

Thank you for your purchase of this Instrument. Please carefully read OPERATION MANUAL before use so as to ensure that you can use it correctly, and to reduce damage as well as to develop its optimum performance.

I. Features:


1. To measure DC voltage, AC voltage, DC current, AC current, resistance, frequency (auto Ranging), diode, Continuity test, inductance, capacitance, transistor (hFE) value.
2. To test current up to AC/DC 10A.
3. Inductance, capacitance, current (mA) ranges have 500mA /250V fuse overload protection.
4. 10A range has 10A/250V fuse overload protection.
5. MAX switch: to lock up LCD max. value.
6. DC/AC switch: AC/DC alternative switch.
7. Easy for holding according to the best design to fit human body engineering, with the optimum inclined view angle and adjustable legs.
8. Safety holster that is made from recovery material.
9. Test leads can be well stored after use.
10. Input end warning sound:
When the range is turned to voltage, resistance, frequency, diode ranges, (test leads) will be connected to mA/CxLx socket or 10A socket, and it will give warning sound to warn input socket is connected to the wrong position.

II. Specification:

2-1 General Specification.

1. Display unit: 3 1/2 digits LCD, with a maximum reading of 1999, units, decimal point and symbol

display.

2. Polarity Indication: when negative value input, automatic display the symbol "-".
3. Zero reset adjustment: automatic zero reset.
4. Overload indication: LCD will show a "OL".
5. Low battery indication: automatic low power test, when battery voltage is lower than work voltage, "BAT" will be shown and you should be ready to replace a new battery.
6. Sampling rate: 2.5 times/sec.
7. Power supply: 9V NEDA 1604 IEC 6F22 JIS 006P battery x 1 pcs.
8. Battery life: 200 hours, approximately.
*Please note capacitance and inductance ranges will consume the max. power, if use very often battery life will be reduced to 100 hours.
9. Operation height: 2000M under the elevation above sea level.
10. Installation categories III. Double and Reinforce Insulation .
11. Operation environment: for indoor use, polluted extent is grade 2.
12. Operation temperature and humidity: 5°C~40°C, below 80% RH.
13. Storage temperature and humidity: -10°C ~ 60°C, below 70% RH.
14. Dimension and weight: 186 x 86 x 39mm, about 390g (incl. battery).
15. Accessories: test leads x 1, operation manual.
16. Ratings and type of fuses:

1. \ominus 0.5A/250V, $5\phi \times 20\text{mm}$ FAST MIN INTERRUPT RATINGS 1500A.
 2. \ominus 10A/250V, $6\phi \times 32\text{mm}$ FAST MIN INTERRUPT RATINGS 200A.
 2-2 Electrical specification: ($23^{\circ}\text{C} \pm 5^{\circ}\text{C}$, below 80%RH).
 Accuracy: $\pm(\text{reading} + \dots\dots\dots\% \dots\dots\dots\text{digits})$.

DCV

Rnge	Resolution	Accuracy	Input impedance	Overload Protection
200mV	100 μ V	$\pm(0.5\% +1)$	10M Ω	DC 1000V AC 750V rms
2V	1mV	$\pm(0.5\% +3)$		
20V	10mV			
200V	100mV			
1000V	1V			

ACV

Range	Resolution	Accuracy 40Hz~500Hz	Input impedance	Overload Protection
200mV	100 μV	$\pm(1.2\% + 4)$	10M Ω	DC 1000V AC 750V rms
2V	1mV			
20V	10mV			
200V	100mV			
750V	1V	$\pm(1.5\% + 4)$		

DCA

Range	Resolution	Accuracy	Voltage Burden	Overload Protection
200 μA	100nA	$\pm(1.2\% + 2)$	< 0.7V	0.5A/250V fuse
2mA	1 μA			
20mA	10 μA			
200mA	100 μA			
10A	10mA	$\pm(2.5\% + 2)$	< 0.3V	10A/250V fuse

ACA

Range	Resolution	Accuracy 40Hz ~500Hz	Voltage Burden	Overload Protection
200 μA	100nA	$\pm(1.5\% + 3)$	< 0.7V	0.5A/250V fuse
20mA	10 μA			
200mA	100 μA			
10A	10mA	$\pm(2.5\% + 3)$	< 0.3V	10A/600V fuse

Frequency Test (Auto Ranging)

Range	Resolution	Accuracy	Max. sensitivity	Overload Protection
2KHz	1Hz	$\pm(0.8\% + 3)$	Lo: 500mVrms 10K-1MHz 5Vrms 1MHz-10MHz Hi: 2Vrms 10-100KHz	DC/AC 350Vrms
20KHz	10Hz			
200KHz	100Hz			
2MHz	1KHz			
10MHz	10KHz			

Diode Test

Range	Resolution	Measuring Voltage	Measuring Current	Overload Protection
	1mV	3.3Vmax	0.7mA	DC/AC 500V rms

Transistor (HFE) Test:

Range	Measurement Range	Measuring Voltage	Measuring Current	Overload Protection
NPN PNP	0~1000	<3.2V	IB \approx 0.7mA	—

Continuity Test:

Range	Resolution	Sound level	open-circuit Voltage	Overload Protection
	0.1 Ω	75 Ω below	MAX 3.3V	DC/AC500Vrms

Resistance Test

Range	Resolution	Accuracy	Open-circuit Voltage	Overload Protection
200 Ω	0.1 Ω	$\pm(1.2\%+4)$	MAX 3.3V	DC/AC 500V rms
2K Ω	1 Ω	$\pm(1.0\%+2)$	>0.3V	
20K Ω	10 Ω			
200K Ω	100 Ω			
2M Ω	1K Ω			
20M Ω	10K Ω	$\pm(2\%+5)$		

Capacitance Test

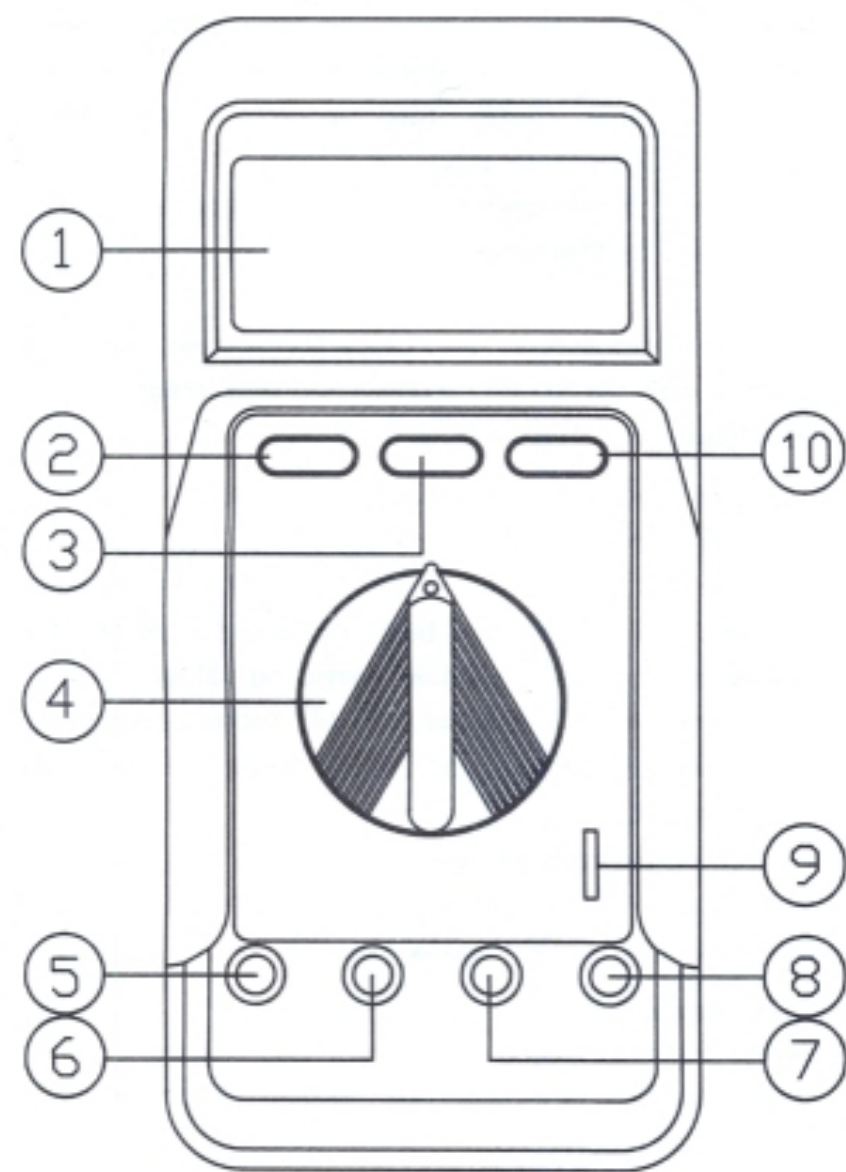
Range	Resolution	Accuracy	Measuring Frequency	Overload Protection
2nF	1pF	$\pm(5\%+10)$	\approx 200Hz/ 1.5sec	0.5A/250V fuse
20nF	10pF			
2 μ F	1nF			
20 μ F	10nF			
2000 μ F	1 μ F		\approx 2Hz/8sec	

Inductance Test

Range	Resolution	Accuracy	Open-circuit Voltage	Overload Protection
2nH	1 μ	$\pm(5\%+10)$	$\approx 1000\text{Hz}$	0.5A/250V Fuse
20nH	10 μ		$\approx 200\text{HZ}$	
200nH	100 μ			
2H	1mH			
20H	10nH			

III.Description of Operating Positions:

- (1)LCD: Display the value measured and indicate all units symbols and ranges.
- (2)ON/OFF: Power ON/OFF switch.
- (3)MAX: Lock up max. value of LCD.
- (4)Function range selective switch: Select according to function range indication on the meter.
- (5)10A measuring socket: For current measuring input below 10A.
- (6)mACxLx measuring socket: Positive input terminal for the current below 200mA, capacitance and inductance measuring.
- (7)COM test socket: For connection of negative input terminal when all functions measuring. (HFE not included) voltage, resistance, frequency, diode and continuity tests.
- (8)V/ Ω test socket: Positive input terminal for AC/DC
- (9)Transistor (HFE) value socket: Special socket for measuring.
- (10) / : Alternate AC or DC voltage or current.



IV. Method of measurements:

4-1 DC voltage (DCV), AC voltage (ACV) measurements:

- 1) Select $V \text{ ---}$ or $V \sim$ proper range subject to the need, (If voltage waiting for measuring were not known, turn to the highest range, then decrease to the optimum resolution subject to actual measuring value).
- 2) Connection of red test lead to "V Ω " socket and black test lead to COM socket.
- 3) The other two ends of test leads for current measuring (series with the circuit waiting for measuring).
- 4) Read measuring voltage value from LCD.

4-2 DC current(DCA), AC current (ACA) measurements:

- 1) Select $A \text{ ---}$ or $A \sim$ proper range subject to the need, (If voltage waiting for measuring were not known, turn to the highest range, then decrease to the optimum resolution subject to actual measuring value).
- 2) Connection of red test lead to "mA" socket (connect to 10A socket if greater than 200mA), and black test lead to COM socket.
- 3) The other two ends of test leads for current measuring (series with the circuit waiting for measuring).
- 4) Read measuring current value from LCD.

4-3 Diode measurement:

- 1) Select function switch to " $\rightarrow| \text{ --- } / \bullet$)" range.
- 2) Insert red test lead into "V Ω " socket, black test lead into COM socket.
- 3) Connect the other end of red test lead to the positive pole (P) of diode and the other end of black test lead to the negative pole (N) of the diode, (LCD value will

show 0.3 - 0.9V).

- 4) The value read from LCD is positive phase voltage drop (Vf) of the diode, and the unit is "voltage".
- 5) When the two test leads are in negative way on Step 3, the value on LCD will indicate open-circuit state value so as to identify if P, N poles of the diode is good or bad.

4-4 Continuity test:

- 1) Insert the red test lead into "V Ω " socket, black test lead into "COM" socket.
- 2) Turn function switch to " $\rightarrow| \text{ --- } / \bullet$)" range.
- 3) Connect the test lead to the circuit(resistor circuit) for testing.
- 4) A continuous sound indication will be given and test value will be shown on LCD if testing resistance is lower than 75 Ω .
*continuity test value is only permitted for testing on the resistance circuit and no voltage, current should exist.

4-5 Resistance measurement:

- 1) Insert red test lead into "V Ω " socket, black test lead into COM socket.
- 2) Select " Ω " range subject to the need, (If current waiting for measuring were not known, turn to the highest range, then decrease to the optimum resolution subject to actual measuring value).
- 3) Connect the test lead to the resistor waiting for testing.
- 4) Read measuring resistance value from LCD.
*When resistance value is waiting for measuring from the circuit, please turn off power on the circuit and

totally discharge measurement the capacitor.

4-6 Frequency measurement(auto ranging)

- 1) Insert red test lead into "VΩ" socket, black test lead into COM socket,
- 2) Turn function switch to "10MHz" range,
- 3) Connect to the test lead to the frequency waiting for testing.
- 4) The meter will be automatic to shift till the best resolution is got.
- 5) Read testing frequency value from LCD.
- 6) Turn the range to 10MHz Hi range if display value were not stable.
- 7) Hi/Lo is voltage level switch for frequency input.

4-7 Inductance measurement:

- 1) Turn off power on the circuit waiting for testing and totally discharge capacitor.
- 2) Turn function range to the most accurate value within the range of inductance such as select the range of correct range.
- 3) Insert the red test lead into mACxLx socket, and black test lead into "COM" socket.
- 4) The other two ends of the test leads waiting for measuring inductance (parallel connection with the circuit waiting for testing).
- 5) Read inductance value waiting for testing from LCD.

*Note: Different inductance range has different testing frequency and response time.

4-8 Capacitance measurement:

- 1) Turn off power on the circuit waiting for testing and totally discharge the capacitor.
- 2) Before discharge of voltage from the capacitor, please

note the safe discharge is to use a 100K resistor by means of parallel connection on the both ends of the capacitor.






- 3) Turn function switch to the most accurate value within the range of capacitance such as select the range of correct range.
- 4) Insert the red test lead into mACxLx socket, and black test lead into "COM" socket.
- 5) The other two ends of the test leads waiting for measuring capacitance (parallel connection with the circuit waiting for testing).
- 6) For measuring if capacitor is electrolytic capacitor or polarity capacitor, red test lead must be connected to positive (+) end, black test lead to the negative (-) end.
- 7) Read the capacitance value waiting for testing from LCD.
- 8) When use 2nF range, please note the value measured is the capacitance value waiting for testing plus capacitance value on the circuit of the meter, if intend to know the capacitance waiting for testing must be deducted the capacitance value on the circuit of the meter such as: LCD display value is 185PF, the capacitance value on the circuit of the meter is 35PF, and the capacitance waiting for testing is 150PF.

*Note:

1. Different capacitance range has different testing frequency and response time.
2. When measuring the capacitance, if any voltage 0.5mA/250V fuse inside the meter will be burned down.

V. Description of Symbols:

- 1)  :Represent DC

- 2)  :Represent AC
- 3)  :Represent grounding
- 4)  :Represent insulation
- 5)  :Represent warning
- 6)  :Represent HV Danger



VI.Warning:

Take extreme care for the following conditions when measuring:

1. Measuring voltage over 20V.
2. Measuring current over 10mA.
3. When measuring AC power supply, it might cause human body electricity conduction.
4. Do not measure voltage, current under humid or wet environment.
5. If any unusual condition of testing end (metal part) and attachment of the meter such as breakage, deformation, fracture, foreign substance, no display, etc., do not conduct any measuring.
6. Do not contact any exposed metal (conduction) parts such as end of test lead, socket, fixing object, circuit, etc.
7. Keep you insulated from the object waiting for measuring.
8. Do not change the fuse with greater value than the specified for the meter, or the fuse not permitted.
9. Do not operate the meter under the environment with explosive gas (material), combustible gas (material), steam or filled with dust.

VII.Precautions:

The meter is a precision instrument, do not exceed the specifications mentioned before to avoid its accuracy when use or storage.

- 1) Do not test or connect voltage over DC1000V, AC750V.
- 2) When function range switch is turned to Ω 、HFE、C、H、、 ranges, do not input voltage or current.
- 3) When maintenance and cleanup, please use soft and dry cloth for cleaning, do not wipe with damp cloth, solvent, water, etc.
- 4) When not use for a long period, please remove the battery and do not store it at the place of high temperature, high humidity.

VIII.Battery Replacement

The meter is powered by 9V battery(NEDA 1604 IEC 6F22 JIS 006P). use the following procedure to replace the battery:

1. Disconnect test leads from any live source, put off the power swith, and remove the test Leads from the front terminals.
2. The case bottom is secured to the case top by four screws, remove the four crews form the case bottom and turn the case over.
3. Reinsert the new battery into the battery case.

Fuse Replacement

Use the battery replacement procedure to examine or replace the meter's fuses.

NAME AND ADDRESS OF MANUFACTURE

TENMARS ELECTRONICS CO., LTD.

TAIPEI OFFICE:

6F, 586, RUI GUANG ROAD, NEIHU, TAIPEI,

TAIWAN