

# PEN MULTIMETER

## OPERATION MANUAL




CE

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## 1. SAFETY PRECAUTIONS AND PROCEDURES

This instrument complies with EN 61010-1 concerning electronic measuring instruments. And the meter is designed patented, 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 symbol .

When taking measurements:

- Avoid operating in humid or wet places - Make sure humidity level is within the limits indicated in section "environmental conditions".
- Avoid operating 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.
- Stop operating immediately 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 condition and, if necessary, replaced with identical ones.
- Do not test, nor connect to any circuit exceeding specified overload protection.
- Do not take measurements under environmental conditions which exceed the limits indicated in chapter 6.1.8 and 6.2.1.
- Make sure that batteries are correctly installed.
- Before connecting the test probes to the installation, make sure the rotary selector is positioned on the right function.
- Make sure 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 is required.

## 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 (Called "overvoltage category") is.

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 ( $V_{DC}$ ) voltage measurement
- AC ( $V_{AC}$ ) voltage measurement
- Frequency measurement
- Resistance measurement
- Continuity test
- Diode test

Measurements are selectable by means of a 7-position rotary selector and three function keys. The selected measurement is displayed with indication of active functions. In order to save batteries, the instrument automatically switches off in 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.

## **3. PREPARATION FOR USE**

### **3.1. INITIAL**

This instrument was checked for 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, please follow the instructions mentioned in paragraph 7.

### **3.2. SUPPLY VOLTAGE**

The instrument is powered by batteries (refer to paragraph 6.1.9 for details on model, no. and battery life). When voltage is 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 guaranteed for 1 year. Afterwards the instrument may need recalibration.

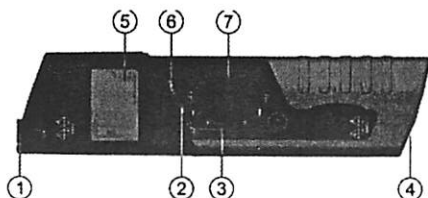
### **3.4. STORAGE**

After a period of storage in extreme environmental conditions which exceed 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



#### LEGEND:

1. V+/Ω input terminal
2. REL key
3. HOLD key
4. COM input terminal
5. LCD
6. RANGE key
7. Rotary selector

Fig. 1: Instrument description

### 4.2. FUNCTION KEYS

Once pressed, the relevant symbol appears on the display and the buzzer beeps.



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. REL

The REL function subtracts a stored value from the present measurement and displays the result. Press "**REL**" to set the relative mode. It will set the display to zero and stores the displayed reading as a reference value, also "REL" is displayed. Press this button again to exit the relative mode.

#### 4.2.3. RANGE

At auto range, press "**RANGE**" button momentarily to select manual range and turn off the "AUTO" symbol. At manual range, press this button momentarily to step up 1 range at one time, press the button more than 1 second to select autorange. At auto range, the meter will select an appropriate range for the measurement being made.

### 4.3. SPECIAL FUNCTIONS

#### 4.3.1. Turning on

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

#### 4.3.2. Auto power off

The instrument automatically turns off in 15 minutes after last pressure of keys or last selector rotation. To resume operation, turn the selector at OFF and turn on the instrument again.

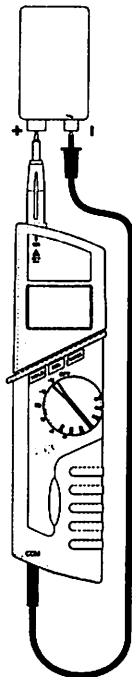
#### 4.4. MEASUREMENTS - DESCRIPTION

##### 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.



1. Turn the selector on  $\overline{\text{V}}$ .
2. Insert the black test lead in the COM jack and the red probe in the V+/ $\Omega$  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. When "O.L." shows on LCD, 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. "-" 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, REL and RANGE functions, please refer to chapter 4.2.

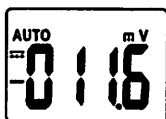


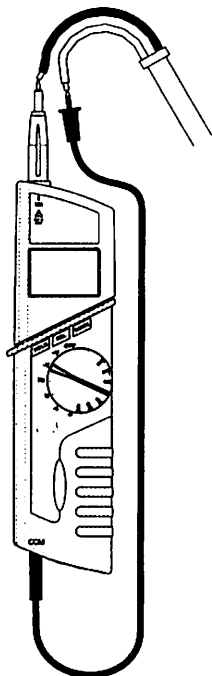
Fig. 3: DC voltage measurement

#### 4.4.2. AC voltage measurement

##### 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.



1. Turn the selector on  $\sim V$ .
2. Insert the black test lead in the COM jack and the red probe in the V+/ $\Omega$  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. "O.L" stands for 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 the instrument.
5. If you want to activate the HOLD, REL and RANGE functions, please refer to chapter 4.2.



##### 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 measurement



#### 4.4.3. Frequency measurement

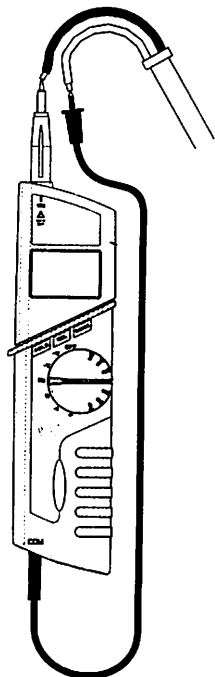


Fig. 5: Frequency measurement

1. Turn the selector at Hz.
2. Insert the black test lead in the COM jack and the red probe in the V+/ $\Omega$  jack (Fig. 5).
3. Connect the red probe and the black test lead to the poles of the circuit under test; the frequency value will be displayed (automatic range detection).
4. "O.L." means the detected frequency 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 you want to activate the HOLD, REL and RANGE functions, please refer to chapter 4.2.

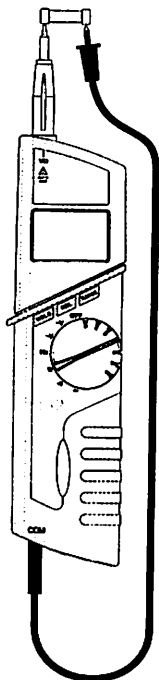


#### 4.4.4. Resistance measurement

### CAUTION



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



1. Turn the selector on  $\Omega$ .
2. Insert the black test lead in the COM jack and the red probe in the V+/ $\Omega$  jack (Fig. 6).
3. Connect the test lead to the circuit under test; the resistance value will be displayed (automatic range detection).
4. if LCD shows "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. If you want to activate the HOLD, REL and RANGE functions, please refer to chapter 4.2.



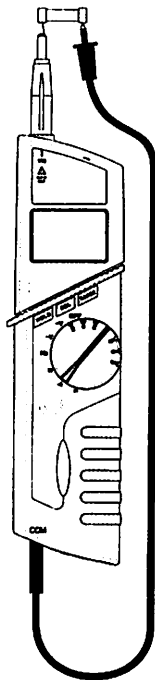
Fig. 6: Resistance measurement

#### 4.4.5. Continuity test

### CAUTION



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



1. Turn the selector on<sup>(1)</sup>.
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. When "O.L." shows on LCD, 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 100Ω.
6. If you want to activate the HOLD, REL and RANGE functions, please refer to chapter 4.2.

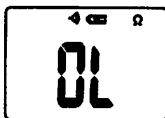


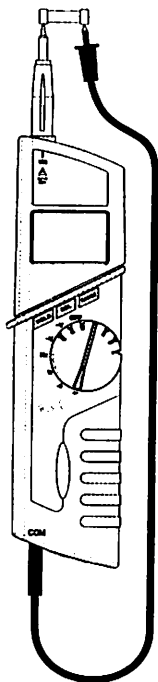
Fig. 7: Continuity test

#### 4.4.6. Diode test

### CAUTION



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



1. Turn the selector on  $\blacktriangleright$ .
2. Insert the black test lead in the COM jack and the red probe in the V+/ $\Omega$  jack (Fig. 7).
3. Connect the test lead to the circuit under test; the resistance value will be displayed (automatic range detection).
4. "O.L" display on LCD means that the detected voltage exceeds the limits which the instrument can measure or that the above described connections are inverted.

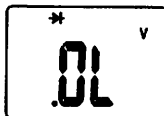


Fig. 8: Diode test

## 5. MAINTENANCE

### 5.1. GENERAL INFORMATION

This is a precision instrument. To guarantee its performances be sure to use it or keep it stored in the suitable environmental conditions. Do not expose it to the high temperature 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

When low battery indication (refer to paragraph 6.1.9) is displayed, it means the batteries are need 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 slight pressure on the cover screws and unscrew them by one third counterclockwise. Pull out the battery cover.
4. Remove all the batteries from the battery holder.
5. Insert two new batteries of the same type (refer to paragraph 6.1.9) ,inspect the polarity signs .
6. Push back the battery holder, make a slight pressure to the cover screws and screw them by one third clockwise. Make sure the battery holder is properly fixed in place now.



Fig. 9: Opening and closing battery cover

### 5.3. CLEANING

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

## 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%.

#### 6.1.1. DC voltage measurement

Range	Resolution	Accuracy	Input impedance	Protection against overloads
0.1 - 399.9mV	0.1mV	±(0.8%rdg+2dgt)	100MΩ	DC/AC 660V rms
0.400 - 3.999V	0.001V		11MΩ	
4.00 - 39.99V	0.01V		10MΩ	
40.0 - 399.9V	0.1V			
400 - 600V	1V	±(1.0%rdg+2dgt)		

#### 6.1.2. AC voltage measurement

Range	Resolution	Accuracy (45 – 500Hz)	Input impedance	Protection against overloads
0.001 - 3.999V	0.001V	±(1.0%rdg+3dgt)	11MΩ	DC/AC 660V rms
4.00 - 39.99V	0.01V		10MΩ	
40.0 - 399.9V	0.1V			
400 - 600V	1V		±(1.0%rdg+2dgt)	

Max crest factor  $\sqrt{2}$

#### 6.1.3. Frequency measurement

Range	Resolution	Accuracy	Protection against overloads
0.001 - 9.999Hz	0.001Hz	±(0.8%rdg+2dgt)	DC/AC 660V rms
10.00 - 99.99Hz	0.01Hz		
100.0 - 999.9Hz	0.1Hz		
1.000 - 9.999kHz	0.001kHz		

Minimum detectable input voltage 3V

Max crest factor  $\sqrt{2}$

#### 6.1.4. Resistance measurement

Range	Resolution	Accuracy	Max open voltage	Protection against overloads
0.1 - 399.9Ω	0.1Ω	±(1.0%rdg+5dgt)	About 0.4V <sub>oc</sub>	DC/AC 600V rms one minute
400 - 3999kΩ	1Ω	±(1.0%rdg+3dgt)		
4.00 - 39.99kΩ	0.01kΩ			
40.0 - 399.9kΩ	0.1kΩ			
400 - 3999kΩ	1kΩ			
4.00 - 39.99MΩ	0.01MΩ	±(3.0%rdg+3dgt)		

#### 6.1.5. Continuity test

Range	Buzzer	Max open voltage	Protection against overloads
⌘)	< 100Ω	About 1.5V <sub>oc</sub>	DC/AC 600V rms

#### 6.1.6. Diode test

Range	Resolution	Max open voltage	Protection against overloads
▶	1mV	About 1.5V <sub>oc</sub>	DC/AC 600V rms

### 6.1.7. Electrical

Conversion	Average value
Display refreshing rate	3 times per second

### 6.1.8. Safety


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

### 6.1.9. General data

#### Mechanical characteristics

Dimensions	250(L) x 51(W) x 30(H)mm
Weight (including batteries)	Approximate 150g

#### 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 200 hours

#### Display

Type	3 ¼ digits LCD with max. reading 3999 counts + symbol and decimal point
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## 6.2. ENVIRONMENT

### 6.2.1. Environmental conditions

Reference temperature	23° ± 5°C
Working temperature	5 + 40 °C
Relative humidity	<80% for temperatures up to 31°C decreasing linearly to <50% relative humidity at 40°C
Storage temperature	-10 + 60 °C
Storage humidity	<70%

### 6.2.2. EMC

This tester was designed in accordance with EMC standards in force and its compatibility has been tested in accordance with EN61326-1 (1997) + A1 (1998).

**This instrument complies with the European Directive on low voltage 73/23/CEE (LVD) and with EMC 89/336/CEE, amended by 93/68/CEE**

## 6.3. ACCESSORIES

The accessories contained inside as following:

- Instrument
- Red test lead
- Black test lead
- Instruction manual
- Bag
- Batteries

## **7. SERVICE**

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