

Metrix+™ 451

OPERATING INSTRUCTIONS

I. Introduction

This measuring appliance is a kind of stable and reliable numeral multi-meter, with battery power supply. The design of the whole circuit takes the double-integral switch as the core, and the entire function with the monolithic integrated circuit management. The user is able to control all measuring ranges without opening the cover. With The entire overload protection, the measuring appliance is loaded with surge electric, can protect the measuring appliance not to be burnt out. The measuring appliance can display various grade of test pen or the right position for the plug, in case you insert it to the wrong place. The measuring appliance can measure the DC voltage and the electric current, the alternating voltage and the electric current, the resistance, capacitance, inductance、frequency、the diode, the transistor hFE parameter and the electric circuit passes or breaks and so on. With accurate measure, and stable and reliable performance, it is your ideal tool.

II. Safety Rules and Notes

The design of this measuring appliance conforms to the safety standard of IEC1010-1. Please read this handbook carefully before use.

1 notes on securities mark

 Warning, be careful!

 Danger of being hit by high-pressured electric!

 Dual insulation protection.

2 when measure, do not surpass the greatest stipulated input value.

3 do not surpass 10V voltage to the input end, except the voltage grade

4 in the process of measuring, do not turn switch to change the measuring range at random, in case to destroy the measuring appliance.

The measuring appliance can display the mark while the voltage is bigger than DC51V and the AC37V, remind the user that the measured voltage has surpassed the safety voltage, please operate carefully. When the electric current is bigger than 1A, it also can display the mark, remind the user the measured current is probably not safe voltage or short-circuits, please be careful.

5 all grades of positions when the input value is bigger than the greatest stipulated value, can display the warning symbol " OL ".

6 measuring appliances should avoid the straight sunlight, the high temperature, and moisture.

7. after use, must release the power switch to turn off the power

8 if it doesn't use or a long time, should take out the battery, in case the battery leaks to damage the parts.

III. Capability

1.General features

- 1-1, basic accuracy of direct current: $\pm 0.5\%$;
- 1-2. way of Display: Liquid crystal display;
- 1-3. greatest display: 1999 (3 1/2), greatest display of the resistance files: 1980;
- 1-4. measure way: Double integral (3 1/2) A/D transformation;
- 1-5. Sampling speed: approximately 2.5 per second;
- 1-6. displays while surpass the measuring range : Highest position display " OL ";
- 1-7. display of insufficient battery: Displays "";
- 1-8.auto power off
- 1-9. Working conditions: 0~40 °C , relative humidity <80%;
- 1-10. storage environment: -10~50 °C , relative humidity <80;
- 1-11 Power source: One 9v battery (NEDA1604/6F22 or same level model);

1-12 appendix: instruction booklet, outside packing box, two pens and 9v battery, CX/HEF test plug.

2.Technical index

Accuracy is specified for a period of year after calibration and at 18°C to

28°C (64°F to 82°F) with relative humidity to 75%.

2-1 DC voltage

range	Resolution	Accuracy
200mV	0.1mV	$\pm (0.5\%+5)$
2V	1mV	
20V	10mV	
200V	100mV	
1000V	1V	$\pm (0.8\%+5)$

Input impedance: 10MΩ。

Overload protection: 200mV: 250V, the rest is direct current or maximum value of AC 1000V。

2--2.AC voltage

range	Resolution	accuracy
2V	1mV	$\pm (0.8\%+5)$
20V	10mV	
200V	100mV	
700V	1V	$\pm (1.2\%+7)$

Input impedance: 10MΩ。

Frequency range: 40Hz~400Hz (200V, 700V measuring range 40Hz~100Hz) 。

Overload protection: direct current or maximum value of AC 1000V。

display: average value (sine wave virtual value calibration)

2-3.DC current

range	Resolution	accuracy
2mA	1μA	$\pm (0.8\%+5)$
200mA	100μA	$\pm (1.2\%+5)$
10A	10mA	$\pm (2\%+5)$

Overload protection: F 0.2A/250V fuse, 10A no fuse

greatest input current: 10A (not surpass10 seconds) 。

Measure voltage: approximately 200mV full measure range.

2--4.AC current

range	Resolution	accuracy
200mA	100μA	$\pm (1.8\%+5)$
10A	10mA	$\pm (3\%+7)$

Overload protection: F 0.2A/250Vfuse, 10A no fuse。

greatest input current: 10A (not surpass seconds) 。

 Measure voltage: 200mV for full measure range。

Frequency range : 40Hz~400Hz。

display: average value (sine wave virtual value calibration)

2--5.resistance

range	Resolution	accuracy
200Ω	0.1Ω	$\pm (0.8\%+3)$
2kΩ	1Ω	
20kΩ	10Ω	
200kΩ	100Ω	
2MΩ	1kΩ	
20MΩ	10kΩ	$\pm (1\%+5)$

Overload protection: 220V virtual value。

Plough voltage: <1V (200MΩ for 3V measure range) 。

2--6.capacitance

range	Resolution	accuracy
20nF	10pF	$\pm (3\%+5)$
200nF	100pF	
2μF	1nF	
20μF	10nF	$\pm (5\%+10)$
200μF	100nF	

Overload protection: F 200mA/250V fuse

2--7 Inductance

Range	Resolution	accuracy
2mH	0.001mH	$\pm (3\%+15)$
20mH	0.01mH	$\pm (3\%+5)$
200mH	0.1mH	
20H	10mH	

Overload protection: F 200mA/250V fuse

2-8 Frequency

Range	Resolution	accuracy
2kHz	1Hz	$\pm (0.5\%3)$
20kHz	10Hz	
200kHz	100Hz	
Input sensitivity(rms)		500mV

Overload Protection : 220V rms .

2-9HFE test of crystal triode

range	illustration	Test conditions
hFE	Display range: 0~1000β	I _{bo} ≈10μA, V _{ce} ≈3V

2-10Continuity

range	Illustration	Test conditions
	Displays the diode forward voltage approximation	Positive direction DC1mA Reverse direction DC3V
	Breakover resistance < approximately 50Ω beep rings, displays the resistance approximation	Plough voltage about 3V

Overload protection: 220V virtual value.

IV. OPERATING INSTRUCTIONS

Before use pay Caution to mark "⚠" beside measures pen, this is to warn you that the tested voltage and electric current can not surpass the instructed measuring range . In addition, to set in the files position to the supposed measure range before use

1. DCV measure

1) inserts the black test lead to the COM jack, inserts the red test lead to VΩ jack.

2) set the range switch to the V $\overline{\text{---}}$ range, Connect test leads across the source or load under measurement., it will display the polarity the red test leads meets

⚠: Caution:

a. if don't know the range of the voltage measured before measure, should set the measure range switch at the highest grade, and then lower the grade gradually

b, if the display monitor only displays " OL ", shows the voltage being measured has surpassed the measuring range, the measure range switch needs to be moved to the highest grade.

c, means not to surpass 1000V voltage, in order to avoid damage interior line of measuring appliance.

d, specially pays Caution when measuring high voltage, avoids getting an electric shock.

2.ACv measure

1) inserts the black test lead to the COM jack, the red test lead VΩ jack.

2) set the measure range switch to the V \sim range, Connect test leads across the source or load under measurement, You can get reading from LCD

⚠Caution: a, refers to the DC voltage pays Caution a, b, d.

b, means not to surpass 700V voltage, in order to avoid damaging interior line of measuring appliance.

3. DC current measure

1) Connect the black test lead to COM jack and the red to the VΩ jack for a maximum 200mA current , for a maximum 10A current, move the red lead to the 10A jack.

2) Set the rotary switch at the desired A $\overline{\text{---}}$ range position.

3) Connect test leads in series with the load under measurement.

4) You can get reading from LCD. The polarity of the red lead connection will

be indicated along with the current value.

NOTE:

a. When the value scale to be measured is unknown beforehand, set the range selector at the highest position.

b. When only the figure 'OL' or 'OL' is displayed, it indicates over-range situation and the higher range has to be selected.

c. "⚠" means the socket mA's maximum current is 200mA and 10A's maximum current is 10A, over current will destroy the fuse. Since 10A is not fused, the measuring time should be less than 10 second to prevent precision from affecting by circuit heating.

4. AC current measure

1) Connect the black test lead to COM jack and the red to the VΩjack for a maximum 200mA current , for a maximum 10A current, move the red lead to the 10A jack.

2) Set the rotary switch at the desired A \sim range position.

3) Connect test leads in series with the load under measurement.

⚠Caution Refers to DC electric current for a, b, c.

5.resistance measure

1) Connect the black test lead to the COM jack and the red table test lead to VΩ jack.

2) Set the rotary switch at the desired Ωrange position, Connect test leads across the resistance under measurement..

⚠ Caution:

a, when the input end leads the way, the measuring appliance displays " OL " for the surpassed measuring range

b, when the measured resistance >1MΩ, the measuring appliance needs several seconds to stabilize the reading, this is normal regarding to high resistance measure

c, when measuring high resistance, as far as possible insert the resistance to VΩand the COM jack directly as far as possible, avoids disturbing.

d, when measuring the on-line resistance, make sure to confirm the measured electric circuit has shut off, at the same time the electric capacity has given out the electricity power, then carry on the survey.

6. capacitor measure

1) Set the rotary switch at the desired " F " range .

2) insert the stochastically matched CX/HEF test plug VΩand the mA jack. Connect the measured capacitor to the input capacity " Cx " jack, please note the polar capacitor has the polar connection (VΩmeets " + ", mA meets " -").

⚠ Caution:

a, before it meets the capacitor, the measuring appliance generally may automatically school slowly to zero, if some drifting reading exists, it won't affect the test precision.

b, when measuring the big electric capacity, needs a period of time to stabilize reading .

c, do not connect the already capacitor which charges (specially to be big capacitor) to the test end.

d, if the non- electric capacity ingredient is big, it will affect the test precision (for example resistance leak and body resistance and so on).

7. Inductor measure

1) Set the rotary switch at the desired " H " range .

2) insert the stochastically matched CX/HEF test plug VΩ and the mA jack. Connect the measured inductor to the input capacity "Lx " jack.

8. Frequency Measurement

1) Connect the black test lead to the COM jack and the red test lead with the V/Ω jack.

2) Set the rotary switch in the Hz range . connect the test leads to the measured sources.

NOTE: Do not apply the voltage above 250V rms to the input ! The display is possible to show readings when a voltage is above 100V rms , but the readings will exceed the technical specification.

9. transistor hFE measure

1) set the rotary switch to the hFE files, insert the stochastically matched CX/HEF test plug $V\Omega$ and the mA jack ($V\Omega$ meets " PNP ", the mA meets " NPN "

2) distinguish the transistor is PNP or NPN, then insert the measured E, B, and C separately to the corresponding test jack

3) the measuring appliance displays hFE approximation, test conditions are base current 10 μ A, V_{ce} approximately 3v.

10.diode measure

1) insert the black test lead to the COM jack, insert the red test lead to $V\Omega$ jack (red test lead polarity is " +").

2) set the rotary switch to the  range, connect the test pen to the measured diode.

 Caution:

a, when the input end leads the way, measuring appliance displays the

surpassed measuring range condition.

b, the measuring appliance displays the value of positive voltage, while

the diode is connected reversely, it display the surpassed condition

11.continuous buzzer pass or break measure

1) insert the black test lead to the COM jack, insert the red test lead to the $V\Omega$ jack.

2) set the rotary switch to the  range (the same as the diode  measuring range), connect the test lead to the two ends of the measured current

3) if the resistance between the two ends being measured is smaller than approximately 50 Ω the buzzers then can send out the sound.

 Caution:

a, when the input end leads the way, measuring appliance displays the surpassed measuring range condition.

b, the measured electric circuit must be measured without power source, because any load signal will be able to cause the buzzer sound, thus cause the wrong judgment.

12.use of back light

1)When carries on the survey under the weak light condition, may press down the " LIGHT " key within 2 seconds, the back light will shine, in order to clearly reading. Again presses down the " LIGHT " key within 2 seconds, the back light will be closed.

2)The back light consumes more electricity, after the lamp bright approximately 6 seconds, it will shut-off automatically. In the survey process press the number maintenance key " HOLD ", can maintain the measuring appliance demonstrating number. Press again, it restores the normal survey.

13.use of HOLD key

In the process of measuring press the reading maintenance key "HOLD", it can keep the device to display the reading, press again, recover to normal measure value.

V. CALIBRATION OF METER

The calibration of this meter includes zero calibration and measured value accuracy calibration. The zero calibration is used for temperature step,

200 Ω and 200M Ω resistance steps (zero calibration does not affect the measuring linearity of this step) , but not for the other steps. When you desire the zero calibration does not take effect (invalid), you can input a greater value at this step, and when the LCD (liquid crystal display) displays " OL ", perform zero calibration again and then start-up again, the zero calibration will be shielded. When perform the zero calibration at resistance step, the displayed value on display should not more than 16 words, or else the " OL " will not displayed at this step.

The calibration method as follows:

1. Press DH key.

2. Switch on the meter and release DH key when hear the "Beep". The "calibrate" will show on the bottom left corner of meter, now the meter enters into calibration mode.

3. The different kinds of calibrations of the meter can be performed by " DH " key. When you want to select its operating function, you can press it for 2 seconds until "select"show on screen indicating that this key has been in the option function mode.

4. When you hold pressing DH key, the optional function as follows:

(1) Adjust the measured displayed value upward, The symbol is "↓";

(2) Adjust the measured displayed value downward, The symbol is ↓";

(3) Zero calibration, the symbol is "zero".

After selecting the function, press this key for 2 seconds and the symbol " select " on screen will disappear, but the prompt of the selected function will keep being shown. According to the prompt, press DH key to increase, reduce or calibrate " 0 " (sometimes, you may press " DH " key several times to increase or reduce to 1 word.) You must enter into "select" mode again when you want to select other kind of function. After calibration, you must exit the selected function and " select " mode, i.e, return to the initial state preceding step 4. When the measured value is identical with the displayed value on meter, press DH key once, the verifying result will be saved when the meter gives two Beeps.

5. Calibrate the temperature step at ambient temperature: keep pressing DH key, switch on the meter, then release DH key when the meter gives two "Beep"s. There are two steps:(1) Calibrate the division value: Select the function mode to enter into zero calibration mode, make the input end short circuit and perform zero calibration, then exit " select " mode, input 12.207mV (the output value of K type thermocouple at 300 $^{\circ}$ C), press DH key, 300 $^{\circ}$ C will be shown on meter when it gives two Beeps, the division value has been calibrated. (2) Zero calibration: Zero calibration is for the ambient-temperature compensation for the cold end of thermocouple. According to the millivolt output value of K type thermocouple at ambient temperature, input it into the meter with opposite polarity, then perform zero calibration for the meter again (the zero calibration will not affect the calibrated division value). After the above two steps completed, short circuit the input end of the meter, the meter will show a temperature value approximate to ambient temperature.

Note: Frequency step does not require calibration. In general, there is

no strict requirements for diode and triode steps and the program will set a approximate value automatically to them after the other steps have been calibrated. When the calibration is required for them, they should be calibrated after the other steps have been calibrated.

6. When all the steps have been calibrated, then switch off the meter and start-up it again to make the calibrating value take effect.

Special attention: The user without calibration condition (no standard value) should not perform calibration himself.

For example: when calibrating 200Ω, the steps as follows:

1. Keep pressing "DH" key.
2. Switch on meter and release " DH " key when hear "beep". Turn the range switch to 200Ω.
3. Press " DH " key for two seconds, release " DH " key when buzzer gives two beeps. The display will show " select ".
4. Press " DH " key three times to select zero calibration function, the display will show " zero ".
5. Press " DH " key for two seconds, release " DH " key when buzzer gives two beeps. The " select " .
6. Make the meter probe short circuit reliably, and press "DH" key once when display stably, release the " DH " key when buzzer gives one beep, and the displayed value will be 00 when the buzzer gives the second beep. (Note: If the displayed value is more than 16 words before the zero calibration, it indicated that the meter has poor contact, you should remove the problem and perform calibration again). By this time, the zero calibration has been completed.
7. Connect the standard resistance to be measured with meter probe and observe the displayed value.
8. Press " DH " key for two seconds, release " DH " key when the buzzer gives two beeps. The display will show " select " .
9. According to the displayed value, press " DH " key to select adjusting upwards or adjusting downwards function. After selection, press "DH" key for two seconds, release it when the buzzer gives two beeps, the "select" . will disappear.
10. Press " DH " key several times until the displayed value is identical with the standard resistance value.
11. Press " DH " key for two seconds, release " DH " key when the buzzer gives two beeps. The display will show" select ".. Press " DH " key continuously to exit all the selected function and the meter will show " select " .
12. Press " DH " key for two seconds, release " DH " key when the buzzer gives two beeps. The " select " . will disappear (exit " select " mode) .
13. Connect the meter probe to the standard resistance reliably and observe whether the displayed value coincides with standard resistance value or not, press " DH " key once, release it when the buzzer gives beep, the calibration result will be saved when the meter gives the second beep. Then you can perform the calibration at the next step. Switch off when all steps have been calibrated. The steps "3. 4. 5. 6" can be skipped for the steps not require zero calibration.

VI. maintenance

1. this appliance is a precise electronic meter, do not modify the internal circuit at random, in case damage.
2. do not connect to the voltage above 1000VDC or virtual value 700V AC, in case get electric shock or damage the device.
3. make sure not to connect to improper measuring range modify internal circuit in order to avoid damages.
4. do not input voltage when the measuring range switch is at electric current, resistance, diode or buzzer position.
5. never use it when it is not completely covered, in case electric shock.
6. when replace the battery and fuse, must after put aside the test pen and cut off the power.
7. keep the cover clean, could use a little water or diluted cleanser, but not gasoline, ethanol, in case corruption.
8. avoid high temperature, high moist environment, in case to worsen the performance.
9. if not used for a long time, take out the battery, in case the battery leaks to damage the interior line.