mode.

Used to set the operation mode of the equipment.

### 8.Menu

Used for equipment system parameter setting.

### 9.Shift

Press (the screen is displayed) to realize the second function of other keys.

### 10.Esc

Return to the superior menu or return to the test page.

### 11.ON

Control the state of the load input channel (open/closed)

### 12.Local

Local/remote switch key, used to switch local control or remote control mode.

### 13.OK

Used to confirm the currently modified option or parameter.

### 14. Positive terminal of input terminal

It is used to connect with the on-load power supply and connect with the negative end of the input terminal to form a loop.

### 15.Vsense input interface

Used for remote voltage measurement

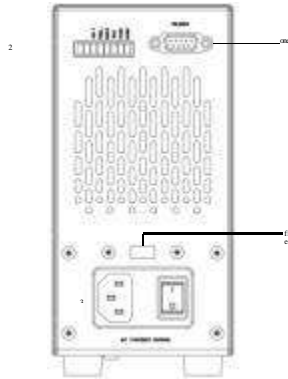
### 16. Input terminal negative terminal

It is used to connect with the on-load power supply and connect with the positive end of the input terminal to form a loop.

### 17. Display screen

2.8 inch TFT true color screen

## Introduction of rear panel



### 1. RS232 interface

External communication interface for remote control.

### 2. Expand the interface

Used for matching RS485 communication, external trigger/sorting and other functions.

### 3. Power switch

Device for turn on/off electronic load

### 4. Power socket

AC220/110V AC power socket (with 0.5A fuse)

### 5. Transfer switch

AC220/110V AC power supply voltage shift switch

## Introduction of SHIFT+ Key Multiplexing Function

Shift+↑(Trigger): trigger manually.

Shift+←(Manual): used to switch the load trigger mode.

Shift+→(Save): used to save the list file.

Shift+↓(Short): used to turn on the short circuit test (only supported in CC/CV/CR/CP mode) Shift+Local: used to switch the voltage compensation channel of Vsense.

Shift+OK: used to view the results after the list test.

Shift+Menu: used to lock and unlock the screen measurement page, and other key actions are invalid after locking.

Shift+Esc: used to delete list files in file settings.

Shift+On: used for calling list files in file settings.

## Chapter V Function Settings

This chapter describes the main functions of electronic load in detail, so that you can have a deeper understanding of the operation of electronic load. This chapter mainly introduces the following functions: system setting, parameter setting, local/remote switching, parameter input/on-load measurement and steady-state mode.

Operation, more mode operation, etc.

### 5.1 System Settings (Menu)

Press Menu to enter system setup. System settings are divided into six parts, system settings, parameter settings, communication settings, file settings,

Device information, manual calibration.



#### 5.1.1 System Settings

system parameter	Set content	description of parameter
Language settings	Chinese /English	Set system language
Effective immediately	Enable/disable	Set whether the adjustment parameters of the knob take effect immediately in partial mode.
Alarm sound	Enable/disable	Set whether to enable alarm tone.
Key sound	Enable/disable	Set whether the key tone is enabled.
Restore factory settings	Yes/no	Select Restore Factory Settings, and the equipment will clear the current setting parameters and return to the factory setting state.

#### 5.1.2 Parameter setting

On the parameter setting page, the parameter setting is used to set the operation parameters and protection parameters of the system, and the specific setting range is related to the model.

Parameter setting	Setting range	description of parameter
Timed unloading	0~99999s	Set the loading time every time, and the load will automatically stop loading no matter what mode runs to the corresponding running time.

Short circuit time	0.1~99999ms	Set the time for short circuit test.
Overvoltage protection	0.01~152V	Set the voltage value of overvoltage protection.
overcurrent protection	0.01~21A(41A)	Set the current value of overcurrent protection.

Power protection	0.01~210W(420W)	Set the power value of over-power protection
soft start	0~99999.9V	Set the delayed start time.
Unloading voltage	0.01~150V	Set the low voltage to automatically end the loading.
Self-starting voltage	0.01-150V	Used for automatic operation when the load detects that the measuring terminal has a voltage value higher than the self-starting voltage in the automatic/overcurrent test mode.
Short-circuit voltage limiting	On/off	When the input terminal voltage is higher than the local protection voltage, directly short-circuit the input terminal.
Trigger input	Trigger /On_Off	Set whether to turn on external trigger (RK8510 only)
Voltage gear	automatic switchover	Not selectable, automatic switching
Current gear	automatic switchover	Not selectable, automatic switching

### 5.1.3 Communication Settings

The communication setting is mainly used to set the communication mode between the electronic load and the upper computer. The electronic load communicates with the upper computer through RS232 or RS485 interface, and users can choose the required connecting wires and realize the remote control of the electronic load. Before connecting the host computer, please make sure that you have selected the specified connecting cable and selected the corresponding communication parameters in the communication settings.

Communication settings	Set content	Setup description
communication interface	RS232/RS485	Set communication interface (supported at the same time)
protocol	Scpi/Modbus_Rtu	Set communication protocol
Baud rate	9600/19200/38400/115200	Set the communication baud rate of the communication interface
mailing address	000-255	Set the current modbus communication address of the load.

### 5.1.4 File Settings

File operation is mainly aimed at calling and deleting list test files. The storage mode of the device is internal Flash, and you can view all the stored files.

### 5.1.5 Device information

Device information You can view the basic information of the equipment, including the model, version number and serial number of the electronic load.

### 5.1.6 Manual calibration

Manual calibration can calibrate the voltage value or current value of each gear.

## 5.2 Local/Remote Switching

Electronic load provides two modes of operation: local operation and remote control. The Local key can be used to switch between the two operation modes. The electronic load initialization operation mode defaults to the local operation mode.

Local operation mode: use the buttons on the electronic load body to operate.

Remote operation mode: the electronic load is connected to the PC through communication cable, and the PC sends commands to perform related operations on the electronic load through the upper computer software. When the electronic load is in the

remote operation mode, other buttons on the panel do not work except the Local button.

When you don't need to use the remote function, you can switch to the Local operation mode through the local button.

The status bar at the top of the screen will display "local" and "remote" signs, indicating the current control state of the load. The user judges the control state of the load according to the display on the screen.

### **5.3 Parameter Input and Operation Control**

There are two ways to input parameters for electronic load. Where parameters need to be input, you can modify the required parameters through the arrow keys or knobs.

#### **5.3.1 Parameter input**

When entering the parameter interface to be set, you can use the up, down, left and right keys and the knob to input parameters.

### 5.3.2 Input control

After the electronic load is turned on, the load is in an unloaded state. The input switch of the electronic load is controlled by pressing the ON key on the front panel of the electronic load.

### 5.4 test mode

Press the Mode key to enter the electronic load mode selection interface.

RK8510 series electronic load has 10 commonly used test modes, which are CC, CV, CR, CP, dynamic, tabulation, battery capacity, battery internal resistance, automatic test and overcurrent test. The user can use the general direction key or rotation in the mode selection interface.

Button to enter the corresponding mode.

Introduction of steady-state operation parameters:

name	brief introduction
CC mode	No matter how much voltage is input, the electronic load always consumes a constant current.
CV mode	The load maintains the input voltage as a set value by changing the consumed current.
CR mode	The electronic load is equivalent to a resistor, which changes the input current with the change of voltage.
customer pricing	The electronic load consumes a fixed power, and the current decreases when the voltage increases to maintain a constant power.
dynamic test	Set two different current/voltage values, and the load switches back and forth between these two values during the test.
List test	Up to 16 different loading modes can be set, and the stepping mode and the upper and lower limits of test judgment can be customized. At the same time, it has the function of saving memory for each group of test modes.
battery capacity	CC/CR/CP discharge the tested battery in three ways, and automatically end the test when it reaches the cut-off value, and can display the current battery discharge capacity in real time (RK8510 can display the discharge curve through the upper computer).
Battery internal resistance	It is mainly used to test the internal resistance of battery, and can also be used to test the internal resistance of power supply.
automatic testing	CC/CV/CR/CP four test methods.
Overcurrent test	It is mainly used to test the overcurrent protection characteristics of power supply or protection board, and the test result is overcurrent protection point and protection time.

#### 5.4.1 Constant current test

In CC mode, no matter how the input voltage changes, the electronic load always consumes constant current.

The user selects CC mode in the mode selection interface and enters the measurement setting interface of CC mode. After pressing OK key to focus on the measurement setting interface, the current constant value can be set, and then pressing OK key again can determine and save the set value. Press the ON key when the electronic load is not loaded, and then press the ON key again to stop the loading.





Figure 5-1 CC Mode Voltage-current Relationship Diagram

### 5.4.2 Constant voltage test

In CV mode, the load keeps the input voltage constant by changing the consumed current.

The user selects CV mode in the mode selection interface and enters the measurement setting interface of CV mode. After pressing OK key to focus on the measurement setting interface, the voltage constant value can be set, and then pressing OK key again can determine and save the set value. When the ON key is pressed in the unloaded state, the electronic load starts to be loaded; Press the ON key again to stop loading.



Figure 5-2 CV mode voltage-current relationship diagram

### 5.4.3 Constant Resistance Test

In CR test mode, the electronic load is equivalent to a resistor, and the load changes the input current with the change of voltage to maintain a constant resistance load.

The user selects CR mode in the mode selection interface and enters the measurement setting interface of CR mode. After pressing OK key to focus on the measurement setting interface, the voltage constant value can be set, and then pressing OK key again can determine and save the set value. When the ON key is pressed in the unloaded state, the electronic load starts to be loaded; Press the ON key again to stop loading.

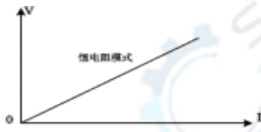


Figure 5-3 CR mode voltage-current relationship diagram

### 5.4.4 Constant power test

In CP mode, the electronic load consumes fixed power, and the equipment will adjust the current with the change of voltage to maintain the set power value.

The user selects CP mode in the mode selection interface and enters the measurement setting interface of CP mode. After pressing OK key to focus on the measurement setting interface, the voltage constant value can be set, and then pressing OK key again can determine and save the set value. When the ON key is pressed in the unloaded state, the electronic load starts to be loaded; Press the ON key again to stop loading.

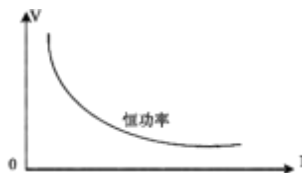


Figure 5-4 CP mode voltage-current relationship diagram

### 5.4.5 Dynamic test mode

RK8510 series electronic load has current dynamic loading mode. In dynamic mode, users can set two fixed-value parameters corresponding to the steady-state mode, and the load is switched back and forth between the two values through the set operation mode.

[dynamic] [local]					
Mode:	CC		Operation mode:	continuously	
Low value:	1.000	A	Low timing:	10.0	ms
High value:	35.000	A	High timing:	10.0	ms
Rising slope:	3.000	A/us	Descending slope:	3.000	A/us
Number of runs:	01000				

Dynamic mode setting parameters:

dynamic test model	description of parameter
Operation mode	Select continuous operation mode: continuous/pulse/flip.
Low value	Set the lower parameter value.
Low timing	Set the low loading time.
high-value	Set the parameter value of the high bit.
High timing	Set the loading time of high position.
Ascending slope	Set the rising slope.
Descending slope	Set the descent slope
Running times	Set the number of times to run the repeating cycle at a time.

For example, in the dynamic CC mode, the user sets the low current value and the high current value, and the load will continuously switch the current value back and forth between the low current value and the high current value.

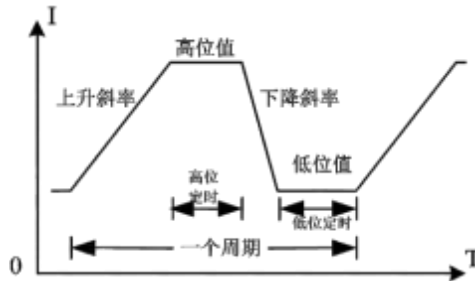


Figure 5-5 Dynamic Test Mode

Supplementary explanation of dynamic mode:

Select the appropriate operation mode: continuous/pulse/flip.

In continuous mode, the load will automatically switch between the two set high/low values until the set number of repetitions is reached, and the test is over.

In pulse mode, the load is loaded with low-order parameters first, and then every time the load receives a tail port pulse.

When the trigger signal (only RK8510 and the trigger input parameter is set to trigger and the trigger channel under the test page is set to [Ext]) or the key trigger signal (the trigger channel under the test page is set to [Manu]) is triggered, the load will switch to the high value, and then switch back to the low value after maintaining the set high timing time; And when the load receives a trigger signal, it will only flip once, and it is not necessary to set the low timing.

When the selected operation mode is rollover, the load will switch to the current on-load state every time it is triggered. At this time, there is no need to set the timing for the high and low bits, and it will switch to another state only after each trigger.

The user selects the dynamic mode in the mode selection interface and enters the setting interface of the dynamic mode. After setting the relevant operation parameters in the setting interface, press the ON key to jump to the dynamic mode test page, and press the ON key again in the non-loaded state in the test page, and the electronic load starts to run with load; Press the ON key again in the running state to stop loading.

#### 5.4.6 List test

The list test function can switch between different modes in turn according to the set parameters. For power products and chargers, through multi-parameter hybrid testing, we can have a more comprehensive and in-depth understanding of the comprehensive working characteristics of the tested products under the actual application field.

List parameter setting:

List mode	parameter	explain
group number	0~60	Set the group number of the test parameters of this group list for easy calling.
step number	1~16	Set the number of steps for this set of list tests.
repeat	1~99999	Sets the number of repetitions of each measurement in the current mode.
run	Continuous/triggEr/ continuous Er/trigger er	Set the switching mode and stopping mode of each step.

The upper part of the list test setting interface is used to set parameters such as list group number; Flash inside the electronic load can save 60 groups of list modes (group 0 cannot be saved). Please set a reasonable group number every time you set the list parameters. Er in the operation mode indicates that the load will automatically stop when there is an abnormality or beyond the inspection range during operation.

There are four options for setting the operation mode: continuous/triggered/continuous Er/triggered Er. In the continuous operation mode, the load will continue to the next step after executing one step until the end of operation; After running one step in the triggered operation mode, you need to wait for the trigger signal before continuing to the next step; Under the operation mode with Er, the test will be automatically stopped when the load runs beyond the limit or other error conditions.

Mode parameter setting:

	List value	explain

model	CC/CV/CR/CP/Open/Short	Select the loading mode of the current step.
define value	Set the fixed value of the set mode.	Set the fixed value of the mode, and the default fixed value of Open/Short is 0.
timing	300~99999ms	Set the on-load execution time of each step, and you can choose any time between 300 and 99999 ms.
check	Off/Current/Voltage/Power	Select inspection items
upper limit	Check the upper limit value of the project	Set the upper limit value of inspection items.
lower limit	Check the lower limit of the project.	Set the lower limit value of inspection items.

The user selects the list mode in the mode selection interface, enters the setting interface of the list mode, and sets it in the setting interface.

After the relevant operation parameters are well, you can save them by Shift+Save, and then press the ON key to jump to the list mode.

Type test page (triggered operation mode has started running at this time but is not loaded); Continuous operation mode is not in the test page.

Press the ON key again in the loaded state to start the loaded operation; The trigger operation mode needs to be switched on when the test page is not loaded.

When the pulse signal of the overloaded tail port is triggered (only RK8510 and the trigger input parameter is set to trigger and the trigger channel under the test page is set to [Ext]) or the key is triggered (the trigger channel under the test page is set to [Manu]), the on-load operation can be started; Press the ON key again in the running state to stop loading.

After the test is completed, the user can check the test results by pressing Shift+OK in the test page. If the test results are within the upper and lower limits set by the user, Pass will be displayed after the test is completed, and Fail will be displayed if the test fails to reach the set upper and lower limits. The user can check whether each item passes or not and save the test record through screen capture.

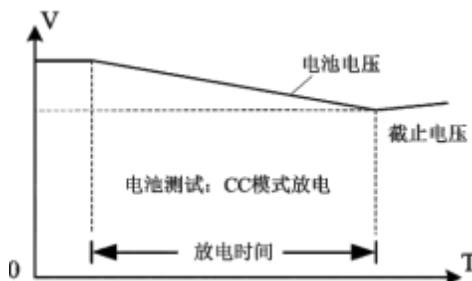
### 5.4.7 battery capacity mode

The battery capacity mode is used to detect the battery capacity; Battery capacity is an important indicator of the battery, which reflects the service life and reliability of the battery, so it is necessary to carry out such tests. When testing the capacity of the battery, the voltage will decrease with the increase of discharge time, so it is necessary to set the cut-off voltage. When the cut-off voltage is reached, the test is over.

Battery capacity mode parameters:

setup parameter	description of parameter
model	Set the discharge mode: CC/CR/CP.
Load size	Set load value
cutoff voltage	Set the lower limit voltage (cut-off voltage) for stopping discharge.

In the battery capacity mode, select any discharge mode as needed, and set the on-load parameters and cut-off voltage of this mode. When the battery is discharged to the cut-off voltage, the electronic load automatically stops loading.



## Figure 5-8 Battery Test Mode

### Description of battery capacity mode:

The user selects the battery capacity mode in the mode selection interface, and enters the setting interface of the battery capacity mode. After setting the relevant operation parameters in the setting interface, press the ON key to jump to the battery capacity mode test page, and press the ON key in the test page in the non-loaded state, and the electronic load starts to run with load; Press the ON key again to stop loading.

In the actual test process, parameters such as battery voltage, discharge current and discharged capacity can be checked at any time.



### 5.4.8 Battery Internal Resistance Test

It is mainly used to test the internal resistance of battery, and can also be used to test the internal resistance of power supply.

**The battery internal resistance is composed of chemical internal resistance and pole piece internal resistance added in series. The internal resistance of pole piece is fixed and accounts for a small proportion of the total internal resistance. The chemical internal resistance increases with the decrease of battery power. Because the resistance internal resistance is not a fixed value, the unified test standard for evaluating the battery internal resistance must be: the internal resistance measured by 4-wire measurement method when the battery is fully charged.**

Battery internal resistance testing methods are divided into DC discharge method and AC clamping method. This instrument is an electronic load whose basic function is to absorb (consume) current, so the measurement method used is DC discharge method. This method makes the battery in the actual discharge working state, and the chemicals inside the battery are in the normal chemical reaction state, so the measured internal resistance is more accurate and reliable.

Preparation steps before testing:

Step 1: Fully charge the battery and let it stand for another hour to standardize the test status. This step can be omitted, but the final test result will not be accurate. If it is to test the internal resistance of the power supply, power it on and adjust the current limit to the maximum.

Step 2: set the load voltage measurement to the far-end Vsense (on the measurement page, switch by pressing the key Shift+Local to switch the back screen.

Display [Vsense], and connect the load input pull line (plus or minus two thick lines from the red and black terminals on the front panel) and the Vsense line (plus or minus two thin lines from the BNC connector on the front panel) to the battery pole piece or the power output terminal;

Step 3, setting the battery capacity to be measured in the battery internal resistance setting measurement page; Usually, the current low point is fixed as 0.5C discharge, and the current high point is fixed as 1C discharge, where c is the battery capacity current value or the rated output current of the power supply (if the battery capacity is large, the maximum discharge current high point is the current limit value of the load, and the discharge current low point is half of the current limit value of the load); For example, for a battery with a capacity of 2000mAH, the low point of discharge current is 1A and the high point of current is 2A; After setting the parameters, press the key ON to start the test.

Test process after startup:

Firstly, the electronic load begins to discharge with a preset low point current, and after 2 seconds, the electronic load automatically records the voltage U1 and current I1 at this moment;

Secondly, the electronic load automatically switches to the high-point current for on-load discharge.

After 2 seconds, the electronic load automatically records the current voltage U2 and current I2, and then turns off the on-load.

Finally, the test is completed, and the calculation result is: internal resistance  $R=(U1 - U2)/(I2-I1)$ , and the test result is displayed in the middle window.

**Summary:** This two-stage measurement method has a total loading time of 4 seconds, and the loading current is  $1C$ , which is equivalent to testing the static internal resistance. For the power battery, more than different capacities can be set to change the discharge current, and more internal resistance values can be obtained after repeated tests. A certain number of internal resistance points are connected, and finally the dynamic internal resistance parameter curve is obtained (manual operation and editing are required). In order to evaluate the performance of the battery, its parameters can be quickly measured by testing the internal resistance of the battery. Relatively speaking, it is much slower to test the capacity of the battery, because the capacity value can only be accurately tested if the fully charged battery is fully discharged, and this discharge time often exceeds one hour.

Note 1: In order to unify the test standard, it is best to leave the battery for 1 hour after being fully charged before testing the internal resistance. For the internal resistance of power supply

Test, as long as it works in constant voltage output mode, it can be tested;

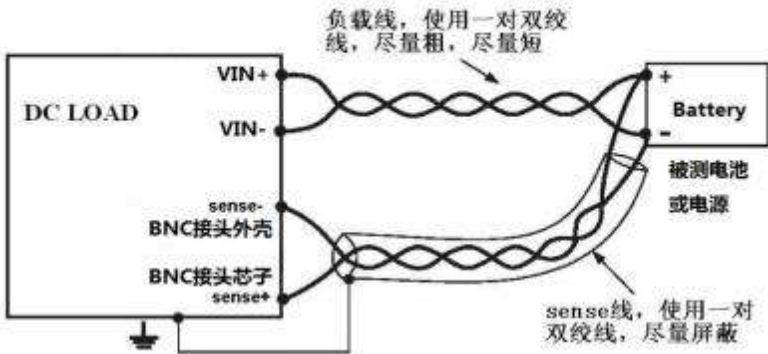
Note 2: the accuracy of voltage measurement directly affects the test results, so it is best to take the remote Vsense connection for voltage measurement.

Accurately collect the voltage on the battery pole piece (or output terminal) as a calculation parameter. Otherwise, the calculation results will not be accurate, because the test results include the contact resistance and the resistance of the load line;

Note 3: Some power supplies or battery packs with boost function, due to their own circuit reasons, the output voltage under load is actually higher than that under no load.

The output voltage of is higher, and the measured internal resistance result is invalid.

电子负载电压远端测量接线示意图



### 5.4.9 Automatic test

Automatic test mode can be used for rapid and simple testing of large quantities of products, and it can also be used for long-term aging monitoring test of a single product, which is of great value to the reliability test of the tested products.

#### **There are two options for starting:**

"Always on" means that the automatic test function has been running, and the upper and lower limits of voltage and current can be compared at any time, and the test results can be given immediately. This startup method is often used for long-term aging monitoring and testing of a single product. If it is a quick and simple test of mass products, it is best to choose "input voltage" as the starting mode. Operation steps: firstly, detect the voltage with input voltage exceeding "self-starting voltage" and wait for a period of time before starting the comparison test; then, delay the detection for a period of on-load time before judging whether the voltage and current are within the upper and lower limits; finally, output the PASS/FAIL result and output the signal.

#### **There are three options for the output signal:**

"One sound" is used for rapid and simple testing of mass products. When the test result of a product is PASS, the buzzer gives a short sound, and when the test result of a product is FAIL, the buzzer gives two short sounds, so that the test result can be known by sound.

"Always ringing" is more suitable for a long-term aging monitoring test of a single product, because the alarm sounds continuously as soon as there is an abnormality in the unattended process, and the user will not miss the abnormal condition of the product. If it's a mass product, it's fast

In the case of quick and simple test, when the test result of a product is PASS, the buzzer will give a short sound, and when the test result of a product is FAIL, the buzzer will give a long sound, and the test result can be known by sound.

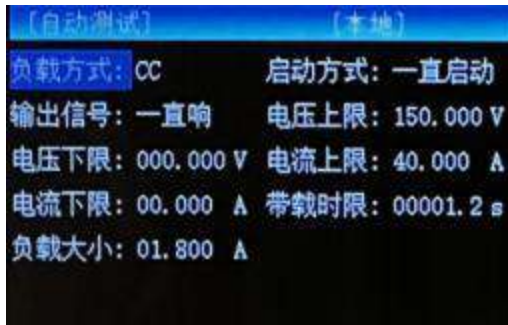
"Port output" is used in the use environment that needs to be muted, or other equipment needs to obtain instrument test results, then after the test is completed, the green plug-in terminal of the back panel of the electronic load will output a level signal of PASS or FAIL, which is provided in the form of triode open collector output, together with a +12V signal. These three ports are isolated from the input of the front panel of the electronic load, and can directly drive two large indicator lights, or drive two relays, or connect two optocouplers.



The user selects the automatic test mode in the mode selection interface to enter the setting interface of the automatic test mode, and in the setting interface,

After setting the relevant operation parameters, press the ON key to jump to the test page of automatic test mode (the input voltage startup mode has started running at this time but is not loaded), and press the ON key again in the non-loaded state of the test page for the continuous startup mode, and the electronic load starts to run with load; Input voltage startup mode In the non-loaded state in the test page, it is detected that the input voltage is higher than.

Start the on-load operation after the voltage rising edge of "self-starting voltage", and press the ON key again to stop the on-load operation.



#### 5.4.10 overcurrent test

This function is used to test the overcurrent protection characteristics of power supply or protection board, and the test result is overcurrent protection point and protection time. If this function is selected, the pulling mode is automatically selected as constant current mode.

The startup mode can be selected as "key startup", which means that the test is started by pressing the "ON" key or by the pulse trigger signal at the tail port of the load (only RK8510 and the trigger input parameter in the parameter setting is set to trigger and the trigger channel under the test page is set to [Ext]) or the trigger button (the trigger channel under the test page is set to [Manu]); Or select "input voltage", which means to start the test after detecting that the input terminal is connected with a rising edge of voltage exceeding "self-starting voltage".

The initial current is the on-load current in the first step after starting the test, and its setting value is smaller than the expected overcurrent protection point of the tested product. For example, if the overcurrent protection point is 10A, the initial current is set to 9A;

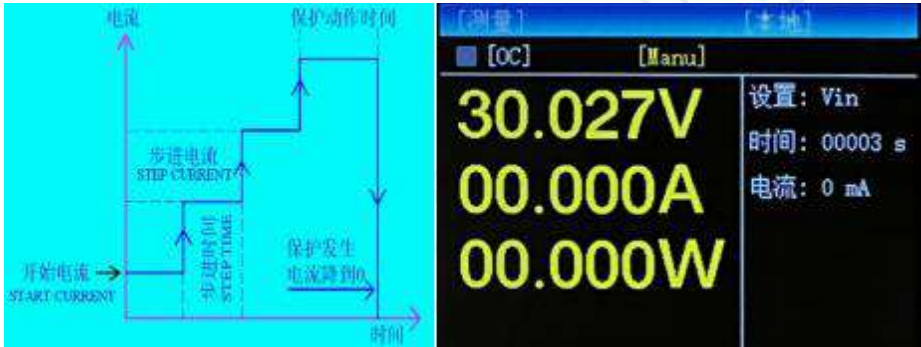
Step current is the current increase value of each step. The smaller the setting value, the more accurate the measurement result, but the test time will be longer, and the error of the "protection time" test value will also be larger. Under normal circumstances, it is 2%-5% of the test result of the over-current protection point of the tested product. For example, if the overcurrent protection point is 10A, the step current is set to 0.2A-0.5; ; In some high-precision over-current protection point test requirements, the stepping current can be set to 0.2%-0.5% of the over-current protection point test results.

**Step time is the time interval of each step, and the minimum value is 0.1 second. Unless it is used for special purposes, its setting value does not need to be greater than 1 second, because this will lead to the long test time.**

**Test flow: After setting the initial current value, stepping current value and stepping time, press the ON key to jump to the overcurrent test mode.**

ON the test page of (which has started running at this time but is not loaded), press the ON key again to trigger the loading, or enter

In voltage mode, the rising edge of input voltage is detected to trigger the start of loading, and the load will start to load from the initial current. Every other step time, the loading current will be increased by a step value until the current step exceeds the output upper limit of the tested power supply, and the power supply enters the short-circuit protection state, so the load will stop loading, and the time from the last step to the start of short-circuit protection of the tested power supply will be calculated, which is the short-circuit protection time of the tested power supply, and the test result of over-current protection point is before the last step. Press the ON key again in the loading state to stop the loading; In the running state, when pressing the key to start the mode, you need to press the Esc key to exit the mode, and when inputting the voltage mode, press the ON key to exit the mode.





## Chapter VI SCPI PC Communication

### 6.1, hardware connection

1. RK8510 series provides standard RS232/RS485 interface (only supported by RK8510). If you want to connect with a computer, you need to purchase the RS232/RS485 adapter provided by our company.

Insert the adapter into the RS232/RS485 interface on the back panel of this machine, and then connect it with the computer through the standard RS232/RS485 connecting cable.

2. Turn on the electronic load host, ensure that the communication protocol in the communication setting page is set to "Scpi", and set the corresponding baud rate.

(It is recommended to set the baud rate to 115200, and the default is 8 bits of data /1 stop bit/no check). No installation is required.

3. Open the PC software "RK8510.exe" provided by our company. This software is portable application and does not need to be installed; Select the serial port corresponding to the connecting cable of the converter, and open the serial port after the baud rate is consistent with the host of the load meter. After the connection is successful, the interface will display the model and current firmware information.

### 6.2, communication process

Open the upper computer software, and the software will send handshake signals to the lower computer regularly. After receiving valid data, the lower computer will return the local data to the upper computer twice, and the upper computer will update the working parameters and working status of the lower computer displayed on the computer according to the returned data.

### 6.3, communication protocol

#### 6.3.1 Overview of SCPI Protocol

All the downlink programming data and uplink return data of the protocol are ASCII characters, and the combination of <CR><LF> is used to inform the end of a frame of data, where <CR> is 0x0D and <LF> is 0x0A. Unit does not need to be added, and the default unit of data is:

Voltage v volts;

Current a amp;

Power w watt;

Resistance  $\omega$  ohm;

Current slope A/us ampere/microsecond;

Time s-seconds

Time ms-ms

#### 6.3.2 Detailed explanation of command

##### 6.3.2.1 Query instruction

1、\*IDN? Inquire about instrument information

Example: query syntax: \*IDN? <CR><LF>

Back to: rek, re8510, 0, 0.0.20008.000000000805

Note:

REK-manufacturer

RK8510-product model

0-Reserved

0.0.20230908-Software version number

2、FETCh:VOLTage? Query real-time voltage value

Example: query syntax: FETCh:VOLTage? <CR><LF>

Return: 30.022

Note: 30.022-Real-time voltage value, in V.

3、 FETCh:CURRent? Query real-time voltage value

Example: query syntax: FETCh:CURRent? <CR><LF>

Return: 2

Note: 2-Real-time current value, float, up to 3 decimal places, unit A.

4、 FETCh:POWer? Query real-time power value

Example: query syntax: FETCh:POWer? <CR><LF>

Return: 25.603

25.603-Real-time power value, float, with 3 decimal places at most, in W.

5、 FETCh:DYNAmic:RUNs? Query the real-time running times of dynamic mode

Example: query syntax: FETCh:DYNAmic:RUNs? <CR><LF>

Return: 6

Note: U32 data

6、 FETCh:LIST:STEPs? Real-time running step of query list test mode

Example: query syntax: FETCh:LIST:STEPs? <CR><LF>

Return: 2

Note: U32 data

7、 FETCh:LIST:RUNs? Real-time running times of query list test mode

Example: query syntax: FETCh:LIST:RUNs? <CR><LF>

Return: 6

Note: U32 data

8、 :LIST:RESult? Query list test mode real-time running results

Example: query syntax: :LIST:RESult? <CR><LF>

Return: 6

Note: U32 data is analyzed as follows:

Bit[1:0]: Operation result of step 1: 00b- unknown, 01b- successful, other-failed.

Bit[3:2]: Operation result of step 2: 00b- unknown, 01b- successful, other-failed.

Bit[5:4]: Operation result of step 3: 00b- unknown, 01b- successful, other-failed.

.....

Bit[31:30]: Operation result of step 31: 00b- unknown, 01b- successful, other-failed  
9. FETCh:BATtery:CAPacity? Inquire about the real-time discharge capacity of battery capacity test mode

Example: query syntax: FETCh:BATtery:CAPacity? <CR><LF>

Return: 122

Note: 122-real-time discharge capacity, U32, in mAh.

10、FETCh:BATtery:RESistance? Inquire about the battery internal resistance test mode result and the battery internal resistance value.

Example: query syntax: FETCh:BATtery:RESistance? <CR><LF>

Return: 58

Note: 58-Battery internal resistance value, U32, in m $\omega$  (ohm)

11、FETCh:AUTO:RUNs? Query the real-time running times of automatic test mode.

Example: query syntax: FETCh:AUTO:RUNs? <CR><LF>

Return: 6

Note: U32 data

12、FETCh:OCP:CURRent? Query the load current value of the overcurrent test mode result.

Example: query syntax: FETCh:OCP:CURRent? <CR><LF>

Return: 3.8

Note: 3.8-load current value, float, unit a.

13、FETCh:OCP:TIME? Query the load protection time of overcurrent test mode results.

Example: query syntax: FETCh:OCP:TIME? <CR><LF>

Return: 124

Note: 124-load protection time, U32 data, in ms.

14、FETCh:RESult? Query the running result of current mode

Example: query syntax: FETCh:RESult? <CR><LF>

Return: 0

Note: 0-unknown; 1-The test was successful; 2-Test failed; 3-End of test; 15、

FETCh:STAtE? Query the running result of current mode

Example: query syntax: FETCh:STAtE? <CR><LF>

Return: 0

Note: U32 data is analyzed as follows:

Bit[0]: Current running status: 0- not running, 1- running;

Bit[1]: Current load status: 0- unloaded, 1- loaded;

Bit[2]: Current overload status: 0- normal, 1- overload;

Bit[3]: Current overcurrent status: 0- normal, 1- overcurrent;

Bit[4]: Current overvoltage status: 0- normal, 1- overvoltage;

Bit[5]: Current undervoltage status: 0- normal, 1- undervoltage;

Bit[6]: Current overtemperature state: 0- normal, 1- overtemperature;

Bit[7]: Current reverse connection status: 0- normal, 1- reverse connection;

Bit[8]: The current parameter communication status is 1: 0-normal, 1- abnormal;

Bit[9]: The current parameter communication status is 2: 0-normal, 1- abnormal;

Bit[10]: The current parameter communication status is 3: 0-normal, 1- abnormal;

Others: reserved;

## 16、STATus:RUNning? Query the current running status

Example: query syntax: STATus:RUNning? <CR><LF>

Return:0

Note: 0-Not running; 1-Running in;

## 17、STATus:TRIGger? Query the current trigger status

Example: query syntax: STATus:TRIGger? <CR><LF>

Return:0

Note: 0-not triggered; 1-triggering;

## 18、FUNCtion:TRIG:LOCK? Query the current trigger lock status.

Example: query syntax: FUNCtion:TRIG:LOCK? <CR><LF>

Return:0

Note: 0-The trigger is not locked (it can be triggered again); 1-Trigger is locked (cannot trigger again);

### 6.3.2.2 Set query instruction 1

1. SYSTem:TLOADOFF This command is used to set and query the scheduled unloading time.

Example: set syntax: SYSTem:TLOADOFF 100<CR><LF>

Note: 100-set timing unloading time, U32, unit s (second), integer value, range 0-99999

Query syntax: SYSTem:TLOADOFF? <CR><LF>

Return: 100

2. SYSTem:TSHOrt This command is used to set and query the short-circuit time.

Example: set syntax: SYSTem:TSHOrt 3000.5 <CR><LF>

Note: 3000.5-set short-circuit time, float, in ms (millisecond), with one decimal place at most, ranging from 0 to 99999.9.

Query syntax: SYSTem:TSHOrt? <CR><LF>

Return: 3000.5

3. SYSTem:OVP This command is used to set and query the overvoltage protection voltage value.

Example: set syntax: SYSTem:OVP 152.000 <CR><LF>

Note: 152.000-set overvoltage protection voltage value, float, unit V, with 3 decimal places at most, ranging from 0.010 to 152.000.

Query syntax: SYSTem:OVP? <CR><LF>

Return: 152

4. SYSTem:OCP This command is used to set and query the current value of overcurrent protection.

Example: set syntax: SYSTem:OCP 42.000 <CR><LF>

Note: 42.000-set overcurrent protection current value, float, unit A, with 3 decimal places at most, ranging from 0.010 to 42.000.

Query syntax: SYSTem:OCP? <CR><LF>

Return: 42

5. **SYSTEM:OPP** This command is used to set and query the overload protection power value.

Example: set syntax: **SYSTEM:OPP 420.000 <CR><LF>**

Note: 420.000-set overload protection power value, float, unit w, with 3 decimal places at most, ranging from 0.010 to 420.000.

Query syntax: **SYSTEM:OPP? <CR><LF>**

Return: 420

6. **SYSTEM:TSDelay** This command is used to set and query the soft start time.

Example: set syntax: **SYSTEM:TSDelay 1000.6 <CR><LF>**

Note: 1000.6-set soft start time, float, in ms, with 1 decimal place at most, ranging from 0.1 to 99999.9.

Query syntax: **SYSTEM:TSDelay? <CR><LF>**

Return: 1000.6

7. **SYSTEM:UNLoadV** This command is used to set and query the unloading voltage value.

Example: set syntax: **SYSTEM:UNLoadV 2.500 <CR><LF>**

Note: 2.500-set unloading voltage value, float, unit V, with 3 decimal places at most, ranging from 0.000 to 152.000 Query syntax: **SYSTEM:UNLoadV? <CR><LF>**

Return: 2.5

8. **SYSTEM:STARtupV** This command is used to set and query the self-starting voltage value.

Example: setting syntax: **SYSTEM:STARtupV 2.500 <CR><LF>**

Note: 2.500-set self-starting voltage value, float, unit V, with 3 decimal places at most, ranging from 0.010 to 152.000.

Query syntax: **SYSTEM:STARtupV? <CR><LF>**

Return: 2.5

9. **SYSTEM:SHOrtVlm** This command is used to set and query the short-circuit voltage limiting function.

Example: set syntax: **SYSTEM:STARtupV 1 <CR><LF>**

Note: 0-Disabled; 1-enabled;

Query syntax: **SYSTEM:STARtupV? <CR><LF>**

Return: 1

10. **SYSTEM:TRIGin** This command is used to set and query the trigger input type.

Example: set syntax: **SYSTEM:TRIGin 1 <CR><LF>**

Note: 0-ON/OFF; ; 1-trigger;

Query syntax: **SYSTEM:TRIGin? <CR><LF>**

Return: 1

### 6.3.2.3 Set query instruction 2

1. **FUNCTION:LOAD:SENSe** this command is used to set and query voltage sampling channels (local and remote Vsense).

Example: set syntax: **FUNCTION:LOAD:SENSe 1 <CR><LF>**

Note: 0-local; 1-remote Vsense; ;

Query syntax: FUNCTION:LOAD:SENSe? <CR><LF>

Return: 1

2. FUNCTION:LOAD:REMOte This command is used to set and query the control type.

Example: set syntax: FUNCTION:LOAD:REMOte 1<CR><LF>

Note: 0-local (key control); 1-Remote (upper computer control);

Query syntax: FUNCTION:LOAD:REMOte? <CR><LF>

Return: 1

3. FUNCTION:LOAD:LOCAlLOCK This command is used to set and query the measurement page lock.

Example: set syntax: function: load: locallock0 < Cr > < lf >

Note: 0-Unlock; 1-lock;

Query syntax: FUNCTION:LOAD:LOCAlLOCK? <CR><LF>

Return: 0

4. FUNCTION:TRIG:SOURce This command is used to set and query the trigger type.

Example: set syntax: FUNCTION:TRIG:SOURce 1<CR><LF>

Note: 0-key is triggered locally; 1-External trigger of tail port;

Query syntax: FUNCTION:TRIG:SOURce? <CR><LF>

Return: 1

5. FUNCTION:MODE This command is used to set and query the running mode.

Example: set syntax: FUNCTION:MODE 1<CR><LF>

Note: 1-CC constant current mode; 2-CV constant pressure; 3-CR constant resistance mode; 4-CP constant power mode; 5-DY dynamic mode; 6-TAB list mode; 7-BAT battery capacity mode; 8-BIR battery internal resistance mode; 9-AUT automatic test mode; 10-OC overcurrent test mode;

Query syntax: FUNCTION:MODE? <CR><LF>

Return: 1

### 6.3.2.4 Set query instruction 3

1.: CC: CC:CURRent This command is used to set and query the constant current value of CC mode operation.

Example: set syntax:: CC:CURRent 1.000 <CR><LF>

Note: 1.000-set current value, float, unit A, with 3 decimal places at most, ranging from 0.010 to 42.000 Query syntax:: CC:CURRent? <CR><LF>

Return: 1

2.: CV:VOLTage This command is used to set and query the constant voltage value of CV mode operation.

Example: set syntax:: CV:VOLTage 12.600 <CR><LF>

Note: 12.600-set voltage value, float, unit V, maximum 3 decimal places, range 0.010-152.000 Query syntax:: CV:VOLTage? <CR><LF>

Return: 12.6

3.: CR:RES This command is used to set and query the constant voltage value of CV mode operation.



Example: setting syntax:: CR:RES 12.600 <CR><LF>

Note: 12.600-set voltage value, float, unit  $\omega$ , with 3 decimal places at most, ranging from 0.050 to 7500.000.

Query syntax:: CR:RES? <CR><LF>

Return: 12.6

4.: CP:POWer This command is used to set and query the constant voltage value of CV mode operation.

Example: setting syntax:: CP:POWer 12.600 <CR><LF>

Note: 12.600-set voltage value, float, unit w, maximum 3 decimal places, range 0.010-420.000

Query syntax:: CP:POWer? <CR><LF>

Return: 12.6

5.: DYNAMic:MODE This command is used to set and query the operation mode of dynamic mode.

Example: set syntax:: DYNAMic:MODE 0<CR><LF>

Note: 0-continuous; 1-pulse; 2-flip;

Query syntax:: DYNAMic:MODE? <CR><LF>

Return: 0

6.: DYNAMic:LEVElA This command is used to set and query the low current value and low running time in dynamic mode. Example: Setting syntax:: dynamic: levela 1.000,3000.5 < Cr > < LF >

Note: 1.000-set low-level current value, float, unit A, with 3 decimal places at most, range 0.010-42.000 3000.5-set low-level running time, float, unit ms, with 1 decimal place at most, range 0.1-99999.9 Query syntax:: DYNAMic:LEVElA? <CR><LF>

Return: 1

7.: DYNAMic:LEVElB This command is used to set and query the high current value and high running time in dynamic mode. Example: Setting syntax:: dynamic: levelb 2.500,3000.5 < Cr > < LF >

Note: 2.500-set high current value, float, unit A, with 3 decimal places at most, range 0.010-42.000 3000.5-set high running time, float, unit ms, with 1 decimal place at most, range 0.1-99999.9 Query syntax:: DYNAMic:LEVElB? <CR><LF>

Return: 1

8.: DYNAMic:RISE This command is used to set and query the rising slope of dynamic mode operation.

Example: set syntax:: DYNAMic:RISE 0.500 <CR><LF>

Note: 0.500-Set the rising slope, float, unit A, with 3 decimal places at most, ranging from 0.001 to 3.000 Query syntax:: DYNAMic:RISE? <CR><LF>

Return: 0.5

9.: DYNAMic:FALL This command is used to set and query the rising slope of dynamic mode operation.

Example: set syntax:: DYNAMic:FALL 0.500 <CR><LF>



Note: 0.500-Set the rising slope, float, unit A, with 3 decimal places at most, ranging from 0.001 to 3.000 Query syntax:: DYNAmic:FALL? <CR><LF>

Return:0.5



10.: DYNAMIC:REPeat This command is used to set and query the running times of dynamic mode.

Example: set syntax:: DYNAMIC:REPeat 6<CR><LF>

Note: 6-Set operation times, U32, range 1-99999.

Query syntax:: DYNAMIC:REPeat? <CR><LF>

Return:6

11.: LIST:GROUPNum This command is used to set and query the group number of list mode.

Example: set syntax:: LIST:GROUPNum 6<CR><LF>

Note: 6-Set the running times, U8, and the range is 1-60.

Query syntax:: LIST:GROUPNum? <CR><LF>

Return:6

12.: LIST:REPeat This command is used to set and query the running times of list mode.

Example: set syntax:: LIST:REPeat 6<CR><LF>

Note: 6-Set operation times, U32, range 1-99999.

Query syntax:: LIST:REPeat? <CR><LF>

Return:6

13.: LIST:MODE This command is used to set and query the operation mode of list mode.

Example: set syntax:: LIST:MODE 0<CR><LF>

Note: 0-continuous; 1-trigger; 2-continuous er; 3-trigger er;

Query syntax:: LIST:MODE? <CR><LF>

Return:0

14.: LIST:STEPNum This command is used to set and query the running steps of list mode.

Example: set syntax:: LIST:STEPNum 6<CR><LF>

Note: 6-Set the number of running steps, U8, ranging from 1 to 16.

Query syntax:: LIST:STEPNum? <CR><LF>

Return:6

15.: LIST:STEP# This command is used to set and query the running parameters of each step of the list mode.

Example: set syntax:: list: step 10, 1.000, 1000, 1,42.000, 0.010 <Cr> <lf>.

Note: 1-Set the range of Step 1, U8, # 1-16

0-Set the operation mode of step 1, 0-CC; 1-CV; 2-CR; 3-CP; 4-OPEN; 5-SHORT ;

1.000-Set the value run in step 1, float, with 3 decimal places at most, and the range is the same as the corresponding setting value in each independent mode; Setting value is invalid in OPEN and SHORT modes;

1000-Set the running time of Step 1, U32, ranging from 300 to 99999;

1-Set the inspection type in step 1, 0- Off; 1- current; 2- voltage; 3- power;

42.000-Set the upper limit value of step 1 inspection, float, check the upper limit range of current 0.01-40.00A, check the upper limit range of voltage 0.01-150.00V, check the upper limit range of power 0.01-400.00W, and the upper limit value is invalid when the inspection is turned off;

0.010-set the lower limit value of the first step inspection, float, and the lower limit range of the inspection current is 0-39.99a; Check the lower voltage range of 0-149.99V; Check the lower power limit of 0-399.99 W. If the lower power limit is turned off, it is invalid.

Query syntax:: LIST:STEP1? <CR><LF>

Returns: 0,1.000,1000,1,42.000,0.010

16.: BATTery:MODE This command is used to set and query the operation mode of battery capacity mode.

Example: set syntax:: BATTery:MODE 0<CR><LF>

Note: 0-CC; ;2 - CR; 3 - CP;

Query syntax:: BATTery:MODE? <CR><LF>

Return:0

17.: BATTery:PARAVALue This command is used to set and query the running value of battery capacity mode.

Example: set syntax:: BATTery:PARAVALue 1.800<CR><LF>

Note: 1.800-value set in combination with operation mode, float, with 3 decimal places at most.

For example, in CC mode, query syntax for current value:: BATTery:PARAVALue?  
<CR><LF>

Return: 1.8

18.: BATTery:VEND This command is used to set and query the cutoff voltage value of battery capacity mode. Example: Setting syntax:: BATTery:VEND 6.800<CR><LF>

Note: 6.800-set cutoff voltage value, float, with 3 decimal places at most, in V.

Query syntax:: BATTery:VEND? <CR><LF>

Return: 6.8

19.: BATTCELLRES:CAP This command is used to set and query the battery capacity value to be tested in battery internal resistance mode. Example: Setting syntax::  
battecellres: CAP4.600 < Cr > < LF >

Note: 4.600-set battery capacity value, float, unit Ah, maximum 3 decimal places, range of 0.100-200.000 Query syntax:: BATTCELLRES:CAP? <CR><LF>

Return: 4.6

20.: AUTO:MODE This command is used to set and query the running mode of automatic test mode.

Example: setting syntax:: AUTO:MODE 0<CR><LF>

Note: 0-CC; ;1 - CV; 2 - CR; 3 - CP;

Query syntax:: AUTO:MODE? <CR><LF>

Return:0

21.: AUTO:STArtMode This command is used to set and query the startup mode of automatic test mode.

Example: set syntax:: AUTO:STArtMode 0<CR><LF>

Note: 0-always started; 1-voltage input start;

Query syntax:: AUTO:STArtMode? <CR><LF>

Return:0

22.: auto: outsignal This command is used to set and query the output signal mode of automatic test mode. Example: Setting syntax:: AUTO:OUTSiGnal < Cr > < lf > .

Note: 0-1 sound; 1-Always ringing; 2-port output;

Query syntax:: AUTO:OUTSiGnal? <CR><LF>

**Return:**0

23.: auto: voluplm14.600 <Cr> <Lf> This command is used to set and query the upper voltage limit for automatic test mode.

Note: 14.600-set voltage upper limit value, float, unit V, with 3 decimal places at most, ranging from 0.010 to 150.000.

Query syntax:: AUTO:VOLTUPLM? <CR><LF>

**Return:** 14.6

24.: AUTO:VOLTDNLM This command is used to set and query the lower voltage limit value of automatic test mode. Example: Setting syntax:: auto: voldnlm10.600 <Cr> <Lf>

Note: 10.600-set voltage lower limit value, float, unit V, maximum 3 decimal places, range 0.000-149.990 Query syntax:: AUTO:VOLTDNLM? <CR><LF>

**Return:** 10.6

25.: AUTO:CURRUPLM This command is used to set and query the current upper limit value of automatic test mode. Example: Setting syntax:: AUTO:CURRUPLM 4.600 <CR><LF>

Note: 4.600-set current upper limit value, float, unit V, maximum 3 decimal places, range 0.010-40.000 Query syntax:: AUTO:CURRUPLM? <CR><LF>

**Return:** 4.6

26.: AUTO:CURRDNLM This command is used to set and query the current lower limit value of automatic test mode. Example: Setting syntax:: AUTO:CURRDNLM 2.600 <CR><LF>

Note: 2.600-set current lower limit value, float, unit V, maximum 3 decimal places, range 0.000-39.990 Query syntax:: AUTO:CURRDNLM? <CR><LF>

**Return:** 2.6

27.: AUTO:TLIMit This command is used to set and query the loading time limit for automatic test mode operation.

Example: setting syntax:: AUTO:TLIMit 3.0<CR><LF>

Note: 3.0-set loading time limit, float, unit s, maximum 1 decimal place, range 0.3-99999.9

Query syntax:: AUTO:TLIMit? <CR><LF>

**Return:** 3

28.: AUTO:LOADVAL This command is used to set and query the running value of automatic test mode.

Example: setting syntax:: AUTO:LOADVAL 2.000<CR><LF>

Note: 2.000-the set operation value, associated with the operation mode, float, with at most 3 decimal places, such as current value in CC mode.

Query syntax:: AUTO:LOADVAL? <CR><LF>

**Return:** 2

29.: OCP:StArTMODe This command is used to set and query the startup mode of overcurrent test mode.

Example: set syntax:: OCP:StartMODE 0<CR><LF>

Note: 0-Press key to start; 1-voltage input start;

Query syntax:: OCP:StartMODE? <CR><LF>

**Return:**0

30.: OCP:ISTart This command is used to set and query the initial current of overcurrent test mode.

Example: setting syntax:: OCP:ISTart 2.000 <CR><LF>

Note: 2.000-set initial current value, float, unit A, with 3 decimal places at most, ranging from 0.010 to 39.990.

Query syntax:: OCP:ISTart? <CR><LF>

**Return:**2

31.: OCP:ISTEP This command is used to set and query the step current of overcurrent test mode.

Example: setting syntax:: OCP:ISTEP 0.200 <CR><LF>

Note: 0.200-set stepping current value, float, unit A, with 3 decimal places at most, ranging from 0.010 to 39.990 Query syntax:: OCP:ISTEP? <CR><LF>

**Return:** 0.2

32.: OCP:TSTEP This command is used to set and query the step time of overcurrent test mode.

Example: setting syntax:: OCP:TSTEP 0.3 <CR><LF>

Note: 0.3-set stepping time, float, unit s, with 1 decimal place at most, ranging from 0.0 to 99999.9 Query syntax:: OCP:TSTEP? <CR><LF>

**Return:** 0.3

33.: OCP:VDLIM This command is used to set and query the cut-off voltage of overcurrent test mode.

Example: set syntax:: OCP:VDLIM 2.500 <CR><LF>

Note: 2.500-set cut-off voltage, float, unit V, maximum 3 decimal places, range 0.010-149.990

Query syntax:: OCP:VDLIM? <CR><LF>

**Return:** 2.500

## Chapter 7 Modbus communication protocol

### 7.1 Introduction of Modbus Protocol Communication

The Modbus-RTU protocol is supported, with baud rates of 9600, 19200, 38400 and 115200 optional (it can be changed in the communication setting page, and 115200 is recommended), no check, 8 data bits and 1 stop bit.

Send format:

address code	function code	Address high position	Low address	High data length	Low data length	CRC low	CRC high
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Return format:

address code	function code	Data length (Byte)	data field	CRC low	CRC high
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Note:

Address code: In a network, please ensure the uniqueness of the address code, the range is 0-255, and address 0 is used as the broadcast code. Function code: This product only uses 03H and 16H function codes to read and set register data respectively.

Data area: the low bit of data comes first in communication.





serial number	address	Register name	data type	Ion g	explain	scope of data	read and write
1	0x1000	Model	string	six	product model		R
2	0x1006	Version	string	six	Software version number		R
3	0x100C	Real_Volt	float	2	Real-time voltage value (v)		R
4	0x100E	Real_Curr	float	2	Real-time current value (a)		R
5	0x1010	Real_Power	float	2	Real-time power value (w)		R
6	0x1012	Run_Time	float	2	Real-time running time (ms)		R
7	0x1014	DyResRuns	U32	2	Dynamic mode operation times		R
8	0x1016	ListResStep	U32	2	List mode running step		R
9	0x1018	ListResRuns	U32	2	List mode running times		R
10	0x101A	ListResRes	U32	2	List mode running result	Bit[1:0]: result of step 1, 00b- unknown, 01b- success, 10b/11b-failure Bit[3:2]: result of step 2, 00b- unknown, 01b- success, 10b/11b-failure .....	R
11	0x101C	BcResCap	U32	2	Battery capacity mode result capacity (mAh)		R
12	0x101E	BrResResist	U32	2	Battery internal resistance mode result internal resistance (mΩ)		R
13	0x1020	AutoResRuns	U32	2	Automatic test mode operation times		R
14	0x1022	OcResCurr	U32	2	Over-current test mode result load current (A)		R
15	0x1024	OcResTime	U32	2	Response time of overcurrent test mode results (ms)		R
16	0x1026	RealState	U32	2	real-time status	Bit[0]: Current running status: 0- not running, 1- running; Bit[1]: Current load status: 0- unloaded, 1- loaded; Bit[2]: Current overload status: 0- normal, 1- overload; Bit[3]: Current overcurrent status: 0- normal, 1- overcurrent; Bit[4]: Current overvoltage status: 0- normal, 1-00000 overvoltage; Bit[5]: Current undervoltage status: 0- normal, 1- undervoltage; Bit[6]: Current overtemperature state: 0- normal, 1- overtemperature; Bit[7]: Current reverse connection status: 0- normal, 1- reverse connection; Bit[8]: The current parameter communication status is 1: 0-normal, 1- abnormal;	R
17	0x1028	RealResult	U16	one	Running result of current mode	0: unknown 1: Success 2: Failure 3 end	R
18	0x1029	RunningState	U16	one	running state	0: Not Running	R
19	0x102A	TriggingState	U16	one	Trigger state	0: Not triggered 1: Triggering	R
20	0x102C	SetRunTime	U32	2	System Scheduled Unloading Time (s)	0-99999s	RW
21	0x102E	SetShortTime	float	2	System short circuit time (ms)	0-99999.9ms	RW
22	0x1030	SetOVP	float	2	System overvoltage protection voltage value (V)	0-0.010 152.000V	RW
23	0x1032	SetOCP	float	2	Current value of system overcurrent protection (A)	0.010-42.000A	RW
24	0x1034	SetOPP	float	2	Power value of system overload protection (w)	0.010-420.000W	RW
25	0x1036	SetSoftStaT	float	2	System soft start time (ms)	0-99999.9ms	RW
26	0x1038	SetVoff	float	2	System unloading voltage value (V)	0-150.000V	RW
27	0x103A	SetVauto	float	2	System self-starting voltage value (V)	0.010-150.000V	RW
28	0x103C	SetShortVLmt	U16	one	System short circuit voltage limiting	0: Disabled 1: enabled	RW
29	0x103D	SetTrigIn	U16	one	System trigger input	0: On/Off 1: Trigger	RW
30	0x103E	OnOff	U16	one	Load working switch	0: Turn off the load 1: Open the load	W
31	0x103F	Stop	U16	one	Load emergency stop	1. Load emergency stop	W
32	0x1040	CtlVsense	U16	one	Vsense channel switching control	0: Default channel 1: v sense channel	RW
33	0x1041	CtlRemote	U16	one	Remote control switching	0: Local control 1. Remote control	RW

34	0x1042	CtlPageLock	U16	on e	Page locking control	0: page unlocked 1: Page Locking	RW
35	0x1043	TrigShort	U16	on e	Short circuit trigger	1: Trigger short circuit	W
36	0x1044	Trig	U16	on e	touch off	1: Trigger	W
37	0x1045	CtlTrig	U16	on e	Trigger control	0: Manual trigger 1: Tail port trigger	RW
38	0x1046	TrigLockState	U16	on e	Trigger lock state	0: Not locked 1: Lock	R

39	0x1047	RunMode	U16	on e	operational mode	1: Constant current mode 2: Constant pressure mode 3: Constant resistance mode 4: Constant power mode 5: Dynamic mode 6: List mode 7: Battery Capacity Mode 8: Battery internal resistance mode 9: Automatic Test Mode 10: Over-current test mode	RW
40	0x1048	CcCurr	float	2	Constant current mode constant current value (a)	0.010-42.000A	RW
41	0x104A	CvVolt	float	2	Constant voltage mode constant voltage value (v)	0.010-150.000V	RW
42	0x104C	CrRes	float	2	Constant resistance mode constant resistance (Ω)	0.050-7500.000Ω	RW
43	0x104E	CpPower	float	2	Constant power mode constant power value (w)	0.010-400.000W	RW
44r	0x1050	DyRunMethod	U16	on e	Dynamic mode operation mode	0: continuous 1: Pulse 2: Flip	RW
45	0x1052	DyLowCurr	float	2	Dynamic mode low current value (a)	0.010-40.000A	RW
46	0x1054	DyLowTime	float	2	Dynamic mode low timing (ms)	0.1-99999.9ms	RW
47	0x1056	DyHighCurr	float	2	Dynamic mode high current value (a)	0.010-40.000A	RW
48	0x1058	DyHighTime	float	2	Dynamic mode high bit timing (ms)	0.1-99999.9ms	RW
49	0x105A	DyUpRate	float	2	Dynamic mode rising slope (A/us)	0.001-3.000A/us	RW
50	0x105C	DyDownRate	float	2	Dynamic mode descent slope (A/us)	0.001-3.000A/us	RW
51	0x105E	DyRuns	U32	2	Dynamic mode operation times	1-99999	RW
52	0x1060	ListGroupNum	U16	on e	List mode group number	0-60	RW
53	0x1062	ListRuns	U32	2	Running times of tear surge mode	1-99999	RW
54	0x1064	ListRunMethod	U16	on e	List mode operation mode	0: continuous 1: Trigger 2: continuous Er 3: triggEr er	RW
55	0x1065	ListStepNum	U16	on e	Number of running steps in list mode	January 16(th)	RW
56	0x1066	ListStep1 (_run_mode) (_set_value) (_timeout) (_check) (_up_limit) (_up_limit)	U16 Float U32 U16 Float float	10	operational mode set value timing check Upper limit value lower limit value	Operation mode: 0-cc/1-cv/2-Cr/3-CP/4-open/5-short; Set value: the range is the same as the set value in each independent mode, and the set value is invalid in OPEN and SHORT modes; Timing: 300-99999ms Check: 0- Off /1- Current /2- Voltage /3- Upper limit value of power: Check the upper limit range of current 0.01-40.00A, check the upper voltage range of 0.01-150.00V, and check the work. The upper limit range of the rate is 0.01-400.00W, and the upper limit value is invalid when the inspection is closed; Lower limit value: check the current lower limit range of 0-39.99A; Check the lower voltage range of 0-149.99a; Check the lower power limit range of 0-399.99W, and turn off the inspection. The lower limit value is invalid;	RW
57	0x1070	ListStep2 (_run_mode) (_set_value) (_timeout) (_check) (_up_limit) (_up_limit)	U16 Float U32 U16 Float float	10	be the same as the above	be the same as the above	RW
58	0x107A	ListStep3 (_run_mode) (_set_value) (_timeout) (_check) (_up_limit) (_up_limit)	U16 Float U32 U16 Float float	10	be the same as the above	be the same as the above	RW

59	0x1084	ListStep4	-	10	be the same as the above	be the same as the above	RW
60	0x108E	ListStep5 (_run_mode) (_set_value) (_timeout) (_check) (_up_limit) (_up_limit)	U16 Float U32 U16 Float float	10	be the same as the above	be the same as the above	RW



61	0x1098	ListStep6 (_run_mode) (_set_value) (_timeout) (_check) (_up_limit) (_up_limit)	U16 Float U32 U16 Float float	10	be the same as the above	be the same as the above	RW
62	0x10A2	ListStep7 (_run_mode) (_set_value) (_timeout) (_check) (_up_limit) (_up_limit)	U16 Float U32 U16 Float float	10	be the same as the above	be the same as the above	RW
63	0x10AC	ListStep8 (_run_mode) (_set_value) (_timeout) (_check) (_up_limit) (_up_limit)	U16 Float U32 U16 Float float	10	be the same as the above	be the same as the above	RW
64	0x10B6	ListStep9 (_run_mode) (_set_value) (_timeout)	U16 Float U32	10	be the same as the above	be the same as the above	RW
65	0x10C0	ListStep10 (_run_mode) (_set_value) (_timeout) (_check) (_up_limit) (_up_limit)	U16 Float U32 U16 Float float	10	be the same as the above	be the same as the above	RW
66	0x10CA	ListStep11 (_run_mode) (_set_value) (_timeout) (_check) (_up_limit) (_up_limit)	U16 Float U32 U16 Float float	10	be the same as the above	be the same as the above	RW
67	0x10D4	ListStep12 (_run_mode) (_set_value) (_timeout) (_check) (_up_limit) (_up_limit)	U16 Float U32 U16 Float float	10	be the same as the above	be the same as the above	RW
68	0x10DE	ListStep13 (_run_mode) (_set_value) (_timeout) (_check) (_up_limit) (_up_limit)	U16 Float U32 U16 Float float	10	be the same as the above	be the same as the above	RW
69	0x10E8	ListStep14 (_run_mode) (_set_value) (_timeout) (_check) (_up_limit) (_up_limit)	U16 Float U32 U16 Float float	10	be the same as the above	be the same as the above	RW
70	0x10F2	ListStep15 (_run_mode) (_set_value) (_timeout) (_check) (_up_limit) (_up_limit)	U16 Float U32 U16 Float float	10	be the same as the above	be the same as the above	RW
71	0x10FC	ListStep16 (_run_mode) (_set_value) (_timeout) (_check) (_up_limit) (_up_limit)	U16 Float U32 U16 Float float	10	be the same as the above	be the same as the above	RW

72	0x1106	BcRunMode	U16		Battery capacity mode load mode	0: Constant current mode 2: Constant resistance mode 3: Constant power mode	RW
73	0x1108	BcLoadValue	float		Battery capacity mode load size	With the setting range of each independent mode.	RW
74	0x110A	BcVoff	float		Battery Capacity Mode Cut-off Voltage (V)	0.010-149.990V	RW
75	0x110C	BrCap	float		Battery internal resistance mode battery capacity (Ah)	0.1-200.000Ah	RW
76	0x110E	AutoRunMode	U16		Automatic test mode load mode	0: Constant current 1: Constant pressure 2: Constant resistance 3: Constant power	RW
77	0x110F	AutoStartMethod	U16		Automatic test mode startup mode	0: Always on 1: Input voltage	RW
78t	0x1110	AutoOutSignal	U16		Automatic test mode output signal	0: 1 sound 1: It keeps ringing 2: Port output	RW
79	0x1112	AutoVupLimit	float		Automatic test mode voltage upper limit (V)	0.010-150.000V	RW
80	0x1114	AutoVdownLimit	float		Automatic test mode voltage lower limit (V)	0-149.990V	RW
81	0x1116	AutoCupLimit	float		Automatic test mode current upper limit (a)	0.010-40.000A	RW
82	0x1118	AutoCdownLimit	float		Automatic test mode current lower limit (a)	0-39.990A	RW
83	0x111A	AutoLoadTime	float		Automatic test mode loading time limit (s)	0.3-99999.9s	RW
84	0x111C	AutoLoadValue	float		Automatic test mode load size	Same as the setting range of each independent mode.	RW
85e	0x111E	OcStartMethod	U16		Starting mode of overcurrent test mode	0: Press key to start 1: Input voltage	RW
86	0x1120	OcStartCurr	float		Automatic test mode initial current (a)	0.010-39.990A	RW
87	0x1122	OcStepCurr	float		Automatic test mode step current (a)	0.010-39.990A	RW
88	0x1124	OcStepTime	float		Automatic test mode stepping time (s)	0.1-99999.9s	RW
89	0x1126	OcVoff	float		Automatic test mode cut-off voltage (V)	0.010-149.990V	RW

## Chapter VIII Accessories and Warranties

### Attachment:

Power cord	1 root
RS232 communication cable (RK8510 optional only)	1 root
operation instruction	1 copy
work certificate	1 copy

After receiving the instrument, the user should check the above contents out of the box. If there is a shortage, please contact our company or dealer unit immediately.

