User's Guide

SUIN

SA5052
Digital Multimeter

Brief Introduction

SA5052 is fast and high accuracy, multi-function and auto measurement instrument for Voltage, Current, Resistance, Frequency. The simple front panel and convenient operation support the demand in measurement.

All Functions:

Measurement Functions:

- DC Voltage: 0.1V, 1V, 10V, 100V, 1000V.

- AC Voltage: 0.1V, 1V, 10V, 100V, 750V.

- DC Current: 10mA, 100mA, 1A, 10A.

- AC Current: 10mA, 100mA, 1A, 10A.

- 2 & 4 wire resistance: 100Ω, 1KΩ, 10KΩ, 100KΩ, 1MΩ, 10MΩ, 100MΩ.

- Frequency: 3Hz-1MHz.

- Period

- Diode

- Continuity

- Thermocouple and Temperature

Additional Functions:

dB, dBm, Percentage (%)，Maximum/Minimum (MAX/MIN), Null, Limits, Data Store and Recall(Store/Recall), Trigger (Trig)

Remote Control:

- RS232 interface

- USB interface

- GPIB interface

Standard Accessories and options

Standard Accessories:

- Power Cord   1

- Testing Lead   1

- CD disk   1

Options:

- IEEE-488 interface board   1

Safety Information

Review the following safe precautions to avoid injury and prevent damage to the product or any products connected to it. To avoid potential hazards, please make sure of the product only as specified.

1. Use power cord as specified.

    Use only power cord specified for this product and approved for the country of use.

2. Ground the product

    This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals, ensure that the product is properly grounded.

3. Instructions

    Review user's manual for detailed information of rating values before making connections to this product.

4. Do not operate without covers

    Do not operate this product with covers or panels removed.

5. Use proper fuse.

    Use only the fuse type and rating specified for this product.

6. Do not operate with suspected failures.

    If you suspect there is damage, stop using and contact us.

7. Provide proper ventilation

    Do not operate this product in wet or damp conditions.

    Do not operate this product under inflammable environment.

In this book

Chapter 1 Quick Start

Chapter 2 Measurement Functions

Chapter 3 Features and Functions

Chapter 1 Quick Start

1.1Front Panel at a Glance

① Measurement Function keys

② Auxiliary function keys

③ Math Operation keys

④ Config Enter keys

⑤ Menu Operation keys (Range)

1.2 Rear Panel at a Glance
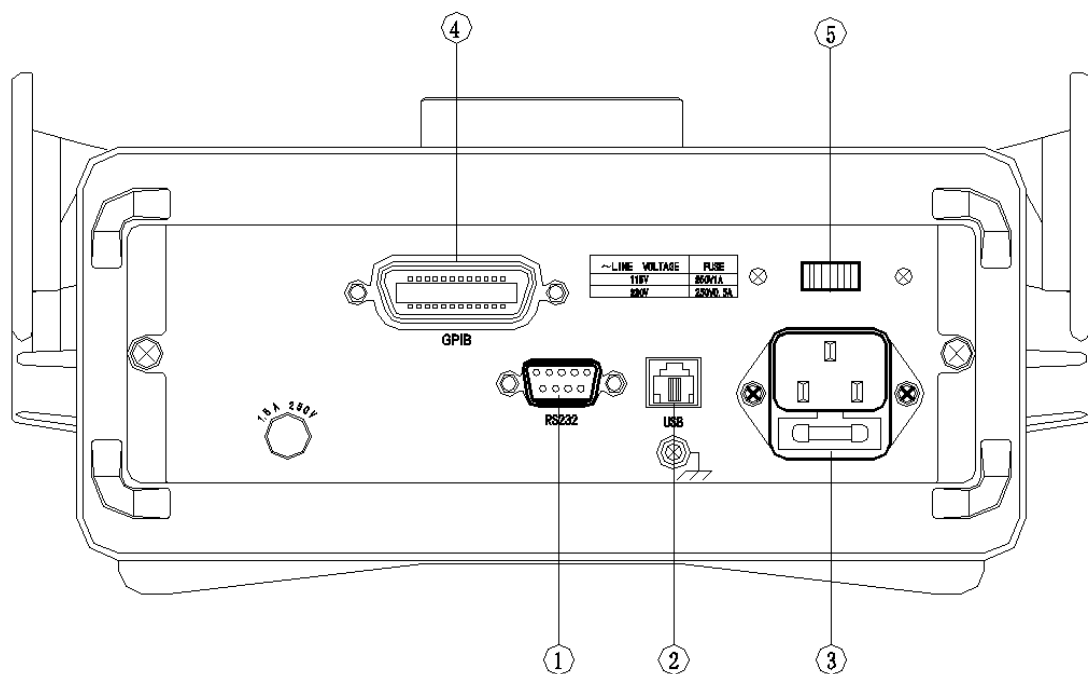
① RS232 interface connector

② USB interface connector

③ Power socket

④ GPIB interface connector

⑤ Power-Line Voltage Settting Switch

1.3 Display Annunciators
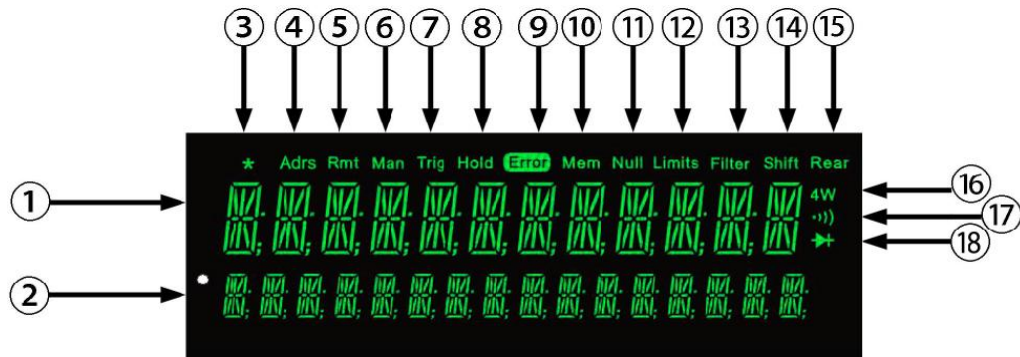
① Main display line

② Secondary display line

③ *   (Turns on during a measurement)

④ Adrs (GPIB interface display)

⑤ Rmt (Remote interface operation)

⑥ Man (Manual ranging, autorange is disabled)

⑦ Trig (Waiting for a single trigger or external trigger)

⑧ Hold (Reading hold is enabled)

⑨ Error (Error Queue)

⑩ Mem (Turns on when reading memory is enabled)

⑪ Null (Null function is enabled)

⑫ Limits (Limit test function is enabled)

⑬ Filter (Filter function is enabled)

⑭ Shift ("Shift" key has been pressed)

⑮ Rear (Rear input terminal are selected)

⑯ 4W (In 4-wire ohms or temperature function)

⑰   ∘⟩⟩ (In continuity test function)

⑱ ⊳⊦ (In diode test function)

1.4 Front Panel Menu at a Glance

The menu of SA5052 is organized in a top-down tree struction with three levels, menu, commonds and parameters.
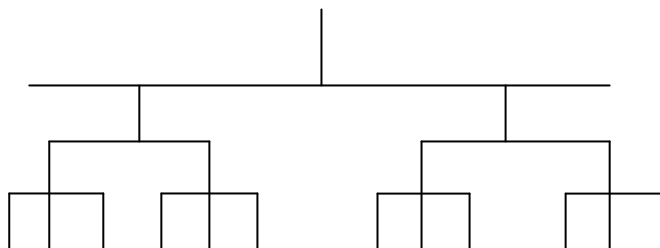
【Config】+【Enter】   enable current measurement function menu

【Config】+"Function keys"   enable current measurement function and math function

【Shift】+【Config】+【Enter】   enable other menus

【<】【>】   left/right shift menu

【Enter】   enter into the next level menu

【Shift】+【Enter】   back to upper level menu

A:Measurement Menu

【Config】+【DCV】/【Config】+【Shift】+【DCV】   :

1:RESOLUTION ⟶ 2:INPUT R

【Config】+【ACV】/【Config】+【Shift】+【ACV】   :

ACV FILTER

【Config】+【Ω2W】/【Config】+【Shift】+【Ω2W】 :

RESOLUTION

【Config】+【Freq】/【Config】+【Shift】+【Freq】 :

RESOLUTION

【Config】+【 ◦⁾⁾⁾ 】   :

0010 OHM

【Config】 + 【Temp】   :

  1:SENSOR⟶   2:UNITS⟶   3:MODE

B:Math Menu

【Config】 + 【NULL】   :   +0.000000m   (NULL VALUE)

【Config】 + 【Limits】   :   +1.000000∧   (HI LIMIT)

【Config】 + 【MX+B】   :   +1.000000∧   (SET M)

【Config】 + 【MIN/MAX】   :   +0.000000E+00 (MIN)

【Config】 + 【Shift】 + 【NULL】   :   +1.000000∧   (dB REF)

【Config】 + 【Shift】 + 【Limits】 :   0600   OHM   (dBm REF)

【Config】 + 【Shift】 + 【MX+B】   :   +1.000000∧   (PERCENT REF)

Other Menu

【Shift】 + 【Config】 + 【Enter】 :

  1:TRIG MENU ⟶ 2:SYS MENU ⟶ 3:INTERFACE ⟶ 4:CAL MENU

C:Trigger Menu

  1:READ HOLD ⟶ 2: N SAMPLES

D:System Menu

  1:RDGS STORE ⟶ 2: BEEP   3:REVISION

E:Interface Menu

  1:RS-232 ⟶ 2:USB ⟶ 3:GPIB

F:Calibration Menu

1:SECURED⟶ [1:UNSECURED]⟶ 2:CALTBRATE

1.5 Front Panel Menu Reference

A:Measurement Menu

1:RESOLUTION   select measurement resolution

2:INPUT R   set input resistance to test DC voltage

3:AC FILTER   select Slow, Medium or Fast AC Filter

4:CONTINUITY   set continuouse buzzer threshold from 1 ohm to 1000

                                            ohms.

5:SENSOR   select temperature sensor type

6:UNITS   select temperature unit

7:MODE   select connection mode

B:Math Menu

1:NULL VALLUE   recall or set the null value memoried in register

2:dB REL   recall and set the dB value memoried in register

3:LIMIT/HI   set the high limit

4LIMIT/LOW   set the low limit

5:dBm REL   set the reference resistance for dBm

6:MX+B/M   set the M in MX+B

7:MX+B/B   set the B in MX+B

8:PERCENT   set the reference in 100%

9:MIN/MAX:MIN   recall the minimum in MIN./MAX

10:MIN/MAX:MAX   recall the maximum in MIN./MAX

11: MIN/MAX:AVERAGE   recall the average in MIN./MAX

12: MIN/MAX:COUNT   recall the count in MIN/MAX

C: Trigger Menu

1:READ HOLD   set the read hold sensitive band

2:N SAMPLES   set the sample number for trigger

D: System Menu

1:RDGS STORE   enable and disable the reading storage

2:BEEP   enable or disable the buzzer

3:REVISION   display the firmware revision

E: Interface Menu

1:RS-232   select RS-232 baud rate

2:USB   select USB operation

3:GPIB   set GPIB address (0-31)

F: Calibration Menu

1:SECURED   calibration protection, input password to cancel it.

1:UNSECURED   input password to enter into caliabration protection.

2:CALTBRATE   run all the calibration of gain

1.6 Other Introductions

1.6.1 If the Multimeter does not turn on

1. Verify that there is AC power to the multimeter.

   Make sure that the power cord is firmly plugged into the power module on the rear

panel.

2. Verify the power-line voltage setting.

   The line voltage is set to the proper value for your country when the multimeter is

   shipped from the factory. If it is not correct, please change the voltage setting as 110Vac

   or 220Vac.

3. Verify that the power-line fuse is good.

   Fuse type: 500mAT, 250V

1.6.2 Replace the power-line fuse

The power-line fuse is assembled in the fuse-holder at rear panel. For all power voltage,

the 500mAT slowly melting fuse is needed.

1.6.3 Replace current input fuse

Current input terminal are protected by two fuses, one is 1.5A, 250Vac fast-melt fuse on

the rear panel.

The other one is assembled in the multimeter to supply the current protection for 10A input terminal, which is 15A, 250Vac fuse. Once replace this fuse, the case of multimeter need to be opened.

1.6.4 State of power-on and reset

Measuring Configuration	Factory Setting
Function	DC(DC Voltage)
Range	Autorange for all funtions
Resolution	51/2 (slow mode)
Input Impedance	10MΩ (for all DC range)
AC Filter	20Hz (Low Filter)
Continouse Threshold	10Ω

Math operation	Factory Setting
Math state	OFF
Math register	Clear（all register）
dB relative value	0
dBm reference value	600Ω

Trigger Operation	Factory Setting
Trigger count	1
Trigger source	Immediate
Trigger delay	Auto Delay

System Operation	Factory Setting

Buzzer mode	ON
Display mode	ON
Reading memory	Clear
Interface	RS232
Baud rate	9600
GPIB address	22

Chapter 2 Measurement Functions

2.1 To measure DC Voltage

Ranges: 100mV, 1V, 10V, 100V, 1000V

Maximum Resolution: 1uV

Configurable parameters: Integration, Input Z
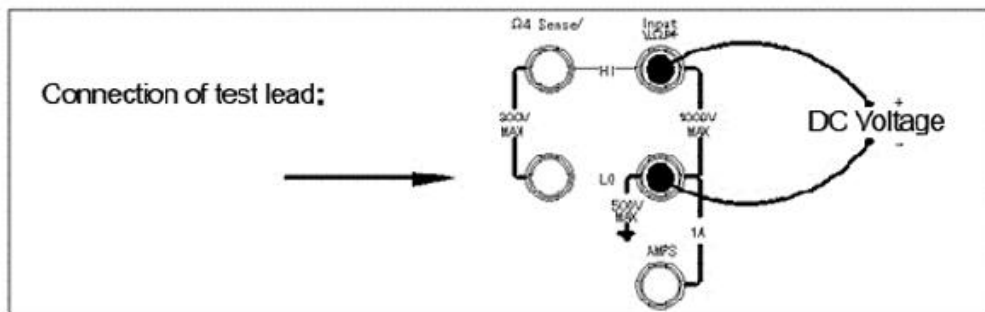
Measurement Method:

1. Connect as picture shows.

2. Press 【DCV】key to measure DC voltage.

3. Press【∧】or【∨】key to select range manually. Press【AUTO/MAN】key to select auto range.

4. If "OVRFLW" is shown, it indicates that the measuring voltage is over the range.

Note: (1) DC voltage over 1000V is never allowed to input terminal to avoide destroy to multimeter and danger to human.

2.2 To measure DC Current

Ranges: 10mA, 100mA, 1A，10A

Maximum Resolution: 100nA

Configurable parameter: Integration

Connection of test lead:

1A DC Current

Connection of test lead:

10A DC Current

Measurement Method:

  1. Connect as picture shows.

  2. Press 【Shift】【DCV】 key to measure DC current.

  3. Press【∧】or【∨】key to select range manually. Press【AUTO/MAN】key to select
     auto range. Auto range set to be 1A. If user would like to test current more than 1A,
     he have to press 【∧】 to set 10A range and make the 10A terminal connected with
     testing lead.

  4. If "OVRFLW" is shown, it indicates that the measuring current is over the range.

  **Note: (1) DC current over 1A, 250V or 10A, 250V is never allowed to input
          terminal to avoid destroy to multimeter and danger to human.**

  **(2) If AMPS fuse is burn out due to the over current, please change the fuse
       on rear panel.**

2.3 To measure AC Voltage

Ranges: 100mV, 1V, 10V, 100V, 750V

Maximum Resolution: 1μV

AC technique: True RMS, AC coupled

Configurable parameters: AC Filter
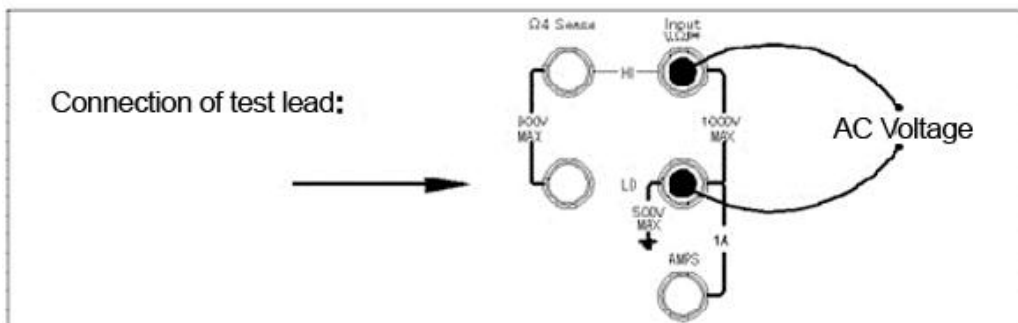
Measurement Method:

1. Connect as picture shows.

2. Press 【ACV】key to measure AC voltage.

3. Press【∧】or【∨】key to select range manually. Press【AUTO/MAN】key to select

   auto range.

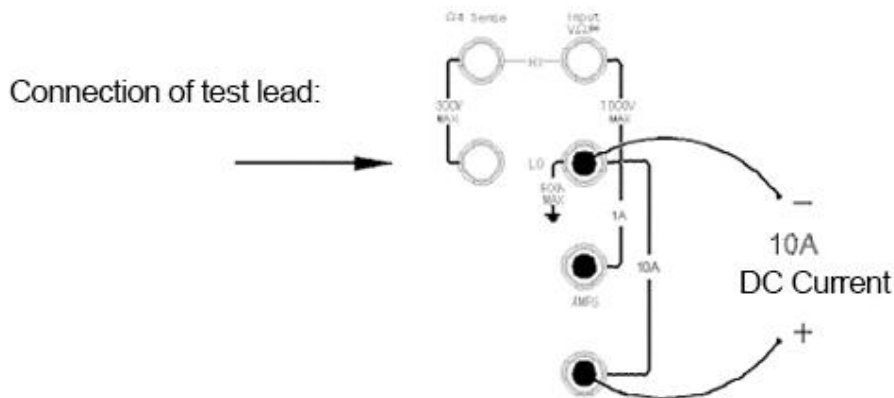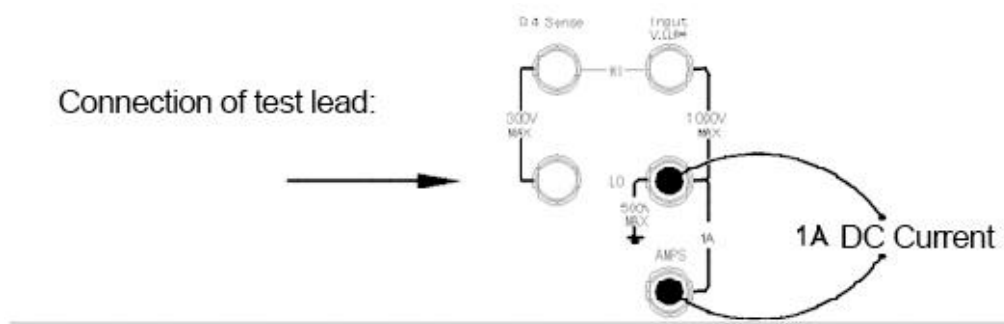4. If "OVRFLW" is shown, it indicates that the measuring voltage is over the range.

Note: (1) AC voltage over 750V TRMS is never allowed to input terminal to avoide

destroy to multimeter and danger to human.

2.4 To measure AC Current

Ranges: 10mA, 100mA, 1A, 10A

Maximum Resolution: 1μA

AC technique: True RMS, AC coupled

Configurable parameters: AC Filter

Connection of test lead:

1A AC Current

Connection of test lead:

10A
AC Current
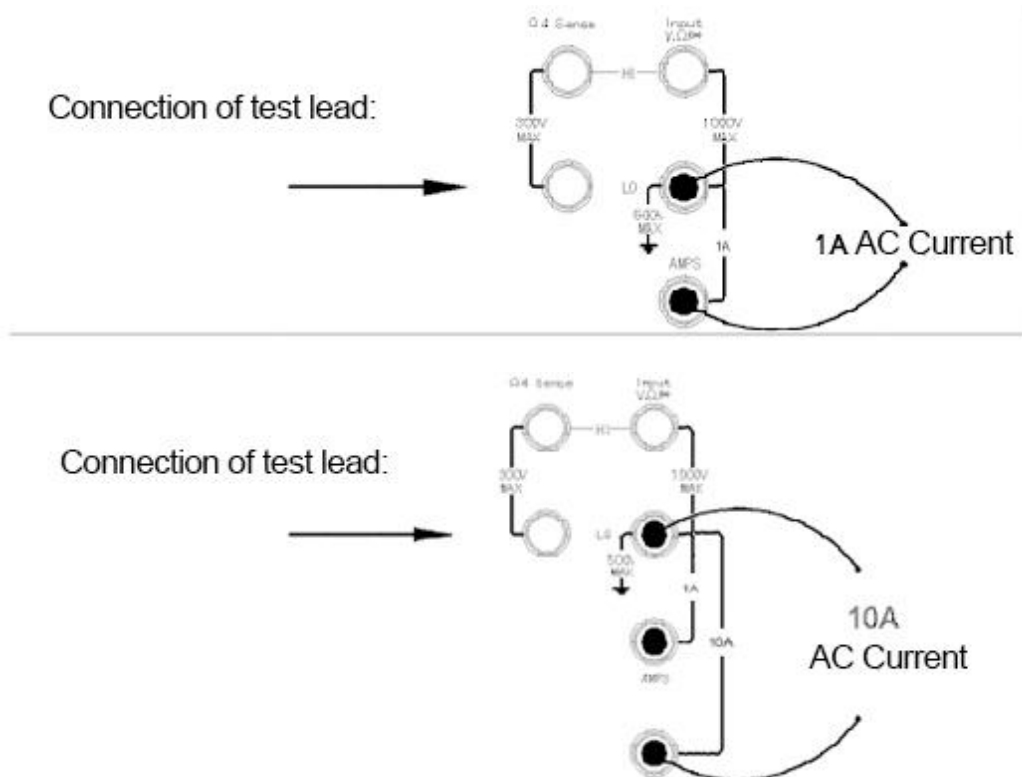
Measurement Method:

1. Connect as picture shows.

2. Press 【Shift】【ACV】 key to measure AC current.

3. Press【∧】or【∨】key to select range manually. Press【AUTO/MAN】key to select auto range. Auto range set to be 1A. If user would like to test current more than 1A, he have to press 【∧】 to set 10A range and make the 10A terminal connected with testing lead.

4. If "OVRFLW" is shown, it indicates that the measuring current is over the range.

Note: (1) DC current over 3A, 250V is never allowed to input terminal to avoid destroy to multimeter and danger to human.

(2) If AMPS fuse is burn out due to the over current, please change the fuse on rear panel.

2.5 To measure 2 wire resistance

Ranges: 100Ω, 1kΩ, 10kΩ, 100kΩ, 1MΩ, 10MΩ, 100MΩ

Maximum resolution: 1mΩ

Cnfigurable parameter: Integration
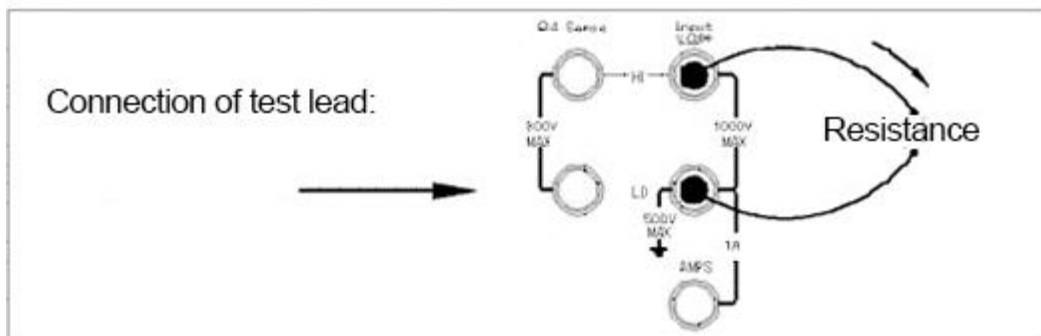
Measurement Method:

1. Connect as picture shows.

2. Press 【Ω2W】 key to measure 2 wire resistance.

3. Press【∧】or【∨】key to select range manually. Press【AUTO/MAN】key to select auto range.

4. If "OVRFLW" is shown, it indicates that the measuring resistance is over the range.

Note: (1) DC voltage over 1000V is never allowed to input terminal to avoide destroy to multimeter and danger to human.

To eliminate the resistance of test lead:

1 Make one end of test lead connected to multimeter and short the probe end together.

2 Press "Null" key.

3 Make the test probe end connected to test circuit and measure the calibrated resistance.

2.6 To measure 4 wire resistance

Ranges: 100Ω, 1kΩ, 10kΩ, 100kΩ, 1MΩ, 10MΩ, 100MΩ

Maximum resolution: 1mΩ

Cnfigurable parameter: Integration

Connection of test lead:
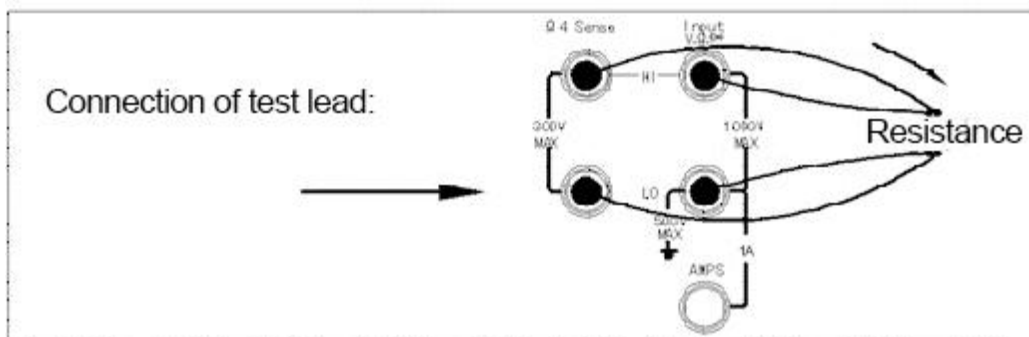
Measurement Method:

1. Connect as picture shows.

2. Press 【Shift】【Ω2W】 key to measure 4 wire resistance.

3. Press【∧】or【∨】key to select range manually. Press【AUTO/MAN】key to select

auto range.

4. If "OVRFLW" is shown, it indicates that the measuring resistance is over the range.

Note: (1) DC voltage over 300V is never allowed to input terminal to avoide destroy

to multimeter and danger to human.

2.7 To measure Frequency (or Period)

Frequency range: 20Hz to 1MHz (1μs to 50ms)

Input signal range: 100mVAC to 750VAC

Technique: reciprocal counting

Configurable parameter: GATE TIME

Connection of test lead:
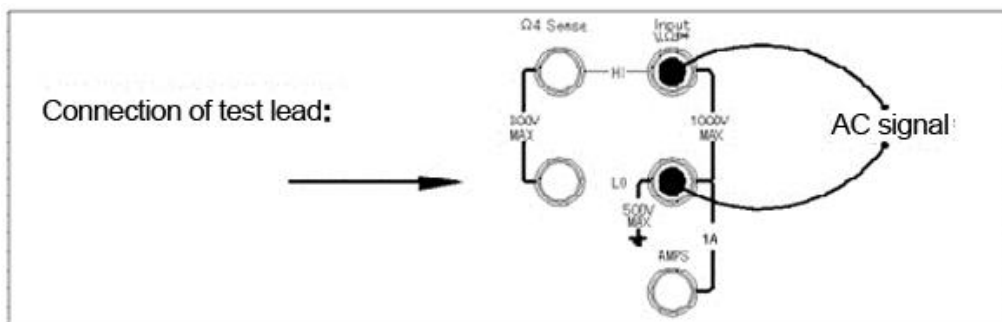
Measurement Method:

1. Connect as picture shows.

2. Press 【Freq】or【Shift】+【Freq】key to measure frequency or period.

3. Press【∧】or【∨】key to select range manually. Press【AUTO/MAN】key to select auto range.

4. If "VAC OVERLOAD" is shown, it indicates measuring voltage is over the range.

Note: (1) DC voltage over 1000V is never allowed to input terminal to avoide destroy to multimeter and danger to human.

2.8 To test continuity

Test current source: 1mA

Maximum resolution: 0.1Ω (range is fixed at 1KΩ)

Beeper threshold: 1Ω to 1kΩ (beeps below adjustable threshold)

Connection of test lead:

Measurement Method:

1. Connect as picture shows.

2. Press 【 ◦⟩⟩ 】 key to measure continuity.

Note: (1) DC voltage over 1000V is never allowed to input terminal to avoide

destroy to multimeter and danger to human.

2.9 To measure diode

Test current source: 1mA

Maximum resolution: 100uV（range is fixed at 10VDC）

Beeper threshold: $0.3V \leq$ Vmeasured $\leq 0.8V$ （not adjustable）

Measurement Method:

1. Connect as picture shows.

2. Press【Shift】【 ◦⟩⟩ 】 key to measure diode.

Note: (1) DC voltage over 1000V is never allowed to input terminal to avoide

destroy to multimeter and danger to human.

2.10 To measure capacitance

Ranges: 1nF, 10nF, 100nF, 1uF, 10uF

Maximum resolution: 1pF

Connection of test lead: → Capacitance
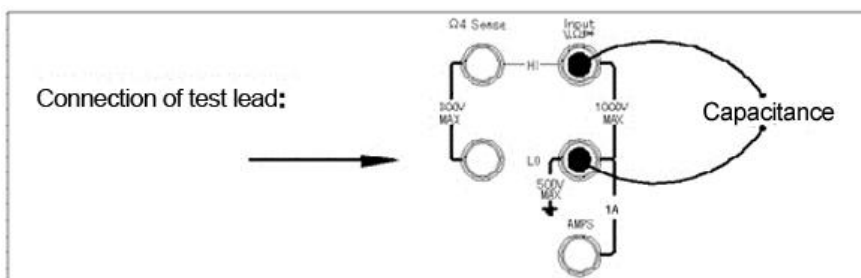
Measurement Method:

1. Connect as picture shows.

2. Press【Shift】【Temp】key to measure diode.

3. Press【∧】or【∨】key to select range manually. Press【AUTO/MAN】key to select auto range. For Manual operation, capacitance less 1/10 of range, that will show LOWER.

4. If "OVRFLW" is shown, it indicates measuring capacitance is over the range.

Note: (1) DC voltage over 1000V is never allowed to input terminal to avoide destroy to multimeter and danger to human.

2.11 To measure temperature

Measurement modes of SA5052 for temperature is RTD. The accuracy of RTD at 4 wire measurement is higher and more stable. Below measuring range under different interaction modes for user selection:

Interaction modes	Temperature(℃)	Temperature℉
RTD(PT100)	-200~800	-392~1312

Configurable parameters: Probe Type, Unit, Mode

Connection of test lead: → RTD

Connection of test lead:
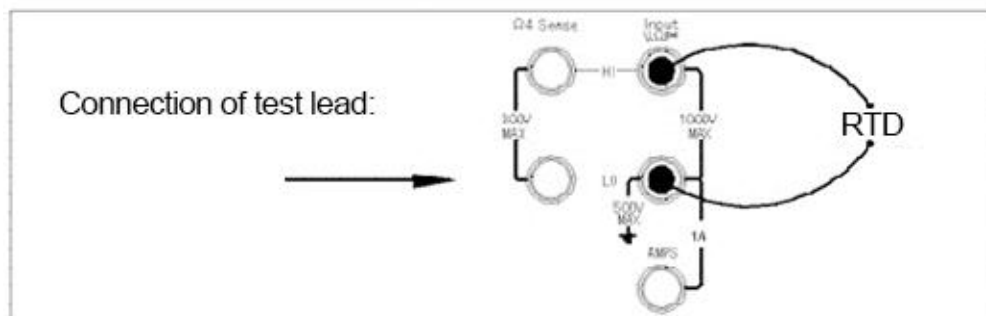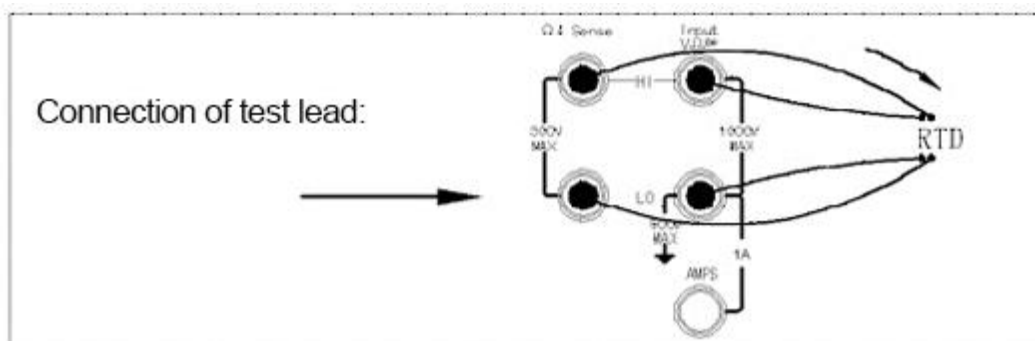
Measurement Method:

　　1. Connect as picture shows.

　　2. Press【Temp】key to measure temperature.
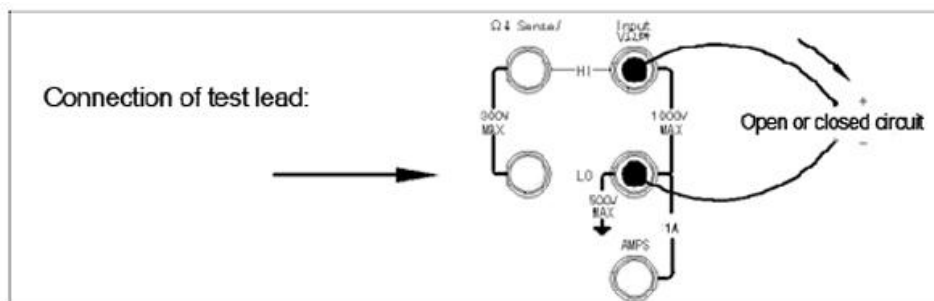
　Note: (1) DC voltage over 1000V is never allowed to input terminal to avoide

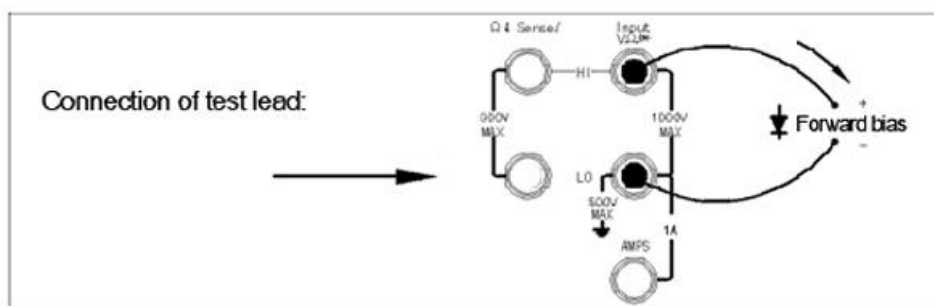　　　　**destroy to multimeter and danger to human.**

Chapter 3 Features and Functions

3.1 Front panel display

SA5052 has two lines display, the indicator on which shows the non-default working state.

3.1.1 Displayed message

When measuring, the main line shows current reading with unit (like ""-1.000,00 VDC"). The second line shows the range. For some measuring functions, the second line can be enabled to indicate the subsidiary measuring function. When menu enabled, the main line show the menu message.

Menu Tutorial

- In this book, the positioning keys include 【∧】, 【∨】, 【<】, 【>】and【Enter】.
- Some keys for menu open, like:

  【Config】to configure current selected measuring function

  【Menu】 to configure the paramenter of system menu

- Press【Shift】 key to open or close shif function as the Shift indicator lights on or off.

- If multimter is under remote control mode (**Remote** indicator enabled), press【Shift】to return to local operation.

- After entering into a menu, press 【<】 or 【>】key to view the menu option from first line. The menu information will roll but not at next line.

- Press 【Enter】key to confirm the choice on the menu level or enter into the next level. If at the last level menu, press【Enter】key to exit.

- When finish the menu operation, press 【Shift】+【Enter】key to exit the menu.

3.1.2 Shortcut keys on front panel

There are two shortcut keys for common used functions: **Range** and **Digit**

Range: to select range directly with positioning keys.

● To change range manually, press 【∧】 or 【∨】 keys. **Man** annunciator is on when manual range is enabled, the second line indicates the selected range.

● Press 【AUTO/MAN】 key to switch between autoranging and manual ranging, and the **Man** annunciator is on or off accordingly.

Digit：to cover up reading on main display (change the display digits).

3.2 Measuring configuration

3.2.1 To set resolution

Different display resolution settings for different functions, for DC Voltage, DC Current and Resistance functions, users should set resolution according to sampling power period multiple. Resolution includes fast 3 ½ , medium 4 ½ , and slow 5 ½ . If you want to increase the measurement accuracy and noise rejection, please set 5 ½ digits. If you want to speed up the measurement, please set 3½ digits.

Resolution is local to all selected functions. Math operation resolution is same as measurement resolution.

Front panel operation：Press【Config】key and relevant function key, which shows RESOLUTION. Then press 【Enter】key to enter into the subdirectory and press 【<】 or 【>】 key to select suitable parameter, finally confirm by【Enter】key pressing.

● The resolution setting is stored in volatile memory. The resolution is set to 5½ digits at power-on and after remote control reset.

● Resolution is fixed as 3½ digis at Continuity and Diode testing.

3.2.2 To set AC Filter

Three AC filter choices for improving the measurement, 20Hz, 100Hz and 200Hz. For ac voltage and ac current testing, filter can be used to improve the measurement result.

Front panel operation： Press【Config】key + 【ACV】 key, which shows ACV FILTER. Then press 【Enter】 key to enter into the subdirectory and press 【<】or【>】key to select suitable parameter, finally confirm by【Enter】key pressing.

- The AC Filter setting is stored in volatile memory. The ac filter is set to slow filter 20Hz at power-on and after remote control reset.

3.2.3 To set DC input impedance

For all dc voltage range, the default input impedance is fixed as 10 MΩ to mimum the noise. But when test low voltage, you should reduce the error by load effect. For example, for the range of 100mVdc, 1 Vdc and 10 Vdc, you can set the resistance above >10 GΩ.

Front panel operation： Press 【Config】+【DCV】 key and select INPUT by pressing of 【<】or【>】 key. Then press 【<】or【>】 key to select suitable parameter, finally confirm by【Enter】key pressing.

- ●The dc input impedance setting is stored in volatile memory. Default setting is 10MΩ at power-on and after remote control reset.(for all DC voltage range).

3.2.4 To set continuity threshold

Range is 1KΩ (2 wire resistance test).

Once the measurement less or equal to continuity threshold, the multimeter will beep and display the actural resistance on front panel. The threshold resistance can be set from 1Ω to 1kΩ.

Front panel operation： Press 【Config】 key + 【 ᵒ⁾⁾ 】 key, which shows threshold resistance. Then press 【<】, 【>】, 【∧】or【∨】key to select suitable parameter, finally confirm by【Enter】key pressing.

- Threshold is only allowed to be set on front panel.
- The threshold resitance setting is stored in volatile memory. Default setting is 10Ω at power-on and after remote control reset.

3.2.5 To set aperture time

For freqeuency and period measurement, the function of aperture time is similar as gate time and intergral time, can be set as 100ms (4 1/2 digits), 0 or 1s (5 1/2 digits).

Front panel operation：Press 【Config】+【Freq】key or【Freq】key, which shows RESOLUTION. Then press 【Enter】 key to enter into subdirectory, press 【<】or【>】 key to select suitable parameter, finally confirm by【Enter】key pressing.

● The speture time setting is stored in volatile memory. Default setting is 1s at power-on and after remote control reset (5 1/2 digits).

3.2.6 To set temperature senor probe

Multimeter has several RTD options, includes D100, F100, PT385, PT3916, PT100.

Front panel operation：Press 【Config】+【Temp】key, which shows termperature parameters, like sensor type, unit, 2 or 4 wire type. Then press press 【<】or 【>】key to select suitable parameter, finally confirm by【Enter】key pressing.

● The temperature parameter setting is stored in volatile memory. Default setting is 4-wire PT100 at power-on and after remote control reset.

3.3 Math operation

Multimter has 7 math operations, includes MAX/MIN, NULL, dB, dBm, MX+B, 100% and Limit testing. Every time only one operation allowed to be enabled for each reading or stored series readings. The operation is local to the selected function, when you cancel, change, turn off the power or perform a remote interface reset, operation is disabled.

Math operation is not available for Conunity or Diode test.

3.3.1 MAX/MIN

You can store the minimum and maximum readings during a series of measurements and the multimeter can calculate the average of all readings and record the reading count.

After enabling min-max, the first reading will be stored as minimum and maximum, and replaced by following smaller value or greater value.

Once find the maximum or minimum, multimeter beeps with the Min or Max annuiator incicating (only if beep function is on) . If the reading has no change but device beeps, the possibility is that the internal resolution of multimeter bigger than display resolution.

Front panel operation：Press【Min/MAX】key to excute operation.Then press【Config】+【Min/MAX】 key and get down to parameter level to select suitable parameter by 【<】or 【>】key if you want to read the maximum, minimum, average and reading count.

●Press 【Min/MAX】key again to disable the function.

●The stored values are cleared when you turn min-max off, turn off the power, or perform a remote interface reset because the parameter settings are stored in volatile memory.

3.3.2 Null

When excuting null measurement, reading shows the difference between the input signal and stored null value. Null function is used for offsetting the resistance of test lead to get more accurate 2-wire resistance.

$$Result = Reading - Null\ value$$

Null can be set from 0 to 100% of full range.

Front panel operation：Press【NULL】key to excute null operation.Then press【Config】+【Null】 key and get down to parameter level to select suitable parameter by 【<】, 【>】, 【∧】 or 【∨】keys if you want to view or change null value.

●Press 【Null】key again to disable the function.

●The stored values are cleared when you turn off the power, or perform a remote interface reset because the parameter settings are stored in volatile memory.

3.3.3 dB

dB is the difference between the input signal and a stored relative voltage, with bothvalues converted to dBm, the formular is:

$$dB = 20 \times log(Vin/Vref)$$

Vin is input signal, $Vref$ is relative reference voltage.

Front panel operation： Press 【Shift】+ 【dB】 key to excute dB operation.Then press
【Config】+【Shift】+【dB】 key and get down to parameter level to select suitable parameter
by 【<】, 【>】, 【∧】 or 【∨】 keys if you want to change voltage.

● Press 【dB】 key again to disable the function.

● dB function is only available for dc and ac voltage measurement. The reference volage is
stored in volatile memory; default setting is 1.0V when power-on after remote interface
reset.

3.3.4 dBm

The dBm operation calculates the power delivered to a resistance referenced to 1 milliwatt.

$$dBm=10\times\log(V_{in}^{2}/Z)/1mW$$

V_{in} is input signal, Z is reference resistance

Front panel operation： Press 【Shift】+ 【dBm】key to excute dBm operation.Then press
【Config】+【Shift】+【dBm】 key to select suitable parameter by 【<】, 【>】, 【∧】
or 【∨】 keys if you want to change Z value.

● Press 【dBm】 key again to disable the function.

● dBm function is only available for dc and ac voltage measurement. The reference
resistance Z ranges from 50Ω to 8000Ω, default setting is 600Ω when power-on or after
remote interface reset.

3.3.5 MX+B

MX+B operation calculates measurements value X and two constants (M and B) linearly.

$$Y=MX+B$$

Constant M is gain, contant B is deviation value.

Front panel operation： Press 【MX+B】 key to excute MX+B operation. If you want to
change M and B, please press 【Config】+【MX+B】 key, first to set M value by 【<】, 【>】,
【∧】 or 【∨】 keys and press【Enter】key to confirm it. Then set B value with same
operation.

● Press 【MX+B】key again to disable the function.

● Reference voltage is stored in volatile memory, default setting is +1.000000^ when power-on or after remote interface reset.

3.3.6   %

% operation calculates the percentage of measurements value to target value.

$$Percent=(Input-Reference)/Reference \times 100\%$$

Input is input signal, Reference is target value

Front panel operation：Press 【Shift】+【%】key to excute % operation. If you want to change reference value, please press 【Config】+【Shift】+【%】 key to set Reference value by 【<】, 【>】, 【∧】 or 【∨】keys and then【Enter】key to confirm it.

● Press 【Shift】+【%】key again to disable the function.

● Reference voltage is stored in volatile memory, default setting is +1.000000^ when power-on or after remote interface reset.

3.3.7 Limit testing

Limit testing operation performs the test as your set high/low limit. High/low limit can be set from 0 to full range and high limit should be greater than low limit. If the test value over the limit, the multimeter will beep (only if beep is on) and indicate "HI" or "LO".

Front panel operation：Press 【Limits】key to excute Limits operation. If you want to change high/low limits, please press 【Config】+【Limits】, first to set high limit by 【<】, 【>】, 【∧】 or 【∨】keys and press【Enter】key to confirm it. Then set low limit with same operation.

● Press 【Limits】key again to disable the function.

● High/Low limit setting is stored in volatile memory, default setting is low limit -1.000000^, high limit +1.000000^ when power-on or after remote interface reset.

3.4 Tirgger

You can trigger the multimeter using manual trigger or auto trigger. Each trigger has many readings. Single triggering takes one reading, but you can set the readings number for each trigger (50000 at most).
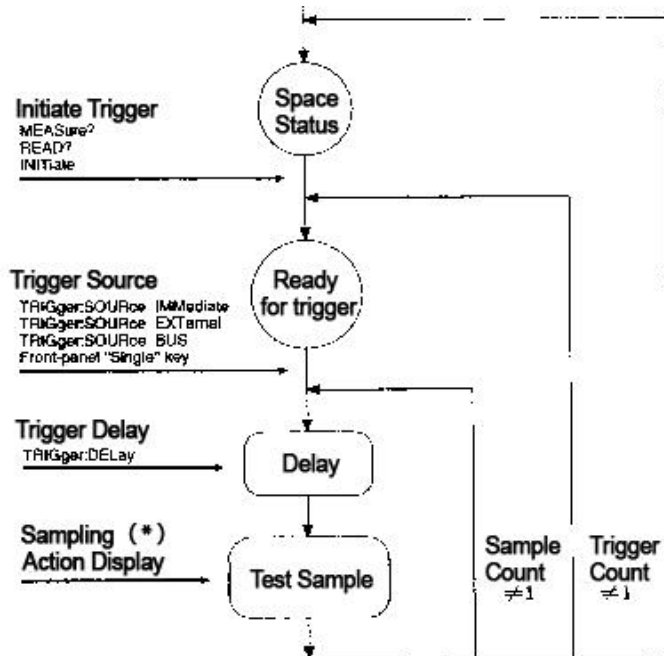
The processing of trigger

3.4.1 To select trigger source

You can trigger the multimeter from front panel using Single trigger, Ext Trig terminal hardware trigger, auto trigger, or from the remote interface using BUS trigger, Ext Trig terminal hardware trigger and instant internal trigger.

Auto trigger

Auto trigger is only enabled on front panel. The default power-on trigger mode is auto trigger.

The auto triggering takes continuous readings as specified parameters setting (function, range, resolution, etc.)

Front panel operation: press 【Shift】+【Sin/Ex】key to enable continuous trigger readings.

Single trigger

Single trigger is only enabled from front panel. When you press the key, multimeter takes one reading or specified readings (sampling count).

When multimeter waits for next trigger, the annuiator "Tig" is on.

Front panel operation: press 【Sin/Ex】key to enable single trigger.

3.4.2 Sampling numbers

Multimter takes one reading each time it receives one trigger signal as selected source if multimeter is at the waiting state. But also can takes 50000 readings for each trigger (no matter from the front panel or remote interface).

Front panel operation: Press【Shift】+【Config】+【Enter】key to display 1: TRIG MENU. Press 【Enter】key to enter into the menu. Find option 2: N SAMPLES by【<】or【>】keys and press【Enter】key to display the sampling numbers. Then set suitable parameters by【<】, 【>】, 【∧】or【∨】keys, finally confirm it by【Enter】key.

● Sampling numbers setting is stored in volatile memory, default setting is 1 when power-on or after remote interface reset.

3.4.3 Read Hold

Read Hold mode can capture and hold the stable readings on screen, used to sample a reading and hold the reading on screen since after moving the probes. Multimeter beeps once catch one stable reading and keep the reading on display (if front panel beep is on).

User can set the sensitivity range for this mode, to determine the reading whether is stable and also show it. The range is indicated by percentage of readings. Only three continuous readings are all within the range, multimeter capture and display the new reading. Sensitivity range: 0.01%, 0.1%, 1.00% or 10% of reading. For example, if you select 1.00% as range, and input signal 5V. Once the continuous three reading are all within the range from 4.975V to 5.025V, multimeter will display the new reading.

Front panel operation:。(1) To set the sensitivity of read hold mode, press 【Shift】+

【Config】+【Enter】key, which display **1: TRIG MENU.** Then press【Enter】key to enter into menu and select option **1: READ HOLD** by【<】or【>】key. Press 【Enter】key again to show percentage and select suitable parameter by 【<】or【>】key. Finally press【Enter】key to confirm. (2) To excute the read hold function, press【Shift】+【Digits】key.

● Sensitivity range setting is stored in volatile memory, default setting is 0.1% when power-on or after remote interface reset.

3.5 System operation

3.5.1 Reading memory

At most 256 readings are allowed to be saved in internal memory. All reading are saved in first-in-first- out order, so first returned reading is also the first saved reading. The memory function is only available on front panel.

Reading memory can be selected together with all functions, math operations and read hold. You also can change the function before enabling the reading memory.

Front panel operation: storage function: (1) To set storage numbers, press 【Shift】+ 【Config】+【Enter】key and select option **2: SYS MENU** by 【<】or【>】key**.** Then press 【Enter】key, which displays **1: RDGS STORE**. Press 【Enter】key again to show storage numbers and select suitable parameter by【<】or【>】key. Finally press【Enter】key to confirm. (2) To excute the store function, press【Shift】+【Recall】key. Mem annuiator on screen will be on. **Recall function:** press【Recall】key to recall the first saved data and select next storages by 【<】or【>】key.

● Reading is saved in volatile memory, default memory is 10 groups, which will be cleared when power-on or after remote interface reset.

3.5.2 System beep

In case of some conditions, the multimeter will beep. But you also can disable the beep on front panel for some conditions.

If disable the beep, the multimeter won't beep in below conditions:

　　① For MAX/MIN function, it finds out the maximum and minimum.

　　② For Read Hold function, it captures the stable reading.

　　③ For Limit Test function, it is out of the limitation.

　　④ For Diode Test function, it tests the forward biased diode.

Since the beep function disabled, but mulimeter still beep under below conditions:

　　① Error occurs.

　　② Over the continuity limitation.

　　③ Key pressing beep.

Front panel operation: press 【Shift】+【Config】+【Enter】key and select option **2: SYS**

MENU by 【<】or【>】key**.** Then press【Enter】key to enter inot menu and select option 2**:**

BEEP by 【<】or【>】key. Finally press【Enter】key to select ON or OFF to enable or disable

the beep.

● Beep status is stored in volatile memory, the default status is on when multimeter power

on or after reset by remote interface.

3.5.3 Firmware vesion inquiry

Multimeter returns 3 codes, first is version number of input/output processor, second is

software vesion and third is FPGA version.

Front panel operation: press 【Shift】+【Config】+【Enter】key and select option 3**: SYS**

MENU by 【<】 or【>】key**.** Then press 【Enter】 key to enter inot menu and select option

5: REVISION by 【<】 or 【>】 key. Finally press【Enter】key to display the revision.

3.5.4 Remote interface configuration

Multimeter has GPIB, RS232 and USB interface for selection, but only one interface can be

enabled each time. Default enabled interfaced is RS232 when out of factory and which is

only selected by front panel.

If you select GPIB interface for multimeter, only one address set for, the range from 0 to 31, default address is 22 when out of factory.

If you select RS232 interface, you need to set the baud rate for multimter, 6 options for your choice, 300, 600, 1200, 2400 and 9600. Default baud rate is 9600.

Front panel operation: press 【Shift】+【Config】+【Enter】key and select option **3: INTERFACE** by 【<】or【>】key**.** Then press 【Enter】 key to enter inot menu and select one interface. If select GPIB, press 【Enter】 key to display address and adjust the value by 【<】, 【>】, 【∧】 or 【∨】key. Finally press 【Enter】key to confirm the address setting and enable the GPIB communication. If select RS232, press 【Enter】key to display the baud rate and adjust the value by 【<】or【>】key. Finally press 【Enter】key again to start RS232 communication. If select USB, no need to set more and multimter will start USB communication once it connected.

3.5.5 Calibration

Calibrating protection

This function can protect multimter from calibration out of authorization. When you need to cablibrate the multimter, you have to input the correct password.

Preset password is stored in permanent memory and not changed even if power-off and reset by remote interface.

Unclock the calibration protect

Front panel operation: 1:SECURED   (CAL MENU)

If multimter under protection, you will see above command when enter into **CAL MENU.** At the same time, the command **2:CALTBRATE** will be hidden, if user want to unlock the protection and please select **SECURED** command and input password, finally press 【Enter】 key.

            000000 CODE

When you enter into **CAL MENU** again, the mulitmeter no longer under protection and you will see the command **2:CALTBRATE** and you can cablitrate it.

Lock the calitration

Front panel operation: 1:UNSECURED   (CAL MENU)

If multimter not under protection, you will see above command when enter into **CAL MENU.** If user want to set the protection and please select **UNSECURED** command and input password, finally press 【Enter】 key.

                          000000 CODE

When you enter into **CAL MENU** again, the mulitmeter is under protection and you will see the command **2:CALTBRATE** hidden and you can not cablitrate it.

Modify the password

If user want to change the password, you will unclock the protection first and then input new password.

Calibration count

Multimeter is calibrated well when out of factory. You can read out the calibration count and which is stored in permanent memory, won't be changed even after power-off.

Maximum count is 32767 and return to 0 once over 32767.

Calibration message

You can view the calibration messages at any time, like last calibrated date.

Front panel operation: press 【Shift】+【Config】+【Enter】key and select option **CAL: MENU** by 【<】 or【>】key**.** Then press 【Enter】 key to enter inot menu and select. Also press 【Enter】 key to enter into the parameter setting.

Chapter 4 Remote Interface

4.1 SCPI language

SCPI (Standard Commands for Programmable Instruments) is a standardized set of commands and be based on ASCII code，through the remote interface to programmer control the instruments.

Based on the level structure (or named as tree system), SCPI commands in this system belongs to common root, which forms as the sub-system. Take the part of sub-system SENSE for example:

SENSE:

   VOLTage:

     DC : RANGe{Crang>}MINimum}MAXimurn}}

   VOLTage:

     DC:RANGe? CMINimum}MAXimum]

SENSe is the root keyword of command, VOLTage and FREQuency are second keywords, DC and VOLTage are third level keywords, the colon (:) separate the keywords from lower level.

Command format

The SCPI command follow the format rule as:

       VOLTage ; DC : RANGe { <range>}MINimum}MAXimum}

As command grammar, most command and parameter are written with both capital and lower-case. Capital is used as abbreviation. But you also can send the entire words (long format) for complete command.

For above command, VOLT and VOLTAGE are both acceptable, same as volt or voltage. But VOL or VOLTAG are wrong words because they are neither abbreviation nor entire words.

Brace { } contains the parameter options of command string, but itself won't be send with command.

Separating character |: separate several parameter options, only one parameter option could be chosen at one time.

Angular bracket < > indicates this option is a parameter value, but itself won't be send with command.

Square bracket [ ]: parameters contains in this character is optional and could be omitted, but itself won't be send with command. If no value appointed to optional parameters, default value will be chosen.

Command separator

Colon (:) is used to separate the keywords for next level, just enter the space between and separate parameter and command keyword with space, if the command contains many parameters, you can use comma (,) to separate, for example:

"CONE:VOLT:DC 10,0.03"

Semicolon ";" is used to separate two commands under one subsystem, easy to reduce the character to minimum. For example:

"TRIG:DELAY 1; COUNT 10"

Which is same as the below two commands.

"TRIG:DELAY 1"

"TRIG:COUNT 10"

Use a semicolon and a colon ";:" to link several commands under different subsystems, if not, will make misunderstanding as below:

"SAMP:COUN 10;:TRIG:SOUR EXT"

Min/Max parameter

You can use MINimum or MAXimum to specify the parameter, for example:

VOLTage : DC:RANGe{<ranged{MINimum}MAXimum }

Select a pecified range. MIN is the mimum of range and MAX is maximum of range.

Setting of inqure parameters:

You can add interrogation ? in the end of command to query the current value of parameters.

For example, the below command to sample count 10 readings:

"SAMP:COUNt 10"

You can use below command to query the sample count:

"SAMP:COUNt?"

You also can query the minimum and maximum count allowed:

"SAMP:COUNt? MIN

"SAMP:COUNt? MAX"

SCPI Command end character:

The command must be end with charater <new line>. IEEE-488QI message is taken as <new line> to be read and terminate a command instead of a <new line>. <new line> following <Carriage return> is also acceptable. The end of command will always renew from the root of SCPI command access.

IEEE-488. 2 common command:

IEEE-488. 2 standards regulate the common command setting, which run the reset, self test and status operation. Univesal command start with *, with 4 to 5 charaters long and includes one or more parameters, the keywords from the first parameters are sperated by space and for more commands, using ; to sperate.

RST;'CLS;'ESE32;'OPC?"

SCPI parameters

SCPI parameter type has 4 formats as following:

Numeric value parameter:

Numeric value parameter is presented by decimal number, composed by digits, minus and decimal point. Floating-point number could be used to indicate either. You also can use two special values Minimum and Maximum to instead parameter value of command. Min set the parameter to be the allowed minimum value, and Max set the parameter to be the allowed maximum value. You can add the unit in the end of parameter value, such as M,K,U and so on.

VOLTage : DC:RANGe{<ranged>|MINimum|MAXimum}

Discrete parameter:

Discrete parameter only has a few of value, and be same as commands, you can use full or abbreviation format, or mixing uppercase and lowercase is also allowed.

TRLGger:SOURce { BUS|IMMediate|EXTernal}

Boolean parameter:

A Boolean parameter specifies a single binary condition which is either true or false. For "True", the parameter value is "ON" or "1", and for "False", the parameter value is "OFF" or "0".

INPut:IMPedance:AUTO { OFF|ON}

Format of output data

Output data type	Output format
non reading query	<80 ASCII charater string
Single reading(IEEE-488)	SD. DDDDDDDDESDD<nl>
Multiple readings (IEEE-488)	SD. DDDDDDDDESDD,…， …,<nl>
Single reading (IEEE-488)	SD. DDDDDDDDESDD<cr><nl>
Multiple readings (IEEE-488)	SD.DDDDDDDDESDD, …, …,<cr><nl>
	S plus-mius sign
	D numeric data

	E index
	\<nl\> new line charater
	\<cr\> c

4.2 Command set

MEASure

:VOLTage:DC? {\<range\>|MIN|MAX|DEF},{\<resolution\>|MIN|MAX|DEF}

:VOLTage:AC? {\<range\>|MIN|MAX|DEF},{\<resolution\>|MIN|MAX|DEF}

:CURRent:DC? {\<range\>|MIN|MAX|DEF},{\<resolution\>|MIN|MAX|DEF}

:CURRent:AC? {\<range\>|MIN|MAX|DEF},{\<resolution\>|MIN|MAX|DEF}

:RESistance? {\<range\>|MIN|MAX|DEF},{\<resolution\>|MIN|MAX|DEF}

:FRESistance? {\<range\>|MIN|MAX|DEF},{\<resolution\>|MIN|MAX|DEF}

:FREQuency? {\<range\>|MIN|MAX|DEF},{\<resolution\>|MIN|MAX|DEF}

:PERiod? {\<range\>|MIN|MAX|DEF},{\<resolution\>|MIN|MAX|DEF}

:CONTinuity?

:DIODe?

:CAP?

CONFigure

:VOLTage:DC {\<range\>|MIN|MAX|DEF},{\<resolution\>|MIN|MAX|DEF}

:VOLTage:DC:RATio {\<range\>|MIN|MAX|DEF},{\<resolution\>|MIN|MAX|DEF

:VOLTage:AC {\<range\>|MIN|MAX|DEF},{\<resolution\>|MIN|MAX|DEF}

:CURRent:DC {\<range\>|MIN|MAX|DEF},{\<resolution\>|MIN|MAX|DEF}

:CURRent:AC {\<range\>|MIN|MAX|DEF},{\<resolution\>|MIN|MAX|DEF}

:RESistance {\<range\>|MIN|MAX|DEF},{\<resolution\>|MIN|MAX|DEF}

:FRESistance {\<range\>|MIN|MAX|DEF},{\<resolution\>|MIN|MAX|DEF}

:FREQuency {\<range\>|MIN|MAX|DEF},{\<resolution\>|MIN|MAX|DEF}

:PERiod {<range>|MIN|MAX|DEF},{<resolution>|MIN|MAX|DEF}

:CONTinuity

:DIODe

:CAP

CONFigure?

[SENSe:]

FUNCtion "VOLTage:DC"

FUNCtion "VOLTage:AC"

FUNCtion "CURRent:DC"

FUNCtion "CURRent:AC"

FUNCtion "RESistance"

FUNCtion "FRESistance"

FUNCtion "FREQuency"

FUNCtion "PERiod"

FUNCtion "CONTinuity"

FUNCtion "DIODe"

FUNCtion " TEMPerature "

FUNCtion " CAP "

FUNCtion?

[SENSe:]

VOLTage:DC:RANGe {<range>|MINimum|MAXimum}

VOLTage:DC:RANGe? [MINimum|MAXimum]

VOLTage:AC:RANGe {<range>|MINimum|MAXimum}

VOLTage:AC:RANGe? [MINimum|MAXimum]

CURRent:DC:RANGe {<range>|MINimum|MAXimum}

CURRent:DC:RANGe? [MINimum|MAXimum]

CURRent:AC:RANGe {<range>|MINimum|MAXimum}

CURRent:AC:RANGe? [MINimum|MAXimum]

RESistance:RANGe {<range>|MINimum|MAXimum}

RESistance:RANGe? [MINimum|MAXimum]

FRESistance:RANGe {<range>|MINimum|MAXimum}

FRESistance:RANGe? [MINimum|MAXimum]

FREQuency:VOLTage:RANGe {<range>|MINimum|MAXimum}

FREQuency:VOLTage:RANGe? [MINimum|MAXimum]

PERiod:VOLTage:RANGe {<range>|MINimum|MAXimum}

PERiod:VOLTage:RANGe? [MINimum|MAXimum]

CAPacity:RANGe {<range>|MINimum|MAXimum}

UNIT:TEMPerature {Cel|Far|K}

UNIT:TEMPerature?

TEMPerature:RTD:TYPE {PT100|D100|F100|PT385|PT3916}

TEMPerature:RTD:TYPE?

[SENSe:]

VOLTage:DC:RANGe:AUTO {OFF|ON}

VOLTage:DC:RANGe:AUTO?

VOLTage:AC:RANGe:AUTO {OFF|ON}

VOLTage:AC:RANGe:AUTO?

CURRent:DC:RANGe:AUTO {OFF|ON}

CURRent:DC:RANGe:AUTO?

CURRent:AC:RANGe:AUTO {OFF|ON}

CURRent:AC:RANGe:AUTO?

RESistance:RANGe:AUTO {OFF|ON}

RESistance:RANGe:AUTO?

FRESistance:RANGe:AUTO {OFF|ON}

FRESistance:RANGe:AUTO?

FREQuency:VOLTage:RANGe:AUTO {OFF|ON}

FREQuency:VOLTage:RANGe:AUTO?

PERiod:VOLTage:RANGe:AUTO {OFF|ON}

PERiod:VOLTage:RANGe:AUTO?

CAPacity: RANGe:AUTO {OFF|ON}

CAPacity: RANGe:AUTO?

[SENSe:]   not apply to frequency and period measurement

VOLTage:DC:RESolution {<resolution>|MINimum|MAXimum}

VOLTage:DC:RESolution? [MINimum|MAXimum]

VOLTage:AC:RESolution {<resolution>|MINimum|MAXimum}

VOLTage:AC:RESolution? [MINimum|MAXimum]

CURRent:DC:RESolution {<resolution>|MINimum|MAXimum}

CURRent:DC:RESolution? [MINimum|MAXimum]

CURRent:AC:RESolution {<resolution>|MINimum|MAXimum}

CURRent:AC:RESolution? [MINimum|MAXimum]

RESistance:RESolution {<resolution>|MINimum|MAXimum}

RESistance:RESolution? [MINimum|MAXimum]

FRESistance:RESolution {<resolution>|MINimum|MAXimum}

FRESistance:RESolution? [MINimum|MAXimum]

CAPacity:RESolution {<resolution>|MINimum|MAXimum}

CAPacity:RESolution? [MINimum|MAXimum]

[SENSe:]

VOLTage:DC:NPLCycles {MINimum|MAXimum}   Integral time

VOLTage:DC:NPLCycles? [MINimum|MAXimum]

CURRent:DC:NPLCycles {MINimum|MAXimum}

CURRent:DC:NPLCycles? [MINimum|MAXimum]

RESistance:NPLCycles {MINimum|MAXimum}

RESistance:NPLCycles? [MINimum|MAXimum]

FRESistance:NPLCycles {0.02|0.2|1|10|100|MINimum|MAXimum}

FRESistance:NPLCycles? [MINimum|MAXimum]

[SENSe:]

FREQuency:APERture {0.1|1|MINimum|MAXimum}   aperture time

FREQuency:APERture? [MINimum|MAXimum]

PERiod:APERture {0.1|1|MINimum|MAXimum}

PERiod:APERture? [MINimum|MAXimum]

[SENSe:]

DETector:BANDwidth {20|100|200|MINimum|MAXimum} specify the lowest frequency

input to determin the AC filter

speed

DETector:BANDwidth? [MINimum|MAXimum]

INPut

:IMPedance:AUTO {OFF|ON}

:IMPedance:AUTO?

ROUTe:TERMinals?

CALCulate

:FUNCtion {NULL|DB|DBM|AVERage|LIMit|PERCent|MXB}

:FUNCtion?

:STATe {OFF|ON}

:STATe?

CALCulate

:AVERage:MINimum?

:AVERage:MAXimum?

:AVERage:AVERage?

:AVERage:COUNt?

CALCulate

:PERCent:TARGet {<value>|MINimum|MAXimum}

:PERCent:TARGet? [MINimum|MAXimum]

CALCulate

:NULL:OFFSet {<value>|MINimum|MAXimum}

:NULL:OFFSet? [MINimum|MAXimum]

CALCulate

:DB:REFerence {<value>|MINimum|MAXimum}   value=-200dbm~200dbm

:DB:REFerence? [MINimum|MAXimum]

CALCulate

:DBM:REFerence {<value>|MINimum|MAXimum}

:DBM:REFerence? [MINimum|MAXimum]

CALCulate

:LIMit:LOWer {<value>|MINimum|MAXimum}

:LIMit:LOWer? [MINimum|MAXimum]

:LIMit:UPPer {<value>|MINimum|MAXimum}

:LIMit:UPPer? [MINimum|MAXimum]

CALCulate

　:MXB:MMFactor {<value>|MINimum|MAXimum}

　:MXB:MMFactor? [MINimum|MAXimum]

　:MXB:MBFactor {<value>|MINimum|MAXimum}

　:MXB:MBFactor? [MINimum|MAXimum]

Triggering Commands

INITiate

READ?

TRIGger

　:SOURce {BUS|IMMediate |EXTernal}

　:SOURce?

SAMPle

　:COUNt {<value>|MINimum|MAXimum}

　:COUNt? [MINimum|MAXimum]

System-Related Commands

FETCh?

READ?

DISPlay {OFF|ON}

DISPlay?

SYSTem

　:BEEPer

　:BEEPer:STATe {OFF|ON}

　:BEEPer:STATe?

SYSTem:ERRor?

SYSTem:VERSion?

DATA:POINts?

*RST

*IDN?

RS-232 Interface Commands

SYSTem:LOCal

SYSTem:REMote

SYSTem:RWLock

4.3 Simple programing

MEASure? command

Using MEASure? Command is the simplest method for measurement, but this command is not so flexible and not allowed to change any settings except of function, range and resolution). The test result is send to output buffer.

CONFigure? command

CONFigure command is more flexbile for programming. When the command excuted, the multimeter will be configured as the best settings but not start measure automatically. So you can change the parameters before measuring. Please use INITiate or READ? Command to enable the auto measurement.

Range and Resolution parameter

When using MEASure? and CONFigure? commands, you can set same function, range and resolution in one commond at the same time. Input expected value for range parameter and mulimeter will select correct range.

When measuring frequency and period, multimeter will select one range for all input signal within range 3Hz to 300KHz, and only used to specify the resolution.

Using resolution parameter to set expected resolution. The unit must match with the measurement function. For example, to measure DC voltage, the resolution unit must be V.

If measure the frequency, the unit of resolution should be Hz.

READ? command

READ? Command is used to change the trigger system status from "Idle" to "Wait trigger". After receiving READ? Command, measurement starts once it meets with the specified trigger conditions and the reading will be send to ouput buffer. And you need to make the reading inputed to bus controller, otherwise the measurement stops once the buffer overflows. The reading won't be stored in internal buffer. Same as INItiate command, the PETCh? Command following READ? Command is required, except that reading is not saved in internal buffer.

INITiate and FETCh? command

INITiate and FETCh? Command are used to control the measuring trigger and reading recall. INITiate Command is used to change the trigger system status from "Idle" to "Wait trigger". After receiving INITiate Command, measurement starts once it meets with the specified trigger conditions and the reading will be saved in internal memory until to be recalled.

4.3.1 MEASure? and CONFigure command

MEASure:VOLTage :DC?{<range>|MIN | MAX|DEF}，{<resolution>|MIN | MAX| DEF

Measure the Ix voltage as specified range and resolution and send the readings to outpu buffer.

MEASure:VOLTage:DC RATio?{<range>|MIN|MAX|DEF}，{<resolution>| MIN | MAX| DEF }

Measure the DC ratio as specified range and resolution and send the readings to outpu buffer. For this measurement, the range is applicable for signal connected to Input terminal. For measurement of reference voltage on Sense terminal, the multimeter will select auto range.

MEASure:VOLTage:AC?{<range>|MIN|MAX|DEF}，{<resolution>|MIN | MAX |

DEF}

Measure the AC voltage as specified range and resolution and send the readings to outpu buffer. For this measurement, the resolution is fixed as 5 1/2 digits, and this paramenter only effects the front panel displaying.

MEASure : CURRent:DC?{<range>|MIN|MAX|DEF}，{<resolution>|MIN| MAX| DEF }

Measure the DC voltage as specified range and resolution and send the readings to outpu buffer.

MEASure:CURRent:AC?{ <range >|MIN|MAX|DEF}, (<resolution>|MIN|MAX|DEF}

Measure the AC current as specified range and resolution and send the readings to outpu buffer. For this measurement, the resolution is fixed as 5 1/2 digits, and this paramenter only effects the front panel displaying.

MEASure:RESistance? { <range>|MIN|MAX|DEF}，(<resolution >|MIN | MAX| DEF }

Measure the 2-wire resistance as specified range and resolution and send the readings to outpu buffer.

MEASure:FRESistance? { <range >|MIN|MAX|DEF}，(<resolution>|MIN |MAX |DEF}

Measure the 4-wire resistance as specified range and resolution and send the readings to outpu buffer.

MEASure:FREQuency?{<range>}MIN|MAX|DEF}，(<resolution>|MIN|MAX|DEF }

Measure the frequency as specified range and resolution and send the readings to outpu buffer. For this measurement, multimeter select one range for all input signal between 3Hz to 900KHz. When there is no input, the measurement result is 0.

MEASure:PERiod?{ 《 range >|MIN|MAX|DEF }, {<resolution>|MIN|MAX|DEF}

Measure the period as specified range and resolution and send the readings to outpu buffer. For this measurement, multimeter select one range for all input signal between 1us and 0.33s.

When there is no input, the measurement result is 0.

MEASure : CONTinuity?

Preset and excute the continuous measurement and send the readings to output buffer. For this measurement, range and resolution are both fixed as 1kHz and 3 1/2 digits.

MEASure : DIODe?

Preset and excute the diode measurement and send the readings to output buffer. For this measurement, range and resolution are both fixed as 1Vdc and 3 1/2 digits.

MEASure :TEMPerature?

Preset and excute the temperature measurement and send the readings to output buffer. For this measurement, resolution is fixed as 5 1/2 digits.

CONFigure:VOLTage:DC{<range>|MIN|MAX|DEF}，**{<resolution>|MIN | MAX | DEF)**

Preset and conofigure the DC voltage measurement as specified range and resolution, and this command does not enable the measurement.

CONFigure:VOLTage:AC{<range>|MIN|MAX|DEF}，**{ <resolution>|MIN |MAX| DEF)**

Preset and conofigure the AC voltage measurement as specified range and resolution, and this command does not enable the measurement. For this measurement, the resolution is fixed as 5 1/2 digits, and this paramenter only effects the front panel displaying.

CONFigure:CURRent:DC{<range>|MIN|MAX|DEF}，**{<resolution>|MIN | MAX | DEF }**

Preset and conofigure the DC current measurement as specified range and resolution, and this command does not enable the measurement.

CONFigure:CURRent:AC{<range>|MIN|MAX|DEF}，**{<resolution>|MIN|MAX|DEF}**

Preset and conofigure the AC current measurement as specified range and resolution, and

this command does not enable the measurement. For this measurement, the resolution is fixed as 5 1/2 digits, and this paramenter only effects the front panel displaying.

CONFigure:RESistance{<range>|MIN|MAX|DEF}，{< resolution>|MIN | MAX| DEF}

Preset and conofigure the 2-wire resistance measurement as specified range and resolution, and this command does not enable the measurement.

CONFigure:FRESistance{<range>|MIN|MAX|DEF}，{<resolution>|MIN|MAX| DEF}

Preset and conofigure the 4-wire resistance measurement as specified range and resolution, and this command does not enable the measurement.

CONFigure:FREQuency{<range>|MIN|MAX|DEF}，{<resolution>|MIN | MAX| DEF }

Preset and configure the frequency measurement as specified range and this command does not enable the measurement. For this measurement, multimeter select one range for all input signal between 3Hz to 900KHz. When there is no input, the measurement result is 0.

CONFigure:PERiodi{<range>|MIN|MAX|DEF}，{<resolution>|MIN|MAX|DEF}

Preset and configure the period measurement as specified range and this command does not enable the measurement. For this measurement, multimeter select one range for all input signal between 33s to 1 us. When there is no input, the measurement result is 0.

CONFigure:CONTimuity

Preset and configure the continuous measurement and this command does not enable the measurement. For this measurement, range and resolution are both fixed as 1KHz and 3 1/2 digits.

CONFigure:DIODe

Preset and configure the diode measurement and this command does not enable the measurement. For this measurement, range and resolution are both fixed as 1Vdc and 3 1/2 digits.

CONFigure :TEMPerature?

Preset and configure the temperature measurement and this command wil not enable the mesurement For this measurement, resolution is fixed as 3 1/2 digits.

CONFigure?

Query the current configuration and return a quoted charater string.

4.3.2 FUNCtion commands

FUNCtion"<function>"

Select measurement function. The function content among the command strings need to be indicated by quotation mark, like (FUNC "VOLTDC"). All functions contents include:

VOLTage:DC

VOLTage:AC

CURRent:DC

CURRent:AC

RESistance (2-wrie resistance)

FRESistance (4-wire resistance)

FREQuency

PERiod

CONTinuity

DIODe

TEMPerature

CAP

FUNCtion?   Query measurement function and return quoted strings.

<function>:RANGe{<range>|MIN|MAX}

Select range for current measurement. For frequency and period measurement, range is applicable for input voltage not frequency (please use FREQuency:VOLTage, or PERiod:VOLTage). MIN is selected as minimum range and MAX is as maximum range.

<function>:RANGe?[MIN|MAX]

Query the measurement range for selected function.

<function>:RANGe:AUTO{OFF|ON}

Enable or disable the auto function for specified functions. For period and frequency measurement, please use FREQuency : VOLTage or PERiod:VOLTage. The threshold for auto setting is: low range should be less than 10% of full range and high range should be more than 120%.

<function>:RANGe:AUTO?

Query auto range setting. Returned value is "0" (OFF) or "1" (ON).

<function>:RESolution(<range>|MIN|MAX}

Select the resolution for specified functions (not applicable for frequency, period and ratio measurement). The resolution unit should be same as the one of measurement function, but no the digits. MIN is selected as the acceptable minimum, that is best resolution. MAX is selected as the acceptable maximum, that is the worst resolution, which are stored in volatile memory.

<function>:RESolution?[MIN|MAX]

Query the resolution for specified function. For frequency and period measurement, the multimeter will return the settings according to the input frequency.

<function>:NPLCycles?{ MIN|MAX}

Select integral time for current function, the unit of which is cycle of power supply. This command is only applicable for DC voltage, DC current, 2-wire and 4 wire resistacne measurements.

<function>:NPLCycles? [MIN|MAX]

Query the intergral time for specified function.

FREQuency:APERture{ 0.1|1|MIN|MAX}

Select aperture time or gate time of frequency measurement, default value is 1s. You can specify 100ms (default value is 4 1/2 digits), or 1s (5 1/2 digits). MIN=0.lS MAX=lS, which are stored in volatile memory.

FREQuency:APERture?[MIN|MAX]

Query the aperture time for frequency measurement.

PERiod:APERture{|0.1|1|MIN|MAX}

Select aperture time or gate time of period measurement, default value is 1s. You can specify 100ms (default value is 4 1/2 digits), or 1s (5 1/2 digits), which are stored in volatile memory.

PERiod:APERture?[MIN|MAX]

Query the aperture time for period measurement.

[SENSe:]DETector:BANDwidtn{20|100|200|MIN|MAX}

Set the possible lowest frequency for input signal. Multimeter will select slow, medium or fast AC filter according to your specified frequency. Default speed is medium. MIN=20Hz MAX=200Hz, which are stored in volatile memory.

[SENSe:]DETector:BANDwidtn? [MIN|MAX]

Query the AC filter and returned value is 20, 100 or 200.

INPut:IMPedance:AUTO {OFF|ON}

Disable or enable the auto resistance input for DC voltage measurement. If the auto resistance input is selected as AUTO OFF, it is fixed as 10MΩ for all ranges. If the auto resistance input is selected as AUTO ON and range is 100mV, 1V or l0V, the setting for input resistance will be more than 10GΩ and stored in volatile memory.

INPut:IMPedance:AUTO?

Query the resistance input mode and returned value is 0 (OFF) or 1 (ON).

4.3.3 Math operation commands

CALCulate:FUNCtion{ NULL|DB|DBM|AVERage|LIMit|MXB|PERCent}

Select math function and only one selected for each time. Default function is Zero, the setting of which is stored in volatile memory.

CALCulate:FUNCtion?

Query the current calculation function and returned valued is NULL, DB, DBM, AVER, LIMa, MXB or PERC.

CALCulate:STATe { OFF|ON}

Disable or enable the specified calculation function, the setting of which is stored in volatile memory.

CALCulate:STATe?

Query the state of calculation function and retured value is 0 (OFF) or 1 (ON).

CALCulate:AVERage:MINimum?

Read the mimimum in limit calculation. When enable calculation or power-off, or reset by remote interface, the multimter will clear this value, for the value is stored in volatile memory.

CALCulate:AVERage:MAXimum?

Read the maximum in limit calculation. When enable calculation or power-off, or reset by remote interface, the multimter will clear this value, for the value is stored in volatile memory.

CALCulate:AVERage:AVERage?

Read the average in limit calculation. When enable calculation or power-off, or reset by remote interface, the multimter will clear this value, for the value is stored in volatile memory.

CALCulate:AVERage:COUNt?

Read the reading count in limit calculation. When enable calculation or power-off, or reset

by remote interface, the multimter will clear this value, for the value is stored in volatile memory.

CALCulate:NULL:OFFSet{<Value>|MIN|MAX}

Save the zero value in zero register. Before writing in calculation register, you must enable the calculation first and the zero setting can be set within the range from 0 to $\pm$ 120 of full range. MIN=Full range $-$ 120% a MAX= 120% of full range, the setting is stored in volatile memory.

CALCulate:NULL:OFFSet? [MIN|MAX}

Query zero value.

CALCulate:DB:REFerence{<Value>| MIN|MAX}

Save the dB value in register. Before writing in calculation register, you must enable the calculation first and the dB setting can be set within the range from 0dBm to $\pm$ 200dBm. MIN= - 200.00dBm MAX=200.00dBm, the setting is stored in volatile memory.

CALCulate:DB:REFerence?[MIN|MAX]

Query dB value.

CALCulate:DBM:REFerence{ <Value>|MIN|MAX}

Select dBm reference from the range 50 to 8000, MIN=50Ω, MAX=8000Ω, the setting is stored in volatile memory.

CALCulate:DBM:REFerence{ MIN | MAX}

Query the dBm reference resistance.

CALCulate:LIMit:LOWer{<Value>|MIN|MAX}

Set the higher/lower limit for limit calculation within the range from 0 to $\pm$ 120% of full range, the setting is stored in volatile memory.

CALCulate:LIMit:LOWer{MIN|MAX}

Query the lower limit.

CALCulate:LIMit:UPPer{ <Value>|MIN|MAX}

Set the higher limit for limit calculation within the range from 0 to $\pm$ 120% of full range, the setting is stored in volatile memory.

CALCulate:LIMit:UPPer{ MIN| MAX}

Query the higher limit.

4.3.4 Trigger

INITiate

INITiate Command is used to change the trigger system status from "Idle" to "Wait trigger". After receiving INITiate Command, measurement starts once it meets with the specified trigger conditions and the reading will be saved in internal memory until to be recalled. Please use FETCh? Command to recall the reading.

READ?

READ? Command is used to change the trigger system status from "Idle" to "Wait trigger". After receiving READ? Command, measurement starts once it meets with the specified trigger conditions and the reading will be send to ouput buffer.

TRIGger:SOURce { BUS|IMMediate|EXTernat}

Select trigger souce. Multimeter receive trigger signal from this source. Software (bus) trigger from remote interface, internal instant trigger or hardware trigger from the Ext Trig port on rear panel are al acceptable for multimeter. The setting is stored in volatile memory.

TRIGger:SOURce?

Query the current trigger source and returned value is BUS or IMM.

SAMPIe:COUNt{<Value>|MIN|MAX}

Set the sample count for each trigger, the count range should be from 1 to 50000. MIN=1,MAX=50000, the setting is stored in volatile memory.

SAMPIe:COUNe? [MIN|MAX]

Query the sample count.

4.3.5 System commands

FETCh?

Send the reading from internal memory to output buffer, and you can read them by bus controller.

SYSTem:BEEPer

Sound a beep at once.

SYSTem:BEEPer:STATe { OFF|ON}

Disable or enable the front beep. The setting is stored in volatile memory.

SYSTem:BEEPer:STATe?

Query the front beep status and returned value is 0 (OFF) or 1 (ON).

SYSTem:VERSion?

Query current SCPI version.

*RST

Reset the multimeter as the power-on settings.

4.3.6 RS-232 interface commands

SYSTem:LOCal.

Set the local mode for RS-232 operation and front panel keypads are available.

SYSTem:REMote

Set the remote mode for RS-232 opertion, and all keys on front panel are not available except of LOCAL key.

SYSTem:RWLock

Set the remote mode for RS-232 opertion, and all keys on front panel are disabled.

Chapter 5 Service and Support

5.1 Warranty

Shijiazhuang Suin Instruments Co., Ltd. will give one year's warranty to maintaining or replacing since consignment for the verified quality problem of the product.

Except for this explanation and the description in the warranty card, the company has no other warranty, in proclamation or in implication. Under no circumstances, the company will responsible for the direct, indirect or other secondary loss.

5.2 Contact us

If you have any questions or inconvenience during the use of our products please do not hesitate to contact us.

Monday to Friday   Beijing Time   8: 00-17: 00

Telephone: 86-311-86086971(after service)   Fax: 86-311-86018511

              86-311-86014314(technical support)

E-mail address: export@suintest.com

Website: http://www.suintest.com

Chapter 6 Specifications

6.1 General Specifications

Power

Voltage: 110V/220V（1±10%）

Power frequency: 50Hz/60Hz

Consumption：   15VA

Enviroment

Working temperature: 0℃～40℃

Storage temperature: -10℃～60℃

Working humity: 0℃～28℃ ≤80%RH（Resistance range≥10M, ≤70%RH）

28℃～40℃ < 70%RH

Storage humity: -10℃～60℃ < 80%RH

Dimensions

HxWxD: 106mm×260mm×375mm

Weight: 3kg

Safety:

Accord with IEC61010-1: 2001, CAT Ⅰ 1000V/CAT Ⅱ 600V, pollution class 2.

6.2 Performance Specifications

Notice:

- Accuracy: ±(% reading + digits), warm up time more than 30minutes

- Temperature: 18℃ ~ 28℃

- Temperature Coefficient: 0～18℃ and 28～40℃ ±0.1% ×Accuracy/℃

DC Voltage

Range	Full Scale[1]	Resolution	Input Impedance

		5 1/2	4 1/2	
100mV	119.999mV	1μV	10μV	≥10,000MΩ
1V	1.19999V	10μV	100μV	≥10,000MΩ
10V	11.9999V	100μV	1mV	≥10,000MΩ
100V	119.999V	1mV	10mV	10MΩ
1000V	1010.00V	10mV	100mV	10MΩ
(1) 20% overranged value could be read for all ranges except of 1000V ranges. 1% overranged value could be read for 1000V range. (1010V)				

Accuracy

Rate	Range	1year 23±5℃[2]
S	100mV	0.02+8[1]
	1V	0.01+4[1]
	10V	0.01+4
	100V	0.01+4
	1000V	0.01+4
M	100mV	0.02+15[1]
	1V	0.01+8[1]
	10V	0.01+8
	100V	0.01+8
	1000V	0.01+8
F	100mV	0.02+4[1]
	1V	0.02+2[1]
	10V	0.02+2
	100V	0.02+2
	1000V	0.02+2
(1)relative zero mode（ZERO）		

Max. Input Voltge: 1000V for whole ranges (dc or ac peak value)

DC Current

Accuracy

Range	Full Scale[1]	Resolution
10mA	12.00000mA	0.1μA
100mA	120.000mA	1μA
1A	1.20000A	10μA
10A	10.0000A	100μA
(1) 20% overranged value could be read within the range of 1A.		

Speed	Range	1 year 23±5℃[2]
S	10mA	0.05+12[1]
	100mA	0.05+4[1]
	1A	0.10+4
	10A	0.2+10
M	10mA	0.05+20[1]
	100mA	0.05+8[1]
	1A	0.10+8
	10A	0.2+20
F	10mA	0.1+4[1]
	100mA	0.1+4[1]
	1 A	0.1+4
	10A	0.2+4
(1) relative zero mode（ZERO）		

AC Voltage

Range	Full Scale[1]	Resolution	Input Impedance
100mV	119.999mV	1μV	1MΩ
1V	1.19999V	10μV	Shunt capacitance
10V	11.9999V	100μV	＜100PF
100V	119.999V	1mV	
750V	750.00V	10mV	
(1) 20% overranged value could be read for all ranges except of 750V ranges.			

Accuracy

Speed	Range	1year 23±5℃[1]				
		20-45	45-20k	20k-50k	50k-100k	100k-300k
S	100.000mV	0.5+200	0.1+200	0.5+250	1.5+250	3.5+250
	1.00000V	0.5+100	0.1+100	0.5+100	1+100	2.5+100
	10.0000V	0.5+100	0.1+100	0.5+100	1+100	2.5+100
	100.000V	0.5+100	0.1+100	0.5+100	1+100	2.5+100
	750.00V	0.5+100	0.1+100	0.5+100	1+100	2.5+100
M	100.000mV	0.5+300	0.1+300	0.5+300	1+300	2.5+300
	1.00000V	0.5+150	0.1+150	0.5+150	1+200	2.5+200
	10.0000V	0.5+150	0.1+150	0.5+150	1+200	2.5+200
	100.000V	0.5+150	0.1+150	0.5+150	1+200	2.5+200
	750.00V	0.5+150	0.1+150	0.5+150	1+200	2.5+200

F	100.000mV	1.5+30	0.2+20	0.5+20	1.5 +20	3 +20
	1.00000V	1.5+20	0.2+10	0.5+10	1.5 +10	3 +10
	10.0000V	1.5+20	0.2+10	0.5+10	1.5 +10	3 +10
	100.000V	1.5+20	0.2+10	0.5+10	1.5 +10	3 +10
	750.00V	1.5+20	0.2+10	0.5+10	1.5 +10	3 +10
(1) The accuracy indicated for inputs more than 5% of full scale.						

Measuring mode: true RMS

Max. Crest factor: 3.0 at full scale

Max. Input: 750Vrms

Any range input can be up to the multiple of 3×10^{-7} voltage and frequency

Input impedance: 1 MΩ and <120pF series connection

AC Current

Accuracy

Range	Full Scale(1)	Resolution
10mA	12.00000mA	0.1μA
100mA	120.000mA	1μA
1A	1.20000A	10μA
10A	10.0000A(	100μA
(1) 20% overranged value could be read within the range of 1A.		

Speed	Range	1year 23±5℃(1)			
		20-45	45-2k	2k-5k	5k-10k
S	10mA	1.2+100	0.5+100	2.5+200	2.5+200
	100mA	1.2+100	0.3+100	2.3+200	2.3+200
	1A	1.2+100	0.3+100	2.3+200	2.3+200
	10A		0.5+100	2.5+200	
M	10mA	1.2+150	0.5+150	2.5+300	2.5+300
	100mA	1.2+150	0.3+150	2.3+300	2.3+300
	1A	1.2+150	0.3+150	2.3+300	2.3+300
	10A		0.5+150	2.5+300	
F	10mA	1+20	0.5+10	3+10	3+10
	100mA	1+20	0.5+10	3+10	3+10
	1A	1+20	0.5+10	3+10	3+10
	10A		0.5+10	3+10	

Measuring mode: true RMS

Max. Crest factor: 3.0 at full scale

Input protection: 10A 250V fuse

2-4 wire Resistance

Range	Full Scale[1]	Resolution		Pass Current
		5 1/2	4 1/2	
100Ω	119.999Ω	1mΩ	10mΩ	1mA
1kΩ	1.19999kΩ	10mΩ	100mΩ	1mA
10kΩ	11.9999kΩ	100mΩ	1Ω	100µA
100kΩ	119.999kΩ	1Ω	10Ω	10µA
1MΩ	1.19999MΩ	10Ω	100Ω	5µA
10MΩ	11.9999kΩ	100Ω	1kΩ	0.5µA
100MΩ	99.9999kΩ	1kΩ	1kΩ	0.5µA
(1) 20% overranged value could be read except of range of 100MΩ				

Accuracy

Speed	Range[1]	1year 23±5℃[3]
S	100Ω	0.03+10 [2]
	1kΩ	0.02+6 [2]
	10kΩ	0.02+6 [2]
	100kΩ	0.02+6
	1MΩ	0.02+6
	10MΩ	0.25+6
	100MΩ	1+10
M	100Ω	0.03+16 [2]
	1kΩ	0.02+8 [2]
	10kΩ	0.02+8 [2]
	100kΩ	0.02+8
	1MΩ	0.02+8
	10MΩ	0.25+16
	100MΩ	1+20
F	100Ω	0.05+8 [2]
	1kΩ	0.02+8 [2]
	10kΩ	0.02+8 [2]
	100kΩ	0.02+8
	1MΩ	0.02+8
	10MΩ	0.25+8
	100MΩ	1+10
(1) To avoid the nosie interference to test lead, the shield leads are suggested for resistance measurement above 100kΩ.		
(2) relative zero mode (ZERO)		

Capacitance

Range	Full Scale	Resolution		Pass Current
		3 1/2		
1nF	0.999nF	1pF		8.54μA
10nF	09.99nF	10pF		12.5μA
100nF	099.9nF	100pF		102.9μA
1μF	0.999μF	1nF		1.029mA
10μF	09.99μF	10nF		1.029mA

Accuracy (slow)

Range		1 year 23±5℃
1nF		1+20
10nF		0.8+10
100nF		0.8+10
1μF		0.8+10
10μF		0.8+10

Max. input protection: 1000Vdc or 750Vac

Continuity

Speed	Range	Resolution	Max.Reading	Accuracy
F	1kΩ	100mΩ	0.9999kΩ	1%+20

Max. input protection: 1000Vdc or 750Vac

Open voltage: +13V

Test current: 1mAVdc

Threshold resistance: reading less than 10Ω to alarm

Diode

Speed	Max.Reading	Resolution
M	09.9999	100μV

Max. input protection: 1000Vdc or 750Vac

Max. 10V stabivolt measurement

Frequency

Frequency Range	Gate Time	Resolution	Full scale
5-100Hz	1s(slow)	1mHz	099.999Hz
100-1k		1mHz	999.999Hz
1-10k		10mHz	9.99999kHz
10-100k		100mHz	99.9999kHz
100-900k		1Hz	1000.00kHz

Accuracy

Voltage Range	Frequency Range	Resolution	Sensitivity

100mV-750V	5-10Hz	0.005+10	50mVrms
	10-100Hz	0.005+8	
	100-900k	0.005+8	

Measuring mode: true RMS

Max. Crest factor: 3.0 at full scale

Input protection: 10A 250V fuse