TENMARS

Autoranging Multimeter

TM-81

User's manual

CE

HB2TM8100000

Content:

1. SAFETY PRECAUTIONS AND PROCEDURES

This meter is compliance with safety Standard EN 61010-1 related to electronic measuring instruments. For your own safety and to avoid damaging the instrument follow the procedures described in this instruction manual and read carefully all notes preceded by this symbol ⚠.

When taking measurements:

- Avoid doing that in humid or wet places - make sure that humidity is within the limits indicated in paragraph 6.2.1.
- Avoid doing that in rooms where explosive gas, combustible gas, steam or excessive dust is present.
- Keep you insulated from the object under test.
- Do not touch exposed metal parts such as test lead ends, sockets, fixing objects, circuits etc.
- Avoid doing that if you notice anomalous conditions such as breakages, deformations, fractures, leakages of battery liquid, blind display etc.
- Be particularly careful when measuring voltages exceeding 20V to avoid risks of electrical shocks.

The following symbols are used:


CAUTION - refer to the instruction manual - an improper use may damage the instrument or its components


Danger high voltage: risk of electric shocks


Double insulated meter


AC voltage


DC voltage

1.1. PRELIMINARY

- This instrument has been designed for use in environments of pollution degree 2.
- It can be used for **VOLTAGE** measurements on installations of CAT III 1000V or CAT IV 600V.
- Only the original test leads supplied along with the instrument guarantee compliance with the safety standards in force. They must be in a good conditions and, if necessary, replaced with identical ones.
- Do not test nor connect to any circuit exceeding the specified overload protection.
- Do not take measurements under environmental conditions exceeding the limits indicated in chapter 6.1.1. and 6.2.1.
- Make sure that batteries are correctly installed.
- Before connecting the test probes to the installation make sure that the rotary selector is positioned on the right function.
- Make sure that LCD and rotary selector indicate the same function.

1.2. DURING USE

CAUTION

An improper use may damage the instrument and/or its components or injure the operator.

- When changing the range, first disconnect the test leads from the circuit under test in order to avoid any accident.
- When the instrument is connected to measuring circuits never touch any unused terminal.
- When measuring resistors do not add any voltage. Although there is a protection circuit, excessive voltage could cause malfunctioning.
- If during measurement the displayed values remain constant check whether the HOLD function is active.

1.3. AFTER USE

- After using the instrument turn it off.
- If you expect not to use the instrument for a long period remove the battery to avoid leakages of battery liquids which may damage its inner components.

1.4. MEASURING (OVERVOLTAGE) CATEGORIES DEFINITIONS

EN 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use, Part 1: General requirements, gives a definition of measuring category, usually called overvoltage category. Paragraph 6.7.4: Measuring circuits:

(OMISSIS)

circuits are divided into the following measurement categories:

- **Measurement category IV** is for measurements performed at the source of the low-voltage installation.

  Examples are electricity meters and measurements on primary overcurrent protection devices and ripple control units.

- **Measurement category III** is for measurements performed in the building installation.

  Examples are measurements on distribution boards, circuit breakers, wiring, including cables, bus-bars, junction boxes, switches, socket-outlets in the fixed installation, and equipment for industrial use and some other equipment, for example, stationary motors with permanent connection to fixed installation.

- **Measurement category II** is for measurements performed on circuits directly connected to the low voltage installation..

  Examples are measurements on household appliances, portable tools and similar equipment..

- **Measurement category I** is for measurements performed on circuits not directly connected to MAINS.

  Examples are measurements on circuits not derived from MAINS, and specially protected (internal) MAINS-derived circuits. In the latter case, transient stresses are variable; for that reason, the norm requires that the transient withstand capability of the equipment is made known to the user.

2. GENERAL DESCRIPTION

This meter performs the herewith measurements:

- DC Voltage
- AC sine voltage
- Resistance
- Continuity test
- Diode test
- Temperature with type K probe (only TM-82)

All selectable by means of a 6-position rotary selector (including OFF position). Also are available the **HOLD** key to hold the displayed value, the **R** key for manual selection of measure ranges, the **MAX** key for measure of maximum value and **SEL** key for selection between diode test and continuity test and temperature measures in °C or °F (only TM-82).

The selected quantity is displayed with indication of measuring unit and active functions.

The instrument disposes of an Auto Power Off function consisting in an automatic switching off 15 minutes after last selector rotation.

3. PREPARATION FOR USE

3.1. INITIAL

This instrument was checked both mechanically and electrically prior to shipment. All possible cares and precautions were taken to let you receive the instrument in perfect conditions. Notwithstanding we suggest you to check it rapidly (eventual damages may have occurred during transport – if so please contact the local distributor from whom you bought the item).
Make sure that all standard accessories mentioned in paragraph 6.3.1 are included. Should you have to return back the instrument for any reason please follow the instructions mentioned in paragraph 7.

3.2. SUPPLY VOLTAGE

The instrument is supplied by 2x1.5V batteries type IEC AAA LR03. When batteries are low, a low battery indication is displayed. To replace/insert batteries please refer to paragraph 5.2.

3.3. CALIBRATION

The instrument complies with the technical specifications contained in this manual and such compliance is guaranteed for 1 year. Annual recalibration is recommended.

3.4. STORAGE

After a period of storage in extreme environmental conditions exceeding the limits mentioned in paragraph 6.2.1 let the instrument resume normal measuring conditions before using it.

4. OPERATING INSTRUCTIONS

4.1. INSTRUMENT DESCRIPTION

4.1.1. Front panel description

LEGEND:

1. LCD
2. **Hold** Key
3. **R** Key
4. **MAX** Key
5. **SEL** Key
6. **Backlight** Key(For TM-82)
7. OFF position
8. ACV position
9. DCV position
10. Ω position
11. →|/•))) position
12. OFF position(for TM-81)
    ℃/℉ position(for TM-82)
13. **COM** and **VΩ→|•)))** input terminals(for TM-81) **COM** and **VΩ→|•)))℃℉**input terminals(for TM-82)

Fig. 1: Instrument description

4.2. DESCRIPTION OF FUNCTION KEYS

4.2.1. HOLD Key

By pressing **HOLD** key the measured value is frozen on the display where the symbol "HOLD" appears. Pressing again **HOLD** to disable this function and resume normal operation.

4.2.2. R (RANGE) Key

By pressing **R** key, the manual mode is activated and the “AUTO” symbol disappears from the display. Press **R** cyclically to change the measuring range and fix the decimal point on the display.
To exit this function keep **R** key pressed for at least 1 second or rotate the selector to another position.

4.2.3. MAX Key

By pressing **MAX** key, maximum value are measured. The symbol corresponding “MAX” is displayed. This value is stored and automatically updated as soon as an higher value is measured by meter. Press **MAX** key again or rotate the selector to another position to exit from this function.

4.2.4. SEL Key

By pressing **SEL** key the selection of a double measured functions which are present at display is possible. In particular this key is active only in ⊣◀/•))) position to select between diode test and continuity test or in **°C°F** position (only TM-82) position to select between °C and °F temperature measure.

4.2.5. Backlight key (only TM-82)

By pressing and hold key for about 3s it’s possible to activate the backlight function on the display. By pressing and hold key again for about 3s to exit from the function or waiting the automatically disable after some seconds. The function is available on each position of the rotary selector.

4.2.6. Auto power Off

The instrument automatically turns off 15 minutes after last pressure of keys or last selector rotation. To resume operation turn the selector on OFF and turn on the instrument again.

4.3. MEASUREMENTS
4.3.1. DC Voltage measurement

CAUTION

The maximum input for DC voltage is 600V. Do not attempt to measure higher voltages to avoid electrical shocks or damages to the instrument.

Fig. 2: Using the meter for DC Voltage measurement

1. Pressing the **R** key to select the correct range or using the Autorange feature (see paragraph 4.2.2). If the voltage value under test is unknown, select the highest range.
2. Insert the test leads into the jacks, the red plug into **VΩ→⊢•))** (for TM-81)/ **VΩ→⊢•))℃℉** (for TM-82) jack and black plug into **COM** jack (see Fig. 2).
3. Connect the red and black test leads to the positive and negative poles of the circuit under test respectively. The voltage value is displayed.
4. If the message "**O.L**" is displayed select a higher range.
5. The symbol "**-**" on the instrument display indicates that voltage has opposite direction with regard to the connection.
6. For HOLD function and Maximum value measurement please refer to paragraph 4.2.

4.3.2. AC Voltage measurement

CAUTION

The maximum input for AC voltage is 600V. Do not attempt to measure higher voltages to avoid electrical shocks or damages to the instrument.

Fig. 3: Using the instrument for AC Voltage measurement

1. Pressing the **R** key to select the correct range or using the Autorange feature (see paragraph 4.2.2). If the voltage value under test is unknown, select the highest range.
2. Insert the test leads into the jacks, the red plug into **VΩ→⊢•))** (For TM-81)/ **VΩ→⊢•))℃℉** (For TM-82) jack and black plug into **COM** jack.
3. Connect the test leads to the circuit under test; the voltage value is displayed.
4. If the message "**O.L**" is displayed select a higher range.
5. For HOLD function and Maximum value measurement please refer to paragraph 4.2.

4.3.3. Resistance measurement

CAUTION

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

Fig. 4: Using the instrument for Resistance measurement

1. Pressing the **R** key to select the correct range or using the Autorange feature (see paragraph 4.2.2). If the resistance value under test is unknown, select the highest range.
2. Insert the test leads into the jack, the red plug into **VΩ→⊢•))** (For TM-81)/ **VΩ→⊢•))℃℉** (For TM-82) jack and black plug into **COM** jack.
3. Connect the test leads to the circuit under test; the resistance value is displayed.
4. Indications as "**.value** **kΩ**" or "**.value** **MΩ**" (respectively for 2kΩ or 2MΩ) mean **0.valuekΩ** and **0.valueMΩ.** The zero before comma is not displayed.
5. If the message "**O.L**" is displayed a higher range must be selected.
6. For HOLD function and Maximum value measurement please refer to paragraph 4.2.

4.3.4. Continuity test

CAUTION

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

Fig. 5: Using the instrument for continuity test

1. Switch on ⊣▶/•)) then push "**SEL"** button.
2. Insert the test leads into the jack, the red plug into **VΩ⊣▶•))** (for TM-81)/ **VΩ⊣▶•))℃℉**(for TM-82) jack and black plug into **COM** jack.
3. Connect the test leads to the circuit under test.
4. The resistance value is displayed and the instrument emits a sound signal if the resistance value is lower than 120Ω.
5. The message "**O.L.**" on the display indicates that the resistance value is higher than 2kΩ.

CAUTION

The displayed value is just indicative and does not correspond to the resistance value.

4.3.5. Diode test

CAUTION

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

Fig. 6: Using the instrument for diode test

1. Switch on →|/•)).
2. Insert the test leads into the jack, the red plug into **VΩ→|•))** (for TM-81)/ **VΩ→|•))℃℉**(for TM-82) jack, and black plug into **COM** jack.
3. Connect the test leads to the diode under test observing the proper polarities.
4. The threshold voltage value expressed in mV under this situation is displayed.
5. If the threshold voltage value is 0V the diode P-N junction is shorted circuit.
6. If the message "**O.L**" is displayed the diode terminals are reversed, the diode P-N junction is damaged.

4.3.6. Temperature measurement (only TM-82)

Fig. 7: Using the instrument for Temperature measurement

1. Switch on **°C°F**.
2. Pressing **SEL** key to select °C or °F measurements.
3. Insert the T10 adapter optional accessory into **VΩ→⊢•))℃℉** jack, and **COM** jack with respect of red and black colours (see Fig. 7).
4. Connect the optional K probe (see paragraph 6.3.2.) into the adapter with respect the correct positive and negative polarity then reading will be displayed.
5. For HOLD function and Maximum value measurement please refer to paragraph 4.2.

5. MAINTENANCE

5.1. GENERAL INFORMATION

This is a precision instrument. To guarantee its performances be sure to use it according to these instructions and keep it stored on suitable environmental conditions. Do not expose it to high temperatures or humidity or direct sunlight. Be sure to turn it off after use. If you expect not to use the instrument for a long period remove batteries to avoid leakages of battery liquid which could damage the its inner components.

5.2. BATTERY REPLACEMENT

When the low battery indication (refer to paragraph 6.1.7) is displayed the batteries are to be replaced.

CAUTION

Before replacing the battery disconnect test leads from any energised circuits to avoid electrical shocks.

1. Turn off the instrument.
2. Disconnect the test leads from the input terminals.
3. Remove the fixing screws from the back case and detach it.
4. Replace the battery with a new one of the same type (refer to paragraph 6.1.7) observing the proper polarities.
5. Replace the back case and screws.
6. Use the appropriate battery disposal methods for your area.

5.3. CLEANING

To clean the instrument use a soft dry clothe. Never use a wet cloth, solvents or water.

5.4. END OF LIFE

Caution: this symbol indicates that equipment and its accessories shall be subject to a separate collection and correct disposal

6. TECHNICAL SPECIFICATIONS

6.1. TECHNICAL FEATURES

The accuracy is indicated as [% of reading + number of digits]. It is referred to the following environmental conditions: temperature 23°C ± 5°C, relative humidity < 75%.

DC Voltage

Range	Resolution	Accuracy	Input Impedance	Overload protection
200mV	0.1mV	±(0.8%rdg +1dgt)	10MΩ	600VDC/ACrms
2V	0.001V			
20V	0.01V			
200V	0.1V			
600V	1V	±(1.0%rdg +2dgt)		

AC Voltage

Range	Resolution	Accuracy (45 ÷ 400Hz)	Input Impedance	Overload protection
200mV	0.1mV	not declared	10MΩ	600VCC/CArms
2V	0.001V	±(1.5%rdg+3dgt)		
20V	0.01V			
200V	0.1V			
600V	1 V			

Resistance

Range	Resolution	Accuracy	Max Open Loop Voltage	Overload protection
200Ω	0.1Ω	±(1.0%rdg + 8dgt)	About 3.0V	600VDC/Acrms (<30sec.)
2kΩ	0.001kΩ	±(1.0%rdg + 3dgt)		
20kΩ	0.01kΩ			
200kΩ	0.1kΩ			
2MΩ	0.001MΩ			
20MΩ	10kΩ	±(3.0%rdg + 3dgt)		

Diode Test

Range	Resolution	Max Open Loop Voltage	Overload protection
▶|	1mV	About 1.5Vdc	600Vrms (< 30sec.)

Continuity Test

Range	Beeper	Max Open Loop Voltage	Overload protection
•))	< 120Ω	About 1.5Vdc	600Vrms (< 30sec.)

Temperature with K probe (only TM-82)

Range	Resolution	Accuracy	Overload protection
-40℃÷ 1℃	1℃	±5°C	600VDC/Acrms (<30sec.)
0℃÷ 800℃		±(2.0%rdg + 3dgt)	
-40°F ÷ 31°F	1°F	±9°F	
32°F ÷ 1382°F		±(2.0%rdg + 5dgt)	

6.1.1. Safety

The instrument complies with: EN 61010-1

Insulation:	Class 2, Double insulation
Pollution degree:	2
Overvoltage category:	CAT IV 600V
Max height:	2000m

6.1.7 General data

Mechanical characteristics

Dimensions:	163(L) x 88(W) x 48(H)mm
Weight (including battery):	approx. 280g

Power supply

Battery type:	2 batteries 1.5V AAA MN2400 LR03 AM4
Indication of low battery:	the symbol " " is displayed when the battery is low
Battery life:	approx. 220 hours

Display

Specifications:	3½ LCD with max. reading 1999 counts + symbol and decimal point

6.2. ENVIRONMENT

6.2.1. Environmental conditions

Reference temperature:	23° ± 5°C
Working temperature:	-5 ÷ 40 °C
Relative humidity:	<80%
Storage temperature:	-10 ÷ 60 °C
Storage humidity:	<70%

6.2.2. EMC

This instrument complies with the requirements of the European Low Voltage Directive 73/23/CEE and Directive CEM 89/336/CEE, revised with 93/68/CEE.

6.3. ACCESSORIES

6.3.1. Standard accessories

- Carrying Case
- Test leads
- Batteries
- User's manual
- Adapter for connection type K probe -T10 **(only TM-82)**
- Type K probe for complex or any place hard to enter (-50~200°C/-58~392°F) – TP-03 **(only TM-82)**

Accessory	**Code**
• Type K probe for liquid or gel temperature (-50~700°C/-58~1292°F)	TP-01
• Type K probe for front or plate temperature (-50~700°C/-58~1292°F)	TP-02
• Type K probe for precise surface temperature ((-50~400°C/-58~752°F))	TP-04

7. SERVICE

7.1. WARRANTY CONDITIONS

This instrument is guaranteed against material or production defects, in accordance with our general sales conditions. During the warranty period the manufacturer reserves the right to decide either to repair or replace the product.
Should you need for any reason to return back the instrument for repair or replacement take prior agreements with the local distributor from whom you bought it. Do not forget to enclose a report describing the reasons for returning (detected fault). Use only original packaging. Any damage occurred in transit due to non original packaging will be charged anyhow to the customer.
The manufacturer will not be responsible for any damage to persons or things.

The warranty doesn't apply to:

- Accessories and batteries (not covered by warranty).
- Repairs made necessary by improper use (including adaptation to particular applications not foreseen in the instructions manual) or improper combination with incompatible accessories or equipment.
- Repairs made necessary by improper shipping material causing damages in transit.
- Repairs made necessary by previous attempts for repair carried out by non skilled or unauthorized personnel.
- Instruments for whatever reason modified by the customer himself without explicit authorization of our Technical Dept.

Our products are patented and our logotypes registered. We reserve the right to modify specifications and prices in view of technological improvements or developments which might be necessary.

7.2. AFTER-SALE SERVICE

Shouldn't the instrument work properly, before contacting your distributor make sure that batteries are correctly installed and working, check the test leads and replace them if necessary. Make sure that your operating procedure corresponds to the one described in this manual.
Should you need for any reason to return back the instrument for repair or replacement take prior agreements with the local distributor from whom you bought it. Do not forget to enclose a report describing the reasons for returning (detected fault). Use only original packaging. Any damage occurred in transit due to non original packaging will be charged anyhow to the customer.
The manufacturer will not be responsible for any damage to persons or things.

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