

# Pro'sKit®



## MT-2017N

### Smart Protective Function Analog Multimeter



## User's Manual

1<sup>st</sup> Edition' 2020

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## INTRODUCTION

This Multi-meter is an accurate, safe handheld meter that comes with mirrored Aluminum dial, robust protective holster alongside, built-in stand and hook-up design. MT-2017 is powered by batteries, offers accurate, reliable measurement of DC/AC Voltage, +/-DCV, DC Current, Resistance and Diode, LED, Transistor, Decibels, Continuity test and Capacitance with very high sensitivity quality movement.

This meter is designed with double-sided glass-epoxy PCB, full overload & misused protection via two Fuses, voltage Suppressor & Diodes, and smart protection on  $\Omega$  testing via the extra Resettable Fuse & Varistor. Ideal for indoor use in laboratory, school, workshop, and home applications.

## SPECIFICATION

Safety Category: IEC61010-1, CAT II 1000V, CAT III 500V and Pollution Degree 2.

Common Environment:  $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ , less than 75% RH.

Operating temperature:  $0^{\circ}\text{C}$  to  $40^{\circ}\text{C}$ ,  $32^{\circ}\text{F}$  to  $104^{\circ}\text{F}$

Storage temperature:  $-10^{\circ}\text{C}$  to  $50^{\circ}\text{C}$ ,  $14^{\circ}\text{F}$  to  $122^{\circ}\text{F}$

Operating Humidity Scope: Less than 90% RH.

Storage Humidity Scope: less than 80% RH.

Dimensione: 171(W) x 108(D) x 37(H) MM

Weight: 370g approx. (including batteries 3pcs)

Accessories: One pair of test leads;

Two Spare Fuses: 0.5A/250V & 10A/250V,  $\Phi 5 \times 20\text{mm}$

Test Functions	Range	Accuracy	Remarks
DC V	0-0.1-2.5-10-50-250 V-1000V	$\pm 3\%$ FSD. $\pm 4\%$ FSD. For 1000V	Input Impedance: 20K $\Omega$ /V Overload Protection: Max. 1000V AC/DC BUT 0.1V/2.5V/10V 250V Max.
Null DCV	$\pm 5\text{V}$ , $\pm 25\text{V}$	$\pm 5\%$ FSD.	Input Impedance: 40K $\Omega$ /V Overload 1000V Max.
AC V	0-10-50-250V -1000V	$\pm 4\%$ FSD. $\pm 5\%$ FSD. For 1000V	Input Impedance: 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, 10A	$\pm 3\%$ FSD. $\pm 4\%$ FSD. For 10A	Drop Voltage: 250 mV Overload protected by Fuses 0.5A/250V & 10A / 250V at 10A range, Max. test time 15sec. for 10A.
$\Omega$	X 1: 0.2 ~ 2K $\Omega$ Midscale at 20 $\Omega$ X 10: 2 ~ 20K $\Omega$ Midscale at 200 $\Omega$ X 100: 20 ~ 200K $\Omega$ Midscale at 2000 $\Omega$ X1K: 200~ 2M $\Omega$ Midscale at 0K $\Omega$ X10K: 2K ~20M $\Omega$ Midscale at 200K $\Omega$	$\pm 4\%$ of ARC of Scale Length	Overload protected the extra thermal Resettable Fuse & Varistor <250V AC/DC (30s.). Normal test can be auto-restored within 1 minute after the voltage load removed off.
Capacitance (uF)	C: 2,000uF Max. .	Approx. Value	Use the R x 1K range

BATT Check	0 ~ 1.5V: GOOD - ? – BAD 0 ~ 9V: GOOD - ? – BAD	$\pm 5\%$ of ARC of Scale Length	Load Current: 270mA for 1.5V 25mA for 9V Overload protected by Fuse & voltage Suppressor <250V AC/DC(5s).
Transistor Check	hFE: 0-1000 via special hFE socket	Approx. Value	At $\Omega$ X 10 Range
LED, Diode Check	via special hFE socket	Approx. Value	At $\Omega$ X 10 Range
Decibel	-22 dB ~ + 62 dB (0dB=1mW at 600 $\Omega$ )	Approx. Value	At ACV ranges Via Test Leads
Continuity Check	Beeper sounding under 200 Ohm		Overload protected by Fuse & voltage Suppressor <250V AC/DC(5s).
POWER Source	Internal Battery: R3P, AAA, 1.5V 2pcs, 6F22, NEDA1604, 9V 1pc		

## CALIBRATION

Ohms Zero Adjustor located at the right side of the panel. Adjust the meter pointer to the Zero mark on the right side of Ohm scale of the meter dial when the test leads are touched together.

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

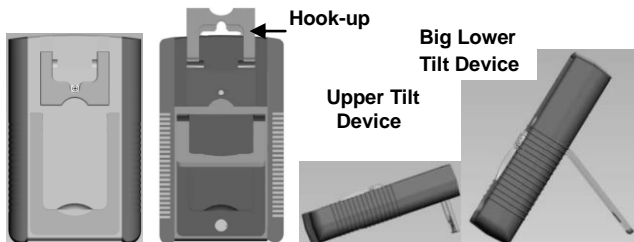
(-) Jack: Plug-in connector at the lower left on the panel for black, negative test lead.

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

## STAND & HOOK-UP

This meter can be used in any operating position. It has two rear support devices, i.e. the upper small bracket and the lower big tilt device. The upper one not only performs the light slanted position, but also hook-up the tester which makes it easier to place the tester and read the display when measuring.

And the lower big tilt device can provide the steeper slant degree position easy for user's reading too.



## 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, and 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 R 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 it 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: USE EXTREME CARE WHEN MAKING MEASUREMENTS FOR HIGH VOLTAGE. 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 get the reading on V.A scale.

### **Null DCV (Central Zero) Measurement**

At these two ranges, it can automatically judge the polarity of circuit as the pointer can move to the center line and become a Null meter.


1. Set the selector switch to the DCV  $\pm 5V$  or  $25V$  range.
2. Connect the BLACK test lead to the "-COM" jack and the RED test lead to the Red "+" jack.
3. Set the Zero  $\Omega$  adjustor to place the pointer exactly to the Central Zero position if need.

4. Connect the test leads across the circuit or load under measurement.

5. Take the readings on the Red dial Null DCV scale.


**NOTE:** If the needle failed to be set at Central Zero position, the power of 9V battery may be weak and should be replaced by new one for normal working.

### **AC Voltage Measurement**

 **WARNING: USE EXTREME CARE WHEN MAKING MEASUREMENTS FOR HIGH VOLTAGE. 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 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. For large current max. 10A, move the red test lead to the Red “10A” jack.
3. Check the needle position and 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 or 10A/250V. The maximum testing time once must be not more than 15sec. and pause 5min. for next time at big current load.

The maximum terminal voltage drop is 250mV except for the 10A range.

**NOTE:** If connected incorrectly with the voltage at these ranges, 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.)

## 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 upper most scale, if it doesn't, use the Ohm 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 Ohm 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, this tester can be automatically restored to the normal working within 1 minute after taking off the test leads or the voltage load from the tester without any damage. (This tester can afford the voltage <250V DC/AC rms. for the period of 30 seconds max.)

## Diode Measurement

1. 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.
2. **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.
3. Read the value IF or IR of the diode on the LI scale.
4. 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**

1. Set the selector switch to the R X 10 range.  
FOR Measuring Transistor hFE
2. 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.
3. Read the approximate hFE Value directly at the hFE scale.

**NOTE:** Current 10 $\mu$ A. VCE 2.8V.

4. When the Base terminal cut, the value of Leak is I<sub>ceo</sub> 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 comes 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 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.)

### **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 Red "+" jack.
3. Connect the test leads to the measuring circuit specially in series with a 0.047 $\mu$ F/400V Metalized Polyester Capacitor. 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 **C (R X1K)** 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 C2000uF 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 yourself:

Error	Possible cause
The multimeter does not work.	Are the batteries exhausted? 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 measurements possible via 10A socket.	Is the fuse defective? Check the fuse 10A (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 Ohm 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**

### **- 1.5V Battery (Pls. see the Picture below for reference)**

- 1) This tester uses 2pcs AAA size 1.5V batteries which are located under the lower battery cover together with the big tilt device on the lower part of the rear case.
- 2) Note the condition of the batteries using the procedure described above, if the battery needs to be replaced, turn the lock by 180° degree and take off the cover of the battery cabinet together with the big tilt device on the rear case.
- 3) Remove 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.
- 4) Replace the battery cover and turn the lock by 180° degree again to tighten the battery cover.

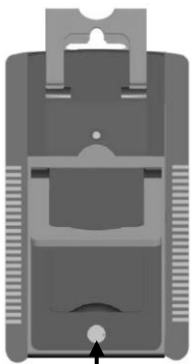
### **- 9V Battery (Pls. see the Picture below for reference)**

- 1) This tester uses One 9V battery which is located under the upper battery cover together with the tilt-Hookup device on the upper part of the rear case.
- 2) Note the condition of the battery 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.
- 3) Take off the spent 9V battery and replace them with a battery of the same type. Observing polarity as indicated battery polarity marking on the bottom of the battery compartment.
- 4) Replace the battery cabinet cover and tighten the screw.

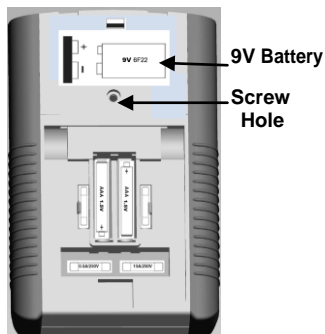
## **2. Fuse Replacement(Pls. see the Picture below for reference)**

- 1) When the fuse needs replacement, use only UL-Listed 0.5A/250V fuse or 10A/250V fuse identical in physical size to the original type  $\Phi 5 \times 20$  mm.
- 2) Open the big lower tilt device on the rear case and then turn the lock by 180° degree and take off the cover of the battery cabinet together with the big tilt device.
- 3) The old fuses inside their holders located on the PCB can be visible and access to be removed. Then take off the melt fuses and install the new fuses into their original places.  
The 0.5A/250V fuse is at the left side and 10A/250V fuse at the right side.
- 4) Replace the battery cover and turn the lock by 180° degree again to tighten the lower battery cover.

NOTE: 2pcs stand-by fuses are provided and located beside the batteries under the lower battery cover with rating marked below the fuses.



**Lock for lower 1.5V  
Battery Cover**



**Lower 1.5V Battery Cabinet  
inside and Fuses Layout**

# ***Pro'sKit®***



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