ENGLISH

User’s manual

Release EN 1.02 - 23/02/2012

Content:

1. SAFETY PRECAUTIONS AND PROCEDURES

This instrument complies with EN 61010-1 concerning 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 - make sure that humidity is within the limits indicated in section “environmental conditions”.
- avoid doing that in presence of explosive gas, combustible gas, steam or excessive dust.
- do not touch exposed metal (conductive) parts such as test lead ends, sockets, fixing objects, circuits etc.
- avoid doing that if you notice anomalous conditions such as breakages, deformations, fractures, foreign substances, blind display etc.
- avoid measuring higher voltages than 20V as you may risk electrical shocks.

The following symbols are used:


Caution: refer to the instruction manual; an improper use may damage the instrument or its components


Danger high voltage: risk of electrical shocks


Double insulated meter


AC voltage


DC voltage


DC/AC voltage

1.1. PRELIMINARY

- This instrument has been designed for use in environments of pollution degree 2.
- It can be used for **VOLTAGE** measurements on installations of CATIV 600V.
- 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 chapter 6.2.1.
- Make sure that batteries are 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

CAUTION

An improper use may damage the instrument and/or its components or injure the operator.

- Before 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 circuits never touch an unused terminal.
- When measuring resistors do not add any voltage. Although there is a protection circuit, excessive voltage would still cause malfunctioning.
- If values remain unchanged on the display during measurement check if HOLD function is on.

1.3. AFTER USE

- Once measurements are completed turn off the instrument.
- If you expect not to use the instrument for a long period remove batteries.

1.4. OVERVOLTAGE CATEGORIES - DEFINITIONS

EN 61010-1 (Safety requirements for electrical equipment for measurement, control and laboratory use, Part 1: General requirements) defines what a measurement category (usually called “overvoltage category”) is. At paragraph 6.7.4: Measuring circuits it says:

(OMISSIS)

Circuits are divided into the following measurement categories:

- **Measurement category IV** is for measurements performed at the source of low voltage installations.

  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 the following measurements:

- DC and AC TRMS voltage
- AC voltage with 1 test lead
- Frequenza
- Frequency with 1 test lead
- Phase sequence test
- Phase conformity test
- Resistance
- Continuity test

selectable by means of a 5-position rotary selector. Three function keys are also available. The selected measurement is displayed with indication of active functions. In order to save batteries the instrument automatically switches off 15 minutes after last pressure on keys or last selector rotation. To resume operation turn the rotary selector on OFF position and switch it on again.

2.1. TRMS VALUE AND MEAN VALUE - DEFINITIONS

Safety testers for alternate quantities are divided into two categories:

- MEAN VALUE instruments: instruments measuring only the value of the wave at the fundamental frequency (50 or 60Hz)
- True Root Mean Square (TRMS) instruments: instruments measuring the true root mean square value of the quantity under test.

In presence of a perfectly sinusoidal wave, both categories provide identical results. But in presence of distorted waves, readings are different. Mean value instruments provide only the value of the fundamental wave while TRMS 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 instruments, the measured values are identical only if the wave is purely sinusoidal. Should it be distorted, TRMS instruments provide higher values than mean 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 we get 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 higher the wave distortion is, the higher the crest factor values get.

3. PREPARATION TO USE

3.1. INITIAL

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).
Make sure that all standard accessories mentioned in paragraph 6.3.1 are included.
Should you have to return back the instrument for any reason please follow the instructions mentioned in paragraph 7.

3.2. SUPPLY VOLTAGE

The instrument is powered by batteries (refer to paragraph 6.1.3 for details on model, no. and battery life). When batteries are low, a low battery indication is displayed.
To replace/insert batteries follow the instructions indicated in paragraph 5.2.

3.3. CALIBRATION

The instrument complies with the technical specifications contained in this manual and such compliance is guaranteed for 1 year. Afterwards the instrument may need recalibration.

3.4. STORAGE

After a period of storage in extreme environmental conditions exceeding the limits mentioned in paragraph 6.2.1 let the instrument return to normal measuring conditions before using it.

4. OPERATING INSTRUCTIONS

4.1. INSTRUMENT - DESCRIPTION

4.1.1. Front panel

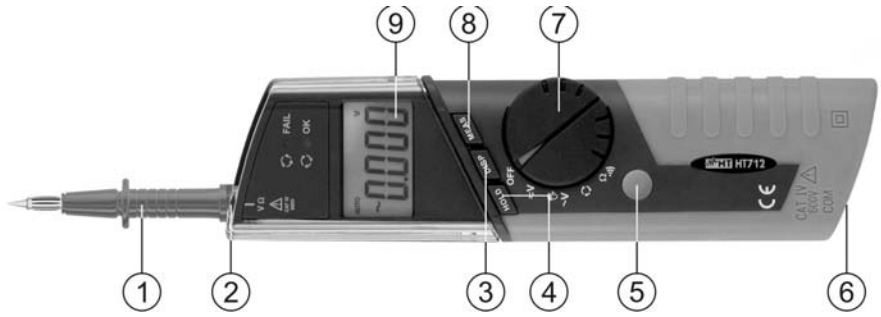

Fig. 1: Instrument description

LEGEND:

1. Test probe (accessory)
2. V+/Ω input terminal
3. DISP key
4. HOLD key
5. Metallic pad
6. COM input terminal
7. Rotary selector
8. MEAS key
9. LCD

4.2. FUNCTION KEYS

Once pressed, the relevant symbol appears on the display and the buzzer beeps. Every time the selector is rotated all functions activated by means of the function keys are cancelled.

Fig. 2: Function keys

4.2.1. HOLD

The data HOLD function key holds the displayed value. Press "HOLD" to activate or deactivate. When the data HOLD function is active the symbol "H" is displayed.

4.2.2. DISP

Press "DISP" key to display voltage and frequency values during AC voltage measurements.

4.2.3. MEAS

Press "MEAS" key to clear the display after phase sequence and phase conformity measurements, and prepare the instrument for further operations.

4.3. SPECIAL FUNCTIONS

4.3.1. Turning on

When the instrument is turned on, all display segments and the LEDs are lit for just one second. Then the instrument is ready for operation.

4.3.2. Auto power off

The instrument automatically turns off 5 minutes after last pressure of keys or last selector rotation. To resume operation turn the selector on OFF and turn on the instrument again.

4.4. MEASUREMENTS - DESCRIPTION

4.4.1. DC voltage measurement

CAUTION

The maximum input for DC voltage is 600V. Don't try to measure higher voltages to avoid risks of electrical shocks or serious damages to the instrument.

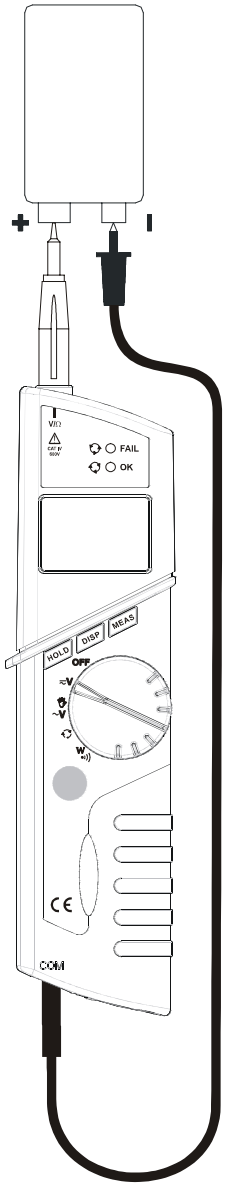

Fig. 3: DC voltage measurement

1. Turn the selector on ≂V.
2. Insert the black test lead in the **COM** jack and the red probe in the V+/Ω jack (Fig. 3).
3. Connect the red probe and the black test lead respectively to the positive and negative poles of the circuit under test; the voltage value will be displayed (automatic range detection).
4. Should you get the message "**O.L**" it means that the detected voltage exceeds the limits which the instrument can measure. In this case stop the measurement by disconnecting the test leads from the circuit under test to avoid risks for yourself and for the instrument.
5. Should you get a symbol "**-**" it means that the detected voltage has an opposite direction compared to the connection shown in Fig. 3.
6. If you want to activate the HOLD function refer to chapter 4.2.

4.4.2. AC voltage and frequency measurement with 2 test leads

CAUTION

The maximum input for AC voltage is 600V. Don't try to measure higher voltages to avoid risks of electrical shocks or serious damages to the instrument.

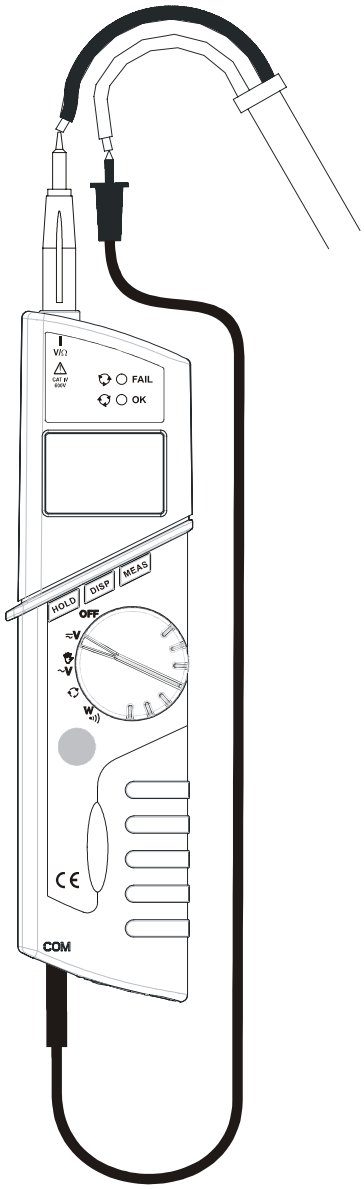

Fig. 4: AC voltage and frequency measurement with 2 test leads

1. Turn the selector on ≂V.
2. Insert the black test lead in the **COM** jack and the red probe in the V+/Ω jack (Fig. 4).
3. Connect the red probe and the black test lead to the poles of the circuit under test; the voltage value will be displayed (automatic range detection).
4. By pressing the "DISP" function key you can display the frequency value instead of the voltage one and vice-versa.
5. Should you get the message "OL" it means that the detected voltage exceeds the limits which the instrument can measure. In this case stop the measurement by disconnecting the test leads from the circuit under test to avoid risks for yourself and for the instrument.
6. If you want to activate the HOLD function refer to chapter 4.2.

4.4.3. AC voltage and frequency measurement with 1 test leads

CAUTION

The maximum input for AC voltage is 600V. Don't try to measure higher voltages to avoid risks of electrical shocks or serious damages to the instrument.

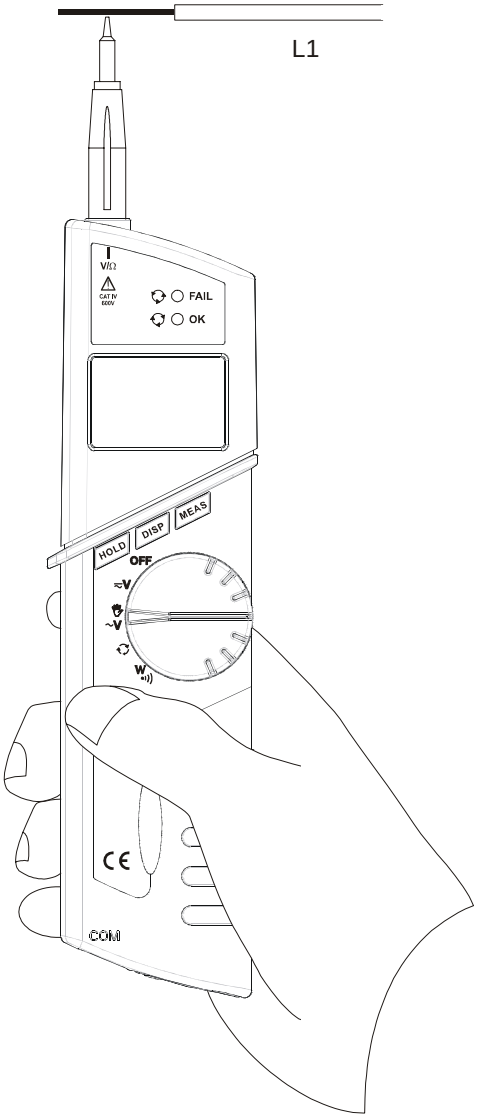

Fig. 5: AC voltage and frequency measurement with 1 test lead

1. Turn the selector on ~V.
2. Insert the red probe in the V+/Ω jack (Fig. 5).
3. Keep the instrument gripped correctly by touching the metallic pad with a finger.
4. Connect the red probe to the desired position of the circuit under test; the voltage value of that point to earth will be displayed (automatic range detection).
5. By pressing the "DISP" function key you can display the frequency value instead of the voltage one and vice-versa.
6. Should you get the message "O.L" it means that the detected voltage exceeds the limits which the instrument can measure. In this case stop the measurement by disconnecting the test leads from the circuit under test to avoid risks for yourself and for the instrument.
7. If you want to activate the HOLD function refer to chapter 4.2.

CAUTION

The instrument detects and displays the AC voltage value between the measuring point and the potential where the operator is located. Such value is typically the earth potential, but in some cases it may differ from it. **DO NOT TOUCH THE PHASE CABLE IF YOU ARE NOT SURE WHETHER VOLTAGE IS PRESENT OR NOT**.

4.4.4. Phase sequence test and phase conformity test

CAUTION

The maximum input for AC voltage is 600V. Don't try to measure higher voltages to avoid risks of electrical shocks or serious damages to the instrument.

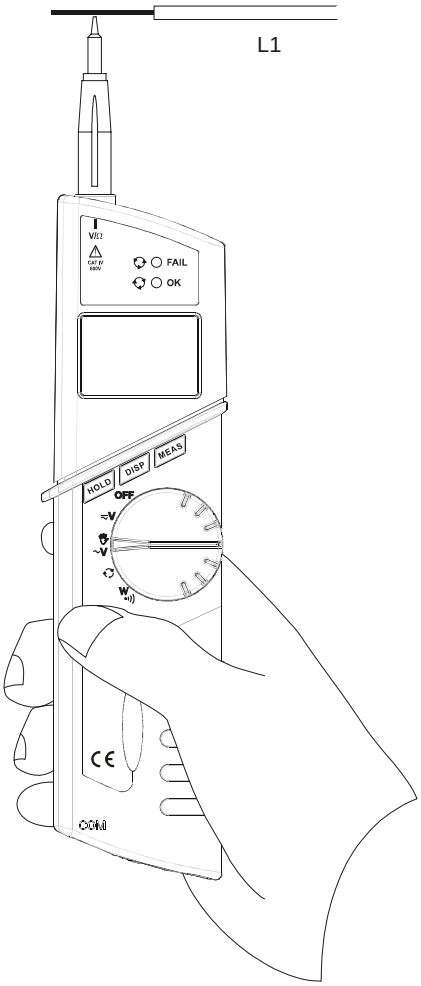

Fig. 6: Phase sequence test and phase conformity test

1. Turn the selector on ↻.
2. Keep the instrument gripped correctly (Fig. 6) by touching the metallic pad with a finger.
3. The symbol "**L1**" appearing on the display means that the instrument is ready to perform the first measurement.

CAUTION

During this measurement:

- the instrument must always be gripped by the operator.
- owing to the instrument's sensitivity, the test probe must not get in touch with (or simply must not be close to) any voltage source that can affect or abort the measurement.

For the phase rotation test:

4. Connect the built in probe to the L1 phase cable or simply lean it to the insulated cable under test.

For the phase concordance test:

4. Connect the built in probe to the L1 phase cable of the first three phase system or simply lean it to the insulated cable under test.

5. When an input voltage higher than 100V is detected, the buzzer beeps and the message "**PH**" is displayed. In this case do not press any key and keep the test probe connected to the L1 phase cable.

CAUTION

If the input voltage value is lower than 100V the instrument doesn't show "**PH**" and it's not possible to perform the phase sequence measurement.

6. After about one second the symbol "**MEAS**" appears on the display indicating that the instrument is performing the first measurement.
7. Once finishing the first measurement (which the operator performs without doing anything) the green LED blinks and the buzzer emits an intermittent sound.

8. Disconnect the test probe to the L1 phase cable (at this point the "**PH**" disappears). The symbol "**L2**" means that the instrument is waiting for the second phase to be measured.

For the phase rotation test:

9. Connect the test probe to the L2 phase cable or simply lean it to the insulated cable under test.

For the phase concordance test:

9. Connect the test probe to the L1 phase cable of the second three phase system or simply lean it to the insulated cable under test.

10. When an input voltage higher than 100V is detected, the buzzer beeps and the message "**PH**" is displayed. In this case do not press any key and keep the test probe connected to the phase cable.
11. After about one second the symbol "**MEAS**" appears on the display indicating that the instrument is performing the second measurement.

CAUTION

Be quick. If you wait more than 10 seconds between the first and the second measurement the instrument displays the message "**SEC**" and it's necessary to repeat all measurements again. In this case press the "MEAS" function key and restart from step 1.

12. The test result is displayed. If the phases to which the probe is connected
    - belong to the same phase, the instrument displays "**1.1.-.**", and lights the green LED
    - follow the correct sequence, the instrument displays "**1.2.3.**" and lights the green LED
    - follow the incorrect sequence, the instrument displays "**2.1.3.**" and lights the red LED
13. To perform a new test press "MEAS" and restart from point 1.

CAUTION

- The detected voltage is NOT the phase to neutral voltage, but the voltage between the conductor and the operator who is holding the instrument. This value can be lower than the phase to neutral voltage. **DO NOT TOUCH THE PHASE CABLE IF YOU ARE NOT SURE WHETHER VOLTAGE IS PRESENT OR NOT**.
- If the operator is insulated from the ground (e.g. insulated floors, shoes with rubber soles etc.) the instrument may not measure correctly.
- We recommend to repeat the test at least twice to make sure that the detected value is correct.

4.4.5. Resistance measurement and continuity test

CAUTION

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

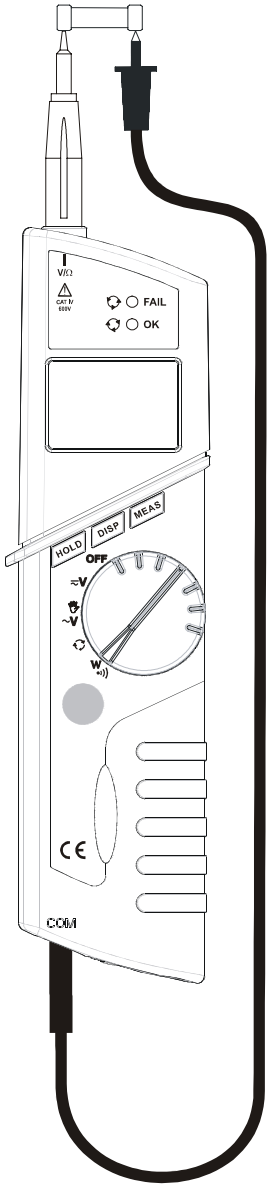

Fig. 7: Resistance measurement and continuity test

1. Turn the selector on Ω ·))).
2. Insert the black test lead in the **COM** jack and the red probe in the V+/Ω jack (Fig. 7).
3. Connect the test lead to the circuit under test; the resistance value will be displayed (automatic range detection).
4. Should you get the message "**0.L**" it means that the detected voltage exceeds the limits which the instrument can measure. In this case stop the measurement by disconnecting the test leads from the circuit under test to avoid risks for yourself and for the instrument.
5. If the buzzer beeps during continuity tests it means that the resistance value is lower than 40Ω.
6. If you want to activate the HOLD function refer to chapter 4.2.

5. MAINTENANCE

5.1. GENERAL INFORMATION

This is a precision instrument. To guarantee its performances be sure to use it or 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.

5.2. BATTERY REPLACEMENT

The low battery indication (refer to paragraph 6.1.3) is displayed the batteries are to be replaced.

CAUTION

Only skilled technicians can open the instrument and replace batteries. Before removing batteries disconnect the test leads from any energized circuits to avoid electrical shocks.

1. Turn off the instrument.
2. Disconnect the test leads from the input terminal.
3. Take off the battery cover by unscrewing it. – Make a light pressure on the cover screws and unscrew them one third counterclockwise. Remove the battery cover.
4. Remove all batteries from the battery holder.
5. Insert two new batteries of the same type (refer to paragraph 6.1.3) respecting the polarity signs.
6. Reposition the battery cover, make a slight pressure on the cover screws and screw them one third clockwise. The cover is properly fixed when the two points present on the mobile cover correspond to the two points present on the fixed part of the battery holder.
7. Do not throw flat batteries in the environment after use.

Opening Closing

Fig. 8: Opening and closing of battery cover

5.3. CLEANING

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

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 FEATURES

The accuracy is indicated as [% of reading + number of digits]. It is referred to the following environmental conditions: temperature 23°C ± 5°C, relative humidity < 70%.

DC voltage measurement

Range	Resolution	Accuracy	Input impedance	Protection against overloads
1.5 ÷ 600.0V	0.1V	±(0.8%rdg+1dgt)	10MΩ	DC/AC 660V rms

AC voltage measurement with 2 test leads

Range	Resolution	Accuracy (40.0 ÷ 69.9Hz)	Input impedance	Protection against overloads
1.5 ÷ 600.0V	0.1V	±(1.5%rdg+5dgt)	10MΩ	DC/AC 660V rms

Crest factor max: 2

Frequency measurement with 2 test leads

Range	Resolution	Accuracy	Protection against overloads
40.0 ÷ 69.9Hz	0.1Hz	±(0.5%rdg+1dgt)	DC/AC 660V rms

Minimum detectable input voltage: 1.6V
Crest factor max: 2

AC voltage measurement with 1 test lead (*)

Range	Resolution	Accuracy	Input impedance
50 ÷ 600V	10V	±(20%rdg+2dgt)	1MΩ

Minimum detectable input frequency: 40.0 ÷ 69.9Hz
Crest factor max: 2
(*) On standard conditions: instrument correctly gripped, standard shoes, standard floor, etc.

Frequency measurement with 1 test lead (*)

Range	Resolution	Accuracy	Input impedance
40.0 ÷ 69.9Hz	0.1Hz	±(1.0%rdg+2dgt)	1MΩ

Minimum detectable input voltage: 50V
Crest factor max: 2
(*) On standard conditions: instrument correctly gripped, standard shoes, standard floor, etc.

Phase sequence test and phase conformity test (*)

Range	Input impedance	Protection against overloads
100 ÷ 600V	1MΩ	600V AC RMS

Crest factor max: 2
(*) On standard conditions: instrument correctly gripped, standard shoes, standard floor, etc.

Resistance measurement

Range	Resolution	Accuracy	Max open voltage	Protection against overloads
0 ÷ 1499Ω	1Ω	±(1.0%rdg+5dgt)	About 0.4V_{DC}	DC/AC 600V rms one minute

Continuity test

Range	Buzzer	Max open voltage	Protection against overloads
·))	< 100Ω	About 1.5V_{DC}	DC/AC 600V rms

6.1.1. Electrical

Conversion	TRMS
Display refreshing rate	3 times per second

6.1.2. Safety

The instrument complies with	EN 61010-1
Insulation	Class 2, Double insulation
Pollution degree	2
Overvoltage category	CAT IV 600 V
For inside use, max height	2000m; 6561ft

6.1.3. General data

Mechanical characteristics

Dimensions	250(L) x 51(W) x 30(H)mm; 9.4 x 2.0 x 1.2in
Weight (including batteries)	approximate 150g; 5.3ounces

Power supply

Battery type	2 batteries 1.5V AAA MN2400 LR03 AM4
Indication of low batteries	"  " is displayed when batteries voltage is too low
Battery life:	Approximate 170 hours

Display

Type	3 ¾ digits LCD with max. reading 3999 counts + symbol and decimal point

6.2. ENVIRONMENT

6.2.1. Environmental conditions

Reference temperature	23 ± 5°C; 73 ± 41°F
Working temperature	5 ÷ 40°C; 41 ÷ 104°F
Relative humidity	<80%RH
Storage temperature	-10 ÷ 60°C; 14 ÷ 140°F
Storage humidity	<70%RH

This instrument complies with the European Directive on low voltage 2006/95/CE (LVD) and with EMC 2004/108/CE

6.3. ACCESSORIES

6.3.1. Standard accessories

- Instrument
- Red test lead — Code: P711EU
- Black test lead — Code: P710EU
- Instruction manual
- Bag — Code: B700
- Batteries

Note: accessories whose part number is not mentioned can not be reordered separately.

7. SERVICE

7.1. WARRANTY CONDITIONS

This instrument is guaranteed for one year 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 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.

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.

7.2. 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.