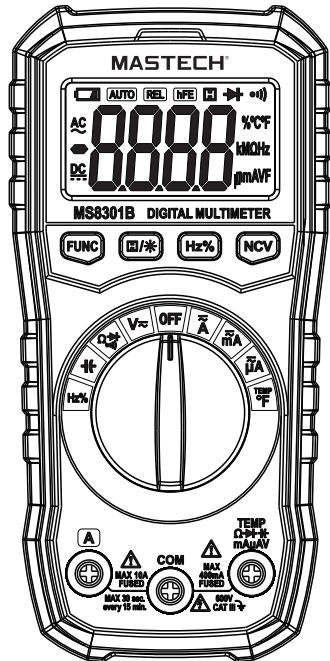


# MASTECH®

## MS8301B

### Digital Multimeter User's Manual



Intertek



# MASTECH®

## CONTENTS

Overview.....	1
Safety Instructions.....	2
Safe Working Habits.....	2
Electric Symbols.....	4
Meter Instructions.....	5
Meter Appearance.....	5
Display.....	6
Keys Operation.....	7
Automatic Power-Off Function.....	7
Measuring Operation.....	8
DC/AC Voltage Measurement.....	8
DC/AC Current Measurement.....	8
Resistance Measurement.....	9
Capacitance Measurement.....	11
Continuity Measurement.....	12
Diode Test.....	12

# MASTECH®

## CONTENTS

Frequency/Duty Ratio Measurement.....	13
Temperature Measurement.....	14
Non-Contact Voltage (NCV).....	14
General Specifications.....	15
Accuracy Indicators.....	15
DC Voltage.....	16
AC Voltage.....	16
Resistance.....	16
Capacitance.....	17
Diode/Continuity Measurement.....	17
DC Current.....	18
AC Current.....	18
Frequency .....	19
Duty Ratio.....	20
Temperature.....	21
Maintenance.....	21
General Maintenance.....	21
Replace Battery.....	22
Replace Fuse.....	23

## Overview

### WARNING

To avoid electric shock or personal injury, please read “safety information” and “warning and related notes” carefully before using the meter.

### WARNING

The special attention should be paid when using the meter because the improper usage may cause electric shock and damage the meter .

The safety measures in common safety regulations and operating instruction should be complied with when using.

In order to make fully use of its functions and ensure safe operations please comply with the usage in this section carefully.

This meter is a small hand-held, safe and reliable 3.5” digital auto measuring range multi-meter with stable performance and novel structure. It can be used to measure AC/DC voltage, AC/DC current, resistance, capacitance, frequency, duty ratio, temperature, diode forward voltage drop, circuit continuity and non-contact voltage tests. It is an ideal maintenance tool easily carried by a large number of users.

## Safety Instructions

This digital multi-meter has been designed according to International Electro Safety Standard EN 61010-1, EN 61010-2-030, EN 61010-2-033 concerning safety requirements for electronic measuring instruments and hand-held digital multi-meters. It meets the requirements for CAT III 600V of EN 61010-1, EN 61010-2-030, EN 61010-2-033 and grade 2 for pollution.

- Users should use the meter strictly according to the provisions of this manual. Otherwise, the warranty for the meter may become invalid.
- The warnings in the user manual are used to remind users of possible danger or dangerous action.
- The notes in the user manual are used to remind users of possible meter damage or condition or action of measured object.

### Safe Working Habits


To avoid possible electric shock or personal injury as well as damage to the meter or measured objects, please use the meter according to the following procedures methods:

- Check the case before using the meter. Don't use the meter with damaged case. Check to see if the case is cracked or lacks plastic parts. Please pay special attention to the joint insulating layer.
- Check to see if the test wire has insulation damage or bare metal. Check test wire continuity. If the wire is damaged, please replace it with a new one before using the meter.

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- Measure known voltage with the meter to verify that the meter is working properly. If the meter is working abnormally, stop using it immediately. A protective device may be damaged. If there is any doubt, please have the meter inspected by a qualified technician.
- Do not test voltage exceeding rated voltage marked on the meter.
- When testing voltage exceeding 30V AC voltage RMS, 42V AC peak or 60V DC, be particularly careful to avoid electric shock.
- When measuring, use correct jack, and select the proper function and measuring range.
- Do not use the meter in explosive gas, vapor or dusty environments.
- When using the probe, fingers should be behind the probe protection device.
- When connecting circuits, connect the common test line first, then connect the charged test line. When disconnecting circuits, disconnect the charged test line first, then disconnect the common test line.
- Before measuring resistance, continuity, and diodes, first turn off power and discharge all high voltage capacitors.
- If the meter is not used in accordance with the instructions, the meter's safety protective function may become invalid.
- For all DC measurements, to avoid the risk of electric shock, please use AC function to verify the existence of any AC voltage. Then, select DC voltage measuring range equal to or greater than the AC measuring range.
- Before measuring current, please check the meter fuse, shut off power to the circuit to be tested, then










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- connect the meter and energize the circuit.
- When opening the case (or part of the case), turn the meter off.
- When the battery low voltage indicator “” becomes lit, replace the battery at once. A low battery will cause meter reading errors and may result in electric shock or personal injury.
- Before opening the case or the battery cover, remove the test wire from the meter.
- When maintaining the meter, use replacement parts specified by the factory.

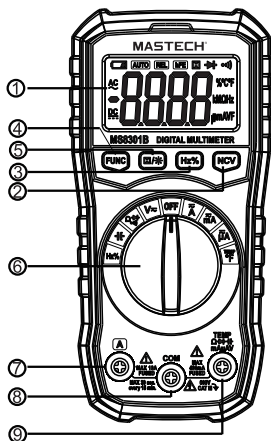
## WARNING

Measure known voltage with the meter to verify that the meter is working properly. If the meter is working abnormally, stop using it immediately. A protective device may be damaged. If there is any doubt, please have the meter inspected by a qualified technician.

## Electric Symbols

	Important safety information. Read the manual.
	High voltage with danger.
	Ground.
	Double Insulation (Class II safety equipment).
	Fuse must be replaced as per the specification herein.
	Accord with the related EU laws and regulations
	AC (Alternating Current)
	DC (Direct Current)
	CONFORMS TO UL STD 61010-1, 61010-2-030 and 61010-2-033, CERTIFIED TO CSA STD C22.2 NO. 61010-1, 61010-2-030 and IEC STD 61010-2-033

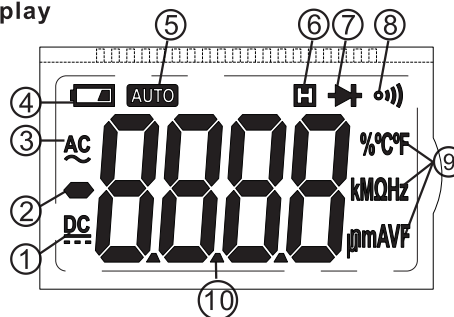
## Meter Instructions Meter Appearance



- (1) LCD display
- (2) NCV key
- (3) Frequency/duty ratio key
- (4) Function selection key
- (5) Data hold /backlight key
- (6) Rotary switch
- (7) Positive input jack of 10A (connected with the red test probe)

- (8) All common input jacks for measuring (connected with the black test probe).
- (9) Positive input jack of voltage, resistance, capacitance, temperature, frequency/duty ratio, mA/μA current, diode and continuity (connected with the red test probe)



## Display



- (1) Direct current/voltage indicator
- (2) Numerical value polarity indicator (negative sign)
- (3) Alternating current/voltage indicator
- (4) Battery low-voltage indicator
- (5) Automatic measuring range indicator
- (6) Data hold indicator
- (7) Diode measurement function indicator
- (8) Continuity measurement indicator
- (9) Measurement unit
- (10) Measurement display value

## Keys Operation

### Hold/Backlight Key

Press “/” to hold the current reading on the display. Press the key again to release the hold. Press “/” for 2 seconds to turn on the backlight. Press the key for 2 seconds again to manually turn off the backlight.

### Function Switch Key

Press “**FUNC**” to switch between functions or between AC/DC current and voltage.

### Frequency/Duty Ratio Key (Hz/%)

In AC voltage/current modes, press “**Hz/%**” and the display will show the frequency measurement.

Press the key again to switch to duty cycle.

Press the key a third time to return to normal display.

In Hz duty cycle mode press the “**Hz/%**” key and the display will show the duty cycle. Press the key again to switch to the frequency measurement

### NCV Key

Press the “**NCV**” key down in any mode and the meter will activate the non-contact voltage detection. Hold the meter up to a voltage source and the buzzer will sound and the NCV indicator will light up if voltage is detected. Release the “**NCV**” key to stop NCV detection.

### Automatic Power-Off Function

In the measurement process, if there is no activity by the function key or function selection switch for 30 minutes, the meter will automatically shutdown (sleep state). Press “**FUNC**” key to power on and the automatic shutdown function will be cancelled.

## Measuring Operation

### AC/DC Voltage Measurement:

- ① Rotate function selection switch to voltage measurement position.
- ② Press “**FUNC**” key to select AC or DC voltage
- ③ Connect black and red test probe to COM input jack and  $V\Omega mA$  input jack, respectively.
- ④ Measure the voltage of circuit to be tested with other ends of test probes (connected with the circuit to be tested in parallel)
- ⑤ Read the measured value from LCD display. When measuring AC or DC voltage, the display will simultaneously show the voltage polarity which is connected with red test probe.

### WARNING

**Don't measure any RMS voltage higher than 600V DC or AC, to prevent injury or damage to meter and equipment.**

### AC/DC Current Measurement:

- ① Turn off the power to the circuit to be tested. Discharge all high voltage capacitors on the circuit to be tested.
- ② Rotate function selection switch to appropriate current position.
- ③ Press “**FUNC**” key to select AC or DC current.
- ④ Depending on the size of the current to be measured, connect the red test probe to 10A or  $V\Omega mA$  input jack and connect the black test probe to COM input jack.

- ⑤ Turn off the circuit to be tested. The black test probe is connected to one end of disconnected circuit (low voltage relatively), and the red test probe is connected to the other end of disconnected circuit (high voltage relatively). (When measuring direct current, connecting test probe reversely would make reading become negative, but the meter won't be damaged.)
- ⑥ Connect the power to the circuit, then read the display reading. If it is overload, "OL" will display on the LCD display.

**⚠ WARNING**

**To prevent injury or damage to meter and equipment, do not make current measurements if voltage exceeds 600V.**

**Note**

**Before measuring current, first check the meter's fuse. When measuring, use correct input end and function. When the test probe is inserted to the current input end, don't connect the other end of the test probe with any circuit in parallel**

**Resistance measurement:**

- ① Rotate function selection switch to resistance measurement position, and turn off the power to the circuit to be tested
- ② If needed, press "FUNC" key to select resistance measurement function

- ③ Connect black and red test probe to COM input jack and  $V\Omega mA$  input jack, respectively.
- ④ Measure the resistance of circuit to be tested with other ends of test probes.
- ⑤ Read the resistance value from LCD display. If it is overload, "OL" will display on the LCD display

**Here are some tips for measuring resistance:**

- The resistance measured on a circuit is usually different from the rated value of resistance. This is because the test current of the meter will flow through all possible channels between test probes.
- When measuring low resistance, to ensure accuracy, make a short circuit between the test probes and read the resistance value of the short circuit. This resistance value should be subtracted after measuring the resistance to be tested.
- When there is no input (for example, open circuit), the display will show "OL", which means that the measured value is out of range.

**⚠ WARNING**

**When measuring resistance or circuit continuity, to avoid injury or meter damage, turn off the power to the circuit and discharge all capacitors.**

## Capacitance Measurement:

- ① Rotate function selection switch to capacitance measurement position, and turn off the power to the circuit to be tested
- ② Connect black and red test probe to COM input jack and VΩmA input jack, respectively.
- ③ Measure the capacitance of circuit to be tested with other two ends of test probes.
- ④ Read the capacitance measuring value from LCD display. If it is overload, “OL” will display on the LCD display

Here are some tips for measuring capacitance:

- When measuring bulk capacitors with this meter, readings will stabilize after a few seconds..
- To improve the accuracy below 20nF, subtract the distributed capacitance of meter and cable.

### WARNING

**When measuring capacitance, to avoid injury or meter damage, turn off the power to the circuit to measured discharge all capacitors**

## Continuity Measurement:

- ① Rotate function selection switch to continuity measurement position, and turn off the power to the circuit to be tested
- ② If needed, press “FUNC” key to select continuity measurement function
- ③ Connect black and red test probe to COM input jack and VΩmA input jack, respectively.
- ④ Measure the circuit to be tested with other ends of test probes.
- ⑤ If the measured circuit resistance is less than about 50Ω, the buzzer will sound continuously.

### WARNING

**When measuring resistance or circuit continuity, to avoid injury or meter damage, turn off the power to the circuit to be measured and discharge all capacitors.**

## Diode Test:

- ① Rotate the function selection switch to diode position, and turn off the power to the circuit to be tested
- ② Connect the black and red test probe to COM input jack and VΩmA input jack, respectively.
- ③ Connect black and red test probe to cathode and anode of the diode to be tested, respectively.



- ④ The meter will display the diode's forward bias voltage value. If the test probe polarity is reversed, the meter will display "OL", which distinguishes the diode's cathode and anode.

**⚠ WARNING**

**When measuring diodes, to avoid injury or meter damage, turn off the power to the circuit and discharge all capacitors.**

## Frequency/Duty Ratio Measurement

- ① Rotate function selection switch to frequency/duty ratio measurement position.
- ② Press "FUNC" key to select frequency or duty ratio measurement function.
- ③ Connect black and red test probe to COM input jack and V $\Omega$ mA input jack, respectively.
- ④ Measure the circuit with the other ends of test probes.
- ⑤ Read the measured result from LCD display.

**⚠ WARNING**

**Don't input the voltage higher than 60V DC or 30V AC in frequency/duty ratio measurement position, to prevent electric shock or meter damage.**

## Temperature Measurement

- ① Rotate function selection switch to temperature measurement position.
- ② Connect negative and positive end of K-type thermocouple to COM input jack and V $\Omega$ mA input jack.
- ③ Place K-type thermocouple to the object or environment to be measured.
- ④ Read the measured result from LCD display.

**⚠ WARNING**

**Don't input the voltage higher than 30V in temperature measurement position, to prevent electric shock or meter damage.**


## Non-Contact Voltage (NCV)

Hold down the "NCV" key and move the tip of the clamp toward the conductor under test. If the detected voltage is  $\geq 110V$  AC (rms), the NCV indicator will flash and the buzzer will beep.

Note

- 1) Do not rely solely on NCV detection to determine the presence of voltage. Detection can be affected by socket design, insulation thickness, or other factors.
- 2) Interference from outside sources could accidentally trigger the NCV detector.

## General Specifications

- Operating environment and condition: 600V CAT III, pollution grade: II.
- Elevation < 2000 m
- Environment temperature and humidity: 0~40°C, <80% RH (do not use meter when temperature <10°C).
- Storage temperature and humidity: -10~60°C, <70% RH (remove the battery).
- Temperature coefficient: 0.1xAccuracy/°C (<18°C or >28°C).
- The maximum allowable voltage between measurement end and ground: 600V DC or 600V AC RMS.
- Fuse protection: grade mA: FF 400mA H 600V 10KA grade 10A: FF 10A H 600V 10KA
- Sampling rate: about 3 times/s.
- Display: 3 3/4 bits of digit LCD display(4000 counts).
- Over-range indication: LCD will show "OL".
- Low battery indication: When the battery voltage is lower than the normal operating voltage, "  " will display on the LCD display.
- Input polarity indication: automatically display "-" symbol.
- Power supply: AAA 1.5Vx2 batteries.
- Dimension(LxWxH): 150mmx74mmx48mm.
- Weight: about 220g.

## Accuracy Indicators

Accuracy: ±(% of reading + digits) with one year of warranty.

Reference conditions: environmental temperature is from 18°C~28°C, relative humidity is not more than 80%.

## DC Voltage

Measuring range	Resolution	Accuracy
400mV	0.1mV	±(0.5% of reading +3 digits)
4V	0.001V	
40V	0.01V	
400V	0.1V	±(0.8% of reading +3 digits)
600V	1V	

Input impedance: 10MΩ

Maximum input voltage: 600V DC or AC (RMS)

## AC Voltage

Measuring range	Resolution	Accuracy
4V	0.001V	±(0.8% of reading +5 digits)
40V	0.01V	
400V	0.1V	
600V	1V	±(1.0% of reading +5 digits)

Input impedance: 10MΩ

Maximum input voltage: 600V DC or AC (RMS).

Frequency response: 40Hz~400Hz, sine wave RMS (average response).

## Resistance

Measuring range	Resolution	Accuracy
400Ω	0.1Ω	±(0.8% of reading +5 digits)
4kΩ	0.001kΩ	
40kΩ	0.01kΩ	
400kΩ	0.1kΩ	
4MΩ	0.001MΩ	
40MΩ	0.01MΩ	

Overload protection: 250V DC or AC (RMS)

## Capacitance

Measuring range	Resolution	Accuracy
50nF	0.01nF	±(3.0% of reading +5 digits)
500nF	0.1nF	
5μF	0.001μF	
50μF	0.01μF	
100μF	0.1μF	

Overload protection: 250V DC or AC (RMS)

## Diode and Continuity Measurement

Function	Measuring range	Resolution	Accuracy
Diode Test →	1.5V	0.001V	Display approximate diode forward voltage drop value.
o))	When built-in buzzer sounds, the resistance to be tested is less than 50Ω.		Open circuit voltage: about 0.4V

Overload protection: 250V DC or AC (RMS)

## DC Current

Measuring range	Resolution	Accuracy
400μA	0.1μA	±(1.0% of reading +5 digits)
4000μA	1μA	
40mA	0.01mA	
400mA	0.1mA	
10A	0.01A	±(2.0% of reading +10digits)

Overload protection: grade mA: FF 400mA H 600V 10KA protection; grade 10A: FF 10A H 600V 10KA protection. Maximum input current: grade mA: 400mA DC ; grade 10A: 10A DC

When measured current is greater than 2A, the continuous measurement time cannot be more than 2 minutes. Disconnect the current and wait 10 minutes before making another measurement.

## AC Current

Measuring range	Resolution	Accuracy
400μA	0.1μA	±(1.2% of reading +5 digits)
4000μA	1μA	
40mA	0.01μA	
400mA	0.1μA	
10A	0.01A	±(2.5% of reading +10digits)

Overload protection: grade mA: FF 400mA H 600V 10KA protection; grade 10A: FF 10A H 600V 10KA protection. Frequency response: 40Hz~400Hz, sine wave RMS (average response)

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Maximum input current: grade mA: 400mA AC RMS;  
grade 10A: AC RMS  
When measured current is greater than 2A, the  
continuous measurement time cannot be more than  
2 minutes. Disconnect the current and wait 10 minutes  
before making another measurement.

## Frequency

### Through grade HZ/DUTY:

Measuring range	Resolution	Accuracy
5.000Hz	0.001Hz	±(1.0% of reading + 5 digits)
50.00Hz	0.01Hz	
500.0Hz	0.1Hz	
5.000KHz	0.001KHz	
50.00KHz	0.01KHz	
100.0KHz	0.1KHz	

- Overload protection: 250V AC RMS.
- The input voltage range:  $\geq 2V$  (input voltage will increase when the frequency to be measured increases).

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### Through grade V or A:

Measuring range	Resolution	Accuracy
50.00Hz	0.01Hz	± (1.5% of reading + 5 digits)
500.0Hz	0.1Hz	
10.00kHz	0.001KHz	

- Measuring scope: 40Hz ~ 10kHz
- The input voltage range:  $\geq 600mV$  AC RMS (input voltage will increase when the frequency to be measured increases)
- Input impedance: 10M $\Omega$
- Maximum input voltage: 600V AC RMS

### Duty Ratio

Measuring range	Resolution	Accuracy
0.1%-99.9%	0.1%	±3%

### Through grade HZ/DUTY:

- Frequency response: 1~100.0KHz
- The input voltage range:  $\geq 2V$  AC RMS (input voltage will increase when the frequency to be measured increases)
- Maximum input voltage: 250V AC RMS

### Through grade V or A:

- Frequency response: 40 ~ 10kHz
- Input voltage range:  $\geq 600mV$  AC
- Input impedance: 10M $\Omega$
- Maximum input voltage: 600V AC RMS

## Temperature

Measuring range	Resolution	Accuracy
-4~1832°F	1°F	±(3.0% of reading +3 digits)

Overload protection: 250V DC or AC (RMS)

## Maintenance

This section provides basic maintenance information, including instructions for the replacement of fuse and battery. Do not try to repair the meter unless you are an experienced maintenance person with the relevant calibration, performance testing and maintenance data.

### General Maintenance

#### WARNING

**To avoid injury or damage to the meter, don't wet the inner parts of the meter. Before opening the case or battery cover, remove the connecting cable between the test probe and the input signal.**

Regularly clean the meter case with damp cloth and a small amount of detergent. Do not use abrasives or chemical solvents. If the input jack becomes dirty or wet, it may affect the measurement readings.

To clean input socket:

- ① Turn off the meter and pull out all the test probes from the input jack.
- ② Remove all dirt from the jacks.
- ③ Apply detergent or lubricant to a new cotton ball (such as WD-40).
- ④ Clean each jack with a cotton ball and lubricant to prevent contamination by moisture in the socket.


## 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.**

If the sign “” appears, it means that the batteries should be replaced.

Loosen the fixing screw of the battery cover and remove it.

Replace the exhausted batteries with new ones. Put the battery cover back and fix it again to its origin form.

### Note:

Do not reverse the poles of the batteries.

## Replace Fuse

### **WARNING**

**To avoid electric shock or personal injury, before opening back cover to replace fuse, turn off the meter and disconnect the test probe from the measurement circuit.**

To replace fuse:

- ① Turn off the power to the meter.
- ② Remove all test probes from the input jacks.
- ③ Loosen screws on the back cover with screwdriver.
- ④ Remove the back cover.
- ⑤ Remove the blown fuse.
- ⑥ Replace with new fuse with the same type.
- ⑦ Put the back cover and tighten the screws.

### **Replace test leads**

If insulation on leads is damaged, replace test leads.

### **Warning**

**Use meet EN 61010-031 standard, rated CAT III 600V, 10A or better test leads.**

