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Chapter 1

Meter Safety Standards

This style of digital multimeter is designed and manufactured according to the safety requirements set out by the IEC1010-1 standards for electronic test instruments and the hand-held digital multimeters. Its design and manufacture is strictly based on the provisions in the 1000V CAT III of IEC1010-1 and the Stipulation of 2-Pollution Grade.

The meter conforms to the European Union's following requirements:89/336/EEC

(EMC Electromagnetic Compatibility),73/23/EEC(LVD Low Voltage Protection)and 93/68/EEC(CE Mark).



Warning

- Before use of the meter firstly check up if there is any crack on the outer shell or if it lacks any plastic part, and check up whether the testing line is damaged or has any exposed metal. The meter can be used only if no any insulating problem be found.
- Carefully read the operating methods and safety prompts in this manual. Using it not based on the methods specified in this manual may cause the meter damaged.
- Non-normal meter must not be used. It should be sent for repairing.
- The meter must not be used in an environment with combustible gases, steam or dust pollution.
- It should be careful to work when measuring votage higher than 30Vac(effective value)or 50Vdc for such voltage having the risk of shock. Avoid the body directly touching ground or any metal substance in which there may be ground

Safety Information

potential during measuring. The body should be kept insulated from ground with dry insulating shoes, insulating pads or insulating clothes.

- When performing measurement with a test probe your fingers should be put behind a finger-protector.
- Must not try to measure a voltage higher than 1000VAC or 1000VDC, the meter may be damaged and the operator's safety may be threatened if the limit for voltage measurement be exceeded.
- when the symbol for electric insufficiency appearing on the display screen it is necessary to replace the batteries for avoiding the possible shock or injure resulted in by erroneous reading.
- In case of replacing batteries, it is necessary firstly to pull out the testing line. AA batteries should be used and they should be put into the meter with the proper polarity.
- Must not make any voltage measurement when the testing line being inserting into the current hole.
- Repair and calibration of the meter must be carried out by experienced professionals, unprofessionals should not repair and calibrate the meter by themselves.

Limited Guarantee and the Liability Scope

This company will undertake repairs freely for any quality problem of the meter which if should be found within 18 months from the date at which it was bought, but which not including replacement of fuse and batteries as well as any damage caused by negligence, wrong use, pollution, change of circuit and non-normal use.

For maintenance beyond the 18-month guarantee period, the company will charge a certain repair fee and materials cost.

Chapter 2

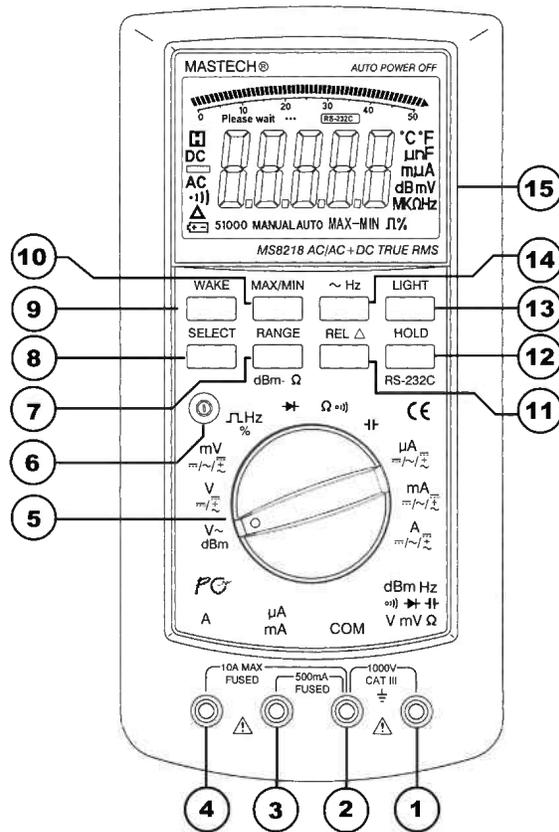
Characteristics

- 50000 counts measurement
- ACV and DCV measurements reach up to 1000V.
- DC measurement accuracy reaches up to 0.03%.
- 0.01 Ω resistance resolution and 1 μ V voltage resolution.
- Linear frequency measurement, logic frequency/duty ratio measurement.
- Capacitance measurement from 0.01nf to 5000 μ F.
- AC/DC true RMS measurement.
- DBm measurement
- Maximum value/minimum value measurement, Relative measurement.
- 50-segment analog bar display.
- Automatic shutdown/continuous working mode selection.
- Back light control.
- RS-232C infrared interface.
- Display, record and graphics software of computer.
- Overload protection.
- Sound alarm for wrong current measurement.
- Secondary plasticizing meter shell, with insulating performance reaching 1000V CAT III

MS8218 True RMS Multimeter
Introduction to the Meter

Explanation on Front Panel

The front panel is shown as in Figure 2-1, explanation being as follows:



(1) V Ω Hz end

It is the input end for all measurement functions except for current measurement, connected with a red meter probe.

(2) COM end

It is the negative input end for all measurements, connected with a black meter probe.

(3) μ A/mA end

It is the positive end for measurement of μ A or mA current, connected with a red meter probe.

(4) A end

It is the positive input end for measurement of 0.5A-10A current, connected with a red meter probe.

(5) Rotary switch

Used for selecting measurement functions such as voltage, current, resistance and Capacitance.

(6) POWER switch

Used for putting on or off the operating power for the meter.

(7) RANGE key

For various kinds of measurements it is used manually to select range. Under the automatic range state (AUTO displaying), it will enter manual range state (MANUAL displaying) with a press on RANGE, after that the range will be changed with a press on RANGE while the small digits on the left lower corner indicating the actual range. When the RANGE key being released after pressing for two seconds the meter will return back to the automatic state. When performing logic frequency measurement and diode measurement pressing RANGE will be void. During dBm measurement, pressing RANGE key will alter the virtual resistance value for calculating dBm.

(8) SELECT key

When setting the rotary switch to a measurement function, the meter will enter its first measurement mode, while pressing the SELECT key it is possible to select the second or the third measurement mode. However, there is only one for the diode and Capacitance measurements.

(9) WAKE key

After the meter being automatically shutdown, by pressing the WAKE key it can be woken up to resume the measurement. In case of pressing POWER switch (for putting on the unit) and WAKE key simultaneously, the meter will in a continuously working state without the automatic shutdown function.

(10) MAX/MIN key

Press MAX/MIN key to enter the record state for the maximum and minimum value and simultaneously display the maximum value. By pressing this key again it will be possible to display the minimum value and the maximum value-minimum value. When releasing the key after pressing it for two seconds, the maximum and minimum record state will be exited. Pressing this key will be void during frequency, diode measurement.

(11) REL Δ key

By pressing REL Δ to enter the relative measurement state, the meter will remember the value measured at the time when pressing the key (it is called the initial value), and after that the value displayed in the meter will be equivalent to the present value – the initial value. By pressing the key again the relative measurement state will be exited. Pressing the key will be void during the frequency and diode measurements.

(12)HOLD key

Used to maintain the measurement data unchanging, by pressing the key again it will resume the measurement. When releasing the key after pressing it for two seconds, the meter will enter the state connecting with the RS-232C interface of computer while sending measurement information to computer. When releasing the HOLD key after pressing it for two seconds again, it will stop to send data to the RS-232C interface.

(13)LIGHT key

By pressing this key for a time, the backlight of the LCD screen will be opened and after five seconds the meter will automatically turn off the backlight. It is also possible to turn off the backlight by pressing the LIGHT key before the five seconds.

(14) \sim Hz key

During the voltage or current measurements, by pressing \sim Hz key the meter will enter the linear frequency measurement state. At this time what being measured is the frequency of voltage or current. By pressing this key again it will exit the linear frequency measurement state.

(15)LCD screen

Used for displaying the measuring results and various symbols.

Understanding Display Screen :

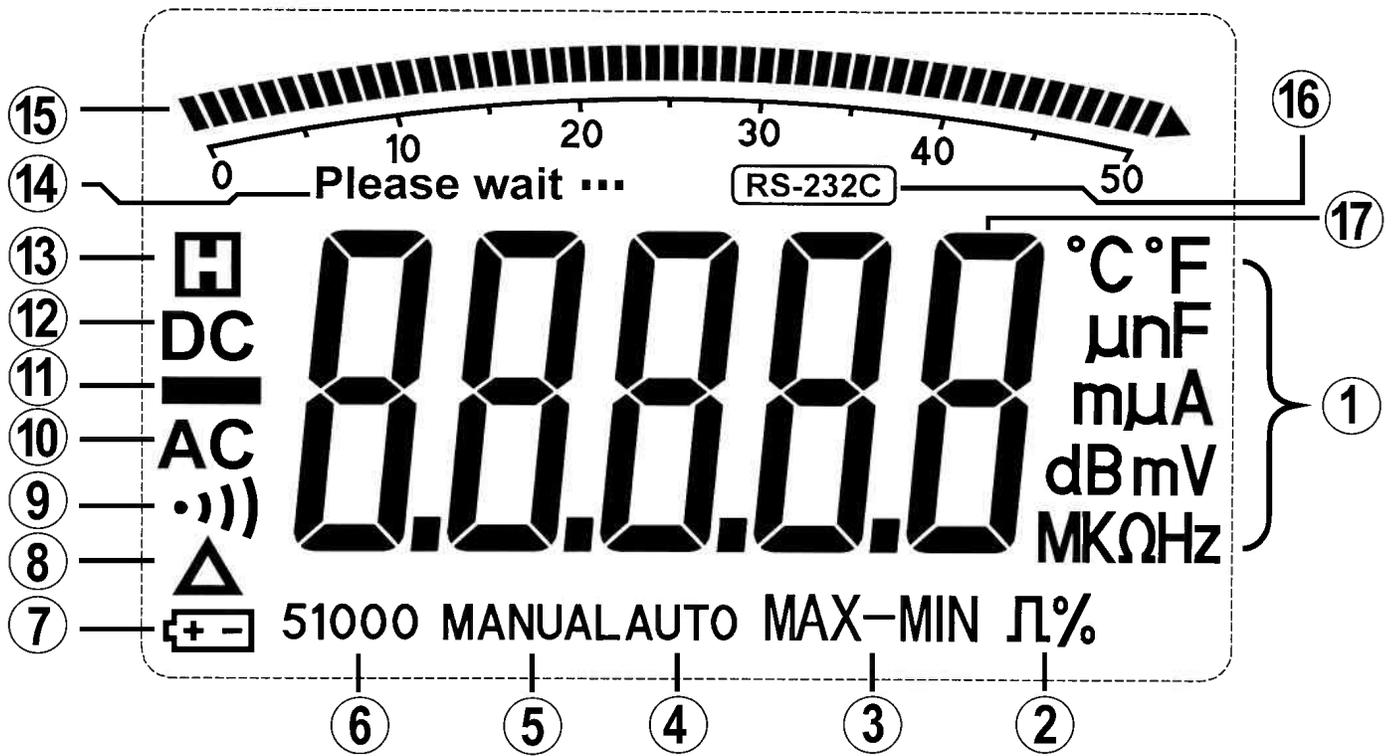
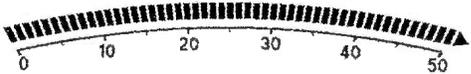


Figure 2—2

LCD screen is shown as in Figure 2-2, with its every symbol's meaning shown as in the Table 1:

Number of Order	Symbol	Functions
1	°C °F	Indicating the measurement unit being °C or °F of temperature
1	mnF	Indicating the measurement unit being μ F or nF of Capacitance
1	m μ A	Indicating the measurement unit being μ A, mA or A of current
1	dBmV	Indicating the measurement unit being dBm of power or mV and V of voltage
1	MKΩHz	Indicating the measurement unit being MΩ, KΩ and Ω of resistance or MHz, KHz and Hz of frequency
2	 %	Indicating the measurement unit being the duty ratio of logic impulse
3	MAX-MIN	Indicating the display value being the maximum value(MAX), the minimum value(MIN) or the maximum value-the minimum value(MAX-MIN)
4	AUTO	Indicating the measurement being automatic range
5	MANUAL	Indicating the measurement being manual range
6	51000	Indicator of range, indicating the full range value of this range in manual range such as 5, 50, 500 and 1000, 5000, etc.
7		Indication to low voltage of the batteries, showing the energy of batteries will be exhausted soon
8		Indicating the measurement being relative measurement while the displayed value being relative value
9	•)))	Indicating it is now performing the continuity measurement

Tabell (continue)		
10	AC	Indicating it is now in the AC measurement state, while DC and AC displaying simultaneously, indicating it is DC+AC measurement
11	—	Indicating the measurement vale being negative
12	DC	Indicating it is now in the DC measurement state, while DC and AC displaying simultaneously, indicating it is DC+AC measurement
13	H	Indicating it is now in the data-holding state
14	Please Wait ...	When measuring 50 μ F~5000 μ F capacitor under automatic range, for ensuring the accuracy of measurement, it is necessary to perform the measurement after fully discharging capacitor while prompting the operator to wait
15		Analog bar, indicating the measurement value with a graphic mode
16	RS-232C	Indicating the meter being in the state for sending data to the RS-232C interface of computer
17		The display zone for the meter's measurement value, showing all the measurement values

Function Descriptions

Along with the conventional measurement functions this meter also possesses some special functions which being described as follows:

- True effective value (TRUE RMS) measurement: all the measurement values of this meter on the AC voltage and AC current are true effective values, which distinguishing this meter from the low-grade meters which only can measure the AC average value.
- dBm measurement: dBm measurement is a value calculated and displayed under the current AC voltage, with a virtual resistance R obtained through RANGE key and according to the following formula: $10 \log_{10}(1000V^2/R)$
It is the AC power expressed in the logarithmic form.
- DC+AC measurement: when measuring voltage or current having both the AC and the DC components, in case of selecting the DC+AC measurement mode, this meter will perform measurements on both DC and AC components respectively and then calculate and display the results according to the following formula: $\sqrt{DC^2 + AC^2}$
DC+AC measurements reflect the general effective values generated jointly by both the DC and AC components.
- Automatic and manual ranges: When turning on the meter's power switch the meter defaults the automatic range state(AUTO displaying), and simultaneously it will automatically select the proper range according to the measured electric parameters. If OL being displayed under automatic range, it indicates the measured value exceeding the meter's maximum range. Pressing the RANGE key under the automatic range the meter will enter the manual range(MANUAL displaying), then pressing the RANGE key again it will be possible to select the required range. The indicator for range will display the maximum value of this range. If OL displaying under the manual range, it indicates the measured value exceeding the

Introduction to the Meter

selected range. Press the RANGE key under the manual range for two seconds and then release it, the meter will go back to the automatic range state.

- Linear frequency measurement: Pressing the \sim Hz key when the meter performing measurements on AC voltage or current as well as on mixture signal of AC and DC, it will be capable to measure the frequency of the AC component. However it has a certain requirements on the amplitude of the AC component.
- Logic impulse duty ratio measurement: logic impulse duty ratio refers to: $(\text{high level width/impulse cycle}) \times 100\%$
- Diode measurement: during diode measurement the meter is indicating to the forward voltage drop of the diode
- Relative measurement: during relative measurement the meter remembers internally the instantaneously measured value(called initial value)when pressing the REL Δ key, and the later displaying value being:

present value – initial value

The relative measurement value reflects the changes of the measured value. It also can be used to take off the errors brought about by lead resistance or distributed capacitance during measuring low resistance and low capacitance. Due to subtraction calculation, negative value may appear during measuring AC current, resistance and capacitance.

- Maximum/minimum value measurement: by pressing MAX/MIN keys the meter can enter the maximum/minimum value record state, and it will continuously update the maximum/minimum values based on the new measurement results. Pressing the MAX/MIN key can display the maximum value, the minimum value and the maximum value-the minimum value in cycles. After exiting the MAX/MIN measurement state the recorded maximum value/minimum values will disappear.

- Automatic shutdown and the continuous operating mode: after the meter being turned on, in case of stopping to pressing any key or stopping to turning the rotary switch for more than fifteen minutes, the meter will automatically shutdown. As the meter will still consume a little energy after its automatic shutdown, so it is better to turn off the POWER switch if the meter remains idle for a long time. If you want the meter to operate continuously without automatically turning off, it can be done only just by pressing down the WAKE key at the same time when turning on the POWER switch.
- Low voltage detection: when the meter detecting the total voltage of the batteries lower than 6.8V, the  symbol on the LCD screen will be lighted to prompt the batteries should be replaced.
- Analog indication bar: analog indication bar is used for graphic measurement value and it always synchronizes with the size of the present measured value. During the maximum value/minimum value measurement and the relative value measurement it still synchronizes with the size of the present measured value, and not indicating the maximum value/minimum value or the relative value.
- RS-232C interface: press the HOLD key for two seconds and then release it, the meter will open the infrared interface for sending the measured data and status to the RS-232C interface of computer. Equipped with record and graphic software (options)the meter can display, record and describe the measured electric quantity on computer. As the data transmission between the meter and computer is depending on light coupling, so measurement of high voltage will not affect the safety of computer.

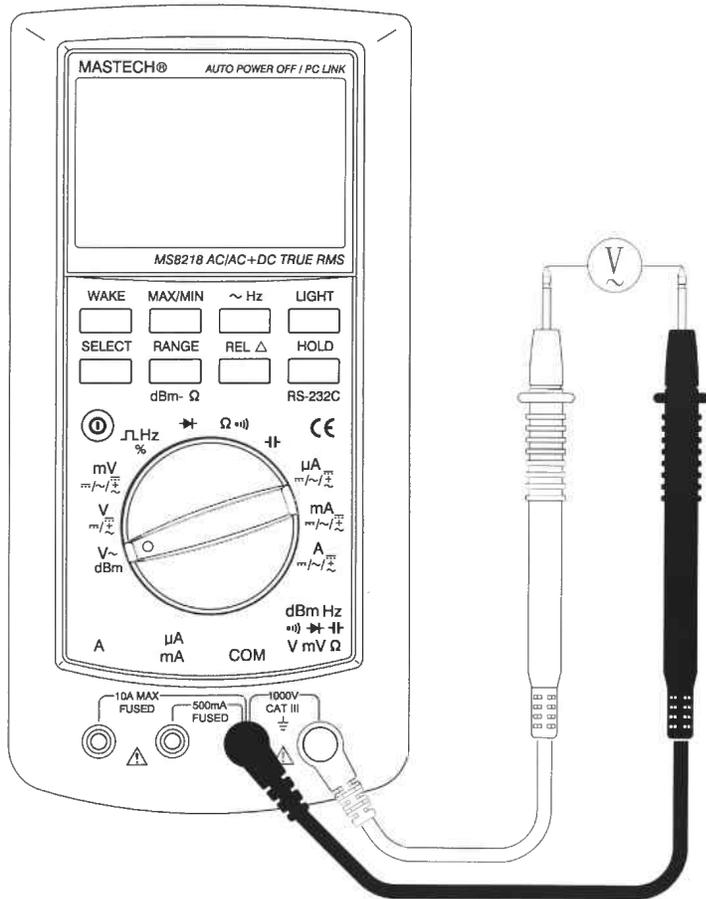
Chapter 3 Operation Methods

ACV/dBm Measurement

The measurement is shown as in Figure 3-1, with voltage range being of AC 0.5V~1000V and the measurement methods being as follows:

1. Turn on the power switch and set the rotary switch to the position of $V\sim/dBm$.
2. Insert the red and black testing lines into **VΩHz** end and **COM** end respectively.
3. Select the **ACV** or **dBm** measurement mode with the **SELECT** key.
4. Connect the meter to the two ends of the measured voltage with the red and black probes.
5. Read the meter's data from the display screen. When OL displaying on the meter, it indicates the measured voltage exceeding the meter's range and it is necessary to remove both the red and black probes from the measured circuit immediately.
6. By pressing the **RANGE** key it is possible to select range manually. Indicator of range displays range. While displaying OL during manual range measurement, it is necessary to select a larger range. When OL displaying under the maximum range, it indicates the voltage exceeding 1000V,so it is necessary to remove both the red and black probes from the measured circuit immediately.
7. To perform dBm measurement, press the **RANGE** key to select the resistance value needed for calculating dBm,there are 4,8,16,32,50,75,93,110,125,135,150,200,250,300,500,600,800,900,1000 and 1200 ohms being possible to be selected respectively.

Notes: in case of probe hanging in the air, the voltage inducted by the testing line may cause unstable readings on the display screen, but that will not affect the accuracy of measurement.



ACV/dBm Measurement

Warning
Not try to measure
a voltage higher then
1000 volt

Figure 3-1

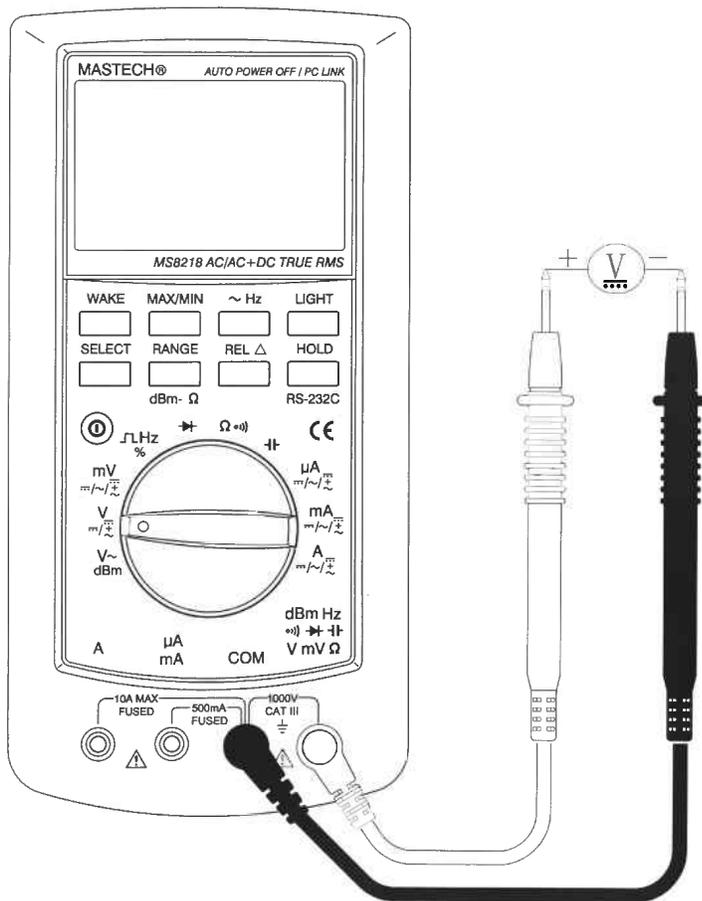
Operation Methods

DCV/DCV + ACV Measurement

The measurement is shown in Figure 3-2, the range of voltage is of AC or DC 0.5V~1000V and the methods are as follows:

1. Turn on the power switch and set the rotary-table switch to the position **V** $\overline{\sim}$ / $\overline{\sim}$.
2. Insert the red testing line into the **V Ω Hz** end and the black testing line into the **COM** end.
3. Press **SELECT** key to select **DCV** or **DCV + ACV** measurement mode.
4. When performing DCV measurement, connect the red probe to the positive polarity of the measured voltage and the black probe to the negative polarity of the measured voltage. While performing DCV + ACV measurement, it will be done by connecting the red probe and the black probe into the two ends of the measured voltage.
5. Read the measured value from the display screen. If OL displaying on the meter, it indicates the measured voltage exceeding the range of the meter and it is necessary to remove the both red and black probes from the measured circuit immediately.
6. When performing DCV measurement, by pressing the **RANGE** key it is possible to select range manually. The indicator of range indicates the range value. If OL displaying during manual range measurement, it is necessary to select a larger range. If OL displaying under the maximum range, it indicates the voltage exceeding 1000V and it is necessary to remove the both red and black probes from the measured circuit immediately. When performing DCV + ACV measurement automatic range will be held and it is null to press the **RANGE** key.

Notes: in case of probe hanging in the air, the voltage inducted by the testing line may cause unstable readings on the display screen, but that will not affect the accuracy of measurement. When performing DCV + ACV measurement it will be relatively slow to refresh the measured data as it needs time to switch AC and DC measurements and to calculate RMS.



DCV
DCV + ACV Measurement

⚠ Warning
Not try to measure
a voltage higher then
1000 volt

Figure 3-2

Operation Methods

DC mV/AC mV/DC mV+AC mV Measurement

The testing chart is shown in the Figure 3-3. The voltage measurement range is of $1\ \mu\text{V}\sim 500\text{mV}$ and the measurement methods are as follows:

1. Turn on the power switch and set the rotary switch to the position **mV** $\overline{\sim}$ / $\overline{\sim}$ / $\overline{\sim}$.
2. Insert the red testing line into the **V Ω Hz** end and the black testing line into the **COM** end.
3. Press the **SELECT** key to select **DCmV** or **ACmV** or **DCmV + ACmV** measurement modes.
4. When performing **DCmV** measurement, connect the red probe to the positive polarity of the measured voltage and the black probe to its negative polarity. While performing **ACmV** or **DCmV + ACmV** measurement, it will be done by connecting the red probe and the black probe into the two ends of the measured voltage.
5. Read the measured value from the display screen. If **OL** displaying on the meter, it indicates the measured voltage exceeding the range of the meter and it is necessary to remove both the red and black probes from the measured circuit immediately.
6. When performing **DCmV** or **ACmV** measurement, by pressing the **RANGE** key it is possible to select range manually. The indicator of range indicates the range value. If **OL** displaying during manual range measurement, it is necessary to select a larger range. If **OL** displaying under the maximum range, it is necessary to remove both the red and black probes from the measured circuit immediately. When performing **DCmV + ACmV** measurement automatic range will be held and it is void to press the **RANGE** key.

Notes: In case of probe hanging in the air, the voltage inducted by the testing line may cause unstable readings on the display screen, but that will not affect the accuracy of measurement. When performing **DCmV + ACmV** measurement it will be relatively slow to refresh the measured data as it needs time to switch AC and DC measurements and to calculate RMS.



**DC mV/AC mV
DC mV+Ac mV Measurement**

Figure 3-3

Operation Methods

Logic Frequency/Duty Ratio Measurement

The testing chart is shown in the Figure 3-4. The frequency range is of 5Hz~2MHz (V_p 2.5~5V), while the duty ratio measurement range being of 5%~95%. And the measurement methods are as follows:

1. Turn on the power switch and set the rotary switch to the position \square Hz % .
2. Insert the red testing line into the **V Ω Hz** end and the black testing line into the **COM** end.
3. Press the **SELECT** key to select the logic frequency(Hz) or duty ratio(\square %) modes.
4. Connect the red testing line to high logic level, the black one to low logic level.
5. Read the measured value from the display screen. If the frequency of the measured signal is lower or higher than the meter's measurement range, the reading will be displayed as zero. If the amplitude of signal is too low or the low level is larger than 1 volt, the reading will also displayed as zero.
6. This measurement is of automatic range, it is null to press the **RANGE** key.



Logic Frequency Duty Ratio Measurement

Figure 3-4

Operation Methods

Diode Measurement

The measurement chart is shown in figure 3-5. The measurement range of diode is of 0~2.5V.

The measurement methods are as follows:

1. Turn on the power switch and set the rotary switch to the position .
2. Insert the red testing line into the **VΩHz** end and the black testing line into the **COM** end.
3. Connect the red probe to the positive polarity of the diode and the black probe to its negative polarity, while the display screen will display the forward voltage drop.
4. Connect the black probe to the positive polarity of the diode and the red probe to its negative polarity, if OL displaying on the display screen, it indicates the backward resistance of the diode being normal, while OL not displaying, it indicates that the diode is backward leaking.

Notes: In case of performing diode test on circuit board, it is necessary firstly to turn off the power of the circuit board and then perform the measurement. As there may be other parallel circuits, so the displayed value of test is not surely the results listed in items 3 and 4.

Diode Measurement

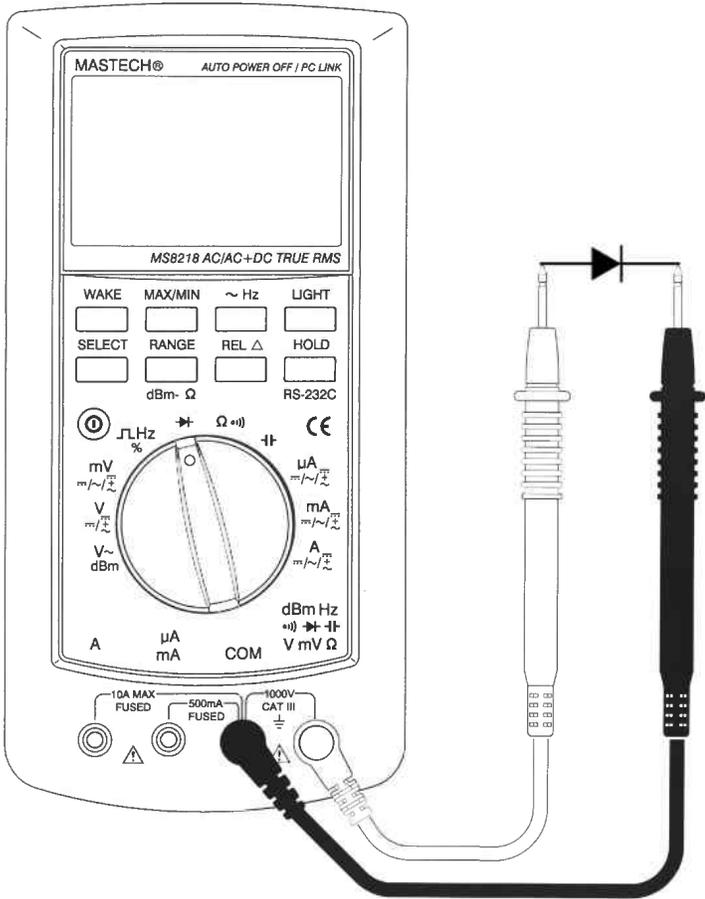


Figure 3-5

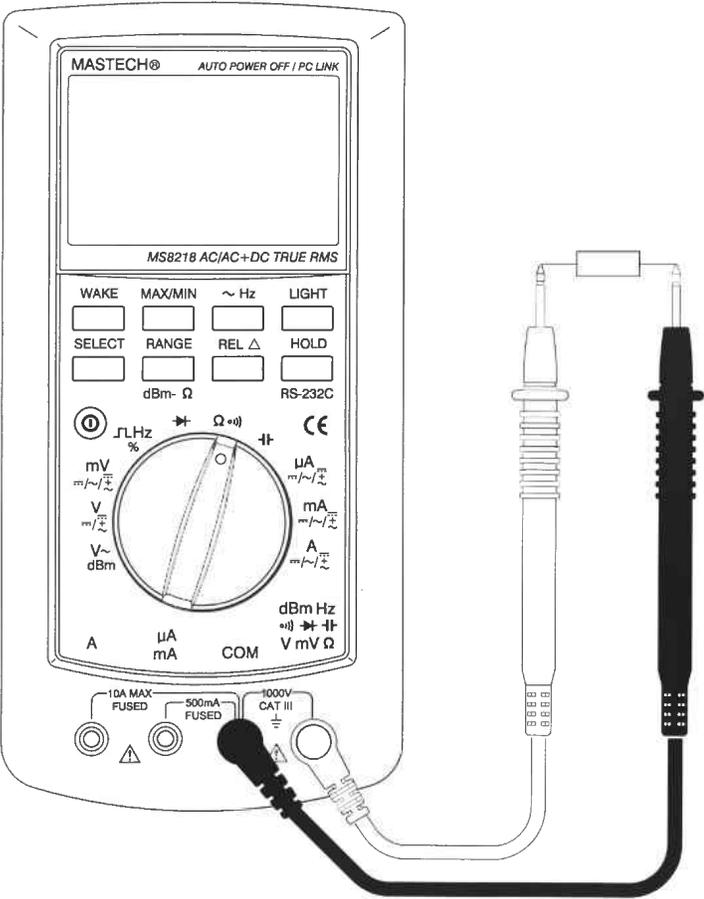
Operation Methods

Resistance/continuity Test

The test chart is seen in Figure 3-6. the measurement range of resistance is of $0.01\ \Omega \sim 50M\Omega$ and the measurement methods are as follows:

1. Turn on the power switch and set the rotary switch to the position $\Omega \bullet \bullet$.
2. Insert the red and black testing lines into the **VΩH** input end and the **COM** input end respectively.
3. Press the **SELECT** key to select resistance (Ω) or the continuity ($\bullet \bullet$) modes.
4. For the resistance measurement, connect the red and black probes to the two ends of resistor and read the resistance value from the display screen. If OL displaying, it indicates the resistor is larger than $50M\Omega$. As for the continuity measurement, connect the red and black probes to the two measured points respectively. In case of the resistance between the two points being less than about $50\ \Omega \sim 60\ \Omega$, the buzzer will sound while the display screen displaying the value of resistance. If OL displaying, it indicates the resistance between the two points is larger than $500\ \Omega$.
5. When the resistance measurement mode being implemented, it is possible to select range by pressing the **RANGE** key. The indicator of range indicates the value of range. If OL displaying during manual range measurement, it is necessary to select a larger range. Under the continuity measurement mode it is null to press the **RANGE** key.

Notes: In case of performing resistance or continuity test on circuit board, it is necessary firstly to turn off the power of the circuit board and then perform the measurement. As there may be other parallel circuits, so the displayed value of test is not surely the actual value of the resistor.



Resistance
Continuity
Measurement

Figure 3-6

Operation Methods

Capacitance Measurement

The measurement chart is seen in figure 3-7. the measurement range of capacitance is of 10PF~5000 μ F and the measurement methods are as follows:

1. Turn on the power switch and set the rotary switch to the position  .
2. Insert the red and black testing lines into the **V Ω Hz** input end and the **COM** input end respectively.
3. If exists voltage in the capacitor, connect the two ends of the capacitor for a short time to discharge.
4. Connect the red and black probes to the two ends of the capacitor, if the measured capacitor is heteropolar, it is necessary to connect the red probe to the positive polarity of the capacitor and the black probe to its negative polarity.
5. Read the capacitance from the display screen. If capacitance value >5300 μ F, the meter will display OL, while capacitance value <10PF,it will display zero.
6. It is possible to select range manually by pressing the **RANGE** key. The indicator of range indicates the value of range. If OL displaying during manual range measurement, it is necessary to select a larger range.If it has been the largest range, which means capacitance value >5300 μ F.

Notes: When performing measurement on 500 μ F—5000 μ F capacitor, in order to ensure measurement accuracy the meter takes a relative long time to discharge capacitor, so it is relatively slow in refreshing the measured value. In addition,not to perform Capacitance measurement on a circuit board on which there are other parallel devices, for that may leads to very large error.

Capacitance Measurement

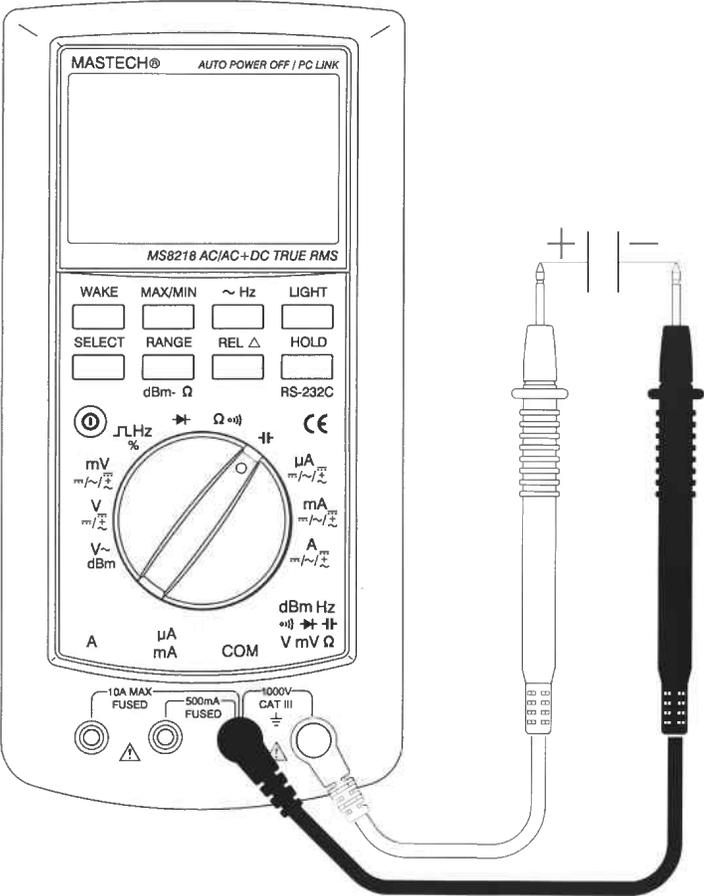


Figure 3-7

Operation Methods

DC μ A/AC μ A/DC μ A+AC μ A Measurement

The measurement is seen in Figure 3-8, the measurement range of current is of AC or DC 0.01 μ A~5000 μ A , and the measurement methods are as follows:

1. Turn on the power switch and set the rotary switch to the position **A** $\overline{\sim}$ / \sim / $\overline{\pm}$.
2. Insert the red testing line into the **mA/ μ A** input end and the black testing line into the **COM** input end.
1. Press the **SELECT** key to select the **Dc μ A**, **Ac μ A** or the **Dc μ A + Ac μ A** measurement modes.
2. Turn off the power of the measured circuit, connect the red and black probes to the measured circuit in serial way and then turn on the power of the measured circuit.
3. Read the measured value from the display screen. If it displays as positive during the DC measurement, it means the current is flowing into the meter from the red testing line, while it displaying as negative, it means the current is flowing into the meter from the black testing line. If it displays as OL, it means current exceeding range.
4. During measurement of **DC μ A or Ac μ A**, it is possible to select range manually by pressing the **RANGE** key. Under the DC μ A + Ac μ A measurement mode, automatic range is held and it is null to press the **RANGE** key.

Notes: Under the DC μ A + AC μ A measurement mode, it is relatively slow to refresh the measured data as it is needs time to switch AC and DC measurements and to calculate RMS.



DC μ A
AC μ A
DC μ A+AC μ A
Measurement

Figure 3-8

Operation Methods

DC mA/AC mA /DC mA + AC mA Measurements

The measurement is seen in the Figure 3-9. The measurement range of current is of AC or DC 1 μ A~500mA and the measurement methods are as follows:

1. Turn on the power switch and set the rotary switch to the position **mA** $\overline{\sim}$ / \sim / $\overline{\sim}$.
2. Insert the red testing line into the **mA/ μ A** input end and the black testing line into the COM input end.
3. Press the **SELECT** key to select the **DC mA**, **AC mA** or the **DC mA + AC mA** measurement modes.
4. Turn off the power of the measured circuit, connect the red and black probes to the measured circuit in a serial way and then turn on the power of the measured circuit again.
5. Read the measured value from the display screen. If it displays as positive during DC measurement, it means the current is flowing into the meter from the red testing line, while it displays as negative, it means the current is flowing into the meter from the black testing line. If it displays OL, indicating current exceeding range.
6. When performing **DC mA or AC mA** measurement, it is possible to select range manually by pressing the RANGE key. Under the **DC mA + AC mA** measurement mode the automatic range is held and it is null to press the **RANGE** key.

Notes: Under the **DC mA + AC mA** measurement mode, it is relatively slow to refresh the measured data as it needs time to switch AC and DC measurements and to calculate RMS.



DC mA
AC mA
DC mA+AC mA
Measurement

Figure 3-9

Operation Methods

DC Ampere/AC Ampere/DC Ampere + AC Ampere Measurement

The measurement is seen in Figure 3-10, the measurement range of current is of AC or DC 0.1mA~10A and the measurement methods are as follows:

1. Turn on the power switch and set the rotary switch to the position **A** $\overline{\sim}$ / \sim / $\overline{\sim}$.
2. Insert the red testing line into the **A** input end and the black testing line into the **COM** input end.
3. Press the **SELECT** key to select the **DC A**, **AC A** or **DC A + AC A** measurement modes.
4. Turn off the power of the measured circuit, connect the red and black probes to the measured circuit in a serial way and then turn on the power of the measured circuit again.
5. Read the measured value from the display screen. During the **DC** measurement, if it displays as positive, it means the current is flowing into the meter from the red testing line, while it displays as negative, it means the current is flowing into the meter from the black testing line. If it displays OL, it indicates current exceeding range.
6. When performing **DC A** or **AC A** measurement, it is possible to select range manually by pressing the Range key. Under the **DC A + AC A** measurement mode, automatic range is held and it is null to press the **RANGE** key.

Notes: Under the DC A + AC A measurement mode, it is relatively slow to refresh the measured data as it needs time to switch AC and DC measurements and to calculate RMS.



DC Ampere
AC Ampere
DC Ampere+AC Ampere
Measurement

Figure 3-10

Operation Methods

Linear Frequency Measurement

The measurement is seen in the Figures 3-1, 3-2, 3-3,3-8 and 3-9. The measurement range is of 5Hz~200KHz and the measurement methods are as follows:

1. When performing voltage or current measurement, in case of measured value being AC or including AC elements, it is possible to measure and display the alternating frequency by pressing the **~Hz** key. However it has a certain requirements for the amplitude of alternating signal and the meter has varied requirements for signal amplitude when it is in different ranges, for information of which please refer to Table 3—1.
2. If the position of rotary switch is in ACV or DCV, after pressing **~Hz** key the indicator of range will indicates the meter's present voltage range. In addition, it is possible to change the range by pressing the **RANGE** key to meet the different voltages.
3. Press **~Hz** key again to exit linear frequency

Table 3-1

Range	Sensibility(sine wave)
500mV	100mV
5V	0.5V
50V	4V
500V	40V
1000V	400V
5000 μ A	1mA
500mA	100mA

Notes: During ampere measurement, due to the very small sample resistor, and the very weak frequency signal produced, so only when current reaching as large as over 5A can the frequency be measured.

Relative Value Measurement

Except for frequency, duty ratio and diode measurements, all other measurements can employ relative measurement. Press **REL Δ** key to enter relative measurement and the meter will record the initial value when pressing the key. And the later displayed value is:

$$\text{Displayed value} = \text{present measurement value} - \text{Initial value}$$

Press **REL Δ** again to exit relative measurement. Changes of measurement value may be found in relative measurement which also can be used for the small resistance and the small capacitance measurements, for example, when performing resistance measurement, connect the red testing line and the black testing line in short, press the **REL Δ** key to record the values of resistance (resistance of both the red and black lines), and after that performing resistance measurement again the lead resistance will have been taken off from the displayed value. When performing capacitance measurement, open the red and black testing line, press **REL Δ** key to record the distributed capacitance, and after that performing capacitance measurement again, the distributed capacitance will have been taken off from the displayed value. During relative measurement, analog bar is always indicating the present measurement value but not the relative value. When measurement over, OL will display instead of showing the relative value.

Notes: When going to relative value measurement under DC+AC mode, press **REL Δ** immediately after the digits refresh.

Maximum Value/Minimum Value/Maximum Value-Minimum Value Measurement

Except for frequency and diode measurements, by pressing the **MAX/MIN** key the meter will enter the maximum value and minimum value record state and display the maximum value. The meter measures the present value and continuously judges if it is necessary to update the maximum or minimum value. Pressing the **MAX/MIN** key again it is possible to select displaying

Operation Methods

the minimum value, the maximum value — minimum value or the maximum value. When the meter being in the maximum and the minimum value record state, the analog bar is always indicating the present measurement value but not the MAX/MIN value. Under the maximum and minimum value record state, press the **MAX/MIN** key for two seconds and then release it, the meter will exit the MAX/MIN record state. When measurement over, OL will display instead of showing the MAX/MIN value.

Backlight Control

Pressing the **LIGHT** key, the LCD display screen's backlight will be lighted and after five seconds it will automatically go out. If press the **LIGHT** key again when the backlight is lighting, the backlight can be turned off in advance. Lighting the backlight will cause three-times higher energy consumption than the ordinary operation. So by less use of backlight, power can be saved.

Data Hold

By pressing the **HOLD** key it is possible to hold the measurement value and the state at the moment of pressing the **HOLD** key. While pressing the key again data measurement will be resumed.

Automatic Shutdown and Continuous Operation Mode Selection

After turning on power, the meter will in default enter the auto-shutdown timing state. Within 15 minutes after stopping to press any key or turn the rotary switch, the meter will automatically turn off. After auto-shutdown, by pressing the **WAKE** key or turning the rotary switch it is possible to wake the meter to resume operation. If you want the meter operates continuously without shutdown, it will be done by pressing the **WAKE** at the same time when turning on power.

Notes: After auto-shutdown there will still be a little electricity consumption in the meter, so it is recommended to turn off the power when the meter is to remain un-working for a long time.

Connected to Computer RS-232C Interface

Pressing the **HOLD** key for two seconds and then releasing it, the meter will begin to send the measured data and state to computer while the LCD display screen displaying **RS-232C**. Then it will be able to record、analyze、draw and print all the measurement on computer as long as you insert one end of the RS-232C cable (options) into the front socket of the meter and another end into the computer RS-232C interface and run the record and graphics software (options).And press the **HOLD** key for two seconds and then release it again, the meter will stop to send data to computer,symbol **RS-232C** on the LCD display screen will go out. When the meter sends data to computer it will cause the increase of the electricity consumption. So **RS-232C** should be turned off when no need to transmute data.

Range and Accuracy

The below-listed accuracies under different ranges refer to those which are guaranteed by the meter within one-year calibration, with normal use under the operating temperature of 18°C-28°C and relative humidity less than 80%.The presentation for accuracy is: \pm (**% reading digits + number of lower digits)

● **AC Voltage/DC Voltage + AC Voltage**

Range	Resolution	Accuracy		
		40Hz-1KHz	1KHz-10KHz	10KHz-20KHz
50mV	0.001mV	$\pm(0.5\% + 40)$	$\pm(1\% + 40)$	$\pm(2.5\% + 40)$
500mV	0.01mV	$\pm(0.5\% + 40)$	$\pm(1\% + 40)$	$\pm(2.5\% + 40)$
5V	0.1mV	$\pm(0.5\% + 40)$	$\pm(1\% + 40)$	$\pm(2.5\% + 40)$
50V	1mV	$\pm(0.5\% + 40)$	$\pm(1\% + 40)$	$\pm(2.5\% + 40)$
500V	10mV	$\pm(0.5\% + 40)$	$\pm(1\% + 40)$	unspecified
1000V	0.1V	$\pm(0.5\% + 40)$	unspecified	unspecified

Notes: above accuracies can be guaranteed within 10%-100% of the full range.

● **DC Voltage**

Range	Resolution	Accuracy
50mV	0.001mV	$\pm(0.03\%+10)$
500mV	0.01mV	$\pm(0.03\%+6)$
5V	0.1mV	$\pm(0.03\%+6)$
50V	1mV	$\pm(0.03\%+6)$
500V	10mV	$\pm(0.03\%+6)$
1000V	0.1V	$\pm(0.03\%+6)$

Notes: above accuracies can be guaranteed within the full range

Technological Specifications

● **AC Current/DC Current + AC Current**

Range	Resolution	Accuracy			Voltage Drop
		40Hz~1KHz	1KHz~10KHz	10KHz~20KHz	
500 μ A	0.01 μ A	±(0.75%+20)	±(1%+20)	±(2%+20)	102μV/μA
5000 μ A	0.1 μ A	±(0.75%+10)	±(1%+10)	±(2%+10)	
50mA	1 μ A	±(0.75%+20)	±(1%+20)	±(2%+20)	1.5mV/mA
500mA	10 μ A	±(0.75%+10)	±(1%+10)	±(2%+10)	
5A	0.1mA	±(0.75%+20)	±(1.5%+20)	±(5%+20)	30mV/A
10A	1mA	±(1.0%+10)	±(1.5%+10)	Unspecified	

Notes: above accuracies can be guaranteed within 10%-100% of the full range

● **DC Current**

Range	Resolution	Accuracy	Voltage Drop
500 μ A	0.01 μ A	±(0.15%+15)	102μV/μA
5000 μ A	0.1 μ A	±(0.15%+10)	
50mA	1 μ A	±(0.15%+10)	1.5mV/mA
500mA	10 μ A	±(0.15%+10)	
5A	0.1mA	±(0.5%+10)	30mV/A
10A	1mA	±(0.5%+10)	

Notes: above accuracies can be guaranteed within the full range

● **Resistance**

Range	Resolution	Accuracy
500 Ω	0.01 Ω	$\pm(0.1\%+10)$
5K Ω	0.1 Ω	$\pm(0.1\%+5)$
50K Ω	1 Ω	$\pm(0.1\%+5)$
500K Ω	10 Ω	$\pm(0.1\%+5)$
5M Ω	100 Ω	$\pm(0.1\%+10)$
50M Ω	1K Ω	$\pm(0.5\%+10)$

Notes: above accuracies can be guaranteed within`the full range

● **Capacitance**

Range	Resolution	Accuracy
50nF	0.01nF	$\pm(1\%+5)$
500nF	0.1nF	$\pm(1\%+5)$
5 μ F	1nF	$\pm(1\%+5)$
50 μ F	10nF	$\pm(1\%+5)$
500 μ F	0.1 μ F	$\pm(2\%+5)$
5000 μ F	1 μ F	$\pm(2\%+5)$

Notes: above accuracies for film capacitor or better can be guaranteed within`the full range.

● **Diode**

Range	Resolution	Accuracy
2.5V	0.1mV	$\pm(1\%+5)$

Notes: the test current is about 0.7mA

Technological Specifications

● Logic Frequency

Frequency Range	Sensitivity	Accuracy
5Hz~2MHz	V _p 2~5V square wave	±(0.006%+4)

● Linear Frequency

Frequency Range	Voltage/Current Range	Sensitivity	Accuracy
5Hz~200KHz (sine wave)	500mV	100mV	±(0.006%+4)
	5V	0.5V	
	50V	4V	
	500V	40V	
	1000V	400V	
	5000 μ A	1mA	
	500mA	100mA	

Notes: Low voltage or low frequency would lower the accuracy.

● Duty Ratio

Frequency Range	Duty Ratio Range	Resolution	Accuracy
5Hz~500KHz	5%~95%	0.01%	±(2%+5)

Chapter 5 Maintenance

Replacement of Batteries

If symbol  appears on the LCD screen during measurement, it indicates the total voltage of batteries being lower than 6.8V. For ensuring measurement accuracy, it is necessary to replace the batteries. Before the replacement, must take off the red and black testing lines from the measured circuit and turn off the power of the meter. Open the cover of the batteries on the back of the meter and take out all the old batteries, replacing them with the 7# batteries. Take care to put in the batteries as the polarity specified on the shell of the meter. The meter must not be used until the cover of batteries being put properly and locked in. When opening the cover of the batteries, should rotate the two plastic bolts for 90° according to the direction of clock hand, while closing the cover, should do for 90° according to the opposite direction of clock hand. Rotation more than 90° may damage the plastic bolts.

Replacement of Fuse

It must take off the red and black testing lines from the measured circuit and turn off the power of the meter before replacement of fuse. It should only use fuse of the same model and the same electric specifications. Two fuses must not be put wrong in positions during their replacement. And the meter must not be used until the cover of fuses being put properly and locked in.

Notes: generally, fuses will not be blown under the normal use of the meter. In case of blowing it is necessary first to find out the reasons for the blowing and then take an account on the use of the meter. Generally, blowing may attribute to:

- Perform voltage measurement when the rotary switch being in the position of current.
- Current exceeds range.

Meter Calibration

There is no any component which can be used for calibration in the meter, calibration of the meter is implemented depending on the built-in software in the meter. Professionals and accuracy-even-higher standard signal sources are required for calibration of the meter. Users possessing such conditions may contact us for calibration methods when there is a need on calibration meter, while those who having not such conditions can contact us for calibration matters.

Others

- In case of any default being found this meter must not be used continuously.
- When the meter needs repair, please send it to experienced professionals or the appointed maintenance department for repairing.
- It should use soft cloth but not organic solvents which have corrosive and dissolving effect on the shell of meter to clean the meter, and it should guard against water dropping into the meter.