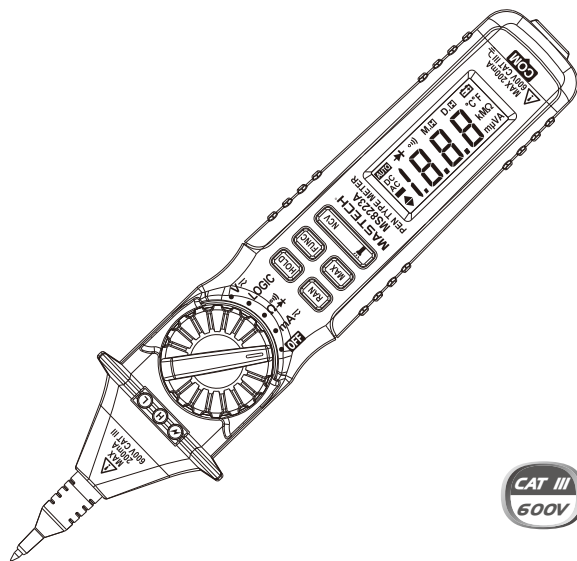


# MASTECH®

MS8223A

## Pen-type Digital Multimeter Manual



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## 1. Safety Information

### WARNING

**To reduce the risk of fire, electrical shock, product damage or personal injury, please follow the safety instructions described in the user manual. read the user's manual before using the meter.**

This instrument conforms to GB/T 13978-92 for digital multimeter technical standards, as well as GB 4793.1-1995 (EN 61010-1:2010) safety standards for electronic measuring instruments with a safety category of CAT III 600V and pollution degree of 2. Follow all safety instructions to ensure safe use of the instrument.

Following these guidelines will yield many years of satisfactory service.

### 1.1 Preparing for use

1.1.1 During use, observe all standard safety rules:

- Use protection to prevent electric shock.
- Do not misuse the instrument.

1.1.2 Check the meter to see if there was any damage during transit.






1.1.3 Check test leads for cracks or breaks in the insulation on the wires.

1.1.4 If the test leads need to be replaced, meter's safety can only be guaranteed with similar spec'd leads.


## 1.2 During Use

- 1.2.1 Always make sure the rotary switch is at the correct function and range.
- 1.2.2 Do not exceed the protection limit values indicated for each function.
- 1.2.3 Do not touch test lead tips while connected to a measurement circuit.
- 1.2.4 In manual range if the value to be measured is unknown, select the highest range first and lower as needed.
- 1.2.5 Do not measure voltages that may exceed 600V between the terminals and ground.
- 1.2.6 Always be careful when working with voltages above 60V DC or 30V AC RMS. Keep fingers behind the probe barriers while measuring.
- 1.2.7 Never connect the meter leads across a voltage source while the rotary switch is in the resistance, diode or continuity mode. Doing so can damage the meter.
- 1.2.8 Do not perform resistance, diode and continuity measurements on powered circuits.
- 1.2.9 Disconnect the test leads from the circuit before changing functions on the rotary switch.
- 1.2.10 Do not place the meter in an environment with high pressure/temperature, dust, explosive gas or vapor.
- 1.2.11 Stop using the meter if any abnormalities or failures occur.
- 1.2.12 Do not connect the test leads to a circuit without the battery securely fastened.
- 1.2.13 Do not store the meter in an area of direct sunlight, high temperature or high humidity.

## 1.3 Safety Symbols

	Important safety information. See manual for details.
	Double insulation protection (category II)
	Complies with European Union (EU) standards
	Earth ground
<b>AC</b>	Alternating Current
<b>DC</b>	Direct Current
	AC or DC
<b>CAT III</b>	Conforms to EN61010-1 standards for overvoltage in category III installations, with a pollution degree of II.

## 1.4 Maintenance

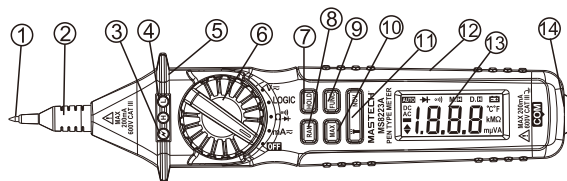
- 1.4.1 Repairs should only be implemented by trained personnel.
- 1.4.2 Remove test leads from measurement circuits before opening the battery cover.
- 1.4.3 In order to avoid incorrect readings that may cause damage or personal injury, replace batteries as soon as the "" symbol appears.
- 1.4.4 Use a damp cloth and mild detergent to clean the meter. Do not use abrasives or solvents.
- 1.4.5 Move the rotary switch to the OFF position when the meter is not in use.
- 1.4.6 Remove the batteries if the meter is not going to be used for an extended period of time.

## 2. Description

- This meter is a professional, portable meter with an easy to read LCD screen.
- Easy to use with one hand, overload protection provided, low battery indication, and suitable for use in factories, schools, by enthusiasts and hobbyists alike.
- Both auto-range and manual-range available.
- Automatic power off feature
- Data hold and Max. hold features
- During use, the instrument automatically shows the value and unit of the measurement.

## 2.1 Front Panel

- 1.Positive test probe (+)
- 2.Probe cover (removable)
- 3.NCV Indicator
- 4.LED indicators
- 5.Protective ring
- 6.Rotary switch
- 7.Data hold button (HOLD)
- 8.Range button (RAN)
- 9.Function button (FUNC)
- 10.Max hold button (MAX)
- 11.Non-contact voltage button (NCV)
- 12.Panel
- 13.LCD screen
- 14.COM jack (-)



## 2.2 Buttons and Functions

### - Function Buttons

Button	Function	Description
<b>HOLD</b>	Any switch position Power-up Option	This Button is used to hold data. Disables automatic power-off feature.
<b>RAN</b>	$V \approx \Omega$ and $mA \approx$	Switch ranges in manual-range. Hold to return to auto-range.
<b>MAX</b>	$V \approx$ Logic $mA \approx$	Used to measure and hold the maximum value.
<b>NCV</b>	Any switch position Power-up Option	Hold for Non-contact voltage detection.
<b>FUNC</b>	$V \approx$ Logic $\Omega \rightarrow \rightarrow \rightarrow$ $mA \approx$	Switches between DC and AC voltage. Keep pressing during the Logic testing. Switches between Resistance measurement, Diode Test and Continuity check. Switches between DC and AC current.


Rotary switch: select between functions.

- Test probe: for  $V/\Omega/\rightarrow \rightarrow \rightarrow$  measurements.
- COM jack: common test lead input.
- LCD display: shows results of measurements.
- LED indicator: In Logic mode, green indicated low level, red indicated high level.
- Probe cover: used when making category III or higher measurements. Twist to remove if making category II or lower measurements.
- Protection ring: Keep hands behind the protection ring and away from the probe to avoid injury.
- NCV Indicator: Detection of NCV, AC voltage indication.

## 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

- Environment conditions: 600V CAT III  
Pollution degree: 2 Altitude < 2000m  
Operating temperature: 0~40°C, 32°F~122°F  
(<80% RH, <10°C non-condensing)  
Storage temperature: -10~50°C, 14°F~122°F  
(<70% RH, battery removed)
- Max. Voltage Between Terminals  
And Earth Ground: 600V DC or AC
- Auto ranges and manual range.
- Display: 20mm LCD
- Max. Show Value: 1999 (3 ½)
- Polarity Indication: '-' indicates negative polarity.
- Overrange Indication: Display 'OL'.
- Sampling Time: approx. 0.4 second
- Unit showing: showing of function and electrical capacity.
- Low Battery Indication:  displayed
- Fuse Protection: FF400mA /600V
- Auto power off time: 15 min.
- Power Supply: 2x1.5V AAA Battery
- Dimension: 222×43×29 mm
- Weight: approx. 129g(including battery)

## 3.2 Technical Specifications

(ambient temperature: 23±5°C, relative humidity <75%)

### 3.2.1 DC Voltage

Measuring Range	Resolution	Accuracy
200mV	0.1mV	±(0.7% reading + 2dgt)
2V	0.001V	
20V	0.01V	
200V	0.1V	
600V	1V	

Input impedance: 10MΩ

- Overload protection: 200mV range: 250V DC or AC rms  
2V-600V ranges: 600V DC or AC rms
- Max. input voltage: 600V DC

### 3.2.2 AC Voltage

Measuring Range	Resolution	Accuracy
200mV	0.1mV	±(0.8% reading + 3dgt)
2V	0.001V	
20V	0.01V	
200V	0.1V	
600V	1V	±(1.0% reading + 3dgt)

Input impedance: 10MΩ


- Overload protection: 200mV range: 250V DC or AC rms  
2V-600V ranges: 600V DC or AC rms
- Frequency range: 40~400Hz
- Response: average (rms of sine wave)
- Max. input voltage: 600V AC rms

## 3.2.3 Resistance

Measuring Range	Resolution	Accuracy
200Ω	0.1Ω	±(1.0% reading + 3dgt)
2kΩ	0.001kΩ	±(1.0% reading + 1dgt)
20kΩ	0.01kΩ	
200kΩ	0.1kΩ	
2MΩ	0.001MΩ	
20MΩ	0.01MΩ	±(1.0% reading + 5dgt)


- Open circuit voltage: approx. 250mV
- Overload protection: 250V DC or AC rms

## 3.2.4 Continuity

Function	Description
	If measured resistance is less than 50Ω, buzzer will sound.

- Open circuit voltage: approx. 500mV
- Overload protection: 250V DC or AC rms

## 3.2.5 Diode test

Function	Resolution	Description
	0.001V	Displays approx. forward-biased voltage

- Forward DC current: approx. 1mA
- Reverse DC voltage: approx. 1.5V
  - Overload protection: 250V DC or AC rms

## 3.2.6 DC Current

Measuring Range	Resolution	Accuracy
20mA	0.01mA	±(1.5% rdg + 3dgt)
200mA	0.1mA	


- Overload protection: resettable fuse

## 3.2.7 AC Current

Measuring Range	Resolution	Accuracy
20mA	0.01mA	±(2.0% rdg + 3dgt)
200mA	0.1mA	

- Overload protection: resettable fuse
- Frequency range: 40~400Hz
- Response: average (rms of sine wave)

## 3.2.8 Logic Test

Function	Description
Logic	

- Input impedance: 1MΩ
- Overload protection: 250V DC or AC rms

## 4. Using the Meter

### 4.1 Reading Hold

4.1.1 During measurement, press the **"HOLD"** button to keep the current reading on the display. **"D.H"** will appear of the display. Press **"HOLD"** again to return to normal display.

### 4.2 Max Hold

4.2.1 During measurement, press the **"MAX"** button and the display will show the maximum value recorded. **"M.H"** will appear on the display. Press **"MAX"** again to return to normal display.

### 4.3 Function Button

4.3.1 In voltage/current modes, press the **"FUNC"** button to switch between AC/DC. At the resistance/diode/continuity position, press **"FUNC"** to switch between these modes.

### 4.4 Manual Range

4.4.1 In voltage/current/resistance modes, the default range is **"AUTO."** Press the **"RAN"** button to switch to manual range. Each press of the button increases the range, and returns to the lowest range once pressed in the highest range. Hold down **"RAN"** to return to auto-range.

### 4.5 Auto Power Off

4.5.1 The meter has an auto power off feature that will turn the meter off automatically if left on. After approx. 14 minutes of non-use, the meter will sound 5 short beeps and then 1 minute later the meter will sound 1 long beep and turn itself off.


4.5.2 After auto power off has occurred, either move the rotary switch or press the **"FUNC"**, **"MAX"** or **"RAN"** buttons to turn the meter back on.

4.5.3 If you hold down the **"HOLD"** button when turning on the meter, this will disable the auto power off function. The auto power off function will re-enable after the meter is turned off again.

### 4.6 Preparing for Measurement

4.6.1 Select the desired function using the rotary switch. If in manual mode, select the highest range first if the value to be measured is unknown beforehand and lower as needed.

4.6.2 When connecting the meter to a circuit, connect the common lead first then the meter's test probe.

4.6.3 If the battery voltage becomes  $<2.4V$ , the  symbol appears on the display. Replace the batteries before making measurements.

### 4.7 DC Voltage

4.7.1 Use the probe cover if making measurements on category III installations.

4.7.2 Insert the black test lead into the COM jack.

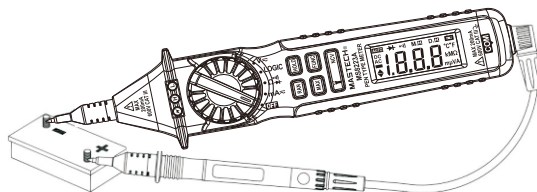
4.7.3 Turn the rotary switch to the **V $\overline{\sim}$**  position.

4.7.4 The default mode is DC voltage. Press **"RAN"** to switch to manual range if needed.

4.7.5 Connect the test probe and test lead across the voltage source or load for measurement.

4.7.6 The display will show the measured value. Observe the polarity of the test probe for DC voltage measurements.





## ⚠ WARNING

**To prevent electric shock and damage to the meter or personal injury, do not measure voltages that may exceed 600V DC.**

### Note:

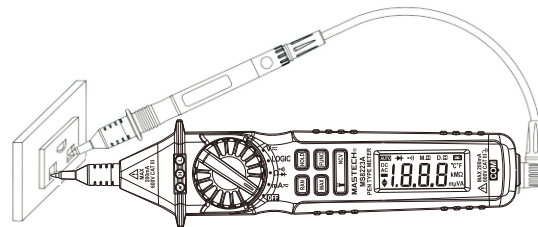
- Before connecting the probe and test lead at lower voltage ranges, the display may show erratic readings. This is normal because the meter is highly sensitive. Once a connection is made, the true reading will be displayed.
- "OL" indicated an over-range situation in manual mode. A higher range should be selected.
- In manual mode, select the highest range first if the value to be measured is unknown beforehand and lower as needed.

## 4.8 AC Voltage

### ⚠ WARNING

**To prevent electric shock and damage to the meter or personal injury, do not measure voltages that may exceed 600V AC rms.**

- 4.8.1 Use the probe cover if making measurements on category III installations.
- 4.8.2 Insert the black test lead into the COM jack.
- 4.8.3 Turn the rotary switch to the  $V_{\sim}$  position.
- 4.8.4 The default mode is DC voltage. Press "FUNC" to switch to AC voltage. Press "RAN" to switch to manual range if needed.
- 4.8.5 Connect the test probe and test lead across the voltage source or load for measurement.
- 4.8.6 The display will show the measured value.



## Note:

- Before connecting the probe and test lead at lower voltage ranges, the display may show erratic readings. This is normal because the meter is highly sensitive. Once a connection is made, the true reading will be displayed.
- "OL" indicated an over-range situation in manual mode. A higher range should be selected.
- In manual mode, select the highest range first if the value to be measured is unknown beforehand and lower as needed.
- Millivolt range (mV) is only available in manual range mode.

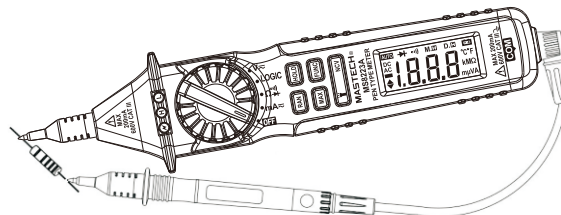
## 4.9 Resistance



### WARNING

**Risk of electric shock. be sure all power to circuit is off and capacitors have fully discharged before measuring resistance**

- 4.9.1 Use the probe cover if making measurements on category III installations.
- 4.9.2 Insert the black test lead into the COM jack.
- 4.9.3 Turn the rotary switch to the  $\Omega$  position. Press "RAN" to switch to manual range if needed.
- 4.9.4 Connect the test probe and test lead across the resistance for measurement.
- 4.9.5 The display will show the measured value.

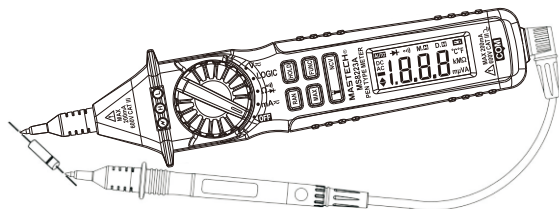


## Note:

- "OL" indicated an over-range situation in manual mode. A higher range should be selected.
- If the resistance measured is greater than  $1M\Omega$ , the meter may take a few seconds to get a stable reading. This is normal for high resistance measurements.
- When the leads are not connected or when measuring an open circuit, the display will read "OL".

## 4.10 Diode Test

- 4.10.1 Use the probe cover if making measurements on category III installations.
- 4.10.2 Insert the black test lead into the COM jack.
- 4.10.3 Turn the rotary switch to the  $\rightarrow$  position.
- 4.10.4 The default mode is resistance. Press "FUNC" to switch to diode test.
- 4.10.5 Connect the test probe to the anode (+) and test lead to the cathode (-) of the diode.
- 4.10.6 The display will show the measured value



## Note:

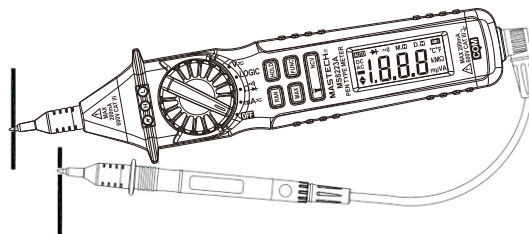
- The display shows the approx. forward voltage drop.
- If the connections are reversed or the leads are not connected, the display will show "OL".

## 4.11 Continuity

### ⚠ WARNING

**Risk of electric shock. be sure all power to circuit is off and capacitors have fully discharged before measuring continuity**

- 4.11.1 Use the probe cover if making measurements on category installations.
- 4.11.2 Insert the black test lead into the COM jack.
- 4.11.3 Turn the rotary switch to the  $\Omega$  position.
- 4.11.4 The default mode is resistance. Press "FUNC" twice to switch to continuity.
- 4.11.5 Connect the test probe and test lead across the circuit for measurement.
- 4.11.6 If the measured resistance is less than 50 $\Omega$ , the buzzer will sound.



## Note:

- If the leads are not connected or the resistance is higher than 200 $\Omega$ , the display will show "OL".

## 4.12 DC Current

### ⚠ WARNING

**Risk of electric shock. never measure current where open circuit voltages exceed 250V to prevent damage to the meter or personal injury.**

- 4.12.1 Use the probe cover if making measurements on category III installations.
- 4.12.2 Insert the black test lead into the COM jack.
- 4.12.3 Turn the rotary switch to the "mA  $\approx$ " position.
- 4.12.4 The default mode is DC current. Press "RAN" to switch to manual range if needed.
- 4.12.5 Connect the test probe and test lead in series with the circuit under measurement.
- 4.12.6 The display will show the measured value. Observe the polarity of the test probe for DC current measurements.

## Note:

- "OL" indicated an over-range situation in manual mode. A higher range should be selected.

## 4.13 AC Current

### WARNING

**Risk of electric shock. never measure current where open circuit voltages exceed 250V to prevent damage to the meter or personal injury.**

- 4.13.1 Use the probe cover if making measurements on category III installations.
- 4.13.2 Insert the black test lead into the COM jack.
- 4.13.3 Turn the rotary switch to the **mA**  $\approx$  position.
- 4.13.4 The default mode is DC current. Press "**FUNC**" to switch to AC current. Press "**RAN**" to switch to manual range if needed.
- 4.13.5 Connect the test probe and test lead in series with the circuit under measurement.
- 4.13.6 The display will show the measured value. Observe the polarity of the test probe for DC current measurements.

#### **Note:**

- "OL" indicated an over-range situation in manual mode. A higher range should be selected.

## 4.14 Logic Test

### WARNING

**To prevent electric shock and damage to the meter or personal injury, do not measure voltages that may exceed 100V AC rms.**

- 4.14.1 Use the probe cover if making measurements on category III installations.
- 4.14.2 Insert the black test lead into the COM jack.
- 4.14.3 Turn the rotary switch to the LOGIC position.

- 4.14.4 Connect the black test lead to the circuit's ground (-) terminal.
- 4.14.5 Hold down the "**FUNC**" button and touch the test probe to the circuit for measurement. The LED near the tip of the meter will indicate the current logic level (red indicates "high" level or "1" and green indicates "low" level or "0").
- 4.14.6 The display will also show the logic level along with the voltage measured (" $\Delta$ " representing "high" level and " $\nabla$ " representing "low" level).

#### **Note:**

- If the leads are disconnected or the voltage measured is less than 1.5V, the LED will be green.
- "**FUNC**" button must be held down during logic testing.

## 4.15 Non-Contact Voltage (NCV)

- 4.15.1 With the rotary switch in any position except OFF, hold down the "**NCV**" button.
- 4.15.2 Move the tip of the meter near the voltage source or conductor. If the voltage detected is greater than 110VAC, the buzzer will beep and the NCV indicator near the tip of the meter will flash.

#### **Note:**

- Voltage may still exist even with no indication given off by the meter. Do not solely rely on NCV detection to determine the presence of voltage. Socket design, insulation thickness and other factors may affect readings.
- The NCV indicator LED may flash while measuring DC/AC voltage due to the presence of induced voltage.
- External environmental interference from additional sources can falsely trigger NCV detection.

## 5. Maintenance

### WARNING

To prevent electric shock and damage to the meter or personal injury, remove test lead before opening battery cover.


### 5.1 Replacing The Batteries

#### WARNING

To avoid electric shock, make sure that the test leads have been clearly move away from the circuit under measurement before opening the battery cover of the meter.

#### WARNING

Do not mix old and new batteries. Do not mix alkaline, standard (carbon-zinc), or rechargeable (ni-cad, ni-mh, etc) batteries.

- 5.1.1 If the sign "", it means that the batteries should be replaced.
- 5.1.2 Loosen the fixing screw of the battery cover and remove it.
- 5.1.3 Replace the exhausted batteries with new ones.
- 5.1.4 Put the battery cover back and fix it again to its origin form.

#### Note:

Do not reverse the polarity of the batteries.

## 5.2 Replacing Test Leads

Replace test leads if leads become damaged or worn.

### WARNING

Use meet EN 61010-031 standard, rated CAT III 600V, or better test leads.

### WARNING

To avoid electric shock, make sure the probes are disconnected from the measured circuit before removing the rear cover. Make sure the rear cover is tightly screwed before using the instrument.

## 6. Accessories

1	Test Lead	Rating: 600V 10A	1
2	Alligator Clip	Rating: 600V 10A	2
3	Batteries	1.5V,AAA	2
4	Manual		1



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