

ENGLISH

User manual



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1 SAFETY PRECAUTIONS AND PROCEDURES

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 the symbol  with the utmost attention.

Before and after carrying out the measurements, carefully observe the following instructions:

- Do not carry out any voltage or current 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, 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:



Caution: refer to the instruction manual. An incorrect use may damage the tester or its components.



High Voltage ranger: electrical shock risk.



This symbol indicates that the clamp can operate on live conductors



Double insulated instrument.



AC Voltage or Current.



DC Voltage or Current.

1.1 PRELIMINARY

- This apparatus has been designed for use in an environment of pollution degree 2. Indoor use
- It measures **CURRENT** and **VOLTAGE** on CAT IV 600V and CAT III 1000V refer to ground plants. For overvoltage categories please see § 1.4
- 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 or connect to any circuit whose voltage or current exceeds the specified overload protection.
- Make sure that the battery are installed correctly.



1.2 BEFORE USE

Always keep to the instructions contained in this manual.



CAUTION

Non compliance with the CAUTIONs and/or the instructions may damage the tester and/or its components or injure the operator.

- When the clamp is connected to the circuits to be tested, never touch unused terminals.
- When testing resistors, do not add voltage. Although there is a protection circuit, excessive voltage would cause malfunctioning.
- Before measuring current, remove the voltage-resistance test leads.
- When measuring current, any strong current near or close to the clamp jaw will affect the accuracy.
- When measuring current, always put the tested conductor in the middle of the clamp jaw in order to obtain a more accurate reading.
- If the reading value or the sign indication remains unchanged during the measurement, check if the HOLD function is active.

1.3 AFTER USE

- Once the measurements are completed, switch off the instrument with **⏻/HOLD** key
- If you expect not to use the clamp for a long time, remove the battery.

1.4 MEASURING (OVERVOLTAGE) CATEGORIES DEFINITIONS

The IEC/EN61010-1 guideline: Safety requirements for electrical equipment for measurement, control and laboratory use, Part 1: General requirements, defines what measuring category, usually called overvoltage category, is. On § 6.7.4: Measuring circuits, it says:

(OMISSIS)

The 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 carries out the following measurements:

- DC and AC voltage.
- Detection of AC voltage without contact (VoltSense)
- AC current
- Resistance and test continuity.
- Diode test

The instrument, depending on the measured parameter, automatically switches between these functions. Is there also a key which performs two features: the switch on/off of the instrument and the **HOLD** function (see § 4.2.1 for details). The selected quantity appears on a high-contrast LCD display with indication of measurement units and functions.

2.1 TRMS AND MEAN VALUE MEASURING INSTRUMENTS

Safety testers for alternate quantities are divided into two big families:

- MEAN VALUE instruments: instruments which measure only the value of the wave at the fundamental frequency (50 or 60 Hz).
- TRUE ROOT MEAN SQUARE instruments, also defined as TRMS: instruments which measure the true root mean square value of the quantity under test.

In presence of a perfectly sinusoidal wave, both families provide identical results. In presence of distorted waves, instead, the readings are different. Mean value instruments provide only the value of the fundamental wave while True RMS instruments provide the value of the entire wave, including harmonics (within the passband of the instrument). Accordingly, if the same quantity is measured with both kinds of instruments, the measured values are identical only if the wave is purely sinusoidal. Should it be distorted, True RMS instruments provide higher values than medium value instruments.

2.2 TRUE ROOT MEAN SQUARE VALUE AND CREST FACTOR DEFINITIONS

The current effective value is defined as follows: "In an interval of time equivalent to a period, an alternate current with effective value having an intensity of 1A, by passing on a resistor, disperses the same energy which would be dispersed in the same period of time by a direct current having an intensity of 1A". From this definition comes the numerical

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

The Crest Factor is defined as the ratio between the Peak Value of a signal and its effective value: $CF (G) = \frac{G_p}{G_{RMS}}$. This value varies according to the waveform of the signal,

for a purely sinusoidal wave it's worth $\sqrt{2} = 1.41$. In presence of distortions the Crest Factor assumes higher values as long as the wave distortion is higher.



3 PREPARATION FOR USE

3.1 INITIAL

The tester has been checked from a mechanical and electrical point of view before shipment.

Every care has been taken to make sure that the instrument reaches you in perfect conditions. However, it's advisable to make a rapid check in order to detect eventual damages which may have occurred in transit. Should this be the case, enter immediately the usual claims with the carrier.

Make sure that all the accessories listed in § 6.3.1 are contained in the package. In case of discrepancies contact the dealer.

In case of returning of the tester please keep to the instructions given in § 7.

3.2 POWER SUPPLY

The instrument is supplied with two 1.5V AAA LR03 batteries, included in the package.

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

3.3 CALIBRATION

The tester complies with the technical features listed in this manual. Its performances are guaranteed for one year.

3.4 STORAGE

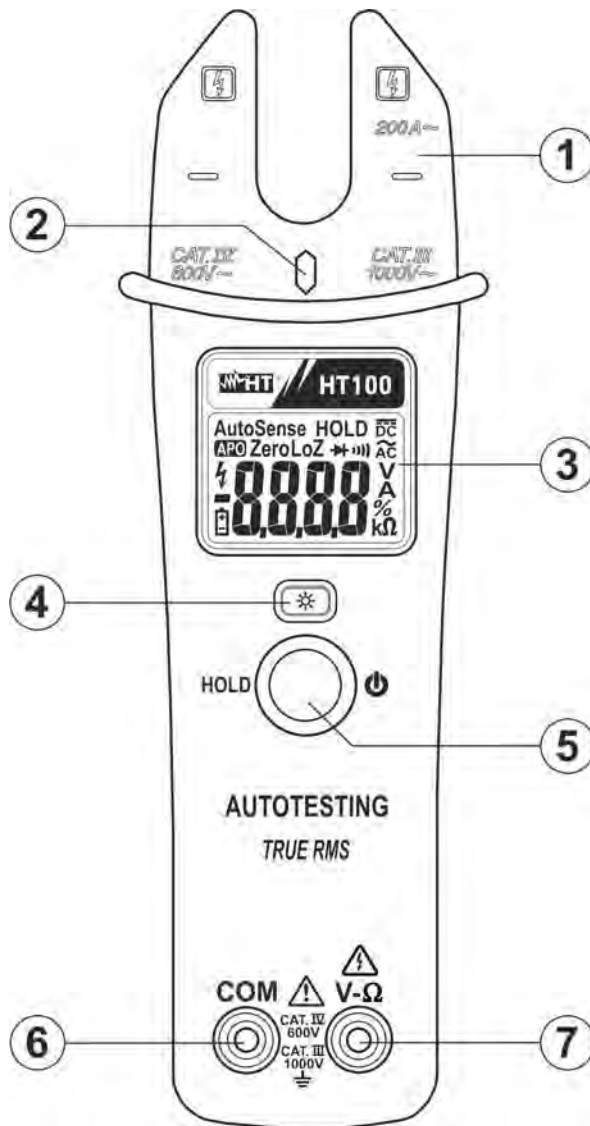
In order to guarantee the accuracy of the measurements, after a period of storage in extreme environmental condition, wait for the necessary time so that the tester returns to normal measuring conditions (see § 6.2.1).



4 OPERATING INSTRUCTIONS

4.1 INSTRUMENT DESCRIPTION

4.1.1 Commands description



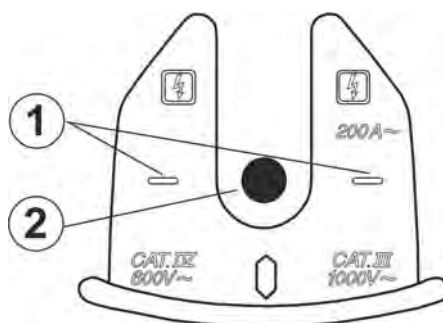
CAPTION:

1. "Open" clamp jaw
2. LED for AC voltage detection
3. LCD display
4. ☀ key
5. ⏻/HOLD key
6. Input terminal **COM**
7. Input terminal **V-Ω**

Fig. 1: Instrument description

4.1.2 Alignment marks

Put the conductor within the jaws on intersection of the indicated marks as much as possible (see Fig. 2) in order to meet the meter accuracy specifications



CAPTION

1. Alignment marks
2. Conductor

Fig. 2: Alignment marks

4.2 DESCRIPTION OF FUNCTION KEYS

4.2.1 /HOLD key

The multifunction /HOLD key allows the herefollowed operations:

- A simply pressure allows to switch on the instrument. After switch on, a quick autotest relative to the battery level charging is performed. For a percentage value <10% replace the batteries (see § 5.2)
- With instrument switched on, the key allows to activate/deactivate the **HOLD** feature in way to fix the result of the measured value at display. The “HOLD” symbol is shown. This feature is not active without any input signals
- Pressing and hold (more than 3s) this key to switch off the instrument

CAUTION



- After switch on the instrument is set in OHM mode and the **kΩ** and **·Ω** symbols are displayed
- The instrument changes to **VAC/VDC** measurement with the herewith voltage values on inputs:
1.3 ÷ 1000VAC or 2.2 ÷ 1000VDC, -0.7 ÷ -1000VDC
- The instrument changes to **Ω** measurement with the herewith voltage values on inputs:
VAC < 1.0V, -0.5V ≤ VDC < 2mV
- The instrument change to **A AC** with the herewith current values:
1.5 < A < 200A

CAUTION:

The function priority is the above stated one (VAC/DC, Ω then AAC) consequently to measure current is **NECESSARY** to disconnect both test leads from the instrument

4.2.2 Backlight key

Press the  key for the backlight activation/deactivation. This light could help the operator reading the display while he's measuring in dark sites.

4.2.3 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 with the /HOLD key
- Switch on the instrument by press and hold the /HOLD key for at least 3s until note three times the “APO” symbol flashing at display. The “APO” symbol then is not more shown at display
- Switch off and on the instrument to automatically enable the feature



4.3 PERFORMING MEASUREMENTS

4.3.1 DC/AC Voltage measurement



CAUTION

- Maximum input is 1000VDC or 1000VACrms. Do not take any voltage measurement exceeding this limit in order not to risk electrical shock or damaging the instrument
- Do not use the instrument to measure voltages in circuits that could be damaged by instrument's low input impedance (approx. 6kΩ)

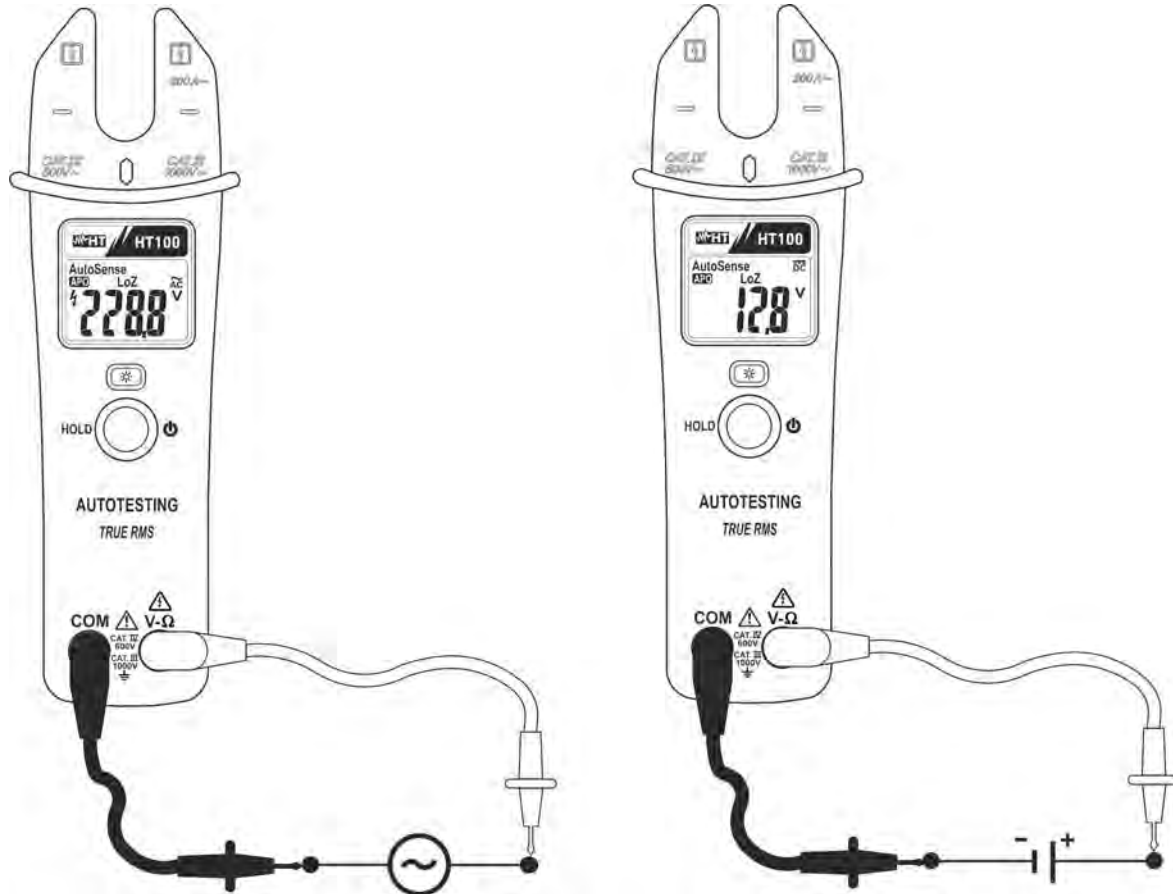


Fig. 3: Taking AC and DC voltage measurement

1. Insert the red test lead plug into **V-Ω** jack and the black test lead plug into **COM** jack
2. Connect the two long ends of test leads to the desired circuit (see Fig. 3) then reading will be displayed. The instrument selects automatically AC or DC notation depending on input voltage type



CAUTION

For Phase to Ground voltage measurement after a RCD device, to avoid unexpected trips-out, preliminarily connect the test leads between Phase and Neutral cables at least 5s, then perform the Phase to Ground measurement

3. “OL” message is shown at display if the voltage under test is over the maximum value that the instrument is able to measure.
4. The “-” symbol at display means that the DC voltage have an opposite sign respect the connection of Fig. 3
5. For HOLD function please refer to § 4.2.1

4.3.2 Use of Voltsense feature

CAUTION



Maximum input is 1000VACrms. Do not take any voltage measurement exceeding this limit in order not to risk electrical shock or damaging the instrument

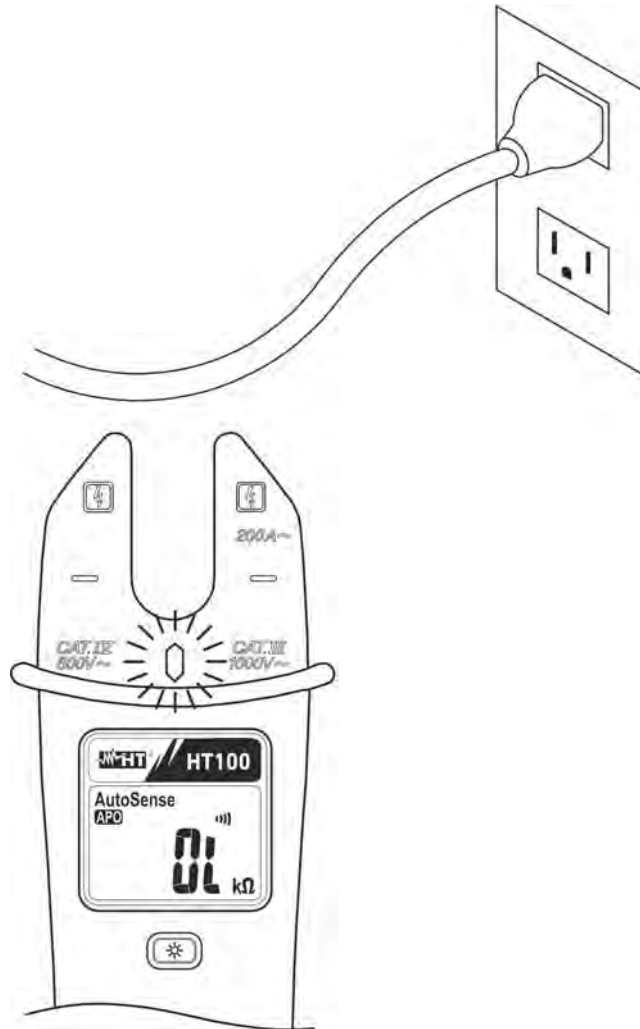


Fig. 4: Taking AC voltage detection check

1. Switch on the instrument with the **⏻/HOLD** key
2. Move the instrument close to point of the test (see Fig. 4)
3. The red LED switch on in fixed mode If an AC voltage is detected

4.3.3 Resistance measurement



CAUTION

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

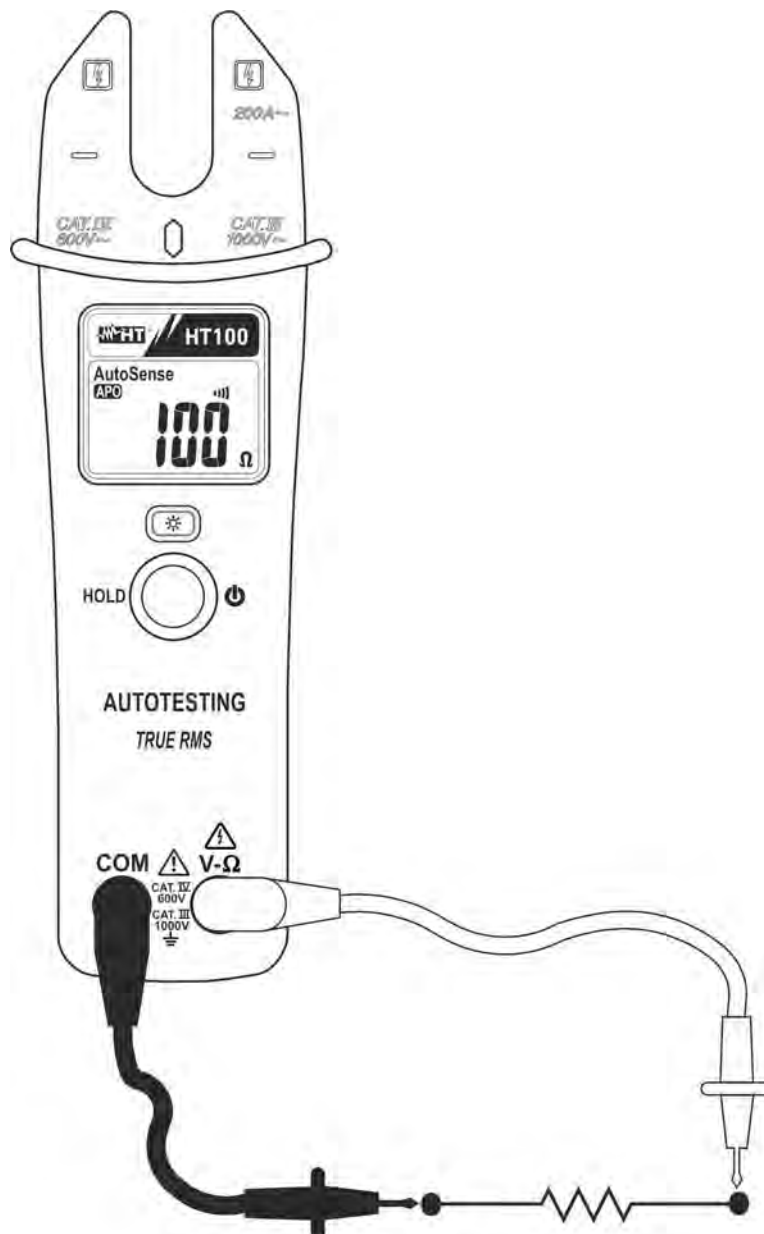


Fig. 5: Taking resistance measurement

1. Insert the red test lead plug into **V-Ω** jack and the black test lead plug into **COM** jack
2. Connect the two long ends of test leads to the desired circuit (see Fig. 5) then reading value of resistance will be displayed
3. When “**OL**” symbol is displayed, the resistance under test is over the maximum value that the instrument is able to measure
4. For HOLD function please refer to § 4.2.1

4.3.4 Continuity test and Diode test



CAUTION

Before taking any in circuit resistance measurement or diode test, remove power from the circuit to be tested and discharge all the capacitors.

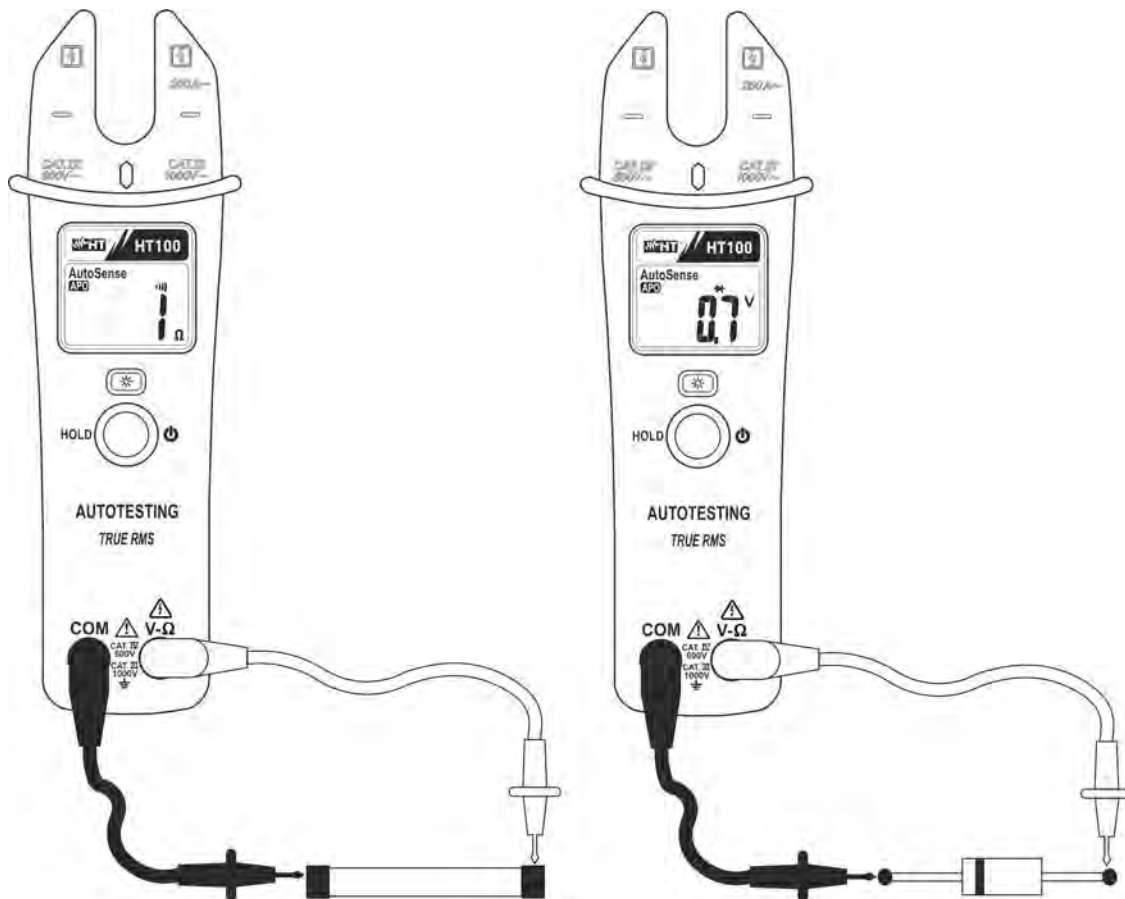


Fig. 6: Taking continuity test and diode test

Continuity test

1. Insert the red test lead plug into **V-Ω** jack and the black test lead plug into **COM** jack and perform continuity test on the object on test (see Fig. 6 – left side). The “•••” is shown at display. Buzzer emits sound if the measured resistance value is less about 25Ω

Diode test

2. Insert the red test lead plug into **V-Ω** jack and the black test lead plug into **COM** jack
3. Connect the red test leads to the anode of diode on test and the black test lead on the cathode ones (see Fig. 6 – right side). The “→|” symbol is shown at display. The correspondent threshold voltage of P-N junction is showed on display
4. Values on the display between 0.4V and 0.7V (direct) and “OL” (reverse) indicate correct connection while “OL” in both directions indicated an interrupted device

4.3.5 AC Current measurement



CAUTION

Make sure that all the test leads are disconnected from the meter terminals for current measurement.

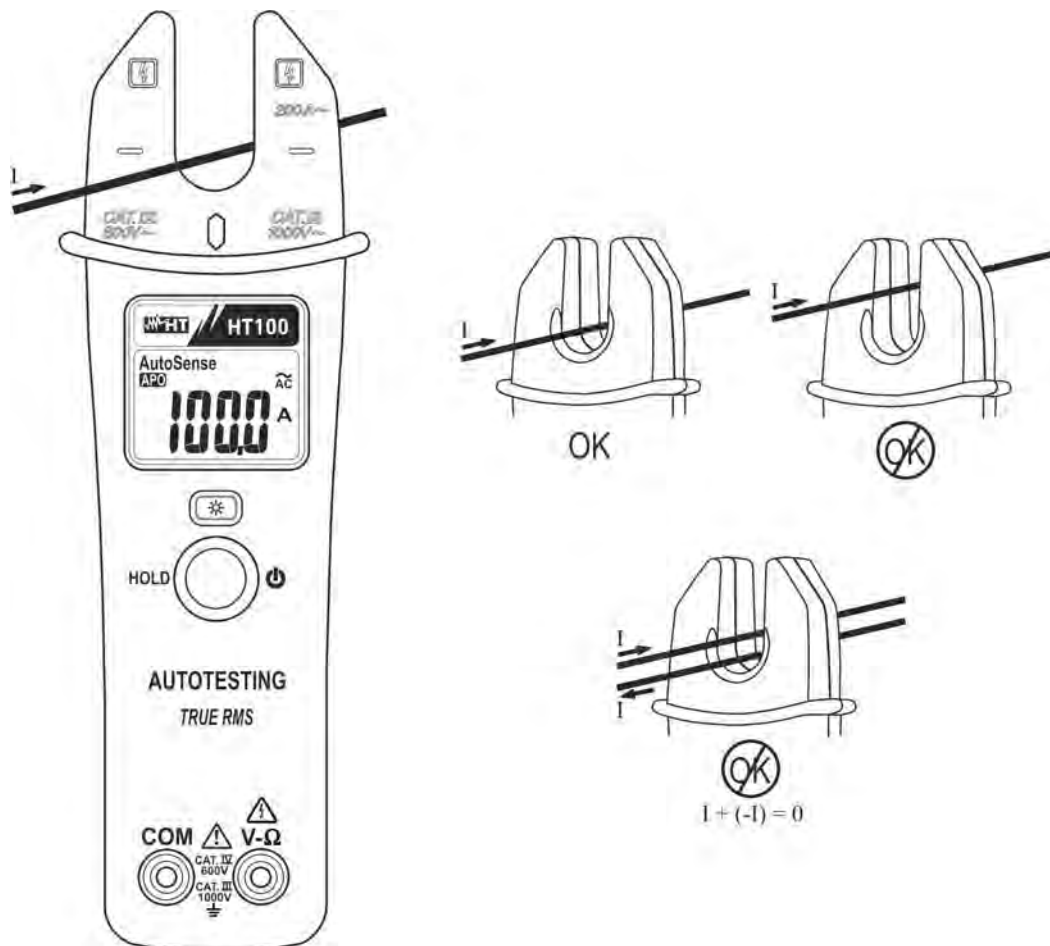


Fig. 7: Taking AC current measurement

1. Put the conductor to be tested inside to the “open” clamp jaw (see Fig. 7) considering the alignment marks (see § 4.1.2). The current value is shown at display.
2. “OL” message is shown at display the current under test is over the maximum value that the instrument is able to measure
3. For HOLD function please refer to § 4.2.1



CAUTION

As the clamp has internal filter it could happen that the meter takes few seconds to reach 0 value on the display. This is not a defect, indeed the user can proceed with a test as the temporary displayed value will not be added to the measured value.

5 MAINTENANCE

5.1 GENERAL INFORMATIONS

1. This is a precision instrument. Whether in use or in storage, please do not exceed the specification requirements to avoid possible damages or dangers.
2. Do not place this meter at high temperatures or humidity or expose it to direct sunlight.
3. Be sure to turn off the meter after use. If you expect not to use the tester for a long time, remove the battery in order to avoid leakages of battery liquid that would damage the internal parts.

5.2 REPLACING THE BATTERIES

When “” appears on the display, replace the batteries.



CAUTION

Only expert and trained technicians must perform this operation. Remove the test leads or the conductor under test before replacing the batteries

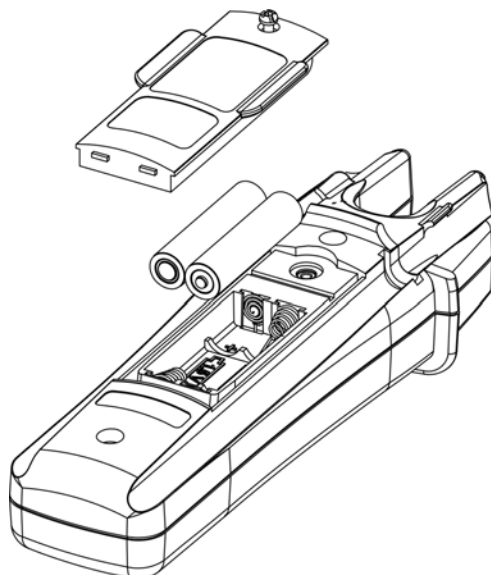


Fig. 8: Taking AC current measurement

1. Switch off the instrument with the /HOLD key
2. Remove the test leads or the objects to be tested
3. Remove the screw from the battery cover, and detach the battery covers from the bottom cover (see § Fig. 8)
4. Remove the batteries
5. Replace batteries with a same type new one (see § 6.1.2)
6. Replace the battery cover and screw
7. Do not scatter old batteries into the environment. Use the relevant containers for battery disposal

5.3 CLEANING

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

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 CHARACTERISTICS

Accuracy indicated as $\pm [\% \text{ rdg} + (\text{num dgt} \times \text{resolution})]$ at $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$, $< 80\% \text{HR}$

AC TRMS Voltage (Autorange)

Range	Resolution	Accuracy (*)	Bandwidth	Input impedance	Overload protection
1.3V ÷ 1000.0V	0.1V	$\pm(0.9\% \text{rdg} + 3 \text{dgt})$ (50Hz ÷ 60Hz) $\pm(1.5\% \text{rdg} + 3 \text{dgt})$ (61Hz ÷ 500Hz)	50Hz ÷ 500Hz	$> 6 \text{k}\Omega$ ca. 420k Ω (@1000V)	1000VDC/ACrms

"Voltsense" function: measurement range 80V ÷ 1000V AC, 50 ÷ 60Hz

(*) Accuracy referred to sinusoidal waveform. For not sinusoidal waveforms consider as follows::

- Add 3.0%rdg for $1.0 \leq \text{CF} < 2.0$
- Add 5.0%rdg for $2.0 \leq \text{CF} < 2.5$
- Add 3.0%rdg for $2.5 \leq \text{CF} < 3.0$

CF = Crest factor

DC Voltage (Autorange)

Range	Resolution	Accuracy	Input impedance	Overload protection
2.2V ÷ 1000.0V	0.1V	$\pm(0.3\% \text{rdg} + 2 \text{dgt})$	$> 6 \text{k}\Omega$ ca. 420k Ω (@1000V)	1000VDC/ACrms
-0.7V ÷ -1000.0V				

AC TRMS Current (Autorange)

Range	Resolution	Accuracy (*)	Bandwidth	Overload protection
1.5 ÷ 200.0A	0.1A	$\pm(3.0\% \text{rdg} + 5 \text{dgt})$	50 ÷ 60Hz	200Arms

Influence of adjacent conductors: $< 0.08 \text{A/A}$

(*) Accuracy referred to sinusoidal waveform. For not sinusoidal waveforms consider as follows::

- Add 3.0%rdg for $1.0 \leq \text{CF} < 2.0$
- Add 5.0%rdg for $2.0 \leq \text{CF} < 2.5$
- Add 3.0%rdg for $2.5 \leq \text{CF} < 3.0$

CF = Crest factor

Resistance and Continuity test

Range	Resolution	Accuracy	Buzzer	Overload protection
0 ÷ 9999 Ω	1 Ω	$\pm(0.9\% \text{rdg} + 2 \text{dgt})$	$\leq 25 \Omega$	1000VDC/ACrms

Max open circuit voltage: 1.6V

Diode test

Range	Resolution	Accuracy	Overload protection
0.4 ÷ 0.8V	0.1V	$\pm(1.0\% \text{rdg} + 3 \text{dgt})$	1000VDC/ACrms



6.1.1 Reference guidelines

Safety:	IEC/EN61010-1, IEC/EN61010-2-032/-2-033
Insulation:	double insulation
Pollution degree:	2
Max height of use:	2000m (6562ft)
Measurement category:	CAT IV 600V, CAT III 1000V to ground

6.1.2 General data

Mechanical specifications

Dimensions (L x W x H):	193 x 54 x 31mm (8 x 2 x 1in)
Weight (including batteries):	280g (10 ounces)
Max conductor size:	16mm (1in)

Power supply

Battery type:	2x1.5V alkaline batteries type AAA LR03
Low battery indication:	"  " is displayed
Battery life:	approx 300 hours
Auto Power OFF	after 20min of idleness (disabled)

Display

Characteristics:	4 LCD, 9999 counts plus sign, decimal point and backlight
Sample rate:	2 times/sec
Conversion mode:	TRMS

6.2 ENVIRONMENTAL CONDITIONS

6.2.1 Climatic conditions

Reference temperature:	23 ± 5°C (73 ± 41°F)
Operating temperature:	0 ÷ 30°C (32 ÷ 86°F) (≤80%RH) 30 ÷ 40°C (86 ÷ 104°F) (≤75%RH) 40 ÷ 50°C (104 ÷ 122°F) (≤45%RH)
Storage temperature:	-20 ÷ 60°C (-4 ÷ 140°F)
Storage humidity:	<80%RH
Temperature coefficient:	0.2 x specified accuracy /°C, <18°C, >28°C

6.3 ACCESSORIES

6.3.1 Standard accessories

- Test leads
- Carrying bag
- Batteries
- User manual

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



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 following unsuitable use of the equipment or by combining the latter with incompatible equipment.
- Repairs resulting from a not correct shipping.
- Repairs resulting from servicing carried out by a person not approved by the company.
- Modifications to the equipment without explicit authorization from our technical department.
- Adaptation to a particular application not provided for by the definition of the equipment or by the instruction manual.

The contents of this manual cannot be reproduced in any form without our authorization.

Our products are patented. Our logotypes are registered. We reserve the right to modify characteristics and prices further to technological developments.

7.2 SERVICE

Shouldn't the instrument work properly, before contacting your distributor make sure that battery is 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.

