

# Pro'sKit®

CE

MT-2019

Protective Function Analog Multimeter



## User's Manual

1<sup>st</sup> Edition: 2019

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## INTRODUCTION

This Multi-meter is an accurate, safe, battery operated, rear tilt-stand, easy to operate handheld instrument with robust protective holster alongside and the adjustable back tilt device with hook-up design. It can offer accurate, reliable measurement of DC/AC Voltage, DC Current, Resistance and Diode, LED, Transistor, Decibels, Continuity Buzzer and Capacitance with very high sensitive quality movement, and good-designed circuit, as well as colorful Aluminum dial plate etc. It has the perfect full overload & miss-used protection via Fuses, Oxide Varactor & Diodes. It is an ideal instrument for indoor use in the laboratory, school, workshop, hobby and home applications.

## SPECIFICATIONS

Safety Category	IEC61010-1, CAT II 1000V, CAT III 500V and Pollution Degree 2
Common Environment	23°C±5°C, less than 75% RH
Temperature Ranges	0°C to 40°C, 32 °F to 104 °F for Operating condition. -10 °C to 50°C, 14 °F to 122°F for Storage condition.
Humidity Scope	Operating condition less than 90% RH Storage condition: less than 80% RH
Accessories	One set of Test Leads; One Spare Fuse: 0.5A/250V
Size	160(W) x 105(D)x 40(H) mm
Weight	390g approx. (including batteries 3pcs)

Test Functions	Range	Accuracy	Remarks
DCV	0-0.1-2.5-10-50-250V -1000V	± 3% FSD. ± 4% FSD. For 1000V	Input Impedence: 20K $\Omega$ /V Overload Protection: Max. 1000V AC/DC BUT at 0.1/2.5/10V,, 250V Max.
ACV	0-10-50-250V -1000V	± 4% FSD. ± 5% FSD. for 1000V	Input Impedence: 9K $\Omega$ /V Overload Protection: Max. 1000V AC/DC But 10V/50V only 250V Max. Band width: 40 ~10K Hz
DC mA	0-0.05-2.5-25- 250 mA,	± 3% FSD.	Drop Voltage: 250mV Overload protected by Fuses 0.5A/250V, and Oxide Varactor. <250V AC/DC(5s).
$\Omega$	X1: 0.2 ~ 2K $\Omega$ midscale at 20 $\Omega$ X10: 2~20K $\Omega$ Midscale at 200 $\Omega$ X100:20~200K $\Omega$ Midscale at 2000 $\Omega$ X1K: 200~ 2M $\Omega$ Midscale at 20K $\Omega$ X10K: 2K ~ 20M $\Omega$ Midscale at 200K $\Omega$	± 4% of ARC of Scale Length	Overload protected by the Oxide Varactor & Fuse <250V AC/DC(5s).
Capacitance (uF)	2000uF	Approximate Value	Use the $\Omega$ X 1K range
BATT Check	0 ~ 1.5V: GOOD - ? – BAD 0 ~ 9V: GOOD - ? – BAD	± 5% of ARC of Scale Length	Load Current: 270mA for 1.5V, 25mA for 9V. Overload protected by Fuse & Oxide Varactor <250V AC/DC(5s).
Continuity Check •)))	Beeper sounding under 200 Ohm		Overload protected by Fuse & voltage Suppressor <250V AC/DC(5s).

Transistor Check	hFE: 0-1000 via special hFE socket	Approximate Value	At $\Omega$ X 10 Range
LED, Diode Check	via special hFE socket	Approximate Value	At $\Omega$ X 10 Range
Decibel	-22 dB ~ + 62 dB (0dB=1mW at 600 $\Omega$ )	Approximate Value	At ACV ranges
Power Source	Internal Battery: R03, AAA, 1.5V 2pcs, 6F22, NEDA1604, 9V 1pc		

## CALIBRATION

$\Omega$  Zero Adjustor located at the right side of the panel, adjusting the meter pointer to the Zero mark on the right side of  $\Omega$  scale of the meter dial when the test leads are touched together.

Mechanical Adjustor Screw: located right below the center of the meter dial to set pointer to Zero mark at the left side of the scale.

(-) Jack: Plug-in connector at the lower left on the panel for Black, negative test lead.

(+) Jack: Plug-in connector at the lower right on the panel for Red, positive test lead.

## OPERATING INSTRUCTIONS

### CAUTION

When making voltage or current measurements, develop the habit of turning off all power to the circuit under test. Connect the test leads at the desired points in the circuit; then turn on the power while taking readings. Turn off the power before disconnecting the test leads from the circuit.

### INTERNAL BATTERY CHECK

To check the battery condition, insert the black test lead into the (-) jack. Set the range switch to the  $\Omega$  X1 range position and short the ends of the two sides of the test leads. If the pointer can not be brought to the zero mark, replace the 1.5V cells or 9V cell. (See battery replacement.)

### BEFORE OPERATING

1. Set the range switch to the proper position before making any measurement.
2. Never apply more voltage or current than the rated value in every position.
3. When the voltage or current to be measured is not known, always start with the highest range.
4. If meter indication is in the lower half of the scale and falls within the range of a lower scale, reset selector switch to the lower range for greatest accuracy.
5. If the meter won't work at all, check the fuse located on the PCB. If it's blown, replace it. (See fuse replacement.)
6. Avoid placing the meter where extreme shock or continuous vibration is encountered and do not store in excessively hot or damp places. Although very rugged, the meter is a sensitive measuring device and should be handled carefully & properly.
7. Do not check resistance, transistor, diode, LED, or capacitance when live voltage or current input across the circuit.
8. When the meter is not in use, keep the selector switch to the "OFF" range position, this provides direct short across meter movement for minimum needle bounce when transporting meter.
9. If you should accidentally apply excessive voltage or current on a certain range, disconnect the leads from the circuit as quickly as possible, check instrument operation on that range by applying proper input. If the meter does not operate properly, check fuse. If it is blown replace it. (See fuse replacement.)

## **OPERATION PROCEDURES**

### **DC Voltage Measurement**

**WARNING: WITH EXTREME CARE WHEN MAKING MEASUREMENTS FOR HUGH VOLTAGE, AND DO NOT TOUCH TERMINAL OR PROBE ENDS.**

1. Set the selector switch to the appropriate DCV range to be used.
2. Connect the BLACK test lead to the “-COM” jack and the RED test lead to the “+” jack.
3. If you know the polarity of the circuit to be tested, connect the black probe to the negative side.
4. If you don't know the polarity, connect the probes to opposite sides of the circuit and watch the pointer. If it goes to the left, reverse the probes. The RED probe will be connected to the positive.
5. Check the needle position and the get the reading on V.A scale.

### **AC Voltage Measurement**

**WARNING: WITH EXTREME CARE WHEN MAKING MEASUREMENTS FOR HUGH VOLTAGE, AND DO NOT TOUCH TERMINAL OR PROBE ENDS.**

1. Set the selector switch to the appropriate ACV range to be used and connect the test leads across the circuit or load under measurement. (Polarity of the test probes is unimportant on ACV test.)
2. Connect the BLACK test lead to the “-COM” jack and the RED test lead to the “+” jack.
3. Check the needle position and the get the reading on V.A scale.

### **DC Current Measurement**

**WARNING: DO NOT APPLY VOLTAGE TO MEASURING TERMINAL WHILE RANGE SWITCH IS IN CURRENT POSITION DO NOT ATTEMPT TO MEASURE AC CURRENT.**

1. Set the selector switch to the appropriate DC mA range to be used and connect the test leads in series with the circuit or the load under measurement. If the pointer deflects to the left, reverse the probes.
2. Connect the BLACK test lead to the “-COM” jack and the RED test lead to the Red “+” jack for Current at/less than 0.25A.
3. Check the needle position and the get the reading on V.A scale.

**Note:**

**Excessive current input across mA range will blow the fuse that must be replaced by a same fuse rating 0.5A/250V.**

**Note: If connected incorrectly with the voltage at these ranges, quickly remove the test leads from the circuit and can avoid the damage to this**

tester.

**(This tester can afford the voltage <250V DC/AC rms. for the period of 5 seconds max.)**

## **Resistance Measurement**

**WARNING: DO NOT APPLY VOLTAGE TO MEASURING TERMINAL WHILE RANGE SWITCH IS IN OHM POSITION.**

1. Set the selector switch to the appropriate  $\Omega$  range to be used.
2. Connect the BLACK test lead to the "-COM" jack and the RED test lead to the Red "+" jack.
3. Short the leads by touching the probes together. Pointer should read zero at the right hand end of the uppermost scale, if it doesn't, use the **0  $\Omega$**  adjust knob on the right hand of the panel to line up the pointer with zero. (If pointer can't be brought to zero, replace battery.)
4. Connect the test leads across the resistance to be measured.
5. Take reading on the top " $\Omega$ " scale and multiply it by the multiplication factor indicated by the selector switch.
6. If there is little or no pointer movement from the left side of the scale, reset the selector switch to higher range. The effective reading scope on an  $\Omega$  meter scale is within the area of between 25 degree of Arc left side to the Midscale and 25 degree right side to the Midscale.

**Note: If connected incorrectly with the voltage, quickly remove the test leads from the circuit as to avoid the damage to this tester. (This tester can afford the voltage <250V DC/AC rms. for the period of 5 seconds max.)**

## **Diode Measurement**

Set the selector switch to the appropriate  $\Omega$  range to be used.

NOTE: To test the diode while current below 0.060 mA at X 10K range; current below 0.15 mA at X 1K range; current below 1.5 mA at X 100 range; current below 15 mA at X 10 range; current below 150 mA at X 1 range.

### **For IF (forward current) Test**

Put the BLACK test lead to the "-COM" jack and the RED test lead to the Red "+" jack. And then connect the Black probe to the Positive terminal of the Diode, the Red probe to the Negative terminal of the Diode.

### **For IR (reverse current) Test**

Reverse the connection.

1. Read the value IF or IR of the diode on the LI scale.
2. Read the linear (forward voltage) VF of the diode on the LV scale.

## CONTINUITY TEST

 **WARNING: DO NOT APPLY VOLTAGE TO MEASURING TERMINAL WHILE RANGE SWITCH IS IN OHM POSITION.**

Set the selector switch to the BUZZ range. Connect the test leads to two points of circuit. If the resistance is lower than 200 Ohm approx., the Beeper sounds.

**Note: Battery voltage is sufficient for Buzzer operation as long as the Zero Ohm pointer can be adjusted to the Zero scale place.**

**Note: If connected incorrectly with the voltage, quickly remove the test leads from the circuit as to avoid damage to this tester.**

**(This tester can afford the voltage <250V DC/AC rms. for the period of 5 seconds max.)**

### Transistor hFE and LED Test

Set the selector switch to the  $\Omega \times 10$  range.

#### For Measuring Transistor hFE

1. Take note the type of transistor "PNP" or "NPN" and then insert the transistor terminals of the Emitter, Base and Collector separately into the proper holes of the socket on the front panel.
1. Read the approximate hFE Value directly at the hFE scale.  
Note: Current  $10\mu\text{A}$ . VCE 2.8V.
2. When the Base terminal cut, the value of Leak is  $I_{\text{ceo}}$  for Transistor.

#### For Measuring LED

Insert the transistor terminals directly into the "+" and "-" holes of the socket on the front panel.

And then check if the LED under testing is lighting.

#### Battery Check

1. This meter can come with two separate battery check ranges to test either DC 1.5V or 9V batteries.
2. Set the selector switch to the appropriate BATT range to be used.
3. Connect the BLACK test lead to the "-COM" jack and the RED test lead to the Red "+" jack.
4. Connect the Red test lead to the positive end of battery and the Black one to the negative end of the battery to be measured.
5. Take reading on the "BATT" scale and check it good or bad as per which portion indicated.

(Note: the mark section of "?" shows that the battery may be starting to decay.)



**Note: If connected incorrectly with the voltage, quickly remove the test leads from the circuit as to avoid the damage to this tester.**

**(This tester can afford the voltage <250V DC/AC rms. for the period of 5 seconds max.)**

### **Decibels Measurement**

1. Set the selector switch to AC 10V range.
2. Connect the BLACK test lead to the “-COM” jack and the RED test lead to the “Output” jack.
3. Connect the test leads to the measuring circuit, and then read the bottom Red dB scale.
4. For more dB scope, change the selector switch to the others of ACV ranges and make the same actions. Add the appropriate number of dB scale reading as noted on the chart below.

**Note: For absolute dB measurements, circuit impedance must be 600 Ohm. 0 dB = 1mw dissipated in a 600 Ohm impedance (equivalent to 0.755V across 600 Ohm)**

ACV RANGE	ADD dB Number
50	14
250	28
1000	40

### **Capacitance Measurement**

**WARNING: DO NOT APPLY VOLTAGE TO MEASURING TERMINAL WHILE MAKING ANY CAPACITANCE MEASUREMENTS.**

**BEFORE TESTING ANY CAPACITORS, DISCHARGE THE CAPACITOR COMPLETELY.**

1. Set the selector switch to the  $\Omega$  X 1K range.
2. Connect the BLACK test lead to the “-COM” jack and the RED test lead to the Red “+” jack.
3. Connect the test leads to the capacitor to be measured (Note the polarity of capacitor).
4. Watch the needle deflection to the right topside, and read the Red C scale on the Dial.

### **TROUBLESHOOTING**

**Nevertheless, problems or malfunctions may occur.**

**For this reason, the following is a description of how you can eliminate possible malfunctions by yourself:**

Error	Possible cause
The multimeter does not work.	Are the batteries exhausted? Is the power indicator lit? Check the state of the batteries and the fuse 0.5A.
No measurements possible via V/mA socket.	Is the fuse defective? Check the fuse 0.5A (fuse replacement)
No change in measured values.	Have you selected the right measuring sockets? Is the measuring range/mode correct (AC/DC)?
Faulty measuring results are displayed.	Has null balancing of the display or a 0 $\Omega$ calibration for the resistance measurement been carried out? Is the batteries not properly assembled in?

## **MAINTENANCE**

**Replacement for Battery and/or Fuse should only be done after the test leads have been disconnected and POWER OFF.**

### **1. Battery Replacement**

- 1) Note the condition of the batteries using the procedure described above, if the battery needs to be replaced, remove the screw and open the upper cover of the battery cabinet on the rear case.
- 2) Take off the spent batteries and replace them with a battery of the same type. Observing polarity as indicated battery polarity marking on the bottom of the battery compartments.
- 3) Replace the battery cabinet cover and tighten the screw.


### **2. Fuse Replacement**

- 1) When the fuse needs replacement, use only UL-Listed 0.5A/250V fuse identical in physical size to the original type  $\Phi 5 \times 20$  mm.
- 2) Disassemble the side Holsters, and take off the screw, then open the whole rear case. Remove the old fuse from its holder; install the new fuse into it.
- 3) Replace the rear cover & Holsters, and tighten the screw.

# MT-2019 指針型防誤測電錶操作使用說明書

## 特點：

本機是指針式，防誤測全保護，斜立型三用電錶(附晶體 LED 座)。具有以下基本特點和參數如下：

- 斜立型，可調後蓋支撐架（拉出後，向上轉動 90 度，壓下可固定）；附帶掛鉤設計（支撐架向上轉動 180 度伸出後蓋，以便懸掛）。
- 配置玻璃釐維環氧樹脂鍍金盤單面電路板，日系電池，並通過 CE 認證。
- 檔位切換簧片採用彈簧寶石軸承及二極體雙向限幅電路
- 具有全面的防誤測超載保護電路及速斷型保險絲多重保護
- 具有緊湊的兩側軟性防滑減震保護套
- 可測直流電壓，直流電流（最大 250mA），交流電壓，電阻，電晶體，二極體，LED，電池，線路導通蜂鳴和電容(2000uF Max.) 等。
- 輸入阻抗：DC20K $\Omega$ /V，AC 9K $\Omega$ /V
- 直流電壓：0.1/2.5/10/50/250/1000V 六檔
- 直流電流：50  $\mu$  A/2.5m/25m/250mA 四檔
- 交流電壓：10/50/250/1000V 四檔
- 電阻：1/10/100/1K/10K 五檔
- 電池：1.5/9V 二檔
- 線路導通:  一檔
- 電容：C ( $\Omega$  X1K) (2000 uF)；
- 標準環境條件：23°C $\pm$ 5°C，濕度< 75% RH。
- 工作環境範圍：0°C ~ 40°C，濕度< 90% RH。
- 儲存條件：-10°C ~ 50°C，濕度< 80% RH。
- 電錶外形尺寸：160（長）x 105（寬）x 40（高）mm
- 電錶重量：390 克（包括電池）

## 規格表：

測試功能	檔位	準確度	說明
直流電壓 DCV	0-0.1-2.5-10-50- 250V -1000V	$\pm$ 3%FSD(滿刻度) $\pm$ 4%FSD(1000V 檔)	輸入阻抗：20K $\Omega$ /V 超載：Max 1000V 但在 0.1/2.5 /10V 各檔， 250V Max.
交流電壓 ACV	0-10-50-250V -1000V	$\pm$ 4%FSD(滿刻度) $\pm$ 5%FSD(1000V 檔) 頻率範圍：40~10KHz	輸入阻抗：9K $\Omega$ /V 超載：Max.1000V 但 10V/50V 檔，250V Max.
直流電流 DCA	0-0.05-2.5-25-250 mA	$\pm$ 3%FSD(滿刻度)	壓降：250mV 超載保護：F0.5A/250V

電阻 $\Omega$	X1:0.2~2K $\Omega$ (中值：20 $\Omega$ ) X10:2~20K $\Omega$ (中值：200 $\Omega$ ) X100:20~200K $\Omega$ (中值：2K $\Omega$ ) X1K:200~2M $\Omega$ (中值：20K $\Omega$ ) X10K:2K~20M $\Omega$ (中值：200K $\Omega$ )	$\pm 4\%$ of ARC(弧長)	超載：最高 AC/DC250V， 最低 DC/AC50V 超載最大測試時間 5 秒。
電容 Capacitance ( $\mu F$ )	2000 $\mu F$	參考值	使用 $\Omega$ X1K 檔
電池測量 BATT Check	0~1.5V:GOOD -?-BAD 0~9V:GOOD-?-BA D	參考值	負載電流：270mA(1.5V 電池)，25mA(9V 電池) 超載：最高 AC/DV250V， 最低 DC/AC 50V， 超載最大測試時間 5 秒。
導通檢測 •))	200 歐姆左右以 內，蜂鳴器會響。		超載：最高 AC/DC 250V， 超載最大測試時間 5 秒。
三極管檢測	hFE: 0-1000	參考值	使用 $\Omega$ X10 檔
LED, 二極管 檢測		參考值	使用 $\Omega$ X10 檔
內部電源	1.5V AAA 電池 2 個 6F22. 9V 電池 1 個		

### 指針防誤測斜立型三用電錶指針閱讀參考表

測試 Test	量程檔位 Range Position	指標刻度讀數 Scale to read	倍數 Multiplied
電阻(歐姆) Resistance( $\Omega$ )	X 1	$\Omega$	$\times 1$
	X10		$\times 10$
	X100		$\times 100$
	X1K		$\times 1000$
	X10K		$\times 10000$
直流電壓(伏特) DC Volt(V)	DC 0.1V	10	$\times 0.01$
	2.5V	250	$\times 0.01$
	10V	10	$\times 1$
	50V	50	$\times 1$
	250V	250	$\times 1$

	1000V	10	x100
直流電流(安培) DC Current (A)	DC 50 $\mu$ A	50	x1
	2.5mA	250	x0.01
	25mA	250	x0.1
	250mA	250	x1
交流電壓(伏特) AC Volt(V)	AC 10V	10V	x1
	50V	50	x1
	250V	250	x1
	1000V	10	x100
三極體 hFE	$\Omega$ X10	IC/IB	x1
二極體 Diode	$\Omega$ X10K		$\mu$ A x1
	X1K		$\mu$ A x10
	X100		$\mu$ A x100
	X10		mA x1
	X 1		mA x10

### 測量注意事項：

#### 1. 指針調零

調整零位調整器，使指針和左側的零位對齊，不必每次測量前都調，但是在開始測量之前，指標都必須確認指標在零位上。

#### 2. 測試棒的連接紅色棒插“+”插孔，黑色棒插入“-COM”插孔。

#### 3. 電錶內部電池檢查將表棒按以上規定方式接入好，再將檔位旋鈕轉到 $\Omega$ X10 檔位。然後，將表棒的兩端短路連接。這時，檢查指針是否正常回歸零位。若不能，則電池電力不足，應要更換新電池。

#### 4. 量程的選擇

選擇測量檔位時，旋鈕上的“三角形”記號對準規定的適當量程。

### 測量工作方式：

#### 1. 直流電壓：

用於測量電池、放大器電路、通訊設備電源、電子管和電晶體電路偏壓的直流電壓。7 個檔位中的每一個檔位標記，分別表示該檔的最大電壓示值。

(※不確定之直流電壓，應從最大值依序向下調整量測)

#### 2. 交流電壓：

用於測量商業交流電壓、交流電源電路、交流放大信號級等。4 個檔位中的每一個檔位標記，分別表示該檔的最大電壓示值。(※不確定之交流電壓，應從最大值依序向下調整量測)

#### 3. 直流電流：(不可測量任何交流電流或電壓！)

用於測量直流電源控制裝置的電流消耗、電晶體電路的工作電流 等。4 個檔位中的每一個檔位標記，分別表示該檔的最大電流示值。

(※不確定之直流電流，應從最大值依序向下調整量測)

**注意：本機具有防誤測保護電路。可短時（5秒內）承受低於 AC/DC 250V 的電壓衝擊，僅爆保險絲。**

4. 電阻：(※此功能不能測試帶電壓電路)

測量電阻值和測試線路和線路間的連通性。5 個檔中的每一個檔位標記，分別表示該檔乘數。(K 即 x1000)

**注意：本機在電阻檔具有防誤測保護電路。可短時（5秒內）承受低於 AC/DC 250V 的電壓衝擊，僅爆保險絲。**

5. 電池測試：

(※電池能用於小的晶體管收音機，但不能用作裝的電源。)

好電池：指針停留在綠色(GOOD)範圍內。電量不足：指針停在“?”尚可使用範圍內。

壞電池：指標停在紅色(BAD)區域。

**注意：本機在檔位具有防誤測保護電路。可短時（5秒內）承受低於 AC/DC 250V 的電壓衝擊，僅爆保險絲。**

6. 導通性測試(Buzz) (※此功能不能測試帶電壓電路)：

將量程選擇旋鈕置於 Buzz 檔，當被測電路 $<200\Omega$ ，蜂鳴器鳴叫。

**注意：本機在檔位具有防誤測保護電路。可短時（5秒內）承受低於 AC/DC 250V 的電壓衝擊，僅爆保險絲。**

7. dB 測試：

本機測量 dB 值時，要將紅色表棒插入專用“OUTPUT”插孔，黑色表棒插入專用“-COM”插孔；然後檢視電錶讀數。

測量在 10V 檔上進行，可直接讀取 dB 刻度(-10dB~+22dB)。

測量在 50V 檔上進行時，刻度讀值要加 14dB，才是實際 dB 值。

測量在 250V 檔上進行時，刻度讀值要加 28dB。

測量在 1000V 檔上進行時，刻度讀值要加 40dB。

例如，在 1000V 檔上最大可測 dB 值是  $22+40=62\text{dB}$ 。

8. hFE(直流放大倍數)和發光二極體(LED)測試：

將量程選擇旋鈕置於“ $\Omega$ ”量程之 X10 檔

**hFE 測試：**

- 調節 0  $\Omega$  調整器使指針和零位對齊-將電晶體的三個管腳直接插入面板上的 hFE 端座。

(※注意區分電晶體的類別“PNP”和“NPN”。)

- 在 hFE 刻度讀出顯示值，所讀之值是 IC/IB，即被測體的直流放大倍數。

**LED 測試：**

- 將 LED 的兩個腳按正負極性直接插入面板上的 LED 的“+”，“-”兩個

端座。

- 檢查 LED 是否正常發光。

#### 9. 二極體測試：

- 將量程選擇旋鈕置於“Ω”檔上有選擇的量程位置，X10K 用於 0~60 $\mu$  A 測試，X1K 用於 0~150 $\mu$  A，X100 用於 0~1.5mA，X10 於 0~15mA，X1 用於 0~150mA 測試。
- 將電錶與二極體連接測 IF(正向電流)，將電錶的“COM”端與二極體陽極相連，“+”端與二極體陰極相連，對於 IR(反向電流)測試連接方法和 IF 相反。
- 在 LI 刻度線讀出 IF 或 IR
- 在測試 IF 或 IR 同時在 LV 刻度上，讀出二極體正向(反向)電壓。

#### 10. 電容測試：

**注意：檢測前，須將電容放電並將電錶調零。(※此功能不能測試帶電壓電路)**

**電容檢測：**

- 1) 將電錶量程選擇旋鈕置於“Ω X1K”檔
- 2) 用表棒連接電容，並注意“+”，“-”極性。
- 3) 觀察指標偏轉最大時，電錶刻度板上紅色 C 刻度。

### 日常保養

**更換電錶內部電池和保險絲管時，必須將表棒從電錶上移調，並切斷電源。**

#### 1. 電池更換：

打開電錶的上部電池倉後蓋，從電池座中拿出不好的電池。再將新的同規格電池放入原位，並注意電池的正負極性，然後，蓋上後蓋並擰緊螺釘。

#### 2. 保險絲管更換：

首先移去電錶兩側的軟性保護套，然後打開電錶的後蓋，從保險絲座中拿出不好的保險絲管。


再將新保險絲管 (0.5A/250V， $\Phi$ 5\*20mm) 換上。必須用同規格 UL 認證的保險絲管。然後，蓋上後蓋並套上保護套，最後鎖緊後蓋螺釘。

(本電錶的電池倉後蓋下一般設有備用保險絲管)。

# MT-2019 指针型防误测电表操作使用说明书

## 特点:

本机是指针式, 防误测全保护, 斜立型三用电表(附晶体 LED 座)。具有以下基本特点和参数如下:

- 斜立型, 可调后盖支撑架(拉出后, 向上转动 90 度, 压下可固定); 附带挂钩设计(支撑架向上转动 180 度伸出后盖, 以便悬挂)。
- 配置玻璃纤维环氧树脂镀金盘单面电路板, 日系电池, 并通过 CE 认证。
- 档位切换簧片采用弹簧宝石轴承及二极管双向限幅电路
- 具有全面的防误测超载保护电路及速断型保险丝多重保护
- 具有紧凑的两侧软性防滑减震保护套
- 可测直流电压, 直流电流(最大 250mA), 交流电压, 电阻, 晶体管, 二极管, LED, 电池, 线路导通蜂鸣和电容(2000uF Max.) 等。
- 输入阻抗: DC20K $\Omega$ /V, AC 9K $\Omega$ /V
- 直流电压: 0.1/2.5/10/50/250/1000V 六档
- 直流电流: 50  $\mu$  A/2.5m/25m/250mA 四档
- 交流电压: 10/50/250/1000V 四档
- 电阻: 1/10/100/1K/10K 五档
- 电池: 1.5/9V 二档
- 线路导通:  一档
- 电容: C ( $\Omega$  X1K) (2000 uF) ;
- 标准环境条件: 23°C $\pm$ 5°C, 湿度< 75% RH。
- 工作环境范围: 0°C ~ 40°C, 湿度< 90% RH。
- 储存条件: -10°C ~ 50°C, 湿度< 80% RH。
- 电表外形尺寸: 160 (长) x 105 (宽) x 40 (高) mm
- 电表重量: 390 克 (包括电池)

## 规格表:

测试功能	档位	准确度	说明
直流电压 DCV	0-0.1-2.5-10-50- 250V -1000V	$\pm$ 3%FSD(满刻度) $\pm$ 4%FSD(1000V 档)	输入阻抗: 20K $\Omega$ /V 超载: Max 1000V 但在 0.1/2.5 /10V 各档, 250V Max.
交流电压 ACV	0-10-50-250V -1000V	$\pm$ 4%FSD(满刻度) $\pm$ 5%FSD(1000V 档) 频率范围: 40~10KHz	输入阻抗: 9K $\Omega$ /V 超载: Max.1000V 但 10V/50V 档, 250V Max.
直流电流 DCA	0-0.05-2.5-25-250 mA	$\pm$ 3%FSD(满刻度)	压降: 250mV 超载保护: F0.5A/250V



电阻 $\Omega$	X1:0.2~2K $\Omega$ (中值: 20 $\Omega$ ) X10:2~20K $\Omega$ (中值: 200 $\Omega$ ) X100:20~200K $\Omega$ (中值: 2K $\Omega$ ) X1K:200~2M $\Omega$ (中值: 20K $\Omega$ ) X10K:2K~20M $\Omega$ (中值: 200K $\Omega$ )	$\pm 4\%$ of ARC(弧长)	超载: 最高 AC/DC250V, 最低 DC/AC50V 超载最大测试时间 5 秒。
电容 Capacitance ( $\mu F$ )	2000 $\mu F$	参考值	使用 $\Omega$ X1K 檔
电池测量 BATT Check	0~1.5V:GOOD -?-BAD 0~9V:GOOD-?-BAD	参考值	负载电流: 270mA(1.5V 电池), 25mA(9V 电池) 超载: 最高 AC/DV250V, 最低 DC/AC 50V, 超载最大测试时间 5 秒。
导通检测 •••))	200 欧姆左右以 内, 蜂鸣器会响。		超载: 最高 AC/DC 250V, 超载最大测试时间 5 秒。
三极管检测	hFE: 0-1000	参考值	使用 $\Omega$ X10 檔
LED, 二极管 检测		参考值	使用 $\Omega$ X10 檔
内部电源	1.5V AAA 电池 2 个 6F22. 9V 电池 1 个		

### 指针防误测斜立型三用电表指针阅读参考表

测试 Test	量程檔位 Range Position	指标刻度读数 Scale to read	倍数 Multiplied
电阻(欧姆) Resistance( $\Omega$ )	X 1	$\Omega$	x1
	X10		x10
	X100		x100
	X1K		x1000
	X10K		x10000
直流电压(伏特) DC Volt(V)	DC 0.1V	10	x0.01
	2.5V	250	x0.01
	10V	10	x1
	50V	50	x1
	250V	250	x1

	1000V	10	×100
直流电流(安培) DC Current (A)	DC 50 $\mu$ A	50	×1
	2.5mA	250	×0.01
	25mA	250	×0.1
	250mA	250	×1
交流电压(伏特) AC Volt(V)	AC 10V	10V	×1
	50V	50	×1
	250V	250	×1
	1000V	10	×100
三极管 hFE	$\Omega$ X10	IC/IB	×1
二极管 Diode	$\Omega$ X10K		$\mu$ A×1
	X1K		$\mu$ A×10
	X100		$\mu$ A×100
	X10		mA×1
	X 1		mA×10

### 测量注意事项:

#### 1. 指针调零

调整零位调整器，使指针和左侧的零位对齐，不必每次测量前都调，但是在开始测量之前，指标都必须确认指标在零位上。

#### 2. 测试棒的连接红色棒插“+”插孔，黑色棒插入“-COM”插孔。

#### 3. 电表内部电池检查将表棒按以上规定方式接入好，再将档位旋钮转到 $\Omega$ X10 档位。然后，将表棒的两端短路连接。这时，检查指针是否正常回归零位。若不能，则电池电力不足，应要更换新电池。

#### 4. 量程的选择

选择测量档位时，旋钮上的“三角形”记号对准规定的适当量程。

### 测量工作方式:

#### 1. 直流电压:

用于测量电池、放大器电路、通讯设备电源、电子管和晶体管电路偏压的直流电压。7个档位中的每一个文件位标记，分别表示该文件的最大电压示值。(※不确定之直流电压，应从最大值依序向下调整量测)

#### 2. 交流电压:

用于测量商业交流电压、交流电源电路、交流放大信号级等。4个档位中的每一个文件位标记，分别表示该文件的最大电压示值。(※不确定之交流电压，应从最大值依序向下调整量测)

#### 3. 直流电流: (不可测量任何交流电流或电压!)

用于测量直流电源控制装置的电流消耗、晶体管电路的工作电流 等。4个档位中的每一个文件位标记，分别表示该文件的最大电流示值。

(※不确定之直流电流，应从最大值依序向下调整量测)

**注意：本机具有防误测保护电路。可短时（5秒内）承受低于 AC/DC 250V 的电压冲击，仅爆保险丝。**

4. 电阻：**(※此功能不能测试带电压电路)**

测量电阻值和测试线路和线路间的连通性。5 个文件中的每一个文件位标记，分别表示该文件乘数。(K 即  $\times 1000$ )

**注意：本机在电阻文件具有防误测保护电路。可短时（5秒内）承受低于 AC/DC 250V 的电压冲击，仅爆保险丝。**

5. 电池测试：

**(※电池能用于小的晶体管收音机，但不能用作装的电源。)**

好电池：指针停留在绿色(GOOD)范围内。电量不足：指针停在“?”尚可使用范围内。

坏电池：指针停在红色(BAD)区域。

**注意：本机在文件位具有防误测保护电路。可短时（5秒内）承受低于 AC/DC 250V 的电压冲击，仅爆保险丝。**

6. 导通性测试(Buzz) (※此功能不能测试带电压电路)：

将量程选择旋钮置于 Buzz 文件，当被测电路 $<200\text{ohm}$ ，蜂鸣器鸣叫。

**注意：本机在文件位具有防误测保护电路。可短时（5秒内）承受低于 AC/DC 250V 的电压冲击，仅爆保险丝。**

7. dB 测试：

本机测量 dB 值时，要将红色表棒插入专用“OUTPUT”插孔，黑色表棒插入专用“-COM”插孔；然后检视电表读数。

测量在 10V 档上进行，可直接读取 dB 刻度(-10dB~+22dB)。

测量在 50V 档上进行时，刻度读值要加 14dB，才是实际 dB 值。

测量在 250V 档上进行时，刻度读值要加 28dB。

测量在 1000V 档上进行时，刻度读值要加 40dB。

例如，在 1000V 档上最大可测 dB 值是  $22+40=62\text{dB}$ 。

8. hFE(直流放大倍数)和发光二极管(LED)测试：

将量程选择旋钮置于“ $\Omega$ ”量程之 X10 档

**hFE 测试：**

- 调节  $0\ \Omega$  调整器使指针和零位对齐-将晶体管的三个管脚直接插入面板上的 hFE 端座。

(※注意区分晶体管的类别“PNP”和“NPN”。

- 在 hFE 刻度读出显示值，所读之值是 IC/IB，即被测体的直流放大倍数。

**LED 测试：**

- 将 LED 的两个脚按正负极性直接插入面板上的 LED 的“+”，“-”两个

端座。

- 检查 LED 是否正常发光。

#### 9. 二极管测试:

- 将量程选择旋钮置于“Ω”档上有选择的量程位置, X10K 用于 0~60 $\mu$  A 测试, X1K 用于 0~150 $\mu$  A, X100 用于 0~1.5mA, X10 于 0~15mA, X1 用于 0~150mA 测试。
- 将电表与二极管连接测 IF(正向电流), 将电表的“COM”端与二极管阳极相连, “+”端与二极管阴极相连, 对于 IR(反向电流)测试连接方法和 IF 相反。
- 在 LI 刻度线读出 IF 或 IR
- 在测试 IF 或 IR 同时在 LV 刻度上, 读出二极管正向(反向)电压。

#### 10. 电容测试:

**注意: 检测前, 须将电容放电并将电表调零。(※此功能不能测试带电压电路)**

**电容检测:**

- 4) 将电表量程选择旋钮置于“Ω X1K”档
- 5) 用表棒连接电容, 并注意“+”, “-”极性。
- 6) 观察指标偏转最大时, 电表刻度板上红色 C 刻度。

### 日常保养

**更换电表内部电池和保险丝管时, 必须将表棒从电表上移调, 并切断电源。**

#### 1. 电池更换:

打开电表的上部电池仓后盖, 从电池座中拿出不好的电池。再将新的同规格电池放入原位, 并注意电池的正负极性, 然后, 盖上后盖并拧紧螺钉。

#### 2. 保险丝管更换:

首先移去电表两侧的软性保护套, 然后打开电表的后盖, 从保险丝座中拿出不好的保险丝管。

再将新保险丝管 (0.5A/250V,  $\Phi$ 5\*20mm) 换上。必须用同规格 UL 认证的保险丝管。然后, 盖上后盖并套上保护套, 最后锁紧后盖螺钉。

(本电表的电池仓后盖下一般设有备用保险丝管)。

# Pro'sKit® 中国地区产品保固卡

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    - 因意外因素或人为因素(包括搬运、挤压、碰撞、高温、输入不合适电压、腐蚀等不可抗力因素)导致的故障或损坏。
    - 因使用非宝工导致的故障及损坏。
  - 非服务保证内容
    - 本机主体外之配件：如砂轮、磨头、抛光轮、切割砂轮片等配件
    - 任何因自然磨损、超负荷工作而引起的损坏。
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