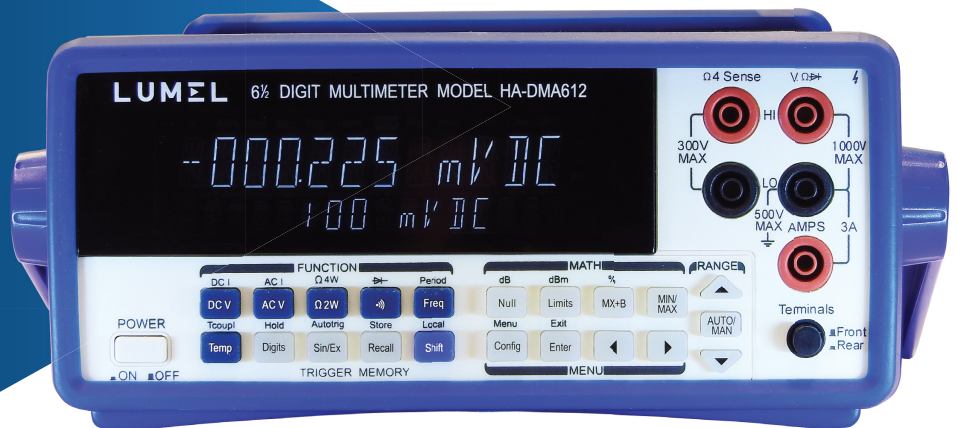


DIGITAL MULTIMETER HA-DMA612



USER'S MANUAL



Brief Introduction

The DMM is 6 ¹/₂ digits, 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, 3A.
- AC Current: 1A, 3A.
- 2 & 4 wire resistance: 100Ω, 1KΩ, 10KΩ, 100KΩ, 1MΩ, 10MΩ, 100MΩ.
- Frequency: 3Hz-990kHz.
- 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 1pc
- Testing Lead 1set
- CD disk 1pc

Options:

- IEEE-488 interface board 1pc

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.

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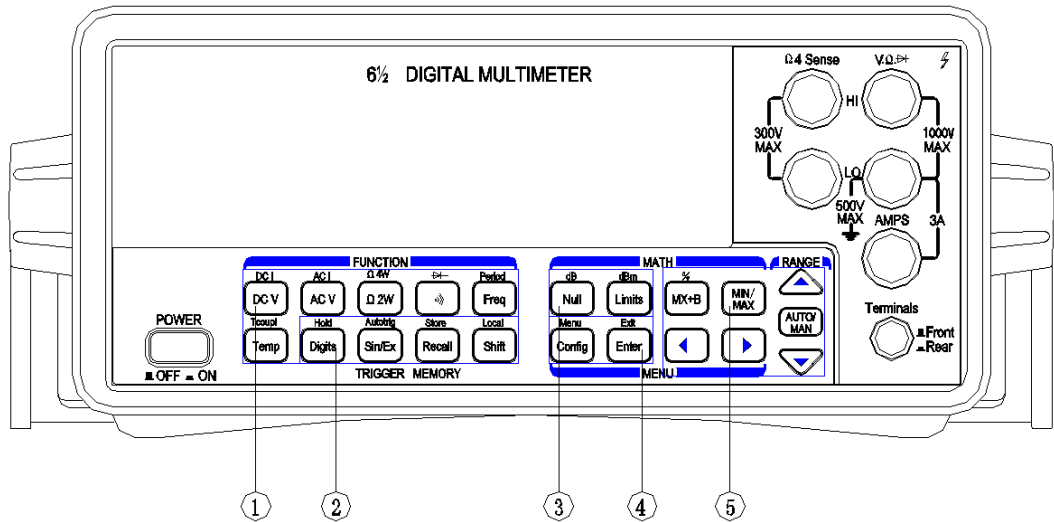
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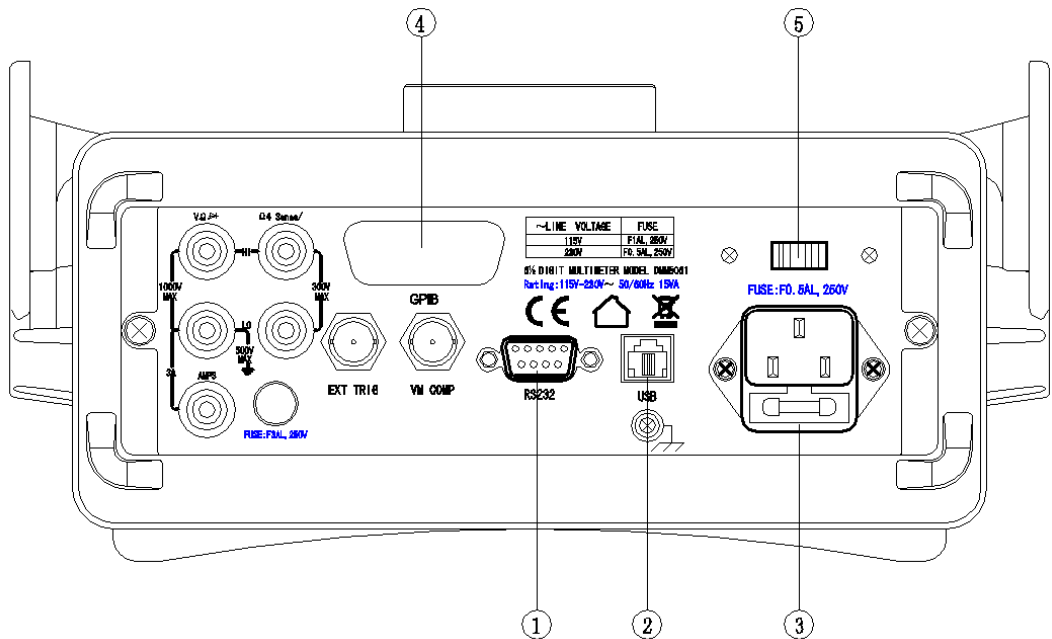
Chapter 1 Quick Start

1.1 Front Panel at a Glance



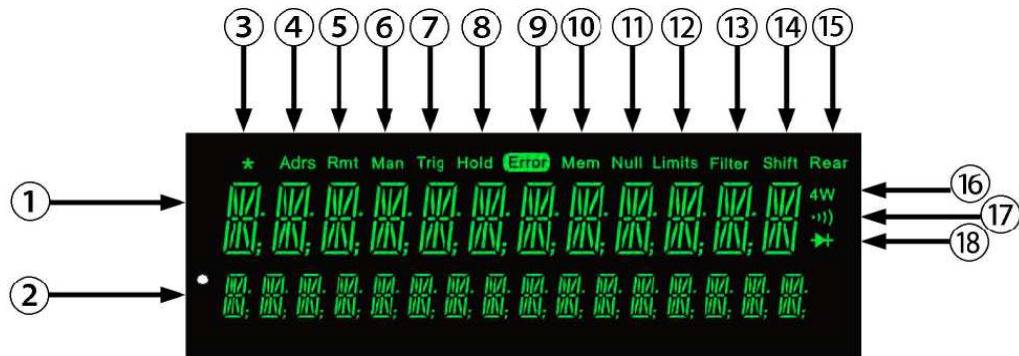
- ① Measurement Function keys
- ② Auxiliary function keys
- ③ Math Operation keys
- ④ Config Enter keys
- ⑤ Menu Operation keys (Range)

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 Setting Switch

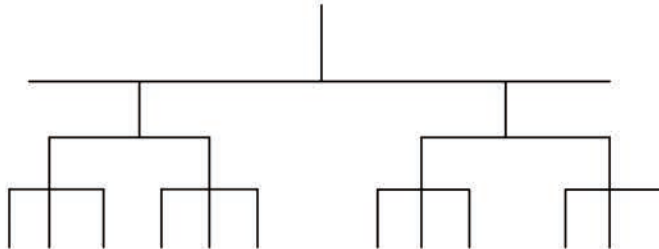
1.3 Display Annunciators



- 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 ω) (In continuity test function)
- ⑱ ∇ + (In diode test function)

1.4 Front Panel Menu at a Glance

The menu of DMM is organized in a top-down tree structure with three levels, menu, commands 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

【Config】 + 【Shift】 + 【Temp】 :

1:TYPE → 2:UNITS → 3:SIM

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:TRIG DELAY → 3:N SAMPLES

D:System Menu

1:RDGS STORE → 2:ERROR → 3:BEEP → 4:REVISION

E:Interface Menu

1:RS-232 → 2:USB → 3:GPIB

F:Calibration Menu

1:SECURED → [1:UNSECURED] → 2:CALTBRATE → 3:MESSAGE

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 continuous buzzer threshold from 1 ohm to 1000 ohms.
5:SENSOR	select temperature sensor type
6:UNITS	select temperature unit
7:MODE	select connection mode
8:TYPE	select thermocouple type
9:SIM	set reference point temperature

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:TRIG DELAY	set the interval before measurement
3:N SAMPLES	set the sample number for trigger

D: System Menu

1:RDGS STORE	enable and disable the reading storage
2:ERROR	correct the error in error queue (up to 20 errors)
3:BEEP	enable or disable the buzzer
4: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 caliabrations protection.
2:CALTBRATE	run all the calibration, includes zero calibration and gain calibration
3:MESSAGE	view the calibration information

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: 250mAT, 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 250mAT slowly melting fuse is needed.

1.6.3 Replace current input fuse

Both front and rear current input terminal are protected by two series fuse, one is 3A, 250Vac fast-melt fuse on the rear panel.

The other one is assembled in the multimeter to supply the current protection for extral level, which is 7A, 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)
Integral Time	10PLC
Auto Zero	On
Aperture	100Ms(Medium mode)
Input Impedance	10MΩ(for all DC range)
AC Filter	20Hz(Medium 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

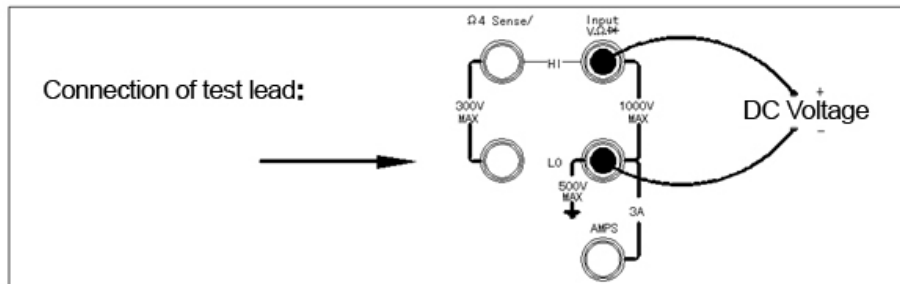
Chapter 2 Measurement Functions

2.1 To measure DC Voltage

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

Maximum Resolution: 0.1uV

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.

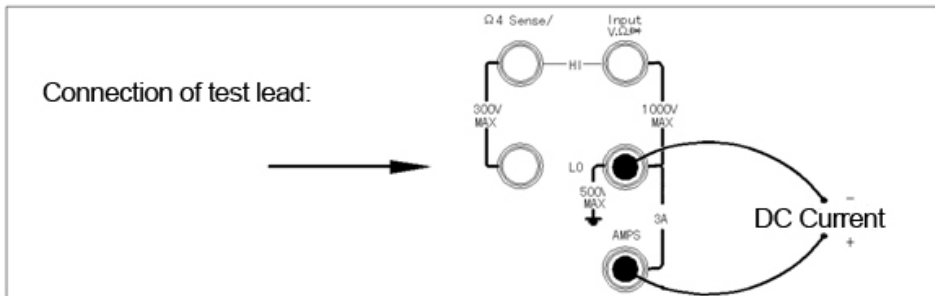
(2) To avoid Terminal EMFs generated by different metal surfaces, you'd better make the pure copper produced testing connector touched with same material.

2.2 To measure DC Current

Ranges: 10mA, 100mA, 1A, 3A

Maximum Resolution: 10nA

Configurable parameter: Integration



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.
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 avoide 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.

(3) To avoid Terminal EMFs generated by different metal surfaces, you'd better make the pure copper produced testing connector touched with same material.

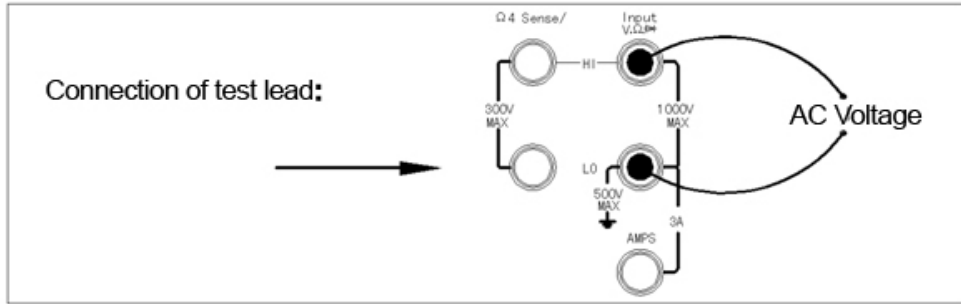
2.3 To measure AC Voltage

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

Maximum Resolution: 0.1μV

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
destruction to multimeter and danger to human.**

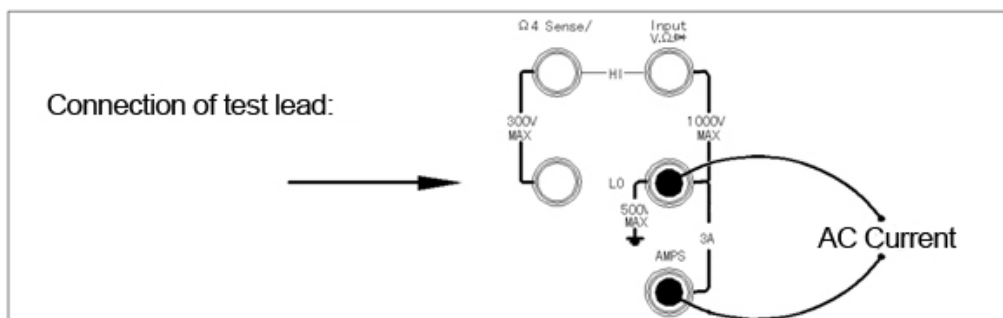
2.4 To measure AC Current

Ranges: 1A, 3A

Maximum Resolution: 1μA

AC technique: True RMS, AC coupled

Configurable parameters: AC Filter



Measurement Method:

1. Connect as picture shows.
2. Press **【Shift】【ACV】** key to measure AC current.
3. Press **【^】** or **【v】** key to select range manually. Press **【AUTO/MAN】** key to select auto range.
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.

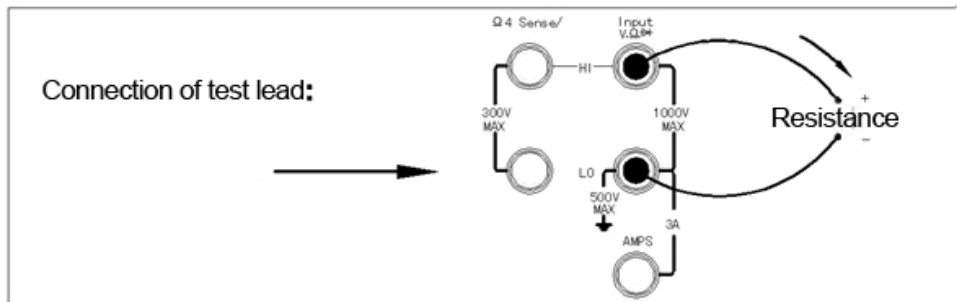
(2) If AMPS fuse is burn out due to the over current, please change the fuse on rear panel.

2.5 To measure 2 wire resistance

Ranges: 100Ω, 1kΩ, 10kΩ, 100kΩ, 1000kΩ, 10MΩ, 100MΩ

Maximum resolution: 0.1mΩ

Cnfigurable parameter: Integration

**Measurement Method:**

1. Connect as picture shows.
2. Press **【Ω2W】** key to measure 2 wire resistance.
3. Press **【^】** or **【v】** 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 avoid destruction to multimeter and danger to human.

To eliminate the resistance of test lead:

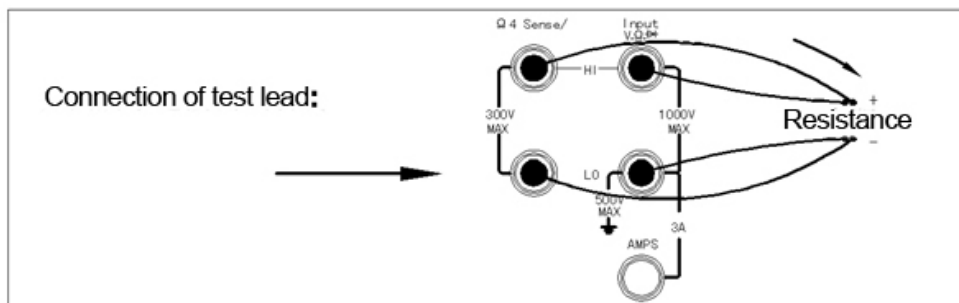
- 1 Make one end of test lead connected to multimeter and short the probe end together.
- 2 Press “Null” key.
- 3 Make the test probe end connected to test circuit and measure the calibrated resistance.

2.6 To measure 4 wire resistance

Ranges: 100Ω, 1kΩ, 10kΩ, 100kΩ, 1000kΩ, 10MΩ, 100MΩ

Maximum resolution: 0.1mΩ

Configurable parameter: Integration



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 avoid destruction to multimeter and danger to human.

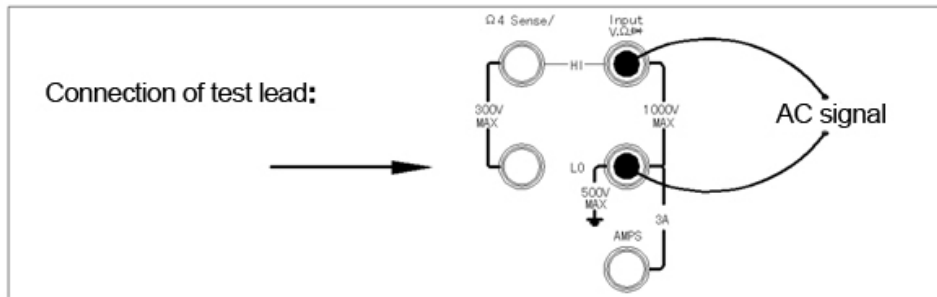
2.7 To measure Frequency (or Period)

Frequency range: 3Hz to 990KHz (333ms to 3.3 us)

Input signal range: 100mVAC to 750VAC

Technique: reciprocal counting

Configurable parameter: GATE TIME



Measurement Method:

1. Connect as picture shows.
2. Press **【Freq】** or **【Shift】** + **【Freq】** key to measure frequency or period.
3. Press **【^】** or **【v】** 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.

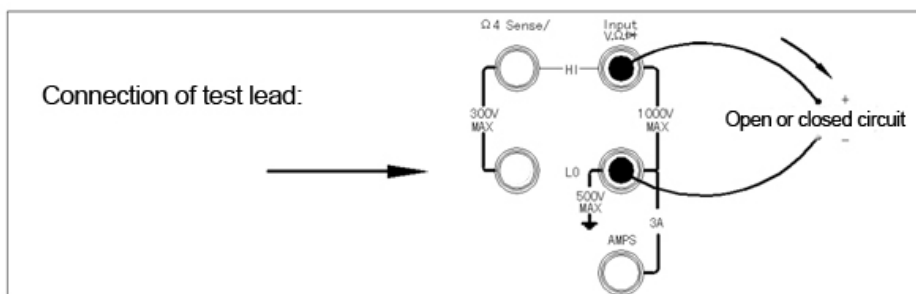
Note: (1) DC voltage over 1000Vpp is never allowed to input terminal to avoid destroy to multimeter and danger to human.

2.8 To test continuity

Test current source: 1mA

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

Beeper threshold: 1Ω to 1000Ω (beeps below adjustable threshold)



Measurement Method:

1. Connect as picture shows.
2. Press **【 \rightarrow 】** key to measure continuity.

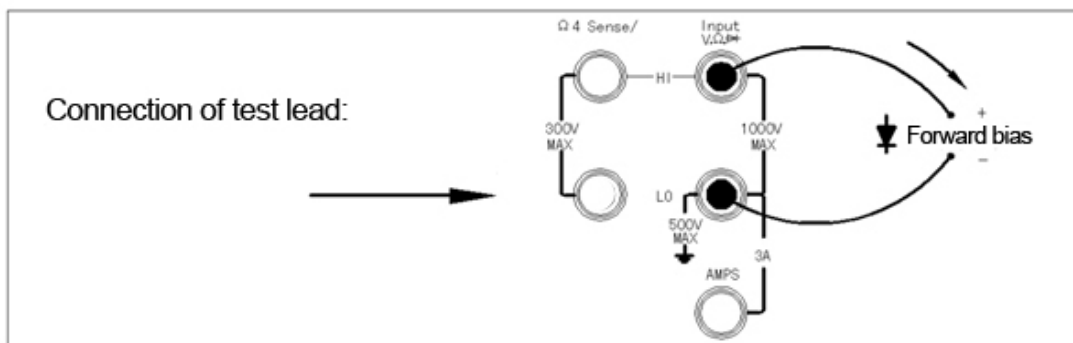
Note: (1) DC voltage over 1000V is never allowed to input terminal to avoid destroy to multimeter and danger to human.

2.9 To measure diode

Test current source: 1mA

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

Beeper threshold: $0.3V \leq V_{\text{measured}} \leq 0.8V$ (not adjustable)

**Measurement Method:**

1. Connect as picture shows.
2. Press **【Shift】【 \rightarrow 】** key to measure diode.

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

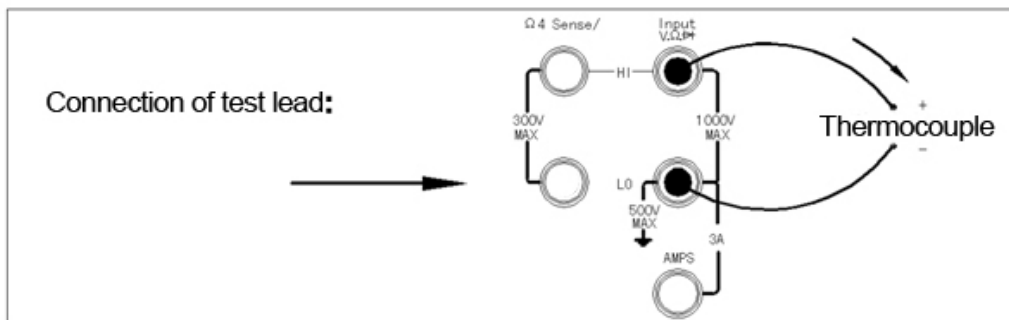
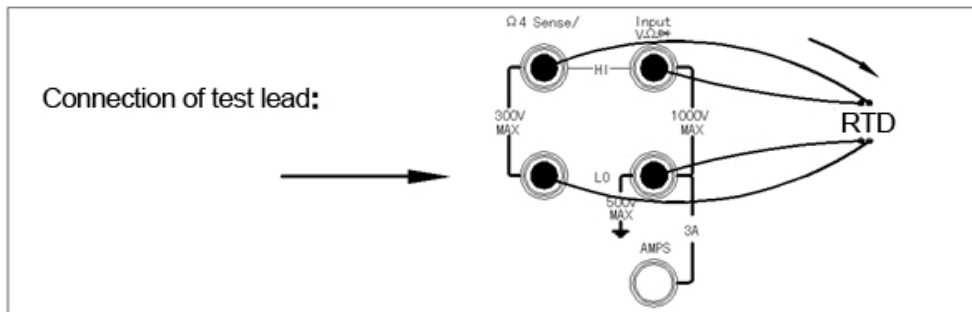
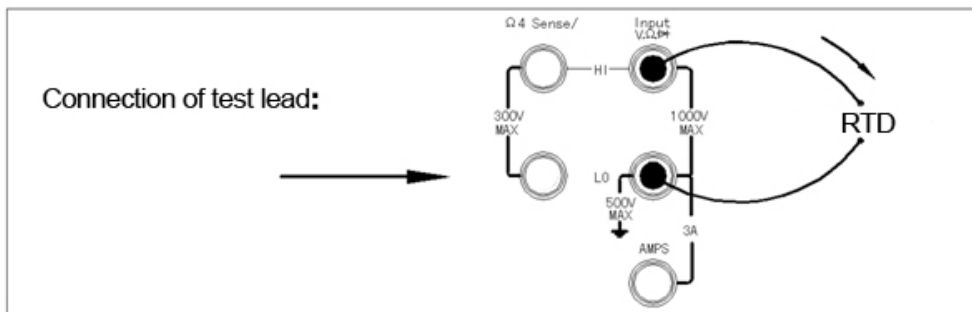
2.10 To measure temperature

The DMM has two measurement modes for temperature, thermocouple and 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 (°C)	Temperature °F
K	0~1370	32~2498
J	0~760	32~1400
R	0~1000	32~1832
RTD(PT100)	-200~800	-392~1312

Configurable parameters: Probe Type, Unit, Mode, Sim (Simulation preset)



Measurement Method:

1. Connect as picture shows.
2. Press **【Temp】** key to measure temperature or press **【Shift】【Temp】** key to measure thermocouple.

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

Chapter 3 Features and Functions

3.1 Front panel display

This DMM 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 ““-1.000,000 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 changes to show the menu message and selectable parameters.

Menu Tutorial

- In this book, the positioning keys include **【^】**, **【v】**, **【<】**, **【>】** and **【Enter】**.
- Some keys for menu open, like:
 - 【Config】** to configure current selected measuring function
 - 【Menu】** to configure the parameter of system menu
- Press **【Shift】** key to open or close shift function as the Shift indicator lights on or off.
- If multimeter is under remote control mode (**Remote** indicator enabled), press **Local** 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 Turn off the display

Just available for remote control function

For safe operation, user needs to disable the front panel display. When disabled, the whole screen is black without any display.

The command for disabling display: DISPLAY OFF

3.1.3 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 **【v】** 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 4½, slow 4½, fast 5½, slow 5½, fast 6½, slow 6½. If you want to increase the measurement accuracy and noise rejection, please set 6½ digits. If you want to speed up the measurement, please set 4½ digits.

Resolution is local to all selected functions. Math operation resolution is same as measurement resolution. When setting the resolution, it will select auto zero mode indirectly.

The relative relationship between resolution and integral time is as below:

Fast 4½-0.02PLC

Slow 4½-1PLC

Fast 5½-0.2PLC

Slow 5½-10PLC

Fast 6½-10PLC

Slow 6½-100PLC

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 4½ digis at Continuity and Diode testing.

3.2.2 To set AC Filter

Three AC filter choices for improving the measurement, 3Hz, 20Hz 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 medium 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】** + **【Enter】** 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 $1K\Omega$ (2 wire resistance test).

Once the measurement less or equal to continuity threshold, the multimeter will beep and display the actual resistance on front panel. The threshold resistance can be set from 1Ω to 1000Ω .

Front panel operation: Press **【Config】** key + **【 ⏏ 】** key, which shows threshold resistance. Then press **【<】**, **【>】**, **【 \wedge 】** or **【 \vee 】** key to select suitable parameter, finally confirm by **【Enter】** key pressing.

- Threshold is only allowed to be set on front panel.
- The threshold resistance 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 frequency and period measurement, the function of aperture time is similar as gate time and integral time, can be set as 10mS (4 1/2 digits), 100mS (default value, 5 1/2 digits) or 1S (6 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 aperture time setting is stored in volatile memory. Default setting is 100mS at power-on and after remote control reset (5 1/2 digits).

3.2.6 To set temperature sensor probe

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

Front panel operation: Press **【Config】**+**【Temp】**+**【Enter】**key, which shows temperature parameters, like sensor type, unit, 2 or 4 wire type. Then 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.

3.2.7 To set switch between front and rear panel

Both front and rear input are selectable for measurement, but the switch is on front panel. Remote interface can't be used for select the input, but can be inquired for current setting for input.

- When select rear input, the annunciator "Rear" will be on.

3.3 Math operation

Multimeter 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 annunciator indicating (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 executing 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.

$$\text{Result} = \text{Reading} - \text{Null value}$$

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

Front panel operation: Press **【NULL】** key to execute null operation. Then press **【Config】** + **【Null】** key and get down to parameter level to select suitable parameter by **【<】**, **【>】**, **【^】** or **【v】** 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 both values converted to dBm, the formula is:

$$dB = 20 \times \log(V_{in}/V_{ref})$$

V_{in} is input signal, V_{ref} is relative reference voltage.

Front panel operation: Press **【Shift】** + **【dB】** key to execute dB operation. Then press **【Config】**+**【Shift】**+**【dB】** key and get down to parameter level to select suitable parameter by **【<】**, **【>】**, **【^】** or **【v】** 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 voltage 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.

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

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 **【v】** 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, constant 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 **【v】** 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 $+1.000000^{\wedge}$ when power-on or after remote interface reset.

3.3.6 %

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

$$\text{Percent} = (\text{Input} - \text{Reference}) / \text{Reference} * 100\%$$

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 **【v】** 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

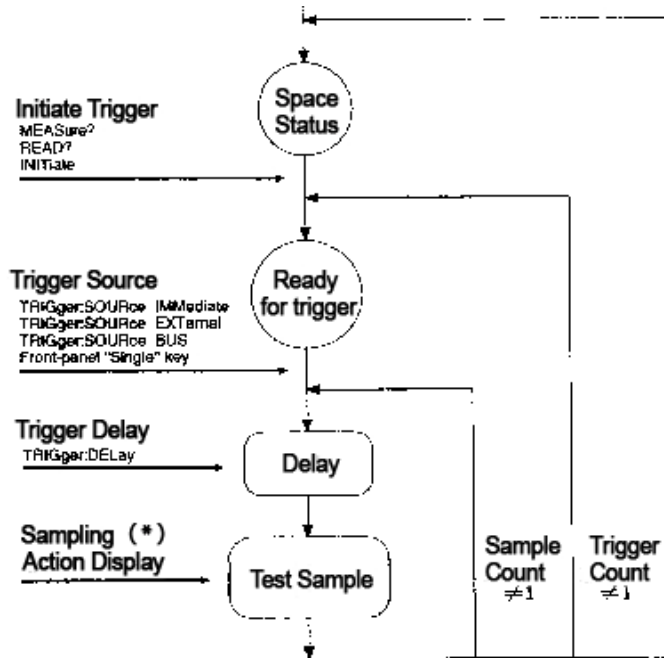
Limit testing operation performs the test as your set high/low limit. High/low limit can be set from 0 to full range and high limit should be greater than low limit. If the test value over the limit, the multimeter will beep (only if beep is on) and indicate “HI” or “LO”.

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 **【v】** 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, and you can insert trigger delay between these 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 from the front panel.

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).

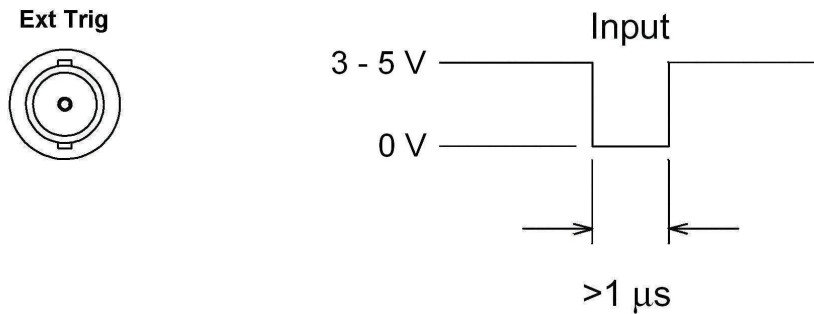
When multimeter waits for next trigger, the annunciator “Tig” is on.

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

External Trigger

Multimeter takes one reading or specified readings each time the Ext Trig (External Trigger) connector on rear panel receives one pulse.

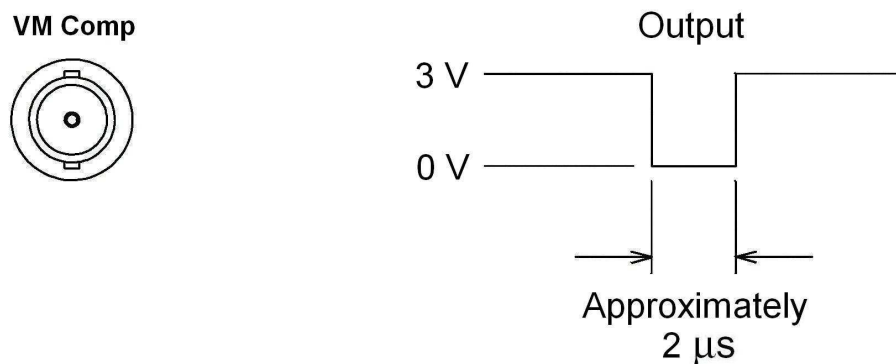
The figure shows the External trigger connector how to select time (for negative pulse)



If next trigger takes when multimeter are getting the first reading, the next trigger will be also accepted and wait for taken after the first reading completed.

Rear-panel VM Comp (multimeter completed) connector applies a pulse after each testing. VM Comp and external trigger will excute the series exchanging of standard hardware signale between the measurement and switch.

The figure shows the **VM Comp** connector how to select time (for negative pulse)



Front panel operation: press **【Sin/Ex】** key to enable the trigger on **Ext Trig** connector.

Internal trigger

Trigger signal always be there for internal trigger model. So when you make the multimeter wait for trigger, it will send trigger signal at once. This is default trigger source for remote interface source.

If you want to select internal trigger source, please send below commands, CONFigure and MEASure? Commands will set the trigger source to IMMEDIATE.

TRIGger:SOURce IMMEDIATE

BUS trigger

Bus trigger is only enabled from remote interface. The trigger mode is similar as signal trigger mode on front panel, just only triggering by sending commands.

To select bus trigger source, please send below command:

TRIGger:SOURce BUS

Then execute any commands below to take the reading.

MEASure?

READ?

INITiate

3.4.2 Sampling numbers

Multimeter takes one reading each time it receives one trigger signal as selected source if multimeter is at the waiting state. But also can take 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 3: N SAMPLES by **【<】** or **【>】** keys and press **【Enter】** key to display the sampling numbers. Then set suitable parameters by **【<】**, **【>】**, **【^】** or **【v】** 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 Trigger delay

You can set the trigger delay between the specified trigger signal and next sample. The delay can make the input signal stable before reading or adjust the group readings.

Trigger delay can be set from 0 to 3600s. Internal trigger delay is auto adjusted period, which is decided by measurement function, range and integral time and AC filter setting. If you set it to be non-auto state, the trigger delay will be available for all measurements and range.

Front panel operation: Press **【Shift】+【Config】+【Enter】** key to display 1: TRIG MENU. Press **【Enter】** key to enter into the menu. Find option 2: TRIG DELAY by **【<】** or **【>】** keys and press **【Enter】** key to display the delay value. Then set suitable parameters by **【<】**, **【>】**, **【^】** or **【v】** keys, finally confirm it by **【Enter】** key.

- Trigger delay setting is stored in volatile memory, default setting is 0.001s when power-on or after remote interface reset.

Auto trigger delay

If user does not specify the trigger delay, the auto trigger delay will be selected, which can ensure the full, stable and accurate measurements for multimeter. The delay is decided by function, range, integral time and AC filter setting.

DC voltage and DC current

Integral Time	Trigger delay
NPLC \geq 1	1.5mS
NPLC<1	1.0mS

2 wire resistance

Range	Tigger delay
100 Ω -100K Ω	1.5mS
1M Ω	15mS

10M-100M Ω	100mS
-------------------	-------

4-wire resistance

Range	Trigger delay
100 Ω -100K Ω	1.0mS
1M Ω	10mS
10M-100M Ω	100mS

AC voltage and AC current

Front panel operation and auto trigger function enabled

AC Filter	Trigger delay
Slow	1.5sec
Medium	200mS
Fast	100mS

Remote operation and single/external trigger

AC Filter	Trigger delay
Slow	7.0sec
Medium	1.0sec
Fast	600mS

Frequency and period

Front panel operation and auto trigger function enabled

Trigger delay
0sec

Remote operation and single/external trigger

Trigger delay
1.0sec

3.4.4 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 80 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 Storage setting is saved in volatile memory, which will be cleared when power-on or after remote interface reset.

3.5.2 Error condition

When Error annuiator on front panel is on, it indicates that the multimeter has detected one or more commands error or hardware bug. At most 20 error sequences could be saved. For each command error or hardware bug, multimeter will beep once.

Error dectecting also follows the order first-in-first-out. First returned error is first saved error. After read, the error will be cleared, if errors are over 20, the last error will be replaced by -350, which is “Error queue overflow”. Not any more error can be saved until some out of the queue. If no error queue takes place, multimeter will response with +0, “No error”.

Front panel operation: press **【Shift】 + 【Config】 + 【Enter】** key and select option **2: SYS MENU** by **【<】** or **【>】** key. Then press **【Enter】** key and select option **2: ERROR** by **【<】** or **【>】** key. Finally press **【Enter】** key to display error code and view it by **【<】** or **【>】** key.

3.5.3 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 **4: 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.

3.5.4 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 **2: 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.

3.5.5 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 into menu and select one interface in 3. If select GPIB, press **【Enter】** key to display address and adjust the value by **【<】**, **【>】**, **【^】** or **【v】** key. Finally press **【Enter】** key to confirm the address setting and enable the GPIB communication. If select RS232, press **【Enter】** key again to display the baud rate and adjust the value by **【<】** or **【>】** key. Finally press **【Enter】** key again to finish parameter setting. Connect the device with PC using RS232 cable, pay attention to set the port number of PC software match with RS232 port, so as to guarantee a normal communication.

If select USB, please operate as following:

Connect the computer and the instrument with a USB cable, and then the computer will prompt that the new hardware is installed and ready for use. Right click the sign of my computer and choose property, select the hardware item and click device manager, then click port and choose 'Silicon Labs CP210x USB to UART Bridge (COMX)', meantime choose the matched USB port number in PC software, to guarantee a normal communication.

3.5.6 Calibration

Calibrating protection

This function can protect multimeter from calibration out of authorization. When you need to calibrate the multimeter, 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.

Unlock the calibration protect

Front panel operation: 1:SECURED (CAL MENU)

If multimeter under protection, you will see above command when enter into **CAL MENU**.

At the same time, the command **2:CALIBRATE** 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 multimeter no longer under protection and you will see the command **2:CALTBRATE** and you can calibrate it.

Lock the calibration

Front panel operation: 1:UNSECURED (CAL MENU)

If multimeter 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 multimeter is under protection and you will see the command **2:CALTBRATE** hidden and you can not calibrate it.

Modify the password

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

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 into 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}MAXimum}}

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 VUL 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{<range>{MINimum}MAXimum }

Select a specified range. MIN is the minimum of range and MAX is maximum of range.

Setting of inquire 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 character <new line>. IEEE-488.2 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. Universal command start with *, with 4 to 5 characters long and includes one or more parameters, the keywords from the first parameters are separated by space and for more commands, using ; to separate.

```
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,..., ...,<n1>
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?

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

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 " TCOuple "

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]

UNIT:TEMPerature {Cel|Far|K}

UNIT:TEMPerature?

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

TEMPerature:RTD:TYPE?

UNIT:TCouple {Cel|Far|K}

UNIT:TCouple?

TCouple:TYPE {K|J|R}

TCouple:TYPE?

:TCouple:RJUNction:SIMulated {<value>|MINimum|MAXimum}

:TCouple:RJUNction:SIMulated?

[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?

[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]

[SENSe:]

VOLTage:DC:NPLCycles {0.02|0.2|1|10|100|MINimum|MAXimum} Integral time

VOLTage:DC:NPLCycles? [MINimum|MAXimum]

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

CURRent:DC:NPLCycles? [MINimum|MAXimum]

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

RESistance:NPLCycles? [MINimum|MAXimum]

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

FRESistance:NPLCycles? [MINimum|MAXimum]

[SENSe:]

FREQuency:APERture {0.01|0.1|1|MINimum|MAXimum} aperture time

FREQuency:APERture? [MINimum|MAXimum]

PERiod:APERture {0.01|0.1|1|MINimum|MAXimum}

PERiod:APERture? [MINimum|MAXimum]

[SENSe:]

DETEctor:BANDwidth {3|20|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]

DATA:FEED RDG_STORE, {"CALCulate"|""} }

DATA:FEED?

Triggering Commands

INITiate**READ?****TRIGger**

:SOURce {BUS|IMMediate |EXTernal}

:SOURce?

TRIGger

:DELay {<seconds>|MINimum|MAXimum}

:DELay? [MINimum|MAXimum]

TRIGger

:DELay:AUTO {OFF|ON}

:DELay:AUTO?

SAMPLE

:COUNt {<value>|MINimum|MAXimum}

:COUNt? [MINimum|MAXimum]

TRIGger

:COUNt {<value>|MINimum|MAXimum|INFinite}

: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**

***TST?**

***IDN?**

RS-232 Interface Commands

SYSTem:LOCal

SYSTem:REMote

SYSTem:RWLock

IEEE-488.2 Common Commands

***CLS**

***ESE <enable value>**

***ESE?**

***ESR?**

***IDN?**

***OPC**

***OPC?**

***PSC {0|1}**

***PSC?**

***RST**

***SRE <enable value>**

***SRE?**

***STB?**

***TRG**

***TST?**

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

multimeter 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 output 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 output 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 output buffer. For this measurement, the resolution is fixed as 6 1/2 digits, and this parameter only affects 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 output 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 output buffer. For this measurement, the resolution is fixed as 6 1/2 digits, and this parameter only affects 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 output 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 output buffer.

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

Measure the frequency as specified range and resolution and send the readings to output

buffer. For this measurement, multimeter select one range for all input signal between 3Hz to 300KHz. When there is no input, the measurement result is 0.

MEASure:PERiod?{ $\langle \text{range} \rangle$ |MIN|MAX|DEF } , { $\langle \text{resolution} \rangle$ |MIN|MAX|DEF}

Measure the period as specified range and resolution and send the readings to output buffer.

For this measurement, multimeter select one range for all input signal between 3.3 μ s 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 4 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 4 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 6 1/2 digits.

MEASure : TCOuple?

Preset and excute the thermocouple measurement and send the readings to output buffer. For this measurement, resolution is fixed as 6 1/2 digits.

CONFigure:VOLTage:DC{ $\langle \text{range} \rangle$ |MIN|MAX|DEF} , { $\langle \text{resolution} \rangle$ |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:DC:RATio{ $\langle \text{range} \rangle$ |MIN|MAX|DEF} , { $\langle \text{resolution} \rangle$ |MIN|MAX|DEF}

Preset and conofigure the DC ratio measurement as specified range and resolution, and this

command does not enable the measurement. For this measurement, the specified range is applicable for signal connected to Input terminal. For measurement of reference voltage on Sense terminal, the multimeter will select auto range.

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

Preset and configure 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 6 1/2 digits, and this parameter only effects the front panel displaying.

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

Preset and configure 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 configure 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 6 1/2 digits, and this parameter only effects the front panel displaying.

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

Preset and configure 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 configure 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 300KHz. 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 3.3us to 0.33s. 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 4 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 4 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 6 1/2 digits.

CONFigure : TCOuple?

Preset and configure the thrmocouple measurement and this command wil not enable the mesurement For this measurement, resolution is fixed as 6 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-wire resistance)

FRESistance (4-wire resistance)

FREQuency

PERiod

CONTinuity

DIODE

TEMPerature

TCouple

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 of 3Hz:.

<function>:NPLCycles?{ 0.02|0.2|10|100|MIN|MAX}

Select integral time for current function, the unit of which is cycle of power supply (default value is 10PLC). This command is only applicable for DC voltage, DC current, 2-wire and 4 wire resistanc measurements. MIN=0.02,MAX=100.

<function>:NPLCycles? [MIN|MAX]

Query the intergral time for specified function.

FREQuency:APERture{ 0.01|0.1|1|MIN|MAX}

Select aperture time or gate time of frequency measurement, default value is 0.1s. You can specify 10ms (4 1/2 digits), 100ms (default value is 5 1/2 digits), or 1s (6 1/2 digits). MIN=0.01s MAX=1s, which are stored in volatile memory.

FREQuency:APERture?[MIN|MAX]

Query the aperture time for frequency measurement.

PERiod:APERture{0.01|0.1|1|MIN|MAX}

Select aperture time or gate time of period measurement, default value is 0.1s. You can specify 10ms (4 1/2 digits), 100ms (default value is 5 1/2 digits), or 1s (6 1/2 digits).

MIN=0.01S MAX=1S, which are stored in volatile memory.

PERiod:APERture?[MIN|MAX]

Query the aperture time for period measurement.

[SENSe:]DETEctor:BANDwidthn{3|20|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=3Hz MAX=200Hz, which are stored in volatile memory.

[SENSe:]DETEctor:BANDwidthn? [MIN|MAX]

Query the AC filter and returned value is 3, 20 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 10M Ω for all ranges. If the auto resistance input is selected as AUTO ON and range is 100mV, 1V or 10V, the setting for input resistance will be more than 10G Ω and stored in volatile memory.

INPut:IMPedance:AUTO?

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

ROUTE:TERMinals?

Query the input mode, returned value is "FRON" or "REAR"

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 returned value is 0 (OFF) or 1 (ON).

CALCulate:AVERage:MINimum?

Read the minimum in limit calculation. When enable calculation or power-off, or reset by remote interface, the multimeter 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 multimeter 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 multimeter 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 multimeter 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 ± 120 of full range. MIN=Full range $\pm 120\%$ 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. Reference balue can be set within the range -1200V to 1200V. MIN= - 1200 and MAX=1200 and 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 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, IMM or EXT.

TRIGger:DELay { <seconds >|MIN|MAX}

Insert the trigger delay between trigger signal and followed sample, if you don't specify the trigger dealy, the multimeter will select one delay by itself. The range of trigger delay is required within the range from 0 to 3600s. MIN=0s, MAX=3600s, the setting is stored in volatile memory.

TRIGger:DELay? [MIN|MAX]

Query the trigger delay.

TRIGger:DELay:AUTO {OFF|ON}

Disable or enable the auto trigger dealay, which is decided by measurement range, integral time and AC filter setting. If you specify the trigger delay, it will diable the auto trigger

delay function.

TRIGger:DELay:AUTO?

Query the auto trigger delay setting and returned value is 0 (OFF) or 1 (ON).

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.

DISPly{OFF|ON}

Open or close the front display. The setting is stored in volatile memory.

DISPly?

Query the setting of front display and returned value is 0 (OFF) or 1 (ON).

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:ERRor?

Query the error sequence of multimeter, allowed storing 20 errors at most in sequence. The returned value follows the order FIFO. Each error string contains 80 characters.

SYSTem:VERSIon?

Query current SCPI version.

DATA:POInts?

Query the reading numbers in internal memory.

***RST**

Reset the multimeter as the power-on settings.

***TST?**

Perform the full self test and return value is 0 or 1. 0 indicates the successful self test and 1 indicates the failure one.

***IDN?**

Read the recognition character strings, please make sure the obligated string variable 35 characters space.

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 operation, and all keys on front panel are not available except of LOCAL key.

SYSTem:RWLock

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

Chapter 5 Error Messages

Multimeter detects the error at the order FIFO, that the first returned error is the first stored error. When you read out all error messages, the ERROR indicator is turned off. For each error, it beeps once.

When error message is over 20, it pops up the message “Too many error”. Since you remove some errors in sequence, no any other error will be stored. If there is no error, it will response “No error”.

When power off the multimeter or excute the *CLS command, the * RST command will not clear the error sequence.

Front panel operation: press **【Shift】** + **【Config】** key and select option **2: SYS MENU** by **【<】** or **【>】** key. Then press **【Enter】** key and select option **2: ERROR** by **【<】** or **【>】** key. Finally press **【Enter】** key to display error code and view it by **【<】** or **【>】** key.

5.1 Error command for remote interface

— 102 Syntax error

Found the syntax error during the commands character strings. Maybe you insert the space into the front or back of the colon or front of comma, like: SAMP:COUN ,1

— 103 Invalid separator

Found the invalid sperator during the commands character strings. Maybe you use the colon, semicolon or space intead of comma, or use comma instead of space, like : TRIG:COUN, or CONF:FREQ 1000 0.1

— 104 Data type error

Found the wrong type of data. Maybe you specify a numeric value instead of charater string. Take the wrong command for example: TRIG:COUN 0.5SECS

— 113 Undefined header

Received command is not applicable for multimeter. Maybe you use the wrong command or

the command is invalid. If you want to use the simple command, please make sure it allows 4 characters at most. Take the wrong command for example: TRIGG : COUN3

— **131 Invalid suffix**

Found the wrong suffix after numeric parameter, like :SENSe:VOLT:DC:RANG 1M

— **222 Data out of range**

Numeric parameter is out of the valid range, like: TRIG : COUN -3

— **532 Cannot achieve requested resolution**

Required resolution can't be achieved. May be you specify the invalid resolution in commands of CONFigure or MEASure.

Chapter 6 Service and Support

6.1 Warranty

We 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.

Chapter 7 Specifications

7.1 General Specifications

Power

Voltage: 110V/220V (1±10%)

Power frequency: 50Hz/60Hz

Consumption: 15VA

Environment

Working temperature: 0°C ~ 50°C

Storage temperature: -20°C ~ 70°C

Working humidity: 0°C ~ 28°C < 90%RH

28°C ~ 40°C < 80%RH

40°C ~ 50°C < 50%RH

Storage humidity: -20°C ~ 70°C < 90%RH

Dimensions

HxWxD: 106mm×260mm×375mm

Weight: 3kg

Safety:

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

7.2 Performance Specifications

Notice:

- Accuracy: ±(% reading + digits), warm up time more than 2 hours
- Temperature: 18°C ~ 28°C。

DC Characteristics

Accuracy specifications ± (% of readings + % of range)

Function	Range	Test current or load voltage	23°C±5°C	Temperature Coefficient 0°C-18°C 28°C-50°C
DC Voltage	100.0000mV		0.0050+0.0045	0.0005+0.0005
	1.000000V		0.0040+0.0007	0.0005+0.0001
	10.00000V		0.0035+0.0005	0.0005+0.0001
	100.0000V		0.0045+0.0006	0.0005+0.0001
	1000.000V		0.0045+0.0010	0.0005+0.0001
	100.0000Ω	1mA	0.010+0.004	0.0006+0.0005

Resistance 4 Wire(1)	1.000000K Ω	1mA	0.010+0.001	0.0006+0.0001
	10.00000K Ω	100 μ A	0.010+0.001	0.0006+0.0001
	100.0000K Ω	10 μ A	0.010+0.002	0.0006+0.0001
	1.000000M Ω	5 μ A	0.010+0.003	0.0010+0.0002
	10.00000M Ω	500nA	0.040+0.003	0.0030+0.0004
	100.0000M Ω	500nA	0.800+0.010	0.1500+0.0002
		10M Ω		
DC Current	10.00000mA	<0.1V	0.050+0.020	0.002+0.0020
	100.0000mA	<0.6V	0.050+0.005	0.002+0.0005
	1.000000A	<1V	0.100+0.010	0.005+0.0010
	3.000000A	<2V	0.120+0.020	0.005+0.0020
Continuity	1000.000 Ω	1mA	0.010+0.030	0.001+0.002
Diode Test	10.0000 V	1mA	0.010+0.020	0.001+0.002

1. Specifications are for 4-wire ohms function, or 2-wire ohms using Math Null. Without Math Null, add 0.2 Ω additional error in 2-wire ohms function.

Conditions: within 10 minutes and $\pm 0.5^{\circ}\text{C}$

Within $\pm 10\%$ of initial value

Following 2 hours warm-up

Fixed range between 10% and 100% of full range

Using 6 1/2 digit slow resolution (100PLC)

Measurements are made using accepted metrology practices.

Measuring Characteristics

DC voltage

Input resistance: 0.1 V, 1 V, 10 V ranges 10M Ω or > 10G Ω
 100 V, 1000 V ranges 10M Ω $\pm 1\%$

Input protection: 1000V on all ranges

AC Characteristics

Accuracy specifications \pm (% of readings + % of range)

Function	Range	Frequency	23 $^{\circ}\text{C} \pm 5^{\circ}\text{C}$	Temperature Coefficient 0 $^{\circ}\text{C}$ -18 $^{\circ}\text{C}$ 23 $^{\circ}\text{C}$ -50 $^{\circ}\text{C}$
	100.0000mV	3Hz-5Hz	2.50+0.1	0.100+0.004
		5Hz-15Hz	1.50+0.1	0.035+0.004
		15Hz-20kHz	0.06+0.04	0.005+0.004
		20kHz-50kHz	0.12+0.05	0.011+0.005

AC Voltage		50kHz-100kHz	0.60+0.08	0.060+0.008
		100kHz-300kHz	4.00+0.50	0.20+0.002
	1.000000V To 750V	3Hz-5Hz	2.50+0.1	0.100+0.003
		5Hz-15Hz	1.50+0.1	0.035+0.003
		15Hz-20kHz	0.06+0.04	0.005+0.003
		20kHz-50kHz	0.12+0.05	0.011+0.005
50kHz-100kHz		0.60+0.08	0.060+0.008	
	100kHz-300kHz	4.00+0.50	0.20+0.02	
AC Current	1A	3Hz-5Hz	2.50+0.1	0.100+0.006
		5Hz-15Hz	1.50+0.1	0.035+0.006
		15Hz-3kHz	0.15+0.06	0.015+0.006
		3kHz-5kHz	0.15+0.06	0.015+0.006
	3A	3Hz-5Hz	2.50+0.1	0.100+0.006
		5Hz-15Hz	1.50+0.1	0.035+0.006
		15Hz-3kHz	0.15+0.06	0.015+0.006
		3kHz-5kHz	0.15+0.06	0.015+0.006

Conditions: Sinewave input
 Within 10 minutes and $\pm 0.5^{\circ}\text{C}$
 Within $\pm 10\%$ of initial value and 1% of initial frequency
 Following 2 hours warm-up
 Fixed range between 10% and 100% of full range (and $< 120\text{V}$)
 Using 6 1/2 digit resolution
 Measurements are made using accepted metrology practices.

Measuring Characteristics

Input impedance: $1\text{M}\Omega \pm 2\%$ in parallel with 100pF

Input protection: 750Vrms all ranges

Frequency and Period Characteristics

Accuracy specifications \pm (% of reading)

Function	Range	Frequency	$23^{\circ}\text{C} \pm 5^{\circ}\text{C}$	Temperature Coefficient $0^{\circ}\text{C} - 18^{\circ}\text{C}$ $23^{\circ}\text{C} - 50^{\circ}\text{C}$
Frequency /Period	100mV	3Hz-5Hz	0.10	0.005
	To	5Hz-10Hz	0.08	0.005
	750V	10Hz-40Hz	0.05	0.001
		40Hz-990kHz	0.02	0.001

Conditions: Within 10 minutes and $\pm 0.5^{\circ}\text{C}$.

Within $\pm 10\%$ of initial value.

Following 2 hours warm-up.

For inputs $> 1\text{KHz}$ and $> 100\text{mV}$.

Using 6 1/2 digit slow resolution (1 second gate time).

Measurements are made using accepted metrology practices.

Measuring Characteristics:

Voltage ranges: 100mVrms full scale to 750Vrms . Auto or manual ranging.

Measurement Considerations

All frequency counters are susceptible to error when measuring low-voltage, low-frequency signals. Shielding inputs from external noise pickup is critical for minimizing measurement errors.



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