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1. SAFETY INFORMATION

WARNING

To ensure safe operation, and in order to exploit to the full the 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 1000V, CAT III 600V and pollution 2.

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

With proper use and care, the digital meter will give you years of satisfactory service.

1.1 PRELIMINARY

- 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.
- When the meter is delivered, check that it has not been damaged in transit.
- When poor condition under harsh preservation or shipping conditions caused, inspect and confirm this meter without delay.
- 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.

- 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

- Before using, you must select the right input jack, function and range.
- Never exceed the protection limit values indicated in specifications for each range of measurement.
- When the value scale to be measured is unknown beforehand, set the range selector at the highest position.
- Do not measure voltage if the voltage on the terminals exceeds 1000V above earth ground.
- Always be careful when working with voltages above 60V DC or 30V AC rms, keep fingers behind the probe barriers while measuring.
- Before rotating the transform switch to change functions and ranges, disconnect test leads from the circuit under test.
- Never perform resistance, temperature, transistor, diode and continuity measurements on live circuits.
- Never use the meter under the condition of the explosive air, steam or dirt.
- 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 rear case is in place and fastened fully.
- Please do not store or use meter in areas exposed to direct sunlight, high temperature, humidity or condensation.

1.3 SYMBOL

 **Caution:** refer to the instruction manual. Incorrect use may result in damage to the device or its components.

 Earth

 This instrument has double insulation.

 Fuse: F 200mA/250V

1.4 MAINTENANCE

- 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.
- Before opening the battery cover or case of the meter, always disconnect test leads from all tested circuits.
- To avoid the wrong reading causing electricity attack, when the meter displays "", you must change the

battery.

- For continue protection against fire, replace fuse only with the specified voltage and current ratings: F 200mA/250V (quick acting).
- Do not use abrasives or solvents on the meter, use a damp cloth and mild detergent only.
- Always set the power switch to the OFF position when the meter is not in use.
- If the meter is to be stored for a long period of time, the batteries should be removed to prevent damage to the unit.

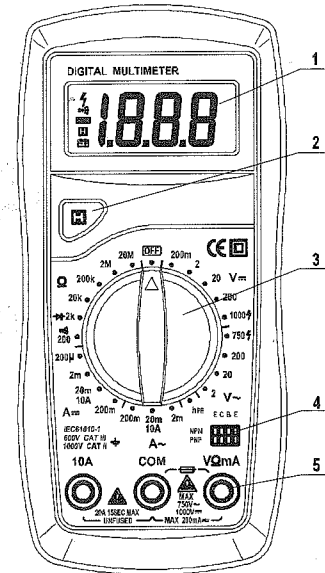
2. DESCRIPTION

- This meter is a portable professional measuring instrument with handsome LCD easily reading.
- Single operation of a transform switch makes measurement convenient. Overload protection and low battery indication are provided, this meter is ideal for use in the fields, workshop, school, hobby and home applications.
- This meter is with the functions of data hold.

NAME OF COMPONENTS

1. LCD display
2. Hold key
3. Rotary switch

4. hFE socket (except MS8221D)
5. Terminals



3. SPECIFICATIONS

3.1 GENERAL SPECIFICATIONS

- Environment conditions:
600V CAT.III and 1000V CAT. II
Pollution degree: 2. Altitude < 2000 m.
- Operating temperature:
0~40°C (32°F to 104°F), (<80% RH, non-condensing)
- Storage temperature:
-10~50 °C(14°F to 122°F), (<70% RH, battery removed)
- Temperature Coefficient:
0.1×(specified accuracy) /°C (<18°C or >28°C)
- MAX. Voltage between terminals and earth ground:
750V AC rms or 1000V DC
- Fuse Protection: mA: F 200mA/250V Ø5×20,
10A: unfused.
- Display: LCD, 1999counts, updates 2-3/sec.
- Over Range indication: LCD will display "1".
- Low battery indication:
The "⎓" is displayed on the LCD.
- Polarity indication: "-" displayed automatically.
- Power source: 4.5V $\equiv$
- Battery type: AAA 1.5V
- Dimensions: 158(L)×74(W)×31(H) mm.
- Weight: 220g. Approx. (battery included).

3.2 Measurement specifications

Accuracy: ±(% of reading + number of digits) at 18°C to 28°C (64°F to 82°F) with relative humidity to 80%.

(Accuracy is specified for a period one year after calibration)

3.2.1 DC VOLTAGE

Range	Resolution	Accuracy	
		MS8221A/8221D	MS8221B/8230B
0.2V	0.1mV	±0.5%±1	±0.5%±2
2V	1mV		±0.5%±3
20V	0.01V		±0.8%±3
200V	0.1V		
1000V	1V	±0.8%±2	±0.8%±5

- Input impedance: MS8221A/MS8221D: 10MΩ
MS8221B/MS8230B: 1MΩ
- Max. input voltage: 200mV range: 250VDC or AC rms
2V - 1000V ranges: 1000VDC or 750V rms

3.2.2 AC VOLTAGE

Range	Resolution	Accuracy	
		MS8221A/8221D	MS8221B/8230B
2V	1mV	±0.8%±3	-
20V	10mV		-
200V	0.01V		±1.2%±5
750V	1V	±1.2%±3	

- Input impedance: MS8221A/MS8221D: 10MΩ
MS8221B/MS8230B: 1MΩ
- Max. input voltage: 200mV range: 250VDC or AC rms
2V - 1000V ranges: 1000VDC or 750V rms
- Frequency range: MS8221A/MS8221D: 40Hz-1000Hz
MS8221B/MS8230B: 40Hz-400Hz
- Response: Average, calibrated in rms of sine wave.

3.2.3 DC CURRENT

Range	Resolution	Accuracy	
		MS8221A/8221D	MS8221B/8230B
200uA	0.1uA	±0.8%±1	±1.0%±2
2mA	1 uA		±1.5%±2
20mA	10 uA		
200mA	100uA	±1.2%±1	
10A	10mA	±2.0%±5	±3.0%±2

Overload protection: F250mA/250V fuse (10A range unfused).

Max. Input Current: mA Jack: 200mA, 10A Jack: 10A

3.2.4 AC Current (MS8221A/MS8221D)

Range	Resolution	Accuracy
2mA	1μA	±1.2%±3
20mA	10μA	
200mA	0.1mA	±2.0%±3
10A	10mA	±3.0%±7

Overload protection: F250mA/250V fuse (10A range unfused).

Max. input current: mA: 200mA dc or 200mA ac rms

10A: 10A continuous, 20A 15 sec. Max

Frequency Range: 40Hz-1kHz

Indication: Average (rms of sine wave)

3.2.5 Transistor hFE (Except MS8221D)

Display: read approximate hFE value (0~1000) of transistor under test (ALL TYPE).

Test condition: base current approx. 10μA (MS8221A) or 2μA (MS8221B/MS8230B).

V_{CE}: approx. 2.8V

3.2.6 Resistance

Range	Resolution	Accuracy	
		MS8221A/8221D	MS8221B/8230B
200Ω	0.1Ω	±0.8%±3	±1.0%±3
2KΩ	1Ω	±0.8%±1	±1.0%±2
20KΩ	10Ω		
200KΩ	100Ω		
2MΩ	1kΩ	±1.0%±2	-
20MΩ	10kΩ		

Overload protection: 250V DC or 250V AC rms.

3.2.7 Diode test

➔ Display: read approximate forward voltage of diode

Forward DC Current: approx. 1mA

Reversed DC Voltage: approx. 2.8V

Overload protection: 250V DC or 250V AC rms

3.2.8 Audible continuity test

• Built-in buzzer sounds if resistance is less than approx. 50Ω.

Open circuit voltage: approx. 2.8V

Overload protection: 250V DC or 250V AC rms

3.2.9 Temperature (Only MS8221B)

Range	Resolution	Accuracy
-20℃ to 0℃	1℃	±5.0%±4
0℃ to 400℃		±1.0%±3
400℃ to 1000℃		±2.0%±3

- Overload Protection: 250V DC or rms AC

3.2.10 Battery Test (Only MS8221D)

Range	Accuracy	Discharge current
1.5V	$\pm 0.8\% \pm 1$	100mA
9V		6mA

Overload protection: 1.5V: F200mA/250V fuse
9V: 250Vdc or 250Vac rms

4. OPERATING INSTRUCTION

4.1 Voltage measurement

- Set rotary switch to the desired V $\overline{\text{---}}$ or V~ range.
- Connect the black and red test leads to the COM and V terminals respectively.
- Connect the test leads to the circuit being measured
- Read the displayed value. The polarity of red test lead connection will be indicated when making a DCV measurement.
- When only the figure "1" is displayed, it indicates overrange situation and the higher range has to be selected.

 **To avoid electrical shock and/or damage to the instrument, do not attempt to take any voltage measurement that might exceeds 1000Vdc or 750Vac rms. Do not apply more than 1000Vdc or 750Vac rms between the common terminal and the earth ground.**

4.2 Current measurement

- Set the rotary switch to the desired A $\overline{\text{---}}$ or A~ range.

- Connect the black test lead to the COM terminal and the red test leads to the mA terminal for a maximum of 200mA. For a maximum of 10A, move the red test lead to the 10A terminal.
 - Connect test leads in series with the load in which the current is to be measured.
 - Read the displayed value. The polarity of red test lead connection will be indicated when making a DCA measurement.
 - When only the figure "1" displayed, it indicates overrange situation and the higher range has to be selected.
- * MS8221B/MS8230B don't have ACA measurement function.**



To avoid damage to the meter, use the proper terminals, function, and range for your measurement.

NOTE:

- When only the figure 'OL' is displayed, it indicates overrange 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 of INPUT maximum current is 200mA, over current will destroy the fuse. 10A's maximum current is 10A, no fuse protection.

4.3 Resistance measurement

- Connect the black test lead to the COM jack and the red test lead to the Ω jack.
- Set the transform switch at the Ω range position.
- Connect test leads across the resistance under measurement.
- You can get reading from LCD.

 **To avoid electrical shock and/or damage to the instrument, disconnect circuit power and discharge all high-voltage capacitors before measuring resistance.**

NOTE:

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

4.4 Diode test

- Set the rotary switch to  range.
- Connect the black and red test leads to the COM and Ω terminals respectively.
- Connect the red test lead to the anode, black test 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.



To avoid electrical shock and/or damage to the instrument, disconnect circuit power and discharge all high-voltage capacitors before testing diodes.

4.5 Continuity test

- Set the rotary switch to  range.
- Connect the black and red test leads to the COM and Ω terminals respectively.
- Connect the test leads to the resistance in the circuit being measured.
- When the test lead to the circuit is below 50Ω , a continuous beeping will indicate it.



To avoid electrical shock and/or damage to the instrument, disconnect circuit power and discharge all high-voltage capacitors before testing for Continuity.

4.6 Temperature measurement (Only MS8221B)

- Set the transform switch at the TEMP range position.
- The LCD display will show the current environment temperature.
- When measuring the temperature with thermocouple, 'K' type probe for this meter can be used. Insert the black plug to the COM jack and the red one to the TEMP jack, touch the end of the temperature sensor to the area or surface of the object for measurement.

- You can get reading from LCD.



To avoid electrical shock, do not connect the thermocouples with the electriferous circuit.

4.7 Battery test (only MS8221D)

- Set the rotary switch to desired **BATT** range.
- Connect the black and red test leads to the COM and $V\Omega$ terminals respectively.
- Connect the test leads across the battery terminals under measurement.
- Read LCD display and determine if the battery is OK.

4.8 Transistor measurement

- Set the rotary switch to hFE range.
- Determine whether the transistor to be tested is NPN or PNP type and locate the Emitter, Base and Collector leads.
- Insert leads of the transistor into proper holes of the hFE socket.
- The meter will show the approx. hFE value at test condition of base current $10\mu A$ and V_{ce} 2.8V.



To avoid electrical shock and/or damage to the instrument, before attempting to insert transistors for testing, always be sure that test leads have been disconnected from any measurement circuits.

5. MAINTENANCE

5.1 General Maintenance

Periodically wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents. Dirt or moisture in the terminals can affect readings.

To clean the terminals:

- Turn the meter off and remove all test leads.
- Shake out any dirt that may be in the terminals.
- Soak a new swab with a cleaning and oiling agent (such as WD-40).
- Work the swab around in each terminal. The oiling agent insulates the terminals from moisture-related contamination.



To avoid electrical shock or damage to the meter, do not get water inside the case. Remove the test leads and any input signals before opening the case

5.2 Fuse replacement

To replace the Meter's fuse (see the Figure):

- Set the rotary switch to **OFF** range.
- Disconnect test leads from any inputs terminals.
- Use a screwdriver to unscrew the two screws secured on the battery cover.
- Separate the battery cover from the bottom case.
- Replace the fuse only with specified ratings:
F 200mA/250V $\varnothing 5 \times 20$ (quick acting).
- Replace the battery cover and secure by the two screws.

⚠ Before replacing the fuse, disconnect test leads from any circuit under test.
To prevent damage or injury, replace the fuse only with specified ratings.

5.3 Battery replacement

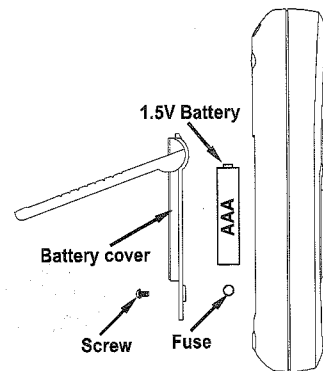
To replace the battery (see the Figure):

- When the battery voltage drop below proper operation range the  symbol will appear on the LCD display and the battery need to be replaced.
- Turn the meter off and remove all test leads.
- Use a screwdriver to unscrew the two screws secured on the battery cover, and remove the battery cover.
- Replace the battery with three new 1.5V battery (AAA).
- Reinstall the battery cover and secure by the two screws.

⚠ Before replacing the battery, disconnect test leads from any circuit under test, turn the meter off and remove test leads from the input terminals.

ACCESSORIES

- | | |
|--|--------------|
| (1) Test Leads | one set |
| (2) Battery: 1.5V, AAA | three pieces |
| (3) Instruction Manual | one piece |
| (4) Thermocouple (K type) (Only MS8221B) | one piece |



⚠ CAUTION

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