

OPERATOR'S  
MANUAL

CAUTION:

\* Before attempting to insert transistors capacitor thermocouple for testing, always be sure that test test leads have been disconnected from any measurement circuits.

\* Components should not be connected to the hFE and capacitor and the thermocouple socket when making voltage measure with test leads.

\*Using this appliance in an environment with a strong radiated radio – frequency electromagnetic field (approximately 3V/m), may influence its measuring accuracy. The measuring result can be strongly deviating from the actual value.

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## 1. SAFETY INFORMATIONS

This multimeter has been designed according to IEC-1010 concerning electronic measuring instruments with an overvoltage category (CAT II) and pollution 2.

Follow all safety and operating instructions to ensure that meter is used safely and is kept in good operating condition.

### 1.1 PRELIMINARY

- \* When using this meter, the user must observe all normal safety rules concerning:
  - Protection against dangers of electronic current.
  - Protection of the meter against misuse.
- \* Full compliance with safety standards can be guaranteed only if used with test leads supplied. If necessary, they must be replaced with the same model or same electronic ratings. Measuring leads must be in good condition.

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### 1.2 DURING USE

- \* Never exceed the protection limit values indicated in specifications for each range of measurement.
- \* When the meter is linked to measurement circuit, do not touch unused terminals.
- \* When the value scale to be measured is unknown beforehand, set the range selector at the highest position.
- \* Before rotating the range selector to change functions, disconnect test leads from the circuit under test.
- \* When carrying out measurements on TV or switching power circuits, always remember that there may be high amplitude voltage pulses at test points which can damage the meter.
- \* Never perform resistance measurements on live circuits.

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- \* Never perform capacitance measurements unless the capacitor to be measured been discharged fully.
- \* Always be careful when working with voltage above 60V dc or 30V ac rms. Keep fingers behind the probe barriers while measuring.
- \* Before attempting to insert transistors capacitor thermocouple for testing, always be sure that test leads have been disconnected from any measurement circuits.
- \* Components should not be connected to the hFE and capacitor socket and the thermocouple has been removed when making voltage measurements with test leads.

### 1.3 SYMBOLS

-  Important safety information, refer to the operating manual.
-  Dangerous voltage may be present.
-  Earth ground
-  Double insulation (protection class II)

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#### 1.4 MAINTENANCE

- \* Before opening the meter, always disconnect test leads from all sources of electric current.
- \* For continue protection against fire, replace fuse only with the specified and current rating: F200mA / 250V (quick acting)
- \* If any faults or abnormalities are observed, the meter can not be used any more and it has to be checked out.
- \* Never use the meter unless the back cover is in place and fastened fully.
- \* Do not use abrasives or solvents on the meter use a damp cloth and mild detergent only.

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#### 1. DESCRIPTION

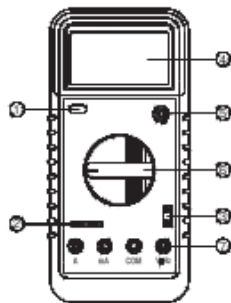
This meter is one of a series portable professional measuring instrument, capable of performing functions:

- DC and AC voltage measurement
- DC and AC current measurement
- Resistance measurement
- Capacitance measurement
- Diode and Transistor test
- Audible continuity test

Some models of this series also provide functions:

- Temperature measurement
- Frequency measurement

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1. POWER SWITCH
2. CAPACITOR MEASURING SOCKET
2. TEMPERATURE MEASURING SOCKET
3. LCD DISPLAY
4. TRANSISOR TESTING SOCKET
5. ROTARY SWITCH
6. INPUT JACKS

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## 2.1 FUNCTION AND RANGE SELECTOR

There are different functions and 32 ranges provided. A rotary switch is used to select functions as well as ranges.

## 2.2 POWER SWITCH


A push-push switch is used to turn the meter on or off.

To extend the battery life, Auto Power- Off function is provided (Optional). The meter will be turned off automatically within around 40 minutes. To turn on the meter again, push the power switch to release it and then push it once more.

## 2.3 INPUT JACKS

This meter has four input jacks that are protected against overload to the limits shown. During use connect the black test lead to COM jack connect red test lead depending on the function selected.

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FUNCTION	RED LEAD CONNECTION	INPUT LIMITS
200mV $\equiv$	V $\Omega$ Hz	250V dc or rms ac
V $\equiv$ & V $\sim$	V $\Omega$ Hz	1000V dc, 700V ac (sine)
Hz	V $\Omega$ Hz	250V dc or rms ac
$\Omega$	V $\Omega$ Hz	250V dc or rms ac
 $\rightarrow$	V $\Omega$ Hz	250V dc or rms ac
mA $\equiv$ & mA $\sim$	mA	200mA dc or rms ac
20A $\equiv$ & 20A $\sim$	A	10Adc or rms ac continuous 20A for15seconds maximum

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## 3. OPERATING INSTRUCTION

### 3.1 MEASURING VOL TAGE

1. Connect the black lead to the COM jack and the red test lead to the V  $\Omega$  Hz jack.

2. Set the rotary switch at the desired V  $\equiv$  or V $\sim$  range position and connect test leads across the source or load under measurement.

The polarity of the red lead connection will be indicated along voltage value when making DC voltage measurement.

3. When only the figure "1" is displayed, it indicates overrange situation and the higher range have to be selected.

### 3.2 MEASURING CURRENT

1. Connect the black lead to the COM jack and the test lead to the mA jack for a maximum of 200mA current. For a maximum of 20A, move the red lead to the A jack.

2. Set the rotary switch at desired A  $\equiv$  or A $\sim$  range position and connect test leads in series with the load under measurement.

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The polarity of the red lead connection will be indicated along with the current value when making DC current measurement.

3. When only the figure "1" displayed, it indicates overrange situation and the higher range has to be selected.

### 3.3 MEASURING FREQUENCY

1. Connect the black test lead to the COM jack and the red test lead to the V  $\Omega$  Hz jack.

2. Set the rotary switch at kHz position and connect test leads across the source or load under measurement.

#### NOTE:

1. Reading is possible at input voltages above 10Vrms, but the accuracy is guaranteed.

2. In noisy environment, it is preferable to use shield cable for measuring small signal.

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### 3.4 MEASURING RESISTANCE

1. Connect the black test lead to the COM jack and the red to the V  $\Omega$  Hz jack. (The polarity of red lead is "+" )

2. Set the rotary switch at desired  $\Omega$  position and connect test leads across the resistor under measurement.

#### NOTE:

1. If the resistance being measured exceeds the maximum value of the range selected or the input is not connected, an overrange indication "1" will be displayed.

2. When checking in – circuit resistance, be sure the circuit under test has all power removed and that all capacitors have been discharged fully.

3. For measuring resistance above 1M  $\Omega$ , the meter may take a few seconds to get stable reading. This is normal for high resistance measurements.

4. At 200M  $\Omega$  range display reading is around 10 counts when test leads are shorted.

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These counts have to be subtracted from measuring results. For example, when measuring 100M  $\Omega$  resistance the display reading will be 101.0 and the correct measuring result should be 101.0-1.0=100.0M  $\Omega$ .

### 3.5 MEASURING CAPACITANCE

1. Set the rotary switch at desired F position.

2. Before inserting capacitor under measurement into capacitance testing socket, be sure that the capacitor has been discharged fully.

3. When measuring capacitors with shorter leads, a testing adapter is provided with the meter. Insert the adapter into the capacitance testing socket on the front panel to continue measurements.

#### △WARNING

To avoid electric shock, be sure the capacitor measuring adapter has been removed before changing to another function measurement.

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### 3.6 TESTING DIODE

1. Connect the black test lead to COM jack and the red test lead to the V  $\Omega$  Hz jack (The polarity of red lead is "+" )
2. Set the rotary switch at  $\rightarrow$  position and connect red lead to the anode, black lead to the cathode of the diode under testing .The meter will show the approx. forward voltage of the diode. If the lead connection is reversed, only figure "1" displayed.

### 3.7 TESTING TRANSISTOR

1. Set the rotary switch at hFE position.
2. Determine whether the transistor to be tested is NPN or PNP type and locate the Emitter, Base and Collectors. Insert leads of the transistor into proper holes of the transistor testing socket.
3. The meter will show the approx. hFE value at test condition of base current  $10 \mu A$  and Vce 3.2V.

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### 3.8 CONTINUITY TEST

1. Connect the black test lead to the COM jack and the red test lead to the V  $\Omega$  Hz jack. (The polarity of the red lead is positive "+" )
2. Set the rotary switch at  $\rightarrow$  position and connect test leads across two points of the circuit under testing. If continuity exists (i.e., resistance less than about  $50 \Omega$ ), built-in buzzer will sound.

### 3.9 MEASURING TEMPERATURE

1. Set the rotary switch at TEMP position and the LCD display will show the current environment temperature.
2. Insert "K" type thermocouple into the temperature measuring socket on the front panel and contact the object to be measured with the thermocouple probe. Read LCD display.  
 $\Delta$ WARNING: To avoid electric shock, be sure the thermocouple has been removed before changing to another function measurement.

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## 4. SPECIFICATIONS


Accuracy is specified for a period of one year after calibration and at  $18^{\circ}C$  to  $28^{\circ}C$  ( $64^{\circ}F$  to  $82^{\circ}F$ ) with relative humidity to 80%.

### 4.1 GENERAL

MAXIMUM VOLTAGE BETWEEN TERMINALS AND EARTH GROUND	1000V dc or 700V rms ac (sine)
FUSE PROTECTION	mA: F 200mA/250V (A: unfused)
POWER SUPPLY	9V battery, Neda 1604 or 6F22
DISPLAY	LCD, 1999 counts, updates 2-3/sec
MEASURING METHOD	Dual-slope integration A/D converter
OVERRANGE INDICATION	"1" figure only on the display
POLARITY INDICATION	"-" displayed for negative polarity
OPERATING TEMPERATURE	$0^{\circ}C$ to $40^{\circ}C$ ( $32^{\circ}F$ to $104^{\circ}F$ )
STORAGE TEMPERATURE	$-10^{\circ}C$ to $50^{\circ}C$ ( $10^{\circ}F$ to $122^{\circ}F$ )

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LOW BATTERY INDICATION

 appears on the display

SIZE (HxWxL)

31.5mm×91mm×189mm

WEIGHT

310g(including battery)

#### 4.2 DC VOLTAGE

Range	Resolution	Accuracy
200mV	0.1mV	±0.5% of rdg ± 1 digit
2V	1mV	±0.5% of rdg ± 1 digit
20V	10mV	±0.5% of rdg ± 1 digit
200V	0.1V	±0.5% of rdg ± 1 digit
1000V	1V	±0.8% of rdg ± 2 digits

Input impedance:10MΩ

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#### 4.3 AC VOLTAGE

Range	Resolution	Accuracy
200mV	0.1mV	±1.2% of rdg ± 3 digits
2V	1mV	±0.8% of rdg ± 3 digits
20V	10mV	±0.8% of rdg ± 3 digits
200V	0.1V	±0.8% of rdg ± 3 digits
700V	1V	±1.2% of rdg ± 3 digits

Input impedance: 10MΩ

Frequency Range: 40Hz to 400Hz

Response: Average, calibrated in rms of sine wave

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#### 4.4 DC CURRENT

Range	Resolution	Accuracy	Burden Voltage
2mA	1μA	±0.8% of rdg ± 1 digit	110mV/mA
20mA	10μA	±0.8% of rdg ± 1 digit	15mV/mA
200mA	0.1mA	±1.5% of rdg ± 1 digit	5.0mV/mA
10A	10mA	±2.0% of rdg ± 5 digit	0.03V/A

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#### 4.5 AC CURRENT

Range	Resolution	Accuracy	Burden Voltage
2mA	1μA	±1.0% of rdg ± 3 digits	110mV/mA
20mA	10μA	±1.0% of rdg ± 3 digits	15mV/mA
200mA	0.1mA	±1.8% of rdg ± 3 digits	5.0mV/mA
10A	10mA	±3.0% of rdg ± 7 digits	0.03V/A

Frequency Range: 40Hz to 400Hz

Response:Average, Calibrated in rms of sine wave

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#### 4.6 RESISTANCE

Range	Resolution	Accuracy
200 $\Omega$	0.1 $\Omega$	$\pm 0.8\%$ of rdg $\pm 3$ digits
2K $\Omega$	1 $\Omega$	$\pm 0.8\%$ of rdg $\pm 1$ digit
20K $\Omega$	10 $\Omega$	$\pm 0.8\%$ of rdg $\pm 1$ digit
200K $\Omega$	100 $\Omega$	$\pm 0.8\%$ of rdg $\pm 1$ digit
2M $\Omega$	1K $\Omega$	$\pm 0.8\%$ of rdg $\pm 1$ digit
20M $\Omega$	10K $\Omega$	$\pm 1.0\%$ of rdg $\pm 1$ digit
200M $\Omega$	100K $\Omega$	$\pm 5.0\%$ of (rdg -10 digits) $\pm 10$ digits

Note: On 200M  $\Omega$  range, if short input, display will read 1 M  $\Omega$ , this 1M  $\Omega$  should be subtracted from measurement results.

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#### 4.7 FREQUENCY

Range	Resolution	Accuracy
2KHz	1Hz	$\pm 2.0\%$ of rdg $\pm 5$ digits
20KHz	10Hz	$\pm 1.5\%$ of rdg $\pm 5$ digits

Sensitivity: 200mA rms and input no more 10V rms

#### 4.8 TEMPERATURE

Range	Resolution	Accuracy		
		-20 $^{\circ}$ C to 0 $^{\circ}$ C	0 $^{\circ}$ C to 400 $^{\circ}$ C	400 $^{\circ}$ C to 1000 $^{\circ}$ C
-20 $^{\circ}$ C to 1000 $^{\circ}$ C	1 $^{\circ}$ C	$\pm 5.0\%$ of rdg $\pm 4$ digits	$\pm 1.0\%$ of rdg $\pm 3$ digits	$\pm 2.0\%$ of rdg

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#### 4.9 CAPACITANCE

Range	Resolution	Accuracy
2nF	1pF	$\pm 4.0\%$ of rdg $\pm 3$ digits
20nF	10pF	$\pm 4.0\%$ of rdg $\pm 3$ digits
200nF	0.1nF	$\pm 4.0\%$ of rdg $\pm 3$ digits
2 $\mu$ F	1nF	$\pm 4.0\%$ of rdg $\pm 3$ digits
20 $\mu$ F	10nF	$\pm 4.0\%$ of rdg $\pm 3$ digits

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### 5. ACCESSORIES

#### 5.1 SUPPLIED WITH THE MUL TIMETER

Test leads                      Electric Rating 1500V, 10A  
 Battery                         9V NEDA    1604 or 6F22  
 Operating Manual  
 Holster  
 Capacitance Testing Adapter

#### 5.2 OPTIONAL ACCESSORY

"K" type thermocouple

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### 5.3 How to use the holster


The holster is used to protect the meter and to make the measurement more comfortable.

It comes with two stands installed together. The figure shows how to use the holster to:

- a. Support the meter with a standard angle.
- b. Support the meter with a small angle using the little stand
- c. Hang the meter on the wall using the little stand. Take the little stand off from the back side of the large stand and insert it into holes located upper on the holster.
- d. Hold test leads.

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### 6. BATTERY & FUSE REPLACEMENT

If the sign "  "appears on the LCD display, it indicates that battery should be replaced. Remove screws on the back cover and open the case. Replace the exhausted battery with a new one.

Fuse rarely need replacement and blow almost always as a result of the operator's error. Open the case as mentioned above, and then take the PCB out from the front cover. Replace the blown fuse with same ratings.

#### WARNING

Before attempting to open the case, be sure that test leads have been disconnected from measurement circuits to avoid electric shock hazard.

For protection against fire, replace fuse only with specified ratings: F 200mA/250V (quick acting).

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