



# DIGITAL MULTIMETER OPERATOR'S MANUAL

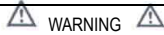
For model DM 91



# DIGITAL MULTIMETER OPERATOR'S MANUAL

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## 1. SAFETY INFORMATION



To ensure safety and in order to exploit to the full functionality of the meter, please follow the directions in the section carefully.

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

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

### 1.1 PRELIMINARY

1.1.1 When using the meter, the user must observe all normal safety rules concerning:

- protection from the dangerous electric current
- protection against misuse

1.1.2 When the meter is delivered, check that it has not been damaged in transit.

1.1.3 When poor condition under harsh presentation or shipping conditions caused, inspect and confirm this meter without delay.

1.1.4 The leads must be in good condition. Before using verify that the insulation on test leads is not damaged and/or the leads wire is not exposed.

1.1.5 full compliance with safety standards can be guaranteed only if used with test leads supplied. If necessary, the must be replaced with the same model or same electric ratings.

### 1.2 DURING USE

1.2.1 Never exceed the protection limit values indicated in specifications for each range of measurement.

1.2.2 When the meter is linked to a measurement circuit, do not touch unused terminals.

1.2.3 When the value scale to be measured is unknown beforehand, set the range selector at the highest position.

1.2.4 Do not measure voltage if the voltage on the terminals exceeds 1000V above earth ground.

1.2.5 Always be careful when working with voltages above 60V DC or 30V AC rms, keep fingers behind the probe barriers while measuring.

1.2.6 before rating the range selector to change functions, disconnect test leads from the circuit under test.

1.2.7 Never connect the meter leads across a voltage sources while the function switch is in the current, resistance, diode or continuity mode. Doing so can damage the meter.

1.2.8 When carrying out measurements on TV or switching power circuits, always remember that there may be high amplitude voltages pulses at test points, which can damage the meter.

1.2.9 Never perform resistance measurements on live circuits.

1.2.10 Never perform capacitance measurements unless the capacitor to be measured has been discharged fully.


1.2.11 If any faults or abnormalities are observed, the meter can not be used any more and it has to be checked out.


1.2.12 Never use the meter unless the rear case in place and fastened fully.


1.2.13 Please do not store or use the meter in areas exposed to direct sunlight, high temperature, humidity or condensation.

### 1.3 SYMBOLS

 important safety information, refer to the operating manual.

 Dangerous voltage may be presence.

 Double insulation (protection Class II)

 Earth ground

### 1.4 MAINTANANCE

1.4.1 Please do not attempt to adjust or repair the mete by removing the rear case while voltage is being applied. A technician who fully understands danger involved should carry out such actions.

1.4.2 Before opening the battery cover of the meter, always disconnect test leads from all sources of electric current.

1.4.3 For continue the battery against fire, replace fuse only with the specified voltage and current ratings: F1-200mA/250V (quick acting, F2-10A/250V (quick acting).

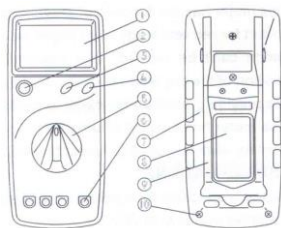
1.4.4 Do not use abrasives or solvents on the meter, use a damp cloth and mild detergent only.

1.4.5 Always set the power switch to the off position when the meter is not in use.

1.4.6 If the meter is to be stored for a long period of time, the batteries should be removed to prevent damage to the unit.

## 2. DESCRIPTION

### 2.1 NAMES OF COMPONENTS



- ① LCD Display
- ② Power Switch
- ③ Backlight set switch
- ④ Data-hold Switch (H)
- ⑤ Rotary Switch
- ⑥ Input Jack
- ⑦ Case
- ⑧ Battery Door
- ⑨ Brace

⑩ Screw

## 2.2 FUNCTION AND RANGE SELECTOR

- This meter is a portable professional measuring instrument with large LCD display and back light for easy reading.
- This meter has the function of preventing the test leads from wrong connecting. The input socket for red test lead is arranged with proper functions and ranges, when the transform switch can't be rotated, stop rotating. It means the selected range isn't suitable with position of the red lead socket. Pull out the read lead and then select the range required, this provides protection for meter to avoid damage by operating improperly.
- This meter has function of Data-hold.
- A rotary switch is used to select functions as well as ranges.

## 3. SPECIFICATIONS

Accuracy is specified for a period of year after calibration and at 18 °C to 28 °C (64 °F to 82 °F) with relative humidity to 75%.

### 3.1 GENERAL SPECIFICATIONS

- 3.1.1 It includes 30 ranges of function.
- 3.1.2 Over-range protection for all ranges.
- 3.1.3 Operating altitude: 2000 meters (7000ft.) maximum.
- 3.1.4 Max Voltage between Terminals and Earth Ground: 1000V DC or AC (peak value).
- 3.1.5 Fuse protection: F1-200mA/250V F2-10A/250V
- 3.1.6 Display: 28mm LCD, word is 28mm high
- 3.1.7 Max Show Value: 1999 (31/2)
- 3.1.8 Polarity Indication: "-" indicates negative polarity.
- 3.1.9 Over-range Indication: display "1" or "-1".
- 3.1.10 Sampling Time: approx. 0.4 second.
- 3.1.11 Power Supply: 9V battery, 6F22 or NEDA 1604.
- 3.1.12 Low Battery Indication: "BAT" displayed
- 3.1.13 Temperature Factor: <0.1x Accuracy/°C
- 3.1.14 Operating Temperature: 0 °C to 40 °C (32 °F to 104 °F)
- 3.1.15 Storage Temperature: -10 °C to 50 °C (10 °F to 122 °F)
- 3.1.16 Dimension: 191x82x36MM (without holster)
- 3.1.17 Weight: approx. 280g (including battery)

### 3.2 ELECTRICAL SPECIFICATIONS

Circumstance Temp.: 23 ± 5 °C Relative Humidity: <70%

#### 3.2.1 DC Voltage

Range	Resolution	Accuracy
200mV	0.1mV	±(0.5% of rdg + 1 digit)
2V	1mV	
20V	10mV	±(0.5% of rdg + 3 digits)
200V	100mV	
1000V	1V	±(0.8% of rdg + 3 digits)

-- Input Impedance: 10M Ω

-- Overload protection: 200mV range: 250V DC or rms AC  
2V-1000V ranges: 1000V DC Or 700V rms AC

#### NOTES:

At the little voltage range, the meter will show unsteady reading when the test leads haven't reach the circuit, it's normal because the meter is very sensitivity. When the test leads touch the circuit, you can get the true reading.

#### 3.2.2 AC Voltage

Range	Resolution	Accuracy
2V	1mV	±(1.0% of rdg + 5 digits)
20V	10mV	
200V	100mV	±(1.2% of rdg + 5 digits)
700V	1V	

-- Input Impedance: 10M Ω

-- Overload protection: 200mV range: 250V DC or rms AC  
2V-700V ranges: 1000V DC Or 700V rms AC

-- Frequency Range: 40 to 400Hz

-- Test on 60Hz/50Hz

-- Response: average, calibrated in rms of sine wave

**NOTES:**

At the little voltage range, the meter will show unsteady reading when the test leads haven't reach the circuit, it's normal because the meter is very sensitivity. When the test leads touch the circuit, you can get the true reading.

**3.2.3 DC Current**

Range	Resolution	Accuracy
20μA	10nA	± (1.2% of rdg + 3 digits)
2mA	1μA	± (1.0% of rdg + 3 digits)
200mA	100μA	± (1.5% of rdg + 5 digits)
10A	10mA	± (2.0% of rdg + 10digits)

-- Overload protection:

20μA to 200mA ranges: F1-200mA/250V fuse

10A range: F2- 10A/250V fuse

-- Max. Input Current: mA Jack – 200mA  
10A Jack – 10A

-- voltage Drop: 200mV

**3.2.4 AC Current**

Range	Resolution	Accuracy
20mA	10μA	± (1.2% of rdg + 5 digits)
200mA	100μA	± (2.0% of rdg + 5 digits)
10A	10mA	± (3.0% of rdg + 10digits)

-- Overload protection:

20mA to 200mA ranges: F1-200mA/250V fuse

10A range: F2- 10A/250V fuse

-- Max. Input Current: mA Jack – 200mA  
10A Jack – 10A

-- voltage Drop: 200mV (full range)

-- Frequency Range: 40 to 500Hz

-- Test on 60Hz/50Hz

-- Response: average, calibrated in rms of sine wave.

**3.2.5 Resistance**

Range	Resolution	Accuracy
200 Ω	0.1 Ω	± (1.0% of rdg + 10 digits)
2K Ω	1 Ω	± (1.0% of rdg + 1 digits)
20K Ω	10 Ω	
200K Ω	100 Ω	
20M Ω	10K Ω	± (1.0% of rdg + 5 digits)
200M Ω	100K Ω	± [5.0% of (rdg-10 digits) + 20 digits]

-- Open Circuit Voltage: 200M Ω range: 3V

other ranges: less than 700mV

-- over-load protection: 250V DC or rms

**NOTES:**

On 200M Ω range, if short input, display will read 1 M Ω . This 1 M Ω should be subtracted from measurements results.


**3.2.6 Capacitance**

range	Resolution	accuracy
2nF	1pF	± (4.0% of rdg + 3 digits)
200nF	0.1nF	
2μF	1nF	
200μF	100nF	± (5.0% of rdg + 3 digits)

**3.2.7 Transistor hFE Test (0-1000)**

Range	Test Range	Test Current / voltage
NPN & PNP	0-1000	I <sub>b</sub> =10μA / V <sub>ce</sub> =3V

**3.2.8 Diode**


Range	Resolution	Function
	1mV	Display: read approximate forward voltage of diode

-- over-load Protection: 250V DC rms AC

-- forward DC current: approximate 1mA

-- Reversed DC voltage: approximate 2.8V

**3.2.9 Continuity**

Range	Function
	Built-in buzzer will sound if resistance is less than 70 Ω

-- over-load protection: 250V DC or rms AC

-- open circuit voltage: approximate 2.8V

### 3.2.10 Frequency Testing

Range	Resolution	Accuracy
200KHz	100Hz	±(1.5% of rdg + 10 digits)

-- Overload Protection: 250V DC or rms AC

-- Sensitivity: 200mV rms and input no more than 10V rms

### 3.2.11 Temperature Testing

Range	Resolution	Accuracy	
-20℃ to 1000℃	1℃	-20~0 ℃	±(5.0% of rdg + 5 digits)
		0~400 ℃	±(1.0% of rdg + 3 digits)
		400~1000 ℃	±(2.0% of rdg + 3 digits)


-- over-load Protection: 250V DC or rms AC

## 4. OPERATING INSTRUCTIONS




### 4.1 DATA HOLD

If you need data hold when measuring, you can put on "H", it will hold the reading; if you put the button again, data hold stops.


### 4.2 BACK LIGHT


If the dark circumstance light makes the reading difficulty when measuring, you can put on  to open the back light.

#### NOTE:

- LED is the main source of back light, its working current is large, although the meter has the timer equipment (time limit is 5 seconds and it will turn off automatically after 5 seconds; often use of back light will shorten life of battery, you'd better not use the back light so frequently if it not necessary.)
- When the battery voltage is less than 7V, it will show , but if you use back light at the same time, maybe  will come up even if voltage is more than 7V, because the working current is higher and the voltage will decline. You need not replace the battery when you use normally (back light is not being used),  will not show up.

### 4.3 PREPARATION FOR MEASUREMENT

4.3.1 Put on the "POWER" button switch. If the battery voltage is less than 7V, display will show , the battery should be replaced at this time.

4.3.2 The "" besides the input jack shows that the input voltage or current should be less than specification on the sticker of meter to protect the inner circuit from damaging.

4.3.3 Select a range properly for the item to be measured and set the rotary switch accordingly.

### 4.4 MEASURING VOLTAGE


4.4.1 Connect the black test lead to COM jack and the red to V/Ω/CAP jack.

4.4.2 Set the rotary switch at the desired  $\sqrt{\text{---}}$  or V~ range position.

4.4.3 Connect test leads across the source or load under measurement.

4.4.4 You can get reading from LCD. The polarity of the red lead connection will be indicated along with the voltage value when making DC voltage measurement.

#### NOTE:

- When only the figure '1' or '-1' is displayed, it indicates over-range situation and the higher range has to be selected.
- When the value scale to be measured is unknown beforehand, set the range selector at the highest position.
- "" means you can't input the voltage more than 1000V DC or 7000V rms AC, it's possible to show higher voltage, but it may destroy the inner circuit.

### 4.5 MEASURING CURRENT


4.5.1 Connect the black test lead to COM jack and the red to the mA jack for a maximum 200mA current, for a maximum 10A current, move the red lead to the 10A jack.

4.5.2 Set the rotary switch at the desired A  $\sqrt{\text{---}}$  or A~ range position.

4.5.3 Connect test leads in series with the load under measurement.

4.5.4 You can get reading from LCD. The polarity of the red lead connection will be indicated along with the current value when making DC current measurement.

#### NOTE:

- When only the figure '1' or '-1' is displayed, it indicates over-range situation and the higher range has to be selected.
- When the value scale to be measured is unknown beforehand, set the range selector at the highest position.
- "" means the socket mA's maximum current is 200mA and 10A's maximum current is 10A, over current will destroy the fuse.

### 4.6 MEASURING RESISTANCE

4.6.1 Connect the black test lead to COM jack and the red to V/  $\Omega$  /CAP jack.

4.6.2 Set the rotary switch at the desired  $\Omega$  range position.

4.6.3 Connect test leads across the resistance under measurement.

4.6.4 You can get reading from LCD.

**NOTE:**

1. When only the figure '1' or '-1' is displayed, it indicates over-range situation and the higher range has to be selected.
2. For measuring resistance above 1M  $\Omega$ , the meter may take a few seconds to get stable reading.
3. When the input is not connected, i.e. at open circuit, the figure '1' will be displayed for the over-range condition.
4. When checking in-circuit resistance, be sure the circuit under test has all power removed and that all capacitors have been discharged fully.
5. At 200M  $\Omega$  range, display reading is around 10 counts when test leads are shorted. These counts have to be subtracted from measuring results. For examples, when measuring 100 M  $\Omega$  resistance, the display reading will be 101.0 and the correct measuring result should be 101.0-1.0=100.0 M  $\Omega$ .
6. the value scale to be measured is unknown beforehand, set the range selector at the highest position.

#### 4.7 MEASURING CAPACITANCE

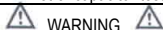
4.7.1 Connect the black test lead to COM jack and the red to V/  $\Omega$  /CAP jack.

4.7.2 Set the rotary switch at the desired F range position.

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

4.7.4 You can get reading from LCD.

4.7.5 When capacitor testing is needed frequently, put the plug of capacitor testing equipment (spare parts) into COM and V/  $\Omega$  /CAP jack, put the capacitor foot into two long socket of capacitor testing equipment, then capacitor testing is ready.



To avoid electrical shock, remove test leads from measurement circuit before measuring the capacitance of a capacitor.

**NOTE:**

1. At the small capacitor range, the reading will include the small value because some influence from the distribution of test leads, but it will not influence the accuracy of measuring.
2. It takes time to get a steady reading while measuring high capacity.

#### 4.8 TRANSISTOR TEST


4.8.1 Set the rotary switch at 'hFE' position.

4.8.2 Determine whether the transistor under testing is NPN or PNP and locate the emitter, base and collector leads. Insert the leads into proper holes of hFE socket on the front panel.

4.8.3 Read the approximate hFE value at the testing condition of base current 1b10uA and Vce 3V.

#### 4.9 DIODE TESTING

4.9.1 Connect the black test lead to COM jack and the red to V/  $\Omega$  /CAP jack. (the polarity of red lead is '+')

4.9.2 Set the rotary switch at the  F range position.

4.9.3 Connect the red lead to the anode and the black lead to the cathode of the diode under testing.


4.9.4 You can get a reading from LCD.

**NOTE:**

1. The meter will show approximate forward voltage drop of the diode.
2. If the lead connections is reversed, only '1' will be displayed.

#### 4.10 CONTINUITY TEST

4.10.1 Connect the black test lead to COM jack and the red to V/  $\Omega$  /CAP jack.

4.10.2 Set the rotary switch at the  range position.

4.10.3 Connect test leads across two points of the circuit under testing.

4.10.4 If continuity exists (i.e. resistance less than about 70  $\Omega$ ), built-in buzzer will sound.

**NOTE:**

If the input open circuit, the figure '1' will be displayed.

#### 4.11 MEASURING FREQUENCY

4.11.1 Connect the black test lead to COM jack and the red to V/  $\Omega$  /CAP jack.

4.11.2 Set the rotary switch at the 200KHz range position.

4.11.3 Connect test leads across the source or load under measurement.

4.11.4 You can get a reading from LCD.

**NOTE:**

1. Reading is possibly at input voltage above 10V rms, but the accuracy is not guaranteed.
2. In noisy environment it is preferable to use shield cable for measuring small signal.

#### 4.12 MEASURING TEMPERATURE

4.12.1 Set the rotary switch at the  $^{\circ}\text{C}$  range position.

4.12.2 The LCD will show the current temperature of the environment.

4.12.3 When measuring temperature with thermocouple, temperature probe for this meter can be used. Insert 'K' type thermocouple into the


temperature measuring socket on the front panel and contact the object to be measured with thermocouple probe.  
4.12.4 You can get a reading from LCD.

## 5. MAINTENANCE



Before attempting to remove the battery door or open the case, be sure that test leads have been disconnected from measurement circuit top avoid electric shock hazard.

### 5.1 BATTERY REPLACEMENT

- 5.1.1 If the symbol  appears on the LCD display, it indicates that the battery should be replaced.
- 5.1.2 Loosen the screws fixing the battery door and remove it.
- 5.1.3 Replace the exhausted battery with a new one.
- 5.1.4 Put the battery door as its origin.

### 5.2 FUSE REPLACEMENT



To avoid electrical shock, remove test leads from measurement circuits before replacing the fuse. For protection against fire, replace fuses only with specified ratings: F1-200mA/250V fuse, F2-10A/250V fuse.

- 5.2.1 Fuses rarely need replacement and blow almost always as a result of the operator's error.
- 5.2.1 Loosen the screws fixing the case and remove it.
- 5.2.3 Replace the blown fuse with specified ratings.
- 5.2.4. Put the case as its origin.

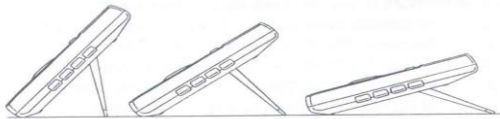
### 5.3 TEST LEADS REPLACEMENT

You must replace the test leads if the lead is exposed, and should adopt the leads with the same specifications as origin.



Full in compliance with safety standards can be guaranteed only if used with test leads supplied, if necessary, they must be replaced with same model or same electric ratings. Electric ratings of test leads: 1000V 10A.

### 5.4 HOW TO USE BRACE



- When this meter isn't used for standing, attach the case to the panel face for safe keeping.
- When measuring, attach it either to the rear case side or use it as a stand illustrated in the cover. It can be changed into three positions for easy reading.
- Turn the standard to the upper meter, take it as a hanging hook.

## 6. ACCESSORIES

- [1] Test Leads: electric rating 1000V 10A
- [2] Battery: 9V, 6F22 or NEDA 1604
- [3] Fuse: F1-200mA/250V
- [4] Fuse: F2-10A/250V
- [5] 'K' type Thermocouple
- [6] Operator's Manual
- [7] Holster