

DMM 3800-18/M3900/M3800

MM30 DIGITAL MULTIMETER

OPERATING MANUAL

6-91

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1. INTRODUCTION

This instrument is a compact, rugged, battery operated, handheld 3½ digit multimeter for measuring DC and AC voltage, DC and AC current, Resistance and Diode, for testing Audible continuity and transistor hFE. The Dual-slope A-D Converter uses C-MOS technology for auto-Zeroing, polarity selection and over-range indication. Full overload protection is provided. It is an ideal instrument for use in the field, laboratory, workshop, hobby and home applications.

2. FEATURES

- Push-button ON/OFF power switch.
- Single 30 position easy to use rotary switch for FUNCTION and RANGE selection
- **18mm in height high Contrast L.C.D.** (DMM 3800 — 18/M3900) (M 3800 13mm in height)
- Automatic overrange indication with the "1" displayed.
- Automatic polarity indication on DC ranges.
- Automatic "ZERO" of all ranges with short circuit.
- Diode testing with 1 mA fixed current.
- Audible Continuity Test.
- Transistor hFE Test.
- Full range over load protection (220V rms)

3. SPECIFICATIONS

Accuracies are \pm (% reading + No. of digits) Guaranteed for 1 year, 23 C \pm 5 C less than 75% RH.

DC Voltage

Range	Accuracy	Resolution
200 mV	$\pm 0.5\%$, of rdg + 1 digit	100 μ V
2V		1 mV
20 V		10 mV
200 V		100 mV
1000 V		1 V

Input Impedance: 10M ohm on all ranges. Overload Protection: 1000V dc or peak ac on all ranges.
Overload Protection: 220 Vrms AC for 200mV range and 1000 VDC or 700 Vrms AC for other ranges.

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AC Voltage

Range	Accuracy	Resolution
200 mV	$\pm 1.2\%$, of rdg + 3 digits	100 μ V
2 V	$\pm 0.8\%$, of rdg + 3 digits	1 mV
20 V		10 mV
200 V		100 mV
700 V	$\pm 1.2\%$ of rdg + 3 digits	1 V

Input Impedance: 10M ohm on all ranges.
Frequency Range: 40 Hz to 1 kHz.
Overload Protection: 220 Vrms AC for 200mV range and 1000 VDC or 700 Vrms AC for other ranges.
Indication: Average (rms of sine wave).

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DC Current

Range	Accuracy	Resolution
200 μ A	$\pm 0.8\%$, of rdg + 1 digit	0.1 μ A
2 mA		1 μ A
20 mA		10 μ A
200 mA	$\pm 1.2\%$, of rdg + 1 digit	100 μ A
2 A		1 mA
20 A, 20 μ A	$\pm 2.0\%$, of rdg + 5 digits	10 mA, 10 nA

Overload Protection: 2A/250V fuse (20A range unfused).
Maximum Input Current: 20A (20A up to 15 seconds).
Measuring Voltage Drop: 200 mV.

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AC Current

Range	Accuracy	Resolution
200 μ A	$\pm 1.0\%$, of rdg + 3 digits	0.1 μ A
2 mA		1 μ A
20 mA		10 μ A
200 mA	$\pm 1.8\%$, of rdg + 3 digits	100 μ A
2 A		1 mA
20 A, 20 μ A	$\pm 3.0\%$, of rdg + 7 digits	10 mA, 10 nA

Overload Protection: 2A/250V fuse (20A range unfused).
 Maximum Input Current: (20A up to 15 seconds).
 Frequency Range: 40Hz to 1kHz.
 Indication: Average (rms of sine wave).
 Measuring Voltage Drop: 200 mV.

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Resistance

Range	Accuracy	Resolution
200 ohm	$\pm 0.5\%$, of rdg + 1 digit	01. ohm
2 K ohm		1 ohm
20 K ohm		10 ohm
200 K ohm		100 ohm
2 M ohm		1 K ohm
20 M ohm	$\pm 1.0\%$, of rdg + 2 digits	10 K ohm

Overload Protection: 220V dc/ac rms on all ranges. (15 S)
 Open Circuit Voltage: Less than 700 mV.
 Relative Humidity: 0 to 75%, 0°C to 35°C, 0°C on 2 M Ω , 20 M Ω
 0 to 90%, 0°C to 35°C on all other ranges.
 0 to 70%, 35°C to 50°C.

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Diode and Audible Continuity Test

Range	Description	Test Condition
	Display read approximate forward voltage of diode	Forward DC current approximately 1mA. Reversed DC voltage approximately 2.8 Volts.
	Built-in buzzer sounds if resistance is less than approximately 30 Ω	Open Circuit Voltage approximately 2.8 Volts.

Overload Protection: Sounds alarm (220V dc/ac rms)
Transistor hFE Test

Range	Description	Test Condition
hFE	Display read approximate hFE value (0-1000) of transistor under test (ALL TYPE)	Base Current approx 10 μ A VCE approximately 2.8 Volts.

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4. GENERAL CHARACTERISTICS

Maximum Display	: 1999 counts (3 ¹ / ₂ digits) with automatic polarity indication.
Indication Method	: LCD display.
Measuring Method	: Dual-Slope integration A-D converter system.
Overrange Indication	: "1" Figure only in the display.
Maximum common mode voltage	: 500V dc/ac rms.
Reading rate time	: 2-3 reading per sec (approximate).
Temperature for guaranteed accuracy	: 23°C ± 5°C.
Temperature Ranges	: Operating 0°C to 40°C, 32°F to 104°F. Storage — 10°C to 50°C, 14°F to 122°F.
Power Supply	: One 9-volt battery (NEDA 1604, 6F22 TYPE or equivalent).
Low Battery Indication	: LO BAT or BAT on the left of display.
Size	: 88W X 172D X 36H m/m.
Weight	: 340g (including 9 volt batteries).
Accessories	: Operating manual, 9V Battery (Zinc-Carbon TYPE) Set of test leads, Spare fuse (2A/250V fast blow TYPE), and Gift Box

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5. OPERATION

PRELIMINARY NOTE

1. Check the 9-volt battery by setting the ON-OFF switch to ON. If the battery is weak, a "LO BAT" or "BAT" sign will appear on the left of the display. If this does not appear on the display, proceed as below. See MAINTENANCE if the battery has to be replaced.
2. The mark, or sign, Δ next to the test lead jacks, is for warning that the input voltage or current should not exceed the indicated values. This is to prevent damage to the internal circuitry.
3. The function switch should be set to the range which you want to test before operation.

5-1 DC Voltage Measurement

1. Connect the BLACK test lead to the COM jack and the RED test lead to the V / Ω jack.
2. Set the FUNCTION switch to the DC V range to be used and connect the test leads across the source or load under measurement. see Fig. 5-1.
The polarity of the RED lead connection will be indicated at the same time as the voltage.

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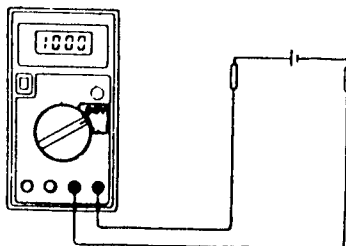


Fig. 5-1 DC Voltage measurement

- Note:**
1. If the voltage range is not known beforehand set the FUNCTION switch to the highest range and work down.
 2. When only the figure "1" is displayed, overrange is being indicated and the FUNCTION switch must be set to a higher range.
 3. Δ : Do not apply more than 1000V to the input. Indication is possible at higher voltages but there is danger of damaging the internal circuitry.
 4. Use extreme caution to avoid contact with high tension circuits when measuring high voltage.

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5-2 AC Voltage measurement

1. Connect the BLACK test lead to the COM jack and the RED test lead to the V / Ω jack.
2. Set FUNCTION switch to the AC V range to be used, and connect the test leads across the source or load under measurement. See Fig 5-2.

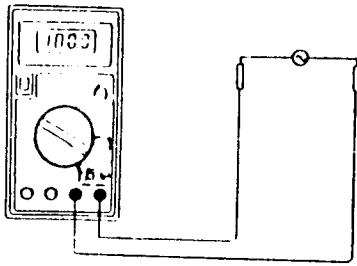


Fig 5-2 AC Voltage measurement

- Note:**
1. See DC Voltage measurement Note 1.2
 2. Δ : do not apply more than 700V rms to the input indication is possible at higher voltages but there is danger of damaging the internal circuitry.
 3. Use extreme caution to avoid contact with high tension circuits when measuring high voltage.

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5-3 DC Current Measurement

1. Connect the BLACK test lead to the COM jack and the RED test lead to the A jack for a Maximum of 2A. For a maximum of 20A, move the red test lead to the 20A jack.
2. Set the FUNCTION switch to the DC A range to be used and connect the test leads in series with the load under measurement see Fig. 5-3.
The polarity at the RED test lead connection will be indicated at the same time as the current.

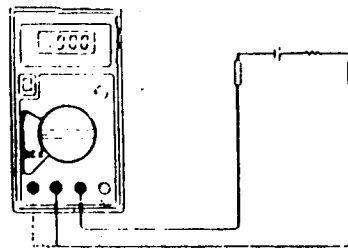


Fig 5-3 DC Current measurement

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- Note:**
1. If the current range is not known beforehand, set the FUNCTION switch to the highest range and work down.
 2. When only the figure "1" is displayed overrange is being indicated and the FUNCTION switch must be set at higher range.
 3. Δ : The Maximum input current is 2A, or 20A depending upon the jack used. Excessive current will blow the fuse which must be replaced. The 20A Range is not protected by a fuse. The fuse rating should not be over 2A to prevent damage to the internal circuitry.
 4. The Maximum terminal voltage drop is 200 mV.

5-4 AC Current Measurement

1. Connect the BLACK test lead to the COM jack and the RED test lead to the A jack, for a maximum of 2A.
For a maximum of 20A, move the RED test lead to the 20A jack.
2. Set the FUNCTION switch to the AC A range to be used and connect the test lead in series with the load under measurement See Fig. 5-4.

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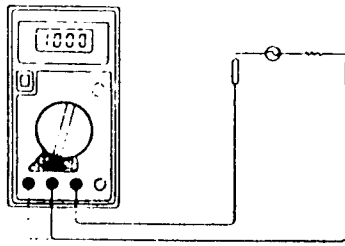


Fig 5-4 AC Current measurement

- Note:**
1. If the current range is not known beforehand, set the FUNCTION switch to the highest range and work down.
 2. When only the figure "1" is displayed overrange is being indicated and the FUNCTION switch must be set to at higher range.
 3. Δ : The Maximum input current is 2A, or 20A depending on the jack used. Excessive current will blow the fuse which must be replaced.
The 20A range is not protected by a fuse.
The fuse rating should not be over 2A.
This is to prevent damage to the internal circuitry.
 4. The Maximum terminal voltage drop is 200 mV.

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5-5 Resistance Measurement

1. Connect the BLACK test lead to the COM jack and the RED test lead to the V / Ω jack.
(Note: The polarity of the RED test lead is "+")
2. Set the FUNCTION switch to the Ω range to be used and connect the test leads across the resistance under measurement see Fig. 5-5.

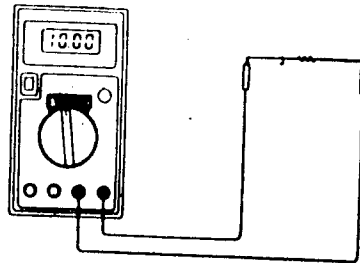


Fig. 5-5 Resistance measurement

- Note:**
1. If the resistance value being measured exceeds the maximum value of the range selected, an over-range indication will be displayed ("1"). Select a higher range. For resistance of approximately 1 Megohm and above, the Meter may take a few seconds to stabilize. This is normal for high resistance readings.

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2. When the input is not connected, i.e. at open circuit, the figure "1" will be displayed for the overrange condition.
3. When checking in-circuit resistance, be sure the circuit under test has all power removed and that all capacitors are fully discharged.
4. The resistance ranges of this instrument are protected by a resistor, which provided a protection of mistesting (220V rms).
5. Some devices may be damaged by the current applied during resistance measurements. The following table lists the voltage and current available on each range.

Range	A	B	C
200 Ω	0.65	0.08	0.44'
2 K	0.65	0.3	0.27
20 K	0.65	0.42	0.06
200 K	0.65	0.43	0.007
2 M	0.65	0.43	0.001
20 M	0.65	0.43	0.0001

A is open circuit voltage at the jack.

B is voltage across a resistance equal to full scale value.

C is current in milliamperes thru a short circuit at the input jacks. All values are typical.

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5-6 Diode Measurements

1. Connect BLACK test lead to the COM jack and the RED test lead to the V / Ω jack.
(Note: The polarity of the RED test lead is "+")
2. Set the FUNCTION switch to the $\rightarrow|$ range and connect the test leads across the diode under measurement see Fig 5-6.

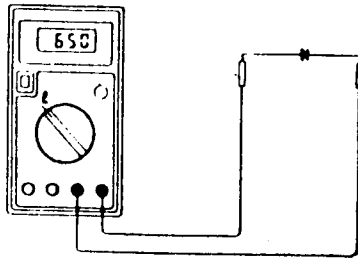


Fig 5-6 Diode measurement

- Note:**
1. When the input is not connected, i.e. at open circuit, the figure "1" will be displayed for the overrange condition.
 2. There is a 1 milliamp Current flow through the device under test.
 3. The meter displays the forward voltage drop in millivolts, and overload when the diode is reversed

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5-7 Audible Continuity Test

1. Connect the BLACK test lead to the COM jack and the RED test lead to the V / Ω jack.
2. Set the FUNCTION switch to the $\rightarrow|$ range (same $\rightarrow|$ range) and connect the test leads across the resistance under measurement. See Fig. 5-7.
3. Buzzer sounds if the resistance between two probes less than approximately 30 ohms.

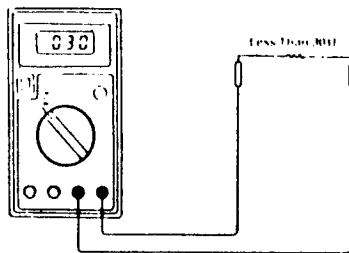


Fig. 5-7. Audible Continuity test

- Note:**
1. When the input is not connected, i.e. at open circuit, the Figure "1" will be displayed for the overrange condition.
 2. If testing in this function is carelessly be wrong operated in power line status (less than 220V). The device will sounds to warning you (causing no damage). The same as diode $\rightarrow|$ range.

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5-8 Transistor hFE Test

1. Set the FUNCTION switch to the hFE range.
2. Determine whether the transistor is NPN or PNP and locate the Emitter, Base and collector leads. Insert the leads into the proper holes in the socket on the front panel See Fig. 5-8.
3. The display will read the approximate hFE value at the test condition of base current 10 μ A, VCE 2.8V.

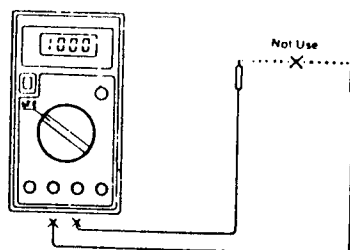


Fig. 5-8 Transistor hFE Test.

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6. MAINTENANCE

Your Digital Multimeter is a precision electronic device. Do not tamper with the circuitry. .
To avoid damage:

- A. Never connect more than 1,000 Volts DC or 700 Volts RMS AC.
- B. Never connect a source of voltage with Function Switch in OHM position.
- C. Never operate the DMM unless the battery cover is in place and fully closed.
- D. Battery and/or fuse replacement should only be done after the test leads have been disconnected and POWER IS OFF.

6-1 9-Volt Battery Replacement

Note the condition of the 9-volt battery using the procedure described above. If the battery needs to be replaced, open the Back cover, remove the spent battery and replace it with a battery of the same type. And place CLOSE AGAINST THE LEFT of the battery slot.

6-2 Fuse Replacement

Should the fuse need replacement, use only 2-amp fuses identical in physical size to the original or use the spare fuse in the storage compartment adjacent to the main fuse in the Case (Top Cover)

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WARRANTY

Warrants this instrument to be free from defects in material and workmanship for a period of one year. Any instrument found defective within one year from the delivery date and returned to the factory with transportation charges prepaid, will be repaired, adjusted, or replaced at no charge to the original purchaser. This warranty does not cover expendable items such as batteries or fuses. If the defect has been caused by a misuse or abnormal operating conditions, the repair will be billed at a nominal cost.