

# ENGLISH


## User manual



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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 any 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 § 7.1.1 and 7.2.1.
- 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.

- When the instrument is connected to the circuit being measured, do not touch any unused terminal.
- 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 measurements are completed, switch off the instrument by pressing the **ON/OFF** key.
- 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

The instrument carries out the following measurements in full Autorange:

- DC voltage
- AC TRMS voltage
- Detection of AC voltage without contact
- Resistance and Continuity test

According to the quantity present at the input, the instrument automatically switches between voltage and resistance measurement. The instrument is also provided with the following function keys: **AutoHold**/ to enable freezing the measured value on the display and to activate the white light torch, **ON/OFF** and a central **V/Ω**/ to manually select resistance measurement and continuity test. The selected quantity appears on the LCD display with the indication of the measuring unit and of the enabled functions. The instrument is provided with a display backlight function which automatically deactivates after approximately 2 minutes' idling. The instrument is also equipped with an Auto Power OFF device which automatically switches it off approx. 15 minutes after the last time the instrument was used.

### 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.

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; TRMS 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 § 7.3.1. In case of discrepancy, please contact the Dealer. In case the instrument should be returned, please follow the instructions given in § 8.

#### 3.2. INSTRUMENT POWER SUPPLY

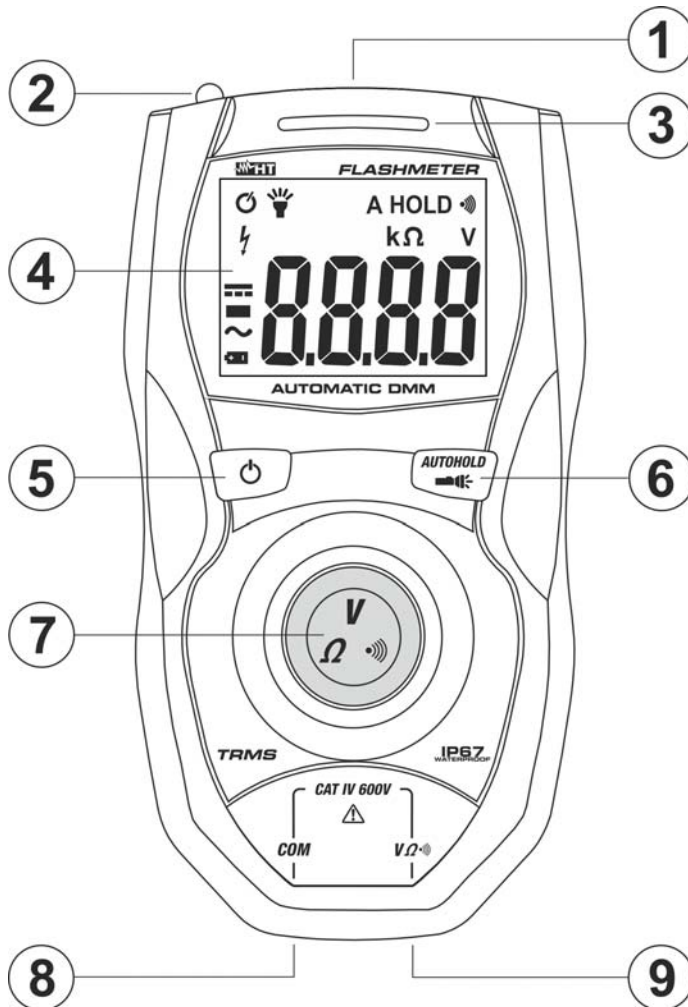
The instrument is supplied with 2x1.5V alkaline batteries type AAA IEC LR03, included in the package. When the battery is flat, the symbol “” appears on the display. To replace/insert the batteries, see § 6.2.

#### 3.3. 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 § 7.2.1).

## 4. NOMENCLATURE

### 4.1. DESCRIPTION OF THE INSTRUMENT

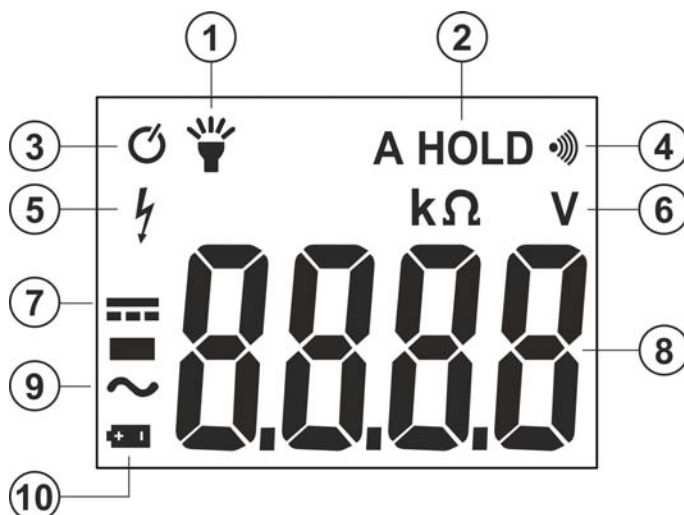


**CAPTION:**

1. White-light torch
2. NCV sensor
3. Detector of AC voltage without contact
4. LCD display
5. **ON/OFF** key
6. **AutoHold** key
7. **V/Ω** key
8. Input terminal **COM**
9. Input terminal **V/Ω**

Fig. 1: Description of the instrument

### 4.2. DESCRIPTION OF THE SYMBOLS SHOWN ON THE DISPLAY



**CAPTION:**

1. Activated white-light torch
2. Active **A HOLD** function
3. Auto Power Off (APO)
4. Activation of continuity test
5. Presence of high voltage
6. Measuring unit
7. DC voltage
8. LCD display
9. AC voltage
10. Low battery symbol

Fig. 2: Description of the symbols shown on the display

### 4.3. DESCRIPTION OF FUNCTION KEYS

#### 4.3.1. ON/OFF key (⏻)

Pressing the ⏻ key allows turning on the instrument. Press and hold the ⏻ key for approx. 1s to turn off the instrument.

#### 4.3.2. AutoHold/🔦 key

Pressing the **AutoHold/🔦** key allows activating/deactivating the built-in white-light torch (see Fig. 1 – part 1) and the symbol “🔦” appears on the display. Press and hold the **AutoHold/🔦** key for approx. 1s to activate/deactivate the **Auto HOLD** function. The symbol “A HOLD” appears on the display and the buzzer beeps twice in a short time. With activated Auto HOLD function, the instrument automatically freezes the measured value on the display when the input signal is steady (3 samplings with a maximum difference of 10% between the highest and the lowest value). The instrument automatically quits the function after approx. 30s seconds.

#### 4.3.3. V/Ω/🔊 key

#### CAUTION



- The instrument switches on in **Ω mode**.
- The instrument **automatically** switches to VAC or VDC if the following voltages are detected:  

VAC > ca. 1.5V ; VDC > ca. 1.0V
- The instrument **automatically** switches to Ω mode with the following measured voltages:  

VAC and VDC < ca. 0.6V
- Press the **V/Ω/🔊** key to manually select resistance measurement and continuity test.

#### 4.3.4. Detection of AC voltage without contact

The instrument allows detecting the presence of AC voltage without contact by using the NCV sensor found on the upper part (see Fig. 1 – part 2).

1. Switch on the instrument by pressing the **ON/OFF** key.
2. Bring the NCV sensor closer to the potential AC source.
3. If the red detector turns on (see Fig. 1 – part 3), AC voltage is present.

#### 4.3.5. Auto-Power-Off function

In order to preserve internal batteries, the instrument switches off automatically approximately 15 minutes after it was last used. The symbol “🔌” identifies the Auto power off function, which cannot be deactivated.



## 5. OPERATING INSTRUCTIONS

### 5.1.1. 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. 3: Use of the instrument for DC voltage measurement

1. Switch on the instrument by pressing the **ON/OFF** key. The measuring mode  $\Omega$  is automatically selected and the indication “**OL.**” appears on the display.
2. Insert the red cable into input terminal **V/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. 3). The instrument automatically switches to DC voltage measurement for **value > ca. 1.0V**. 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. 3.
6. To use the AutoHOLD function, see § 4.3.2

### 5.1.2. 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. 4: Use of the instrument for AC voltage measurement

1. Switch on the instrument by pressing the **ON/OFF** key. The measuring mode  $\Omega$  is automatically selected and the indication “**OL.**” appears on the display.
2. Insert the red cable into input terminal **V/Ω/ symbol** 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 instrument automatically switches to AC voltage measurement for **value > ca. 1.5V**. 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. To use the AutoHOLD function and the NCV sensor, see § 4.3.2 and § 4.3.4

### 5.1.3. 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.

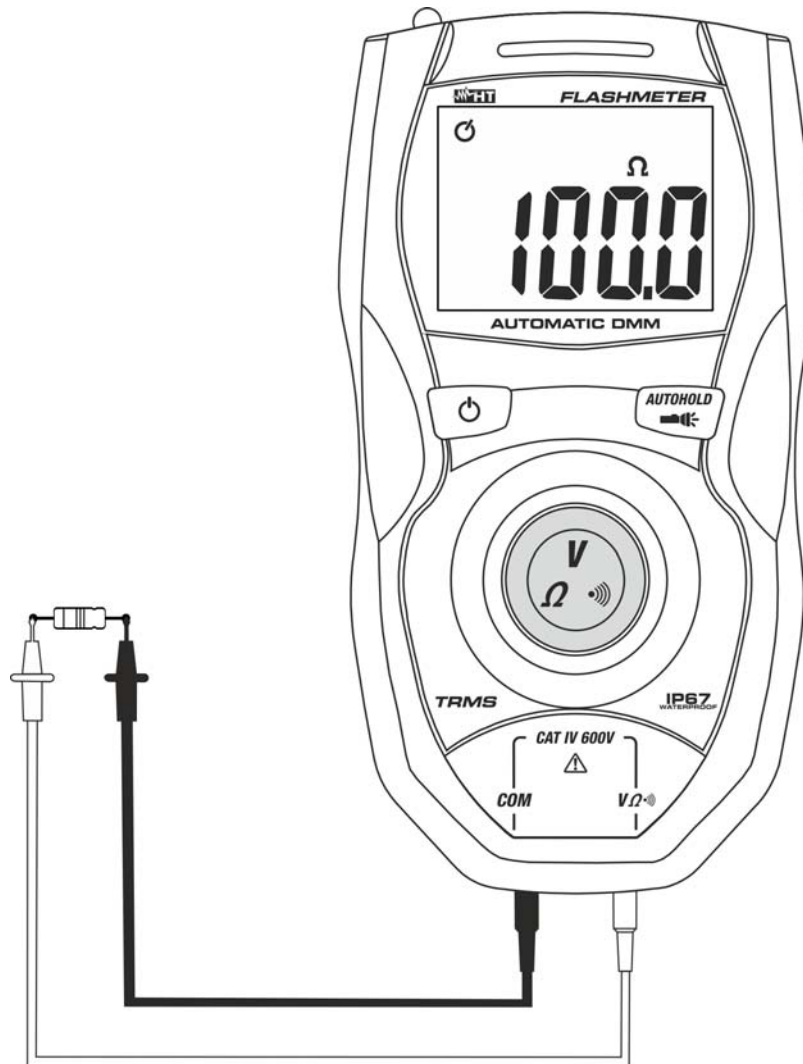


Fig. 5: Use of the instrument for Resistance measurement

1. Switch on the instrument by pressing the **ON/OFF** key. The measuring mode  $\Omega$  is automatically selected and the indication “**OL.**” appears on the display.
2. Insert the red cable into input terminal **V/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. 5). The display shows the value of resistance.
4. The message “**O.L.**” indicates that the value of resistance exceeds the maximum measurable value.
5. To use the AutoHOLD function, see § 4.3.2

#### 5.1.4. 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.

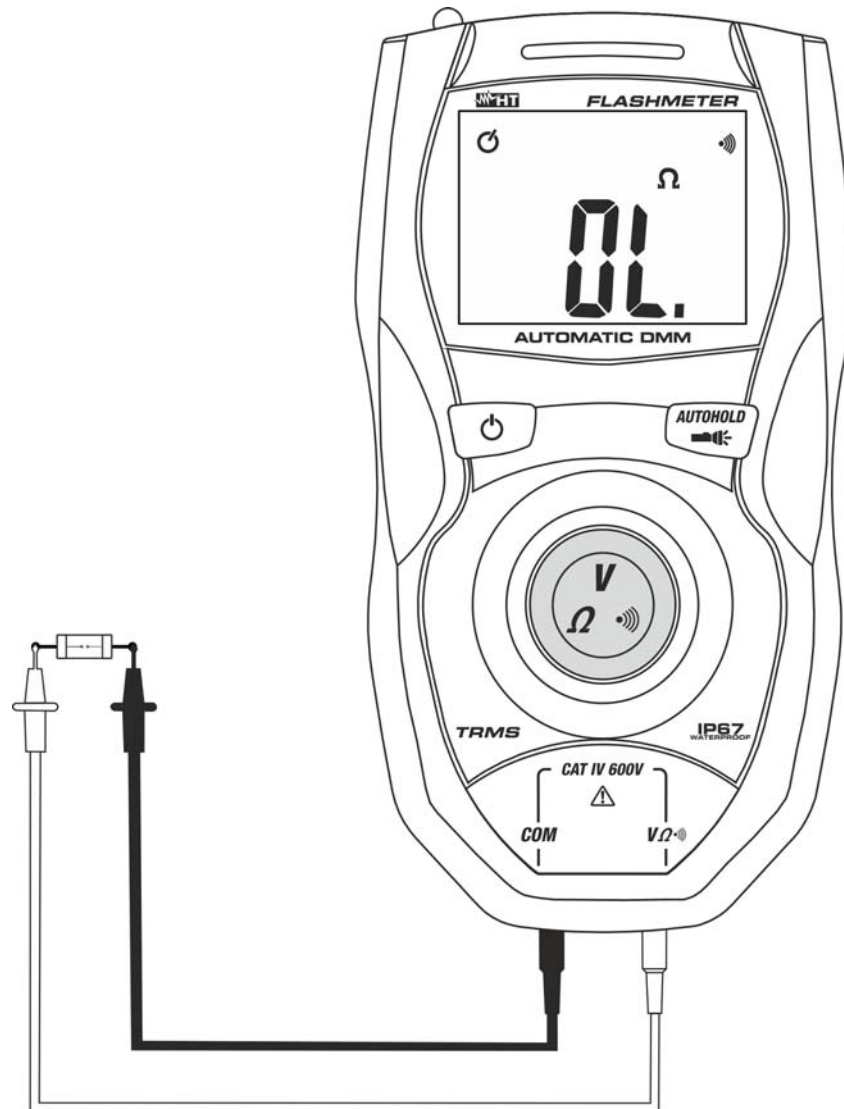


Fig. 6: Use of the instrument for Continuity test

1. Switch on the instrument by pressing the **ON/OFF** key. The measuring mode  $\Omega$  is automatically selected and the indication “**OL.**” appears on the display.
2. Press the **V/Ω/Ω** key until the symbol “ $\Omega$ ” appears on the display.
3. Insert the red cable into input terminal **V/Ω/Ω** and the black cable into input terminal **COM**.
4. Position the test leads in the circuit to be measured (see Fig. 6). The continuity buzzer activates for  $R < 40\Omega$
5. To use the AutoHOLD function, see § 4.3.2

## 6. MAINTENANCE

### 6.1. 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.

### 6.2. REPLACING THE BATTERY

When the LCD display shows symbol “+ I”, batteries must be replaced.



#### 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. Switch off the instrument by pressing the **ON/OFF** key.
2. Loosen the battery compartment cover fastening screw and remove the cover.
3. Remove the batteries and insert the same number of new batteries of the same type (see § 7.1.2), respecting the indicated polarity.
4. Restore the battery compartment cover and fasten the relevant screw.
5. Do not scatter old batteries into the environment. Use the relevant containers for disposal.

### 6.3. CLEANING THE INSTRUMENT

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

### 6.4. 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.

## 7. TECHNICAL SPECIFICATIONS

### 7.1. TECHNICAL CHARACTERISTICS

Accuracy calculated as  $\pm[\% \text{reading} + (\text{num. digits} \cdot \text{resol})]$  referred to  $18^{\circ}\text{C} \div 28^{\circ}\text{C}, < 70\% \text{HR}$ .

#### DC voltage (Autorange)

Range	Resolution	Accuracy	Input impedance	Protection against overcharge
400.0V	0.1V	$\pm(1.0\% \text{rdg} + 5 \text{digits})$	>10M $\Omega$	600VDC/ACrms
600.0V				

#### AC TRMS voltage (Autorange)

Range	Resolution	Accuracy (*) (40Hz $\div$ 1kHz)	Input impedance	Protection against overcharge
400.0V	0.1V	$\pm(1.0\% \text{rdg} + 5 \text{digits})$	>9M $\Omega$	600VDC/ACrms
600.0V				

(\*) Accuracy specified from 5% to 100% of the measuring range.

#### Resistance (Autorange)

Range	Resolution	Accuracy	Protection against overcharge
40.0 $\Omega$	0.1 $\Omega$	$\pm(2.0\% \text{rdg} + 18 \text{digits})$	600VDC/ACrms
400.0 $\Omega$		$\pm(2.0\% \text{rdg} + 10 \text{digits})$	
4.000k $\Omega$	0.001k $\Omega$		
40.00k $\Omega$	0.01k $\Omega$		
400.0k $\Omega$	0.1k $\Omega$		

#### Continuity test with buzzer

Function	Buzzer	Test current	Protection against overcharge
•))	<40 $\Omega$	<0.3mA	600VDC/ACrms

### 7.1.1. 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)

### 7.1.2. General characteristics

#### Mechanical characteristics

Size (L x W x H):	140 x 75 x 40mm (6 x 3 x 2in)
Weight (battery included):	220g (8 ounces)

#### Power supply

Battery type:	2x 1.5V batteries type AAA IEC LR03
Low battery indication:	symbol "⊕" on the display
Battery life:	approx. 80h (backlight ON), approx. 400h (backlight OFF)
Auto power off:	after approx. 15 minutes' idling

#### Display

Characteristics:	4-digit LCD, 4000 dots, decimal sign and point with backlight
Out-of-range indication:	"OL." symbol on the display
Sampling frequency:	3times/s
Conversion:	TRMS

## 7.2. ENVIRONMENT

### 7.2.1. 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:	<75%HR
Storage temperature:	-20°C ÷ 60°C (-4°F ÷ 140°F)
Storage humidity:	<80%HR
Mechanical protection:	IP67
Falling test:	2m (7ft)

**This instrument satisfies the requirements of Low Voltage Directive 2014/35/EU (LVD) and of EMC Directive 2014/35/EU**

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

## 7.3. ACCESSORIES

### 7.3.1. Standard accessories

- Pair of leads with 2/4mm tip
- Batteries
- Carrying case
- User manual

## 8. ASSISTANCE

### 8.1. 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.**

### 8.2. ASSISTANCE

If the instrument does not operate properly, before contacting the After-sales Service, please check the conditions of batteries 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.