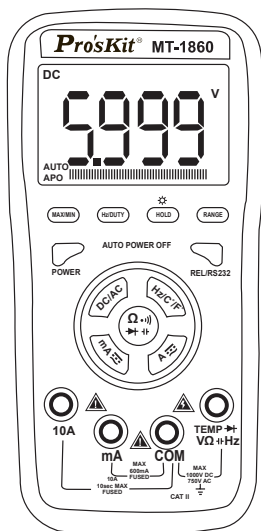


# Pro'sKit<sup>®</sup>

# Professional Digital Multimeter



## MT-1860

# User's Manual

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## General

MT-1860 endowed with the key touching function instead of the traditional mechanical knobs, is a new type of 3 5/6 digital multimeter equipped with the LCD display device with the text height of 33mm which has the merits of visual display, easy operation, stable performance and high reliability. It can be used to measure DC voltage, AC voltage, DC current, AC current, resistance, capacitance, frequency, temperature, diode and make on-and-off test. Meanwhile, it is available for unit symbol display, data retention, the measurement of maximum and minimum value, automatic/manual range switching, automatic power off and alarm function. The complete machine takes a switching integrated circuit which can directly drive LCD microprocessor and double-integrating A/D and a digital display drive offering high resolution and high precision. Due to its complete functions, high measurement accuracy and convenient operation, the multimeter is the ideal tool in laboratory and factory as well as for radio fans and family.

## Open-package Inspection

Open the package box and take out the meter, check carefully if the following accessories are absent or damaged. If there is any absence or damage, please contact the distributor immediately.

Digital Multimeter	1 PC
Instruction Manual	1 copy
Test Leads	1 pair
Temperature Probe (K-Thermocouple)	1 PC
PC Interface Cable	1 PC
Software Disk	1 PC
Holster	1 PC

## Safety Note


In accordance with IEC1010 clause (the safety standard issued by International Electrotechnical Commission), MT-1860 is designed and produced according to the safety requirements of pollution level II.

### **Warning:**

In order to avoid endangering the operator's safety, prior to the operation of the instrument, please read the instruction manual carefully, and conform to the safety warning information and operation instruction strictly to use the instrument.









1. When voltage above 30V, current above 10mA, AC power line with inductive load or power line during electric fluctuation is measured, please beware of electric shock.
2. Prior to measurement, check if the measurement function is in conformity with the

LCD display, and if the push button switch is at the trigger position. Check if the meter pen is contacted reliably, connected correctly, and grounded well and etc. In order to avoid electric shock.

3. Only if the meter is used with the matched meter pen, can it meet the requirement of safety standard. When the line of the meter pen is damaged, it is necessary to replace another one of the same model or the same electrical specification.
4. Don't use other unconfirmed or disapproved protector tube to replace the protector tube inside the meter. Only the protector tube of the same model or same specification can be replaced. Before the replacement, the meter pen must leave the measuring point and ensure there is no any signal at the input terminal.
5. Don't use other unconfirmed or disapproved battery to replace the battery inside the meter. Only the battery of the same model or same electrical specification can be replaced. Before the replacement, the meter pen must leave the measuring point and ensure there is no any signal at the input terminal.
6. When the electrical measurement is made, never let your body get in touch with the ground directly, and don't touch uncovered metal terminal, output port, lead clamp and etc. Where earth potential may exist. Dry clothes, rubber shoes, rubber cushion and other insulating material are usually used to keep your body insulated against the ground.
7. Don't store and use it in the high-temperature, high-humidity, inflammable and strong magnetic field environment.
8. It may do damage to the meter and endanger the operator's safety if the voltage value beyond the permitted ultimate voltage value is measured. The ultimate voltage value permitted for measurement is marked on the instrument panel, and never measure the value exceeding the standard. Don't input the ultimate value out of regulation in order to avoid electric shock and the damage to the meter.
9. When the meter pen is inserted into the current socket, don't measure any voltage for fear that the meter should be damaged and the operator's safety be endangered.
10. Don't try calibrating or repairing the meter. When it is indeed necessary for that, only the qualified professional personnel who have had special training or gained approval can make it.
11. During measurement, the requirement of measurement function must be in accordance with LCD display. Please be sure to disconnect the line of the meter pen with the measured object first and ensure there is no any input signal. It is forbidden to switch the function/range selection switch during measurement
12. When "  " is shown on LCD display, please replace battery immediately to ensure the measurement precision.
13. It is not allowed to insert the meter pen into the current terminal to measure voltage!

14. Please don't change the circuits of the meter freely for fear that the meter be damaged and the safety be endangered.

## Description of Safety Symbols

	Warning!		Battery Under voltage
	High Voltage! Danger!		AC/DC
	Ground		In accordance with the instructions of European Trade Union
	Double Insulation		Fuse

## Description of Instrument Panel and Push button Functions

### 1. Instrument model.

### 2. LCD display area.

### 3. Function button: Used to select various measurement functions.

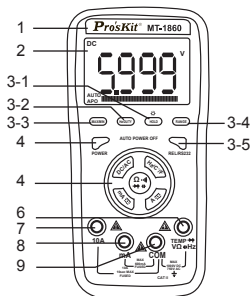
3-1 "Hold" backlight switch and reading-keeping switch. If the switch is pressed over 2 seconds, the backlight turns on. Further press the switch over 2 seconds, the backlight turns off or automatically turns off after 10 seconds.

Pressing the switch within 2 seconds could lock or unlock the data retention. Press the switch once to lock and press it again to unlock.


3-2 Hz/DUTY: Press the key in the gear of frequency can switch between the frequency and the Duty Cycle. Press the key in the gear of AC Voltage or AC Current can switch among the voltage, current, frequency and duty cycle.

3-3 MAX/MIN: The maximum value and minimum value.

Press the function button and enter MAX mode, in which the maximum value is held; press the button again to enter MIN mode, in which the minimum value is held. After the MAX/MIN mode is entered, the display device indicates the MAX/MIN value. No analog bar display and auto power off function in this working environment. Press



down MAX/MIN button for 2 seconds, and then exit from MAX or MIN test.

- 3-4 Range: Automatic/Manual Range Switch. Pre-set it to automatic range when the device starts up, then switch it to manual range. In the mode of manual range, press the "RANGE" button once, it will skip to the previous shift. When it goes to the highest shift, it goes back to the lowest shift when the button is pressed again. The procedure repeats again in the same order. Press the button over 2 seconds, it will exit from manual range and enter the state of automatic range measurement.
- 3-5 REL: Relative Value Measurement. Press this key to show the relative value measurement, press again to cancel the relative value measurement. The procedure repeats in the same order. Press this key over 2 seconds, it will switch to RS232, which can be showed on the LCD screen and the RS232 data transmission is thus open. Further press the key over 2 seconds, the RS232 icon disappears on the LCD screen. Now the RS232 data transmission terminates. The procedure repeats.
4. "POWER" is the power switch.
5. Function Selection Button.
6.  Input Port: Measure the positive input terminal of voltage, frequency, resistance, capacitance, diode as well as on-and-off test, and insert red meter pen.
7. 10A current input jack: Measure the positive input terminal of 10A shift AC/DC current, and insert red meter pen.
8. mA input port: Measure the positive input terminal of AC/DC.
9. COM input port: Measure the negative input terminal, and insert black meter pen.

## Other Functions

### 1. Automatic power off


After the meter is stopped for 15 minutes, it will cut off power automatically (power off), and then enter the dormant (power off) state. The built-in buzzer will send out warning tone in one minute before it powers off. If you want to restart power (power on), please press the power switch. If you want to cancel automatic power-off, please press "REL" key over 2 seconds until the RS232 symbol appears. Meanwhile the "APO" symbol will be also turned off.

## Property

### 1. General features

1-1. Display mode: LCD

1-2. Maximum display: 5999.3 5/6 display automatic polarity display and unit display.

- 1-3. Analog bar. 30 times/sec, display of 61 analog bars.
- 1-4. Measurement mode: dual integration A/D conversion.
- 1-5. Sampling rate: About 3 time/sec.
- 1-6. Over range: Display "OL"
- 1-7. Low voltage display: about 2.4v, the symbol  displayed.
- 1-8. Working temperature: 0~40°C
- 1-9. Storage temperature: -10~50°C, relative humidity <80%
- 1-10. Power: Two 1.5v batteries ("AAA" batteries)
- 1-11. Volume (Dimensions): 185mm×91mm×49mm (Length x width x height)
- 1-12. Weight: About 410g (including battery )

## 2. Technical features

- 2-1. Accuracy:  $\pm(a\% \text{ reading} + d \text{ digits})$ , the ambient temperature for ensuring accuracy: 23 $\pm$ 5°C, relative humidity <75%.
- 2-2. The warranty period of calibration is one year from ex-factory date.

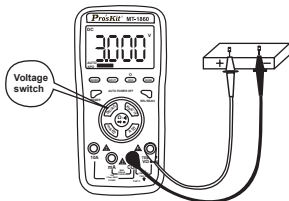
## DC Voltage (DCV)

1. Press "AC/DC", select automatic measurement of DC voltage., and respectively plug in the red and black meter pens into the terminals of "VΩHz" and "COM", as shown in the following diagram.
2. The initial state of the meter is the DC voltage automatic measurement mode, which shows the symbols of "DC" "AUTO" "APO". Press "RANGE" is to select manual range mode; Press "MAX/MIN" once to show the Max measurement value. Press "MAX/MIN" again to show the Min measurement value. Press "MAX/MIN" over 2 seconds is to cancel the measurement of the MAX/MIN value.
3. Touch the measuring point with the meter measuring pen and connect it in parallel to the circuit being tested, and the polarity of the red meter pen wire and the tested voltage value are spontaneously displayed on the display.

### **Caution:**

- a) Voltages over DC1000V or AC750V cannot be tested.
- b) When measuring high voltages, special precautions must be taken to avoid electrical shock. When measurement is completed, immediately disconnect the meter pen and the measured circuit.
- c) In case "OL" is displayed for manual range mode, it indicated the range has been exceeded and it is necessary to select higher range mode to complete this measurement.

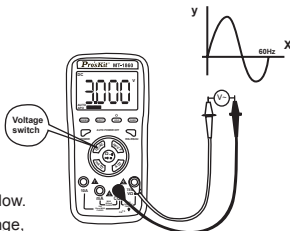
Range	Accuracy	Resolution
600mV	$\pm(0.5\%+4d)$	0.1mV
6V		1mV
60V		10mV
600V		100mV
1000V	$\pm(1.0\%+4d)$	1V



- Input impedance: 600mV range>60M $\Omega$ , the others are 10M $\Omega$ . Overload protection: 1000VDC or 750V alternative peak.

## AC Voltage (ACV)

1. Circularly press the "AC/DC" key until it selects the AC Voltage automatic measurement mode. Meanwhile, the symbol "AC", "AUTO", "APO" will appear on the LCD. Respectively plug in the red and black meter pens into the terminals of "TEMP/Hz" and "com". See the picture re below.
2. The initial state of the meter is automatic range, which shows "AUTO" symbol. Press the "Range" key and switch it to manual range mode. In the AC mode of automatic/manual range, the frequency/ duty cycle can be measured by pressing "Hz/DUTY". However, the frequency response now is low, which is suitable for the measurement of high voltage and low frequency in the environment of magnetic field interference such as 220V/50Hz-400Hz, 380V/50Hz-400Hz.



## ⚠ Caution:

Voltages over DC1000V or AC750V cannot be tested. In case "OL" is displayed for manual range mode, it indicated the range has been exceeded and it is necessary to select higher range mode to complete this measurement.

Range	Accuracy	Resolution
6V	$\pm(0.8\%+10d)$	1mV
60V		10mV
600V		100mV
750V	$\pm(1.0\%+6d)$	1V



- Input impedance: 10M $\Omega$ .
- Overload protection: 1000VDC or 750V alternating peak.
- Display: Mean value response (calibrated with sine wave).
- Frequency response: (40-400)Hz.
- Duty Cycle Display: (0.1%-99.9%).

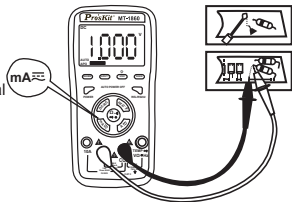
## DC Current (DCA)

1. Press the "mA" button or "A" button.

Plug the black meter pen into the terminal of "COM" and the red meter pen into the terminal of "mA" or "10A". See the picture below.

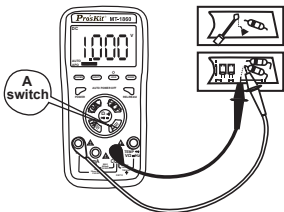
2. Circularly press the "mA" button or "A" button. Select automatic DC 600mA and 10A current to test. The "DC", "AUTO", "APO" symbols will appear on the LCD screen.

3. In case "OL" is displayed on the display, it indicates the current being measured has exceed the current range, and please select higher ranges for measurements.



### Caution:

- a) At the 10A mode, current bigger than 10A cannot be measured, and at mA mode, the current bigger than 600 mA cannot be measured. Otherwise this will lead to the burning of the fuse or damage the instrument.
- b) When the meter pen is plugged in the input terminal of the current, it is strictly prohibited to have the meter pen connected in parallel on any circuits.



Range	Accuracy	Resolution
60mA	$\pm(1.0\%+10d)$	10 $\mu$ A
600mA		100 $\mu$ A
6A	$\pm(1.2\%+10d)$	1mA
10A		10mA

- The maximum input current: 10A (not exceeding 15s)
- Overload protection: 0.6A/250V fuse; 10A/250V fuse.

## AC Current (ACA)

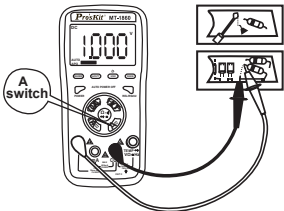
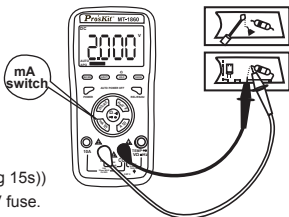
1. Press the "mA" button or "A" button. Plug the black meter pen into the hole of "COM" and the red meter pen into the hole of "mA" or "10A". See the picture below.
2. Circularly press the "mA" button or "A" button. Select automatic AC 600mA and 10A current to test. The "AC", "AUTO", "APO" symbols will appear on the LCD screen.
3. In case "OL" is displayed on the display, it indicates the current being measured has exceeded the current range, and please select higher ranges for measurements.

### ⚠ Caution:

- a) At the 10A mode, current bigger than 10A cannot be measured, and at mA mode, the current bigger than 600 mA cannot be measured. Otherwise this will lead to the burning of the fuse or damage the instrument.
- b) When the meter pens plugged in the input terminal of the current, it is strictly prohibited to have the meter pen connected in parallel on any circuits.

Range	Accuracy	Resolution
60mA	±(1.5%+10d)	10μA
600mA		100μA
6A	±(2.5%+15d)	1mA
10A		10mA

- The maximum input current: 10A (not exceeding 15s)
- Overload protection: 0.6A/250V fuse; 10A/250V fuse.
- Frequency response: 40~400Hz.
- Duty Cycle Display: (0.1%-99.9%).



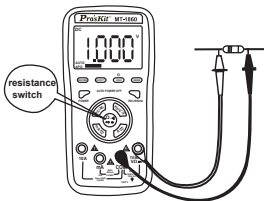
## Resistance

1. Press the " $\Omega$ " button, and respectively plug the red and black meter pens into the holes of "TEMP" and "COM".
2. Circularly press " $\Omega$ " button and select resistance measurement. Meanwhile, a cor-

responding symbol will appear on the LCD screen. In automatic resistance measurement mode, you could select manual measurement by pressing "Range".

### **Caution:**

- When measuring the capacity, all the powers within the tested circuits must be disconnected and the capacitance shall be sufficiently discharged.
- When measuring the resistance, any occurrence of voltage may lead to inaccurate readings, and if the 250V protection voltage is exceeded, it may damage the meter or threaten the safety of the user.
- When the range of 600Ω is in use, first short-circuit the meter pens and measure the resistance of the lead wires and then deduct it in the actual measurement.



Range	Accuracy	Resolution
600Ω	±(0.8%+5d)	0.1Ω
6kΩ	±(0.8%+4d)	1Ω
60kΩ		10Ω
600kΩ		100Ω
6MΩ		1kΩ
60MΩ	±(1.2%+10d)	10kΩ

- Open circuit voltage: 600mV.
- Overload protection: 250V DC or AC peak values.

### **Diode and On-and-Off Test**

- Press " $\Omega$ " button and respectively plug the red and black pens into "TEMP  $\rightarrow$  VΩ +Hz" and "COM".
- Circularly press " $\Omega$ " button to select the diode or buzzer measurement. In Diode mode, LCD screen displays " $\nabla$ " and voltage symbol, and the buzzer symbol " $\Omega$ " is also displayed on the screen.
- Connect the red meter pen to the positive of the diode, the black meter pen to the negative of the diode.

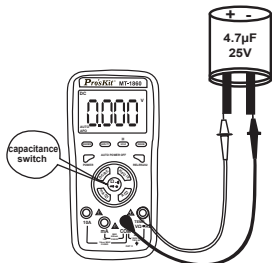
### **Caution:**

- In case the diode is open circuit or the polarities are connected reversely, "OL" will



Range	Accuracy	Resolution
40nF	$\pm(5.0\%+30d)$	10pF
400nF	$\pm(3.5\%+8d)$	100pF
4 $\mu$ F		1nF
40 $\mu$ F		10nF
200 $\mu$ F	$\pm(5.0\%+10d)$	100nF

- Overload protection: 250V DC or AC peak value.



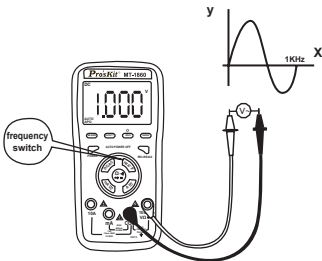
## Frequency (Hz)

1. Press "Hz/C/F" button to conduct frequency measurement.  
Respectively plug in the meter pen into "V $\Omega$ Hz" and "COM".
2. Have the testing end of the meter pen connected in parallel with the signal sources to be measured and read the results from the display. (Note: No analog bar will be displayed in this mode)
3. When testing frequency, press "Hz/DUTY" once to conduct duty cycle measurement.  
Press "Hz/DUTY" once more to enter the frequency status.
4. Read the current results from the display.

### ⚠ Caution:

- a) Do not input signals higher than 60V, otherwise it may damage the instrument and pose dangers to human safety.
- b) After all the measurements are completed, it is necessary to disconnect the meter pen and the tested circuit.

Range	Accuracy	Resolution
10Hz	$\pm(0.3\%+2d)$	0.001Hz
100Hz		0.01Hz
1000Hz		1Hz
10kHz		10Hz
100kHz		100Hz
1MHz		1kHz
20MHz		10kHz



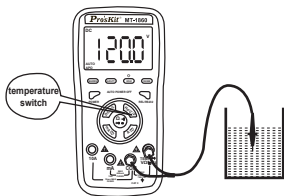
- Input sensitivity: 1.5V effective value. Overload protection: 250VDC or alternating peak

## Temperature Measurement

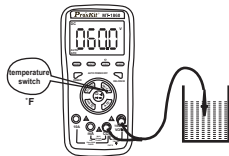
1. Press “Hz / °C / °F” button over 2 seconds, select temperature mode for celsius measurement. Meanwhile, the temperature symbol will be displayed. Further press “Hz / °C / °F”, it will be displayed as Fahrenheit. The procedure repeats in the same order. To exit from temperature measurement, press “Hz / °C / °F” button over 2 seconds.
2. Respectively plug the positive input end and negative insertion end of temperature probe into the terminals of “TEMP  $\rightarrow$   $\frac{V\Omega}{\mu Hz}$ ” and “COM”.
3. Put the induction end of temperature probe on the surface of the tested object. See the picture on the right.
4. Read the current testing results from the display.

### ⚠ Caution:

- a) When the input end is open circuit, it indicates normal temperature.
- b) Do not change the temperature sensor at random, otherwise the accuracy of measurement can not be guaranteed.
- c) Do not input voltage in temperature mode, otherwise the meter may be damaged.



Range	Accuracy	Resolution
-20°C~400°C	$\pm(1.0\%+50d)$	0.1°C
400°C~1000°C	$\pm(1.5\%+15d)$	1°C
0°F~1832°F	$\pm(1.0\%+50d)<750^\circ\text{F}$	0.1°F
	$\pm(1.5\%+15d)\geq 750^\circ\text{F}$	1°F




- K-Thermocouple (Nickel-chromium - nickel silicon) banana probe.

## Communication Connection

1. Select setup to conduct installation according to the corresponding instrument models indicated by the disk in the package.
2. Connect the instrument to computer by USB cable.
3. Press “RS232/REL” over 2 seconds and the “RS232/REL” symbol will be displayed on screen.
4. Once the testing data is transmitted to computer, you could start recording, analyzing, processing and printing the data. For more details, please kindly refer to instructions in the software.

## Instrument Maintenance

This instrument is a sophisticated instrument and the user shall not modify the electric circuit at will.

1. Cautions should be taken to water prevention, dust-prevention and fall prevention.
2. It shall not be stored in such environments as high temperature, high humidity and strong electromagnetic field.
3. Please use wet cloth and mild detergent to clean the exterior of the instrument and do not use such strong solvents as abrasives and alcohol.
4. In case it is not used for a prolonged period of time, the battery shall be removed so as to avoid the battery leakage from corroding the instrument.
5. Pay attention to the status of battery use, and when the LCD displays a flashing "" symbol, the battery shall be replaced.

### The steps are as follows:

1. Loosen the screw on the back cover that secures the battery door and exit the battery door.
2. Remove the 3V batteries and replace them with two new ones. Although a 3V battery of any standard can be used, but in order to lengthen the service life, alkaline batteries should be used.
3. Mount the battery door and tighten the screw;
4. Replacement of fuse: The steps are as the above. When replacing the fuse, please use the fuse of the same size and type.

### Precaution:

1. Do not connect DC or AC peak voltages higher than 1000V.
2. Don not measure voltage value on the current mode, resistance mode, diode mode and buzzer mode.
3. When the battery has not been mounted properly or the back cover has not been tightened, please do not use this meter.
4. Prior to the replacement of battery or fuse, please remove the measuring pen from the measuring point and switch off the meter.

- This Instruction is subjected to change without any further notice.
- The content of this Instruction is considered correct, and in case readers find any errors and missing parts, please contact the manufacturer.
- The Company shall not be held liable for any accidents and hazards resulted from the mal-operations by the user.
- The function elaborated by this Instruction shall not be taken as the reasons for using the product for special purpose