Programmable DC Electronic Load
SME1700+ Series

User Manual

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Technical Specifications

Technical Specifications		SME1701+		SME1701A+		SME1703+		SME1703A+		SME1703B+	
Input	Voltage	150V		500V		150V		500V		150V	
	Current	30A		15A		30A		30A		60A	
	Power	175W		175W		350W		350W		350W	
	Min. Operating Volt.	1.5V@30A		1.8V@15A		1.2V@30A		3V@30A		1.5V@60A	
	Min. Rising Time	20µS									
Operating Mode		Constant Current (CC) Mode, Constant Resistance (CR), Mode, Constant Voltage (CV) Mode and Constant Power (CP) Mode									
Voltage	Range	0-15V	0-150V	0-50V	0-500V	0-15V	0-150V	0-50V	0-500V	0-15V	0-150V
	Setting Resolution	0.2 mV	2 mV	0.2 mV	2 mV	0.2 mV	2 mV	0.2 mV	2 mV	0.2 mV	2 mV
	Setting Accuracy	0.05% + 0.05% FS									
	Measurement Resolution	1 mV	10 mV	1 mV	10 mV	1 mV	10 mV	1 mV	10 mV	1 mV	10 mV
	Measurement Accuracy	0.08% + 0.05% FS									
Current	Range	0-3 A	0-30 A	0-1.5A	0 – 15A	0-3A	0-30A	0-3A	0 – 30 A	0 – 6A	0 – 60A
	Setting Resolution	0.05 mA	0.5 mA	0.05 mA	0.5 mA	0.05 mA	0.5 mA	0.05 mA	0.5 mA	0.1 mA	1 mA
	Setting Accuracy	0.05% + 0.05% FS									
	Measurement Resolution	0.1 mA	1 mA	0.1 mA	1 mA	0.1 mA	1 mA	0.1 mA	1 mA	0.1 mA	1 mA
	Measurement Accuracy	0.08% + 0.05% FS									
Resistance	Range	0.05Ω - 30kΩ		0.12Ω - 30kΩ		0.04Ω-30kΩ		0.1Ω - 30kΩ		0.03Ω - 20kΩ	
	Resolution	0.1Ω									
	Accuracy	1%									
Power	Range	0 - 175W		0 - 175W		0 - 350W		0 - 350W		0 - 350W	
	Resolution	10 mW									
	Accuracy	0.5% + 0.1% FS									
Dynamic Mode											
Dynamic Mode	Range	20 µS to 60 S									
	Resolution	2 µS									
	Accuracy	1 µS + 100 pp									
	Rising Slope	0.6 A/ms – 1.5 A/µs		0.3 A/ms - 0.75 A/µs		0.6 A/ms - 1.5 A/µs		0.6 A/ms – 1.5 A/µs		1.2 A/ms – 3 A/µs	

Measurement											
Ripple	Range	0 - 15V	0 - 150V	0 - 50V	0 - 500V	0 - 15V	0 - 150V	0 - 15V	0 - 150V	0 - 15V	0 - 150V
	Band Width	250 kHz									
	Accuracy	0.1%									
Protection Function		Over Voltage Protection (OVP) Over Current Protection (OCP), Over Power Protection (OPP)									
Storage		Internal 20 groups									
General Specifications											
Interface		RS232C, Handler									
Power Source		Voltage : 220 V ± 10%, Frequency 50 Hz/60Hz ± 5%									
Power Consumption		< 50 VA									
Temperature		0˚C - 40˚C									
Humidity		< 90%									
Dimensions		W : 350 x H : 122 x D : 425 mm									
Weight		3 kg				4.8 kg					
Standard Accessories		Mains Cord, CD									

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Chapter 1 Overview

1.1 Introduction

SME1700+ series is a DC electronic load with high precision, high intelligence and easy operation. This series of instruments integrates a variety of test functions, has excellent performance, and adopts TFT LCD display, which is clear and easy to operate. It can meet the needs of rapid operation on the production site and the needs of high accuracy and stability in the laboratory.

The special functions and advantages of the instrument are as follows:

- 500kHz synchronous sampling, 0.1mA, 1mV resolution
- Voltage/current ripple, peak, peak and valley measurement
- A dozen measurement functions
- Support remote compensation function
- Support file storage function
- 480X272 pixels, 24-bit color, 4.3-inch color TFT LCD screen, used to set test conditions and display of measurement results, etc.
- Number keyboard and knob operation
- High accuracy and high resolution
- Low ripple and low noise
- Intelligent fan control, save energy and reduce noise
- Software control and detection can be done by computer
- Dual-range programmable voltage and current load

1.2 Condition of Use

1.2.1 Power

Power supply voltage: 220V (1±10%)

Power frequency: 50Hz/60Hz (1±5%)

Power consumption: <50VA

1.2.2 Ambient temperature and humidity

Normal working temperature: 0℃～40℃, humidity: <90%RH

Reference working temperature: 20℃±8℃, humidity: <80%RH

Transportation environment temperature: 0℃～55℃, humidity: 93%RH

1.2.3 Warm-up Time:

Warm-up time after starting: ≥ 20 minutes

1.2.4 Points to Note

(1) Please do not use it in bad environments such as dust, vibration, direct sunlight, corrosive gas, etc.

(2) The instrument is not used for a long time, please store it in it's original packaging box or similar box in a ventilated room with a temperature of 5℃～40℃ and a relative humidity not more than 85%RH. The air should not contain a corrosion measuring instrument Harmful impurities and direct sunlight should be avoided.

(3) This instrument has been carefully designed to reduce the noise interference caused by the AC power input, but it should still be used in a low noise environment as much as possible. If it cannot be avoided, please install a power filter.

(4) There is a cooling fan at the rear of the instrument, and there are cooling vents on the left and right to avoid the internal temperature rise affecting the accuracy. Please ensure that the instrument is in a well-ventilated state.

(5) Do not switch the instrument frequently to avoid the loss of stored data.

1.3 Weight and Dimension

Dimension (W*H*D): 350mm*122mm*425mm

Weight: SME1701+, SME1701A+ : 3kg approx..

SME1703+, SME1703A+, SME1703B+ : 4.8kg approx..

1.4 Safety Requirement

This instrument is a Class I safety instrument

1.4.1 Insulation Resistance

Under the reference working condition, the insulation resistance between the power terminal and the shell is ≥ 50M;

Under humid and hot transportation conditions, the insulation resistance between the power terminal and the housing is ≥ 2M;

1.4.2 Insulation Strength

Under the reference working condition, the AC voltage between the power terminal and the housing can withstand the rated voltage of 1.5kV and the frequency of 50Hz for 1 minute without breakdown or arcing.

1.4.3 Leakage Current

Leakage current is not greater than 3.5mA.

Chapter 2 Panels

The content of this chapter is only a brief description. For specific operation and detailed explanation, please refer to the corresponding content in Chapter 3.

2.1 Front Panel

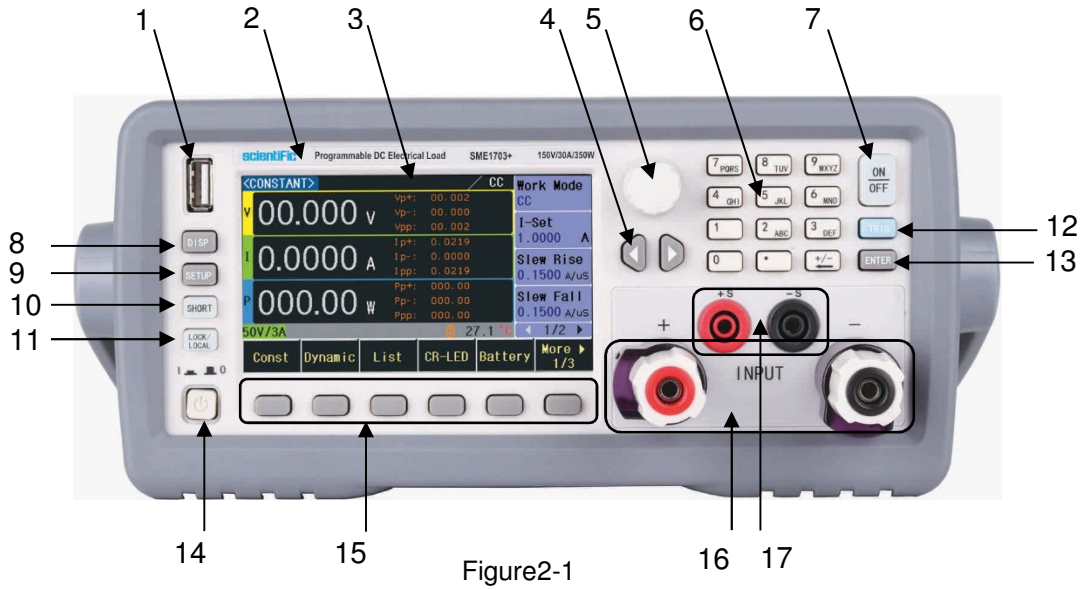


Figure2-1

1	USB Interface	U Disk Interface
2	Trade Model	Make & Model Number
3	LCD	480*272 dot matrix LCD display, showing all measurement parameters, status, measurement results, etc.
4	Left and right arrow keys	Used to move the cursor or turn pages
5	Knob	for moving cursor up and down and value adjustment
6	Numeric keypad	for entering values
7	[ON/OFF] Key	Load start or stop button
8	[DISP] Key	Enter the function setting page
9	[SETUP] Key	Enter the system settings page
10	[SHORT] Key	Shortcut key for short circuit test
11	[LOCK/LOCAL] Key	Used to lock the key to switch the remote control. When the key is on, the keyboard is locked and the instrument can only be controlled remotely
12	[TRIG] Key	Trigger button for specific functions
13	[ENTER] Key	Confirmation button for numerical setting
14	(POWER) ⌿	Turn on or off 220V mains power, turn on the power when in

		the pressed position; turn off the power when in the ejected position
15	SOFTKETs	The functions of the six keys in this part are not fixed, and correspond to the functions of the soft key menu bar in the corresponding LCD screen.
16	INPUT	Load input port
17	Remote Compensation (SENSE)	The instrument selects the measurement port for remote measurement

Table 2-1

2.2 Rear Panel

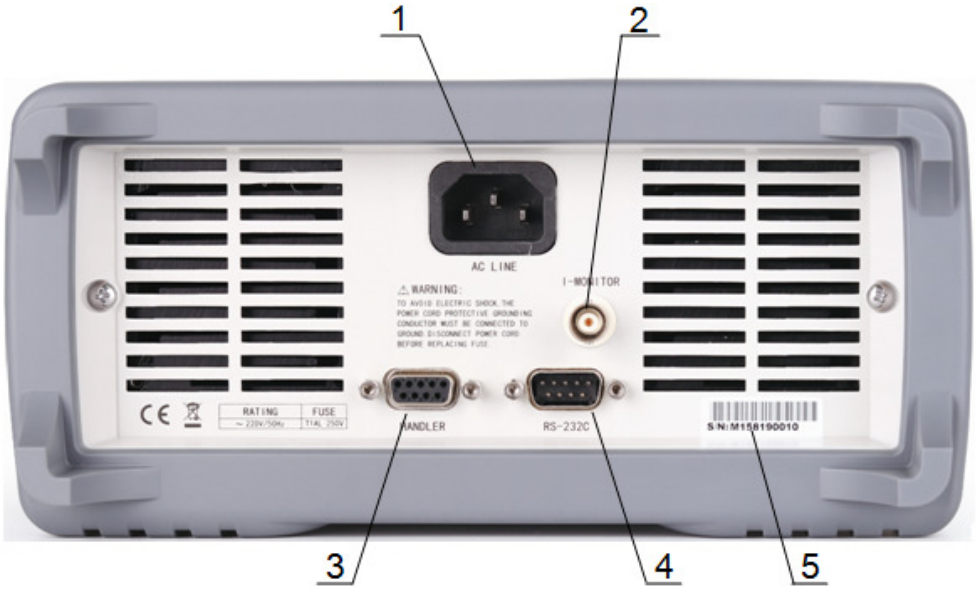


Figure 2-2

1	Three-wire power socket	for connecting 220V/50HZ AC power supply
2	Current monitoring terminal (I-MONITOR)	Used for current detection on the rear panel, output (0-10V)
3	HANDLER	Instrument interface signal input and output port
4	RS-232C	Serial communication interface
5	Nameplate	Record production date, model, batch number, manufacturer, etc.

Table 2-2

2.3 Basic Display Area Description

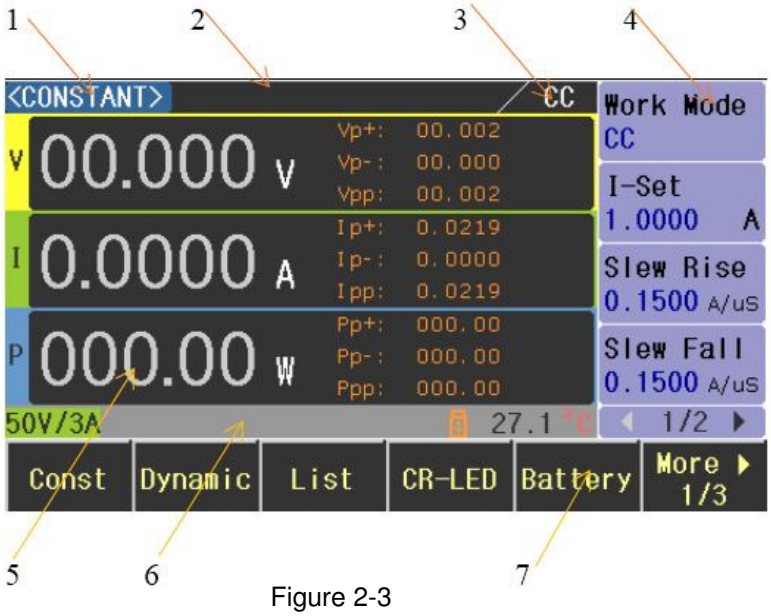


Figure 2-3

(1) Title bar: displays the name of the current page.

(2) Information prompt area: real-time display of load prompt information or error information.

(3) Working mode display area: displays the working mode during static operation.

(4) Parameter setting area: used for parameter setting under the current function.

(5) Sampling display area: real-time display of various test results sampled.

(6) Status information area: display the current range of the load, short circuit, power part temperature and other working status.

(7) Software menu area: corresponds to the soft keys on the front panel, and corresponds to various operations according to the menu information.

2.4 Summary of the Displayed Page

2.4.1 DISP (Function Display Page)

- Static operation (Const): Set CC, CV, CR and CP four basic load functions.
- Dynamic operation: Make the load switch back and forth between two currents.
- List operation (List): continuous programmable sequence load mode
- CR-LED: Simulate the test function that the load is LED.
- Battery test (Battery): Provide battery discharge test, support CC, CR and CP modes.
- Time test (Timing): Provide time measurement in basic mode.
- Over-current test (OCP): Provide over-current protection function test.
- Over-voltage test (OVP): Provide overvoltage protection function test.
- Over-power Test (OPP): Provide overpower protection function test.

- Load Effect: Load function of test instrument or equipment.
- Frequency sweep (Sweep): Vp+ and Vp- of test instruments or equipment under severe conditions.
- Automatic test (Auto): Programmable multiple test modes.

2.4.2 SETUP (System Settings Page)

- System setting (System): Set the basic working mode of the instrument.
- Von/Voff: Set the loading and unloading voltage of the instrument.
- Protect: Set the protection value of the voltage, current and power of the instrument.
- File (File): save the instrument parameters and data.
- Communication Settings (RS-232): Set the communication parameters and methods of the instrument.

Chapter 3 Function Setting and Use

This series of instruments integrates four basic modes of CC, CV, CR and CP and a variety of advanced functions such as dynamic operation, battery test, load effect, frequency conversion scanning and so on.

Operation method:

1. Press the DISP button on the front panel to enter the <Function Display> page.
2. Select the corresponding function through the soft key bar shown in Figure 3-1 below to enter the setting page of the function.

Figure 3-1

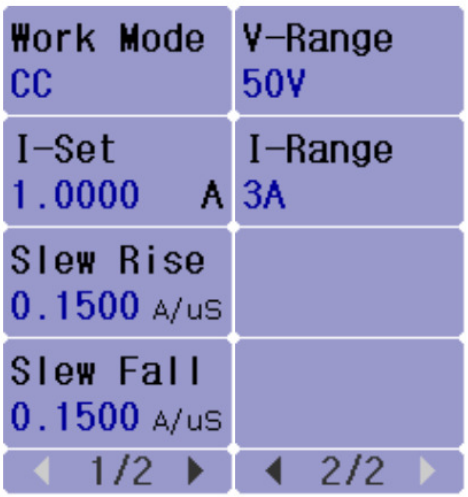
3. The parameter setting area is shown in Figure 3-2. Rotate the knob to move the cursor to the corresponding setting item, enter the value or select the corresponding function according to the soft key bar.

Figure3-2

4. Press the ON/OFF key, the load starts to work.

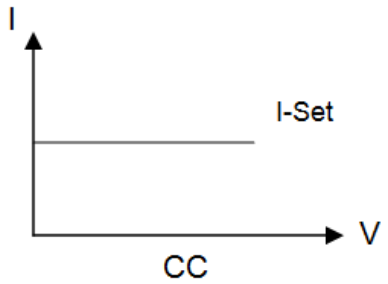
3.1 Static Mode(Static)

The static mode mainly includes four basic modes: constant current (CC), constant voltage (CV), constant resistance (CR) and constant power (CP). After entering this page, select the desired working mode.



3.1.1 Constant Current(CC)

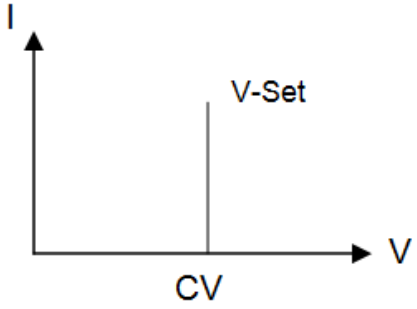
In this mode, no matter how the input voltage changes, the load will be pulled according to the set current, so that the load works in a constant current mode.



- Working current: the current value when the load is normally loaded
- Rising slope: the rate of change of the current from 0 to the set value
- Descent slope: the rate of change of current from set value to 0

3.1.2 Constant Voltage (CV)

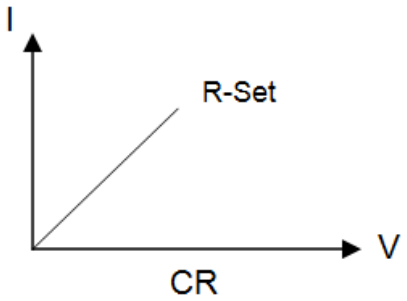
In this mode, the load maintains the input voltage at a constant value by pulling the load current.



- Working voltage: the input voltage when the load works normally
- Rising slope: the rate of change of the voltage from 0 to the set value

3.1.3 Constant Resistance (CR)

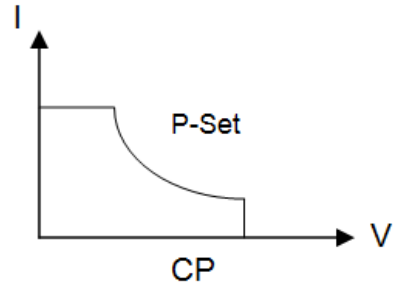
In this mode, the load is equivalent to a constant resistance.



- Working resistance: the load is equivalent to the resistance value

3.1.4 Constant Power (CP)

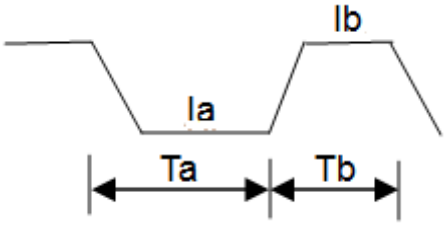
In this mode, the load will be pulled with a constant power value



- Working power: the load maintains a constant power value

3.2 Dynamic Mode (Dynamic)

The dynamic mode enables the load to switch back and forth between two set values. This function can test the dynamic characteristics of the power supply. The principle is shown in the figure. The current drops from Ib to Ia and is maintained for a period of time. The total time of the process is Ta, and then rises from Ia to Ib and is maintained for a period of time. The total time of the process is Tb. Switch back and forth in this way to test the dynamic characteristics of the power supply.



- Set value-A: value of current Ia
- Time-A: the total time of current from Ib to Ia (0.02mS～60S)
- Setting value-B: current Ib value
- Time-B: the total time that the current is maintained from Ia to Ib (0.02mS～60S)
- Rise slope: the rate of change of current from low level to high level
- Decline slope: the rate of change of current from high level to low level
- Dynamic mode: continuous, pulse, flip

  Continuous: The load will switch continuously between high and low load current according to the set current, slope, and duration.

  Pulse: Each time the trigger signal is received, the load current will change from Ia to Ib according to the set slope for Tb time, and then return to Ia according to the set slope.

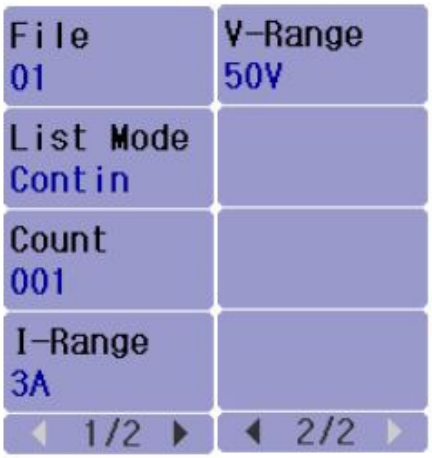
  Rollover: Each time the trigger signal is received, the load current will change from Ia to Ib according to the set slope. When the trigger signal is received again, the current changes from Ib to Ia.
- Number of repetitions: In continuous mode, the number of times the load current switches between two set values

  Unlimited: unlimited times.

  User value: number of times in continuous mode, range 1 to 65535 times.

3.3 Sequential operation (List)

The List function is used for the simulation of real loads or the editing of complex carrier shapes. The loads are continuously loaded in sequence according to the sequence edited in the file. The load supports up to 10 files, each file supports up to 100 steps, and each step can set the current load value, duration and slope.



(1) File settings:

- File: directly input the file to be programmed through the numeric keys
- Working mode: the way of sequential loading in a single file

  Continuous: continuous load sequence load

  Counting: Every time a trigger signal is received, the load is pulled in sequence, and "counting" cycles are repeated, and the loading stops after the end.

  Single step: Each time the trigger signal is received, the load is loaded according to the next setting parameter in the file.
- Counting: In continuous mode, the list repeats the loading cycle, the range is 1 to 100.

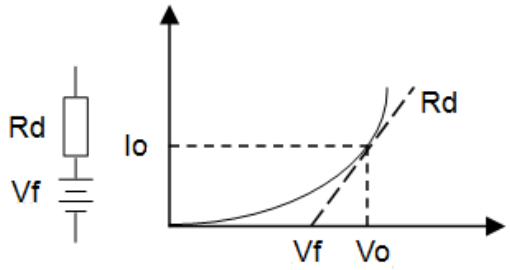
(2) List settings:

- Current: the load current of each step
- Time: the duration of each step, the range is 20uS～50S
- Slope: the current change rate from the previous step to this step

Figure 3-3

3.4 CR-LED

The load provides the LED simulation function. The LED equivalent circuit is shown in the following figure, which is a series of resistance Rd and voltage source Vf. Its VI curve is equivalent to the tangent of the real LED nonlinear VI curve at the operating point (Vo,Io).



- Turn-on voltage (Vo): LED forward working voltage at forward working current Io
  It can be obtained from the VI curve in the LED specification. The real load is usually a series connection of n sections of LEDs, so Vo should be set to n times the parameters of a single section.
- On current (Io): forward current at the operating point, ie the rated output current of the LED
- Rd coefficient (Rd Coeff): the ratio of the series equivalent resistance (Rd) and the total equivalent resistance of the LED load (Vo/Io)
  Rd Coeff = Rd/(Vo/Io)

Users only need to set the above three parameters according to the LED specification, and then adjust it arbitrarily within the output voltage range of the LED power supply, and then the real LED analog load test can be performed.

3.5 Battery Test (Battery)

The load provides battery power test function. The discharge conditions support three modes of CC, CP and CR. There are three conditions of voltage/capacity/time to stop discharge. You can choose to set up. As shown in Figure 3-4, after starting the test, the load displays the discharge duration, accumulated AH battery capacity and WH battery capacity, when the stop condition is met, the load completes the test and stops loading.

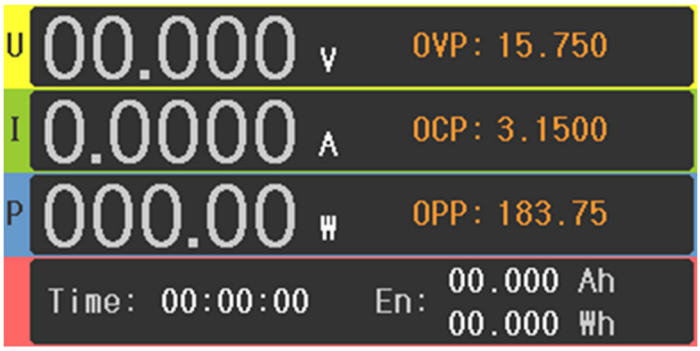
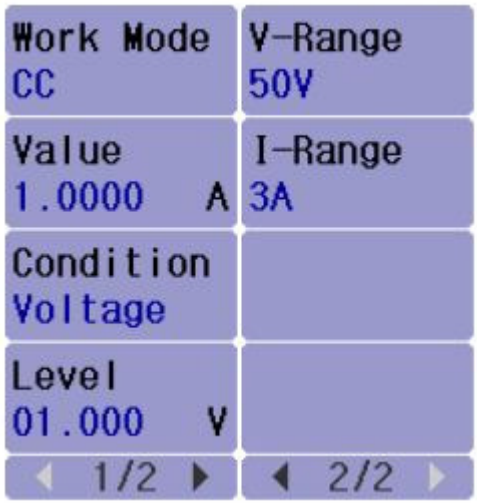


Figure 3-4

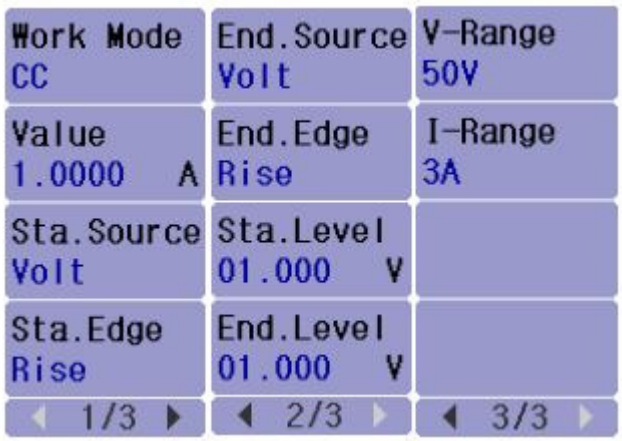


- Mode: The load supports three discharge modes of CC, CR and CP
- Loaded value: loaded parameters, according to the discharge mode, respectively current, resistance and power
- Stop condition: select voltage, time, battery capacity (Ah) and battery capacity (Wh)
- Threshold: according to the selected stop condition, when the threshold is met, the discharge ends

3.6 Time Test (Timing)

The load provides a time test function with a test accuracy of 0.1mS. The load is measured under the predetermined loading conditions, and the time interval is measured according to the two signals at the beginning and the end.

Figure 3-5



- Working mode: CC, CV, CR, CP and OFF can be selected in load mode
- Set value: the load value set according to the working mode
- Starting condition: Trigger timing signal, optional voltage, current or external trigger signal
- Starting edge: select the starting trigger mode, selectable rising edge or falling edge
- Starting value: when the starting condition is voltage or current, the corresponding trigger value
- End condition: signal to end timing, optional voltage, current or external trigger signal
- End Edge: End trigger mode selection, selectable rising edge or falling edge
- End value: when the end signal is voltage or current, the corresponding trigger value

3.7 Overcurrent Protection Test (OCPT)

The load provides the overcurrent protection test function. The principle is shown in the following figure. The load starts from the initial current (I-Start) and gradually increases the current to the cut-off current (I-End) according to the set steps (Steps). When it detects that the input level drops to the trigger level (V-Trig), it is considered that the source under test has achieved OCP protection. During this process, the load not only detects the OCP protection point, but also captures the power of the maximum power point. , Voltage and current values.

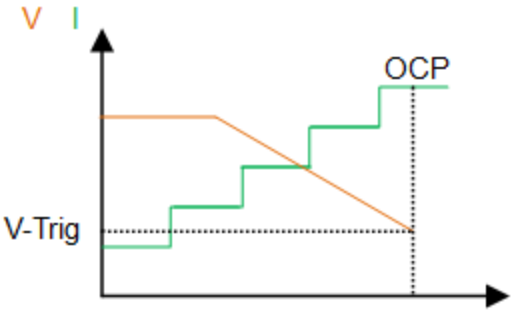


Figure 3-6

- Starting current: the current value when starting to load
- Cut-off current: the current value after ending load

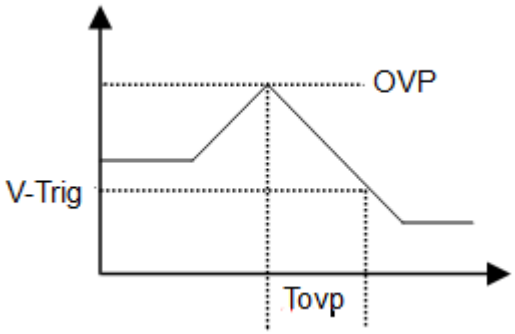
- Increasing steps: the total steps of increasing current from the beginning to the end, range 1~1000
- Residence time: the duration of single-step current
- Trigger level: confirm the level value that triggers overcurrent protection
- Load lock: choose whether to continue loading after the test

  Close: End the load after the test is completed.

  Open: Continue to load after the test is completed.

3.8 Over Voltage Protection Test (OVP)

The load provides over-voltage protection (OVP) test function. The principle is as shown in the figure below. The load captures the peak point and the falling edge of the input voltage and triggers at the preset level (V-Trig) at the moment of the falling edge. During this process, the voltage The peak value is the overvoltage protection point (OVP) of the power supply under test, and the time from the peak value to the trigger level (V-Trig) is the OVP response time (Tovp) of the power supply under test.



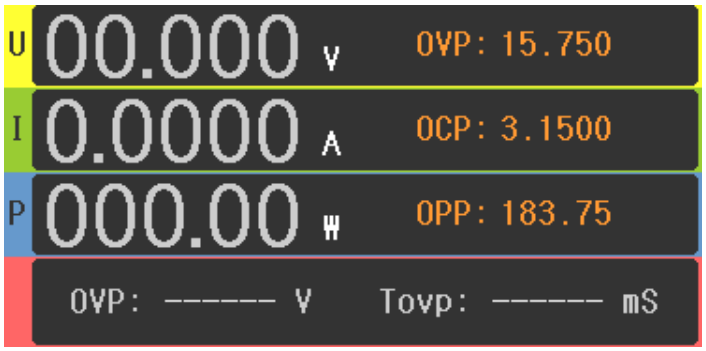
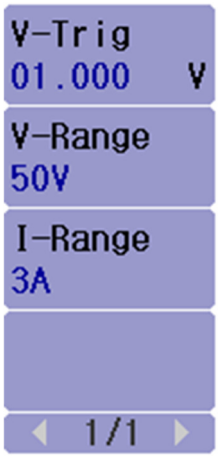


Figure 3-7



- Trigger level: confirm the protection voltage should be higher than the output voltage after the measured source voltage is protected

3.9 OPPT

The load provides power protection test function, the principle is the same as 3.7 over current test (OCPT).

3.10 Load Effect

The load provides a load effect test function. During the test, the load will be loaded under 3 different load currents, the minimum current (I-Min), the normal current (I-Normal) and the maximum current (I-Max), and separately Continue for a preset time (Delay), then record the voltage value under different loads, and finally calculate the negative ΔV, load regulation (Regulation) and power supply internal resistance (Rs) according to the following enumerated formulas.

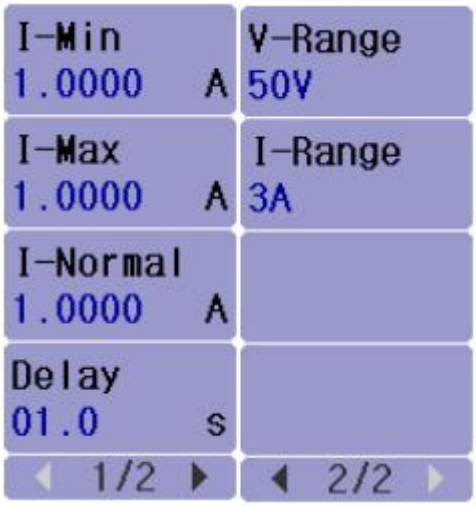
$\mathrm{Vmax} = \mathrm{Vdc@Imin} \quad \mathrm{Vmin} = \mathrm{Vdc@Imax} \quad \mathrm{Vnormal} = \mathrm{Vdc@Inormal}$

$$\Delta \mathrm{V} = \mathrm{Vmax} - \mathrm{Vmin}$$

$$\mathrm{Rs} = \frac{\Delta V}{Imax - Imin}$$

$$\mathrm{Regulation} = \frac{\Delta V}{Vnormal}$$

Figure 3-8



- Minimum current: low level load current
- Maximum current: high level load current
- Normal current: normal working current
- Delay: the duration of each step of load current

3.11 Sweep

The load provides dynamic frequency conversion scanning function to capture Vp+ and Vp- in the worst case of the power supply under test. The load is switched repeatedly between two current loads according to the preset current slope, and the duration of each current level will be determined by the scan frequency and duty ratio (Duty). When starting to work, the sweep frequency will gradually increase or decrease from the start frequency (Fstart) according to the step frequency (Fstep) to the cutoff frequency (Fend), and the sweep duration of each frequency point is (Dwell). During the scanning process, the input voltage will be accompanied by the transient of the current, resulting in overshoot and drop. As shown in Figure 3-9, the load will display the peak voltage (Vp+) and the valley value (Vp-) of the overshoot in real time, and finally show the maximum value of Vp+ Value and Vp-minimum value, and the frequency of occurrence.

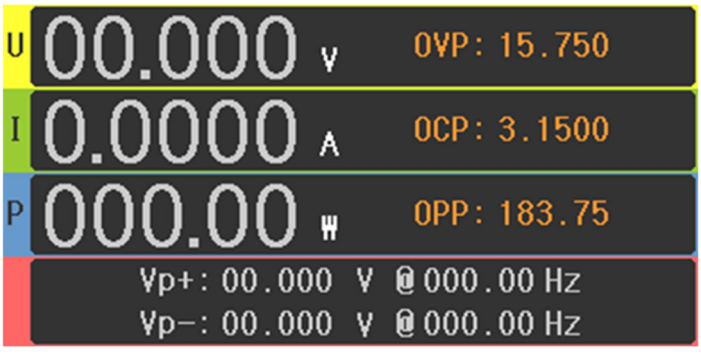
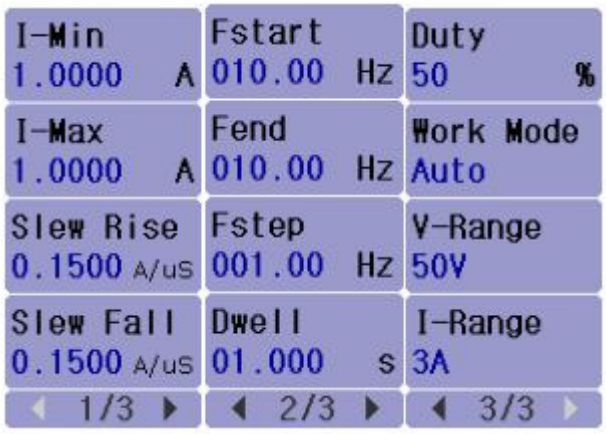


Figure 3-9



- Minimum current: low level load current
- Maximum current: high level load current
- Rise slope: current rise rate
- Decline slope: current decline rate
- Start frequency: start scan frequency, range 0.01Hz~25KHz
- Cutoff frequency: cutoff scan frequency, range 0.01Hz~25KHz
- Step frequency: the frequency of single step increment or decrement, range 0.01Hz~25KHz
- Duration: the duration of each frequency point, ranging from 0.001 to 99.999S
- Duty ratio: the ratio of the maximum current to the total time is 1%~99%
- Working mode: automatic, manual

  Auto: In this mode, the frequency is automatically switched according to the setting.

  Manual: In this mode, the user switches the frequency manually.

3.12 Automatic Test (AUTO)

The automatic test function is used for product inspection of the production line. The load is loaded and tested in sequence according to the steps edited in the file, and the pass or fail is automatically determined.

The load supports up to 10 files, each file supports up to 50 steps of testing, and each step can set the loading conditions and limit judgment.

Setting method:

1. Select the file to be edited and set the number of cycles of the file.

2. Enter the file list by editing the file, and turn the knob to select the step to be set.
3. Select the load mode of the current step through mode selection.
4. Set the load parameters of the current step through parameter settings.
5. Set the judgment conditions when loading this step through the condition setting, including the judgment limit type, the limit value, the operation after the judgment failure, and jump to the next way.

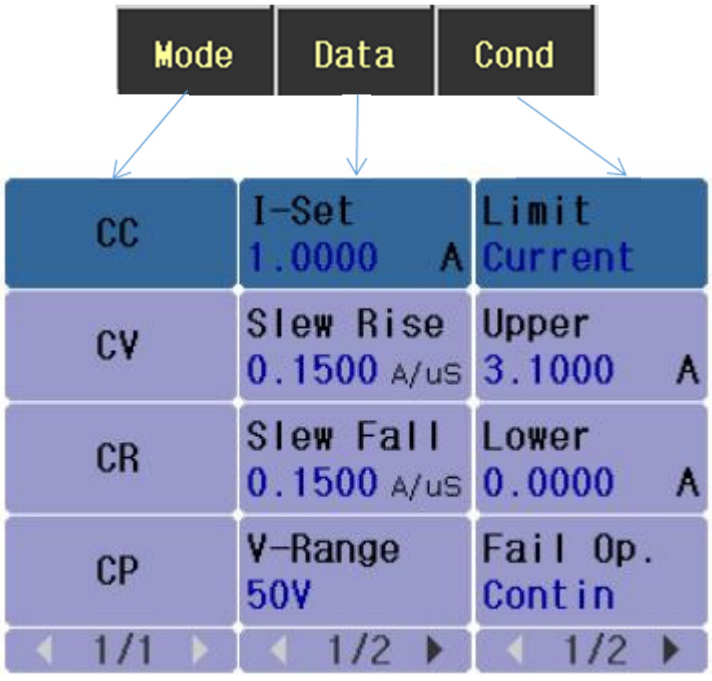


Figure 3-10

6. Repeat steps 2-5 to complete all steps.

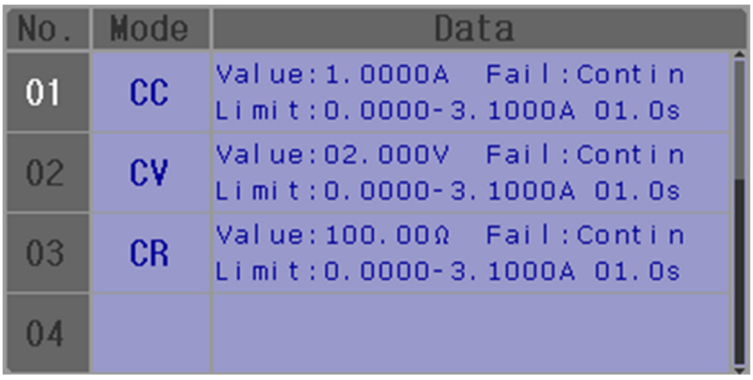


Figure 3-11

7. After completing the settings on the file list, press the ON/OFF key to start the automatic test.
   - File: Input the file to be edited through the numeric keys
   - Count: the number of cycles of a file list repeated loading test
   - Mode: select the mode of loading at each step, four modes of CC, CV, CR and CP
   - Working value: according to the mode selected in each step, set the load value
   - Rising slope: the rising rate of current
   - Declining slope: the decreasing slope of current
   - Limit type: the type of judgment used to judge whether the test value at this step passes
   - Upper limit value/lower limit value: the qualified range of the test value in this step, if it is in this range, it will pass, if it is not in this range, it will fail
   - Failed operation: If the test fails in this step, you can choose to continue to the next step or end the test
   - Delay type: after each step of the test, you can choose to delay for a period of time or wait for the trigger signal to perform the next test
   - Time: Select the time value for the next test after a delay

As shown in Figure 3-12, after pressing the ON/OFF key, the load will be loaded in sequence according to the set parameters of each step. If the set count value is greater than 1, the load will repeatedly load the file list multiple times. After the test, the display area will display The serial number of the failed list.

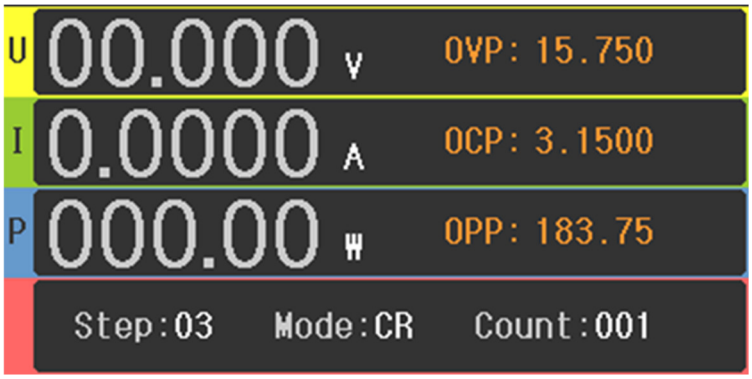

U
00.000 V
OVP: 15.750
I
0.0000 A
OCP: 3.1500
P
000.00 W
OPP: 183.75
Step:03
Mode:CR
Count:001

Figure 3-12

Chapter 4 System Setup

This module is mainly used to set the basic parameters of the system and the working mode of the load.

Operation method: Press the SETUP button to enter the system setting interface, select the corresponding setting function through the software bar button, enter the setting interface of the function, and then you can set the corresponding parameters of the function.

4.1 SYSTEM Setup (System)

4.1.1 Language

- English

4.1.2 Key Sound

- OFF
- ON

4.1.3 Remote Compensation

The current will produce a voltage drop on the connection line. The longer the connection line, the greater the resistance of the connection line, or the greater the current, the greater the voltage drop will be. To reduce the error caused by the voltage measurement, the load provides remote compensation function, as shown below. In addition to the [+ -] input of the load connected to the power supply; an additional two wires are required to connect the power supply.

- OFF
- ON

4.1.4 Start-up Parameters

This function is used to select whether to load the data of the last shutdown when the instrument is turned on, or to boot with the default factory parameters.

- Factory parameters: no data is loaded when the instrument is turned on, and the instrument is turned on with the factory parameters

- User parameters: the instrument will load the setting mode and parameter data of the instrument when it was turned off last time. If a file is checked in the file setting page, the parameters in the file will be loaded when the instrument is turned on

4.1.5 Display Mode

During the operation of the load, the user can choose to display certain parameters or block some parameters in the data sampling display area.

**U,I,P PPon: as shown in Figure 4-1, display voltage, current, power, peak value, ripple value

The peak sampling rate of voltage and current is 500kHz.

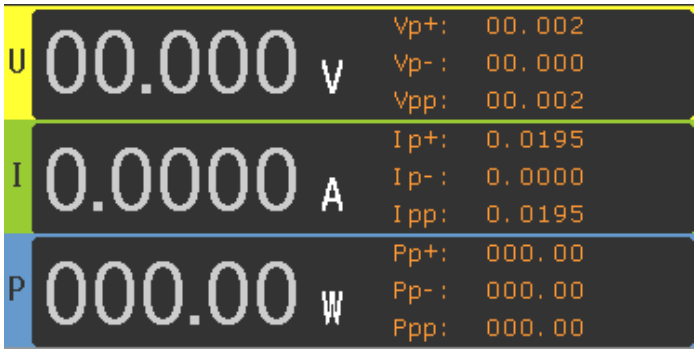


Figure 4-1

**U,I,P PPoff: as shown in Figure 4-2, display voltage, current and power values

Figure 4-2

**U,I,P,R:as shown in Figure 4-3, display voltage, current, power and resistance

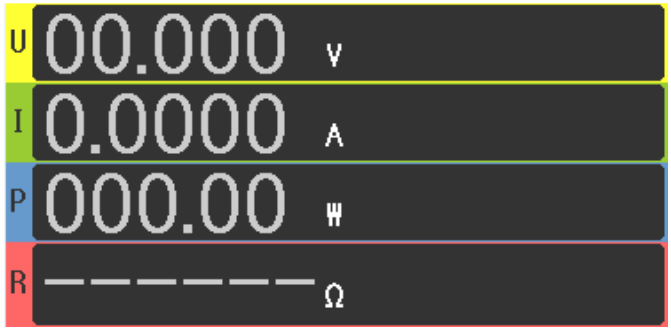


Figure 4-3

** Waveform: as shown in Figure 4-4, display the current sampled voltage and current values in the form of waveform

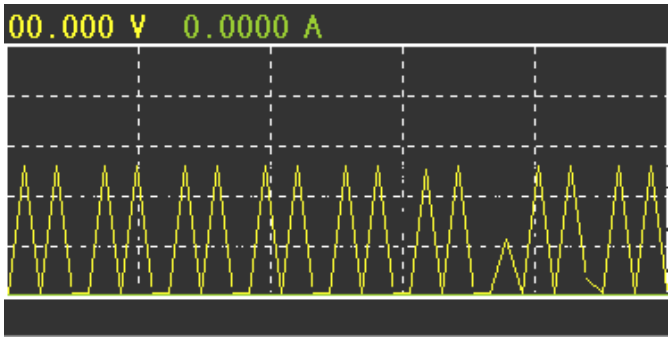


Figure 4-4

4.1.6 Source under Test

Set the output type of the DUT in advance. Very important in CR, CP and other modes.

- CC:DUT is a constant current source
- CV: DUT is a constant voltage source

4.1.7 External Analog

Port 5 in the Handler interface on the rear panel of the instrument is the EXT-PROG port (see Chapter 7), which is used for external analog input. By connecting this port to 0-10V voltage to simulate the input from 0 to full scale, thus adjust the input voltage and current value of the load.

- OFF
- ON

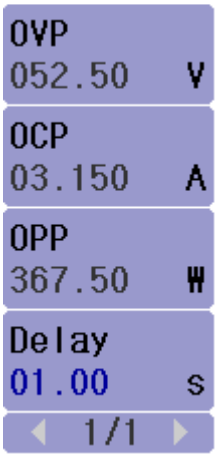
4.2 Load Unload (Von/Voff)

This module is used to set the CC mode pull-down and unload voltage.

- Pull voltage: Press the ON/OFF button. When the input voltage is lower than this value, the ON/OFF button light flashes. When the input voltage is greater than this value, the ON/OFF button light is always on and the load begins to pull.
- Unloading voltage: When the load is officially loaded, when the input voltage value is lower than this value, the instrument is turned off and the load stops pulling.

4.3 Security Setting (Protect)

The load provides voltage, current and power protection functions. According to user settings, when the sampled value exceeds the protection value, the load stops pulling.



- Over-voltage protection: voltage protection value
- Over current: current protection value
- Over power: power protection value.

  Default value: As the range is switched, the protection value is automatically adjusted to 1.05 times the current range value.

  User value: According to user needs, the value can be set not to exceed the maximum range.
- Protection off: According to user needs, you can choose whether to continue loading or stop loading when the protection value is exceeded.

  OFF: When the load triggers protection, continue to load.

  On: When the load triggers protection, stop pulling.
- Turn-off delay: It is used to stop the load delay time when the load triggers protection, to prevent accidental pulses from triggering the load protection. If the load protection is still triggered after the delay time expires, the load is stopped.

4.4 File Store

The instrument supports saving and loading of load parameters and configurations.

- File storage: used to display and set the list of configuration files.

  Internal files: A list of files saved internally in the load.

  External files: a list of files saved in the U disk.
- Data storage: Method of saving sampling parameters

  Auto: Automatically save the sampling parameters.

  Manual: Manually press to save sampling parameters.

4.4.1 Internal File Save

The instrument can save the current parameter settings and configuration of the load in Flash.

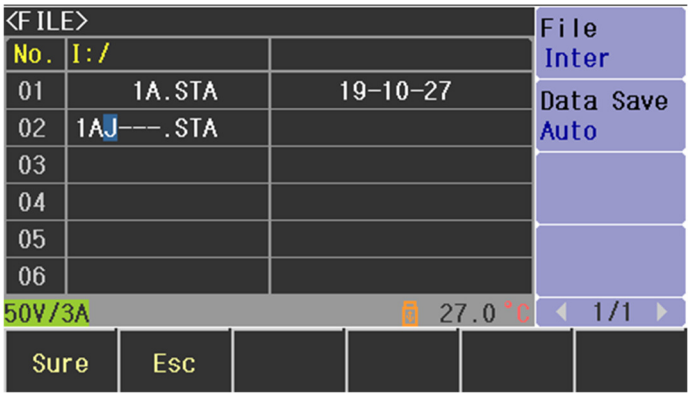


Figure 4-5

save method:

1. Move the cursor to the "File Storage" option, select the internal file, and press Edit to enter the internal file list.
2. Move the cursor to select the location of the empty file and press Save to display "------.STA".
3. Numeric Keyboard can input the file name, press a certain number key repeatedly to switch back and forth between numbers and letters, and left and right direction keys can move the cursor to select the position of the input file name.
4. After inputting the file name, press to confirm, and the current parameters and configuration of the load are stored in Flash.

   Load on boot:

   1. Make sure that the start up parameters are user parameters (see 4.1.1).
   2. Move the cursor to the file that needs to be loaded and press load, the file displays √, indicating that the file is loaded when the computer is turned on.

4.4.2 External File Call

The instrument can save the parameters and configuration of the load to the U disk, and can also call the corresponding file in the U disk.

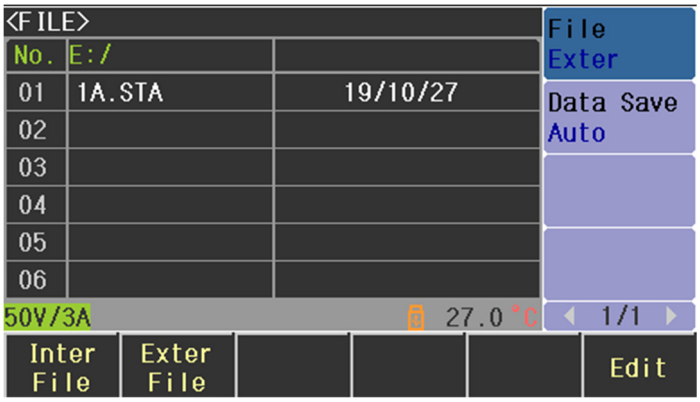


Figure 4-6

1. Save to U disk: Insert the U disk, move the cursor to the corresponding internal file, press the Save to U disk option, the file will be saved to the STA folder corresponding to the U disk.
2. Call file from U disk: plug in U disk, select external file for file storage, STA file in STA folder in the U disk will be displayed in the list, enter the list by editing, select the file, press load, then the file will replace the parameters and configuration of the current load.

4.4.3 Save Sampling Parameters

The instrument can save the data sampled by the load in real time in the U disk CSV folder, and the saved data types are Volt, Curr, Pow, Vpp, Ipp and Ppp.

Method:

1. Plug in the U disk and press the LOCK/LOCAL key to put the keyboard in the Lock state.
2. Press the Left arrow key, the load starts to collect data. If the "data storage" selects the automatic mode, the load automatically collects data every 3s. If the manual mode is selected, each time the Left arrow key is pressed, the data is collected. data.
3. When the data collection is completed, press the right arrow key to complete the data collection, the collected data is stored in the U disk.

4.5 Communication Setup (RS232)

The load supports RS232 communication.

- Baud rate: 4800, 9600, 19200, 38400, 115200
- Data bits: 5, 6, 7, 8
- Stop bits: 1, 2
- Parity: No parity, odd parity, even parity, flag, space


Baud Rate
9600
Data Bit
8
Stop Bit
1
Parity
None
1/1

Chapter 5 Other Functions

5.1 Short Circuit Test Function

The load can simulate a short-circuit circuit at the input, and perform a short-circuit load test according to the maximum current value of the maximum range of the load. When the load stops pulling, press the SHORT button on the front panel, the load starts a short circuit test, and the LEDs corresponding to the SHORT button and the ON/OFF button light up. If you need to stop the short circuit test, you need to press the ON/OFF key to stop.

5.2 USB Interface Function

The USB interface on the front panel of the instrument can be used for various operations of the U disk. The size of the U disk must be less than 8g. When the U disk is inserted into the USB port, three folders of PIC, CSV and STA will be automatically generated in the U disk.

5.2.1 Copy Screen

Insert the U disk into the USB interface, press the LOCK/LOCAL key to put the instrument in the Lock state, and then press the ENTER key, the current LCD screen will be saved in the PIC folder corresponding to the U disk in gif format. Every time you press the ENTER key, the U disk will copy the screen once.

5.2.2 STA File Save

Check 4.4.2

5.2.2 CSV File Save

Check 4.4.3

Chapter 6 Interface and Communication

This instrument can use RS232C serial interface for data communication and remote control without instrument panel. This chapter introduces how to use the interface.

6.1 Remote Control Interface

6.1.1 RS232 Interface Descriptions

The RS232C interface provided by the instrument is used to communicate with the computer. Through the RS232C interface, the computer can perform almost all functions on the instrument panel.

6.1.1.1 RS232 Interface Introduction

The currently widely used serial communication standard is the RS-232 standard, which can also be called the asynchronous serial communication standard, and is used to realize data communication between computers and computers, and between computers and peripherals. RS is the abbreviation of "Recommended Standard" (recommended standard), 232 is the standard number, the standard is the standard officially published by the American Electronics Industry Association (EIA) in 1969, which specifies that one bit at a time is transmitted via a data line.

The configuration of most serial ports is usually not strictly based on the RS-232 standard: use a 25-pin connector on each port (IMB AT uses a 9-pin connector). The most commonly used RS-232 signals are shown in Table 6-1:

Signal	Symbol	25-pin connector pin number	9-pin connector pin number
Request to Send	RTS	4	7
Clear to Send	CTS	5	8
Data Set Request	DSR	6	6
Data Carrier Detection	DCD	8	1
Data Terminal Preparation	DTR	20	4
Send Data	TXD	2	3
Receive Data	RXD	3	2
Ground	GND	7	5

Table 6-1

Like most serial ports in the world, the serial interface of this instrument is not strictly based on the RS-232 standard, but only provides a minimal subset. As shown in Table 6-2 below:

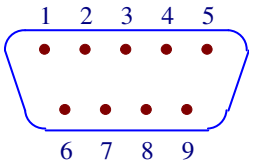
Signal	Symbol	Connector Pin#
Send Data	TXD	3
Receive Data	RXD	2
Ground	GND	5

Table 6-2

This is the simplest and most economical method of using serial port communication.

ⓘNote: The pin definition of the serial port of this instrument is basically the same as that of the standard 9-pin RS232C connector.

The RS232C connector of this instrument uses a 9-pin DB type socket, and the pin sequence is as shown in the figure below:



(From outside)

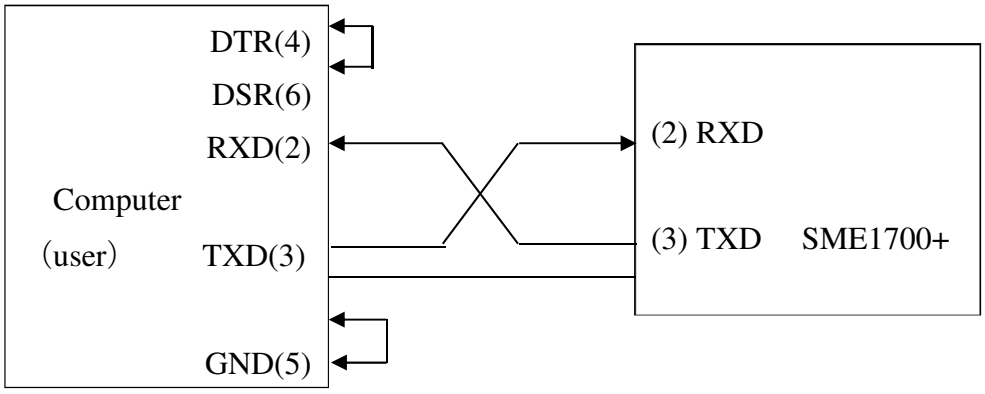
It can be directly connected to it using a standard DB type 9-core female plug.

⚠Waring: In order to avoid electrical shock, the power should be turned off when plugging or unplugging the connector;

⚠Waring:Please do not short-circuit the output terminals at will or short-circuit with the cabinet to avoid damaging the device

6.1.2 Communicate with a Computer

- The connection between the instrument and the computer is as shown in the figure:



As can be seen from the above figure, the pin definition of this instrument is the same as the pin definition of the 9-pin connector serial interface used by the IMB AT compatible machine.

Users can use the double-core shielded wire to make a three-wire connection cable (the length should be less than 1.5m) according to the figure, or purchase the serial interface cable between the computer and the instrument from Scientific or directly purchase the standard DB9 core. Cable (crossover).

When making a self-made connection cable, pay attention to short-circuit pins 4 and 6 and 7 and 8 on the computer connector.

- When communicating with the computer through the serial port, the bus mode of the instrument should be set first, the parameters are shown in Table 5-3:

Transfer Method	Full duplex asynchronous communication with start bit and stop bit
Baud Rate	9600 bps
Data Bit	8 BIT
Stop Bit	1 BIT
Check	No
Terminator	NL（new line，ASCII code 10）
Contact Method	Software
Connector	DB9 core

Table 5-3

Software Protocol

Since hardware communication is not used on the RS232 interface, in order to reduce the possible data loss or data errors in the communication, the instrument uses character loopback to communicate with the software. Please refer to the following when compiling computer communication software:

(1) The command string syntax and format are described in Chapter 8 "Command Reference".

(2) The commands sent by the host are transmitted in ASCII code, with NL (line feed character, ASCII code 10) as the end character, and the instrument begins to execute the command string after receiving the end character.

(3) Each time the instrument receives a character, the character will be sent back to the host immediately. The host should continue to send the next character after receiving this character. If the loop back characters cannot be received, the possible factors are

1. The serial port connection is faulty.
2. Check whether the instrument has turned on the RS232 port function.
3. The instrument is executing a bus command and temporarily cannot respond to serial acceptance. At this time, the last character sent was ignored by the instrument. If you want to ensure the integrity of the command string, the host should resend the characters that have not been sent back.

(4) The instrument sends information to the host only in the following two situations:

1. Receive the command character of the host normally, and send it back with this character.
2. Execute the query command and send the query result to the host.

(5) Once the instrument executes the query command, the query result will be sent immediately, regardless of whether the current command string has all been executed. Therefore, there can be multiple queries in a command string, but the host must have a corresponding number of read results. This protocol recommends that only one query be included in a command string.

(6) The query result is sent out in ASCII code string, with NL (namely line feed, ASCII code 10) as the end character.

(7) When the instrument sends the query result, it is sent continuously (at an interval of about 1ms), the host should be in the state of receiving data, otherwise it may cause data loss.

(8) After the host generates the query, it is necessary to ensure that the empty query result is read (the end is accepted when NL is received) to avoid the conflict between the query and the loop back; similarly, the host should also read the empty loopback character before reading the query result.

(9) For some bus commands that take a long time to complete, such as clearing, etc., the host should take the initiative to wait, or synchronize the execution of the previous command in response to the user's keyboard input confirmation to avoid the next command during the command execution process The command was ignored or made an error.

(10) Communication software compiled with DOS application software should be run in a pure DOS environment that supports serial ports. If run under WINDOWS, errors may occur due to the different management methods of the serial ports.

6.2 Command Specification

6.2.1 Command Structure

The instrument uses SCPI (Standard Commands for Programmable Instruments) commands, but the instrument does not support all common commands. SCPI commands are tree-like structures, which can have up to three layers, where the highest layer is called a subsystem command. Only when the subsystem command is selected, the layers under the command can be effective, and the colon is used to separate the command hierarchy. Example Figure 6-1.

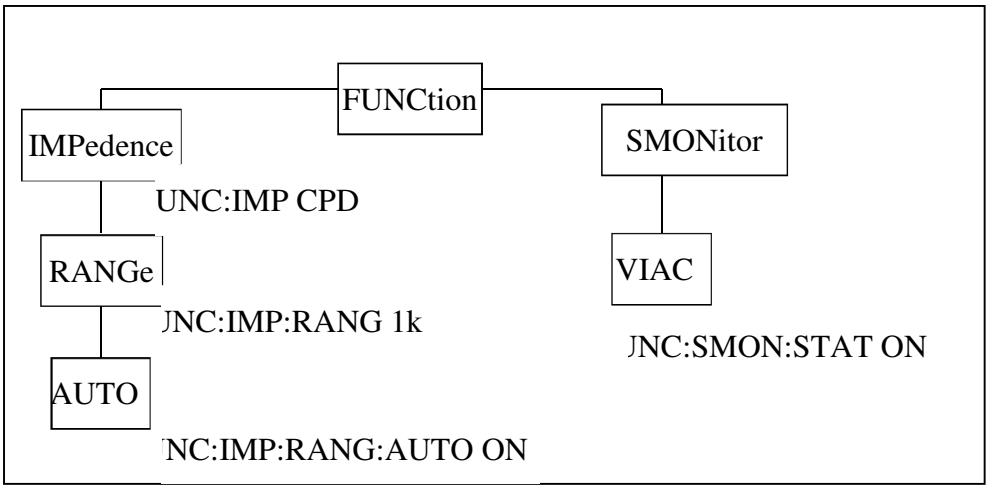


Figure6-1 Command Tree Example

6.2.1.1 Basic Rules of Command Structure

- Ignore case.
  Example: FUNC:IMP CPD = func:imp cpd = Func:Imp CpD
- The space is used to separate the command and the parameter of the command, the command before the space and the corresponding parameter of the command after the space
  Example: In FUNC: IMP CPD, IMP is a command and CPD is its parameter.
- Some commands have no parameters.
  For example: Trigger command TRIG, open clear command CORR:OPEN.
- Spaces (_ means spaces) cannot be placed before or after the colon.
  Example: FUNC_:_IMP CPD FUNC:IMP CPD
- Commands can be abbreviated or all spelled (in later command narratives, abbreviations are given in capital letters)
  Example: FUNCTION:IMPEDANCE CPD = FUNC:IMPEDANCE CPD
- The command is followed by a question mark (?) to execute a query corresponding to the command.
  Example: FUNC:IMP?

6.2.1.2 Abbreviations for Commands and Parameters

- If the number of characters of a complete command or parameter (hereinafter referred to as long format) is less than 4 (including 4 characters), the abbreviation is the same as the long format;
  When the number of characters in the long format is greater than 4:
  If the fourth character is a vowel, the abbreviation takes the first three characters.
  If the fourth character is not a vowel, the abbreviation takes the first 4 characters.
  E.g:

MODE is abbreviated as MODE.

TRIGger is abbreviated as TRIG.

LEVel is abbreviated as LEV.

FREQuency is abbreviated as FREQ.

- The description of some commands or parameters is composed of more than two words. The long format is to take the first character of the first word and the last word, and then take the abbreviated format from the long format.

  For example, the long format of Percent TOLerance is PTOlerance, abbreviated as PTOL.

☞Tip: The instrument does not distinguish between upper and lower case in the processing of commands, including units.

6.2.2 Symbol Conventions and Definitions

1. The syntax symbols used in the command:

   : The colon is the level of the command, indicating to enter the next level of the command

   * The commands after the asterisk are public commands

   ? Question mark means query

   , The comma is a multi-parameter separator

   Spaces are separators of commands and parameters

   "" The quoted content is quoted as-is, and the command analysis program does not do any processing on it

2. In the following command explanation, the following symbols may be used:

   NR1: integer, for example: 123

   NR2: fixed-point number, for example: 12.3

   NR3: floating point number, for example: 12.3E+5

   NL: line feed, integer 10, is the end of the string input and output

   ^END: EOI (end) signal of IEEE-488 bus

   <> The characters contained in angle brackets indicate program code parameters.

   [] Square brackets indicate that the included items are optional. The square brackets with an asterisk (for example, [,<value>*]) indicate that the included items (<value>) are repeated up to the maximum number.

   {} When the braces contain several items, it means that only one item can be selected.

6.3 Command Reference

6.3.1 Common Commands

1. *IDN?

   Used to read the version number of the instrument.

2. *RST

   Reset and restart the instrument.

3. *TRG

   Give the instrument a trigger command, which is equivalent to the [TRIG] key on the front panel.

6.3.2 Instrument Commands

1. SYStem system setting instruction

(1) SYStem: LANG sets the interface language of the instrument

Command syntax: SYStem:LANG <lang>

Parameter: EN

Example: SYS:LANG EN

Query syntax: SYS:LANG?

Return: en

(2) SYStem: VOICe sets the buzzer switch

Command syntax: SYStem:VOICe <bool>

Parameter: ON | OFF | 0 | 1

Example: SYS:VOIC 1

Query syntax: SYS:VOIC?

Returns: 0 | 1

(3) SYStem: REMOTe sets the remote compensation switch

Command syntax: SYStem:REMOTe <bool>

Parameter: ON | OFF | 0 | 1

Example: SYS:REMOT 1

Query syntax: SYS:REMOT?

Returns: 0 | 1

(4) SYStem: PMem sets whether to load parameters at boot

Command syntax: SYStem:PMem <pm>

Parameter: DEFault | USER

Example: SYS:PM USER

Query syntax: SYS:USER?

Returns: default | user

(5) SYStem: DISPlay sets the instrument sampling display parameters

Command syntax: SYStem:DISPlay <NR1>

Parameter: 0-4

Example: SYS:DISP 0

Query syntax: SYS:DISP?

Returns: <NR1>

(6) SYStem: SOURce sets the source of the instrument under test

Command syntax: SYStem:SOURce <sour>

Parameter: CURRent | VOLTage

Example: SYS:SOUR CURR

Query syntax: SYS:SOUR?

Back: CURRent | VOLTage

(7) SYStem: EPRo sets the external analog switch

Command syntax: SYStem:EPRo <bool>

Parameter: ON | OFF | 0 | 1

Example: SYS: EPR 1

Query syntax: SYS:EPR?

Returns: 0 | 1

2. INPut load switch instruction

(1) INPut controls the opening or closing of the load

Command syntax: INPut[:STATe] <bool>

Parameter: ON | OFF | 0 | 1

Example: INP 1

Query syntax: INP?

Returns: 0 | 1

(2) INPut: SHORt controls the opening or closing of the short circuit test

Command syntax: INPut:SHORt<bool>

Parameter: ON | OFF | 0 | 1

Example: INPut:SHORt 1

Query syntax: INPut:SHORt?

Returns: 0 | 1

3. FUNCtion(MODE) select the function of the instrument

Command syntax: FUNCtion <mode>

Parameters: CURR | VOLT | RES | POW | DYN | LIST | LED | BAT | TIM | OCP |

Example: FUNC CURR

Query syntax: FUNC?

Returns: <mode>

4. CURRent current setting instruction

(1) CURRent: RANGe sets the current range in the current mode, and determines the range according to the falling point of the set value

Command syntax: CURRent:RANGe <Nrf+>

Parameters: 0-MAX | MINimum | MAXimum

Example: CURR:RANG MIN

Query syntax: CURR:RANG?

Returns: <Nrf+>

(2) CURRent sets the current working value in static CC mode

Command syntax: CURRent <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: CURR 1.5

Query syntax: CURR?

Returns: <NR2>

(3) CURRent: SLEW sets the same current rise and fall slope in static CC mode

Command syntax: CURRent:SLEW[:BOTH] <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: CURR: SLEW 0.5

Query syntax: CURR:SLEW?

Returns: <NR2>, <NR2>

(4) CURRent:SLEW:RISE sets the current rising slope in static CC mode

Command syntax: CURRent:SLEW:RISE <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: CURR:SLEW:RISE 0.5

Query syntax: CURR:SLEW:RISE?

Returns: <NR2>

(5) CURRent: SLEW: FALL sets the current falling slope in static CC mode

Command syntax: CURRent:FALL:RISE <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: CURR:SLEW:FALL 0.5

Query syntax: CURR:SLEW:FALL?

Returns: <NR2>

5. VOLTage voltage setting instruction

(1) VOLTage:RANGe sets the voltage range in the current mode, and determines the range according to the falling point of the set value

Command syntax: VOLTage:RANGe <Nrf+>

Parameters: 0-MAX | MINimum | MAXimum

Example: VOLT:RANG MIN

Query syntax: VOLT:RANG?

Returns: <Nrf+>

(2) VOLTage sets the voltage working value in static CV mode

Command syntax: VOLTage <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: VOLT 1.5

Query syntax: VOLT?

Returns: <NR2>

(3) VOLTage: SLEW sets the voltage slope in static CV mode

Command syntax: VOLTage:SLEW <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: VOLT:SLEW 1.5

Query syntax: VOLT:SLEW?

Returns: <NR2>

(4) VOLTage:ON Set the load voltage (Von)

Command syntax: VOLTage:ON <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: VOLT:ON 0.2

Query syntax: VOLT:ON?

Returns: <NR2>

(5) VOLTage:OFF sets the load unloading voltage (Voff)

Command syntax: VOLTage:OFF <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: VOLT:OFF 0.1

Query syntax: VOLT:OFF?

Returns: <NR2>

6. RESistance sets the resistance working value in static CR mode

Command syntax: RESistance <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: RES 100

Query syntax: RES?

Returns: <NR2>

7. POWer sets the power working value in static CP mode

Command syntax: POWer <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: POW 100

Query syntax: POW?

Returns: <NR2>

8. DYNamic sets various parameters of dynamic mode

(1) DYNamic:ALEVel sets the A value of dynamic mode

Command syntax: DYNamic:ALEVel <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: DYN:ALEV 1

Query syntax: DYN:ALEV?

Returns: <NR2>

(2) DYNamic: BLEVel sets the B value of the dynamic mode

Command syntax: DYNamic:BLEVel <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: DYN BLEV 2

Query syntax: DYN:BLEV?

Returns: <NR2>

(3) DYNamic: AWIDth sets the duration of A value in dynamic mode

Command syntax: DYNamic:AWIDth <NR2>

Parameters: 0.00001 – 60s | MINimum | MAXimum

Example: DYN:AWID 10

Query syntax: DYN: AWID?

Returns: <NR2>

(4) DYNamic: BWIDth sets the duration of B value in dynamic mode

Command syntax: DYNamic:BWIDth <NR2>

Parameters: 0.00001 – 60s | MINimum | MAXimum

Example: DYN:BWID 10

Query syntax: DYN: BWID?

Returns: <NR2>

(5) DYNamic: SLEW sets the same current rising and falling slope in dynamic mode

Command syntax: DYNamic:SLEW[:BOTH] <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: DYN: SLEW 0.5

Query syntax: DYN:SLEW?

Returns: <NR2>, <NR2>

(6) DYNamic: SLEW: RISE sets the current rising slope in dynamic mode

Command syntax: DYNamic:SLEW:RISE <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: DYN:SLEW:RISE 0.5

Query syntax: DYN:SLEW:RISE?

Returns: <NR2>

(7) DYNamic: SLEW: FALL sets the current falling slope in dynamic mode

Command syntax: DYNamic:FALL:RISE <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: DYN:SLEW:FALL 0.5

Query syntax: DYN:SLEW:FALL?

Returns: <NR2>

(8) DYNamic: REPeat sets the number of repetitions in dynamic continuous mode

Command syntax: DYNamic:REPeat <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: DYN:REP 10

Query syntax: DYN:REP?

Returns: <NR1>

(9) DYNamic: MODE sets the working mode in dynamic continuous mode

Command syntax: DYNamic:MODE <mode>

Parameter: CONTinuous | PULSe | TOGGle

Example: DYN:MODE PULS

Query syntax: DYN:MODE?

Back: CONT | PULS | TOGG

9. LIST Set the parameters in list mode

(1) LIST:FILE Select the List file to be set

Command syntax: LIST:FILE <NR1>

Parameters: 1-10 | MINimum | MAXimum

Example: LIST:FILE 1

Query syntax: LIST:FILE?

Returns: <NR1>

(2) LIST:MODE Set the working mode of the current List file

Command syntax: LIST:MODE <mode>

Parameter: CONT | COUNT | STEP

Example: LIST:MODE STEP

Query syntax: LIST:MODE?

Back: CONT | COUNT | STEP

(3) LIST:COUNT sets the number of cycles in counting mode

Command syntax: LIST:COUNT <NR1>

Parameters: 0-100 | MINimum | MAXimum

Example: LIST:COUNT 20

Query syntax: LIST:COUNT?

Returns: <NR1>

(4) LIST ADD increases the number of List steps

(5) LIST CLEAR clears the current List file data

(6) LIST DONE completes the current List file data

(7) LIST: LEVel sets the data corresponding to the number of steps in List

Command syntax: LIST:LEVel:<NR1> <NR2>,<NR2>,<NR2>

Parameters: <serial number>, <current>, <duration>, <slope>

Example: LIST:LEV:5 2,20,0.2

Query syntax: LIST:LEVel:<NR1>?

Returns: <NR2>,<NR2>,<NR2>

10. LED Set the parameters in LED mode

(1) LED:VOLTage Set LED turn-on voltage

Command syntax: LED:VOLTage <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: LED:VOLT 5

Query syntax: LED:VOLT?

Returns: <NR2>

(2) LED: CURRent sets the LED conduction current

Command syntax: LED:CURRent <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: LED:CURR 2

Query syntax: LED:CURR?

Returns: <NR2>

(3) LED: RCOeff sets the LED conduction coefficient

Command syntax: LED:RCOeff <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: LED: RCO 0.5

Query syntax: LED:RCO?

Returns: <NR2>

11.BATtery set the parameters in battery test mode

(1) BATtery:MODE Set the discharge mode of battery test

Command syntax: BATtery:MODE <mode>

Parameter: CURRent | RESistent | POWer

Example: BAT:MODE CURR

Query syntax: BAT:MODE?

Back: CURR | RES | POW

(2) BATtery:CONDition sets the stop condition of battery test

Command syntax: BATtery:CONDition <cond>

Parameter: VOLTage | TIMe | AH | WH

Example: BAT:COND VOLT

Query syntax: BAT:COND?

Back: VOLT | TIM | AH | WH

(3) BATtery:VALue sets the load value of battery test

Command syntax: BATtery:VALue <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: BAT:VAL 5

Query syntax: BAT:VAL?

Returns: <NR2>

(4) BATtery: LEVel sets the threshold for battery test

Command syntax: BATtery:LEVel <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: BAT:LEV 5

Query syntax: BAT:LEV?

Returns: <NR2>

12. TIMing set the parameters in time test mode

(1) TIMing: LOAD: MODE Set the load mode during time test

Command syntax: TIMing:LOAD:MODE <mode>

Parameter: CURR | VOLT | POW | RES | OFF

Example: TIM:LOAD:MODE CURR

Query syntax: TIM:LOAD:MODE?

Back: CURR | VOLT | POW | RES | OFF

(2) TIMing: LOAD: VALue set the load value during time test

Command syntax: TIMing:LOAD:VALue <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: TIM:LOAD:VAL 1

Query syntax: TIM:LOAD:VAL?

Returns: <NR2>

(3) TIMing: TSTart: SOURce sets the trigger source to start the test

Command syntax: TIMing:TSTart:SOURce <sour>

Parameter: VOLT | CURR | EXT

Example: TIM:TST:SOUR VOLT

Query syntax: TIM:TST:SOUR?

Back: VOLT | CURR | EXT

(4) TIMing: TSTart: EDGe sets the trigger edge for starting the test

Command syntax: TIMing:TSTart:EDGe <edge>

Parameter: RISE | FALL

Example: TIM:TST:EDG RISE

Query syntax: TIM:TST:EDG?

Back to: RISE | FALL

(5) TIMing: TSTart: LEVel sets the trigger level for starting the test

Command syntax: TIMing:TSTart:LEVel <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: TIM:TST:LEV 1

Query syntax: TIM:TST:LEV?

Returns: <NR2>

(6) TIMing: TEND: SOURce set the trigger source to stop the test

Command syntax: TIMing:TEND:SOURce <sour>

Parameter: VOLT | CURR | EXT

Example: TIM:TEND:SOUR VOLT

Query syntax: TIM:TEND:SOUR?

Back: VOLT | CURR | EXT

(7) TIMing: TEND: EDGe sets the trigger edge to stop the test

Command syntax: TIMing:TEND:EDGe <edge>

Parameter: RISE | FALL

Example: TIM:TEND:EDG RISE

Query syntax: TIM:TEND:EDG?

Back to: RISE | FALL

(8) TIMing: TEND: LEVel sets the trigger level to stop the test

Command syntax: TIMing:TEND:LEVel <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: TIM:TEND:LEV 1

Query syntax: TIM:TEND:LEV?

Returns: <NR2>

(9) TIMing: RESult query time test result

Command syntax: TIMing:RESult?

Example: TIM:RES?

Returns: <NR2>

13.OCP Set parameters in OCP test mode

(1) OCP: ISTart sets the starting current of OCP test

Command syntax: OCP:ISTart <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: OCP:IST 3

Query syntax: OCP:IST?

Returns: <NR2>

(2) OCP: IEND sets the OCP test cut-off current

Command syntax: OCP:IEND <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: OCP:IEND 3

Query syntax: OCP:IEND?

Returns: <NR2>

(3)OCP:STEP sets the incremental steps of OCP test

Command syntax: OCP:STEP <NR1>

Parameters: 1-1000 | MINimum | MAXimum

Example: OCP:STEP 100

Query syntax: OCP:STEP?

Returns: <NR1>

(4) OCP: DWELL sets the OCP test single step residence time

Command syntax: OCP:DWELL <NR2>

Parameters: 0.00001-0.99999 | MINimum | MAXimum

Example: OCP:DWELL 0.1

Query syntax: OCP:DWELL?

Returns: <NR2>

(5) OCP: VTRig sets the OCP test trigger level

Command syntax: OCP:VTRig <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: OCP:VTR 3

Query syntax: OCP:VTR?

Returns: <NR2>

(6) OCP:RESult[:OCP] Query the current value of the overcurrent protection point

Command syntax: OCP:RESult[:OCP]?

Example: OCP:RES?

Returns: <NR2>

(7) OCP:RESult:PMAX query PMAX point

Command syntax: OCP:RESult:PMAX?

Example: OCP:RES:PMAX?

Returns: <NR2>,<NR2>,<NR2>

14. OVP Set the parameters in OVP test mode

(1) OVP: VTRig sets the OVP test trigger level

Command syntax: OVP:VTRig <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: OVP:VTR 3

Query syntax: OVP:VTR?

Returns: <NR2>

(2) OVP:RESult[:OVP] Query voltage value at OVP point

Command syntax: OVP:RESult[:OVP]?

Example: OVP:RES?

Returns: <NR2>

(3) OVP:RESult:TIME query Tovp value

Command syntax: OVP:RESult:TIME?

Example: OVP:RES:TIME?

Returns: <NR2>

15. OPP Set the parameters in OPP test mode

(1) OPP: PSTart sets the starting power of OPP test

Command syntax: OPP:PSTart <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: OPP:PST 3

Query syntax: OPP:PST?

Returns: <NR2>

(2) OPP:PEND sets the cut-off power of OPP test

Command syntax: OPP:PEND <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: OPP:PEND 3

Query syntax: OPP:PEND?

Returns: <NR2>

(3) OPP:STEP sets the incremental steps of OPP test

Command syntax: OPP:STEP <NR1>

Parameters: 1-1000 | MINimum | MAXimum

Example: OPP:STEP 100

Query syntax: OPP:STEP?

Returns: <NR1>

(4) OPP: DWELL set OPP test single step residence time

Command syntax: OPP:DWELL <NR2>

Parameters: 0.00001-0.99999 | MINimum | MAXimum

Example: OPP: DWELL 0.1

Query syntax: OPP:DWELL?

Returns: <NR2>

(5) OPP: VTRig sets the OPP test trigger level

Command syntax: OPP:VTRig <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: OPP:VTR 3

Query syntax: OPP:VTR?

Returns: <NR2>

(6) OPP:RESult[:OPP] Query the power value of the overpower protection point

Command syntax: OPP:RESult[:OPP]?

Example: OPP:RES?

Returns: <NR2>

(7) OPP:RESult:PMAX query PMAX point

Command syntax: OPP:RESult:PMAX?

Example: OPP:RES:PMAX?

Returns: <NR2>,<NR2>,<NR2>

16. LEFFect Set the parameters in load effect mode

(1) LEFFect: IMIN sets the low level load current

Command syntax: LEFFect:IMIN <NR2>

Parameter: 0-I-Normal | MINimum | MAXimum

Example: LEFF:IMIN 2

Query syntax: LEFF:IMIN?

Returns: <NR2>

(2) LEFFect: IMAX sets the high level load current

Command syntax: LEFFect:IMAX <NR2>

Parameter: I-Normal-MAX | MINimum | MAXimum

Example: LEFF:IMAX 5

Query syntax: LEFF:IMAX?

Returns: <NR2>

(3) LEFFect: INORMal sets the normal load current

Command syntax: LEFFect:INORMal <NR2>

Parameter: IMIN- IMAX | MINimum | MAXimum

Example: LEFF:INORM 2

Query syntax: LEFF:INORM?

Returns: <NR2>

(4) LEFFect: DELay sets the current load time of each step

Command syntax: LEFFect:DELay <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: LEFF:DEL 20

Query syntax: LEFF:DEL?

Returns: <NR2>

(5) LEFFect:RESult:VOLTage Query the difference between the maximum voltage and the minimum voltage

Command syntax: LEFFect:RESult:VOLTage?

Example: LEFF:RES:VOLT?

Returns: <NR2>

(6) LEFFect:RESult:RESistance query internal resistance

Command syntax: LEFFect:RESult:RESistance?

Example: LEFF:RES:RES?

Returns: <NR2>

(7) LEFFect:RESult:REGulation query load adjustment rate

Command syntax: LEFFect:RESult:REGulation?

Example: LEFF:RES:REG?

Returns: <NR2>

17. SWEEP sets the parameters in the frequency conversion scan mode

(1) SWEEP: MODE sets SWEEP working mode

Command syntax: SWEEP:MODE <mode>

Parameter: AUTO | MANul

Example: SWEEP:MODE AUTO

Query syntax: SWEEP:MODE?

Back to: AUTO | MANUL

(2) SWEEP: IMIN sets Sweep minimum current

Command syntax: SWEEP:IMIN <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: SWEEP:IMIN 2

Query syntax: SWEEP:IMIN?

Returns: <NR2>

(3) SWEEP: IMAX sets the maximum current of Sweep

Command syntax: SWEEP:IMAX <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: SWEEP:IMAX 2

Query syntax: SWEEP:IMAX?

Returns: <NR2

(4) SWEEP: SLEW sets the same current rise and fall slopes in Sweep mode

Command syntax: SWEEP:SLEW[:BOTH] <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: SWEEP:SLEW 0.5

Query syntax: SWEEP:SLEW?

Return: <NR2>,<NR2>

(5) SWEEP:SLEW:RISE Set the current rising slope in Sweep mode

Command syntax: SWEEP:SLEW:RISE <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: SWEEP:SLEW:RISE 0.5

Query syntax: SWEEP:SLEW:RISE?

Returns: <NR2>

(6) SWEEP:SLEW:FALL Set the current falling slope in Sweep mode

Command syntax: SWEEP:FALL:RISE <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: SWEEP:SLEW:FALL 0.5

Query syntax: SWEEP:SLEW:FALL?

Returns: <NR2>

(7) SWEEP: FSTart sets the start frequency of Sweep

Command syntax: SWEEP:FSTart <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: SWEEP:FST 100

Query syntax: SWEEP:FST?

Returns: <NR2>

(8) SWEEP:FEND set Sweep cutoff frequency

Command syntax: SWEEP:FEND <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: SWEEP:FEND 100

Query syntax: SWEEP:FEND?

Returns: <NR2>

(9) SWEEP: FSTEP set Sweep step frequency

Command syntax: SWEEP:FSTEP <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: SWEEP:FSTEP 10

Query syntax: SWEEP:FSTEP?

Returns: <NR2>

(10) SWEEP: DWELL sets the duration of Sweep single point frequency

Command syntax: SWEEP:DWELL <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: SWEEP:DWELL 10

Query syntax: SWEEP:DWELL?

Returns: <NR2>

(11) SWEEP:DUTY Set Sweep duty cycle

Command syntax: SWEEP:DUTY <NR1>

Parameters: 0-MAX | MINimum | MAXimum

Example: SWEEP:DUTY 10

Query syntax: SWEEP:DUTY?

Returns: <NR1>

18. AUTO set parameters in automatic test mode

(1) AUTO: FILE Set the file and serial number to be set

Command syntax: AUTO:FILE <NR1>,<NR1>

Parameters: <file number>,<serial number>

Example: AUTO:FILE 1,1

Query syntax: AUTO:FILE?

Return: <NR1>,<NR1>

(2) AUTO: COUNT selects the number of loop counts corresponding to the file number

Command syntax: AUTO:COUNT <NR1>

Parameters: 0-MAX | MINimum | MAXimum

Example: AUTO:COUNT 10

Query syntax: AUTO:COUNT?

Returns: <NR1>

(3) AUTO ADD increases the number of steps corresponding to the selected file number

Command syntax: AUTO ADD

(4) AUTO CLEAR clears the data of the selected file

Command syntax: AUTO CLEAR

(5) AUTO DONE completes the data of the selected file

Command syntax: AUTO DONE

(6) AUTO: MODE selects the working mode of the selected file and serial number

Command syntax: AUTO:MODE <mode>

Parameters: CURRent | VOLTage | RESistance | POWer

Example: AUTO:MODE CURR

Query syntax: AUTO:MODE?

Returns: CURR | VOLT | RES | POW

(7) AUTO: LEVel sets the working value of the selected file and serial number

Command syntax: AUTO:LEVel <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: AUTO:LEVel 5

Query syntax: AUTO:LEVel?

Returns: <NR2>

(8) AUTO: SLEW sets the rising and falling slopes of the selected file and the same serial number

Command syntax: AUTO:SLEW[:BOTH] <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: AUTO:SLEW 3

Query syntax: AUTO:SLEW?

Returns: <NR2>

(9) AUTO: SLEW: RISE sets the rising slope of the selected file and serial number

Command syntax: AUTO:SLEW:RISE <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: AUTO:SLEW:RISE 3

Query syntax: AUTO:SLEW:RISE?

Returns: <NR2>

(10) AUTO: SLEW: FALL sets the falling slope of the selected file and serial number

Command syntax: AUTO:SLEW:FALL <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: AUTO:SLEW:FALL 3

Query syntax: AUTO:SLEW:FALL?

Returns: <NR2>

(11) AUTO: IRANge sets the current range of the selected file and serial number

Command syntax: AUTO:IRANGe <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: AUTO:IRANGe MAX

Query syntax: AUTO:IRANGe?

Returns: <NR2>

(12) AUTO: VRANGe sets the voltage range of the selected file and serial number

Command syntax: AUTO:VRANGe <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: AUTO:VRANGe MAX

Query syntax: AUTO:VRANGe?

Returns: <NR2>

(13) AUTO: LIMIT sets the limit type of the selected file and serial number

Command syntax: AUTO:LIMIT <mode>

Parameters: CURRent | VOLTage | POWer | NONE

Example: AUTO:LIMIT CURR

Query syntax: AUTO:LIMIT?

Returns: CURR | VOLT | POW | NONE

(14) AUTO: UPPer sets the upper limit of the selected file and serial number

Command syntax: AUTO:UPPer <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: AUTO:UPPer 3

Query syntax: AUTO:UPPer?

Returns: <NR2>

(15) AUTO: LOWer sets the lower limit of the selected file and serial number

Command syntax: AUTO:LOWer <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: AUTO:LOWer 3

Query syntax: AUTO:LOWer?

Returns: <NR2>

(16) AUTO: FAIL to set the failed operation of the selected file and serial number

Command syntax: AUTO:FAIL <mode>

Parameters: CONTINuous | ABORT

Example: AUTO:FAIL CONTIN

Query syntax: AUTO:FAIL?

Returns: CONTIN | ABORT

(17) AUTO: TYPe sets the delay type of the selected file and serial number

Command syntax: AUTO:TYPe <mode>

Parameters: TIMe | TRIG

Example: AUTO:TYP TIM

Query syntax: AUTO:TYP?

Returns: TIM | TRIG

(18) AUTO: TIMe sets the delay time of the selected file and serial number

Command syntax: AUTO:TIMe <NR2>

Parameters: 0-MAX | MINimum | MAXimum

Example: AUTO:TIM 3

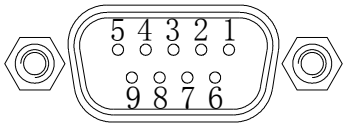
Query syntax: AUTO:TIM?

Returns: <NR2>

Chapter 7 Handler

7.1 Basic Information

This instrument provides users with a powerful HANDLER interface, as shown in Figure 7-1. This interface can be used to receive external trigger signals, control signals, and output of instrument sorting results.



HANDLER

Table 7-1 shows the functions of each interface of the HANDLER interface.

1	DGND	Digital ground (earth/chassis ground/power ground)
2	ON	External ON/OFF control signal, low pulse is effective
3	TRIG	External trigger signal, low pulse is effective
4	AGND	Inside the instrument
5	VF/EXT-PROG	Inverse voltage polarity signal/external analog (two signals are optional, and the factory is EXT-PROG)
6	PASS2	Success signal
7	PASS1	Success signal
8	FAIL2	Failure signal
9	FAIL1	Failure signal

Table 7-1

7.2 Operation Instruction

This section introduces how to use the functions of the HANDLER interface.

7.2.1 ON

This interface function is equivalent to the front panel ON/OFF key, and the low pulse signal is effective. When a low pulse signal is received, the load is pulled and the ON/OFF button LED lights up. When the low pulse signal is received again, the load stops pulling and the ON/OFF button LED is off.

7.2.2 TRIG

The interface can be used together for multiple functions.

- Dynamic mode: In this mode, the interface function is equivalent to the TRIG key on the front panel, and the low pulse signal is effective. For detailed functions, see chapter 3.2 Dynamic Mode (Dynamic).

- Time test: In this mode, the start condition or end condition is set as external trigger, and the rising or falling edge is set at the same time. When the interface receives the corresponding signal, the load realizes the corresponding function. For detailed functions, see Chapter 3.6 Timing Test (Timing).
- Automatic test: Under the changed mode, when the delay type of a step is set as trigger, the interface function is equivalent to the TRIG key on the front panel, and the low pulse signal is effective. For detailed functions, see Chapter 3.11 Auto Test (Auto).

7.2.3 VF/EXT-PROG

The instrument can be configured within the instrument, the factory default is EXT-PROG.

- VF: Reverse polarity indication signal. When the polarity of the load input terminal is reversed, this port outputs.
- EXT-PROG: external analog input, you can simulate the input from 0 to full scale by connecting the 0-10V voltage of this port to adjust the input voltage and current value of the load. In the <System Settings> page, you can select whether the external analog quantity is connected to the function of the instrument.

7.2.4 PASS/FAIL

Connect this interface to the external relay interface. During the automatic test, the corresponding Pass or Fail signal is output according to the load test result.

Chapter 8 Service & Maintenance

Maintenance

There are no user serviceable parts inside the unit. Your DC Electronic Load is thoughtfully engineered for ease of use, accuracy and reliability. The instrument is carefully tested and calibrated using standards traceable to National Laboratories. Take care of your instrument by cleaning the exterior of the instrument regularly with a dusting brush. Dirt which is difficult to remove on the casing & plastic parts, can be removed with a moist cloth (99% water, 1% mild detergent) spirit or washing benzene(petroleum ether) can be used to remove greasy dirt. The display may be cleaned with water or washing benzene (but not with spirit- alcohol solvents), it must then be wiped with a dry clean lint-free cloth. Under no circumstances the cleaning fluid should get into the instrument. The use of cleaning agents can attack the plastic & paint surfaces.

Dispatch Procedure for Service

No user serviceable parts are inside the instrument, should it become necessary to send back the instrument to factory for service, please observe the following procedure:

1. Before dispatching the instrument please write to us giving full details of the model number, serial number, fault noticed and contact details of concerned person.
2. After receipt of your communication, our service department will advise you whether it is necessary to send the instrument back to us for repairs or the adjustment is possible in your premises.
3. Dispatch the instrument (only on the receipt of our advice) securely packed in original packing duly insured and freight paid along with accessories and a copy of the faults details noticed at our Service Center listed on last page of this manual, nearest to you.

Chapter 9 Warranty Conditions

Scientific warrants all its Instruments to be free from defects in material and workmanship when used under normal operating conditions in accordance with the instructions given in the manual for a period of 12 (Twelve) months from date of purchase from Scientific or its authorized dealers.

The service during the warranty period will be rendered on return to factory / service center basis.

1. Its obligation under this warranty is limited to repairing or replacing at its own discretion. This warranty shall not apply to any defect, failure or damage caused by accident, negligence, mis-application, alteration or attempt to repair, service or modify in any way.
2. This warranty does not include display, fuses, batteries or accessories. This warranty is only valid with the original purchaser who must have properly registered the product within 15days from date of purchase. No other warranty is expressed or implied.
3. When it becomes necessary to return the instrument to our Factory facility, kindly pack it carefully in the original carton or equivalent and ship it duly insured, transportation charges prepaid.
4. Your Scientific instrument is a complex electronic device and deserves the best service available by technicians thoroughly familiar with its service and calibration procedures.