ENGLISH

User manual

Version EN 1.00 - 08/01/2016

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1. PRECAUTIONS AND SAFETY MEASURES

The instrument has been designed in compliance with directive IEC/EN61010-1 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 symbol ⚠ with the utmost attention.
Before and after carrying out 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 contact with the circuit being measured if no measurements are being carried out
- Avoid 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.
- Pay special attention when measuring voltages higher than 20V, since a risk of electrical shock exists

In this manual, and on the instrument, the following symbols are used:

⚠ Warning: 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

⎓ DC voltage

1.1. PRELIMINARY INSTRUCTIONS

- This instrument has been designed for use in environments of pollution degree 2.
- It can be used for **VOLTAGE** measurements on installations in CAT IV 600V
- We recommend following the normal safety rules devised to protect the user against dangerous currents and 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 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 § 6.1.1 and § 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 rotary 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 being measured.
- When the instrument is connected to the circuit being measured, do not touch any unused terminal.
- Avoid measuring resistance if external voltages are present. Even if the instrument is protected, excessive voltage could cause it malfunction.
- 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 batteries.

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

HT60 carries out the following measurements in Autorange:

- DC voltage
- AC TRMS voltage
- Resistance and Continuity test
- Capacity
- Frequency
- Duty Cycle
- Diode test
- Temperature with K-type probe

Each of these functions can be selected using the 7-position rotary switch, including an OFF position. The instrument is also provided with a **HOLD** function key to enable freezing the measured value on the display and to activate the display's backlight, an **Hz%** key to select frequency and duty cycle tests, a **REL** key to carry out relative measurements and a **MODE** key to select resistance measurement, continuity test, diode test and capacity test. 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 device which automatically switches it off approx. 30 minutes after the last time the instrument was used.

2.1. MEASURING AVERAGE VALUES ANDTRMS 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.

With a perfectly sinusoidal wave, the two families of instruments provide identical results. With distorted waves, instead, the readings 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 instruments 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 of 1A intensity, circulating on a resistor, dissipates the same energy that, during the same time, would be 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 § 6.3.1. In case of discrepancy, please contact the Dealer.
In case the instrument should be returned, please follow the instructions given in § 7.

3.2. INSTRUMENT POWER SUPPLY

The instrument is supplied with 1x9V alkaline battery type IEC 1604 NEDA 6F22, included in the package. When the battery is flat, the symbol "+ III" appears on the display. To replace/insert the battery, see § 5.2.

3.3. CALIBRATION

The instrument has the technical specifications described in this manual. Its performance is guaranteed for 12 months from the date of purchase.

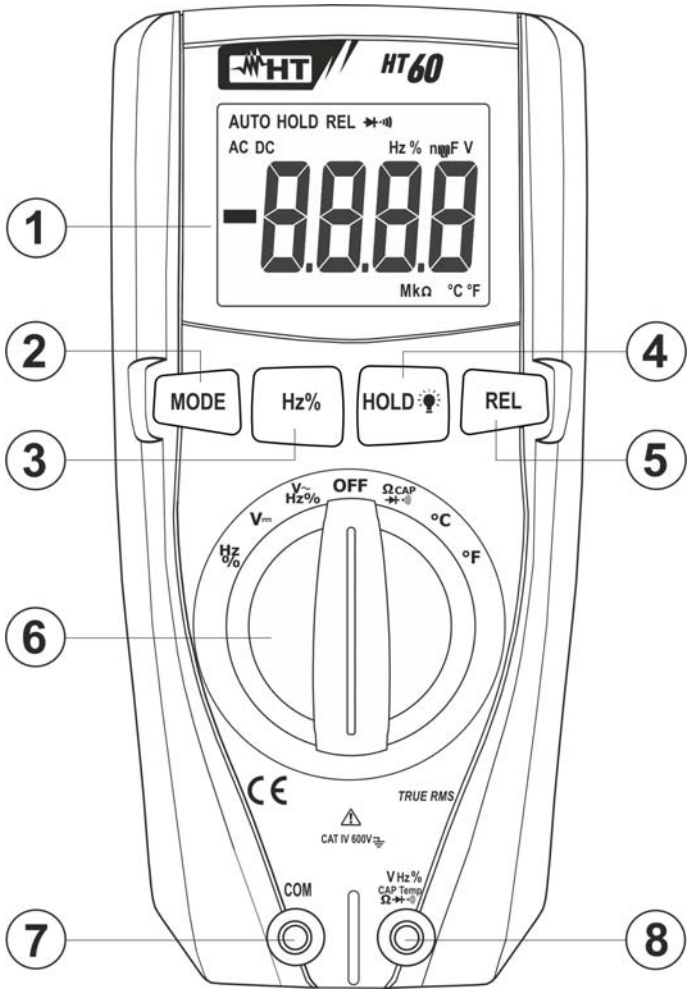
3.4. STORAGE

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

4. OPERATING INSTRUCTIONS

4.1. DESCRIPTION OF THE INSTRUMENT

4.1.1. Description of the controls



CAPTION:

1. LCD display
2. **MODE** key
3. **Hz%** key
4. **HOLD** key
5. **REL** key
6. Rotary selector switch
7. Input terminal **COM**
8. Input terminal **VHz%CAPTemp Ω**

Fig. 1: Description of the instrument

4.2. DESCRIPTION OF FUNCTION KEYS

4.2.1. HOLD key

Pressing the **HOLD** key freezes the value of the measured quantity on the display. After pressing this key, the message "HOLD" appears on the display. Press the **HOLD** key again to exit the function.
Press and hold the same key for longer than one second to activate and deactivate the display's backlight. This function is active in any position of the rotary switch.

4.2.2. Hz% key

Press the **Hz%** key to select frequency measurement and duty cycle test in positions **Ṽ Hz%** and **Hz%** of the rotary switch. The frequency range is different in the two positions.

4.2.3. REL key

Press the **REL** key to activate relative measurement. The instrument zeroes the display and saves the displayed value as a reference value which subsequent measurements will be referred to. The symbol "REL" appears on the display. This function is not active for the following measurements: Hz, Duty Cycle, Continuity Test, Diode test and Temperature. Press the key again to exit the function.

4.2.4. MODE key

Pressing the **MODE** key allows selecting a double function on the rotary switch. In particular, it is active in position **ΩCAP**→|/•))) to select diode test, continuity test, capacity measurement and resistance measurement.

4.2.5. Auto-Power-Off function

In order to preserve internal batteries, the instrument switches off automatically approximately 30 minutes after it was last used. Turn the rotary switch to OFF before switching on the instrument again by turning the switch to any other position.

4.3. DESCRIPTION OF ROTARY SWITCH FUNCTIONS

4.3.1. DC Voltage measurement

CAUTION

The maximum input DC voltage is 600V. Do not measure voltages exceeding the limits given in this manual. Exceeding voltage limits could result in electrical shocks to the user and damage to the instrument.

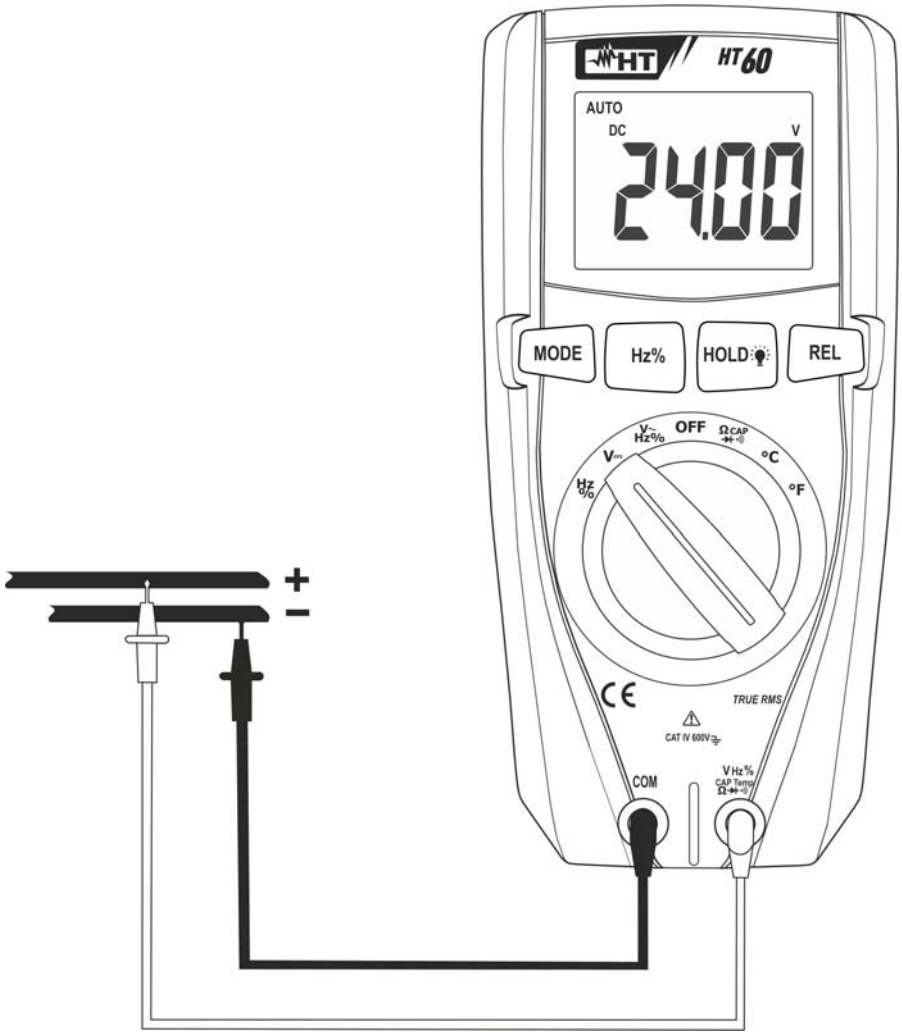


Fig. 2: Use of the instrument for DC voltage measurement

1. Select position **V⎓**. The symbol "DC" is shown on the display.
2. Insert the red cable into input terminal **VHz%CAPTemp Ω**▶⊢•))) and the black cable into input terminal **COM**
3. Position the red lead and the black lead respectively in the spots with positive and negative potential of the circuit to be measured (see Fig. 2). The display shows the value of voltage.
4. The message "**O.L.**" indicates that the value of DC voltage exceeds the maximum measurable value.
5. When symbol "**-**" appears on the instrument's display, it means that voltage has the opposite direction with respect to the connection in Fig. 2.
6. To use the HOLD function and Relative measurement, see § 4.2

4.3.2. AC Voltage measurement

CAUTION

The maximum input AC voltage is 600V. Do not measure voltages exceeding the limits given in this manual. Exceeding voltage limits could result in electrical shocks to the user and damage to the instrument.

Fig. 3: Use of the instrument for AC voltage measurement

1. Select position **V~Hz%**. The symbol "AC" is shown on the display.
2. Insert the red cable into input terminal **VHz%CAPTemp** Ω and the black cable into input terminal **COM**.
3. Position the test leads in the desired spots of the circuit to be measured (see Fig. 3). The display shows the value of voltage.
4. The message "**O.L.**" indicates that the value of AC voltage exceeds the maximum measurable value.
5. Press the **Hz%** key until symbols "**Hz**" or "**%**" are shown in order to activate the display of frequency and duty cycle associated to the value of AC voltage.
6. To use the HOLD function and Relative measurement, see § 4.2

4.3.3. Resistance measurement 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.

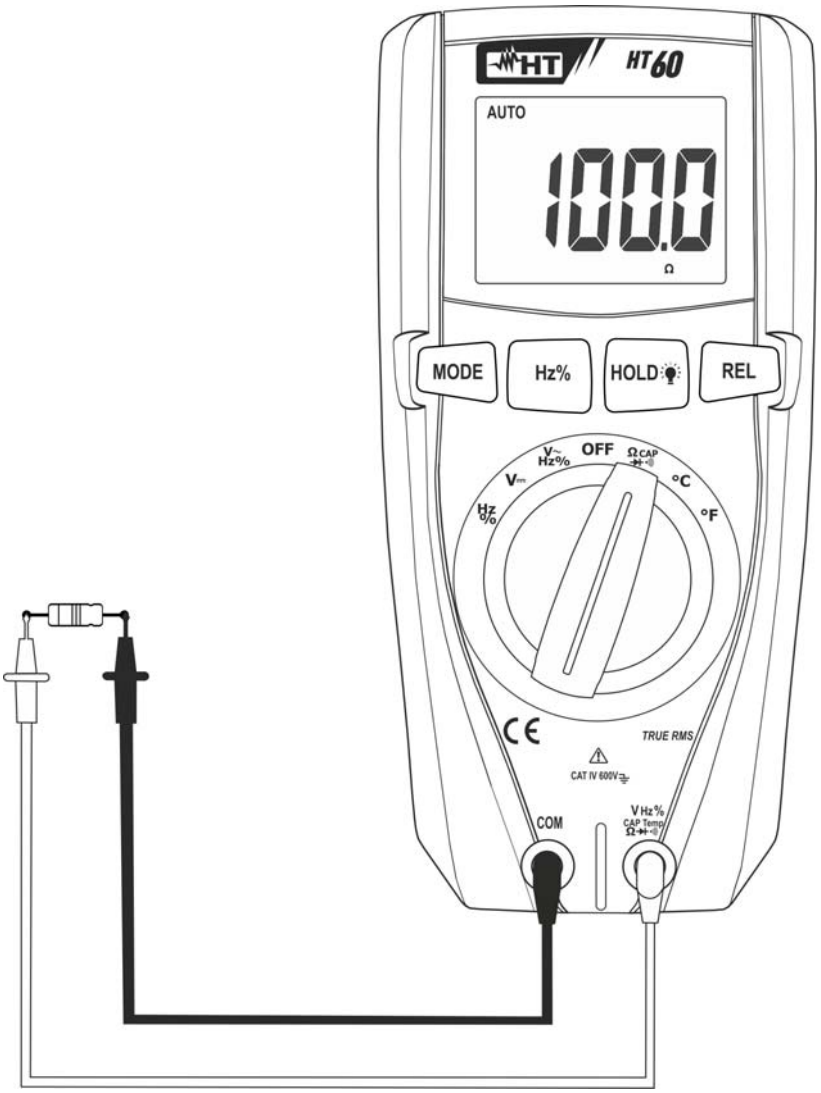


Fig. 4: Use of the instrument for resistance measurement and continuity test

1. Select position **ΩCAP**
2. Insert the red cable into input terminal **VHz%CAPTemp** Ω and the black cable into input terminal **COM**.
3. Position the test leads in the desired spots of the circuit to be measured (see Fig. 4). The display shows the value of resistance.
4. The message "**O.L.**" indicates that the value of resistance exceeds the maximum measurable value.
5. Press the **MODE** key until symbol "•))" is shown in order to activate continuity test and connect the instrument as for Resistance measurement. The continuity buzzer activates for R<30.Ω
6. To use the HOLD function, see § 4.2.

4.3.4. Diode 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.

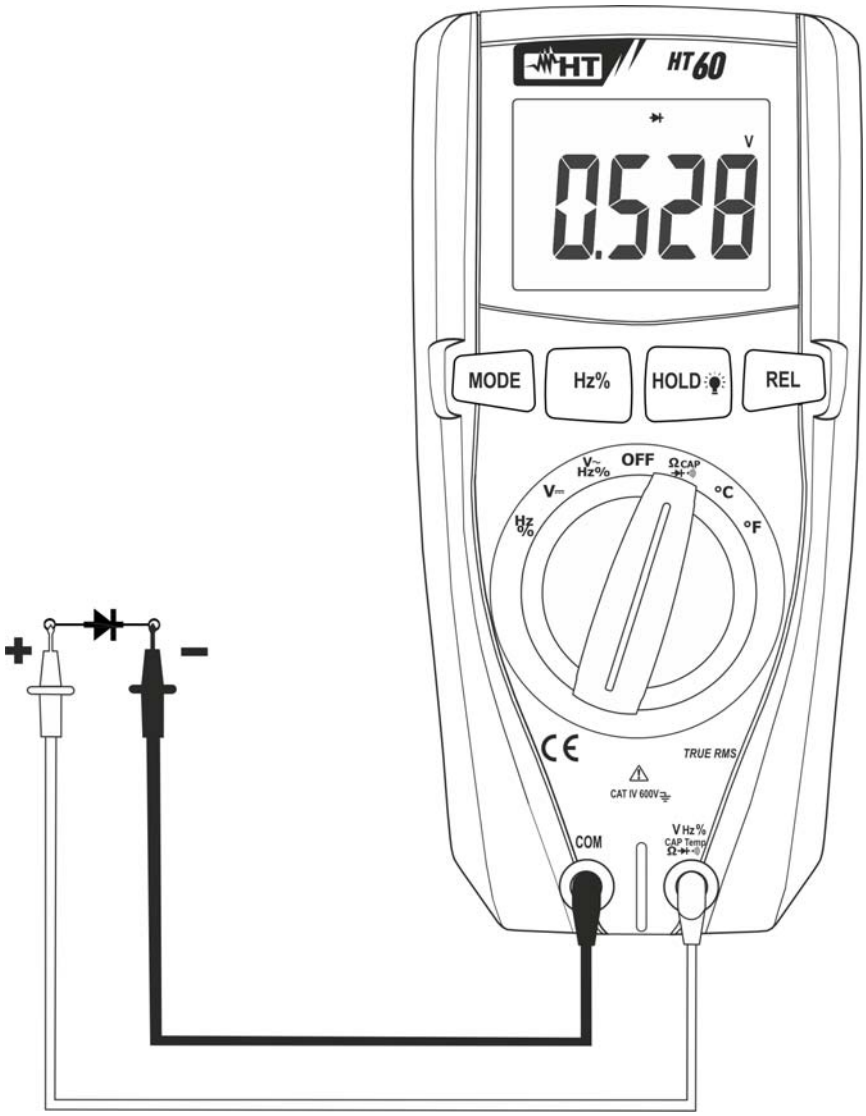


Fig. 5: Use of the instrument for diode test

1. Select position **ΩCAP**.
2. Press the **MODE** key until the symbol "" is displayed.
3. Insert the red cable into input terminal **VHz%CAPTemp** and the black cable into input terminal **COM**.
4. Position the leads at the ends of the diode to be tested, respecting the indicated polarity (see Fig. 5). The value of directly polarized threshold voltage is shown on the display.
5. If threshold value is equal to 0mV, the P-N junction of the diode is short-circuited.
6. If the display shows the message "**O.L.**", the terminals of the diode are reversed with respect to the indication given in Fig. 5 or the P-N junction of the diode is damaged.

4.3.5. Frequency and Duty Cycle measurements

CAUTION

The maximum input AC voltage is 250V. Do not measure voltages exceeding the limits given in this manual. Exceeding voltage limits could result in electrical shocks to the user and damage to the instrument.

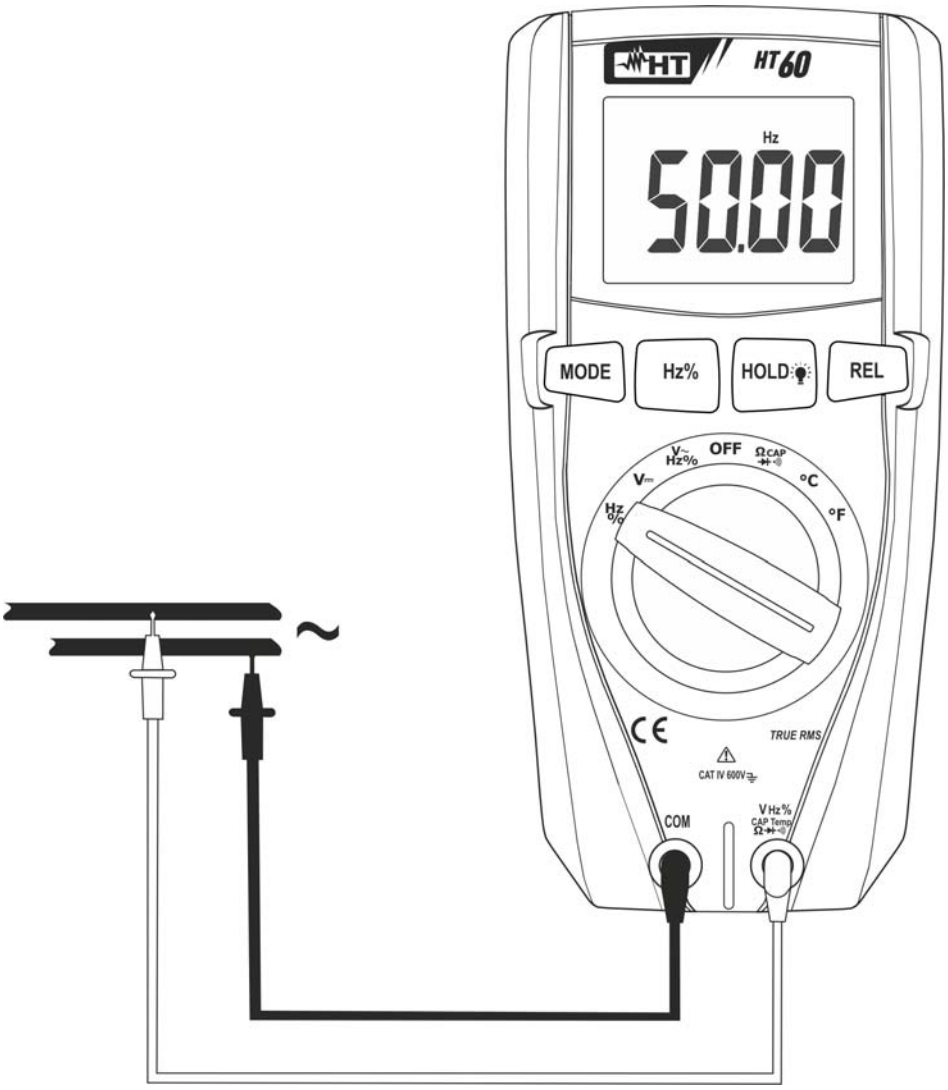


Fig. 6: Use of the instrument for frequency measurement and duty cycle test

1. Select position **Hz%**. The symbol "Hz" is shown on the display.
2. Insert the red cable into input terminal **VHz%CAPTemp** Ω and the black cable into input terminal **COM**.
3. Position the test leads in the desired spots of the circuit to be measured (see Fig. 6). The display shows the value of frequency.
4. The message "**O.L.**" indicates that the value of frequency exceeds the maximum measurable value.
5. Press the **Hz%**key until symbol "%" is shown in order to activate Duty Cycle measurement and connect the instrument as for Frequency measurement. The result is shown on the display.
6. To use the HOLD function, see § 4.2.

4.3.6. 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. When connecting the multimeter and the capacitance to be measured, respect the correct polarity (when required).

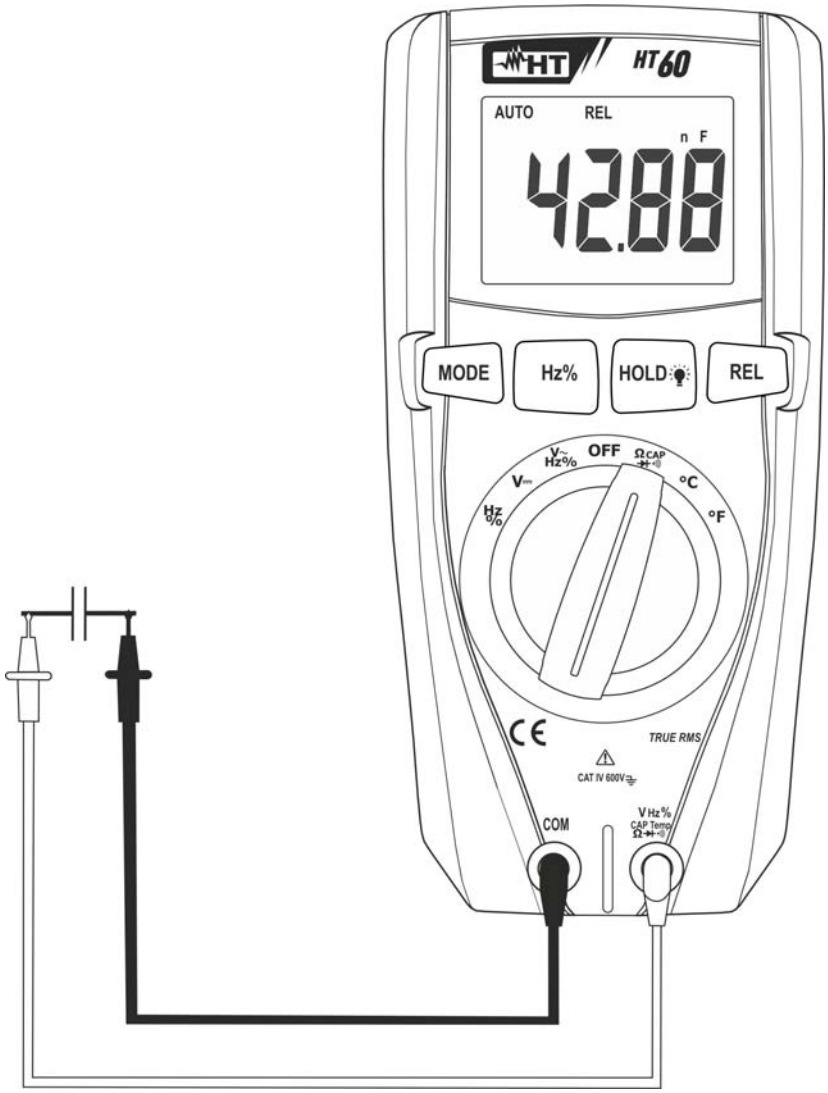


Fig. 7: Use of the instrument for Capacitance measurement

1. Select position **ΩCAP**
2. Press the **MODE** key until the symbol "nF" is displayed.
3. Insert the red cable into input terminal **VHz%CAPTemp** and the black cable into input terminal **COM**.
4. Press the **REL** button before carrying out measurements.
5. Position the leads at the ends of the capacitor to be tested, respecting, if necessary, the positive (red cable) and negative (black cable) polarity (see Fig. 7). The display shows the value of capacitance.
6. The message "**O.L.**" indicates that the value of capacitance exceeds the maximum measurable value.
7. To use the HOLD function and Relative measurement, see § 4.2

4.3.7. Temperature measurement

CAUTION

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

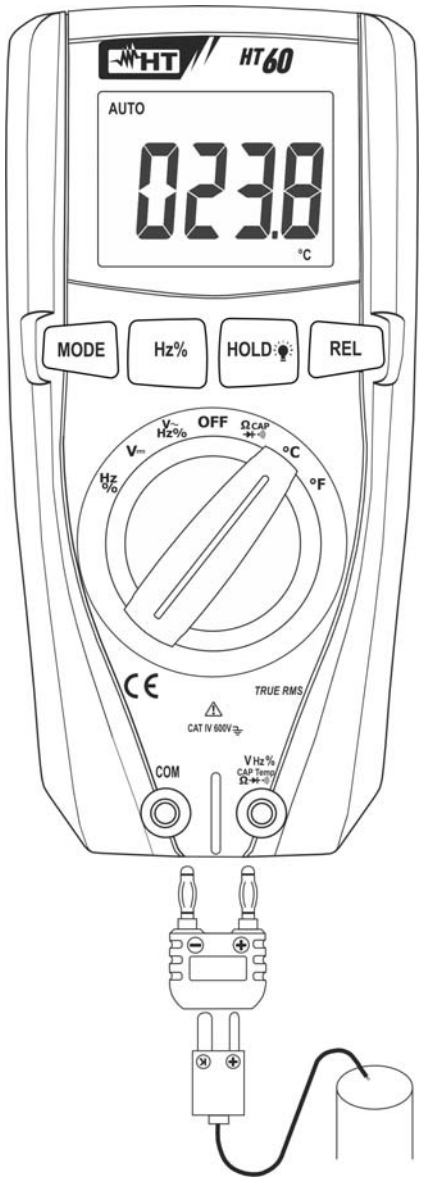


Fig. 8: Use of the instrument for Temperature measurement

1. Select position **°C** or **°F** on the instrument.
2. Insert the provided adapter into input terminals **VHz%CAPTemp** Ω (polarity +) and **COM** (polarity -) (see Fig. 8).
3. Connect the provided K-type wire probe or the optional K-type thermocouple (see § 6.3.2) to the instrument by means of the adapter, respecting the positive and negative polarity on it. The display shows the value of temperature.
4. The message "**O.L.**" indicates that the value of temperature exceeds the maximum measurable value.
5. To use the HOLD function, see § . 4.2

5. MAINTENANCE

5.1. GENERAL INFORMATION

- The instrument you purchased is a precision instrument. While using and storing the instrument, carefully observe the recommendations listed in this manual in order to prevent possible damage or danger during use.
- 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.

5.2. REPLACING THE BATTERY

When the LCD display shows the lat battery symbol "+ III" (see § 6.1.2), it is necessary to replace the battery.

CAUTION

Only expert and trained technicians should perform this operation. Before carrying out this operation, make sure you have disconnected all cables from the input terminals.

1. Position the rotary switch to **OFF** and remove the cables from the input terminals.
2. Turn the fastening screw of the battery compartment cover from position "🔒" to position "🔓" and remove it.
3. Remove the battery and insert a new battery of the same type (see § 6.1.2), respecting the indicated polarity.
4. Restore the battery compartment cover into place and turn the fastening screw from position "🔓" to position "🔒".
5. Do not scatter old batteries into the environment. Use the relevant containers for disposal.

5.3. CLEANING THE INSTRUMENT

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

5.4. END OF LIFE

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

6. TECHNICAL SPECIFICATIONS

6.1. TECHNICAL CHARACTERISTICS

Accuracy calculated as ±[%reading + (num. dgt*resol)] referred to 18°C÷28°C,<75%HR.

DC voltage (Autorange)

Range	Resolution	Accuracy	Input impedance	Protection against overcharge
4.000V	0.001V	±(1.2%rdg + 2dgt)	7.8MΩ	600VDC/ACrms
40.00V	0.01V			
400.0V	0.1V			
600V	1V	±(1.5%rdg + 2dgt)		

AC TRMS voltage (Autorange)

Range	Resolution	Accuracy (*) (50 ÷ 400Hz)	Input impedance	Protection against overcharge
4.000V	0.001V	±(1.2%rdg + 8dgt)	7.8MΩ	600VDC/ACrms
40.00V	0.01V	±(1.5%rdg +3dgt)		
400.0V	0.1V			
600V	1V	±(2.0%rdg + 4dgt)		

(*) Accuracy specified from 5% to 100% of the measuring range, Frequency range: 50Hz ÷ 400Hz

Resistance (Autorange)

Range	Resolution	Accuracy	Protection against overcharge
400.0Ω	0.1Ω	±(1.2%rdg + 4dgt)	250VDC/ACrms
4.000kΩ	0.001kΩ	±(1.0%rdg + 2dgt)	
40.00kΩ	0.01kΩ	±(1.2%rdg + 2dgt)	
400.0kΩ	0.1kΩ		
4.000MΩ	0.001MΩ		
40.00MΩ	0.01MΩ	±(2.0%rdg + 3dgt)	

Diode test

Function	Resolution	Accuracy	Max voltage with open circuit	Protection against overcharge
⊣▶⊢	1mV	±(10%rdg + 5dgt)	approx. 1.5VDC	250VDC/ACrms

Continuity test with buzzer

Function	Buzzer	Test current	Protection against overcharge
•)))	<30Ω	<0.3mA	250VDC/ACrms

Frequency (Autorange)

Range	Resolution	Accuracy	Higher	Protection against overcharge
5.000Hz	0.001Hz	±(1.5%rdg + 5dgt)	>8Vrms	250VDC/ACrms
50.00Hz	0.01Hz			
500.0Hz	0.1Hz	±(1.2%rdg + 3dgt)		
5.000kHz	1Hz			
50.00kHz	10Hz			
500.0kHz	100Hz			
5.000MHz	1kHz	±(1.5%rdg + 4dgt)		
10.00MHz	10kHz			

Note: in AC Voltage range, frequency range is: 10Hz ÷10kHz ; Sensitivity: > 15Vrms

Duty cycle (Autorange)

Range	Resolution	Accuracy	Sensitivity	Protection against overcharge
0.5 - 99%	0.1%	±(1.2%rdg + 2dgt)	>8Vrms	250VDC/ACrms

100µs< pulse duration <100ms; Frequency range: 5Hz ÷ 150kHz
Note: in AC Voltage range, frequency range is: 10Hz ÷10kHz ; Sensitivity: > 15Vrms

Capacitance (Autorange)

Range	Resolution	Accuracy	Protection against overcharge
40.00nF	0.01nF	±(5.0%rdg + 7dgt)	250VDC/ACrms
400.0nF	0.1nF	±(3.0%rdg + 5dgt)	
4.000µF	0.001µF		
40.00µF	0.01µF		
100.0µF	0.1µF	±(5.0%rdg + 5dgt)	

Temperature with K probe (Autorange)

Range	Resolution	Accuracy (*)	Protection against overcharge
-20°C ÷ 400°C	0.1°C	±(3.0%reading + 5°C)	250VDC/ACrms
400°C ÷ 760°C	1°C		
-4°F ÷ 752°F	0.1°F	±(3.0%reading + 9°F)	
752F ÷ 1400°F	1°F		

(*) Accuracy of the only instrument without probe

6.1.1. Reference standards

Safety:	IEC/EN61010-1
EMC:	IEC/EN61326-1
Insulation:	double insulation
Pollution level:	2
Overvoltage category:	CAT IV 600V
Max operating altitude:	2000m (6562ft)

6.1.2. General characteristics

Mechanical characteristics

Size (L x W x H):	175 x 85 x 55mm (7 x 3 x 2in)
Weight (battery included):	360g (13 ounces)

Power supply

Battery type:	1x 9V battery type NEDA 1604 IEC 6F22
Low battery indication:	symbol "+ III" on the display
Automatic power off:	after approx. 30 minutes' idling

Display

Characteristics:	4-digit LCD display with maximum reading 4000 dots plus decimal sign and point.

6.2. ENVIRONMENT

6.2.1. Environmental conditions for use

Reference temperature:	18°C ÷ 28°C (64°F ÷ 82°F)
Operating temperature:	0°C ÷ 50°C (32°F ÷ 122°F)
Allowable relative humidity:	<70%HR
Storage temperature:	-20°C ÷ 60°C (-4°F ÷ 140°F)
Storage humidity:	<80%HR

This instrument satisfies the requirements of Low Voltage Directive 2006/95/EC (LVD) and of EMC Directive 2004/108/EC
This instrument satisfies the requirements of European Directive 2011/65/EU (RoHS) and 2012/19/EU (WEEE).

6.3. ACCESSORIES

6.3.1. Standard accessories

- Pair of test leads
- Adapter + K-type wire probe
- Battery
- Carrying bag
- User manual

6.3.2. Optional accessories

• Pair of test leads	Code KIT4000A
• K-type probe for air and gas temperature (-40 ÷ 800 °C)	Code TK107
• K-type probe for semisolid substance temperature (-40 ÷ 800 °C)	Code TK108
• K-type probe for liquid substance temperature (-40 ÷ 800 °C)	Code TK109
• K-type probe for surface temperature (-40 ÷ 400 °C)	Code TK110
• K-type probe for surface temperature with 90° tip (-40÷400°C)	Code TK111

7. ASSISTANCE

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. ASSISTANCE

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.