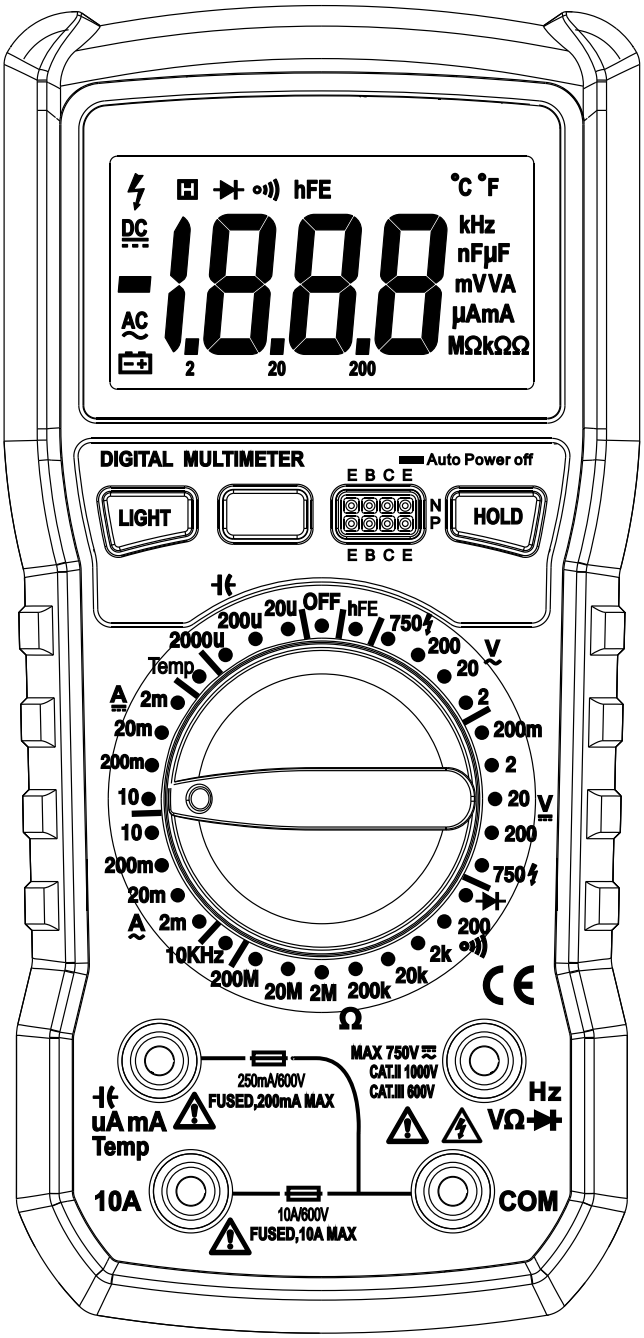
DIGITAL MULTIMETER



CAT.II 1000V
CAT.III 600V

OPERATION MANUAL

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1. GEHERAL INSTRUCTION

This digital multimeter (the Meter) has been designed and produced in compliance with the International Electronic Safety Standard IEC-61010@IEC: 2001 relevant to electronic measuring instruments and portable digital multimeters.

It meets the requirements for IEC-61010, 600V CAT IV, and pollution grade 2. Before using this Meter, please read this user's manual carefully and follow the related safety instructions.

International electrical symbols used on the Meter and in this manual are explained in 1.13

1.1 Safety Information

1.1.1 Safety instructions

* Measurement type III (CAT. III) is the measurement made within the building equipment.

  Note: for example, wiring of switchboard and circuit protector within fixed equipment includes cable, bus bar, junction box, switch, socket output end, equipment for industrial purposes and other equipment (such as permanently connected to fixed motor of fixed equipment) for measurement.

* Measurement type II (CAT. II) is the measurement made in the circuit which is connected directly to low voltage equipment.

  Note: For example, measuring household equipment, portable instruments and similar devices.

* Measurement type I (CAT. I) is the measurement made in the circuit which is not directly connected with bus bar.

  Note: For example, the measurement which is not made in the circuit not derived from bus bar and special (internal) protection bus circuit. (For the latter, the instant overload varies, so the instant overload resistance of equipment must be clearly marked.)

* When using this Meter, Users should comply with the following standard safety procedures:

-The safety instructions to prevent electric shock

- The safety instructions to prevent wrong use

* To ensure your safety, please use the test probes provided with the meter. Before use, please check and make sure they are not damaged.

1.1.2 Safe operation

* The reading may be unstable even big errors when the Meter is used near a source of strong electromagnetic interference.
* Do not use the Meter or the probes when they are damaged.
* Use the Meter only as specified, or the protection supplied by the Meter can be compromised or disabled.
* Be very careful when working around exposed conductors or bus bar.
* Do not use the Meter around explosive gas, vapor, or in dusty environments.
* Measure a known voltage first to make sure that the Meter operates correctly. Do not use it if operated incorrectly. The protection may be damaged. The Meter should be sent for maintenance.
* Use only correct terminals, function and range measurement.
* Set the Max. range when the range of signal is unknown.
* Limit operation to the specified measurement category, voltage or amperage ratings.
* **Do not touch the unused terminal when the Meter is connected to the circuit under test.**
* Carefully operating in case of electrical shock when the voltage under test >60V DC or 30V rms.

* Use test leads, keep fingers behind the finger guards on the test leads
* Connect the common test lead before the live test and remove the live test lead before the common test lead.
* Remove the test leads from the circuit under test before changing the measurement range
* For all DC functions, including manual and automatic range, to prevent possible electrical shock caused by wrong readings, please measure with AC function first to confirm if there is any current. Then choose a equal or larger DC range.
* For all DC functions, including manual or automatic measuring range, to avoid the risk of electric shock due to possible incorrect readings, please use AC function to verify the existence of any AC voltage. Then, select DC voltage measuring range equal to or greater than the AC measuring range.
* Disconnect power and discharge all high-voltage capacitors before you measure resistance, capacitance, continuity, or a diode junction.
* Do not measure resistance and continuity in live circuit.
* Examine the fuse, remove circuit power before you connect the Meter in the circuit before you measure current
* Be very cautious of high amplitude voltage pulse of the circuit under test when you make TV maintenance or measure power conversion circuit. To prevent possible damage to the meter, you should use the TC filter to weaken these pulses.

* The meter is powered by 1 * 9V 6F22 battery. The battery should be correctly installed into the battery case.
* Replace the battery when the low battery indicators shows to prevent incorrect measurement
* Do not use the Meter when its case (or a part of the case) is missing.

1.1.3 Symbols

Symbols used on the Meter and the manual:

	Important information. See manual before using the Meter. Wrong use may cause damage to the Meter or its components.
~	AC (Alternating Current)
⎓	DC (Direct Current)
≂	Alternating Current or Direct Current
	Earth Ground
	Double Insulated
	Fuse
CE	Conforms to European Union directives

1.1.4Safe maintenance

* Remove all the test leads before you open the cover or case.
* Use only specified replacement parts.
* Before you open the Meter, disconnect all the circuit power. To prevent possible damage to the parts of the Meter, ensure you are not with static electricity.

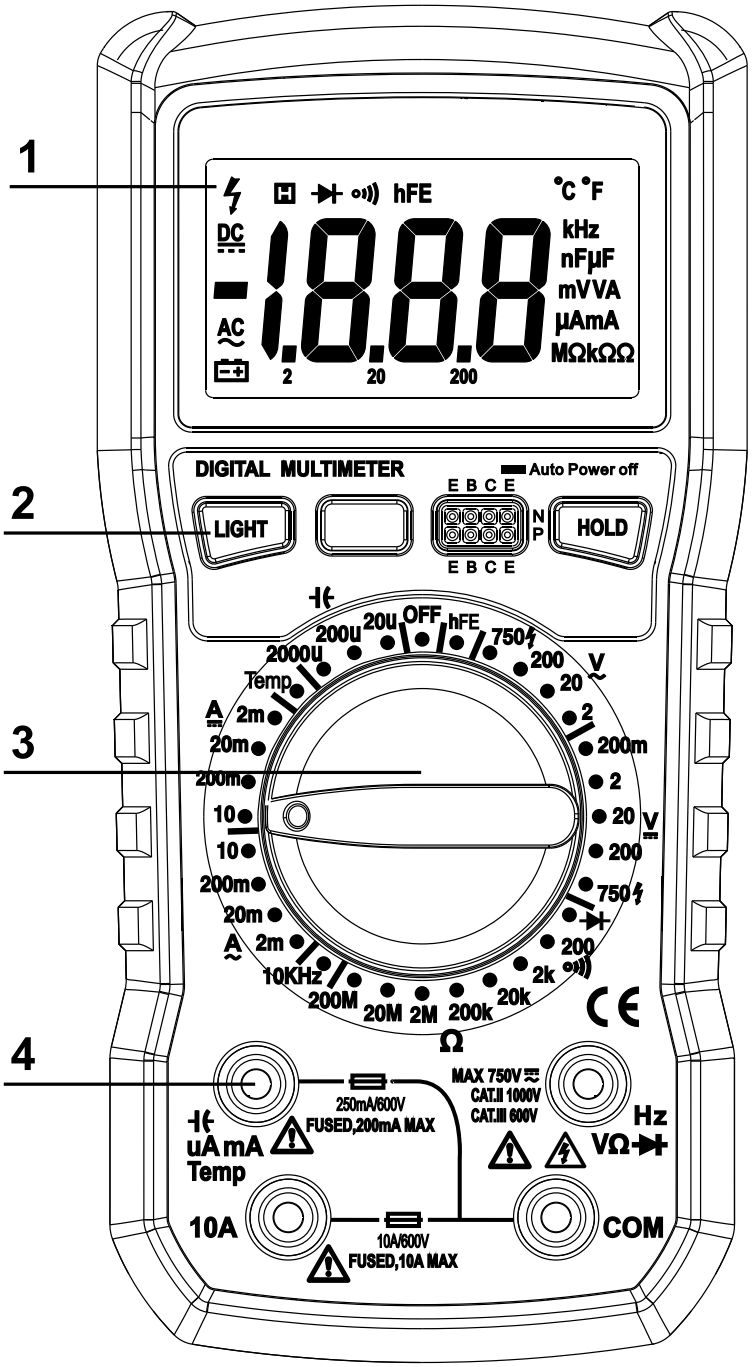
* Have an approved technician calibrate, maintain or repair the Meter.
* Before open the Meter, be cautious of possible capacitance still existing in the Meter since there may be hazardous voltage even after powering off.
* Stop using the Meter and send it to repair as soon as you find any abnormal phenomenon on the Meter. Do not use again before quality confirmed.
* Remove the battery if the meter will not be used for a long time. Do not store it in a high temperature and humidity environment.

1.2 Input Protections

* In voltages measurement modes (not including 200mV range), the Max. input voltage is DC 750V or AC 750V (In 200mV range, the max. input voltage is AC 250V or RMS)
* In frequency , resistance, continuity and diode measurement modes, the Max. voltage should be < 380V or RMS
* In capacitance, temperature , mA and transistor hFE measurement modes, protection comes from the fuse (F250mA/250V) or (F250mA/600V)

2. METER DESCRIPTION

2.1 Front View



1. LCD Display 2. Function Keys 3. Rotary Switch 4. Input terminals

2.2 LCD Display

Refer to Table 1 for description about LCD display.

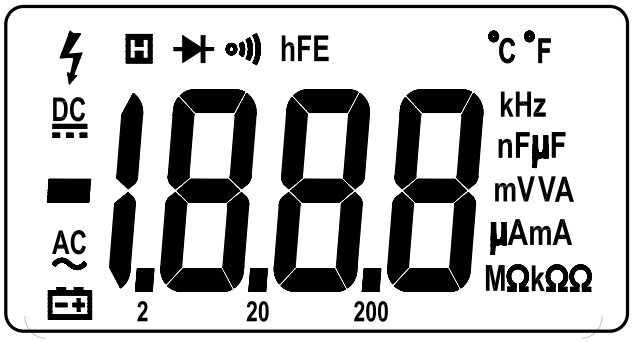


Figure1 Display

Table 1 Display Symbols

Smbols	Description
	Battery is low. ⚠ **To prevent wrong readings and possible electrical shock or personal injury, you should replace the battery immediately when the symbols appears.**
▬	Negative input polarity indication
AC	Alternating current input indication Ac voltage or current is displayed and calibrated according to the average of the absolute values and showed equivalent sinusoidal RMS values.
DC	Direct current input indication.
	Diode test is selected.
	Continuity is selected.
H	Display Hold is enabled.

Table2 Symbols on the case

TEMP	TEMP： centigrade-temperature
V, mV	V: Volt -the unit of voltage mV: Millivolt, $1x10^{-3}$ or 0.001 volt
A, mA, uA	A: Ampere- unit of current mA: $1x10^{-3}$ or 0.001 Ampere uA: $1x10^{-6}$ or 0.000001 ampere
Ω, kΩ, MΩ	Ω： Ohm, the unit of resistance. KΩ： $1x10^{3}$ or 1000 ohm MΩ： $1x10^{6}$ or 1, 000, 000 ohm
kHz	kHz： $1x10^{3}$ or 1000 hertz
uF,	uF： $1x10^{-6}$ or 0.000001 farad

2.3 Function Keys

Refer to Table 3 for description about function keys

Table3 Function Keys

Keys	Functions	Description
HOLD	**All ranges**	Press **HOLD** key to enter or exit readings hold mode.
LIGHT	**All ranges**	Press **LIGHT** key to active or turn off back light.

2.4 Terminals

Refer to Table 4 for Description about terminals

Table 4 Terminals

Terminals	Description
COM	Common terminal for all measurements. (Connect with black test leads or multifunction sockets)
VΩHz	Positive input terminal for voltage, resistance, frequency , diode measurements and continuity test. (Connect with red test leads.)
TEMP mA	Positive input terminal for current, capacitance , diode and temperature measurements.
10A	10A positive current input terminal (Connect with red test leads).

2.5 Accessories

Instruction Manual	One piece
Test Leads	One pair
K Type Thermocouple TP01	One piece

3. OPERATION INSTRUCTIONS

3.1 General Operations

3.1.1 Reading hold mode

In reading hold mode, the current readings will be kept on the display. Change the measurement function or gear, or press **HOLD** key to exit this mode.

Methods to enter and exit HOLD mode:

1. Press "**HOLD**" to store the reading, and "H" will be displayed simultaneously
2. Press "**HOLD**" again back to normal measuring mode.

3.1.2 Battery saving function

After approx. 30 idleness, the power will be off to save battery. Press LIGHT to activate the meter.

3.2 Measurement Instructions

3.2.1Measure voltage AC/DC

⚠ ***Do not measure voltage > 750V DC or AC rms in case of personal injury or damage to the Meter or the equipment.***

Do not apply voltage > 750V DC or AC rms between common terminal and earth ground

Voltage is the potential difference between two points

AC voltage polarity changes over time, while DC voltage polarity does not

Voltage DC rang: 200.0mV, 2.000V, 20.00V, 200.0V, 750V;

Voltage DC rang: 2.000V, 20.00V, 200.0V, 750V

Measure voltage AC/DC:

1. Turn the rotary switch to correct position.
2. Connect the black test lead to **COM** terminal and the red test lead to **V** terminal.
3. Touch the probes to the correct test points of the circuit to measure the voltage. (Connect with the circuit under test in parallel.)
4. Read the measured voltage on the display. The voltage polarity tested by the red test lead will be shown on the display.

Note:

In 200mV DC or 2V AC range, there will be value on the display even if no value input or no test leads connected . Short connect " **V-Ω**" and "**COM**" terminals to return to zero

3.2.2 Measure resistance

> ⚠ ***To prevent possible damage to the Meter or the equipment under test, disconnect circuit power and discharge all high-voltage capacitors before you measure resistance.***

Resistance is resistance force of current. The unit of resistance is ohm (Ω).

Resistance range: 200.0 Ω , 2.000k Ω , 20.00k Ω , 200.0k Ω , 2.000MΩ, 20.00MΩ, 200.0MΩ.

Measure resistance:

1. Turn the rotary switch to correct position.

2. Connect the black test lead to **COM** terminal and the red test lead to **VΩ** terminal.
3. Touch the probes to the correct test points of the circuit to measure the resistance.
4. Read the measured voltage on the display

Some tips for measuring resistance:

Usually, the resistance under test differs from the rated resistance, this is because the current output by the Meter is tested by the test leads or all other possible channels.

When measuring low resistance, in order to maintain the accuracy, firstly short connect the two test leads and take down the resistance value, then minus it from the resistance under test.

In 20MΩ and 200MΩ range, reading needs several seconds to stabilize

In 200MΩ range, there will be approx. 10 digits on the display if short connect the test leads. You should minus it from the measurement result. For example: When measuring 100MΩ, the reading is 101.0, then the correct result must be 101.0-1.0=100.

When no signal input (e.g. open circuit), the LCD displays "OL", which means overrange.

3.2.3 Test diode

⚠ ***To prevent possible damage to the Meter or the equipment under test, disconnect circuit power and discharge all high-voltage capacitors before you test diodes.***

Test a diode outside the circuit:

1. Turn the rotary switch to ⊣◀ position.
2. Connect the black test lead to **COM** terminal and the red test lead to Ω terminal.
3. Connect the black probe to the cathode side and the red test lead to the anode side of the diode being tested.
4. Read the forward bias voltage value on the display. If the polarity of the test leads is reversed with diode polarity, the display reading shows "OL".

A good diode should generate 0.5~0.8V forward voltage drop; But the reading of the reverse biased voltage will vary depending on resistance values of other channels between two test probes.

3.2.4 Test continuity

> ⚠ ***To prevent possible damage to the Meter or the equipment under test, disconnect circuit power and discharge all high-voltage capacitors before you test continuity.***

Test continuity :

1. Turn the rotary switch to 200.0Ω 🔊 position.
2. Connect the black test lead to **COM** terminal and the red test lead to Ω terminal.
3. Touch the probes to the correct test points of the circuit to measure the resistance.
4. In test continuity mode, if the resistance is <50 Ω , the beeper will sound continuously.

3.2.5 Measure capacitance

> ⚠ ***To prevent possible damage to the Meter or the equipment under test, disconnect circuit power and discharge all high-voltage capacitors before you test continuity. Discharge all capacitors when using dc voltage function***

Capacitance range: 20μF, 200μF, 2000μF

Measure capacitance:

1. Turn the rotary switch to correct position.
2. Connect the black test lead to **COM** terminal and the red test lead to ⊣⊢ terminal
3. Touch the probes to the correct test points of the circuit to measure the capacitance. Read the measured voltage on the display

Note:

When measuring large capacitance, allow some time to stabilize the reading.

3.2.6 Test transistor

> ⚠ ***To prevent possible personal injury or damage to the Meter, do not apply voltage >250V DC or AC rms to Common and hFE terminals.***

1. Turn the rotary switch to **hFE** position
2. Distinguish if the transistor type is NPN or PNP, then plug the e.b.c. pins of the transistor into the corresponding sockets.
3. Read the tested approx. hFE value on the display.

3.2.7 Measure frequency

> ⚠ ***To prevent possible personal injury or damage to the Meter, do not measure the frequency of voltage >380V DC or AC rms.***

Frequency measurement steps:

1. Turn the rotary switch to **20kHz** position
2. Connect the black test lead to **COM** terminal and the red test lead to **Hz** terminal.
3. Touch the probes to the correct test points of the circuit to measure the frequency.
4. Read the measured voltage on the display

3.2.8 Measure temperature

> ⚠ ***To prevent possible personal injury or damage to the Meter, do not apply voltage >250V DC or AC rms to Common and ℃ terminals;***
>
> ***To prevent possible electrical shock, do not measure objects with voltage >60V DC or 24V AC rms***
>
> ***To prevent fire or possible damage to the Meter, do not measure temperature in microwave ovens.***

Temperature measurement steps:

1. The rotary switch to the TEMP position, K-type thermocouple into the jack in the correct polarity, red and black COM TEMP, the LCD display will show the ambient temperature.
2. Measure the surface or inner of the object with the testing end of the thermocouple.
3. Read the temperature on the display.

3.2.9 Measure current

> ⚠ ***To prevent possible personal injury or damage to the Meter, do not measure current when the open circuit voltage or between terminals and earth ground >250V; To prevent possible damage to the Meter or the equipment under test, examine the fuse of the Meter before you measure current. Use only correct terminals, function and range. When one end of the test leads are connected with the terminals, do not connect the other end in parallel with any circuits***

Current DC range: 2.000mA, 20.00mA, 200.0mA, 10.00A;

Current AC range: 2.000mA, 20.00mA, 200.0mA, 10.00A;

Measure current:

1. Remove circuit power. Discharge all the high-voltage capacitors of the circuit to be measured.
2. Turn to rotary switch to correct position.
3. Connect the black test lead to **COM** terminal and the red test lead to **mA** terminal if the current to be measured <200mA; to **10A** terminal if 200mA~10A.
4. Break the circuit path to be measured. Then connect the black test lead to the (low-voltage) end of the break circuit and the red test lead to the (higher-voltage) end. (Reverse connection will result the negative readings, but no damage to the Meter.)
5. Apply power, read the measured current on the display. If "OL" is shown, it designates the input value over range, you should change to higher range.
6. Remove circuit power, discharge all the high-voltage capacitors, remove the test leads from the Meter and restore the circuit.

4 TECHNICAL SPECIFICATIONS

4.1 General Specifications

Operation environmental conditions: 600V CAT.III, pollution degree: 2.

Operating altitude: < 2000 m

Operating temperature: 0~40°C (<80% RH, <10°C, ignore)

Storage temperature: -10~60°C (<70% RH, remove batteries)

Temperature coefficient: 0.1 x accuracy /°C (<18°C or >28°C)

MAX. allowable voltage between terminals and earth ground: 750V DC or 750V AC rms.

Fuse protection:

mA gear: ceramic fuse F1 250mA/250V or 250mA/600V

10A gear: ceramic fuse F2 10A/250V or 10A/600V

Sampling speed: approx. 3 times / second

Display: 3 1/2 LCD display.

Overload Indication: shows "OL" on the LCD

Low battery indication: shows "  " when the batteries are below their required voltage

Input polarity indication: auto display " -"

Power: 9V DC ⎓

Battery Type: NEDA 1604, 6F22 or 006P

Size: 195(L)×92(W)×55(H) mm.

Weight: approx. 380g (battery included)

4.2 Accuracy Specifications

Accuracy is defined as ±(% reading + digits) at 18°C ~28°C, < 80% RH, one year warranty period

4.2.1 Voltage DC

Range	Resolution	Accuracy
200mV	0.1mV	±(0.5% rdg +1 digit)
2V	1mV	
20V	10mV	
200V	100mV	
750V	1V	±(0.8% rdg +2 digits)

Input impedance: 10MΩ

MAX. input voltage: 750V DC or 750 AC rms; 250V DC or AC rms (200mV range)

4.2.2 Voltage AC

Range	Resolution	Accuracy
2V	1mV	±(0.8% rdg +3 digits)
20V	10mV	
200V	100mV	
750V	1V	±(1.2% rdg +3 digits)

Input impedance: 10MΩ

MAX. input voltage: 750V DC or 750 AC rms; 250V DC or AC rms (200mV range)

Frequency response: 40Hz~400Hz (40~200Hz at 750V range), sinusoidal RMS(average response)

4.2.3 Frequency

Range	Resolution	Accuracy
20kHz	10 Hz	±(1.5% rdg +5 digits)

Input voltage range: 200mV~10V DC rms

Overload protection: 380V DC or 380V AC rms

4.2.4 Resistance

Range	Resolution	Accuracy
200Ω	0.1Ω	±(0.8% rdg +3 digits)
2kΩ	1Ω	±(0.8% rdg +1 digit)
20kΩ	10Ω	
200kΩ	100Ω	
2MΩ	1kΩ	
20MΩ	10kΩ	±(1.0% rdg +2 digits)
200MΩ	0.1MΩ	±[5.0% (rdg−10digits) +10 digits]

Overload protection: 380V DC or 380V AC rms

Open circuit voltage<700mV

4.2.5 Diode

	Range	Resolution	Test Environment
Diode 	1 V	0.001V	Forward current DC: approx. 1mA; Reverse voltage DC: approx. 1.5V. LCD shows approx. forward voltage of diode
Overload protection: 380V DC or 380V AC rms			

4.2.6 Continuity

	Range	Resolution	Description	Environment
	200Ω	0.1Ω	Built-in buzzer sounds when resistance is < 50Ω.	Open circuit voltage: approx. 3V
Overload protection: 380V DC or 380V AC rms				

4.2.7 Transistor

Range	Description	Test condition
hFE	Read the approx. value on the display (0 -1000)	Base current: approx. 10 μA Vce: approx. 2.8V

4.2.8 Capacitance

Range	Resolution	Accuracy
20μF	10nF	±(4.0% rdg +3 digits)
200μF	100nF	
2000μF	1μF	

Overload protection: ceramic fuse(F250mA/250V)or(F250mA/600V)

4.2.9 Temperature

Range	Resolution	Accuracy
-20℃~0℃	1℃	±(5.0%rdg+4digits)
1℃~400℃		±(1.0%rdg+3digits)
401℃~1000℃		±2.0%rdg

* Temperature specifications don't include the error of thermocouple

Overload protection: ceramic fuse(F250mA/250V)or(F250mA/600V)

4.2.10 Current DC

Range	Resolution	Accuracy
2mA	1μA	±(0.8% rdg +1 digit)
20mA	10μA	±(1.5% rdg +1 digit)
200mA	0.1mA	
10A	10mA	±(2.0% rdg +5 digits)

Overload protection: ceramic fuse (F1 250mA/250V or 250mA/600V);
ceramic fuse (F2 10A/250V or 10A/600V)

Max. input current: mA gear: 250mADC or AC rms
10A gear: 10ADC or AC rms

The measuring time must be < 2 minutes when current >5A. Keep the Meter 10 minutes idle after measurement.

4.2.11 Current AC

Range	Resolution	Accuracy
2mA	1μA	±(1.0% rdg +3 digits)
20mA	10μA	±(1.8% rdg +3 digits)
200mA	0.1mA	±(1.8% rdg +3 digits)
10A	10mA	±(3.0% rdg +7 digits)

Overload protection: ceramic fuse (F1 250mA/250V or 250mA/600V);
ceramic fuse (F2 10A/250V or 10A/600V)

Max. input current: mA gear: 250mADC or AC rms
10A gear: 10ADC or AC rms

The measuring time must be < 2 minutes when current >5A. Keep the Meter 10 minutes idle after measurement.

Frequency response: 40Hz~400Hz, sinusoidal RMS (average response)

5. MAINTENANCE

Only expert and trained technicians should perform maintenance operations.

5.1 General Maintenance

> ⚠ ***To prevent possible personal injury or damage to the Meter, do not wet the inside of the Meter. Disconnect all the test leads before you open the case or cover.***

Periodically use wet cloth and slight cleanser to clean the Meter case. Do not abrasives or solvents in case of corrosion to the Meter. Wet or dusty input terminals may result wrong readings. Some tips for cleaning the input terminals:

1. Power off the Meter, disconnect all the test leads from the Meter.

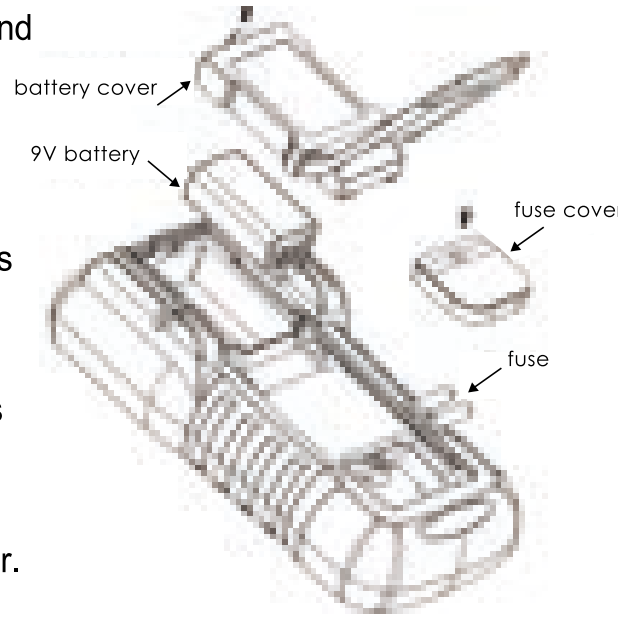
2. Remove all the dirt from the terminals with a new cotton ball with cleanser or lubricant (such as WD-40).

5.2 Replace battery and fuse

> ⚠ ***To possible prevent electrical shock or personal injury caused by wrong readings, immediately replace the batteries as soon as "⊟" shows on the LCD.***
> ***Remove all the test leads before you open the battery cover***

Follow these steps to replace the battery and the fuse (see Figure 2):

Figure 2. Replace battery and fuse



1. Turn off the power.
2. Remove all the test leads from the terminals.
3. Loosen the fixing screws of the battery cover.
4. Take off the battery cover.
5. Take away the old batteries.
6. Replace by 9V (6F22) battery.
7. Install the cover and screws.
8. .replace the fuse before turn off the instrument power supply.
9. pull all test pens out of the input socket.
10. a screw with a screwdriver to loosen the fixed insurance cover.
11. remove the need to replace the fuse.
12. replace the new with the specifications of the fuse.
13. mounted on the insurance cover, tighten the screws.

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