Pro'sKit®

MT-1220 / MT-1225

3 1/2 Digital Multimeter

User's Manual
1nd Edition, 2022

※ General Information

The meter is a multi-function instrument with high measurement accuracy, fast response, and high safety level. Embedded with a special IC up to 2000 counts, this IC is composed of high-precision A/D converter with high-speed digital processor. It is with accurate measurement, high resolution, fast operation, complete software calibration, no change in long-term use in accuracy, which is suitable for professional engineers, maintenance engineers, teaching, etc.

Please read carefully this operation manual and pay attention to safety guidelines before operating this meter.

1.1 Safety Information

1.1.1 Safety Instructions

- Before operating this meter, the operator must observe all standard safety procedures in the two respects below:
  A. Safety procedures against electric shock
  B. Safety procedures against unintended use
- To ensure your personal safety, please use the test lead that accompanies the meter. Before operating this meter, ensure that the test lead is flawless.

1.1.2 Safety Considerations

- When the meter is used in the vicinity of the equipment that produces strong electromagnetic interferences, the reading on the meter will grow unstable and even produce serious errors.
- Don't operate the meter or pen-shaped meter whose appearance is damaged.
- The safety function of the meter will become null if the meter is not properly operated.
- The meter must be operated with great care when working in the vicinity of an exposed conductor or bus line.
- The meter is prohibited from being used in the vicinity of any explosive gas, vapor or dust.
- The measurement must be made with correct input terminals and functions and within the allowable measuring range.
- To prevent the meter from being damaged, the value to be input shall not exceed the extremes allowed by each measuring range.
- When the meter has already been connected to the line being measured, the operator is prohibited from touching the input terminal that is not in service.
- When the voltage measured exceeds DC60V or AC30V (valid value),

the operator shall be careful enough to avoid electric shock.

- When making measurement with a test lead, place your fingers behind its protective ring.
- When switching to another measuring range, be sure that test lead has already been taken off the measured circuit.
- For all DC functions, to prevent potential electric shock as a result of incorrect reading, please first use AC functions to check the absence of any AV voltage. Then, select DC voltage measuring range equivalent to or greater than that for AC voltage.
- Before the tests on electric resistance, diode, continuity, the operator must cut off the power supply to the circuit to be measured, and discharge all high-voltage capacitors within the circuit to be measured.
- The electric resistance measurement or continuity test cannot be carried out in any live electrical circuit.
- Before the current measurement, the operator must first examine the protective tube of the meter. Before connecting the meter to the circuit to be measured, the operator must first power off the aforesaid circuit.
- Before repairing TV sets or measuring power switching circuit, the operator must be careful enough to prevent high amplitude voltage impulse from damaging the meter.
- This meter uses 3 x 1.5V AAA batteries that must be correctly installed into the battery compartment.
- When  appears, the batteries must be replaced immediately. The low level of a battery will result in incorrect reading on the meter, which is likely to bring electric shock or personal injury to the operator.
- In measurement, category II voltage shall not exceed 600V respectively.
- The meter shall not be in service if its case (or part of its case) is dismantled.

1.1.3 Safety Symbol:

The safety symbols that appear on the meter's body and in this Operation Manual:

	Warning, an important safety symbol. The operator must consult this Operation Manual before using the meter. Unintended use may lead to the damage to the device or its components.
	High voltage warning
	Equipment with double insulation or reinforced insulation protection
	AC (alternating current)

⎓	DC (direct current)
⏚	Ground
⏛	Fuse
CAT. II 600 V	Over-voltage protection
CE	Conform with European Union standard

1.1.4 Maintenance Practices for Safety

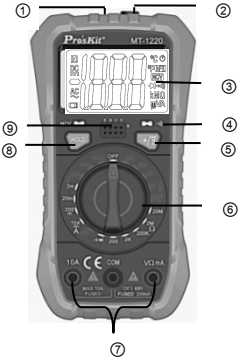
- The operator must first pull out the test lead when the meter's case is opened or the battery cover is dismantled.
- The designated replacement parts must be used at the moment of maintenance.
- The operator must cut off all relevant power supplies before opening the meter. At the same time, the operator must avoid damage to the meter's elements by ensure that he himself doesn't carry any static.
- The meter can only be calibrated, repaired and maintained by professionals.
- When the meter's case is opened, the operator must understand the fact that the presence of some capacitance may promise the dangerous voltages even if the power supply to the meter is cut off.
- The operator should stop using and maintain the meter immediately if any abnormality has been observed on the meter. The operator must see to it that the meter cannot be in service unless it is proved conforming.
- When the meter is left idle for a long period, the operator shall remove the battery and place it in a place free from high temperature and humidity.

1.2 Input Protection Measures

- The meter can sustain the maximum input voltage of 600V (DC/AC) at the moment of voltage measurement.
- The limit voltage is 250 ACV or the equivalent RMS voltage when the resistance, continuity or diode is under measuring.
- The protective tube (F200mA/250V) is used for protection purpose when mA current measurements are carried out. The protective tube (F10A/250V) is used for protection purpose when A current measurements are carried out.

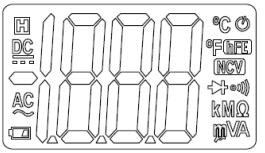
2. General Description

2.1 Schematic Diagram



①. LED light
②. Non-contact voltage indicator
③. LCD screen
④. Buzzer
⑤. Backlight & LED key
⑥. Rotary switch
⑦. Input socket
⑧. Data hold key
⑨. hFE socket

2.2 Symbols Description



Symbol	Description
	Low battery ⚠**To avoid electric shock or personal injury as a result of incorrect reading, promptly replace the battery when the low battery symbol appears.**
	Auto power off
	Negative input polarity
AC	Input voltage AC
DC	Input voltage DC
	Diode test or Continuity test
H	Data hold
NCV	Non-contact AC voltage detection
hFE	hFE test
V, mV	Voltage unit

A, mA, μA	Current unit
Ω, kΩ, MΩ	Resistance unit

2.3 Functional Keys Description

Key	Function
HOLD	Press the key to hold the measured value for the current moment. Press the key again to cancel this function.
"☀/🔦"	Short press the key to turn on backlight and short press again to exit. It will automatically off after about 15 seconds with no operation Long press the key to turn on the illumination function and the backlight at the same time. Short press the key again to turn off the illumination function. It will automatically off after about 30 seconds with no operation

2.4 Input Socket Description

Input socket	Description
COM	All public input terminals to be measured are connected to test leads in black or the public output plugs of exclusive multi-function test sockets.
VΩmA	Positive input terminals (connected to a test lead in red) for voltage measurement, electric resistance, diode measurement, beep on/off test, mA positive input terminal (connected to a test lead in red).
10A	10A positive input terminal (connected to a test lead in red).

2.5 Accessories

1. Operation Manual X 1 pce
2. Test lead X 1 pair

3. Operational Guidelines

3.1 Auto Power Off

If no operations are made in 15 minutes following the initialization, the meter will sound to remind the operator to automatically cut off power supply and enter the state of dormancy. The meter can be rebooted when the operator presses any key in the auto power off mode.

3.2 Measurement guidelines

3.2.1 AC Voltage and DC Voltage Measurement

The meter provides DC voltage measuring ranges as follows: 200.0mV, 2.000V, 20.00V, 200.0V and 600V, and AC voltage measuring ranges: 200.0V and 600V.

> ⚠ ***To avoid any electric shock and/or damage to the meter, do not attempt a voltage measurement if the voltage (valid value) is over 600V DC or AC current.***
> ***To avoid any electric shock and/or damage to the meter, don't attempt to impose between any public terminal and ground any voltage whose valid value is over 600V for DC or AC current.***

- Turn the rotary switch to the position ～V or ⎓V.
- Connect the test lead in black and test lead in red to COM input socket and V input socket respectively.
- Use another two ends of the test lead to measure the voltage of the circuit to be measured. (In parallel connection with the circuit to be measured)
- Read the measured voltage value on LCD screen. When DC voltage measurement is attempted, the display unit will show the voltage polarity of the circuit connected to the pen-shaped meter in red.

3.2.2 Electric Resistance Measurement

Ohm is the unit of electric resistance (Ω).
The measuring ranges of electric resistance of this meter are 200.0Ω, 2.000kΩ, 200.0kΩ, 2.000MΩand 20.00MΩ

> ⚠ ***To avoid the meter or the measured equipment from damage, do not attempt a resistance measurement unless the operator has already cut off all power sources for the circuit to be measured and fully discharged all high-voltage capacitors.***

- Turn the rotary switch to the appropriate position.
- Connect the test lead in black and test lead in red to COM input socket and V/Ωinput socket respectively.
- Use another two ends of the test lead to measure the electric resistance of the circuit to be measured.
- Read the measured electric resistance value on LCD screen.

Notes:

- The measured value of the electric resistance of the circuit differs a bit from the rated value of the electric resistance.
- To ensure measurement accuracy, in attempting a low resistance measurement, first put two pen-shaped meters in short circuit and capture the resistance reading of these short circuits. Then subtract the aforesaid reading from the measured resistance.
- When the meter is in open circuit, the display unit will show "OL" that indicates the measured value is over the measuring range.

3.2.3 Diode or Beep Continuity Test

> ⚠ ***To avoid the meter or the measured equipment from damage, do not attempt a diode test unless the operator has already cut off all power sources for the circuit to be measured and fully discharged all high-voltage capacitors.***

Diode test outside the circuit:

- Turn the rotary switch to the position  .
- Connect the test leads in black and in red to COM input socket and V/Ωinput socket respectively.
- Connect the test leads in black and in red to the positive and negative poles of the diode to be tested respectively.
- The meter displays the forward bias value of the diode to be tested. If the polarity of the test lead is reversed, the meter will display "OL".

Steps for a continuity test:

- Connect the test lead in black and test lead in red to COM input socket and V/Ωinput socket respectively.
- Use another two ends of the test lead to measure the resistance of the circuit to be measured. If the measured distance the beeper will sound continuously, and the LED will be on.

3.2.4 hFE Measurement

> ⚠ ***To avoid any electric shock and/or damage to the meter, do not attempt a frequency measurement if the voltage is over 36V for DC current or AC current (valid value).***

- Turn the rotary switch to the position hFE.
- Check the transistor is NPN or PNP type, insert the emitter, base and collector separately to the correct hole, the approximate value will be displayed on LCD.

3.2.5 Current Measurement

The meter provides DC current measuring ranges as follows: 2mA, 20.00mA, 200.0mA and 10.00A.

> ⚠ ***Do not attempt a measurement on the current in a circuit, if when the voltage between the open-circuit voltage and the ground is over 250V. If the fuse is blown at the moment of measurement, you are likely to damage the meter or get yourself hurt.***
>
> ***To avoid any damage to the meter or equipment to be measured, do not attempt a current measurement unless you have examined the meter's protective tube. In attempting a measurement, you should use the correct input sockets, function positions and measuring ranges. When a test lead is inserted into the current input socket, do not put the other end of the test lead in parallel connection with any circuit.***

- Turn the rotary switch to the appropriate position.
- Connect the test lead in black to COM input socket. Connect the test lead in red to a mA input socket when the measured current is less than 200mA; connect the test lead in red to a 10A input socket when the measured current is 200mA~10A.
- Disconnection of the circuit to be measured Connect the test lead in black to the end of disconnected circuit (the voltage is lower) and connect the test lead in red to the end of the disconnected circuit (voltage is higher).
- Connect the power to the circuit and capture the displayed reading. If the display unit only shows "OL", it means the input is over the selected measuring range. At this moment, turn the rotary switch to a higher measuring range.

3.2.6 Temperature Measurement

- Turn the rotary switch to the appropriate position (℃).
- Insert the cathode of thermocouple's cold end to " COM" jack and anode to " V/Ω" terminal, put the working end on or in the tested object, temperature value can be read on LCD in Celsius.

3.2.7 NCV Test (Non-contact Voltage Detection)

Turn the rotary switch to NCV position, and place the top of the meter approach the conductor. If the meter detects the AC voltage, the indicators for signal density (high, medium and low) will be on in accordance with the

detected density, while the beeper will sounds alarms at different frequencies.

Note:

- Voltage may still remain in the absence of any indication. The operator shall not rely on non-contact voltage detector to check the presence of voltage. The detection operation may be affected by various factors, including socket design, insulation thickness and type.
- When the voltage is input into the meter's input terminal, the voltage sensor LED may be on as a result of induced voltage.
- External sources of interference (like flashlight and motor) may trigger non-contact voltage detection.

4. Technical Parameters

4.1 Overall Parameters

- Operating environment:
  600V CAT II, Pollution level: 2
  Altitude: < 2000 m
  Working temperature & humidity: 0~40^{O}C
  (The requirements will not be considered when temperature is less than 10℃ and relative humidity is below 80%).
  Storage temperature & humidity: -10~60^{O}C
  (Batteries shall be removed when RH is below 70%).
- Coefficient of temperature: 0.1×accuracy/ ^{O}C (<18 ^{O}C or >28 ^{O}C).
- Allowable max voltage between terminal to be measured and ground: 600V DC or AC (valid value)
- Protection of protective tube: mA position: protective tube F 200mA/250V; A position protective tube F 10A/250V
- Rotation rate: approximately 3 revolutions/second
- Display unit: 2000 counts displayed on LCD screen. Automatically display the symbol for unit in accordance with measurement function position.
- Outrange indication: the LCD screen will display "OL".
- Battery Low indication: "  " will appear when the battery's voltage is below the normal working voltage.
- Input polarity indication: "–" will automatically appear.
- Power: 3 x 1.5V AAA battery
- Dimensions: 148mm(L)×79mm(W)×48mm(H).
- Weight: Approximately 210g (not included batteries or test leads)

4.2 Precision Indicator

Accuracy: ±(% reading + digit)

The accuracy warranty will run for 1 year upon the ex-factory date.

Reference conditions: Ambient temperature is between 18℃ and 28℃ and relative humidity is no more than 80%.

4.2.1 DC Voltage

Measuring range	Resolution	Accuracy
200mV	0.1mV	±(0.5% Reading + 5 digits)
2V	1mV	
20V	10mV	
200V	100mV	
600V	1V	±(0.8% Reading +5 digits)

Input impedance:1MΩ

Maximal input voltage: 600V DC or AC valid value

4.2.2 AC Voltage

Measuring range	Resolution	Accuracy
200V	100mV	±（1% readings +10 digits）
600V	1V	±（1.2% readings +10 digits）

Input impedance:1MΩ

Maximal input voltage: 600V DC or AC valid value

Frequency response: 40Hz-400Hz

4.2.3 Electric Resistance

Measuring range	Resolution	Accuracy
200Ω	0.1Ω	±(1% Reading + 3 digits)
2kΩ	1Ω	
200kΩ	100Ω	
2MΩ	1kΩ	
20MΩ	10kΩ	±(1.5% Reading +3 digits)

Overload protection: 250V DC/AC

Open-circuit voltage: 2.4V

4.2.4 Diode Test

Functions	Testing conditions
Diode test	Forward DC current: approximately 0.8mA; Open-circuit voltage: approximately 2.4V. The display unit shows the approximate value of the diode's forward voltage drop.

)))	The buzzer beeps when the resistance is less than 30Ω

Overload protection: 250V DC/AC

4.2.5 hFE Test

Functions	Value	Testing conditions
NPN or PNP	0~2000	Basic current is approx. 10uA,Vce is approx.2.8V

4.2.6 DC Current

Measuring range	Resolution	Accuracy
2mA（only MT-1220）	0.001mA	±(1% Reading + 5 digits)
20mA	0.01mA	
200mA	0.1mA	
10A	0.01A	±(3.0% Reading + 10 digits)

Overload protection:
protective tube for mA measuring range (F200mA/250V) ;
protective tube for 10A measuring range (F10A/250V) .
When the measured current is over 5A, the duration of continuous measurement shall not be over 10 seconds. The current measurement shall be carried out 1 minute after the completion of previous measurement.

4.2.7 Temperature (only MT-1225)

Measuring range	Resolution	Accuracy
-20℃～1000℃	1℃	±(1.0% Reading + 3 digits)

Overload protection: 250V DC/AC

5. Meter Maintenance

This section provides the basic information on maintenance, including the descriptions about replacement of protective tubes and batteries. Do not attempt the meter maintenance unless you are experienced in maintenance and have read the information on calibration, performance test and maintenance.

5.1 General maintenance

⚠ ***To avoid any electric shock or damage to the meter, do not attempt to clean the inside of the meter. You must remove the line connecting a test lead to input signals, before opening the case or battery cover.***

You must regularly use damp cloth and a small quantity of detergent to clean the meter's shell. Don't attempt the use of any abrading or chemical solvent. The dirty or damp input socket may affect reading.

Steps for cleaning input sockets:

- Disenable the meter and pull all test leads out of the input socket.
- Clean up all dirty substances on sockets.
- Use a new cotton ball with a detergent or lubricant to clean each socket, because lubricant can prevent the socket vulnerable to dampness from pollution.

5.2 Battery & Fuse Replacement

> ⚠ ***To avoid any electric shock or personal injury as a result of incorrect reading, replace batteries once the symbol " " appear on the display unit.***
>
> ***To avoid any electric shock or personal injury, don't attempt to open the battery cover to replace batteries, unless you have already powered off the device and carried out an examination to ensure that the test lead has been disconnected from the circuit to be measured.***

Battery Replacement:

1. Turn off the power of the meter.
2. Disconnect all test leads from the input socket.
3. Use a screwdriver to remove the screw of battery cover.
4. Take off the battery cover.
5. Take out the old batteries carefully and replace with 3 pcs 1.5 V AAA new batteries.
6. Fix the battery cover.

Fuse Replacement

When fuse is blown, replace with the same type of fuse.

1. Turn off the power of the meter and take out the holster.
2. Use a screwdriver to remove the screw of back cover.
3. Take off the back cover.
4. Remove the blown fuse and replace with the same type of fuse
5. Screw the back cover
6. Put the holster back.