

# TENMA®



**True RMS Digital Multimeter**

**Model: 72-7780**

## **SAFETY INFORMATION**

**Please read these instructions carefully before use and retain for future reference.**










This meter is designed to meet IEC61010-1, 61010-2-032, and 61010-2-033 in Pollution Degree 2, Measurement Category (CAT II 600V, CAT III 600V) and double Insulation.

- Do not operate the meter or use test leads if they appear damaged, or if the meter is not operating properly.
- There are no user-serviceable parts in this product. Refer servicing to qualified personnel.
- Do not apply voltage between the COM and OHM terminals, while in the resistance measuring state.
- Do not measure current with the test leads inserted into the voltage or OHM terminals.
- To avoid electrical shock and personal injury, do not attempt to measure voltage higher than 600V AC/DC, although the readings may be obtained.
- Do not expose the instrument to direct sunlight, extreme temperature or humidity.
- Before measuring current, check the fuses and turn the power to the circuit off before connecting the meter to the circuit.
- Disconnect circuit power and discharge all high voltage capacitors before testing continuity, diode, resistance, capacitance or current.
- Take caution when voltages are above 60V DC and 30V AC rms.
- Do not use the meter around explosive gas or vapour.
- When using the test leads, keep your fingers behind the finger guards.
- Remove test leads from the meter before opening the meter case or battery door.
- Never operate the meter with the cover removed or the battery door open.
- Use only the test leads supplied or the protection may be impaired.
- Probe assemblies for mains measurements shall be rated as appropriate for measurement category III according to IEC 61010-031 and shall have a voltage RATING of at least the voltage of the circuit to be measured.
- Replace the batteries as soon as the low battery indicator appears on the display.
- Remove dead batteries from the meter or if it is not going to be used for a long time.
- Never mix old and new batteries together, or different types of batteries.
- Never dispose of batteries in a fire, or attempt to recharge ordinary batteries.
- Before replacing the battery, turn off the meter and disconnect all the test probes.
- To prolong battery life turn off the meter after use.

## **WHAT'S INCLUDED**

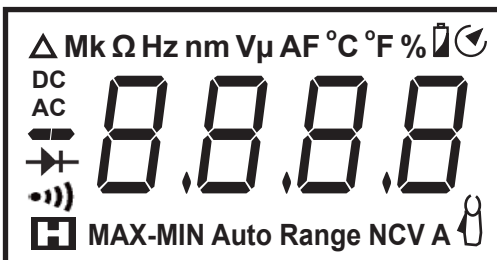
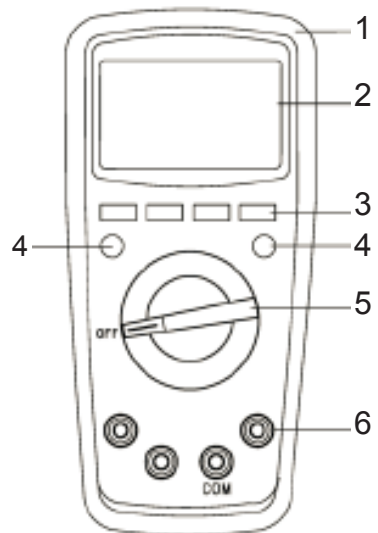
- Digital multimeter
- User manual
- Cat III 600V test lead
- Point type K thermocouple
- Current clamp




## SYMBOL GUIDE






	AC or DC
	Grounding
	Double insulated
	Warning
	Low battery
	Continuity Buzzer
	Diode
	Fuse
	Conforms to European Union directives

## FUNCTIONS

1. Casing
2. LCD Display
3. Function buttons x 4
4. Option buttons
5. Range selector
6. Test lead input terminals



Display symbol	Instruction
	Data hold prompt
	Negative reading
AC/DC	AC/DC measurement
MAX-MIN	Max/Min value measurement prompt
	Low voltage internal battery
Auto Range	Uto range prompt

Display symbol	Instruction
	Diode measurement prompt
	Circuit on/off measurement prompt
	Relative measurement prompt
$\Omega$ / k $\Omega$ / M $\Omega$	Resistance units
Hz / kHz / MHz	Frequency units
%	Duty ratio measurement unit
mV / V	Voltage units
$\mu$ A/mA/A	Current units
nF/ $\mu$ F/mF	Capacitance units
$^{\circ}$ C	Centigrade temperature unit
$^{\circ}$ F	Fahrenheit temperature unit
(EF)NCV	non contact AC voltage sensing
	Auto power off
	Current clamp

### RANGE button

- The range button selects between auto and manual range when measuring voltage, impedance or resistance.
- Press it repeatedly to select high range or low range.
- Press and hold for more than 2 seconds and the meter will exit manual range.

### MAX/MIN button

- This button is used to switch into the manual range mode when auto shutdown is disabled. Voltage, resistance, impedance and temperature
- The maximum value is displayed initially.
- Pressing the button again displays the minimum value.
- Press and hold for more than 2 seconds and the meter will exit data recording mode.

### REL button

- Press to enter the manual range mode. The displayed value will be taken as reference value and the difference between the reference value and the measured value will be displayed.
- Press again to exit the measurement mode.

### Hz/% button

- Press to switch between measurement of frequency, AC voltage/current modes.

### Select button

- Used to select between UFC and VFC modes when measuring AC voltage.
- Press and hold for 2 seconds to switch between modes or end the selection.

### HOLD button

- Lock and hold the displayed value, press again to return to normal.

## OPERATING PARAMETERS

- Operating temperature: 23°C± 5°C
- Relative Humidity: ≤75%.
- Temperature Coefficient: 0.1× (specified accuracy)/1°C

## DC VOLTAGE

Range	Resolution	Accuracy	Overload Protection
60.00mV	10μV	±(0.5%+2)	600V DC/AC
600.00mV	0.1mV		
6.000V	1mV	±(0.7%+3)	
60.00V	10mV		
600.0V	0.1V		
600V	1V		

**Note:** The input impedance is 10MΩ.

## AC VOLTAGE

Range	Resolution	Accuracy	Overload Protection
60.00mV	10μV	±(1.0%+3)	600V DC/AC
600.0mV	0.1mV		
6.000V	1mV	±(0.8%+3)	
60.00V	10mV		
600.0V	0.1V		
600V	1V	±(1.0%+3)	
VFC 200.0V~600V	±(4.0%+3)	0.1/1V	


### Notes:

- Input Impedance: ~10MΩ
- Frequency Response: 45Hz~1KHz (VFC: 45~400Hz)
- Maximum input voltage: 600Vrms

## RESISTANCE


Range	Resolution	Accuracy	Overload Protection
600.0Ω	0.1Ω	±(1.0%+2)	600Vp
6.000kΩ	1Ω	±(0.8%+2)	
60.00kΩ	10Ω		
600.0kΩ	100Ω		
6.000MΩ	1kΩ	±(1.2%+2)	
60.00MΩ	10kΩ	±(1.5%+2)	

## DIODE AND CONTINUITY

Range	Resolution	Accuracy	Overload Protection
	0.1Ω	When $\leq 10\Omega$ , the buzzer beeps.	600Vp

### Notes:

- The open circuit voltage is about \*1V.
- The buzzer may beep when the resistance of a circuit under test is  $< 10\Omega$ .
- The buzzer does not beep when the resistance of a circuit under test is higher than 150Ω.

Range	Resolution	Accuracy	Overload Protection
	1mV	Displays approximate forward voltage drop	600Vp

### Notes:

- The normal voltage drop of a good silicon junction is about 0.5~0.8V.

## CAPACITANCE

Range	Resolution	Accuracy	Overload Protection
9.999nF	1pF	Under REL status $\pm(4\%+10)$	600Vp
99.99nF~999.9μF	10pF~0.1μF	$\pm(4\%+5)$	
9.999nF~99.99mF	1μF~10μF	$\pm 10\%(\leq 2mF)$	

## FREQUENCY/DUTY RATIO

Range	Resolution	Accuracy	Overload protection
0.1%~99.9%	0.1%	For reference only	600Vp
9.999Hz~9.999MHz	0.001Hz~0.001MHz	$\pm(0.1\%+4)$	

Input range a: (DC level zero)

- $\leq 100kHz$ :  $\geq 100mV_{rms} \leq a \leq 20V_{rms}$
- $> 100kHz \sim 1MHz$ :  $\geq 200mV_{rms} \leq a \leq 20V_{rms}$
- $> 1MHz$ :  $500mV_{rms} \leq a \leq 20V_{rms}$
- $5MHz \sim 10MHz$ :  $900mV_{rms} \leq a \leq 20V_{rms}$

### Note:

- Duty ratio % only applicable for measurement  $\leq 100kHz$
- During measurement of AC voltage or current, to read online frequency or duty ratio the following input should be met:  
Frequency response:  $\leq 1kHz$

## CURRENT CLAMP MEASUREMENT

Range	Resolution	Accuracy	Overload Protection
60A DC	0.01A	$\pm(1.0\%+3)$	600Vp
60A AC		$\pm(1.2\%+3)$	

## DC CURRENT

Range	Resolution	Accuracy	Overload Protection
600.0μA	0.1μA	±(0.7%+2)	600V DC/AC Fuse 0.6A Fuse 10A
6000μA	1μA		
60.00mA	10μA		
600.0mA	0.1mA	±(1.0%+3)	
6.000A	1mA		
10.00A	10mA		

## AC CURRENT

Range	Resolution	Accuracy	Overload Protection
600.0μA	0.1μA	±(1.0%+3)	600V DC/AC (<1A range) Fuse 0.6A (>10A range) Fuse 10A
6000μA	1μA		
60.00mA	10μA		
600.0mA	0.1mA	±(1.2%+3)	
6.000A	1mA		
10.00A	10mA		

### Note:

- Frequency response: 45~1kHz
- Display : true RMS

## TEMPERATURE MEASUREMENT

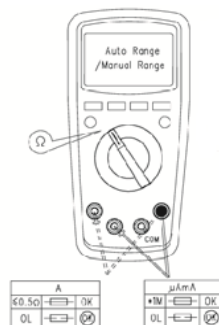
Range		Resolution	Accuracy
°C	-40~1000°C	-40~0°C	±3
		>0~100°C	±(1.0%+3)
		>100~1000°C	±(2.0%+3)
°F	-40~1832°F	-40~32°F	±5
		>32~212°F	±(1.5%+5)
		>212~1832°F	±(2.5%+5)

### Note:

- The K type point (Ni-Cr and Ni-Si) thermocouple is only applicable for the measurement of temperature under 230°C/446°F.

## Internal Fuse Check

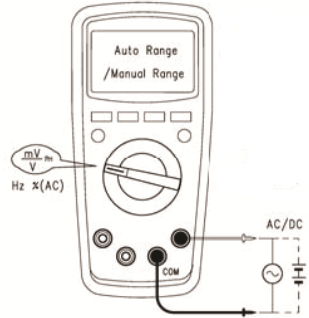
- By using the resistance measurement function, the state of the internal fuses can be tested.
  1. Turn the range selector to Ω.
  2. Connect the test leads as shown to check each fuse.



## OPERATION

### Measuring DC/AC Voltage

- To measure DC/AC voltage, perform the following steps:
  - Insert the red test lead into the **VΩHz°C** terminal and the black test lead into the **COM** terminal.
  - Turn the range selector to **mV** measurement mode and connect the test probes in parallel with the object being measured. The measured value shows on the display. Press **REL**  $\Delta$  to switch from auto range as default to manual range during the measurement if required.
  - When the load impedance is  $\sim 10\text{M}\Omega$  the load may cause measurement errors, but it is so low it can be ignored if the circuit impedance is under 10k.

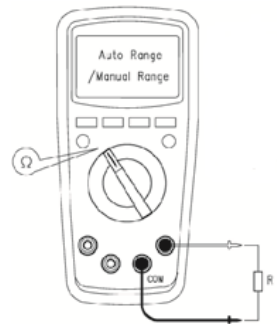


#### Note:

- When a measurement has been completed, disconnect the test probes from the circuit under test, and remove the test leads from the input terminals.
- Do not attempt to measure voltages over 600Vrms as although a measurement may be given, the meter may be damaged.

### Measuring Resistance

- To measure the resistance, perform the following steps:
  - Insert the red test lead into the **VΩHz°C** terminal and the black test lead into the **COM** terminal.
  - Turn the range selector to **Ω**. Press **REL**  $\Delta$  to switch from auto range as default to manual range during the measurement if required.
  - Connect the test probes with the object being measured. The measured value shows on the display.
  - If measuring low resistance the test leads will add about  $0.1\Omega\sim 0.2\Omega$  to the reading. To obtain an accurate reading, short the test probes and use the REL measurement mode.



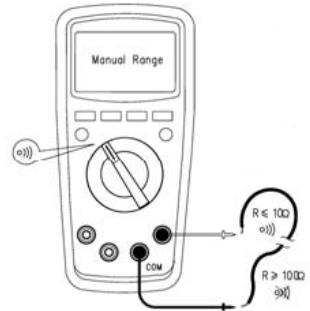
#### Notes:

- OL is displayed if the reading is out of range.
- Turn off all power to the circuit under test and discharge all capacitors before connecting the meter.
- To obtain a more precise reading, you could remove the object being measured from the circuit when measuring.
- When a measurement has been completed, disconnect the test probes from the circuit under test, and remove the test leads from the input terminals.
- Do not exceed 60VDC or 30VAC in this mode.



## Measuring Continuity

- To measure continuity, perform the following steps:
  - Insert the red test lead into the **VΩHz°C** terminal and the black test lead into the **COM** terminal.
  - Turn the range selector to **•|)** measurement mode and connect the test probes to the object being measured.
  - Press **SELECT** to switch to continuity measurement mode if needed.
  - The measured value shows on the display.
  - The buzzer will sound if the resistance of a circuit under test is less than  $10\Omega$ .
  - The buzzer may sound if the resistance of a circuit under test is between  $10\Omega$  and  $150\Omega$ .
  - The buzzer does not sound if the resistance of a circuit under test is higher than  $150\Omega$ .

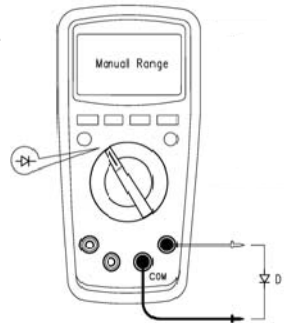


### Note:

- Turn off all power to the circuit under test and discharge all capacitors before connecting the meter.
- When a measurement has been completed, disconnect the test probes from the circuit under test, and remove the test leads from the input terminals.

## Diode Check

- Use the diode test mode to check diodes, transistors and other semiconductor devices. In diode test mode, a current is sent through the semiconductor junction and the voltage drop across the junction is measured.
- A good silicon junction drop is between  $0.5V$  and  $0.8V$ .
- To test a diode out of a circuit, perform the following steps:
  - Insert the red test lead into the **VΩHz°C** terminal and the black test lead into the **COM** terminal.
  - Turn the rotary switch to **▶|**. Press **SELECT** to switch to diode measurement mode if needed.
  - For forward voltage drop readings on any semiconductor component, connect the red test probe to the component's anode and the black test probe to the cathode.

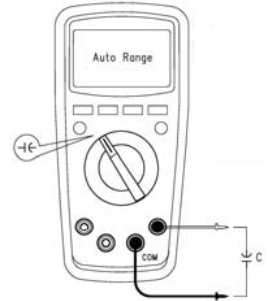


### Notes:

- Test voltage for diode check is  $\sim 3.2V$ .
- Turn off all power to the circuit under test and discharge all capacitors before connecting the meter.
- When a measurement has been completed, disconnect the test probes from the circuit under test, and remove the test leads from the input terminals.

## Capacitance measurement

- To measure the resistance, perform the following steps:
  - Insert the red test lead into the **VΩHz°C** terminal and the black test lead into the **COM** terminal.
  - Turn the range selector to **←**, the meter and leads will display a fixed internal capacitance. Press **REL Δ** to switch to relative measurement which will automatically deduct this value from the measured value.
  - Connect the test probes with the object being measured. The actual value shows on the display.
  - Several seconds may be needed to measure a high value capacitor.

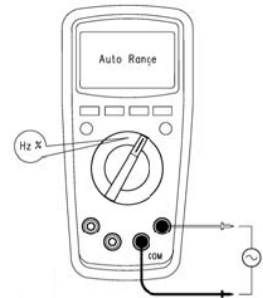


### Notes:

- OL is displayed if the reading is out of range.
- Turn off all power to the circuit under test and discharge all capacitors before connecting the meter.
- When a measurement has been completed, disconnect the test probes from the circuit under test and remove the test leads from the input terminals.

## Duty Cycle measurement

- To measure duty cycle, perform the following steps,
  - Insert the red test lead into the **~)→VΩ** terminal and the black test lead into the **COM** terminal.
  - Turn the rotary switch to **Hz** to select duty cycle measurement mode.
  - Connect the test probes with the object being measured. The measured value shows on the display.



### Note:

- When a measurement has been completed, disconnect the test probes from the circuit under test and remove the test leads from the input terminals.

## Temperature measurement

- To measure temperature, perform the following steps:
  - Insert the red Thermocouple lead into the **VΩHz°C** terminal and the black lead into the **COM** terminal.
  - Turn the rotary switch to **°C°F** to select temperature measurement mode.
  - The measured value shows on the display.



### Note:

- When a measurement has been completed, disconnect the thermocouple from the circuit under test and remove the test leads from the input terminals.

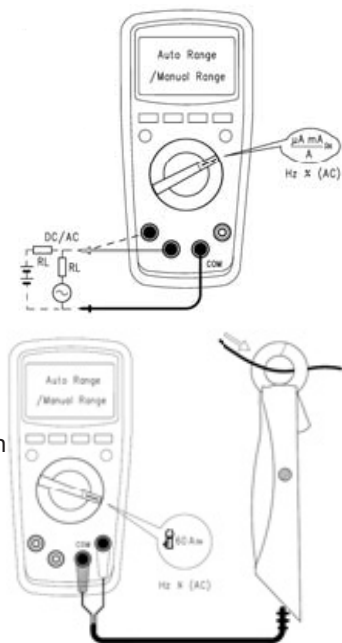
## AC and DC Current measurement

- To measure current, perform the following steps,
  - Turn the rotary switch to **A** and press **SELECT** to switch between DC (as default) and AC RMS measurement mode.
  - Connect the red test lead to either **mA** or **A** terminal and the black lead into the **COM** terminal.

3. Connect the test leads to the circuit to be measured in series.
4. Alternatively connect the current clamp to the **VΩHz°C** terminal and the **COM** terminal.
5. Turn the rotary switch to  $\text{A}$  to measure up to 60A AC or DC.
6. Open the clamp jaws and pass the cable into the clamp and close the jaws.
7. The measured value shows on the display.

#### Notes:

- If you do not know the approximate value to be measured, use the higher value setting and input connection initially.
- Never connect the meter in parallel with any circuit.
- When measuring AC current, pressing Hz% button will display the AC frequency/duty ratio.
- When a measurement has been completed, disconnect the test probes from the circuit under test and remove the test leads from the meter.
- The operating temperature must be 0°C ~40°C when measuring current.



#### Non-contact AV Voltage sense

- To detect AC voltage or electromagnetic field, perform the following steps:
  1. Turn the rotary switch to **NCV**.
  2. Allow the front end of the meter to be close to the object to be sensed.
  3. EF is displayed if the analogue quantity of AC voltage is detected.
  4. - is displayed if the detected voltage is > critical voltage.
  5. - - - is displayed accompanied by the sounder level depending on the detected voltage Vd.

#### Note:

- Test leads are not required when the rotary control is set to NCV.



#### Other Functions

- The meter will automatically power off to save the battery if no button is pressed in 15 minutes. Pressing any button will wake the meter up. The sounder will beep 1 min prior to power off and again as it powers down.
- To switch off the auto power off, hold the SELECT button when powering on. The sounder will beep to inform you that auto power off is disabled. The sounder will beep every 15 minutes.
- Restore auto power off by turning off the meter and turning back on again.
- A valid button or rotary control selection will produce a short beep.
- A continuous tone is emitted if the measured reading is over range for the selection made when in the AC or DC voltage or current mode.

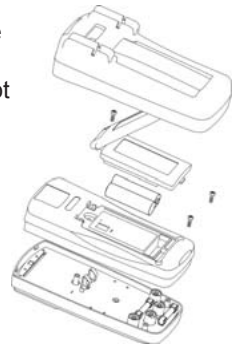
## SPECIFICATIONS

Function	Range/description
Operating Temperature:	0°~40°C (32°F~104°F)
Relative Humidity:	≤75%@ 0°C~30°C ≤50%@ 30°C~40°C
Operating ASL:	0~2000m
Battery Type:	2 off 1.5V AA
Dimensions (H x W x L):	175 x 80 x 48mm
Weight:	350g incl battery
Range:	Auto
Polarity:	Auto
Display:	6000 refresh 2~3 per second
DC Voltage:	0 to 600V
AC Voltage true RMS:	0 to 600V

## MAINTENANCE

### Replacing the battery

- When the meter displays the low battery symbol, replace the batteries immediately in order to maintain normal operation. If the battery symbol remains on the display the meter cannot be used until they have been replaced.
- Disconnect and remove all test probes from any live source and the meter.
- Open the battery cover on the rear case with a screwdriver.
- Remove the old batteries and fit new 1.5V AA batteries into the battery holder.
- Replace the battery cover.



### Cleaning

- Clean the meter with a clean, soft cloth.
- Do not use any chemicals, abrasives or solvents that could damage the meter.
- Clean the terminals with a mild detergent, as dirt on the terminals can affect readings.



### INFORMATION ON WASTE DISPOSAL FOR CONSUMERS OF ELECTRICAL & ELECTRONIC EQUIPMENT

These symbols indicate that separate collection of Waste Electrical and Electronic Equipment (WEEE) or waste batteries is required. Do not dispose of these items with general household waste. Separate for the treatment, recovery and recycling of the materials used. Waste batteries can be returned to any waste battery recycling point which are provided by most battery retailers. Contact your local authority for details of the battery and WEEE recycling schemes available in your area.



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