

MS8216

DIGITAL MULTIMETER

OPERATOR'S MANUAL

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1. SAFETY INFORMATION



WARNING

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

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 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 against the dangers of electrical current

- Protection of the meter against misuse

1.1.2 When the meter is delivered, check if it has been damaged in transit.

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

1.1.4 Test 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, they 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 Do not measure voltage if the voltage on the terminals exceeds 600V above earth ground.
- 1.2.4 Always be careful when working with voltages above 60V DC or 30V AC rms, keep fingers behind the probe barriers while measuring.
- 1.2.5 Never connect the meter leads across a voltage source while the function switch is in the current, resistance, diode or continuity mode. Doing so can damage the meter.
- 1.2.6 Before stir the transform switch to change functions, disconnect test leads from the circuit under test.
- 1.2.7 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.
- 1.2.8 Never perform resistance measurements on live circuits.

- 1.2.9 If any faults or abnormalities are observed, the meter can not be used any more and it has to be checked out.
- 1.2.10 Never use the meter unless the rear case is in place and fastened fully.
- 1.2.11 Please do not store or use 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 MAINTENANCE

- 1.4.1 Please do not attempt to adjust or repair the meter by removing the

rear case while voltage is being applied. A technician who fully understands danger involved should only carry out such actions.

- 1.4.2 Before opening the case of the meter, always disconnect test leads from all sources of electric current.
- 1.4.3 Do not use abrasives or solvents on the meter, use a damp cloth and mild detergent only.
- 1.4.4 ALWAYS set the power switch to the OFF position when the meter is not in use.
- 1.4.5 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 Data HOLD Button (H-D)

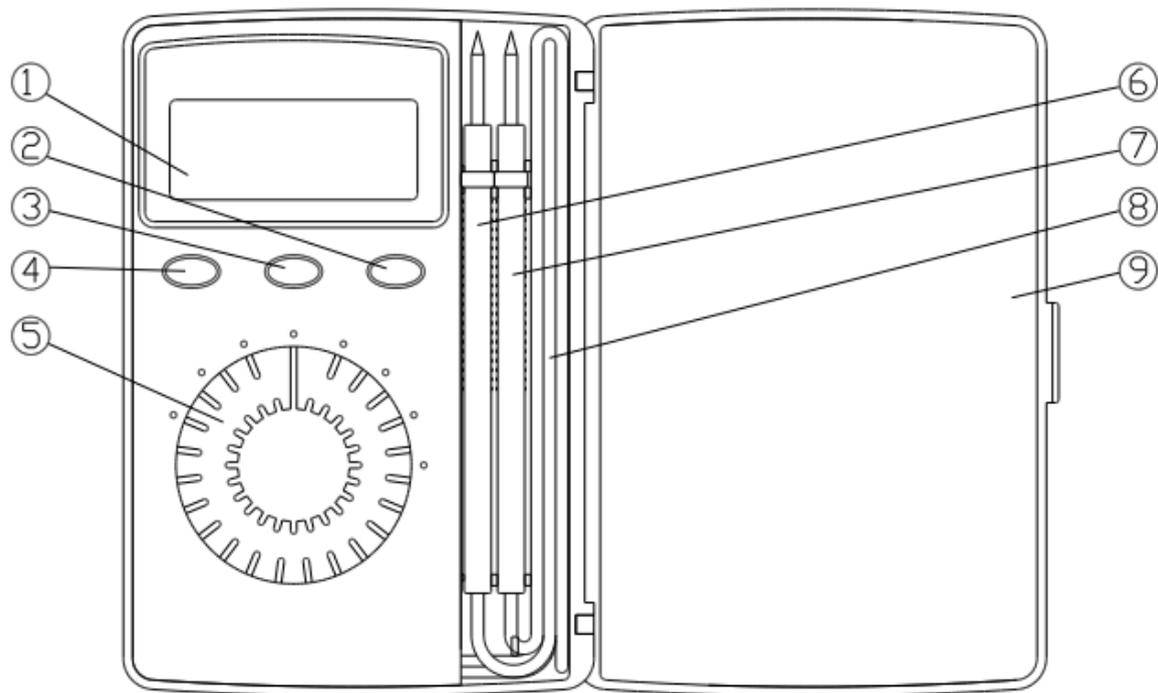


Fig 1

- ③ Hz/Duty Transform Button (H/D)
- ④ Relative Transform Button (REL)
- ⑤ Transform Switch
- ⑥ Red Test Lead
- ⑦ Black Test Lead
- ⑧ Test Lead Store Space
- ⑨ Cover

2.2 FUNCTION AND RANGE SELECTOR

- This meter is a portable professional measuring instrument with perfect LCD.
- This meter has function of auto range and data hold.
- When using, it can show ranges engineering unit enunciators measuring results.

- This meter has function of auto power off.

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 7 function with 29 ranges.

3.1.2 Auto ranges.

3.1.3 Overrange protection for all ranges.

3.1.4 Max. Voltage Between Terminals And Earth Ground: 600V DC or rms
AC

3.1.5 Operating Altitude: 2000 meters (7000 ft.) maximum

3.1.6 Display: LCD

3.1.7 Max. Show Value: 3999 counts max

3.1.8 Polarity Indication: ‘-’ indicates negative polarity.

- 3.1.9 Overrange Indication: Display '0L' or '-0L'
- 3.1.10 Sampling Time: approx. 0.4 second
- 3.1.11 Unit showing: showing of function and electrical capacity.
- 3.1.12 Auto power off time: 15 min.
- 3.1.13 Power Supply: 1.5V (LR44 battery) ×2
- 3.1.14 Low Battery Indication: '  ' displayed
- 3.1.15 Temperature Factor: $< 0.1 \times \text{Accuracy} / ^\circ\text{C}$
- 3.1.16 Operating Temperature: 0°C to 40°C (32°F to 104°F)
- 3.1.17 Storage Temperature: -10°C to 50°C (10°F to 122°F)
- 3.1.18 Dimension: $110 \times 76 \times 11\text{mm}$
- 3.1.19 Weight: approximate 100g (including battery)

3.2 ELECTRICAL SPECIFICATIONS

Circumstance Temperature: $23 \pm 5^\circ\text{C}$ Relative Humidity: $< 70\%$

3.2.1 DC Voltage

Range	Resolution	Accuracy
400mV	0.1mV	$\pm(0.7\% \text{ of rdg} + 2d)$
4V	1mV	
40V	10mV	
400V	100mV	
600V	1V	

- Input Impedance: $10M\Omega$
- Max. Input Voltage: 600V DC or rms AC

NOTE:

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

3.2.2 AC Voltage

Range	Resolution	Accuracy
4V	1mV	$\pm(0.8\% \text{ of rdg} + 3d)$
40V	10mV	
400V	100mV	
600V	1V	

- Input Impedance: $10M\Omega$
- Max. Input Voltage: 600V DC or rms AC
- Frequency Range: 40 to 1kHz
- Response: Average, calibrated in rms of sine wave

NOTE:

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

3.2.3 Resistance

Range	Resolution	Accuracy
400 Ω	0.1 Ω	$\pm(1.2\%$ of rdg + 2d)
4k Ω	1 Ω	
40k Ω	10 Ω	
400k Ω	100 Ω	
4M Ω	1k Ω	
40M Ω	10k Ω	$\pm(2.0\%$ of rdg + 5d)

- Open Circuit Voltage: 0.25V
- Overload Protection: 250V DC or rms AC

3.2.4 Capacitance

Range	Resolution	Accuracy
4nF	1pF	± (3.0% of rdg + 3 digits)
40nF	10pF	
400nF	0.1nF	
4 μ F	1nF	
40 μ F	10nF	
200 μ F	100nF	

- Overload Protection: 250V DC or rms AC

3.2.5 Frequency

Range	Resolution	Accuracy
9.999Hz	0.001Hz	\pm (2.0% of rdg + 5 digits)
99.99Hz	0.01Hz	\pm (1.5% of rdg + 5 digits)
999.9Hz	0.1Hz	\pm (1.5% of rdg + 5 digits)
9.999kHz	1Hz	\pm (1.5% of rdg + 5 digits)
99.99kHz	10Hz	\pm (2.0% of rdg + 5 digits)
199.99kHz	100Hz	\pm (2.0% of rdg + 5 digits)
>200kHz		Take it only as reference

- By Hz range:

Input Voltage range: 0.5V – 10V rms AC (Input voltage must be enlarged with increasing frequency under measurement)

Overload protection: 250V DC or rms AC

- By V range:

Input Voltage range: 0.5V – 600V rms AC (Input voltage must be enlarged with increasing frequency under measurement)

Input Impedance: 10M Ω

Max. Input Voltage: 600V DC or rms AC

NOTE:

When measuring frequency, the range by Hz range is larger than by Hz of Voltage range, but the value measured beyond the range is just for reference.

3.2.6 Duty Cycle

Range	Resolution	Accuracy
0.1-99.9%	0.1%	$\pm 3.0\%$

- By Hz range:

Input Voltage range: 0.5V – 10V rms AC (Input voltage must be enlarged with increasing frequency under measurement)

Overload protection: 250V DC or rms AC

Frequency Response: 0 ~ 200kHz

- By V range:

Input Voltage range: 0.5V – 600V rms AC (Input voltage must be enlarged with increasing frequency under measurement)

Input Impedance: 10M Ω

Max. Input Voltage: 600V DC or rms AC

Frequency Response: 0 ~ 200kHz

NOTE:

When measuring frequency, the range by DUTY of Hz range is larger than by DUTY of Voltage range.

3.2.7 Diode

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

- Forward DC Current approximate 1mA Reversed DC Voltage approximates 1.5V
- Overload Protection: 250V DC or rms AC

3.2.8 Continuity

Range	Function
	Built-in buzzer will sound, if resistance is lower than 40Ω.

- Open circuit voltage approximate: 0.5V
- Overload Protection: 250V DC or rms AC

4. OPERATING INSTRUCTION

4.1 DATA HOLD

If you need data hold when measuring, you can put on "H-D"; it will hold the reading; if you put the button again, data hold is not continue.

4.2 RELATIVE TRANSFORM

Put down the "REL." when measuring the AC voltage range, DC voltage range, and capacitance range. Meter will be transformed at relative measuring, the initial display will show "000". Press the "REL" again, meter will recover the normal working condition.

4.3 Hz/DUTY TRANSFORM

Put down the "H/D." when measuring the Hz range. Meter will be transformed at DUTY range. Press the "H/D" again, meter will recover the Hz range.

When measuring the voltage range, put down the "H/D" and change to the Hz range. The frequency of the signal for the voltage is measured now.

Press the "H/D" again and change to the DUTY range. The DUTY CYCLE of the signal for the voltage is measured now. Press the "H/D" again, meter will be back to the condition of the voltage measuring. The range of voltage is locked under this condition. The locking condition can be cancelled by rotating the transform switch.

4.4 AUTO POWER OFF

If no operation within fifteen minutes after power is on, meter will auto power off with five short sounds and one long.

After auto power off, if stir the transform switch or put down any button of "H-D"、"REL"、"H/D" , meter will recover the working condition.

4.5 PREPARATION FOR MEASUREMENT

4.5.1 Stir the transform switch. If the battery voltage is less than 2.4V, display will show "" , the battery should be changed at this time.

4.5.2 The " " besides the input lead shows that the input voltage or

current should be less than specification on the sticker of the meter to protect the inner circuit from damaging.

4.5.3 Select a transform switch accordingly for the item to be measured.

4.6 MEASURING AC VOLTAGE

4.6.1 Set the transform switch at the AC V range position.

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

4.6.3 You can get reading from LCD.

NOTE:

1. “” means you can't input the voltage which more than 600V DC or 600V rms AC, it's possible to show higher voltage, but it's may destroy the inner circuit.

2. Pay attention not to get an electric shock when measuring high voltage.

4.7 MEASURING DC VOLTAGE

4.7.1 Set the transform switch at the DC V range position.

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

4.7.3 You can get reading from LCD. The polarity of the red lead connection will be indicated along with the voltage value.

NOTE:

1. “” means you can't input the voltage which more than 600V DC or 600V rms AC, it's possible to show higher voltage, but it's may destroy the inner circuit.
2. Pay attention not to get an electric shock when measuring high voltage.

4.8 MEASURING RESISTANCE

4.8.1 Set the transform switch at the desired Ω range.

4.8.2 Connect test leads across the resistance under measurement.

4.8.3 You can get reading from LCD.

NOTE:

1. For measuring resistance above $1M\Omega$, the meter may take a few seconds to get stable reading.

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 have been discharged fully.

4.9 MEASURING CAPACITANCE

- 4.9.1 Set the transform switch at the || range position.
- 4.9.2 Connect test leads across the capacitance under measurement.
- 4.9.3 You can get reading from LCD.

WARNING

To avoid electric shock, be sure the capacitors have been discharged fully before measuring the capacitance of a capacitor.

NOTE:

1. It takes certain time (200 μ F range 30 seconds) to steady the reading when measuring high capacity.

2. When measuring low capacity range under the open circuit, put down the “REL” to make the display show “000”, then you might get reading from it.

4.10 MEASURING FREQUENCY

4.10.1 Set the transform switch at the Hz range position (or at the ACV range and the DCV range, put down the “H/D” to transform to Hz measuring position).

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

4.10.3 You can get reading from LCD.

4.11 MEASURING DUTY CYCLE

4.11.1 Set the transform switch at the Hz range position (or at the ACV range and the DCV range, put down the “H/D” to transform to DUTY measuring position).

4.11.2 Put down the “H/D” Transform the meter to DUTY range.

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

4.11.4 You can get reading from LCD.

4.12 TESTING DIODE

4.12.1 Set the transform switch at the  range position.

4.12.2 Connect the red lead to the anode, the black lead to the cathode of the diode under testing.

4.12.3 You can get reading from LCD.

NOTE:

1. The meter will show the approximate forward voltage drop of the diode.
2. If the lead connection is reversed, only figure '0L' will be displayed.

4.13 CONTINUITY TEST

4.13.1 Set the transform switch at the  range position.

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

4.13.3 If continuity exists (i.e., resistance less than about 40Ω), built-in buzzer will sound.

4.13.4 You can get reading from LCD.

NOTE:

If the input open circuit(or the circuit resistance measured is higher than 400Ω), then the figure 'OL' will be displayed.

5. MAINTENANCE

5.1 BATTERY REPLACEMENT

WARNING

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

- 5.1.1 If the sign '' appears on the LCD display, it indicates that the battery (LR44) should be replaced.
- 5.1.2 Open the rear case, loosen the screw and then remove the rear case.
- 5.1.3 Replace the exhausted battery with a new one.
- 5.1.4 Put the rear case as its origin.

5.2 TEST LEADS REPLACEMENT



WARNING

Full in 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 electric ratings. Electric ratings of the test leads: 600V 1A

5.2.1 You must be replaced the test leads if the lead is exposed.

5.2.2 Open the rear case, loosen the screw and then remove the rear case.

5.2.3 Replace the exhausted test leads with a new pair.

5.2.4 Then strip the wire and solder it at the position as aboriginal.

5.2.5 Put the rear case as its origin.

5.3 STORE OF TEST LEADS

When placing the teat leads in the storing space, first roll its wire 3 times, then put it into the store space as illustrated (Fjg3).

6. ACCESSORIES

- | | | | |
|---|------------------|------------|------------|
| ① | Battery: | 1.5V, LR44 | two pieces |
| ② | Operating Manual | | one piece |