

# **BENCH TYPE DIGITAL MULTIMETER**

## **OPERATION MANUAL**

### **I. GENERAL**

This instrument is a 4½ digital bench multi-meter, the circuit design of the meter takes the large-scale integrated circuit A/D analog-to-digital converter technology. It can be used to measure AC and DC voltage, current, resistance, diode, continuity, frequency, capacitance, triode and other parameters, and has data hold, Max. or Min. value, backlight, relative value and other functions.

For AC measuring, it is performed by high accuracy TRUE RMS, can test the bandwidth of the frequency, and the TRUE RMS of any waveform can be accurately measured.

## **II. OPEN PACKING FOR CHECKING**

Open the box, take out the meter, checking the items below if they are missing or damaging:

Test lead	1pair
Manual	1pc
Power line	1pcs
Adapter	1pc

Please contact with your supplier if you find out any problems.

## **III. SAFETY NOTES**

Please pay attention to the warning signs and warning words. The warning indicates a situation or action that poses a danger to the user and may cause damage to the instrument or the tested equipment. The meter is in accordance with the safety requirements of electronic

measuring instruments GB4793.1 and safety standard IEC61010 to design and product, in conformity with double insulation, standard for overvoltage (CAT III 600V) and pollution level 2. Please follow operating instructions of the manual to use the meter. Otherwise, the protection provided by the meter will be weakened or lost.

1. Check the meter and test lead before use to prevent any damage or abnormal phenomenon. If you find any abnormal situation, such as bare test leads, damaged case, LCD no display, etc., please don't use it. It is strictly forbidden to use the meter without case or cover are not properly covered to avoid electric shock
2. If the test leads are damaged, you must replace it instead of the test lead with the same model or the same electrical specifications.
3. When the meter is measuring, do not touch the bare wires, connectors, unused input terminals or the circuit being measured.

4. When measuring voltages higher than DC 48V or AC 36V, be sure to wear protective equipment, and remember the finger not to exceed guard position of the test lead to prevent electric shock.
5. When the range of the measured value cannot be determined, the function range switch must be placed at the maximum range position.
6. Do not apply more than rated voltage or current that marked on the instrument between the terminal and the terminal, or between any terminal and the ground.
7. The function switch must be placed in the correct range during measurement. Disconnect the test lead from the measured circuit before convert the functional range switch. It is strictly forbidden to change range during the measurement to avoid damage to the instrument.
8. Do not store or use the meter in a high temperature, high humidity, flammable and explosive and strong magnetic field environment.

9. Please do not optionally change the internal wire of the instrument to avoid damage of the instrument and hidden danger of the user.

10. The power supply should be turned off after measurement. When you not plan to use it for a long time, you should unplug the power line.

11. Safety symbols

“⚠” exists damage voltage, “⚡”GND, “◻” dual insulation, “⚠” must refer to manual.

#### IV. ELECTRIC SYMBOL

⚠	Warning	==	DC
⚠	High voltage damage	~	AC
⚡	Ground	⌚	AC and DC
◻	Dual insulation	⚡	Fuse
CE	Accord with the order of European Union		

## **V. SPECIFICATION**

5.1 Power supply: 220V/ 110V AC(47Hz-62Hz)

5.2 Manual range

5.3 4½ digit large LCD display with backlight ( display range: 75×40mm ) , Max. reading: 19999.

5.4 Voltage measurement up to 1000V DC / 1000V AC.

5.5 DC, AC current up to 20A.

5.6 ACV frequency response: 50k Hz.

5.7 Frequency, resistance, capacitance, triode, diode and continuity test.

5.8 Overload protection: 250V RMS.

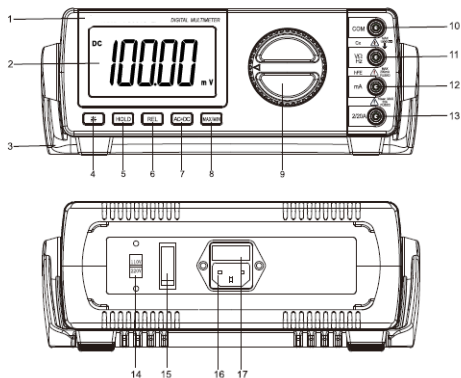
5.9 Operation environment: 0°C--40°C, relative humidity <75% RH

5.10 Electromagnetic compatibility: In the 1V/m radio frequency field, the total accuracy = specified degree + 5% of the range, it has no specified index if the radio frequency exceed 1V/ml.

5.11 Dimension: 260mm×220mm×82mm.

5.12 Weight: approx.1kg.

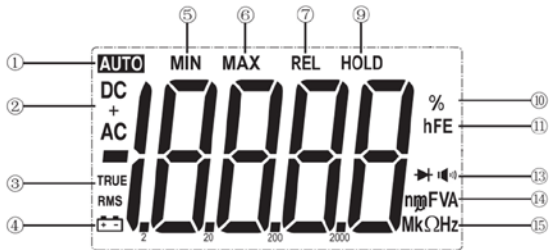
## VI. APPEARANCE STRUCTURE



1. Model brand	10. COM input terminal
2. Display	11. V/ $\Omega$ /Hz/Cx input terminal
3. Bracket	12. 200mA input terminal
4. Screen switch	13. (2~20) A input terminal
5. Hold switch	14. 110V/220V switch
6. Relative value switch	15. Power switch
7. AC+DC select switch	16. Power jack
8. Maximum/minimum switch	17. Fuse (200mA/250V)
9. Range knob	


## VII. DISPLAY SCREEN





①	Auto range	⑨	Data hold
②	DC and AC	⑩	Duty cycle
③	TRUE RMS	11	Triode
④	Low battery	13	Diode, Continuity
⑤	Min. measurement	14	Microampere, Milliampere, Ampere
⑥	Max. measurement	15	Ohm, Kilo ohm, Mega ohm, Frequency
⑦	Relative value measurement		

## VIII. BUTTON FUNCTION

	Short press to turn on/off the locked screen function (the LCD display turn off when the screen is locked)
HOLD	Short press to turn on/off the data hold function, short press at the frequency range to switch the duty cycle measurement
REL	Short press the voltage/current/capacitance range to perform relative value measurement, short press it again to exit this function
AC-DC	Short press the AC voltage/current range to perform "AC+DC" measurement
MAX/MIN	Short press the resistance/voltage/current range to perform maximum/minimum measurement, long press it to exit this function

## **IX. OPERATE INSTRUCTIONS**

Heat the machine for 30 minutes before use, and then place the range switch at the measured position. Pay attention to the symbol " $\Delta$ " next to the jack of the test lead. It is to warn you should pay attention to the test voltage and current not to exceed the indicated value. Please ensure that the power supply of the meter is normal and prevent leakage, otherwise it will affect the measurement accuracy of the meter.

### **1. AC and DC voltage measurement**

- 1) Insert the black test lead into the COM jack and the red test lead into the " $\frac{V\Omega}{Hz}$ " jack.
- 2) Turn the knob to the corresponding ACV/DCV range, and connect the test leads across to the tested circuit. The AC voltage value or the DC voltage value of the red test lead contact point is displayed on the screen.

- 3) Read the measurement result from the display.
- 4) Short press "AC+DC" at the AC voltage range to perform "AC+DC" measurement.

△Note:

- a) If you do not know about the measured voltage range in advance, you should turn the knob to the highest range, and then turn to the corresponding range according to the displayed value;
- b) If the screen displays "OL", it indicates that the measuring range has been exceeded, and the knob must be turned to a higher range.
- c) When measuring high voltage (above 36V), you need to wear personal protective equipment (approved rubber gloves, masks, and flame-retardant clothing, etc.) to prevent injury caused by electric shock and arc when dangerous live conductors are exposed.

## **2. AC and DC current measurement**

- 1) Insert the black test lead into the "COM" jack and the red test lead into the "mA" jack. (Maximum is 200mA or 2 /20A maximum jack is 20A).
- 2) Turn the knob to the corresponding ACA/DCA range, and connect the test leads to the tested power supply or circuit. The AC current value or the DC current value of the red test lead contact point is displayed on the screen.
- 3) Read the measurement result from the display.
- 4) Short press "AC+DC" at AC current range to perform "AC+DC" measurement.

△Note:

- a) If you do not know about the measured voltage range in advance, you should turn the knob to the highest range, and then turn to the corresponding range according to the displayed value; it is strictly

forbidden to measure the voltage in the current jack.

- b) If the screen displays "OL", it indicates that the measuring range has been exceeded, and the knob must be turned to a higher range.
- c) When measuring 20A, it should be noted that if you continuously measure high current, the circuit will heat up, affect the measurement accuracy and even damage the instrument.
- d) When measuring large currents (above 10A), you need to wear personal protective equipment (approved rubber gloves, masks, and flame-retardant clothing, etc.) to prevent injury caused by electric shock and arc when dangerous live conductors are exposed.

### **3. Resistance measurement**

- 1) Insert the black test lead into the COM jack and the red test lead into the " $\frac{V\Omega}{Hz}$ " jack.
- 2) Turn the knob to the corresponding resistance range and connect

the two test leads to the measured resistance.

3) Read the measurement results from the display.

△Note:

- a) If the resistance value exceeds the selected range value, it will display “OL”, at this time, you should turn the knob to a higher range; when the measured resistance value exceeds above 1 MΩ, It is normal when measuring high resistance that the reading takes a few seconds to stabilize.
- b) When the measured resistance is less than 100Ω, in order to ensure the accuracy of the measurement value, you can short-circuit the test lead, then press the “REL” key to open relative measurement function when the meter appearing resistance value of the test lead, and finally measure the resistance value of objects.
- c) It will display “OL” when the input terminal is under open circuit.

- d) When measuring on-line resistance, be sure that all the power of the measured circuit is turned off and all capacitors are released completely.
- e) It is strictly forbidden to input the voltage signal at the resistance range.

#### **4. Capacitance measurement**

- 1) Insert the black test lead into the COM jack and the red test lead into the " $V_{\Omega}$ " jack.
- 2) Turn the knob to the capacitance range, put the test lead of the corresponding polarity (note: the polarity of the red test lead is "+" pole) to connect the measured capacitance.
- 3) Read the measurement results from the display.

$\Delta$ Note:

- a) The capacitance range can be switched automatically, such as



screen display "OL", indicating that it has exceeded the range and maximum measurement 2mF;

- b) When measuring the capacitance, due to the influence of the distributed capacitance of the lead and the instrument, it may be have some residual reading when measure the capacitance, and it is more obvious when measuring the small range capacitance. In order to obtain accurate results, you can press the "REL" key to measure relative value and get more accurate reading.
- c) When measuring large capacitance, it is normal that the reading takes a few seconds to stabilize.
- d) Before measuring the capacitance, the capacitance must be released completely to prevent damage to the meter.
- e) It is strictly forbidden to input the voltage signal at the capacitance range.

f) Units:  $1\text{mF} = 1000\mu\text{F}$        $1\mu\text{F} = 1000\text{nF}$        $1\text{nF} = 1000\text{pF}$

### **5. Diode and continuity test**

- 1) Insert the black test lead into the "COM" jack and the red test lead into the " $\frac{V\Omega}{Hz}$ " jack (note: the polarity of the red test lead is "+");
- 2) Turn the knob to the " $\rightarrow \cdot \cdot \cdot$ " range, it is defaulted the diode range when opening, and it can switch automatically between the diode range and the continuity range; connect the test lead to the tested diode, and the reading is the approximate value of the forward voltage drop of the diode; for silicon PN junction, 500mV-800mV is confirmed as a normal value. If the tested diode is open circuit or polarity is reversed, display "OL".
- 3) Connect the test leads to the two points of the tested circuit. If the resistance between the two points is less than about  $50 \pm 20\Omega$ , the screen display " $\cdot \cdot \cdot$ " and the built-in buzzer will sound.

## 6. Triode hFE

- 1) Turn the knob to hFE range;
- 2) Insert the emitter, base, and collector into the corresponding jacks of the triode jack respectively if you decide to measure the NPN or PNP type of the transistor.
- 3) Read the measurement result from the display.

## 7. Frequency measurement

- 1) Insert the black test lead into the "COM" jack and the red test lead into the " $\frac{V\Omega}{Hz}$ " jack.
- 2) Turn the range switch to the frequency range and connect the test leads or cables across to the signal source or the tested load.
- 3) Short press the "HOLD" key to perform duty cycle measurement.

△Note:

- a) When the input exceeds 20Vrms, reading is workable but accuracy

is not guaranteed.

- b) In noisy environment, it is preferable to use shielded cable for measuring small signal.
- c) Do not touch the high-voltage circuits when measuring it.
- d) Do not input any voltage exceed 250V DC or AC peak value to avoid damage to the instrument.
- e) The frequency range is automatic range test, ranging from 10Hz to 20MHz.

## **X. TECHNICAL CHARACTERISTIC**

Accuracy:  $\pm$  (a% reading +the lowest effective digit), Make sure the temperature is  $(23\pm 5)$  °C, and the relative humidity  $<75\%$ , one year guaranteed from the production date

### **1.DC voltage (DCV)**

RANGE	ACCURACY	RESOLUTION
200mV	$\pm(0.05\%+5)$	10 $\mu$ V
2V		100 $\mu$ V
20V		1mV
200V		10mV
1000V	$\pm(0.1\%+5)$	100mV

Input resistance: About 5M $\Omega$  for 200mV range, 10M $\Omega$  for other ranges.

Overload protection: 200mV range is 250V DC or AC peak value, other range is 1000V DC or AC peak value.

The accuracy is 10% to 100% of the range, and the voltage range short-circuit allows  $\leq 5$  words of remaining readings.

## **2.AC voltage (ACV) TRUE RMS**

The meter adopts TRUE RMS, which expands the frequency response

and can accurately measure the RMS of various voltage waveforms; (It can be used to AC+DC measurement)

RANGE	INPUT FREQUENCY	ACCURACY	RESOLUTION
200mV	40Hz–1kHz	$\pm(0.7\%+30)$	10 $\mu$ V
	1kHz–10kHz	$\pm(2\%+30)$	
	10kHz–20kHz	$\pm(3\%+60)$	
	20kHz-50kHz	$\pm(10\%+250)$	
2V	40Hz–1kHz	$\pm(0.5\%+30)$	100 $\mu$ V
	1kHz–10kHz	$\pm(2\%+30)$	
	10kHz–20kHz	$\pm(5\%+60)$	
20V	40Hz–1kHz	$\pm(0.5\%+30)$	1mV

	1kHz–10kHz	$\pm(2\%+30)$	
	10kHz–20kHz	$\pm(5\%+60)$	
200V	40Hz–1kHz	$\pm(0.5\%+30)$	10mV
	1kHz–5kHz	$\pm(2\%+30)$	
1000V	40Hz–200Hz	$\pm(0.8\%+10)$	100mV
	200Hz–400Hz	$\pm(1.2\%+80)$	

Input resistance:  $2M\Omega$  for all range.

Overload protection: 200mV range is 250V DC or AC peak value, other range is 1000V DC or AC peak value.

Display: 1) TRUE RMS (applicable for range 10% or 100%)

- 2) Part range maybe cannot return to zero, it's normal and has no effect to the tested accuracy.
- 3) Accuracy will be up  $\pm(1\%+150)$  under AC+DC measuring.

### 3.DC current (DCA)

RANGE	ACCURACY	RESOLUTION	LOAD VOLTAGE
200 $\mu$ A	$\pm(0.35\%+10)$	0.01 $\mu$ A	1mV/ $\mu$ A
2mA		0.1 $\mu$ A	101mV/mA
20mA		1 $\mu$ A	11mV/mA
200mA		10 $\mu$ A	1.5mV/mA
2A	$\pm(0.8\%+10)$	100 $\mu$ A	275mV/A
20A	$\pm(2.0\%+15)$	1mA	42mV/A

Note: 20A range:  $\leq 5$ A allows continuous measurement

5A~20A continuous measurement time should be  $\leq 10$  seconds;

The interval time should be  $\geq 5$  minutes

Overload protection: 200mA/250V fuse, 20A/250V fuse.

The accuracy is 10%~100% of the range.

### 4.AC current (ACA) TRUE RMS



RANGE	ACCURACY	RESOLUTION	LOAD VOLTAGE
20mA	$\pm(0.8\%+80)$	1 $\mu$ A	11mV/A
200mA		10 $\mu$ A	1.5mV/A
2A		100 $\mu$ A	275mV/A
20A	$\pm(2.5\%+35)$	1mA	42mV/A

Frequency response: standard sine and triangle wave: 40Hz~1k Hz

Display: true RMS (applicable to 10%~100% of range);

Accuracy will be up  $\pm (1\%+150)$  under AC+DC measuring.

Overload protection: 200mA/250V fuse, 20A/250V fuse.

Note: 20A range:  $\leq 5A$  allows continuous measurement; 5A~20A continuous measurement time should be  $\leq 10$  seconds; interval time should be  $\geq 5$  minutes.

## 5.RESISTNCE ( $\Omega$ )

RANGE	ACCURACY	RESOLUTION	SHORT-CIRCUIT CURRENT	OPEN-CIRCUIT VOLTAGE
200Ω	$\pm(0.5\%+30)$	0.01Ω	About 260uA	About 1V
2kΩ	$\pm(0.5\%+40)$	0.1Ω		
20kΩ		1Ω	About 50uA	
200kΩ		10Ω	About 5uA	
2MΩ		100Ω	About 0.5uA	
20MΩ	$\pm(0.6\%+50)$	1kΩ	About 0.05uA	

Overload protection: 250V DC or AC peak value; measuring error is not including lead resistance.

The accuracy is 10%~100% of the range.

## 6.CAPACITANCE (CAP)

RANGE	ACCURACY	RESOLUTION
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20nF	$\pm(3.5\%+20)$	1pF
200nF		10pF
2 $\mu$ F		100pF
20 $\mu$ F		1nF
200 $\mu$ F	$\pm(5\%+30)$	10nF
2mF		100nF

Measuring Range of Accuracy: 10%~100%; Large capacitance response time:  $\geq 1\text{mF}$  about 8s;

Measured error is not including lead distributed capacitance.

### 7. FREQUENCY (FREQ.)

RANGE	ACCURACY	RESOLUTION
20Hz~200kHz	$\pm(0.1\%+3)$	0.01Hz~0.1kHz
200kHz~2MHz		0.1kHz~0.001MHz

2MHz~20MHz		0.001MHz~0.01MHz
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Overload protection: 250V DC or AC peak value (within 15s)

△Frequency input amplitude requirements:

10Hz-100kHz:  $1V_{rms} \leq \text{input amplitude} \leq 20V_{rms}$ .

100kHz-10MHz:  $3V_{rms} \leq \text{input amplitude} \leq 20V_{rms}$ .

Duty cycle:

10%-90% range, suitable for 10Hz-1k Hz square wave;

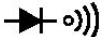
30%-70% range, suitable for 1k Hz-10kHz square wave;

Input amplitude:  $3V_{pp} \leq \text{input amplitude} \leq 20V_{pp}$

### 8. hFE MEASUREMENT

RANGE	DISPLAYING	TEST CONDITION
hFE NPN or PNP	0~1000.0	Basic current is approx. $10\mu A$ , Vce is approx. 3V

### 9. DIODE AND CONTINUITY TEST

RANGE	DESCRIPTION	TEST CONDITION
	<p>The measuring value is the approx. value for forward voltage drop. when the tested resistance is less than <math>50\Omega \pm 20\Omega</math>, buzzer sounds and display the approx. value. The open voltage is approx. 3V</p>	<p>Forward DCA is approx. 1mA, backward DCV is less than 3V</p>

Overload protection: 250V DC and AC peak value.

## **XI. MAINTENANCE**

It is an accurate meter, do not change the circuit at will.

1. Before replacing any parts of the meter, remove the input signal and AC power line, and replace fuse according to the following:

- 1) Power fuse: slow-blow 200mA/250V
- 2) Fuse for measuring current: 200mA/250V and 20A/250V.

These two fuses are in the main circuit, must be replaced by qualified person.

2. Note

- 1) Be careful of waterproof, dustproof and anti-falling
- 2) Do not store or operate the meter in high temperature and humidity, inflammable and explosive, and strong magnetic place.
- 3) Please use a damp cloth and mild detergent to clean the surface of the meter, do not use abrasives, alcohol or other strong solvents.