ENGLISH

User manual

Release EN 1.01 - 14/05/2012

Table of contents:

1. PRECAUTIONS AND SAFETY MEASURES

The instrument has been designed in compliance with Directive IEC/EN 61010-1 relevant to electronic measuring instruments. For your safety and in order to prevent damaging the instrument, please carefully follow the procedures described in this manual and read all notes preceded by the symbol ⚠ with the utmost attention. Before and after carrying out the measurements, carefully observe the following instructions:

- Do not carry out any measurement in humid environments.
- Do not carry out any measurements in case gas, explosive materials or flammables are present, or in dusty environments.
- Avoid any contact with the circuit being measured if no measurements are being carried out.
- Avoid any contact with exposed metal parts, with unused measuring probes, circuits, etc.
- Do not carry out any measurement in case you find anomalies in the instrument such as deformation, breaks, substance leaks, absence of display on the screen, etc.
- Use extreme care when voltage exceeds 20V. This kind of voltage can cause electric shock

The following symbols are used in this manual:


CAUTION: observe the instructions given in this manual; improper use could damage the instrument or its components.


High voltage danger: electrical shock hazard.


Double-insulated meter.


AC voltage or current.


DC voltage or current.


Ground reference

1.1. PRELIMINARY INSTRUCTIONS

- This instrument has been designed for use in environments of pollution degree 2
- It can be used for **VOLTAGE** and **CURRENT** measurements on installations with overvoltage CAT III 1000V and CAT IV 600V
- Please take the standard safety precautions aimed at protecting you against dangerous electrical currents and protecting the instrument against incorrect use
- Only the leads supplied with the instrument guarantee compliance with the safety standards. They must be in good conditions and be replaced with identical models, when necessary
- Do not test circuits exceeding the specified voltage limits
- Do not perform any test under environmental conditions exceeding the limits indicated in § 6.2.1.
- Check that the battery is correctly inserted
- Before connecting the test leads to the circuit to be tested, make sure that the switch is correctly set.
- Make sure that the LCD display and the rotary switch indicate the same function.

1.2. DURING USE

Please carefully read the following recommendations and instructions:

CAUTION

Failure to comply with the Caution notes and/or Instructions may damage the instrument and/or its components or be a source of danger for the operator.

- Before activating the rotary switch, disconnect the test leads from the circuit under test.
- When the instrument is connected to the circuit under test, do not touch any unused terminal.
- Avoid measuring resistance if external voltages are present. Even if the instrument is protected, excessive voltage could cause a malfunction of the instrument.
- While measuring, if the value or the sign of the quantity being measured remain unchanged, check if the HOLD function is enabled.

1.3. AFTER USE

- When measurement is complete, set the rotary switch to OFF to turn off the instrument
- If the instrument is not to be used for a long time, remove the battery

1.4. DEFINITION OF MEASUREMENT (OVERVOLTAGE) CATEGORY

Standard “IEC/EN61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use, Part 1: General requirements” defines what measurement category, commonly called overvoltage category, is. § 6.7.4: Measured circuits, reads:

(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 on installations inside buildings.

  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 standard requires that the transient withstand capability of the equipment is made known to the user.

2. GENERAL DESCRIPTION

The instrument HT401 carries out the following measurements:

- DC and AC TRMS voltage
- DC and AC TRMS current
- Resistance and Continuity test
- Frequency of voltage and current
- Capacitance
- Diode test
- Temperature with type K probe
- DC/AC voltage measurement with low impedance (AutoV)

Each of these functions can be selected using the 10-position rotary switch, including an OFF position. The instrument is also equipped with function keys (see § 4.2) a bargraph and backlight. The selected quantity appears on the LCD display with the indication of the measuring unit and of the enabled functions.
The instrument is also equipped with an Auto Power OFF function which automatically switches off the instrument approx. 20 minutes after the last time a function key was pressed or the rotary switch was turned. To switch on the instrument again, turn the rotary switch.

2.1. MEASURING AVERAGE VALUES AND TRMS VALUES

Measuring instruments of alternating quantities are divided into two big families:

- AVERAGE-VALUE meters: instruments measuring the value of the sole wave at fundamental frequency (50 or 60 Hz).
- TRMS (True Root Mean Square) VALUE meters: instruments measuring the TRMS value of the quantity being tested.

In the presence of a perfectly sinusoidal wave, the two families of instruments provide identical results. In the presence of distorted waves, instead, the rdg shall differ. Average-value meters provide the RMS value of the sole fundamental wave; TRSM meters, instead, provide the RMS value of the whole wave, including harmonics (within the instrument's bandwidth). Therefore, by measuring the same quantity with instruments from both families, the values obtained are identical only if the wave is perfectly sinusoidal. In case it is distorted, TRMS meters shall provide higher values than the values read by average-value meters.

2.2. DEFINITION OF TRUE ROOT MEAN SQUARE VALUE AND CREST FACTOR

The root mean square value of current is defined as follows: "*In a time equal to a period, an alternating current with a root mean square value with an intensity of 1A, circulating on a resistor, dissipates the same energy that, during the same time, would have been dissipated by a direct current with an intensity of 1A*". This definition results in the numeric expression:

G= $\sqrt{\frac{1}{T}\int_{t_0}^{t_0+T} g^2(t)dt}$ The *root mean square value* is indicated with the acronym RMS.

The Crest Factor is defined as the relationship between the Peak Value of a signal and its RMS value: CF (G)= $\frac{G_p}{G_{RMS}}$ This value changes with the signal waveform, for a purely sinusoidal wave it is $\sqrt{2}$ =1.41. In case of distortion, the Crest Factor takes higher values as wave distortion increases.

3. PREPARATION FOR USE

3.1. INITIAL CHECKS

Before shipping, the instrument has been checked from an electric as well as mechanical point of view.
All possible precautions have been taken so that the instrument is delivered undamaged.

However, we recommend generally checking the instrument in order to detect possible damage suffered during transport. In case anomalies are found, immediately contact the forwarding agent.

We also recommend checking that the packaging contains all components indicated in § 6.3. In case of discrepancy, please contact the Dealer.

In case the instrument should be replaced, please carefully follow the instructions given in § 7.

3.2. INSTRUMENT POWER SUPPLY

The instrument is powered by a single 9V battery type NEDA1604, JIS006P, IEC6F22 included in the package.

In order to prevent compromising its charge, the battery is not inserted in the instrument. For battery installation, follow the instructions given in § 5.1.

The "  " symbol appears when the battery is flat. Replace the battery by following the instructions given in § 5.2.

3.3. CALIBRATION

The instrument has the technical specifications described in this manual. The instrument's performance is guaranteed for one year.

3.4. STORAGE

In order to guarantee precise measurement, after a long storage time under extreme environmental conditions, wait for the instrument to come back to normal condition (see the environmental specifications contained in § 6.2.1 before use).

4. OPERATING INSTRUCTIONS

4.1. INSTRUMENT DESCRIPTION

4.1.1. Description of the controls

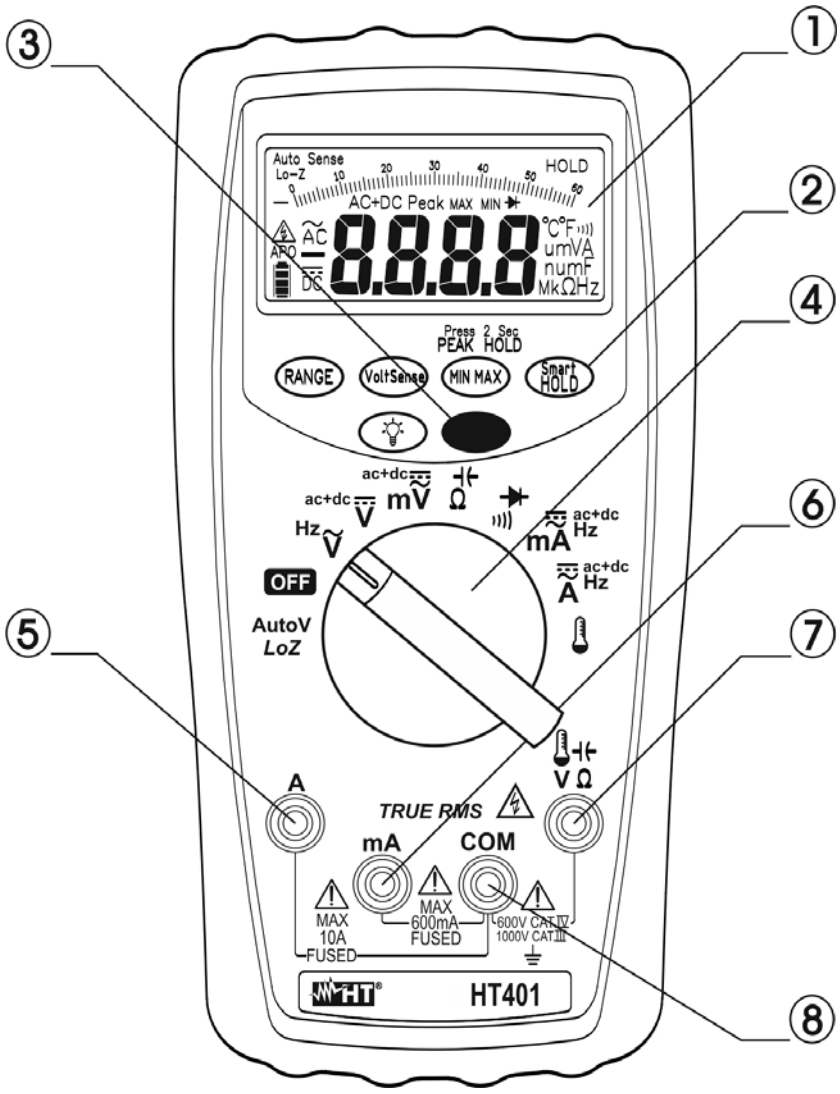

Fig. 1: Instrument description

CAPTION:

1. LCD display
2. Function keys
3. **MODE** key
4. Rotary switch
5. Input terminal **A**
6. Input terminal **mA**
7. Input terminal for measuring **⊣⊢VΩ** .
8. Input terminal **COM**

4.2. DESCRIPTION OF FUNCTION KEYS

The following § describes the functions of the different keys. When pressing a key, the display shows the symbol of the activated function and the buzzer sounds.

4.2.1. RANGE key

Press the **RANGE** key to activate the manual mode and to disable the Autorange function. The symbol “RANGE” appears in the upper left part of the display. In manual mode, cyclically press the **RANGE** key to change measuring range: the relevant decimal point will change position. The **RANGE** key is not active in the switch position / . In Autorange mode, the instrument selects the most appropriate ratio for carrying out the measurement. If a rdg is higher than the maximum measurable value, the indication “**O.L**” appears on the display. Press and hold the **RANGE** key for more than 1 second to exit the manual mode and restore the Autorange mode.

4.2.2. VoltSense key

The **VoltSense** key permits the detection of AC voltage without contact. Perform the herewith steps:

1. Switch on the instrument in any position of selector
2. Approach the instrument close to the point of test
3. Press and hold the **VoltSense** key. If an AC voltage is detected a continuous sound is emitted by the instrument and the number of LCD segments indicates the intensity of electric field in the point of test. **In case of no indication from the instrument a voltage could be present**
4. Release the **VoltSense** key to exit from the function

4.2.3. MIN MAX key

Pressing the **MIN MAX** key once activates the detection of maximum and minimum values of the quantity being tested. Both values are constantly updated and are displayed cyclically every time the same key is pressed again. The display shows the symbol associated with the selected function: “MAX” for maximum value and “MIN” for minimum value. The flashing symbol “MAX MIN” shows the current value on the display. The **MAX MIN** key is not active when the HOLD function is activated.
Press and hold the **MIN MAX** key for more than 1 second or turn the selector to exit the function.

4.2.4. SMART HOLD key

Pressing the **SMART HOLD** key keeps the value of the measured quantity on the display. The symbol “HOLD” appears on the display, the instrument emits a continuous acoustic alarm and the display flashes if the measured value differs by more than 50 dgt from the value read on the display. Press the **SMART HOLD** key again or turn the rotary switch to exit the function.

4.2.5. Backlight key

Press the key to activate/deactivate the backlight of the display. This function is active in any position of the rotary switch.

4.2.6. MODE key

Press the **MODE** key to activate the secondary functions (orange-coloured on the switch). Pressing the key again takes the instrument back to primary (initial) functions.

4.3. INTERNAL MODES OF INSTRUMENT

4.3.1. PEAK/HOLD mode

When operating in PEAK/HOLD function, the instrument records the Max or Min voltage or current peak values. When a new MAX peak value or MIN peak value is detected, the instrument saves the new values. Press the key again to stop recording peak values.
Press and hold the **MIN/MAX** key for 2 seconds to activate the **PEAK HOLD** mode.
Press and hold the **MIN MAX** key for more than 1 second or turn the selector to exit the function.

4.3.2. AC+DC mode

In the voltage and current measurements by pressing **MODE** key the selection of “AC+DC” measurement mode is possible. This mode permits the evaluation of possible DC components overlapped on a generic alternate waveform signal and this can be very useful for the measurements on impulsive signals typically of non-linear loads (e.g: welders, electric ovens, etc).

4.3.3. AutoV LoZ mode

This mode permits to perform the AC voltage measurement with a low input impedance in way to avoid the wrong rdg due to stray voltage in capacitive coupled

CAUTION

Inserting the instrument between phase and ground conductors, the RCDs protection devices can be tripping out during the test. In this case the measurement can be performed only inserting the instrument between phase and neutral conductor firstly checking the neutral electrical potential

4.3.4. Disabling the Auto Power OFF function

In order to preserve internal batteries, the instrument switches automatically off approximately 20 minutes after it was last used. The symbol “APO” appears on the display when this function is active. When the instrument must be used for long periods of time, it may be useful to deactivate the Auto Power Off function as follows:

- Switch off the instrument (OFF)
- Switch on the instrument by turning the rotary switch and pressing and holding the **MODE** key. The “AoFF” message is shown at display
- Switch off and on the instrument to automatically enable the feature

4.3.5. Wrong insertion indication

A continuous sound and a “Prob” message are shown by the instrument in case of wrong insertion of test leads according to the position of function selector. Fit the test lead in the correct configuration in way to stop the alarm condition

4.4. OPERATING INSTRUCTIONS

4.4.1. DC Voltage measurement

CAUTION

The maximum input DC voltage is 1000 V. Do not measure voltages exceeding the limits given in this manual. Exceeding these limits could result in electrical shocks to the user and damage to the instrument.

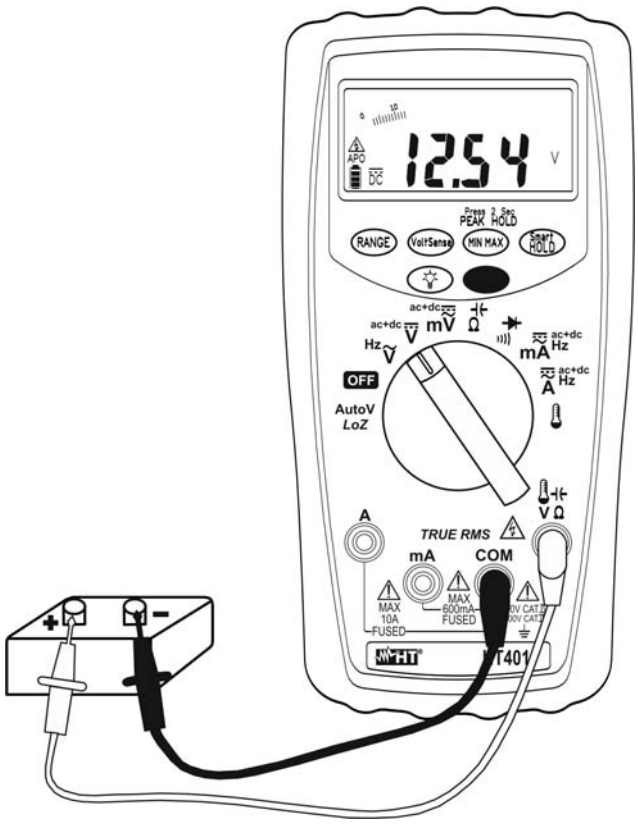

Fig. 2: DC voltage measurement

1. Select $\overline{\overline{\mathbf{V}}}$ or $\mathbf{m}\overline{\overline{\mathbf{V}}}$ positions
2. Press the **MODE** key to activate “DC” or “AC+ DC” modes (see § 4.3.2)
3. Press the **RANGE** key to activate manual range selection (see § 4.2.1) or use the Autorange feature. If the voltage value is unknown select the maximum range
4. Insert the red cable into input lead **VΩ** and the black cable into input lead **COM**
5. Position the red lead and the black lead respectively in the points with positive and negative potential of the circuit to be measured (see Fig. 2). The voltage value is shown on the display
6. The message “**O.L**” indicates that the voltage being measured exceeds the maximum value measurable by the instrument
7. When symbol “**-**” appears on the instrument’s display, it means that voltage has the opposite direction with respect to the connection in Fig. 2
8. For Maximum and Minimum value measurement and HOLD function measurement, please refer to § 4.2

4.4.2. AC Voltage measurement and Frequency

CAUTION

The maximum input AC voltage is 1000 V. Do not measure voltages exceeding the limits given in this manual. Exceeding these limits could result in electrical shocks to the user and damage to the instrument.

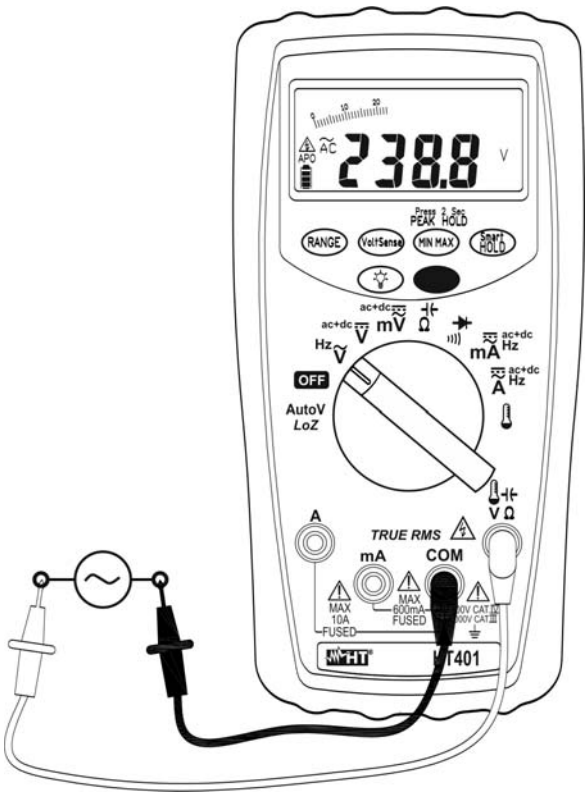

Fig. 3: AC voltage measurement

1. Select the $\tilde{V}$ or $m\tilde{V}$ position
2. Press the **MODE** key to activate “AC” or “AC+ DC” modes (see § 4.3.2)
3. Press the **RANGE** key to activate manual range selection (see § 4.2.1) or use the Autorange feature. If the voltage value is unknown select the maximum range
4. Insert the red cable into input lead **VΩ** and the black cable into input lead **COM** (see Fig. 3)
5. Position the test leads in the desired points of the circuit to be measured. The voltage value is shown on the display
6. The message “**O.L**” indicates that the voltage being measured exceeds the maximum value measurable by the instrument
7. Press the **MODE** key to activate Hz frequency measurement (only $\tilde{V}$ position). The “Hz” symbol is shown at display. Bargraph is disabled for this measurement
8. For Maximum and Minimum value measurement, HOLD function and PEAK HOLD measurement, please refer to § 4.2

4.4.3. AC Voltage measurement with low input impedance

CAUTION

The maximum input AC voltage is 1000 V. Do not measure voltages exceeding the limits given in this manual. Exceeding these limits could result in electrical shocks to the user and damage to the instrument.

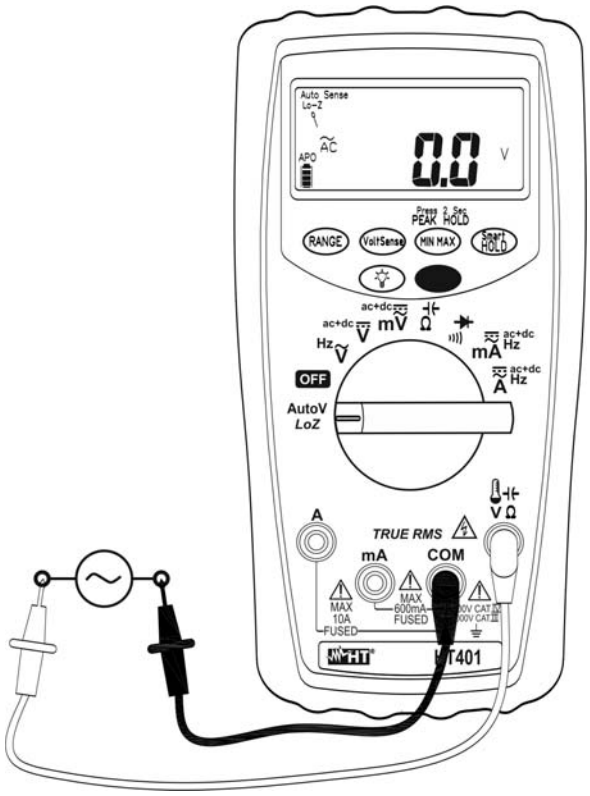

Fig. 4: AC voltage with low impedance (LoZ)

1. Select the **AutoV *LoZ*** position (see § 4.3.3)
2. Insert the red cable into input lead **⊣⊢VΩ** and the black cable into input lead **COM** (see Fig. 4)
3. Position the test leads in the desired points of the circuit to be measured. The voltage value is shown on the display
4. The message "**O.L**" indicates that the voltage being measured exceeds the maximum value measurable by the instrument
5. For HOLD function please refer to § 4.2

CAUTION

- Inserting the instrument between phase and ground conductors, the RCDs protection devices can be tripping out during the test. In this case the measurement can be performed only inserting the instrument between phase and neutral conductor firstly checking the neutral electrical potential
- Wait about 1 hours to perform resistance/continuity test measurements after the AutoV test

4.4.4. DC Current measurement

CAUTION

The maximum input DC current is 10A. Do not measure currents exceeding the limits given in this manual. Exceeding these limits could result in electrical shocks to the user and damage to the instrument

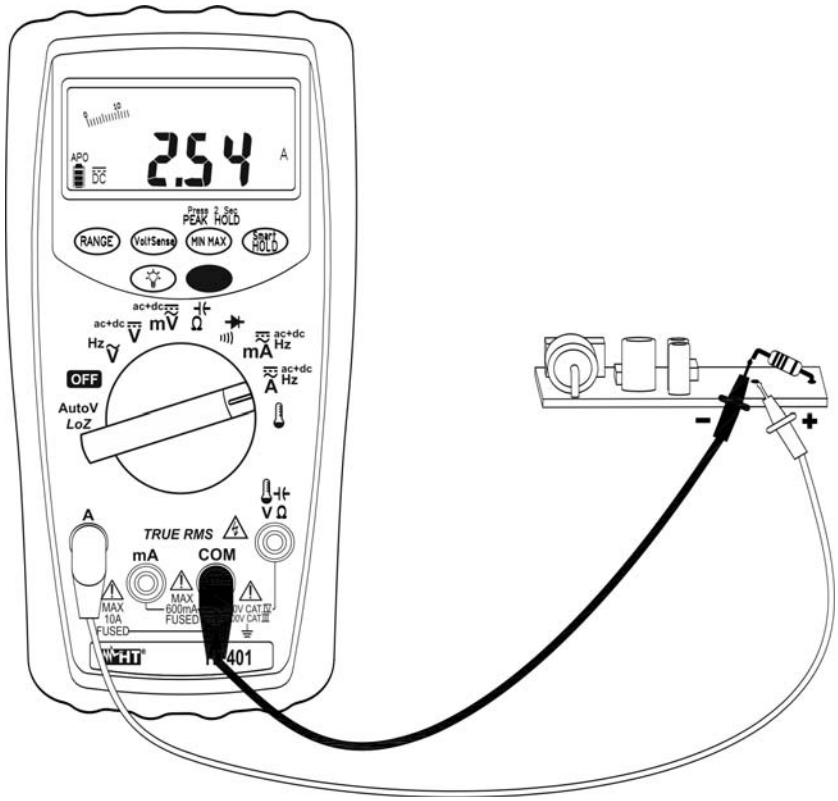

Fig. 5: DC current measurement

1. Cut off power supply from the circuit to be measured.
2. Select the **mA** or **A** positions
3. Insert the red cable and the black cable into the input terminals **mA** or **A** and **COM**
4. Press the **MODE** key to activate “DC” or “AC+ DC” modes (see § 4.3.2)
5. Press the **RANGE** key to activate manual range selection (see § 4.2.1) or use the Autorange feature. If the current value is unknown select the maximum range
6. Connect the red lead and the black lead in series to the circuit whose current you want to measure, respecting polarity and the current direction indicated in Fig. 5
7. Supply the circuit to be measured. The display shows the value of current.
8. The message “**O.L**” indicates that the current being measured exceeds the maximum value measurable by the instrument
9. When symbol “**-**” appears on the instrument’s display, it means that current has the opposite direction with respect to the connection in Fig. 5
10. For Maximum and Minimum value measurement and HOLD function measurement, please refer to § 4.2

4.4.5. AC Current measurement and Frequency

CAUTION

The maximum input AC current is 10A. Do not measure currents exceeding the limits given in this manual. Exceeding these limits could result in electrical shocks to the user and damage to the instrument.

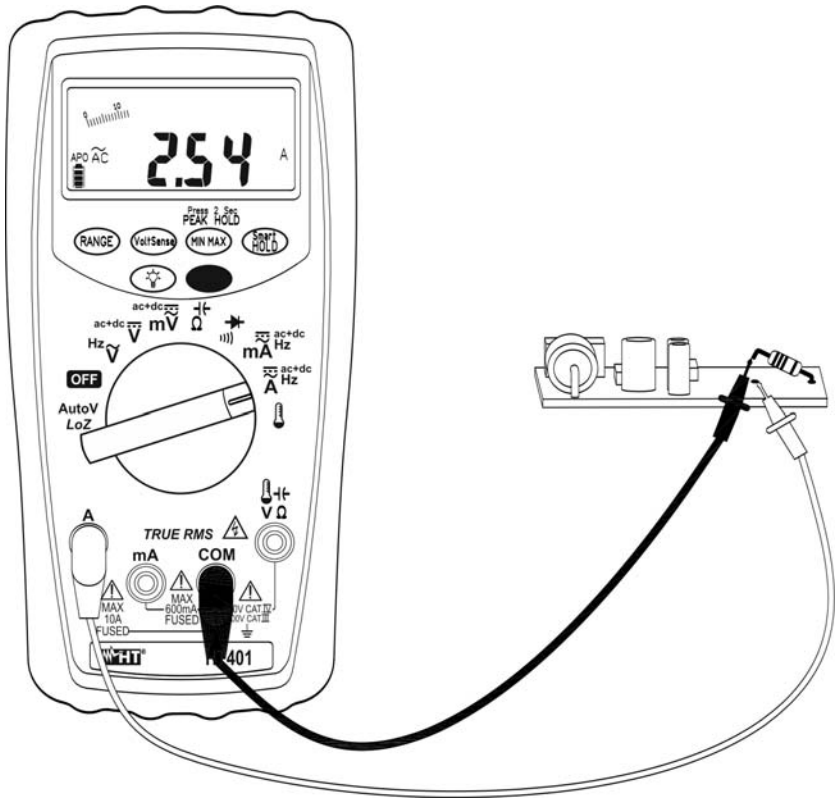

Fig. 6: AC current measurements

1. Cut off power supply from the circuit to be measured.
2. Select the $\widetilde{\mathbf{mA}}$ or $\widetilde{\mathbf{A}}$ positions
3. Insert the red cable and the black cable into the input terminals **mA** or **A** and **COM**
4. Press the **MODE** key to activate “AC” or “AC+ DC” modes (see § 4.3.2)
5. Press the **RANGE** key to activate manual range selection (see § 4.2.1) or use the Autorange feature. If the current value is unknown select the maximum range
6. Connect the red lead and the black lead in series to the circuit whose current you want to measure, respecting polarity and the current direction indicated in Fig. 6
7. Supply the circuit to be measured. The display shows the value of current.
8. The message “**O.L**” indicates that the current being measured exceeds the maximum value measurable by the instrument
9. Press the **MODE** key to activate Hz frequency measurement (only $\widetilde{\mathbf{V}}$ position). The “Hz” symbol is shown at display. Bargraph is disabled for this measurement
10. For Maximum and Minimum value measurement, HOLD function and PEAK HOLD measurement, please refer to § 4.2

4.4.6. Resistance measurement

CAUTION

Before attempting any resistance measurement, cut off power supply from the circuit to be measured and make sure that all capacitors are discharged, if present.

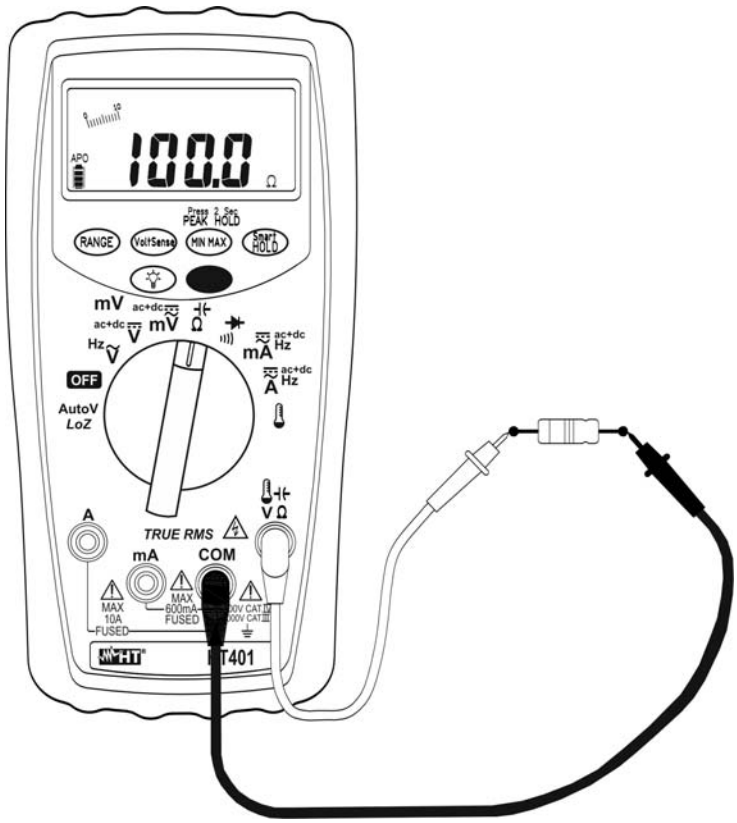

Fig. 7: Resistance measurement

1. Select the position **Ω / ⊣⊢**
2. Insert the red cable into input lead **⊣⊢VΩ** and the black cable into input lead **COM**
3. Press the **RANGE** key to activate manual range selection (see § 4.2.1) or use the Autorange feature. If the resistance value is unknown select the maximum range
4. Position the test leads in the desired points of the circuit to be measured. The value of resistance is shown on the display (see Fig. 7)
5. The message "**O.L**" indicates that the resistance being measured exceeds the maximum value measurable by the instrument.
6. For Maximum and Minimum value measurement and HOLD function please refer to § 4.2

4.4.7. Diode and Continuity test

CAUTION

Before attempting any resistance measurement, cut off power supply from the circuit to be measured and make sure that all capacitors are discharged, if present.

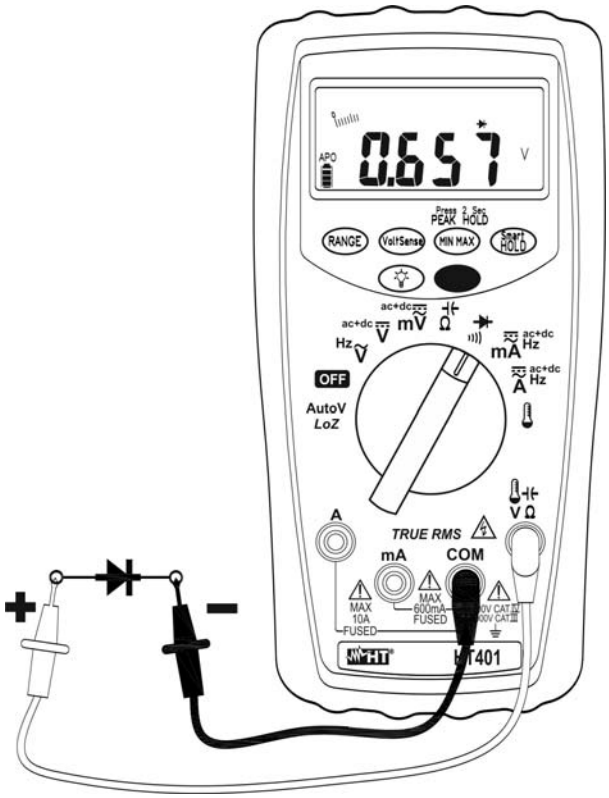

Fig. 8: Diode and continuity test

1. Select the position ·)) / ⊣
2. Press the **MODE** key to start testing diodes. The "⊣" symbol is shown at display
3. Insert the red cable into input lead ⊣⊢VΩ and the black cable into input lead **COM**
4. Connect the red lead to the anode and the black lead to the cathode of the diode (see Fig. 8). The instrument's display shows the direct polarization voltage. This voltage is typically 0.4 ~ 0.9V with good junctions.
5. Reverse connections and measure potential drop at the ends of the diode. An "**O.L**" result on the display indicates the correct operation of the junction.
6. Press the **MODE** key to select Continuity test. The "·)) " symbol is shown at display
7. Insert the red and black cables as described in "Resistance measurement" to carry out the measurement. The buzzer is ON for resistance values < 30Ω
8. For HOLD function please refer to § 4.2

4.4.8. Capacitance measurement

CAUTION

Before carrying out capacitance measurements on circuits or capacitors, cut off power supply from the circuit being tested and let all capacitance in it be discharged

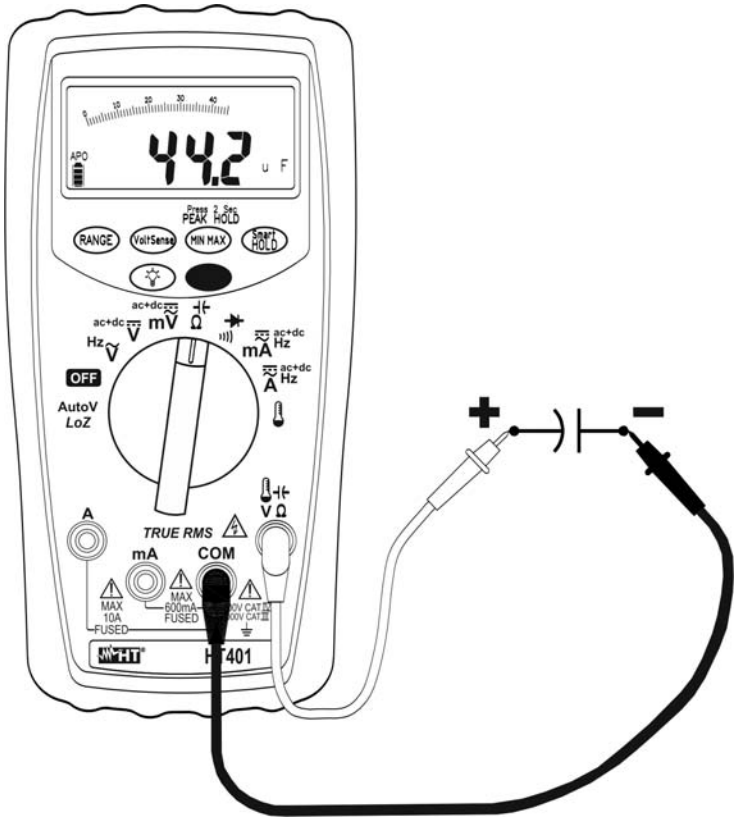

Fig. 9: Capacitance measurement

1. Select the position **Ω / ⊣⊢**
2. Press **MODE** key to activate capacitance measurement
3. Insert the red cable into input lead **⊣⊢VΩ** and the black cable into input lead **COM**
4. Press the **RANGE** key to activate manual range selection (see § 4.2.1) or use the Autorange feature. If the capacitance value is unknown select the maximum range
5. Position the leads at the ends of the capacitor to be tested, respecting the indicated polarity. The value of capacitance is shown on the display with automatic range selection
6. The message "**O.L**" indicates that the capacitance being measured exceeds the maximum value measurable by the instrument.
7. For Maximum and Minimum value measurement and HOLD function please refer to § 4.2

4.4.9. Temperature measurement

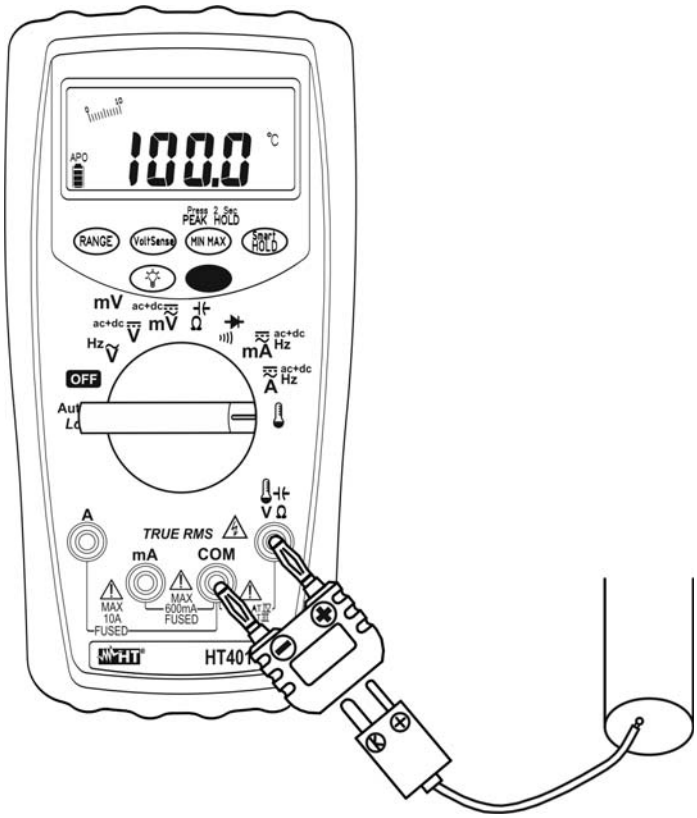

Fig. 10: Temperature measurement

1. Select the position
2. Press the **MODE** key to select measurement in °C or °F
3. Insert the supplied adapter into the input terminals **VΩ** and **COM** respecting the red and black colours found on it.
4. Connect the K-type probe to the instrument by means of the adapter, respecting the positive and negative polarity on the probe's plug. The display shows the value of temperature
5. The message "**O.L**" indicates that the temperature being measured exceeds the maximum value measurable by the instrument
6. For Maximum and Minimum value measurement and HOLD function please refer to § 4.2

5. MAINTENANCE

CAUTION

- Only expert and trained technicians should perform maintenance operations. Before carrying out this operations, make sure you have disconnected all cables from the input terminals
- Do not use the instrument in environments with high humidity levels or high temperatures. Do not expose to direct sunlight
- Always switch off the instrument after use. In case the instrument is not to be used for a long time, remove the battery to avoid liquid leaks that could damage the instrument's internal circuits

5.1. BATTERY AND FUSES REPLACEMENT

When the LCD displays the flashing symbol "▯", it is necessary to replace the battery.

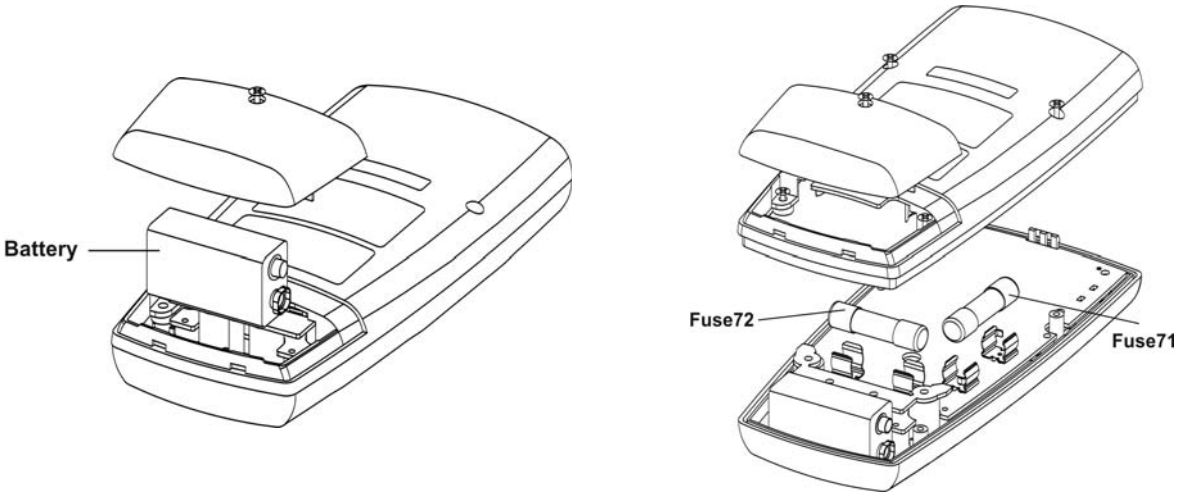

Fig. 11: Replacement of the battery and internal fuses

Replacing battery

1. Position the rotary switch to OFF and remove the cables from the input terminals.
2. Remove the protection shell from the instrument
3. Loosen the screw of the rear battery compartment cover, remove the cover and extract the battery (see Fig. 11)
4. Insert a new battery of the same type (see § 6.1.3) respecting the indicated polarity, close the compartment and reinsert the protection shell

Replace fuses

1. Position the rotary switch to OFF and remove the cables from the input terminals
2. Remove the protection shell from the instrument
3. Loosen the screw of the rear battery compartment cover and the four fastening screws of the rear semi-shell
4. Remove the damaged fuse and insert a new fuse of the same type (see § 6.1.3). Close the semi-shell and reinsert the protection shell

5.2. CLEANING THE INSTRUMENT

Use a soft and dry cloth to clean the instrument. Never use wet cloths, solvents, water, etc.

5.3. END OF LIFE

CAUTION: the symbol on the instrument indicates that the appliance and its accessories must be collected separately and correctly disposed of.

6. TECHNICAL SPECIFICATIONS

6.1. TECHNICAL CHARACTERISTICS

Accuracy is indicated as [% rdg + (dgt number) * resolution] at 23°C ± 5°C,< 80%HR

DC Voltage

Range	Resolution	Accuracy	Input impedance	Protection against overcharge
60.00mV	0.01mV	±(0.08%rdg+10dgt)	10MΩ // < 100pF	1000VDC/ACrms
600.0mV	0.1mV	±(0.08%rdg+2dgt)		
6.000V	0.001V			
60.00V	0.01V			
600.0V	0.1V			
1000V	1V			

AC TRMS Voltage

Range	Resolution	Accuracy (50Hz ÷1kHz)	Input impedance	Protection against overcharge
60.00mV	0.01mV	±(1.2%rdg+5dgt)	10MΩ // < 100pF	1000VDC/ACrms
600.0mV	0.1mV			
6.000V	0.001V	±(0.8%rdg+5dgt)		
60.00V	0.01V			
600.0V	0.1V			
1000V	1V			

For non-sinusoidal voltages, add the following errors depending on the crest factor (**CF**):
1.4 < CF < 2.0 → 1%rdg to the accuracy
2.0 < CF < 2.5 → 2.5%rdg to the accuracy
2.5 < CF < 3.0 → 4.0%rdg to the accuracy
Max crest factor: 3.0 (0 ÷ 3000dgt); 2.0 (3000 ÷ 5000dgt); 1.6 (5000 ÷ 6000dgt)
PEAK HOLD feature: specified accuracy ±150dgt

AC + DC TRMS Voltage

Range	Resolution	Accuracy (50Hz ÷1kHz)	Input impedance	Protection against overcharge
60.00mV	0.01mV	±(2.0%rdg+10dgt)	10MΩ // < 100pF	1000VDC/ACrms
600.0mV	0.1mV			
6.000V	0.001V	±(2.0%rdg+5dgt)		
60.00V	0.01V			
600.0V	0.1V			
1000V	1V			

For non-sinusoidal signals, add the same errors as AC TRMS voltage
PEAK HOLD feature: specified accuracy ±150dgt

Auto-V (low impedance AC/DC voltage measurement)

Range	Resolution	Accuracy	Input impedance	Protection against overcharge
600.0VDC	0.1V	±(0.8%rdg+3dgt)	about 3kΩ	1000VDC/ACrms
1000VDC	1V			
600.0VAC	0.1V			
1000VAC	1V			

For non-sinusoidal signals, add the same errors as AC TRMS voltage
PEAK HOLD feature: specified accuracy ±150dgt

DC Current

Range	Resolution	Accuracy	Measuring time	Protection against overcharge
60.00mA	0.01mA	±(0.8%rdg+3dgt)	3min (A) 10min (mA)	max 440mA (mA) max 11A (A)
600.0mA	0.1mA			
6.000A	0.001A			
10.00A	0.01A			

AC TRMS Current

Range	Resolution	Accuracy (50Hz ÷1kHz)	Measuring time	Protection against overcharge
60.00mA	0.01mA	±(1.2%rdg+3dgt)	3min (A) 10min (mA)	max 440mA (mA) max 11A (A)
600.0mA	0.1mA			
6.000A	0.001A			
10.00A	0.01A			

For non-sinusoidal currents, add the same errors as AC TRMS voltage
PEAK HOLD feature: specified accuracy ±150dgt

AC + DC TRMS Current

Range	Resolution	Accuracy (50Hz ÷1kHz)	Measuring time	Protection against overcharge
60.00mA	0.01mA	±(2.0%rdg+5dgt)	3min (A) 10min (mA)	max 440mA (mA) max 11A (A)
600.0mA	0.1mA			
6.000A	0.001A			
10.00A	0.01A			

For non-sinusoidal signals, add the same errors as AC TRMS voltage
PEAK HOLD feature: specified accuracy ±150dgt

Frequency

Range	Resolution	Accuracy	Minimum frequency	Protection against overcharge
100.00Hz	0.01Hz	±(0.1%rdg+2dgt)	1Hz	1000VDC/ACrms
1000.0Hz	0.1Hz			
10.000kHz	0.001kHz			
100.00KHz	0.01KHz			

Sensitivity: > > 5.0Vpp (VAC 1Hz ~ 10kHz); > 10Vpp (VAC 10kHz ~ 100kHz); > 2mApp (ACmA); > 0.2App (ACA)

Resistance

Range	Resolution	Accuracy (*)	Maximum open circuit voltage	Protection against overcharge
600.0Ω	0.1Ω	±(0.8%rdg+5dgt)	2.5V (600Ω and 6kΩ)	1000VDC/ACrms
6.000kΩ	0.001kΩ	±(0.8%rdg+2dgt)		
60.00kΩ	0.01kΩ		0.6V (other ranges)	
600.0kΩ	0.1kΩ			
6.000MΩ	0.001MΩ			
40.00MΩ (*)	0.01MΩ	±(1.0%rdg+5dgt)		

Test current : approx. 0.1mA
(*) Specified for measurements 1 hour after Auto-V test. Add 10dgt for measurements before this interval
(**) Small instability < ± 50dgt for measurements >10 MΩ

Diode test

Range	Resolution	Accuracy	Test current	Open circuit voltage	Protection against overcharge
2.000V	1mV	±(1.5%rdg+2dgt)	< 0.4mA	<2.5V	1000VDC/ACrms

Continuity test

Range	Resolution	Accuracy	Protection against overcharge
600Ω	0.1Ω	±(0.8%rdg+5dgt)	1000VDC/ACrms

Buzzer activated for R < 30Ω and deactivated for R > 100Ω

Capacity

Range	Resolution	Accuracy	Protection against overcharge
1.000μF	0.001μF	±(1.2%rdg+2dgt)	1000VDC/ACrms
10.00μF	0.01μF		
100.0μF	0.1μF		
1.000mF	0.001mF		
10.00mF	0.01mF		

Maximum time for reaching results: 0.7s C<1mF; 3s C> 1 mF

Temperature with type K probe

Range	Resolution	Accuracy (*)	Protection against overcharge
-40.0 ÷ 400 °C	0.1°C	±(1.0%rdg+10dgt)	1000VDC/ACrms
-40.0 ÷ 752 °F	0.1°F	±(1.0%rdg+18dgt)	

(*) The specified accuracy applies at the reference environmental temperature ±1°C. If temperature differs by more than 5 degrees, to obtain the declared accuracy, a stabilization time of 2 hours is required

6.1.1. Electrical characteristics

Conversion: TRMS
Sampling frequency: 3 times per second
Temperature coefficient: 0.15x(accuracy) /°C, <18°C or >28°C

6.1.2. Reference standards

The instrument complies with standards: IEC/EN 61010-1, UL61010-1,
Insulation: double insulation
Pollution level: 2
Overvoltage category: CAT IV 600V, CAT III 1000V
Max height of use: 2000m (6561ft)

6.1.3. General characteristics

Mechanical characteristics

Size (with shell): 190(L) x 94(W) x 48 (H) mm (7.5 x 3.7x 1.9 in)
Weight (battery included): 460g (1Lv)

Power supply

Battery type: 1x9V battery NEDA1604, JIS006P, IEC6F22
Low battery indication: symbol "" at display
Battery duration: approx. 150 hours (no backlight)
Auto Power OFF: after 20 minutes of idleness
Fuses: FUSE71: F11A/1000V, 20kA
FUSE72: F440mA/1000V, 10kA

Display

Characteristics: 4 LCD, 6000 dots plus decimal sign, bargraph and backlight
Over range indication: "**O.L**" or "**-O.L**"

6.2. ENVIRONMENT

6.2.1. Environmental conditions for use

Reference temperature:	23 ± 5°C (73 ± 41°F)
Operating temperature/humidity:	-10 ÷ 50°C (14 ÷ 122°F) -10 ÷ 30°C (<80%RH); 30 ÷ 40°C (<75%RH); 40 ÷ 50°C (<45%RH)
Storage temperature/humidity:	-20 ÷ 60°C (-4 ÷ 140°F) (battery not inserted)
Storage humidity:	<80%RH (battery not inserted)

This instrument satisfies the requirements of Low Voltage Directive 2006/95/EC (LVD) and of EMC Directive 2004/108/EC

6.3. ACCESSORIES

6.3.1. Standard accessories

- Couple of test leads
- K probe adapter and wire probe
- Protection holster
- Battery (not inserted)
- User manual

6.3.2. Optional accessories

Couple of test leads	Cod. 4413-2
K-type probe for air and gas temperature	Cod. TK107
K-type probe for semisolid substance temperature	Cod. TK108
K-type probe for liquid substance temperature	Cod. TK109
K-type probe for surface temperature	Cod. TK110
K-type probe for surface temperature with 90° tip	Cod. TK111

7. SERVICE

7.1. WARRANTY CONDITIONS

This instrument is warranted against any material or manufacturing defect, in compliance with the general sales conditions. During the warranty period, defective parts may be replaced. However, the manufacturer reserves the right to repair or replace the product.

Should the instrument be returned to the After-sales Service or to a Dealer, transport will be at the Customer's charge. However, shipment will be agreed in advance.
A report will always be enclosed to a shipment, stating the reasons for the product's return.
Only use original packaging for shipment; any damage due to the use of non-original packaging material will be charged to the Customer.
The manufacturer declines any responsibility for injury to people or damage to property.

The warranty shall not apply in the following cases:

- Repair and/or replacement of accessories and battery (not covered by warranty).
- Repairs that may become necessary as a consequence of an incorrect use of the instrument or due to its use together with non-compatible appliances.
- Repairs that may become necessary as a consequence of improper packaging.
- Repairs which may become necessary as a consequence of interventions performed by unauthorized personnel.
- Modifications to the instrument performed without the manufacturer's explicit authorization.
- Use not provided for in the instrument's specifications or in the instruction manual.

The content of this manual cannot be reproduced in any form without the manufacturer's authorization.

Our products are patented and our trademarks are registered. The manufacturer reserves the right to make changes in the specifications and prices if this is due to improvements in technology.

7.2. SERVICE

If the instrument does not operate properly, before contacting the After-sales Service, please check the conditions of battery and cables and replace them, if necessary.
Should the instrument still operate improperly, check that the product is operated according to the instructions given in this manual.

Should the instrument be returned to the After-sales Service or to a Dealer, transport will be at the Customer's charge. However, shipment will be agreed in advance.
A report will always be enclosed to a shipment, stating the reasons for the product's return.
Only use original packaging for shipment; any damage due to the use of non-original packaging material will be charged to the Customer.