



Figure 1. The Photo of Actual MS2108A



Figure 2. The Photo of Actual MS2108A

#### FEATURES

- Display: LCD
- Operating altitude: Max. 2000m
- Overrange indication: OL or -OL
- Operating temperature: 0°C~40°C

- Storage temperature: -10°C~50°C
- Maximum voltage between terminals and earth ground: 600V DC and rms AC

#### APPLICATIONS

It is widely used to measure AC and DC voltage, current, resistance, frequency, duty, capacitance, as well as continuity and diode test.






#### DESCRIPTIONS

MS2108 is a portable professional measuring instrument with LCD and back light easily reading. The single-hand operation design for the range switch makes measurement simple and easy. Overload protection and low battery indication are provided. It is an ideal multi-function instrument with scores of practical applications for professional, workshop, school, hobby and home use. Both auto range and manual range are available.

MS2108 is equipped with many functions, such as reading hold function, true root mean square value measuring function (at AC A and AC V range), inrush current measuring function, auto zero function (at DC A range), maximum value measuring function, minimum value measuring function, measuring frequency by clamp and auto power off.

#### SYMBOL

Table 1.


	Caution, risk of danger (important safety information; refer to the datasheet.
	Application around and removal from hazardous live conductors is permitted.
	Double insulation (protection class II)
CAT III	Overvoltage (installation) category III, pollution degree 2 per IEC1010-1 refers to the level of impulse withstand voltage protection provided.
	Conforms to European Union Directive
	Earth (ground) terminal



#### SPECIFICATIONS

Calibration is required once a year, to be carried out at a temperature between 18°C and 28°C (64°F to 82°F) and relative humidity below 75%.

Table 2. General Specifications

Auto range and manual range options are available.	
Overrange protection is provided for all ranges.	
Maximum voltage between terminals and earth ground	600V DC or rms AC
Display	LCD
Operating Altitude	Max. 2000m
Maximum Value Display	6599 digits
Polarity Indication	Automatic, '-' for negative polarity.
Overrange Indication	OL or -OL
Sampling Time	Approx. 0.4 second per sample
Unit Indication	Function and unit
Auto Power Off Time	30 minutes
Operating Power	1.5V×3 AAA batteries
Battery Low Indication	 on LCD
Temperature Factor	< 0.1×Accuracy/°C
Operating Temperature	0°C to 40°C
Storage Temperature	-10°C to 50°C
Dimension	208mm×78mm×35mm
weight	Approx. 340g

#### Electrical Specifications

Ambient temperature: 23±5°C      Relative humidity: <75%

##### True RMS

For measuring non-sinusoidal waveforms, test error which is occurred by using True RMS measurement techniques is less than by using traditional average-reading techniques.

Both sinusoidal and non-sinusoidal waveforms can be tested by True RMS Clamp Meter exactly. At AC A & AC V ranges, even short two test probes there are still 1-50 digits

might be displayed on LCD. This is normal. Test result will not be affected.

At AC A and AC V range, True RMS value can be tested only when input signal is more than 2% of full range.

To ensure the precision of test result, input signal should be:

AC voltage: >13mV

AC current: >1.3A

Table 3. AC Current

AC Current		
Range	Resolution	Accuracy
66A	0.01A	± (3.0% of rdg+10digits)
600A	0.1A	
Max. input current: 600A		
Frequency range: 40 to 400Hz		



Response: true root mean square value

Table 4. Inrush Current

Range	Resolution	Accuracy
66A	0.01A	<60A take it only as reference ± (10.0% of rdg+60 digits)
600A	0.1A	
Integration: 100ms Measurement range: 30~600A Max. input current: 600A Frequency range: 40 to 400Hz Response: true root mean square value		

Table 5. DC Current

DC Current		
Range	Resolution	Accuracy
66A	0.01A	± (3.0% of rdg+10 digits)
600A	0.1A	
Max. input current: 600A DC		

Table 6. DC Voltage

Range	Resolution	Accuracy
660mV	0.1mV	± (0.8% of rdg+3 digits)
6.6V	0.001V	
66V	0.01V	
600V	0.1V	± (1.0% of rdg+5digits)
Input impedance: 10MΩ Overload protection: 660mV range: 250V DC or rms AC, 6.6V-600V ranges: 600V DC or 600V rms AC. Max. input voltage: 600V DC		

#### Note

At small voltage range, unsteady readings will appear before the test leads contact the circuit. This is normal because the meter highly sensitive. When the test leads contact the circuit, the true reading will be shown.

Table 7. AC Voltage

Range	Resolution	Accuracy
660mV	0.1mV	± (1.5% of rdg+10 digits)
6.6V	0.001V	± (1.2% of rdg + 5 digits)
66V	0.01V	
600V	0.1V	± (1.5% of rdg+10 digits)
Input impedance: 10 MΩ Overload protection: 660mV range: 250V DC or rms AC, 66V-600V ranges: 600V DC or 600V rms AC. Max. input voltage: 600V rms AC		



Frequency range: 40 to 400Hz

Response: true root mean square value

#### Note

At small voltage range, unsteady readings will appear before the test leads contact the circuit. This is normal because the meter is highly sensitive. When the test leads contact the circuit, the true reading will be shown.

#### Frequency

Table 8. By a Range (from current clamp):

Range	Resolution	Accuracy
660Hz	0.1Hz	$\pm (1.5\% \text{ of rdg} + 5 \text{ digits})$
1kHz	0.0011Hz	
>1kHz	0.0011Hz	Take it only as reference
Measurement range: 10~1kHz		
Input voltage range: $\geq 0.2\text{V rms AC}$ (higher input voltage at higher frequency)		
Input current range: $\geq 1\text{A rms AC}$ (higher input current at higher frequency)		
Max. input current: 600A rms AC		

Table 9. Duty Cycle

Range	Resolution	Accuracy
10%-95%	0.1%	$\pm 3.0\%$

#### By A range (from current clamp)

Frequency response: 10-1kHz

Input current range:  $\geq 1\text{A rms AC}$  (higher input current at higher frequency)

Max. input current: 600A

#### By V range

Frequency response: 10-10kHz

Input voltage range:  $\geq 0.2\text{V rms AC}$  (higher input voltage at higher frequency)

Input impedance: 10 M $\Omega$

Max. input voltage: 600V rms AC

Table 10. Resistance

Range	Resolution	Accuracy
660 $\Omega$	0.1 $\Omega$	$\pm (1.2\% \text{ of rdg} + 2 \text{ digits})$
6.6k $\Omega$	0.001 k $\Omega$	
66k $\Omega$	0.01 k $\Omega$	
660k $\Omega$	0.1 k $\Omega$	
6.6M $\Omega$	0.001Mk $\Omega$	
66 M $\Omega$	0.1M $\Omega$	$\pm (2.0\% \text{ of rdg} + 5 \text{ digits})$
Open circuit voltage: 0.4V		
Overload protection: 250V DC or rms AC		



Table 11. Diode

Range	Resolution	Function
	0.001V	Displaying approximate forward voltage of diode.
Forward DC current~1mA Reversed DC voltage~3.3V Overload protection: 250V DC or rms AC		

Table 12. Continuity

Range	Resolution	Function
	0.1Ω	Built-in buzzer will sound, if resistance is lower than 30Ω.
Open circuit voltage~1.2V Overload protection: 250V DC or rms AC		

Table 13. Capacitance

Capacitance		
Range	Resolution	Accuracy
6.6μF	0.001μF	<2μF± (4.0% of rdg+50digits) ± (4.0% of rdg+3digits)
66μF	0.01μF	
660μF	0.1μF	
6.6mF	0.001mF	
66mF	0.01mF	
Overload protection: 250V DC or rms AC		

## OPERATION INSTRUCTION

### Holding Readings

Press the “**HOLD/B.L**” button to hold the readings while taking measurement and the value on the display will be held.

Press the “**HOLD/B.L**” button again to release the reading hold function.

### Switching Ranges

When the meter is turned on, it is at the auto range mode for measuring current, voltage, resistance, capacitance and frequency.

Press the “**RAN**” button for manual range mode. The range will go up one level at each press and return to the lowest level when the highest level is reached.

Press the “**RAN**” button for one or more seconds to return to the auto range.

Press the “**RAN**” button to get back to normal test during working in maximum or minimum value measuring function.

Note:

At frequency range, meter can't be set to manual range mode.

### Switching Frequency or Duty

During working at the voltage or current ranges, press the “Hz/%” button one time, frequency of the voltage or current will be measured. Press the “Hz/%” button twice, the meter will be changed into the duty range for measuring the duty cycle of the voltage or current. At the same time, the meter is changed into manual mode.

Press the “Hz/%” button again, meter will be back to the condition of the voltage or current measuring.

Note:

During working at maximum or minimum value measuring function, the meter can't be changed into frequency or duty cycle measuring mode.

### Switching Maximum or Minimum Value

At all ranges, press the “**MAX/MIN**” button one time, the meter can be set to maximum value measuring mode; press the button twice, the meter can be set to minimum value measuring mode; press the button three times, the meter will get back to normal test mode, and the maximum and minimum value will be recorded by the chip.



Press the “MAX/MIN” button more than one second or press the “RAN” button, the meter will get back to normal test.

Note:

During measuring maximum or minimum value, the meter will be set to manual mode automatically.

During working at frequency or duty measuring function, the meter can't be changed into maximum or minimum value measuring mode.

### Switching Functions

AC A range

Press the “SEL” button, the meter will get into inrush current test mode.

If press the “SEL” button again, the meter will get into inrush current test mode again.

Press the “SEL” button more than one second or press the “RAN” button, the meter will get back to normal test mode.

DC A range

Press the “SEL” button, the meter will get into zero.

If press the “SEL” button again, the meter will get into zero again.

Press the “SEL” button more than one second or press the “RAN” button, the meter will get back to the normal test mode.

Press the “SEL” button to switch between AC and DC measurement at the voltage ranges.

Press the “SEL” button to switch among resistance, diode and continuity ranges.

### Back Light and Clamp Lighting Bulb



Press the “HOLD/B.L” button for two or more seconds to switch on the back light if the light in the environment is too dim for taking reading, which will last for 30 seconds.



During the back light is working, press the “HOLD/B.L” for two or more seconds, it will be turned off.

At the current range, when the back light switched on, the clamp lighting bulb will be turned on at the same time.

Note:

LED, which requires a larger working current, is the main source of back light. Although the meter is equipped with a timer set at 30 seconds (i.e. the back light will be off automatically after 30 seconds), frequent use of the back light will shorten the life of the batteries. Therefore, do not use the back light unless necessary.

When the battery voltage is  $\leq 3.7V$ , the symbol “” (battery low) will appear on the LCD. When the back light is on, even if the batter is  $\geq 3.7V$ , the “” may appear

because of its large working current which will cause the voltage to drop. (The accuracy of the measurement cannot be assured when “” symbol appears.) In this case, you need not replace the batteries yet. Normally, the batteries can last until the “” appears when the back light is not being used.


### Auto Power Off


If there is no any operation within any thirty minutes after power is on, meter will auto power off.

After auto power off, if press the “SEL” button, meter will recover the working condition.

Press both power on and one of “MAX/MIN” or “RAM” or “Hz/%” button at the same time more than one second for exiting auto power off function.

### Preparation for Measurement

Switch on the power by turning the rotary selector. If the battery voltage is lower than 3.7V, the “” symbol will appear and the batteries should be replaced.

The “” symbol shows that the input voltage or current should not exceed the specified value in order to protect the internal circuit from damage.


Turn the rotary selector to the required function and range to be measured. Under the manual mode, choose the highest range when the value scale to be measured is unknown.

Connect the common test lead first and then the charged test leads when making connection. Take away the charged test lead first when disconnecting.

### Measuring AC Current

#### WARNING

Beware of electrocution.  
Ensure that the test leads are disconnected from the meter before making current clamp measurement.

Set the rotary selector to the A  range position.

Auto range mode or manual range mode can be selected by pressing the “RAN” button.

Press the trigger to open jaw. Fully enclose only one conductor.

Take the reading on the LCD.

Note:

Do not put more than one cable into the jaw during test; otherwise incorrect test value might be obtained.


For optimum results, center the conductor in the jaw.

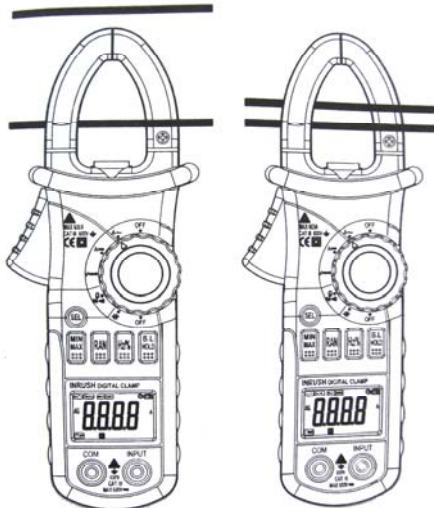
At the manual range mode, when only ‘OL’ is shown on the LCD, it means the measurement has exceed the range. A higher range should be selected.





Under the manual range mode, when the scale of the value to be measured is unknown beforehand, set the range to the highest.

“” means the maximum input current is 600A rms AC.




Correct Incorrect  
Figure 3. Correct and Incorrect

#### Measuring Inrush Current

##### WARNING

Beware of electrocution.  
Ensure that the test leads are disconnected from the meter before making current clamp measurements.

Set the rotary selector to the **A**  range position.

Press the trigger to open jaw. Fully enclose only one conductor.

Press the “**SEL**” to enter the INRUSH current measurement mode. Then LCD display “- - - -” until the motor starting up and being detected. Then detection will be done only one time and the output reading will be hold.

Take the reading on the LCD.


Note:

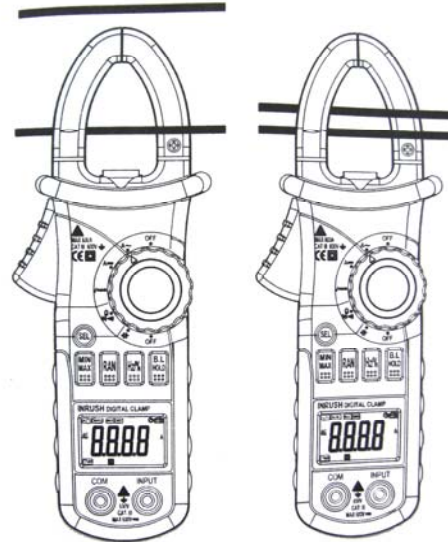
Do not put more than one cable into the jaw during test; otherwise incorrect test value might be obtained.

For optimum results, center the conductor in the jaw.

At the manual range mode, when only ‘OL’ is shown on the LCD, it means the measurement has exceeded the range. A higher range should be selected.

Under the manual range mode, when the scale of the value to be measured is unknown beforehand, set the range to the highest.

“” means the maximum input current is 600A rms AC.




Correct Incorrect  
Figure 4. Correct and Incorrect

#### Measuring DC Current

##### WARNING

Beware of electrocution.  
Ensure that the test leads are disconnected from the meter before making current clamp measurements.

Set the rotary selector to the **A**  range position.

Auto range mode or manual range mode can be selected by pressing the “**RAN**” button.

Press the “**SEL**” button, the meter will be set to zero.

Press the trigger to open jaw. Fully enclose only one conductor.

Take the reading on the LCD.

Symbol “-” will be displayed on the LCD if the direction of the current is negative.


Note:

Do not put more than one cable into the jaw during test, otherwise incorrect test value might be obtained.

For optimum results, center the conductor in the law.

At the manual range mode, when only ‘OL’ or ‘-OL’ is shown on the LCD, it means the measurement has exceeded the range. A higher range should be selected.

Under the manual range mode, when the scale of the value to be measured is unknown beforehand, set the range to the highest.

“” means the maximum input current is 600A DC.

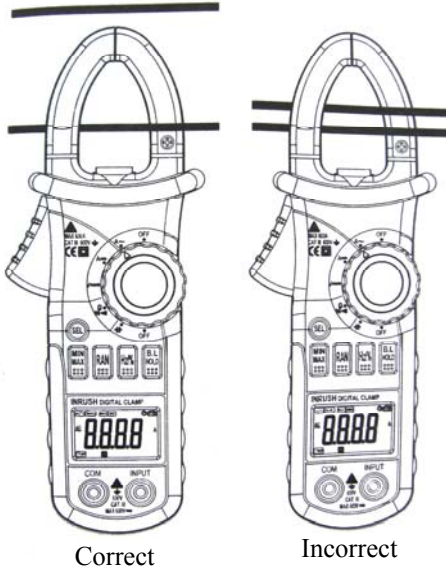


Figure 5. Correct and Incorrect

If the test result is more than 610V rms AC, symbol “OL” will be displayed on LCD and the build-up buzzer will sound.



Figure 6. Measuring AC Voltage

### Measuring AC Voltage

#### ⚠ WARNING

Beware of electrocution.  
Pay special attention to avoid electric shock when measuring high voltage.  
Do not input the voltage which more than 600V rms AC.

Plug the black test lead into the **COM** jack and the red test lead into the **INPUT** jack.

Set the rotary selector to  $\text{V} \sim$  position to make the meter get into AC V range.

Auto range mode or manual range mode can be selected by pressing the “**RAN**” button.

Connect the test leads to the voltage source or load terminals for measurement.

Take the reading on the LCD.

Note:

At small voltage range, unsteady readings may appear before the test leads contact the circuit. This is normal because the meter is highly sensitive. When the test leads contact the circuit, the true reading will be shown.

At the manual range mode, when only ‘OL’ is shown on the LCD, it means the measurement has exceeded the range. A higher range should be selected.

At the manual range mode, when the scale of the value to be measured is unknown beforehand, select the highest range first and lower the range gradually.

“⚠” means the maximum input voltage is 600V rms AC.

### Measuring DC Voltage

#### ⚠ WARNING

Beware of electrocution.  
Pay special attention to avoid electric shock when measuring high voltage.  
Do not input the voltage which more than 600V DC.

Plug the black test lead into the **COM** jack and the red test lead into the **INPUT** jack.

Set the rotary selector to at the  $\text{V} \sim$  range position.

Press the “**SEL**” button to turn to DC V range. Auto range mode or manual range mode can be selected by pressing the “**RAN**” button.

Connect the test leads to the voltage source or load terminals for measurement.

Take the reading on the LCD. The polarity symbol denotes the polarity of the end connected by the red test lead.

At small voltage range, unsteady readings will appear before the test leads contact the circuit. This is normal because the meter is highly sensitive. When the test leads contact the circuit, the true reading will be shown.

Under the manual range mode, when only ‘OL’ or ‘-OL’ is shown on the LCD, it means the measurement has exceeded the range. A higher range should be selected.

Under the manual range mode, when the scale of the value to be measured is unknown beforehand, select the highest range first and lower the range gradually.

“⚠” means the maximum input voltage is 600V DC.





If the test result is more than 610V DC, symbol “OL” will be displayed on LCD and the build-up buzzer will sound.

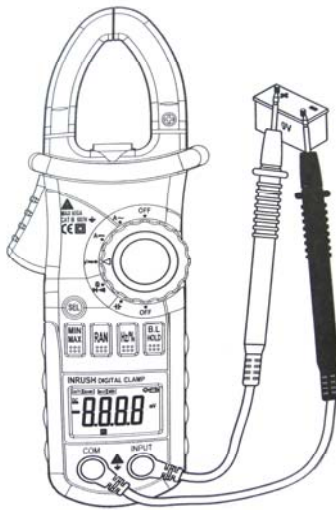


Figure 7. Measuring DC Voltage

### Measuring Frequency

By A range (from current clamp):

#### ⚠ WARNING

Beware of electrocution.

Ensure that the test leads are disconnected from the meter before making current clamp measurements.

Do not put more than one cable into the jaw during test; otherwise incorrect test value might be obtained.

Frequency test range is 10Hz-1 kHz. '00.0' will be displayed on LCD if the test frequency is lower than 10.0Hz. It is possible to test the frequency which is higher than 1 kHz but the tolerance of the test result cannot be ensured.

“⚠” means the maximum input current is 600A rms AC.

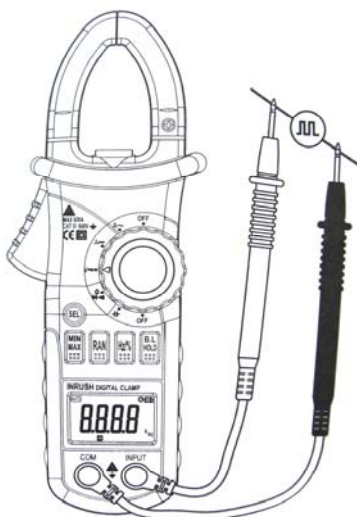
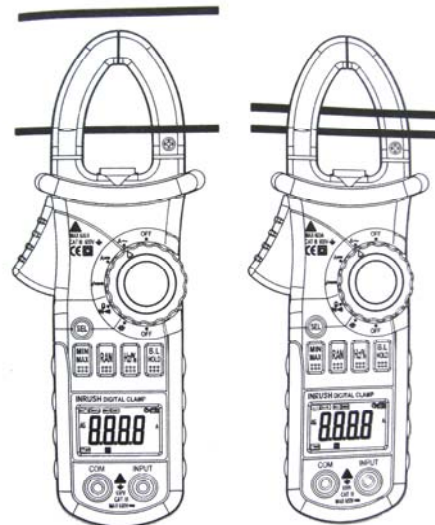


Figure 9. By V Range



Correct

Incorrect

Figure 8. Correct and Incorrect

By V range:

#### ⚠ WARNING

Beware of electrocution.

Pay special attention to avoid electric shock when measuring high voltage.

Do not input the voltage which more than 600V rms AC.

Plug the black test lead into the **COM** jack and the red test lead into the **INPUT** jack.

Set the rotary selector to the  $\text{V} \sim$  range position.

Press the “Hz/%” to switch to frequency measurement.

Connect test leads to the two ends of the source or load for measurement.

Take the reading on the LCD.

Note:

Frequency test range is 10Hz-10 kHz. '00.0' will be displayed on LCD if the test frequency is lower than 10.0Hz. It is possible to test the frequency which is higher than 10 kHz but the tolerance of the test result cannot be ensured.

“⚠” means the maximum input voltage is 600V rms AC.

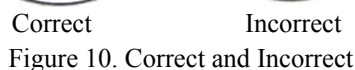


Figure 10. Correct and Incorrect



Figure 12. Measuring Resistance


#### Measuring Resistance

##### **WARNING**

Beware of electrocution.

When measuring in-circuit resistance, make sure that the power of the circuit under test has been turned off and that all capacitors have been fully discharged.

Plug the black test lead into the **COM** jack and the red test lead into the **INPUT** jack.

Set the rotary selector to the  $\Omega$   range position to make the meter get into AC V range.

Auto range mode or manual range mode can be selected by pressing the “**RAN**” button.

Connect the test leads to the ends of the resistor or circuit for measurement.

Take the reading on the LCD.

Note:

At the manual range mode, when ‘OL’ is shown on the LCD, it means the measurement has exceeded the range. A higher range should be selected.

When the input is open, ‘OL’ will appear on the LCD to indicate that the range has been exceeded.


For measuring resistance above  $1M\Omega$ , it may take a few seconds to get a steady reading. This is normal for high resistance reading.



Figure 13. Testing Diode

#### Testing Diode

Plug the black test lead into the **COM** jack and the red test lead into the **INPUT** jack.

Set the rotary selector to the  $\Omega$   range position.

Press the “**SEL**” button to switch to  test.

Connect the red test lead to the anode and the black test lead to the cathode of the diode for testing.

Take the reading on the LCD.

Note:

The meter will show the approximate forward voltage drop of the diode.

When the test leads have been reversed or open, ‘OL’ will appear on the LCD.



Figure 14. Testing Continuity


#### Testing Continuity


##### ⚠ WARNING

Beware of electrocution.

Make sure that the power of the circuit has been turned off and the capacitors have been fully discharged before testing the continuity of a circuit.

Plug the black test lead into the **COM** jack and the red test lead into the **INPUT** jack.

Set the rotary selector to the  $\Omega$   range position.

Press the “**SEL**” button to switch to  continuity test.

Connect the test leads to the two ends of the circuit for measurement.

If the resistance of the circuit being tested is less than  $30\Omega$ , the built-in buzzer will sound.

Take the reading on the LCD.

Note:

If the test leads are open or the resistance of the circuit is over  $660\Omega$ , “OL” will appear on the LCD.



Figure 15. Measuring Capacitance


#### Measuring Capacitance

##### ⚠ WARNING

Beware of electrocution.

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

Plug the black test lead into the **COM** jack and the red test lead into the **INPUT** jack.

Set the rotary selector to the  range position.

After fully discharged the capacitor, connect the test leads to the two ends of the capacitor for measurement.

Take the reading on the LCD.

Note:


It may take some time (about 10 seconds for the 66mF range) for steady readings when measuring high capacity.

#### MAINTENANCE

##### 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.

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.

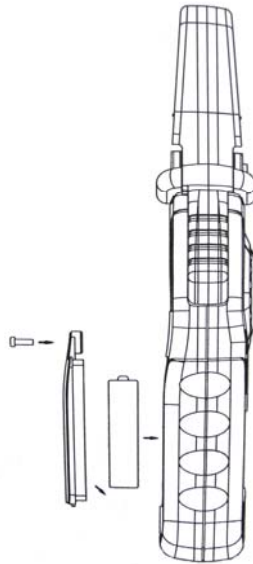


Figure 16. Replacing Test Leads

#### Replacing Test Leads

The replacement must be test leads in good working condition with the same or equivalent rating: 1000V 10A

A test lead must be replaced if the insulation layer has been damaged, e.g. the wire inside is exposed.

#### ORDERING INFORMATION

Table 14. Unit Price

Part#	Unit Price
MS2108	\$63.84

#### NOTICE

1. ATI reserves the right to make changes to its products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete.
2. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgment, including those pertaining to warranty, patent infringement, and limitation of liability. Testing and other quality control techniques are utilized to the extent ATI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.
3. Customers are responsible for their applications using ATI components. In order to minimize risks associated with the customers' applications, adequate design and operating safeguards must be provided by the customers to minimize inherent or procedural hazards. ATI assumes no liability for applications assistance or customer product design.
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