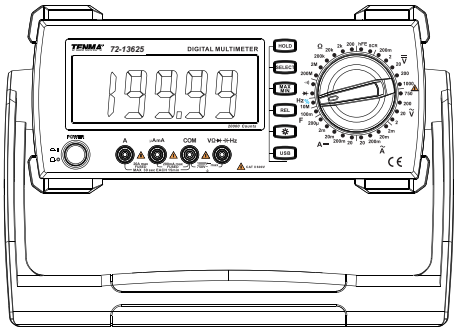
TENMA®

72-13625 Benchtop Digital Multimeter User Manual



⚠ **Warning**: **When the measured voltage is greater than 600V, The instrument cannot be used for measurements in CAT II, CAT III and CAT IV environment**

I. Overview

UT8802 is a manual range, benchtop digital multimeter that features 19999 display counts, large LCD screen with backlight, full scale overload protection and a unique design. This instrument can be used to measure AC and DC voltage, AC and DC current, resistance, frequency, capacitance, transistor, hFE, diode (LED), SCR, continuity, etc.
This manual contains relevant safety and warning information. Please read the contents carefully and strictly follow all warnings and cautions.

II. Inspection of open box

Open the packing box and take out the instrument. Please check if the following items are deficient or damaged. Please contact your supplier immediately if any item is deficient or damaged.

User Manual (CD-ROM)---------- 1 pc
Test leads ---------- 1 set
Alligator clip ---------- 1 set
Power cable (AC 220 V)---------- 1 pc
Software application CD ---------- 1 pc
USB interface wire ---------- 1 pc

III. Safety rules

This instrument strictly follows the EN 61010-1: 2010, EN 61326: 2013, RoHS, pollution grade II safety standard, CAT II 600V.

⚠ Unplug the power cord when the instrument is not in use.

⚠ Note: In the case that the instrument is not used in accordance with the operation instructions, the protection provided by the instrument may be weakened or lost.

CLEANING

Be sure meter is turned off and wipe with a clean ,dry lint-free cloth.
Do not use abrasive cleaners or solvents

Power cord specification:

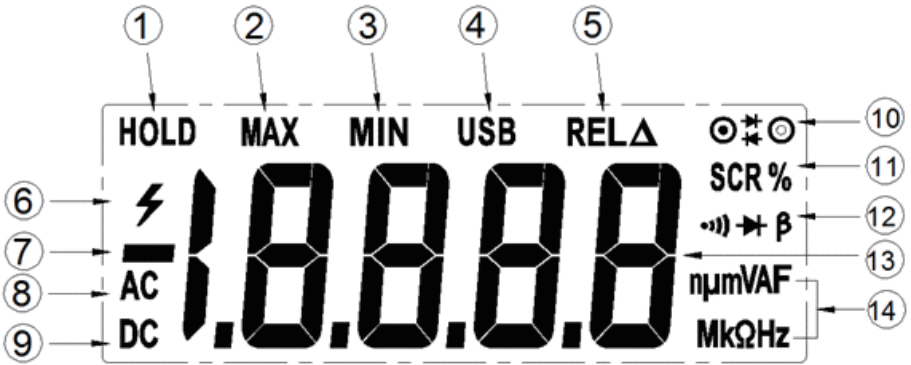
Name	Description	Rating	Approval NO.
CORD	H05VVF 3X0.75mm²	300/500V	116006
PLUG	XR-T002	16A 250~	40036455
CONNECTOR	XR-W002	10A 250~	40040244

1. Before using the instrument, please check if there is any item which is damaged or behaving abnormally. If any abnormal item is found (such as: test lead bared, housing case damaged, LCD broken, etc.), please stop using the instrument. It is strictly prohibited to use an instrument without shell cover. Otherwise, there is a danger of electric shock.
2. If the test lead has been damaged, it must be replaced with the one of the same type or the same electrical specification.
3. When measuring, do not touch exposed wires, connectors, unused inputs, or the circuits being measured.
4. When measuring the voltage higher than 60 V dc or 36 Vrms, remember not to exceed the finger baffle plate position on the test lead in order to prevent electric shock.
   Before each use, verify operation by testing a known working circuit that is within the rating of this unit.
5. If the range of the voltage to be measured is unknown, the maximum range should be selected and then gradually decreased.
6. Never input voltage and current which exceeds the rated range indicated on the instrument housing.
7. Before switching the function knob to select the test range, make sure to disconnect the test probes with the circuit to be tested. It is strictly prohibited to turn the function knob during the measurement in order to avoid damages to the instrument.
8. Do not use or store the instrument in high temperature, high humidity, flammable, explosive and strong magnetic field environments.
9. Do not change the internal circuit of the instrument in order to avoid the damage to the instrument and user.
10. After the measurements are finished, the power supply should be turned off. If the instrument is not used for a long time, please unplug the power cord.

IV. Comprehensive index

1. The maximum voltage between input and COM terminal is DC 1000V or AC 750V
2. μA, mA input terminal protection: (CE) 400mA, 1000V fuse, Φ6.3x32mm
3. 10A input terminal protection: (CE) F1 (12A, H, 1000V) fast melt fuse Φ6.3x32mm
4. 19999 display counts, update rate 2 ~3 times per second.
5. Manual range
6. Polarity display: Auto
7. Over range symbol : OL
8. Operating temperature: 0～ 40℃ (32°F～104°F)
9. Storage temperature: -10～ 50℃ (14°F～122°F)
10. Relative humidity: 0℃～30℃ ≤75%RH, 30℃～40℃ ≤50%RH
11. Electromagnetic compatibility:
    In the field with less than 1 V/m radio frequency, the total accuracy = designated accuracy + range of 5%,
    In the field with more than 1 V/m radio frequency, the accuracy is not specified.
12. Power Supply: AC 100V/120V/127V/220V/230VAC/240V, 450-440Hz, 28VA max
    Protection fuse being used: For AC 100V/120V/127V,AC 250V T 250mA
    For AC 220V/230V/240V, AC 250V T 125mA
    μA mA FUSE: 400mA/1000V
13. Outer dimension: (320 x 265 x 110) mm
14. Weight: about 3100g (accessories excluded)
15. Safety standards: IEC 61010: CAT II 600V
16. CAT II: It is applicable to test and measuring circuits connected directly to utilization points (socket outlets and similar points) of the low-voltage MAINS installation.
17. Temperature coefficient: 0.1 X (specified accuracy) /℃ (< 18℃ or > 28℃)

V. Symbols on LCD screen



1. **HOLD**: Hold mode
2. **MAX**: Max value test
3. **MIN**: Min value test
4. **USB**: USB communication
5. REL Δ Relative value test
6. High voltage test
7. Negative voltage
8. AC:AC voltage test
9. **DC**: DC voltage test
10. Diode and SCR Polar
11. **SCR /%**: SCR/duty cycle test
12. Continuity test
    Diode test
    β Transistor hFE test
13. Digital reading
14. Measurement unit

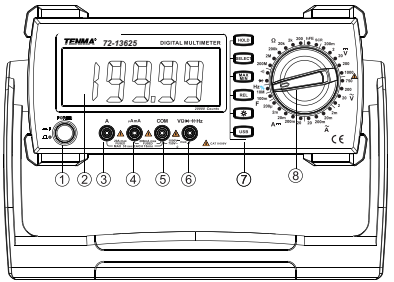
VI. Function buttons & terminals introduction

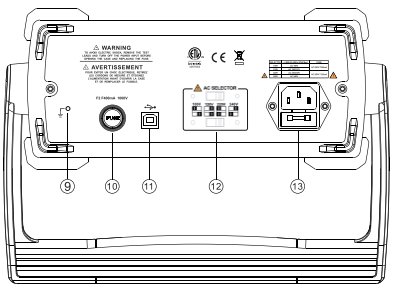
1.Terminals :

Range	Input terminal	Function
V⎓	V ⟷ COM	DC voltage test
V~	V ⟷ COM	AC voltage test
Ω	V ⟷ COM	Resistance test
•)))	V ⟷ COM	Continuity test
Hz %	V ⟷ COM	Frequency, Duty cycle test
F	V ⟷ COM	Capacitance test
A⎓	μA mA ⟷ COM A ⟷ COM	DC current test
A~	μA mA ⟷ COM A ⟷ COM	AC current test
▶|	V ⟷ COM socket adapter (UT-S03 A)	Diode (LED) test
hFE	socket adapter (UT-S03 A)	Transistor amplification test
SCR	socket adapter (UT-S03 A)	SCR test

Function buttons:

1. Power On/Off button
2. LCD display screen
3. 20 A current input socket
4. µA and mA current input socket
5. COM terminal
6. Input terminal for V, Ω, Diode, Cap, Frequency
7. Function buttons
   HOLD: Data holding button
   SELECT : Function selection button
   MAX/MIN: MAX/MIN value t button
   REL: Relative value measurement button
   ☼ : Backlight button
   USB: USB communication button
8. Function switch
9. Grounding terminal
10. Fuse socket
11. USB interface
12. Switch to select AC voltage
13. Socket





Symbols on meter

	Power on
	Power off
	Direct current
	Alternating current
	Ground Terminal
	Caution, possibility of electric shock
	Warning or caution, To ensure safe operation and service of this meter, follow all warnings and instructions detailed in this manual.
	USB port
	Do not place equipment and its accessories in the trash. Items must be properly disposed of in accordance with local regulations.
	Comply with European Union Directive
	Conforms to UL STD. 61010-1, 61010-030, Certified to CSA STD. C22.2 No. 61010-1, 61010-030.
CAT II	It is applicable to test and measuring circuits connected directly to utilization points (socket outlets and similar points) of the low-voltage MAINS installation.

VII: Measurement operation instructions

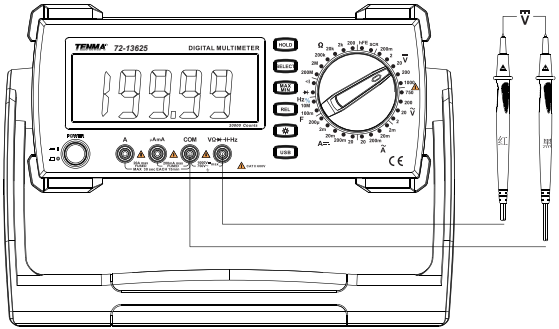


Figure 1

1.Measurement of DC voltage (see Figure 1)

1. Insert the black test lead into the COM socket, the red test lead into the V socket.
2. Switch the function knob to “V” position. And then connect test leads with the power supply (for measuring open circuit voltage) or the load (for measuring load voltage drop), the polarity will be displayed on the screen.

⚠ Note:

- Do not input any voltage higher than 1000V. Otherwise there is a risk that the instrument might get damaged. When measuring high voltage, pay attention to avoid electric shock.
- To disconnect probe and measured circuit then remove probe from input end after finishing all measurement operations.

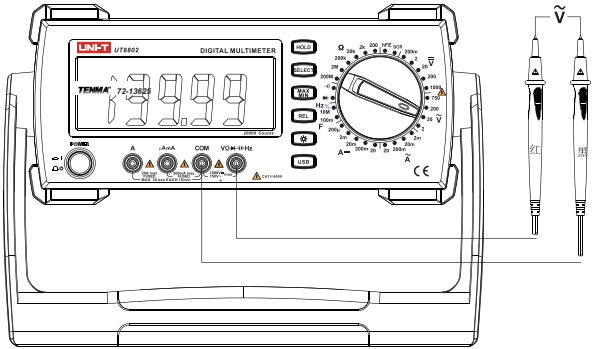


Figure 2

2.Measurement of AC voltage (see Figure 2)

1. Insert the black test lead into the COM socket, the red test lead into the V socket.
2. Switch the function knob to “V” position. Connect test leads with the power supply (for measuring open circuit voltage) or the load (for measuring load voltage drop).

⚠ Note:

- Do not input any voltage that is higher than 750V. Otherwise there is a risk that the instrument might get damaged.When measuring high voltage, pay attention to avoid electric shocked.
- To disconnect probe and measured circuit then remove probe from input end after finishing all measurement operations.

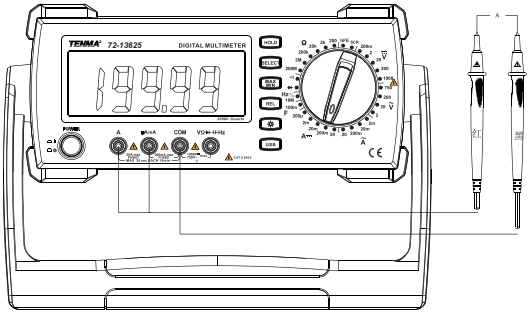


Figure 3

3.Measurement of AC /DC current (see Figure 3)

1. Insert the black test lead into the COM socket, the red test lead into the “μA” “mA” or “A” socket.
2. Switch the function knob to “A-” or “A~” position, then connect the instrument in series with the circuit to be tested.

⚠Note:

- Before measuring current, the power supply of the circuit should be switched off, and discharge all capacitors.
- If the range of the current to be measured is unknown, the maximum range should be chosen, and gradually decreased.
- If the current to be tested is greater than 10A, the measurement time should be less than 30 seconds and the wait time of performing the next test should be more than 15 minutes.
- Disconnect probes and remove from input end after all measurements are completed.

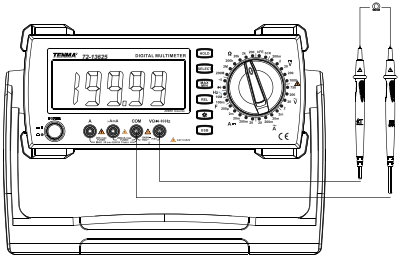


Figure 4

4.Measurement of Resistance (see Figure 4)

1. Insert the black test lead into the COM socket, the red test lead into the Ω socket.
2. Switch the function knob to Ω position, then connect test leads with the resistance to be measured.

⚠ Note:

- Before measuring current, the power supply of the circuit should be switched off, and get the residual charge stored in the high voltage capacitor fully discharged.
- In low resistance measurement, the test leads will bring about 0.1Ω to 0.2Ω resistance measurement error. In order to obtain accurate readings, the relative measurement function can be used. Short circuit the test leads and pressΔbutton to enter the REV test mode.
- If the measurement in shorting the test leads is more than 0.5Ω, please check the test leads if they are behaving abnormally
- When measuring the resistance above 1 M ohm, it may take a few seconds to make the readings steady. This is the normal phenomenon for measuring high resistance. In order to obtain the steady data quickly, it is recommended to use the short test wire to measure high resistance.
- Do not input the voltage higher than AC 30Vrms or DC 60V. Otherwise there is a risk that the instrument might get damaged.
- To disconnect probe and measured circuit then remove probe from input end after finishing all measurement operations.

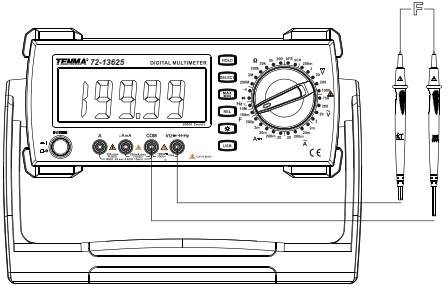


Figure 5

5. Measurement of capacitance (see Figure 5)

1. Insert the black test lead into the COM socket, the red test lead into the ⊣⊢ socket.
2. Switch the function knob to “F” position, and then connect test leads with the capacitor to be measured.

⚠ Note:

- If the measurement value is out of range (too small or too large), the “OL” symbol will be displayed on the screen.
- If the capacitance to be tested is too small , the REL measuring mode should be used in order to avoid the influence coming from distributed capacitance so as to to get the correct reading.
- If the capacitance to be tested is greater than 600 µF, in order to get the correct reading, it will take a long time to finish the measurement.
- Before the measurement, make sure that the residual charges stored in the high voltage capacitor are fully discharged in order to avoid the risk that the instrument might get damaged.
- Do not input the voltage higher than AC 30 Vrms or DC 60V. Otherwise there is a risk that the instrument might get damaged.
- To disconnect probe and measured circuit then remove probe from input end after finishing all measurement operations.

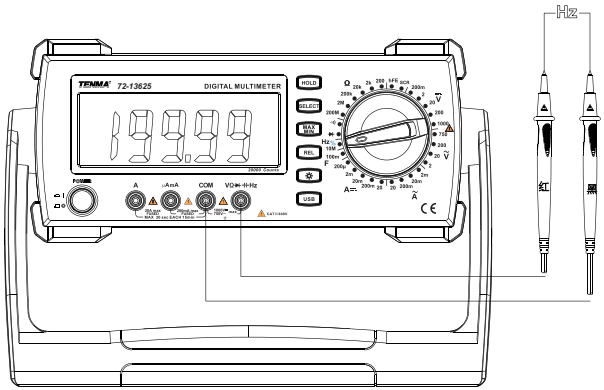


Figure 6

6. Measurement of Frequency (see Figure 6)

1. Insert the black test lead into the COM socket, the red test lead into the “Hz” socket.
2. Switch the function knob to “Hz” position, and then connect test leads with signal source to be tested.

⚠ Note:

- Do not input the voltage higher than AC 36 Vrms. Otherwise there is a risk that the instrument might get damaged.
- To disconnect probe and measured circuit then remove probe from input end after finishing all measurement operations.

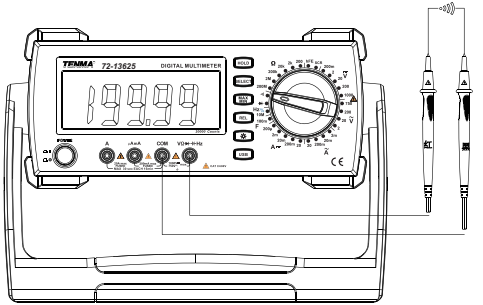


Figure 7

7. Measurement of Continuity (see Figure 7)

1. Insert the black test lead into the COM socket, the red test lead into the “Ω” socket.
2. Switch the function knob to ”•)))” position, and then connect test leads with the circuit to be tested.
3. if the resistance to be tested is less than 50Ω, the buzzer goes off.
4. if the resistance to be tested is more than 100Ω, the buzzer doesn’t go off.

⚠ Note:

- Before measuring, the power supply for the circuit must be turned off and the residual charge stored in the capacitors should be fully discharged.
- If the measured resistance is less than 50Ω, the measured circuit will be regarded as being in good conduction status, and the buzzer goes off.
- if the measured resistance is greater than 100Ω, the measured circuit will be regarded as in open status
- Do not input the voltage higher than AC 36 Vrms. Otherwise there is a risk that the instrument might get damaged.
- To disconnect probe and measured circuit then remove probe from input end after finishing all measurement operations.

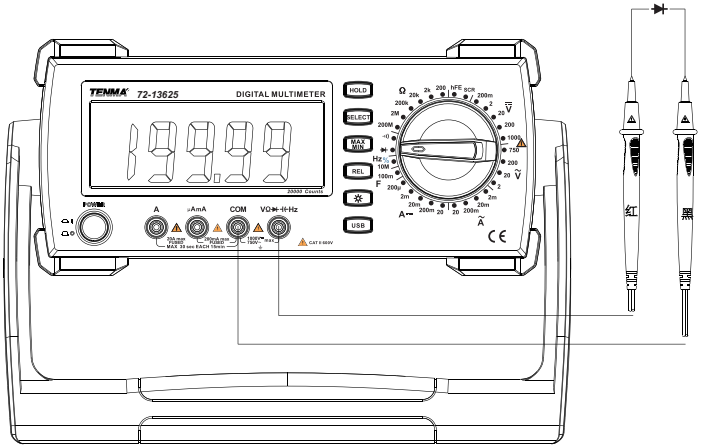


Figure 8

8. Measurement of Diode (see Figure 8, Figure 9)

Method one:

1. Insert the black test lead into the COM socket, the red test lead into the "⊣◀" socket.
2. Switch the function knob to"⊣◀" position, and then connect test leads with the Diode to be tested.
   When the ⊣◀ symbol is displayed on screen, where the red test lead is connecting is the positive, where the black test lead is connecting is the negative.
   When the ◀⊣ symbol is displayed on screen, where the red test lead is connecting is the negative, where the black test lead is connecting is the positive.

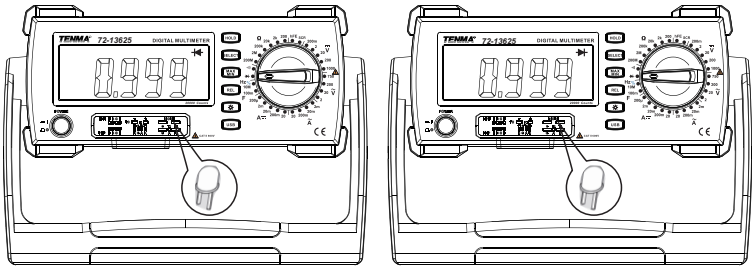


Figure 9

Method two:

1. Insert adaptor UT-S03A into where it is required to be loaded on the instrument (Figure 9).
2. Insert the Diode to be test into the adaptor UT-S03A

   When the ⊣◀ symbol is displayed on screen, the right of the socket is the positive. The left of the socket is the negative.

   When the ▶⊢ symbol is displayed on screen, the right of the socket is the negative. The left of the socket is the positive.

   Note:

   If the Diode to be tested is NG, symbol “OL” or “0.000” will be displayed on screen.

   Before measuring, the power supply for the circuit must be turned off and the residual charge stored in the capacitors should be fully discharged.

   The OCV to be used to test diode is about ±9V.

   Do not input the voltage higher than AC 36 Vrms, DC 48V. Otherwise there is a risk that the instrument might get damaged.

   To disconnect probe and measured circuit then remove probe from input end after finishing all measurement operations.

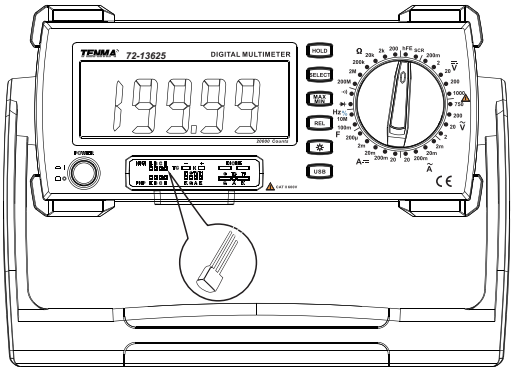


Figure 10

9. Measurement of Transistor (see Figure 10)

1. Insert adaptor UT-S03A into where it is required to be loaded on the instrument.
2. Switch the function knob to ”SCR” position.
3. Insert transistor to be tested into adaptor UT-S03A according with the polarity indicated on the adaptor.

⚠Note:

- Before measuring, the power supply for the circuit must be turned off and the residual charge stored in the capacitors should be fully discharged.
- Do not input the voltage higher than AC 36 Vrms, DC 48V. Otherwise there is a risk that the instrument might get damaged.
- To disconnect probe and measured circuit then remove probe from input end after finishing all measurement operations.

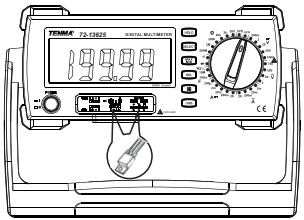


Figure 11

10. Measurement of SCR (see Figure 11)

1. Insert adaptor UT-S03A into where it is required to be loaded on the instrument.
2. Switch the function knob to “SCR” position.
3. Insert transistor to be tested into adaptor UT-S03A according with the polarity indicated on the adaptor.
4. The below contents will be displayed on screen.

Voltage displayed on LCD	SCR Polarity prompt symbol	Judgment	SCR Polarity
0.1V~2V	⊙⇅⊙	Good	Bipolar
0.1V~2V	▶|	Good	Unipolar
ERR	– – –	SCR NG	Unknown
OL	– – –	SCR NG or not well connected	Unknown

⚠ Note:

- Before measuring, the power supply for the circuit must be turned off and the residual charge stored in the capacitors should be fully discharged.
- Do not input the voltage higher than AC 36 Vrms, DC 48V. Otherwise there is a risk that the instrument might get damaged.
- To disconnect probe and measured circuit then remove probe from input end after finishing all measurement operations.

VIII. Technical specification

Error limit : ±(% reading + digit), one year guarantee period
Ambient temperature: 18~28 ℃
Ambient humidity: no more than 75%RH

1. DC voltage

Function	Range	Resolution	Accuracy
			±(% reading + digit)
DCV	200mV	10μV	±(0.1%+5)
	2V	100μV	±(0.1%+3)
	20V	1mV	
	200V	10mV	
	1000V	0.1V	±(0.2%+5)

- Input impedance : approximately 10M ohm.
- Max input voltage : 1000v

2. AC voltage

Function	Range	Resolution	Accuracy
			±(% reading + digit)
DCV	2V	100μV	±(0.5%+20)
	20V	1mV	
	200V	10mV	
	750V	0.1V	±(0.8%+40)

- Input impedance: approximately 10 M ohm
- Max input voltage : 750Vrms
- Frequency response : 40Hz～1KHz
- Display: sine wave RMS (average response)
- There would be some residual readings displayed on LCD screen while without input, but this does not affect the measurement accuracy.

3.DC current

Function	Range	Resolution	Accuracy
			±(% reading + digit)
DCA	200μA	10nA	±(0.5%+20)
	2mA	100nA	
	20mA	1μA	
	200mA	10μA	
	20A	1mA	±(1.5%+40)

If the current to be tested is greater than 10A.

- the measuring time must be less than 30 seconds
- the interval time of must be over 15 minutes.

4.AC current

Function	Range	Resolution	Accuracy
			±(% reading + digit)
ACA Frequency response: 40～400Hz	2mA	0.1μA	±(0.8%+40)
	20mA	1μA	
	200mA	10μA	
	20A	1mA	±(2.0%+40)

- Frequency response 45Hz～400Hz
- If the current to be tested is greater than 10A , the measuring time must be less than 30 seconds
- the interval time of must be over 15 minutes .

5.Resistance

Function	Range	Resolution	Accuracy
			±(% reading + digit)
Ω	200Ω	0.01Ω	±(0.5%+10)
	2kΩ	0.1Ω	±(0.5%+10)
	20kΩ	1Ω	
	200kΩ	10Ω	
	2MΩ	100Ω	
	200MΩ	1kΩ	For reference

● If the resistance to be tested is greater than 20M ,
the measured result is only for the reference .

6.Capacitance

Function	Range	Resolution	Accuracy
			±(% reading + digit)
F	20nF	1pF	±(2.5%+10)
	200nF	10pF	±(1.5%+10)
	2μF	100pF	
	20μF	1nF	
	200μF	10nF	
	2mF	100nF	
	20mF	1μF	±(10%+10)
	100mF	10μF	For reference

If the capacitance to be tested is greater than 20F.
the measured result is only for the reference .

7.Frequency / Duty cycle

Function	Range	Resolution	Accuracy
			±(% reading + digit)
Hz	200Hz	0.01Hz	±(1%+5)
	2kHz	0.1Hz	
	20kHz	1Hz	
	200kHz	10Hz	
	2MHz	100Hz	
	10MHz	1kHz	
%	10Hz～10kHz 5%～99%	0.1%	±(1.5%+2)

- ≤100 kHz：100 m Vrms≤Amplitude≤20Vrms
- 100 kHz～1 MHz：200 m Vrms≤Amplitude≤20Vrms
- 1 MHz～5 MHz： 500 m Vrms≤Amplitude≤20Vrms
- 5 MHz～10 MHz：900 m Vrms≤Amplitude≤20Vrms

8.Diode / Triode / SCR / Continuity

Function	Range	Resolution	Accuracy
			±(% reading + digit)
Diode	9.0V	1mV	10%
SCR	9.0V	1mV	10%
Triode hFE	2000	1β	Not specified
Continuity	100Ω	0.1Ω	Not specified

- If the measured resistance is greater than 100Ω, the circuit is regarded as open status.
- The buzzer will not go off.
  if the measured resistance is less than 50Ω, the circuit is regarded as in good conduction status, the buzzer will go off.
- SCR is the abbreviation of "Silicon Controlled Rectifier"

IX. Power supply setting and fuse replacement (see Figure 12)

1. Power supply settings:

1) Turn the red switch to the corresponding position
2) Setting steps:
   a.Unplug the power cord
   b.Turn the red switch to corresponding position
   c.Selectable positions are shown below

Position	Voltage	Demonstration	Description
1	100V		Input corresponding voltage
2	120V/127V		
3	220V/230V		
4	240V		

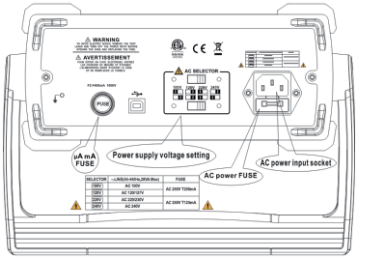


Figure 12

2. Fuse replacement:

1) Unplug the test leads from the instrument.
2) Turn off the power supply for the instrument
3) Open the fuse housing with a screwdriver.
4) Replaced the fuse with new one.

Tenma Test Equipment
300 S. Riverside Plaza #2200
Chicago IL, 60606
USA
www.Tenma.com