


# ENGLISH


## User manual



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## 1. SAFETY PRECAUTIONS AND PROCEDURES

This meter is compliance with safety Standard IEC/EN61010-1 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
- 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



Double insulated instrument



AC Voltage



DC Voltage



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** measurements on installations of CAT III 600V
- This instrument can perform only AC sinusoidal voltage measurements
- You must comply with the usual safety regulations aimed at protecting you against the dangerous electric current and protecting the instrument against an incorrect operation
- 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 § 7.2.1
- Make sure that battery is 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

Read the recommendations which follow and the instructions in this manual:



### 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

IEC/EN61010-1 guideline: 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. § 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

The instrument performs, in completely Autorange, the below measurements:

- DC Voltage
- AC Voltage
- Resistance and Continuity test
- Capacitance
- Frequency
- Duty cycle
- Diode test

All selectable by means of a 5 position rotary selector (including OFF position). Also are available the **HOLD** key to hold the displayed value and enable/disable backlight feature, the **Hz%** key for manual selection of frequency and duty cycle measurements, the **REL** key for Relative measures and the **MODE** key for selection of different features which are common to the same position of rotary selector. 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 30 minutes after last selector rotation.

## 3. PREPARATION FOR USE

### 3.1. INITIAL CHECKS

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 § 7.3.1 are included. Should you have to return back the instrument for any reason please follow the instructions mentioned in § 8.

### 3.2. SUPPLY VOLTAGE

The instrument is supplied by 1x9V battery type IEC 1604 NEDA 6F22. When battery is low, a “+ III” low battery indication is displayed. To replace/insert battery please refer to § 6.2.

### 3.3. STORAGE

After a period of storage in extreme environmental conditions exceeding the limits mentioned in § 7.2.1 let the instrument resume normal measuring conditions before using it.

## 4. NOMENCLATURE

### 4.1. INSTRUMENT DESCRIPTION

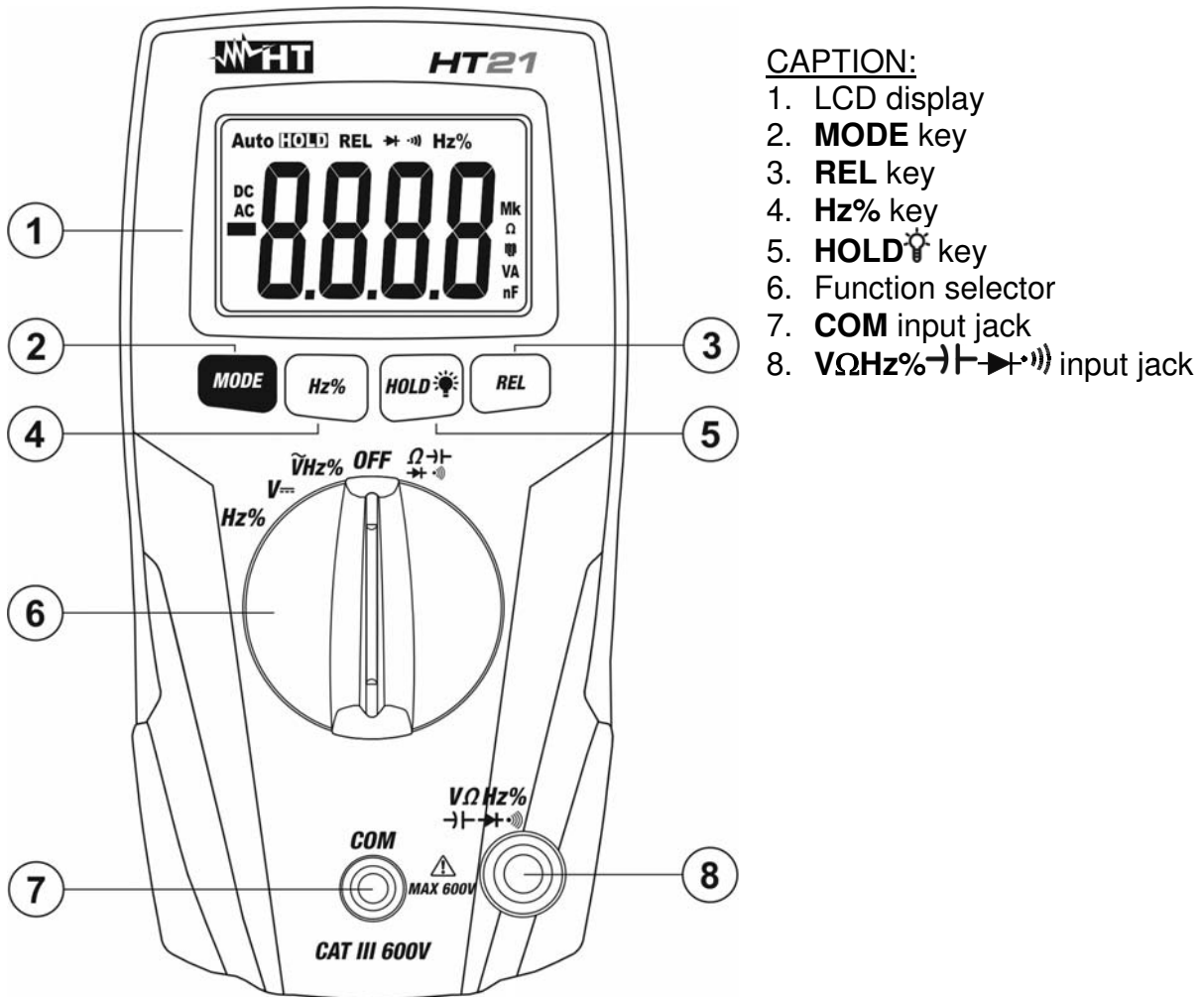




Fig. 1: Instrument description

## 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. By pressing the key at least 1 second the enable/disable of backlight feature can be performed. This feature is active for any position of rotary selector.

### 4.2.2. **Hz%** key

By pressing **Hz%** key the selection of frequency and duty cycle measurements on  $\tilde{V}_{Hz\%}$  and **Hz%** positions of selector is performed. The frequency range is different in this two positions.

### 4.2.3. **REL** key

By pressing **REL** the relative measure is activated. The meter sets the display to zero and saves the actual value as reference. The "REL" symbol is shown at display. This function is not active on Hz, Duty Cycle, Continuity Test, Diode Test measurements. Pressing again the key to exit from this function.

### 4.2.4. **MODE** key

By pressing **MODE** key the selection of a double measured functions which are present at display is performed. In particular this key is active only in  $\Omega \rightarrow \text{---} \rightarrow \text{---} \rightarrow \text{---}$  position to select among Diode Test, Continuity Test and Resistance measurements.

### 4.2.5. **Auto Power OFF**

The instrument automatically turns off 30 minutes after last pressure of keys or last selector rotation. To resume operation turn the selector on OFF and turn on the instrument again.

## 5. OPERATING INSTRUCTIONS

### 5.1. 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.

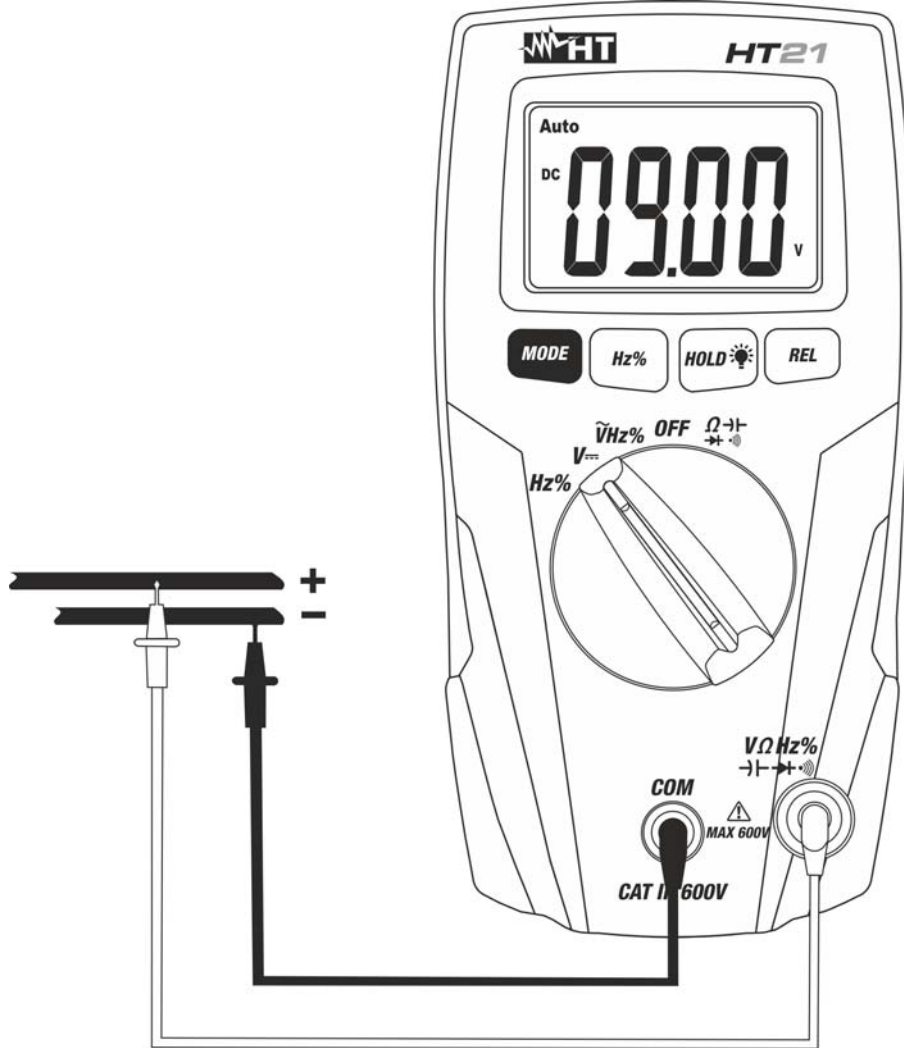


Fig. 2: Using the meter for DC Voltage measurement

1. Switch on **V<sub>DC</sub>**. "DC" symbol is displayed
2. Insert the test leads into the jacks, the red plug into **VΩHz%** jack and black plug into **COM** jack
3. Connect the red and black test leads to the positive and negative poles of the circuit under test respectively (see Fig. 2). The voltage value is displayed
4. If the message "**O.L**" is displayed the higher range is reached
5. The symbol "-" on the instrument display indicates that voltage has opposite direction with regard to the connection of Fig. 2
6. For HOLD function and Relative measurement please refer to § 4.2



## 5.2. 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. Switch on  $\tilde{V}Hz\%$ . "AC" symbol is displayed
2. Insert the test leads into the jacks, the red plug into  $V\Omega Hz\% \rightarrow \rightarrow \rightarrow$  jack and black plug into **COM** jack
3. Connect the test leads to the circuit under test (see Fig. 3). The voltage value is displayed
4. If the message "**O.L**" is displayed the higher range is reached
5. Pressing the **Hz%** key until the symbols "Hz" or "%" are shown at display to meaning the readings of frequency or duty cycle associated to voltage AC value
6. For HOLD function and Relative measurement please refer to § 4.2

### 5.3. RESISTANCE AND CONTINUITY TEST MEASUREMENTS



#### CAUTION

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

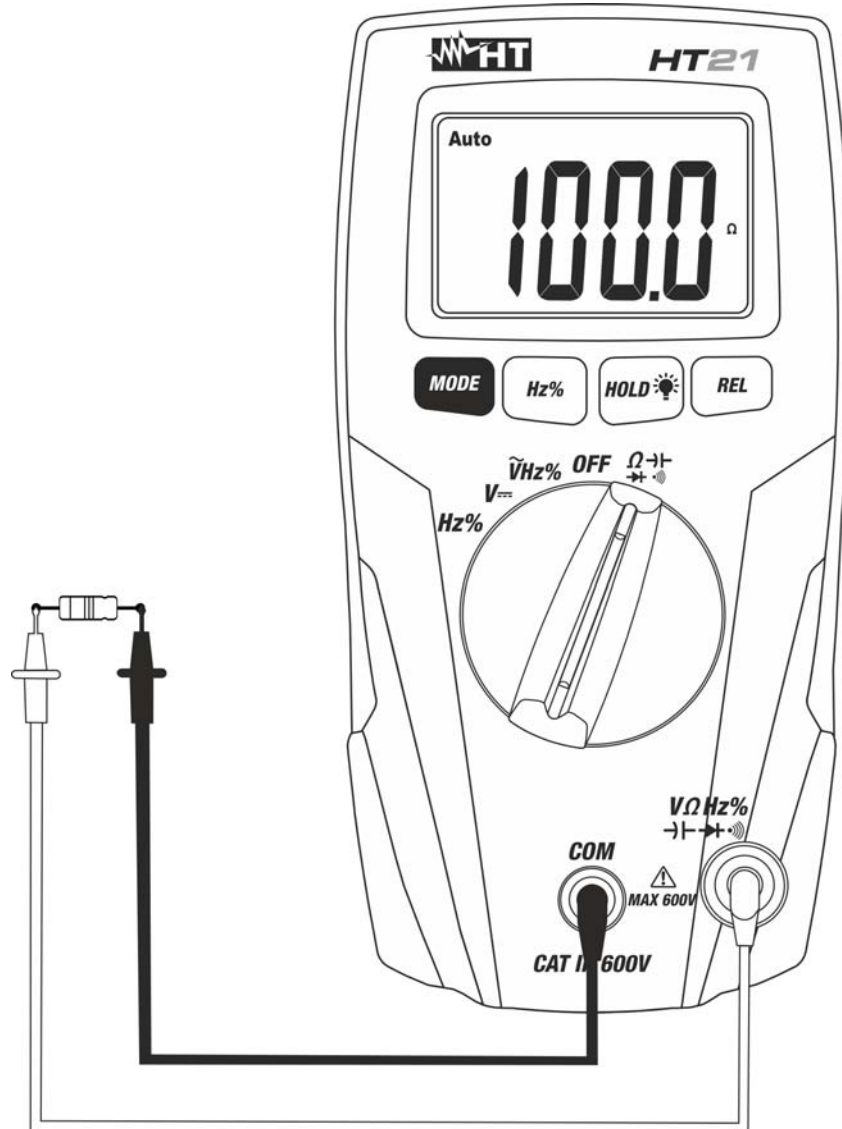


Fig. 4: Using the instrument for Resistance and Continuity test measurements

1. Switch on  $\Omega \rightarrow \rightarrow \rightarrow$ . "Ω" symbol is displayed
2. Insert the test leads into the jacks, the red plug into  $V\Omega Hz\% \rightarrow \rightarrow \rightarrow$  jack and black plug into **COM** jack
3. Connect the test leads to the circuit under test (see Fig. 4). The resistance value is displayed
4. If the message "O.L" is displayed the higher range is reached
5. Pressing the **MODE** key until the symbol  $\rightarrow \rightarrow \rightarrow$  is shown at display to meaning the Continuity test and connect the meter as resistance measurement. Buzzer emits sound if the measured resistance value is less about  $R < 35\Omega$
6. For HOLD function please refer to § 4.2

## 5.4. DIODE TEST



### CAUTION

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

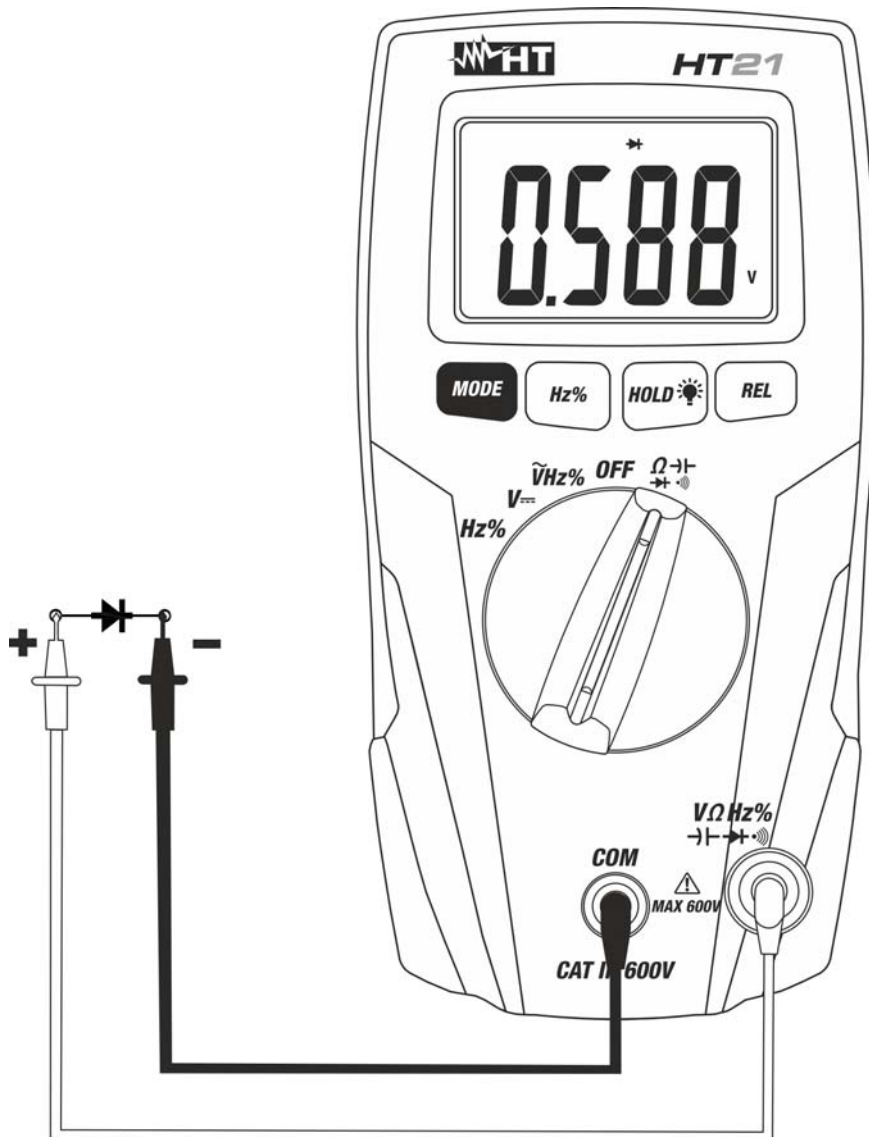


Fig. 5: Using the instrument for Diode test

1. Switch on  $\Omega \rightarrow | \rightarrow | )$
2. Pressing the **MODE** key until the symbol  $\rightarrow |$  is shown at display to meaning the diode test
3. Insert the test leads into the jacks, the red plug into  $V\Omega Hz \% \rightarrow | \rightarrow | )$  jack and black plug into **COM** jack
4. Connect the test leads to the diode under test observing the proper polarities indicated in Fig. 5. 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

## 5.5. FREQUENCY AND DUTY CYCLE MEASUREMENTS



### CAUTION

The maximum input for AC voltage is 250V. Do not attempt to measure higher voltages to avoid electrical shocks or damages to the instrument.

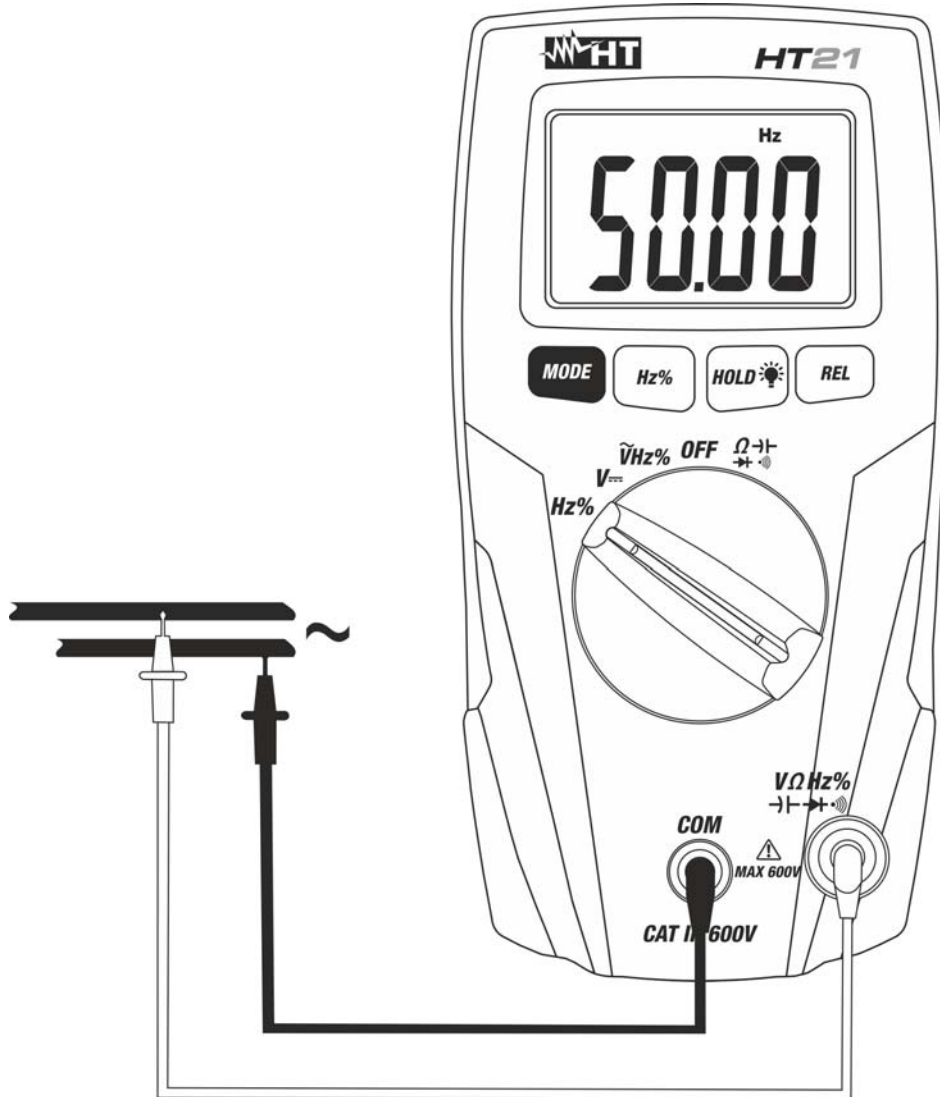


Fig. 6: Using the instrument for Frequency and Duty cycle measurements

1. Switch on **Hz%**. "Hz" symbol is displayed
2. Insert the test leads into the jacks, the red plug into **VΩHz%** jack and black plug into **COM** jack
3. Connect the test leads to the circuit under test (see Fig. 6). The frequency value, with kHz or MHz units, is displayed
4. If the message "**O.L**" is displayed the higher range is reached
5. Pressing the **Hz%** key until the "%" symbol is shown at display to meaning the Duty Cycle test and connect the meter as frequency measurement. The measured value is displayed
6. For HOLD function please refer to § 4.2

## 5.6. CAPACITANCE MEASUREMENT



### CAUTION

Before taking capacitance measurement in circuit remove power from the circuit being tested and discharge all capacitors. Connect the test capacitor to the inputs respecting the polarity connections when required.

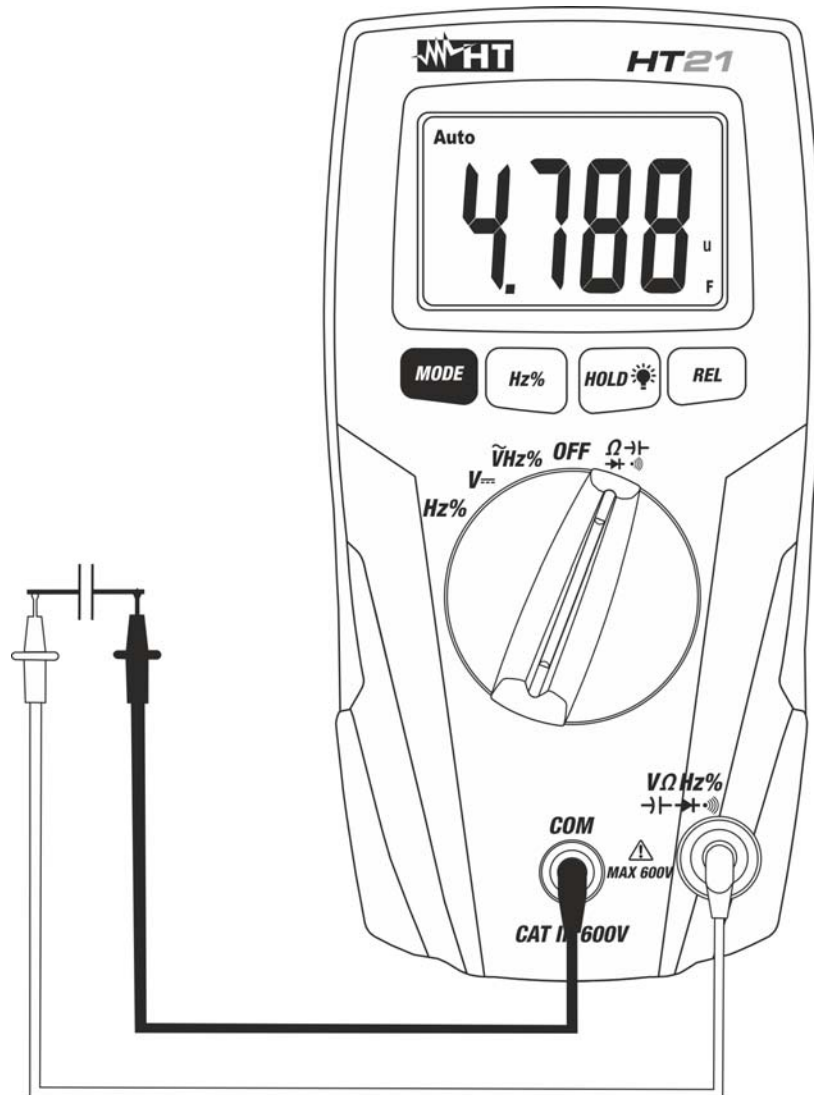


Fig. 7: Using the instrument for Capacitance measurement

1. Switch on  $\Omega \rightarrow \text{Hz} \rightarrow \text{kHz} \rightarrow \text{MHz}$
2. Pressing the **MODE** key until the "nF" symbol is shown at display to meaning the capacitance measurement
3. Insert the test leads into the jacks, the red plug into  $V\Omega\text{Hz}\% \rightarrow \text{kHz} \rightarrow \text{MHz}$  jack and black plug into **COM** jack
4. Press the **REL** key before start the measurement
5. Connect the red and black test clamps to the capacitor terminals respecting if necessary the proper polarities (see Fig. 7). The capacitance value is shown on display
6. If the message "O.L" is displayed the higher range is reached
7. For HOLD function and Relative measurement please refer to § 4.2

## 6. MAINTENANCE

### 6.1. GENERAL INFORMATION

- In order to go guarantee the performances of the instrument 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.

### 6.2. BATTERY REPLACEMENT

When the “+ III” low battery indication is displayed the battery is 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 § 7.1.2) observing the proper polarities
5. Replace the back case and screws
6. Use the appropriate battery disposal methods for your area

### 6.3. CLEANING

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

### 6.4. END OF LIFE



**CAUTION:** this symbol indicates that equipment, the battery and its accessories shall be subject to a separate collection and correct disposal.

## 7. TECHNICAL SPECIFICATIONS

### 7.1. TECHNICAL FEATURES

Accuracy calculated as  $\pm[\% \text{reading} + (\text{num. dgts} \times \text{resolution})]$  at  $18^{\circ}\text{C} \div 28^{\circ}\text{C}$ ,  $<70\% \text{RH}$

#### DC Voltage (Autorange)

Range	Resolution	Accuracy	Input impedance	Overload protection
4.000V	0.001V	$\pm(1.2\% \text{rdg} + 2 \text{dgt})$	7.8M $\Omega$	600VDC/ACrms
40.00V	0.01V			
400.0V	0.1V			
600V	1V	$\pm(1.5\% \text{rdg} + 2 \text{dgt})$		

#### AC Voltage (Autorange)


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

Frequency range: 50Hz  $\div$  400Hz


#### Resistance (Autorange)

Resistance (Auto-range)		Accuracy	Overload protection
Range	Resolution		250VDC/ACrms
400.0Ω	0.1Ω	±(1.2%rdg + 4dgt)	
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

Feature	Resolution	Accuracy	Max open voltage	Overload protection
	1mV	$\pm(10\% \text{rdg} + 5 \text{dgt})$	circa 1.5VDC	250VDC/ACrms

#### Continuity test

Feature	Buzzer	Test current	Overload protection
	<150 $\Omega$	<0.3mA	250VDC/ACrms

#### Frequency (Autorange)

Frequency (Auto range)		Accuracy	Sensitivity	Overload protection
Range	Resolution	±(1.5%rdg + 5dgt)	>8Vrms	250VDC/ACrms
5.000Hz	0.001Hz			
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			

#### Duty cycle (Autorange)

Range	Resolution	Accuracy	Sensibilità	Overload protection
0.5 - 99%	0.1%	$\pm(1.2\% \text{rdg} + 2 \text{dgt})$	>8Vrms	250VDC/ACrms

100 $\mu\text{s}$  < durata impulso <100ms; Frequency range: 5Hz  $\div$  150Hz



## Capacitance (Autorange)

Range	Resolution	Accuracy	Overload protection
40.00nF	0.01nF	$\pm(5.0\%rdg + 7dgt)$	250VDC/ACrms
400.0nF	0.1nF	$\pm(3.0\%rdg + 5dgt)$	
4.000 $\mu$ F	0.001 $\mu$ F		
40.00 $\mu$ F	0.01 $\mu$ F		
100.0 $\mu$ F	0.1 $\mu$ F	$\pm(5.0\%rdg + 5dgt)$	

### 7.1.1. Reference guidelines

Safety:	IEC/EN61010-1
EMC:	IEC/EN61326-1
Insulation:	double insulation
Pollution degree:	2
Overvoltage category:	CAT III 600V
Max height:	2000m (6562ft)

### 7.1.2. General data

#### Mechanical characteristics

Dimensions (L x W x H):	145 x 70 x 60mm (6 x 3 x 2in)
Weight (including battery):	245g (9ounces)
Mechanical protection:	IP40

#### Power supply

Battery type:	1x9V battery NEDA 1604 IEC 6F22
Battery life:	ca 30h (backlight ON), ca 130h (backlight OFF)
Low battery indication:	"+ III" symbol is displayed
Auto Power OFF:	After 30 minutes of idleness

#### Display

Specifications:	4 LCD, 4000 counts + symbol and decimal point
Sample rate:	2times/s

## 7.2. ENVIRONMENT

### 7.2.1. Environmental conditions

Reference temperature:	18°C ÷ 28°C (64°F ÷ 82°F)
Working temperature:	0°C ÷ 50°C (32°F ÷ 122°F)
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 2014/35/EU (LVD) and of EMC Directive 2014/30/EU**

**This instrument satisfies the requirements of European Directive 2011/65/EU (RoHS) and 2012/19/EU (WEEE)**

## 7.3. ACCESSORIES

### 7.3.1. Accessories provided

- Pair of test leads
- Battery
- Carrying bag
- User manual



## 8. SERVICE

### 8.1. 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
- Faults due to 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 the manufacturer's authorization.

**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.**

### 8.2. 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.