Mastech

Mastech
MS2109B Digital
Clamp Meter

Mastech MS2109B Digital Clamp Meter Instruction Manual

Mastech

Contents

Mastech MS2109B Digital Clamp Meter

Introduction

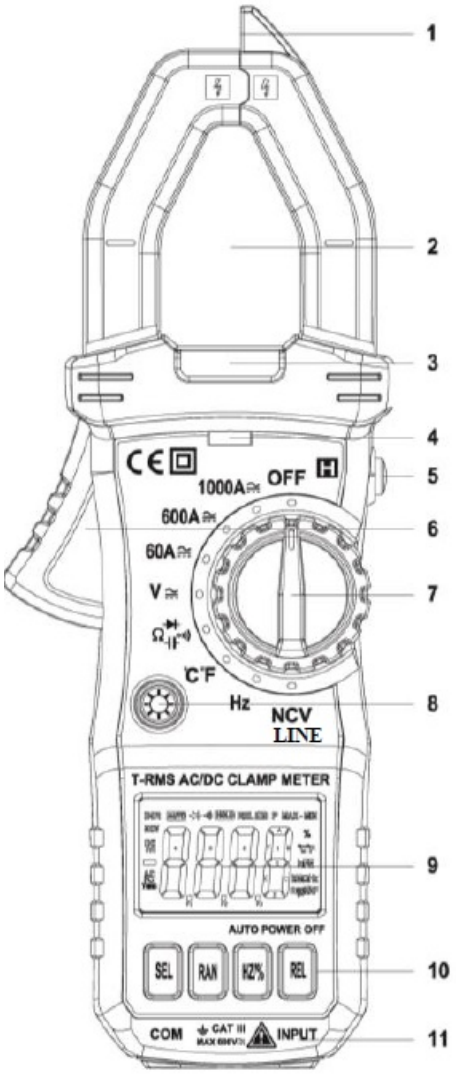
This series of digital clamp meters has been designed and manufactured in accordance with the international electrotechnical safety standard IEC-61010-2-032, which specifies safety requirements for electronic measuring instruments and handheld current clamp meters. The series complies with the IEC-61010-2-032 standard for 600V CAT III and the Pollution Degree 2 Standard.
Before using this instrument, please read this user manual thoroughly and pay attention to the relevant safety guidelines.

Safety Information

Operating Precautions

- The instrument must be warmed up for 30 seconds before taking measurements.
- Do not use the instrument or the test leads if they are visibly damaged.
- To comply with safety standards, the instrument must be used with the provided test leads only. If the test leads are damaged, they must be replaced with the same model or with leads that have the same electrical specifications.
- If the instrument is placed in a noisy environment or an environment with high interference, the readings may become unstable or show large errors.
- Ensure that the test leads are not connected to any circuit before changing the range setting.
- When the magnitude of the measured signal is uncertain, set the range dial to the highest range.
- Ensure that the test leads and function dial are in the correct positions when taking measurements.
- When using the test leads, keep your fingers behind the protective guard on the test leads.
- Exercise caution when measuring voltages exceeding 60V DC or 30V AC RMS to avoid electric shock.

Instrument Panel Description



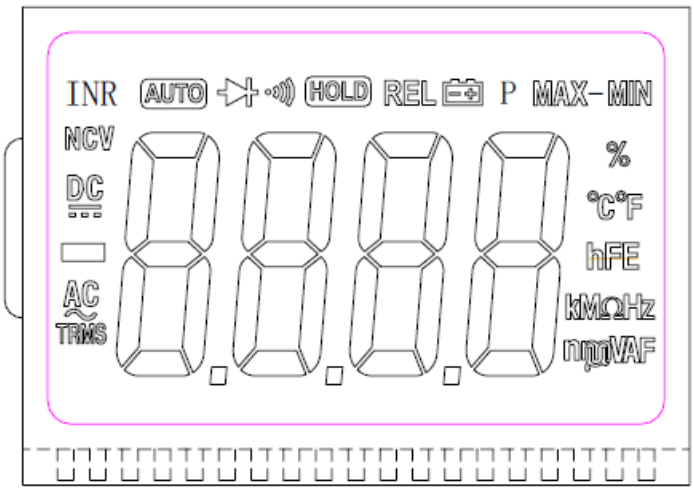
Panel Feature Description

Panel Feature Description		
No.	Feature	Description
1	NCV Sensing Area	This is the non-contact voltage (NCV) detection area. When in the NCV mode, if voltage is detected in this area, the NCV alarm will activate.
2	Clamp Head	When measuring current, place one conductor (wire) of the circuit being tested into the clamp head area. The current value can be read from the current range on the meter.
3	Flashlight	When the clamp head flashlight function is activated, the LED for the flashlight turns on.

4	NCV Indicator Light	The red LED flashes when the NCV function triggers an alarm.
5	Clamp Head Flashlight Button	Available only on the MS2109B model, press this button once to turn on the clamp head flashlight.
	Data Hold	Available only on the MS2109C/D models, pressing this button once freezes the data currently displayed on the LCD. Press again to cancel.
6	Clamp Trigger Position	The clamp jaws can open to a maximum size of 21.5 mm.
7	Range Dial	Turn the dial to select the corresponding measurement function.
8	Backlight Button	1. MS2109B: Press and hold the button for about 2 seconds to turn on the backlight. Press and hold again for about 2 seconds to turn it off.
		2. MS2109C/D: Press the button once to turn on the backlight and press again to turn it off. When the range is set to **current**, the LED flashlight function can be activated simultaneously.
9	LCD Display	Displays the current measurement value.
10	Function Buttons	1. SEL: The Measurement function selection button can be used to switch between AC/DC, °C/°F, and resistance/diode/continuity test.
		2. RAN: Manual range selection button. In the voltage and resistance ranges, user can manually select the required range.
		3. HOLD: Data hold function. Press it once to freeze the current data on the LCD display. Press it again to cancel.
		4. MAXH: Maximum value hold. It holds the maximum value of the current measurement cycle. If a larger value is input during the cycle, the display is

		automatically updated.
		5. Hz/%: It switches between frequency and duty cycle and is active in AC mode .
		6. REL: Relative value measurement. In **DC** current mode, pressing this button f unctions as a zero reset. In **AC** current measurement mode, holding down the R EL button activates inrush current measurement mode. The LCD displays for ab out 0.5 seconds before starting the measurement. It records the maximum value over an approximately 80ms integration cycle. If a larger value is detected, the di splay is updated. Pressing the button repeats the measurement, whereas holdin g down the button exits the mode.
11	Input Jacks	Input ports for all measurements except current. INPUT: Positive input, COM: Co mmon terminal.

LCD Display



Explanation of LCD Display Symbols

Symbol	Explanation	Symbol	Explanation
HOLD	Data Hold		Low Voltage Indicator
	Diode Measurement		Continuity Test Indicator
MAXH	Maximum Value Hold Symbol	LPF	Low-Pass Filter Function
NCV	Non-Contact Voltage Detection	**INR**	Inrush Current Function
mV V	Voltage Unit Symbol	**uA mA A**	Current Unit Symbol
Hz KHz MHz	Frequency Unit Symbol	**pF nF uF mF**	Capacitance Measurement Unit
DC	DC Voltage	**AC**	AC Voltage
hFE	Transistor	**°C**	Celsius Temperature
TRMS	True RMS Measurement	**°F**	Fahrenheit Temperature
%	Duty Cycle Measurement	**REL**	Relative Value Measurement

Function Button Descriptions

POWER (Power Switch)

- Description: Turns the instrument on or off.

PK HOLD (Peak Hold Button)

- Description: When this button is pressed, the instrument will display the maximum measured value during the entire measurement process starting from when the button was pressed.

APO SET (Auto Power Off Setting Button)

- Description: If this button is pressed before turning on the power, the instrument will automatically power off after about 15 minutes. If the button is kept in the raised position, the instrument's power will not automatically turn off.

HOLD (Data Hold Button)

- Description: When this button is pressed, the instrument will freeze the data displayed as of that moment, and will not update with further measurements.

(AC/DC Switching Button)

- Description: Press (or trigger) this button to toggle between measuring AC and DC signals.

HZ/DUTY (Frequency/Duty Cycle Switching Button)

- Description: When this button is triggered, the instrument will toggle between displaying the frequency and duty cycle of the measured signal.

REL△ (Relative Value Measurement Button)

Description: Press this button to enter relative value measurement mode. The currently displayed value will be set as the reference value for relative measurements, and subsequent displayed values will be the actual measurement minus this reference value. To exit relative measurement mode, press and hold this button for more than 1 second to return to normal measurement mode.

RANGE (Range Selection Button)

Description: Pressing this button puts the instrument into manual range selection mode. Each press increases the range, and after reaching the highest range, pressing the button again cycles back to the lowest range. This allows for manual selection of the desired measurement range. To return to automatic range measurement mode, press and hold the switch for more than 1 second.

(Diode/Buzzer, DC/AC Measurement Selection Button)

- Description: When the function dial is set to the or voltage/current range, pressing this button toggles the diode and buzzer functions or the DC/AC measurement functions.

Technical Specifications

General Specifications

Operating Conditions
Working Temperature (Humidity): 0°C to 40°C <80%RH Storage Temperature (Humidity): -10°C to 60°C <70%RH, with battery removed

- Maximum voltage between any input terminal and ground: 600V RMS
- Measurement Principle: Dual-slope integrating A/D converter
- Sampling Rate: Approximately 2 times per second

Display

- MS2109B: 3 1/2 digit LCD display, maximum reading of 1999.
- MS2109C: 3 3/4 digit LCD display, maximum reading of 3999.
- MS2109D: 3 5/6 digit LCD display, maximum reading of 5999.
- Unit symbols are automatically displayed according to the selected measurement range.
- Range Switching: Automatic.

Overload Indicator

- The LCD will display “OL”. When the input voltage exceeds 600V RMS, the LCD will display “OL” (for DCV and ACV modes).
- Input Polarity Indication: Automatically displays the “–” symbol.

Low Battery Indicator

- When the battery voltage is below the normal operating voltage, the symbol will appear on the LCD display.

- Battery: DC 1.5V ×3 SIZE AAA
- Maximum clamp Opening Size: φ23mm
- Maximum Measurable Conductor Size: φ23mm
- Dimensions: 194(L) × 72(W) × 35(H) mm
- Weight: Approximately 230 g (including batteries)
- Accessories: 1. User manual ×1
- Test leads ×1 set
- Warranty card ×1
- Carrying pouch ×1
- Temperature probe ×1 (not included with MS2109B)

Accuracy Specifications
Accuracy: ± (percent of reading + number of counts), guaranteed for 1 year Reference Conditions: Ambient temperature of 18°C to 28°C and relative humidity not exceeding 80%
* When measuring AC current, please place the conductor being tested at the center of the clamp head. If it is not placed at the center, the accuracy of the reading may be affected.

AC Current (ACA)

2A	0.001A	±(2.5%+10d)
20A	0.01A	
200A	0.1A	
600A	1A	

Frequency Response: MS2109B: 40–60Hz

Range	Resolution	MS2109C	MS2109D
40A/60A	0.01A	±(2.5%+10d)	±(2.5%+10d)
400A/600A	0.1A		
1000A	1A	/	

Frequency Response: TRMS 40Hz–1kHz

DC Current (DCA)

200mV/400mV/600mV	0.1mV	±(0.5%+3d)
2V/4V/6V	0.001V	±(0.8%+5d)
20V/40V/60V	0.01V	
200V/400V/600V	0.1V	
600V/1000V	1V	±(1.0%+5d)

Input impedance: 10MΩ
Maximum input voltage: 600V DC or 600V AC RMS

AC Voltage (ACV)

Range	Resolution	Accuracy
200mV/400mV/600mV	0.1mV	±(0.8%+3d)
2V/4V/6V	0.001V	±(1.0%+5d)
20V/40V/60V	0.01V	
200V/400V/600V	0.1V	
600V/750V	1V	±(1.2%+5d)

- Input impedance: 10MΩ
- Low-pass filter function: MS2109B LPFACV (-3db@1kHz)
- Frequency Response: MS2109B:40–400Hz
- Other models: MS2109C/MS2109D TRMS 40Hz–1KHz
- Maximum input voltage: 600V DC or 600V AC RMS

DC Voltage (DCV)

Range	Resolution	MS2109D
40A/60A	0.01A	±(2.5%+10d)
400A/600A	0.1A	
1000A	1A	

Resistance

Range	Resolution	Accuracy
200Ω/400Ω/600Ω	0.1Ω	±(1.0%+10d)
2kΩ/4kΩ/6kΩ	0.001KΩ	±(0.8%+5d)
20kΩ/40kΩ/60kΩ	0.01KΩ	
200kΩ/400kΩ/600kΩ	0.1KΩ	
2MΩ/4MΩ/6MΩ	0.001MΩ	
20MΩ/40MΩ/60MΩ	0.01 M Ω	±(2.0% +10d)

Overload protection: 250V DC or AC RMS

Diode, Continuity Test( )

Range	Description
	Displays the forward voltage drop of the diode; for reverse, it shows "OL".
	If resistance is less than 30Ω, the buzzer will sound.

Overload protection: 250V DC or AC RMS

Temperature (TEMP) (not applicable to MS2109B

Range	-20℃ to 1000℃
Resolution	1℃

Accuracy	-20℃ to 0℃	±(5% reading + 4 digits)
	0℃ to 400℃	±(2% reading + 3 digits)
	400℃ to 1000℃	±(3% reading + 3 digits)
Range	-4℉ to 1832℉	
Resolution	1℉	
Accuracy	-4℉ to 50℉	±(5% reading + 4 digits)
	50℉ to 750℉	±(2% reading + 3 digits)
	750℉ to 1832℉	±(3% reading + 3 digits)

Overload protection: 250V DC or AC RMS

Frequency (FREQ) (not applicable to MS2109B)

Range	Resolution	Accuracy
10Hz	0.01 Hz	±(0.5%+2d)
100Hz	0.1 Hz	
1kHz	0.001 kHz	
10kHz	0.01 kHz	
100kHz	0.1kHz	
1MHz	0.001MHz	

10MHz	0.01MHz	

Overload protection: 250V DC or AC RMS

Capacitance (CAP) (not applicable to MS2109B)

Range	Resolution	Accuracy
10nF	0.01nF	±(4.0%+25d)
100nF	0.1nF	±(4.0%+15d)
1uF	0.001uF	
10uF	0.01uF	
100uF	0.1uF	
1mF	1uF	±(5.0%+25d)
10mF	10uF	
100mF	100uF	

Overload protection: 250V DC or AC RMS
Non-Contact AC Voltage Detection (NCV): Measures AC voltage >30V- 1000V/50Hz-60Hz.
Live Wire Identification (Live): Measures AC voltage >110V-250V/50Hz-60Hz.

Operating Instructions

Current Measurement
Ensure that all test leads are removed from the input sockets.
To avoid risk of electric shock, do not measure the current of high-voltage (>600V) conductors.

- Turn the dial to the desired Current range.
- Select the correct range based on the size of the signal being measured.
- Pull the trigger to open the clamp and place the wire to be measured (a single wire) in the center of the clamp head. Ensure that the clamp is fully closed.
- Read the current value on the LCD.
- If the display shows “OL”, it indicates overload, and the dial must immediately be set to a higher range for measurement.

Note:

1. For MS2109D, press the SEL button to select either DC or AC current.

Voltage Measurement

- The maximum input voltage for the voltage range is 600V
- RMS. To avoid risk of electric shock or instrument damage, do not attempt to measure voltage higher than 600V RMS.
- Turn the dial to the Voltage range.
- Press the SELECT function button to choose “DCV” or “ACV” measurement mode.

- Connect the black test lead to the COM input jack. Connect the red test lead to the INPUT jack.
- Use the test leads to measure the voltage of the circuit being tested (connect the test leads in parallel with the circuit).
- Read the voltage value on the LCD.

Note:

1. In the 200mV and AC 2V ranges, the instrument may display some readings even without any input or connection to the test leads.
   This is normal and does not affect the accuracy of the measurement.
2. For MS2109B, select DCV or ACV by turning the dial.
3. For MS2109B, select LPF range to activate the LPF function.

Resistance Measurement
Before performing resistance measurements in a live circuit, ensure that all power sources to the circuit are disconnected and all capacitors are discharged.

- Turn the dial to the  range and press the SEL button to choose the measurement mode.
- Connect the black test lead to the COM input jack. Connect the red test lead to the INPUT jack.
- Use the test leads to measure the resistance of the resistor being tested.
- Read the resistance value from the LCD.

Note:

1. If the test leads are shorted while in the Ω range, due to the resistance of the test leads, the display may show a small value above zero. Subtract this short-circuit value from the displayed result.
2. When measuring resistance in a live circuit, other components connected in parallel with the circuit being tested may affect the accuracy of the measurement.
3. The Ω range on the MS2109B is a dedicated range, so there is no need to press the SEL button to select it.

Diode Test
Before performing diode measurements in a live circuit, ensure that all power sources to the circuit are disconnected and all capacitors are discharged.

- Turn the dial to the  range and press the SEL button to select diode measurement mode.
- Connect the black test lead to the COM input jack. Connect the red test lead to the INPUT jack.
- Connect the red test lead to the anode (positive terminal) of the diode and the black test lead to the cathode (negative terminal).
- Read the forward voltage drop value of the diode on the LCD.

Note:

- When measuring diodes in a live circuit, other components connected in parallel with the circuit being tested may affect the accuracy of the measurement.

Continuity Test
Before performing testing in a live circuit, ensure that all power sources in the circuit are disconnected and all capacitors are discharged.

- Turn the  dial to the range and press the SEL button to select continuity test mode.
- Connect the black test lead to the COM input jack. Connect the red test lead to the INPUT jack.
- Use the test leads to test the continuity of the circuit.
- During the continuity test, if the resistance of the circuit being tested is below approximately 30Ω, the buzzer will emit a continuous sound.

Temperature Measurement (not applicable to MS2109B)

- Turn the dial to the ℃/℉ range.
- Press the SEL button to switch between ℃ and ℉ modes.
- The LCD will display the ambient temperature of the instrument.
- When measuring temperature with a thermocouple, insert the red plug of the K-type thermocouple into the INPUT jack and the black plug into the COM jack, then use the thermocouple probe to contact the object or area to be measured.
- Read the temperature of the object from the LCD.

Note
The instrument uses a cold-junction compensation circuit located inside the front end of the instrument. Due to the instrument's good sealing, it takes time to reach thermal equilibrium with the measuring environment. Therefore, the instrument should be placed in the measuring environment for an extended period to obtain a more accurate reading.

Non-Contact Voltage Detection (NCV)

- Turn the dial to the LINE NCV range.
- Move the NCV detection area at the top of the clamp meter close to the object. If the instrument detects a live conductor, the front NCV indicator light will flash, and the buzzer will emit a "beep alarm sound, alerting the user to the presence of voltage.

Please proceed with caution

Note:

1. Even if there is no indication, voltage may still be present. Do not rely solely on the non-contact voltage detector to determine whether a conductor is live.
2. Detection results may be affected by factors such as socket design, insulation thickness, and material type.
3. External sources of interference (e.g., flashlights, motors, etc.) may affect the instrument, causing inaccurate detection.

Live Wire Identification (LINE NCV)

- Turn the dial to the LINE NCV range position.

- Insert the red test lead into the INPUT jack and use the tip of the red test lead to touch the AC voltage. When the instrument emits a “beep-beep-beep” alarm sound and the red LED indicator light turns on, the wire being touched is the live wire.

Note:

1. If the circuit has severe leakage (around ≥15V), the instrument may also give an audible and visual warning when the red test lead touches the neutral wire.
2. Detection results may be affected by factors such as socket design, insulation thickness, and material type.
3. External sources of interference (e.g., flashlights, motors, etc.) may affect the instrument, causing inaccurate detection.

Capacitance Measurement

Before performing capacitance measurements in a live circuit, ensure that all power sources to the circuit are disconnected and all capacitors are discharged.

- Turn the dial to the range and press the SEL button to choose the (capacitance) measurement mode.
- Connect the black test lead to the COM input jack. Connect the red test lead to the INPUT jack.
- Use the test leads to connect to the two terminals of the capacitor being tested.
- Read the capacitance value from the LCD.

Note:

1. While in the Capacitance range, interference from the test leads, may cause a small offset that does not return to zero. Subtract this value from the final measurement.
2. When measuring capacitance in a live circuit, other components connected in parallel with the circuit being tested may affect the accuracy of the measurement

Maintenance

- This series of digital multimeters are precision instruments. Users should not modify the internal circuits or adjust the internal potentiometer without authorization. Please pay special attention to the following points:
- Do not measure DC voltages higher than 1000V or AC voltages above 750V RMS!
- Do not input voltage signals while in the Resistance  or modes!
- Do not test voltage signals while in the Current measurement mode!
- Do not input voltage signals into the inductance or capacitance test sockets!
- Do not use the instrument for any measurement if the battery is not properly installed or if the back cover is not securely tightened!
- Before replacing the battery or fuse, remove the test leads from the test points and turn off the power switch. Follow these steps to replace the fuse:

1. Unscrew the screws securing the back cover and remove the back cover.
2. Carefully remove the circuit board, laying it flat on a clean surface with the LCD display facing you.

3. Remove the damaged fuse and replace it with one of the same specification and model. After replacement, reassemble the circuit board and close the case.

Note: For 9V or 1.5V batteries, replace the battery when the instrument displays the or BAT symbol . Follow these steps for battery replacement:

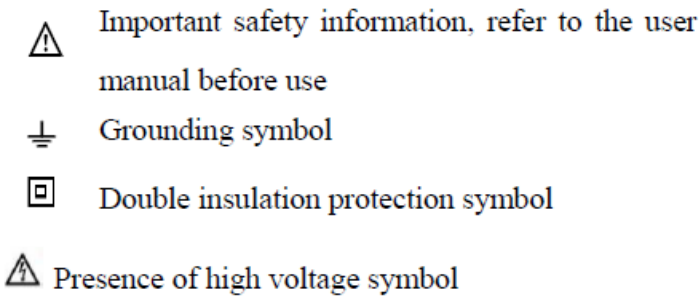
1. Unscrew the screws securing the battery compartment cover and remove the cover.
2. Remove the 9V or 1.5V battery and replace it with a new one.
   Although any standard battery will work, alkaline batteries are recommended due to their longer usage life.
3. Reattach the battery cover and tighten the screws to complete the battery replacement.

To avoid electric shock, ensure that the instrument is turned off and the test leads are disconnected before opening the back cover.
Regularly clean the instrument with a damp cloth and a small amount of detergent. Do not use chemical solvents to clean the case.

- Repairs and calibrations must be performed by professionals.
- To prevent contamination or damage from static electricity, take appropriate protective measures before opening the instrument case.
- If any abnormal conditions are observed, immediately discontinue use and send the instrument for repairs.
- Do not use the instrument if the case is not securely closed, or if the screws are not tightened.
- If the instrument will not be used for a long period, remove the battery and avoid storing it in high-temperature or high-humidity environments
- The contents of this manual are subject to change with version updates, without further notice *** V1.2
- Do not exceed the input limit specified for each range to avoid damaging the instrument.
- When measuring current, the test leads should not be inserted into the input jacks.
- When holding the clamp meter during measurement, your fingers should remain behind the safety guard on the body of the meter.
- Before measuring resistance in a live circuit, ensure all power sources are disconnected and all capacitors are discharged.
- When the symbol appears, replace the battery promptly to avoid inaccurate readings.

Safety Symbols

Safety symbols on the instrument and in the user manual:



Overview of Functions for MS2109 Series Products

Model Features	MS2109B	MS2109C	MS2109D
Display Digits	3 1/2	3 3/4	3 5/6
Maximum Display	1999	3999	5999
Basic Accuracy	0.5%	0.5%	0.5%
DC Voltage (DCV)	200mV-600V	400mV-600V	600mV-1000V
AC Voltage (ACV)	200mV-600V	400mV-600V	600mV-750V
LPF AC Voltage	200mV-600V	/	/
AC Current (ACA)	2A-600A	40A-600A	60A-1000A
LPF AC Current	/	/	/
DC Current (DCA)	/	/	60A-1000A
Resistance (Ω)	200W-20MW	400W-40MW	600W-60MW
Capacitance (CAP)	/	10nF-100mF	10nF-100mF
Frequency (Hz)	/	10Hz-10MHz	10Hz-10MHz
Temperature (℃/℉)	/	-20℃-1000℃	-20℃-1000℃
Inrush Current (INR)	/	/	√
True RMS (T-RMS)	/	√	√
Diode	√	√	√
Continuity Test	√	√	√
Clamp Head Illumination	√	√	√
NCV (Non-Contact Voltage Detecti on)	√	√	√

Live Wire Identification	√	√	√
Manual Range (RAN)	√	√	√
Function Selection (SEL)	√	√	√
Data Hold (HOLD)	√	√	√
Maximum Value (MAXH)	√	/	/
Relative Value (REL)	/	√	√
Backlight	√	√	√
Auto Power Off	√	√	√
Safety Certification	CAT III 600V	CAT III 600V	CAT III 600V

Frequently Asked Questions

- **Q: Can I measure both AC and DC current with this clamp meter?**
  A: Yes, depending on the model, you can measure both AC and DC current within the specified ranges. Refer to the user manual for detailed instructions on selecting the appropriate function.
- **Q: Is it safe to measure high voltages with this clamp meter?**
  A: The clamp meter is rated for specific voltage ranges. It is important to adhere to these limits to ensure safety and prevent damage to the instrument. Always follow safety precautions when working with high voltages.

Documents / Resources

	Mastech MS2109B Digital Clamp Meter [pdf] Instruction Manual MS2109B, MS2109C, MS2109D, MS2109B Digital Clamp Meter, MS2109B, Digital Clamp Meter, Clamp Meter

References

- User Manual