

Analog Multimeter


OPERATOR'S MANUAL

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1. SAFETY PRECAUTIONS AND PROCEDURES

This apparatus conforms to safety standard EN 61010-1, relating to electronic measuring instruments.

For your own safety and that of the apparatus, you must follow the procedures described in this instruction manual and especially read all the notes preceded by the symbol  carefully.

Take extreme care for the following conditions when measuring:

- Do not measure voltage, current under humid or wet environment.
- Do not operate the meter under the environment with explosive gas (material), combustible gas (material), steam or filled with dust.
- Keep you insulated from the object waiting for measuring.
- Do not contact any exposed metal (conductive) parts such as end of test lead, socket, fixing object, circuit, etc.
- To prevent mechanical damage of analog pointer coil do not submit the instrument to vibration or shock.
- If any unusual condition of testing end (metal part) and attachment of the meter such as breakage, deformation, fracture, foreign substance, no display, etc., do not conduct any measuring.
- Measuring voltage over 20V because it might cause human body electricity conduction.

The followings symbols are used:



Caution: Refer to the instruction manual. Incorrect use may damage the apparatus or its components



Danger high voltage: risk of electric shock.



Meter double insulated.



DC voltage or current.



AC voltage or current.

1.1. PRELIMINARY

- This apparatus has been designed for use in an environment of pollution degree 2.
- It can be used for **VOLTAGE** measurements on installations of surge voltage category II up to 600 volts.
- You must comply with the usual safety regulations aimed at:
 - ◆ Protecting you against the dangerous electric current.
 - ◆ Protecting the instrument against an incorrect operation.
- Only the leads supplied with the instrument guarantee compliance with the safety standard. They must be in a good condition and they must be replaced, if necessary with an identical model.

- Do not test or connect to any circuit with voltage or current exceeding the specified overload protection.
- Check if the batteries are installed correctly.
- Prior to connecting the test probes to the installation, check that the function selector is positioned on the required measurement.

1.2. DURING USE

Read the recommendation which follow and the instruction in this manual:



WARNING
Non compliance with the warnings and/or the instructions for use may damage the apparatus and/or its components or injure the operator.

- When measuring voltage ensures that the instrument is not switched to a current or resistance range. Always ensure that the correct terminals are used for the type of measurements to be made.
- When changing range, first disconnect the test leads from the circuit under test in order to avoid any accident.
- When the apparatus is connected to the measuring circuits never touch an unused terminal.
- When measuring resistor, please do not add any voltage. Though there is a protection circuit, excessive voltage will still cause malfunction.
- When measuring current ensure that the circuit is powered off before opening it in order to connect test leads.
- Extreme care should be taken when using the instrument in conjunction with a current transformer connected to the terminals. High voltage may be produced at the terminals if an open circuit occurs.
- This meter is not available for AC current measurements or non-sine wave AC voltage.

1.3. AFTER USE

- Once the measurements are completed, remove the leads from the input terminals.
- If the instruments is not be used for a long period, remove the batteries.

2. GENERAL DESCRIPTION

Dear customer, we thank you for your patronage. The multimeter you have just purchased will grant you accurate and reliable measurements provided that it is used according to the present manual's instructions.

The apparatus can perform the following measurement.

- AC values of the voltage (V_{ac}) without DC components.
- DC values of the voltage (V_{dc}) without AC components.
- DC values of the current (I_{dc}) without AC components.
- Resistance values.
- Continuity Test.
- Battery Test.
- LED Test.
- Decibel values.

Each of these parameters can be selected by means of an 20-position rotary.

3. PREPARATION FOR USE

3.1. INITIAL

All the equipment has been checked mechanically and electrically prior to shipment.

Every care has been taken to ensure that the instrument reaches you undamaged.

However, it is wise to carry out a rapid check in order to detect any possible damage which might have been caused during transport. Should this be the case, immediately enter the usual claims with courier.

Check the packaging contained according to packaging list reported in paragraph 5.3.1. In case of discrepancies contact the dealer.

In the event of re-shipment of the equipment please follow the instructions reported in paragraph 6.

3.2. SUPPLY VOLTAGE

The instrument is battery supplied; it use two batteries model UM3 1.5V AA size IEC LR6 and one battery model 9V IEC 6F22 NEDA 1604 included in packaging. The batteries are involved in Ω measurement only and grant autonomy is about 10 hours of continuous work in $\Omega \times 1$ position.

3.3. CALIBRATION

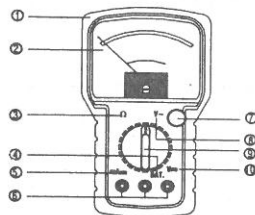
The instrument fulfils the technical characteristics listed in this manual. The performances of the specifications are guaranteed for one year.

3.4. STORAGE

In order to guarantee the accuracy of the measurements, after a period of storage in extreme environment condition, wait for the time necessary so that the apparatus returns to normal measuring conditions (see environments specifications paragraph 5.2.1).

4. OPERATING INSTRUCTIONS

4.1. INSTRUMENT DESCRIPTION



LEGEND:

1. Case with protective holster.
2. Analog display.
3. Resistance range.
4. Battery test range.
5. DC Current range.
6. Input Terminal.
7. Resistance zero adjustment knob.
8. AC voltage range.
9. Rotary switch.
10. DC voltage range.

Fig. 1: Instrument description.

4.2. MEASUREMENT DESCRIPTION

4.2.1. DC Voltage measurement



WARNING
Maximum input for DC voltage is 600V $\overline{\text{---}}$. Do not attempt to take any voltage measurement that exceeds the limits. Exceeding the limits could cause electrical shock and damage the multimeter.

1. Select a proper range for DC voltage (1, 2.5, 25, 250 or 600 DCV).
2. If the voltage range is not known beforehand, set the range switch to the highest range and work down.
3. Insert the test leads into the jack, the red plug into $V \Omega mA$ jack, and black plug into COM jack.
4. Insert the two long ends of test leads to the desired circuit, then reading will be displayed in the second "DCV.A" scale.

4.2.2. AC Voltage measurement

WARNING



Maximum input for AC voltage is 600V ~ .Do not attempt to take any voltage measurement that exceeds the limits. Exceeding the limits could cause electrical shock and damage the multimeter.

1. Select a proper range for AC voltage (10, 50, 250 or 500 ACV).
2. If the voltage range is not known beforehand, set the range switch to the highest range and work down.
3. Insert the test leads into the jack, the red plug into **VΩ mA** jack, and black plug into **COM** jack.
4. Insert the two long ends of test leads to the desired circuit, then reading will be displayed in the third "ACV" scale.

4.2.3. DC Current measurement

WARNING



Make sure that circuit under test is powered off before open it to insert test leads. Ensure that the instrument is not connected across load with any Voltage.

1. Power off the circuit under test.
2. Select a proper range for DC current (50μA, 5, 50, 500mA, 10A). If the current range is not known beforehand, set the range switch to the highest range and work down.
3. Insert the test leads into the jack; the black plug into **COM** jack and the red plug into the jack corresponding the position chosen with the rotary switch (**VmAΩ** jack for 50μA, 5, 50, 500mA ranges or 10A jack for 10 DCA).
4. Insert the two test leads in series with the load in which the current is to be measured.
5. Power on the circuit under test.
6. The reading will be displayed in the second "DCV.A" scale.
7. If the analog pointer doesn't move during current measuring control the fuses inside the multimeter and replace them if necessary (ref. Paragraph 4.3.3).

4.2.4. Battery check for 1.5V and 9.0V



Maximum input for DC voltage is 10V. Do not attempt to take any voltage measurement that exceeds the limits. Exceeding the limits could cause electrical shock and damage the multimeter.

1. Select a proper for Battery check (1.5V, 9.0V).
2. Insert the test leads into the jack, the red plug into **VmAΩ** jack, and black plug into **COM** jack.
3. Insert the two long ends of test leads to the battery under test.
4. The reading will be displayed in the "BATT" scale ("RED" colour for bad, "GREEN" colour for good).

4.2.5. Resistance measurement

WARNING



Before taking any in circuit resistance measurement, remove power from the circuit being tested and discharge all the capacitors.

1. Select a proper coefficient for Resistance measuring (Rx1, Rx10, Rx100, Rx1k, Rx10k).
2. Insert the test leads into the jack, the red plug into **VΩ mA** jack, and black plug into **COM** jack.
3. Short the two probes together and adjust the knob to set the pointer at zero position of the first "Ω" scale.
4. If the pointer can't reach zero position replace the batteries with new ones and repeat step 2 again.
5. Insert the two long ends of test leads to the desired circuit; the resistance measuring will be got multiplying the reading displayed in the first "Ω" scale .
6. As measuring resistance, any voltage existing in circuit is not allowed. If a capacitor is installed, it must be discharged before test.

4.2.6. Continuity Test

WARNING



Before taking any in circuit resistance measurement, remove power from the circuit being tested and discharge all the capacitors.

1. Select the Rx1 position.
2. Insert the test leads into the jack, the red plug into **VΩmA** jack, and black plug into **COM** jack.
3. Short the two probes together and adjust the knob to set the pointer at zero position of the first "Ω" scale.
4. If the pointer can't reach zero position replace the batteries with new ones and repeat step 2 again.
5. Insert the two long ends of test leads to the desired circuit; the instrument will emit an acoustic signal when the reading will be lower than 30Ω approx.
6. As measuring resistance, any voltage existing in circuit is not allowed. If a capacitor is installed, it must be discharged before test.

4.2.7. Decibel measurement



WARNING

Maximum input for AC/DC voltage is 500V/1000V.
Do not attempt to take any voltage measurement that exceeds the limits. Exceeding the limits could cause electrical shock and damage the multimeter. Disconnect test leads from the circuit under test prior to select a different range.

1. Select a proper range for AC voltage (10, 50, 250 or 500V) according with the following table:

Range dB (dB)	-10 +22	4 +36	18 +50	24 +56
Range AC (V)	10	50	250	500
Correction Factor (dB)	0	14	28	34

2. If the dB range is not known beforehand, set the range switch to the highest range and work down.
3. Insert the test leads into the jack, the red plug into **VQmA** jack, and black plug into **COM** jack.
4. Insert the two long ends of test leads to the desired circuit.
5. The reading will be displayed in the third "ACV" scale. The measured dB will get from the following formula:

$$dB = dB(\text{read on dB scale}) + \text{Correction Factor}$$

Note: for absolute dB measurements, circuit impedance must be 600Ω, 0dB=1mW dissipated in a 600Ω load.

For the signal with DC component, connect a capacitor with capacity >0.1F between test probes and circuit under test.

4.2.8. LED Test



WARNING

Before taking any in circuit resistance measurement, remove power from the circuit being tested and discharge all the capacitors.

1. Select the Rx10 position.
2. Insert the test leads into the jack, the red plug into **VQmA** jack, and black plug into **COM** jack.
3. Short the two probes together and adjust the knob to set the pointer at zero position of "LI" or "LV" scale.
4. If the pointer can't reach zero position replace the batteries with new ones and repeat step 2 again.
5. Apply the two long ends of test leads to the Diode terminals in order to light it (the black terminal is positive and the red terminal is negative); the reading will be displayed in the "LI" and "LV" scale, showing the current and voltage values in direct polarizing.

4.3. PREVENTIVE MAINTENANCE

4.3.1. General information

1. This multimeter is a precision instrument. Whether in use or in storage, please do not exceed the specification requirements to avoid any possible damage or danger during use.
2. Do not place this meter in high temperature or humidity or expose to direct sunlight.
3. Be sure to turn the meter off after use. For long time storage, remove the batteries to avoid leakage of batteries liquid that would damage the interior parts.
4. To prevent mechanical damage of analog pointer coil do not submit the instrument to vibration or shock.

4.3.2. Batteries replacement

When the pointer doesn't reach the 0Ω even adjusting the "0ΩADJ" knob replace batteries.



WARNING

Before attempting batteries removal disconnect test leads from any energized circuits to avoid electrical shock.

1. Disconnect the test leads from the circuit under test.
2. Remove the protective case, the screws from the batteries cover, and detach the batteries covers from the bottom cover.
3. Remove the batteries and replace it with new ones of the same type (2xUM3 1.5Volt AA size battery, IEC LR6; 1x9V IEC 6F22 NEDA 1604) observing the proper polarity from the diagram inside the batteries compartment.
4. Replace the batteries cover, screws and protective case.

4.3.3. Fuses replacement



WARNING

Before attempting fuses removal disconnect test leads from any energized circuits to avoid electrical shock.

1. Disconnect the test leads from the circuit under test.
2. Remove the protective case, the screws from the batteries cover, and detach the batteries covers from the bottom cover.
3. Replace the fuses with new ones only with identical type and rating (0.5A/250V and 10A/250V).
4. Replace the batteries cover and screws.

4.3.4. Cleaning

For cleaning the instrument use a soft dry cloth. Never use a Wet cloth, solvents or water, etc.

5. TECHNICAL SPECIFICATIONS

5.1. CHARACTERISTICS

Accuracy is indicated as \pm [% of reading].

It is referred to the following reference conditions: 23°C \pm 5°C with RH<75%.

5.1.1. DC Voltage

Range	Sensitivity	Accuracy
0.1V	20k Ω /V	\pm (3% full range)
2.5V		
25V		
250V		
500V		

5.1.2. AC Voltage

Range	Sensitivity	Accuracy
10V	9k Ω /V	\pm (4% full range)
50V		
250V		
500V		

5.1.3. DC Current

Range	Accuracy	Voltage Drop
50 μ A	\pm (3% full range)	\leq 0.6V
5mA		
50mA		
500mA		
10A		\leq 0.3V

5.1.4. Resistance

Range	Accuracy
Rx1	\pm (3% of arc) arc length 75.3mm
Rx10	
Rx100	
Rx1k	
Rx10k	

5.1.5. Battery Test

Range	Test Current
1.5V	150mA
9V	15mA

5.1.6. Safety

Comply with:
Insulation:
Pollution:
For inside use, max height:
Over voltage:

EN61010-1.
Class 2, double reinforced insulation.
Level 2.
2000m.
CAT II 600V

5.1.7. General data

Mechanical characteristics

Size: 180(H) x 100(H) x 40(D) mm.
Weight (not including holster): about 320g

Supply

Batteries type: 2xUM3 1.5Volt AA size battery, IEC LR6
1x9V IEC 6F22 NEDA 1604

Batteries life (only for Ω measurement): About 10 hours of continuous work.

Fuses: 5x 20mm 500mA/250V Fast Acting
5x 20mm 10A/250V Fast Acting

Display

Display Type: Analog display.

5.2. ENVIRONMENTAL CONDITIONS

5.2.1. Climatic conditions

Reference temperature: 23° \pm 1°C
Operating and storage temperature: -5 \div 40°C
Operating and storage humidity: <75% RH

5.2.2. EMC

This apparatus was designed in accordance with EMC standards in force and its compatibility has been tested in accordance with the following standards: EN55022, EN50082-1.

This product conforms to the prescriptions of the European directive on low voltage 73/23/EEC and to EMC directive 89/336/EEC, amended by 93/68/EEC.

5.3. ACCESSORIES

5.3.1 Standard accessories

The accessories contained inside the packaging are the following:

- Batteries
- Test leads
- Instruction manual
- Protective case

6. SERVICE

6.1. WARRANTY CONDITIONS

This equipment is guaranteed against any material fault or manufacturer's defect, in accordance with the general conditions of sale. During the warranty period (one year), faulty parts may be replaced, with the manufacturer reserving the right to decide either to repair or replace the product.

In the event of returning the equipment to the after-sales service or to a regional branch, the outward transport is payable by the customer. The delivery must be agreed in advance with consignee.

For delivery indicate by means a note enclosed with the equipment, as clear as possible, the reasons for returning it use only the original packing.

Any damaging caused by shipment using NOT original packaging will be charged in any case to the consignor.

The manufacturer will not be responsible for any damage against persons or things.

The warranty doesn't apply to the following cases:

- Accessories and batteries aren't include in warranty.
- Repairs following unsuitable use of the equipment or by combining the latter with incompatible equipment.
- Repairs resulting from a not correct shipping.
- Repairs resulting from servicing carried out by a person not approved by the company.
- Modifications to the equipment without explicit authorisation from our technical departments.
- Adaptation to a particular application not provided for by the definition of the equipment or by the instruction manual.

The contents of this manual may not be reproduced in any form whatsoever without our agreement.

Our products are patented. The logotypes are registered. We reserve the right to modify characteristics and prices as part of technological developments which might require them.

6.2. SERVICE

If the equipment shouldn't work correctly, before contacting the SERVICE, test the batteries condition, the test leads, etc., and change them if necessary.

If the equipment still doesn't work check if your operating procedure agrees with the latter described in the manual.

In the event of returning the equipment it must be re-sent to the after-sales service (at address or to a regional branch), the outward transport is payable by the customer. The delivery must be agreed in advance with consignee.

For delivery indicate by means a note enclosed with the equipment, as clear as possible, the reasons for returning it use only the original packing.

Any damage caused by delivery with NO original packaging will be charged in any case to the consignor.