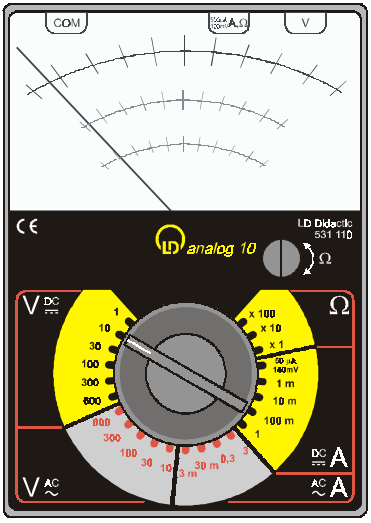
LD Didactic

GA 531 110, 06/05-Sel

LD analog 10

Analog multimeter



Instruction sheet

Contents

1 Safety notes

The analog multimeter LD *analog 10* has been designed and tested in accordance with the safety regulations IEC EN 61010-1. If the device is used appropriately, the safety of the multimeter and the security of the person using it are guaranteed. However, safety is not guaranteed if the multimeter is used improperly or handled carelessly. Therefore it is indispensable to read this instruction sheet carefully before using the multimeter and to observe the instructions.

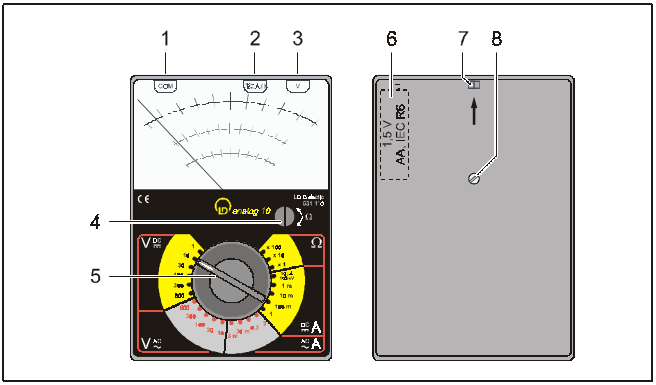
- The multimeter may only be operated by persons who are able to identify shock hazard and to take corresponding safety precautions.
- If measurements which imply shock hazard are carried out, a second person has to be informed.
- Unexpected voltages at measuring objects (e.g. defective devices or capacitors) have to be reckoned with.
- The instrument leads and housing of the multimeter must not be damaged e.g. by cracks or ruptures.
- Never open the housing before having removed all instrument leads form the multimeter.
- The multimeter must not be used for measurements in circuits with corona discharge (high voltage!).
- Particular care has to be taken in HF circuits, where dangerous mixed voltages may occur.
- In humid environments, no measurements must be carried out. Hands, shoes, the floor and the workplace have to be dry.
- Make sure that the nominal voltage between the phase and the neutral conductor never exceeds 600 V in measurements according to CAT II (i.e. on circuits with direct electrical connection to the power supply system) and 300 V in measurements according to CAT III (i.e. in building installation).
- The measuring ranges must not be overloaded by more than the permissible amount (see section 9).

2 Description

The analog multimeter LD *analog 10* is suitable for measuring voltages, currents, resistances as well as amplifications or attenuations, e.g. in four-pole networks. All measuring ranges can be selected by means of just one rotary switch. A mirror behind the scale enables virtually parallax-free reading of the pointer deflection.

The moving-coil element of the multimeter is largely insensitive to external fields and it is protected against overload by means of two anti-parallel diodes. The robust plastic housing and the spring-loaded bearing jewels of the moving-coil element protect the device against damage in case of mechanical stress.

3 Components



1 Common terminal (ground, for all measuring ranges)
2 Terminal for resistance and current measurement
3 Terminal for voltage measurement
4 Potentiometer rotary button (to set the full-scale deflection to 0 Ω)
5 Range selection switch
6 Battery compartment (accessible after removing the bottom part of the housing)
7 Catch (for locking the bottom part of the housing)
8 Setscrew (for setting the zero position of the pointer mechanically)

4 Operation

4.1 Range selection:

- When carrying out current and voltage measurements, always set the range selection switch to the highest range; then switch down to lower ranges until the optimum pointer deflection is reached.
- When the measurement is finished, set the range selection switch back to the highest range.

4.2 Mechanical zero control:

- Disconnect all instrument leads from the measuring circuit.
- Hold the multimeter horizontally and correct the zero of the pointer by means of the setscrew.

4.3 Exchanging the battery or the fuse:

Before opening the housing, remove all instrument leads from the multimeter !

- Press the lug at the front of the multimeter inward, e.g. using a small screwdriver, and remove the bottom part of the housing.
- Put a 1.5 V battery (IEC R6) into the battery compartment according to the polarity indicated. Make sure that the contacts are clean and reliable. (A battery is only required for resistance measurements).

or

- Clamp a new fuse F 3.15 A 500 V (IEC127, ∅6.3 mm × 32 mm) in the fuse holder.
- Put the bottom part of the housing back onto the top part of the housing and press both parts together until they catch.

4.4 Setting the full deflection to 0 Ω, battery check

- Set the range selection switch to the position ×1 Ω.
- Short the sockets COM and  .
- Using the potentiometer rotary button, set the full deflection to 0 Ω.

If the full deflection can no longer be set or if the display is no longer constant, the battery has to be exchanged.

5 Voltage measurements

The nominal voltage between the phase and the neutral conductor must not exceed 600 V in voltage measurements according to CAT II and 300 V in measurements according to CAT III !

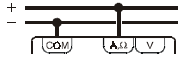
5.1 DC voltage up to 600 V:

Range: 600, ..., 1 V DC
Scale: V,A DC

5.2 AC voltage up to 600 V:

Range: 600, ..., 10 V AC
Scale: V,A AC

5.3 DC voltage up to 100 mV



Range: (50 μA) 100 mV DC
Scale: V, A DC

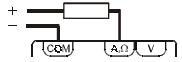
6 Current measurements

The nominal voltage between the phase and the neutral conductor must not exceed 600 V in current measurements according to CAT II and 300 V in measurements according to CAT III !

The multimeter has to be series-connected with the load at the position where the voltage to ground is minimal !

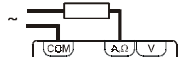
In the range 3 A, the measuring time must not exceed 1 min !

6.1 DC current up to 1 A



Range: 1 A DC, ..., 50 μA DC (100 mV)
Scale: V,A DC

6.2 AC current up to 3 A



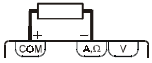
Range: 3 A, ..., 3 mA AC
Scale: V,A AC

7 Resistance measurements

Resistances are measured with the DC voltage from the battery (1.5 V, IEC R6). In the range Ω ×1, the battery is loaded heavily. Therefore the measurement should be carried out in a short time.

Only idle elements may be measured. External voltages would distort the measuring result.

- When carrying out measurements on semiconductors, connect the positive pole to the COM socket and the negative pole to $\frac{500\mu A}{100mA}$A,Ω.
- When measuring resistances over a long period and after changing to other resistance measuring ranges, check the full deflection of 0 Ω and, if necessary, readjust it.



Range: Ω ×100, ..., Ω ×1
Scale: Ω

8 Amplification and attenuation measurements

In communication engineering, the amplification or attenuation of a signal is almost exclusively given as the logarithm of the ratio of the voltage measured and a reference voltage in units of decibel. Positive values in dB correspond to an amplification, and negative values correspond to an attenuation. The reference voltage of the multimeter is 0.775 V (1 mW at 600 Ω); at this voltage, the amplification is 0 dB (more precisely: dBm).

Range: 600, ..., 10 V AC
Scale: dB
The scale is valid for the range 10 V. If other ranges are used, a constant has to be added to the reading.

Range:	30 V	100 V	300 V	600 V
Constant:	10 dB	20 dB	30 dB	36 dB

9 Measuring ranges and permissible overload

9.1 Voltage measurement

DC voltage			AC voltage		
Range	Internal resistance	Permissible overload (AC/DC)	Range	Internal resistance	Permissible overload (AC/DC)
100 mV	2 kΩ	200 mV !!!	10 V	66.7 kΩ	300 V
1 V	20 kΩ	200 V *	30 V	200 kΩ	500 V
10 V	200 kΩ	500 V	100 V	667 kΩ	600 V
30 V	600 kΩ	600 V	300 V	2 MΩ	600 V
100 V	2 MΩ	600 V	600 V	4 MΩ	720 V
300 V	6 MΩ	600 V	* 240 V for 10 s at most		
600 V	12 MΩ	720 V			

9.2 Current measurement

DC current			AC current		
Range	Voltage drop	Permissible overload (AC/DC)	Range	Voltage drop	Permissible overload (AC/DC)
50 µA	100 mV	8 mA	3 mA	1.5 V	36 mA
1 mA	500 mV	36 mA	30 mA	1.6 V	400 mA
10 mA	500 mV	400 mA	300 mA	1.6 V	900 mA
100 mA	500 mV	900 mA	3 A **	1.8 V	3.5 A
1 A	190 mV	3.5 A	** max. measuring time 1 min		

9.3 Resistance measurement

Switch	Range and centre of scale	Max. meas. current
Ω ×1	1 Ω ... 35 kΩ ... 5 kΩ	45 mA
Ω ×10	10 Ω ... 350 kΩ ... 50 kΩ	4.5 mA
Ω ×100	100 Ω ... 3.5 kΩ ... 500 kΩ	0.45 mA

10 Technical data

10.1 General data:

Ranges:	23
Scale length:	87 mm
Pointer stop:	0 ... 100°
Dimensions:	100 mm × 140 mm × 35 mm
Weight:	250 g

10.2 Reference conditions:

Ambient temperature:	23 °C
Position of use:	horizontal
Frequency:	50 ... 60 Hz
Signal shape:	sine (max. deviation 1 %) for AC

10.3 Accuracy: (at reference conditions)

Voltage:	±2.5 % of scale length
Current:	±2.5 % of scale length
Resistance:	±2.5 % of scale length

10.4 Influence quantities and nominal ranges of use:

Temperature (0 ... 40 °C):	±1 % / 10 K for DC
	±2.5 % / 10 K for 100 mV/50 μA DC
	±1.5 % / 10 K for AC
Frequency (30 Hz ... 1 kHz):	±2.5 % of scale length

10.5 Electrical safety:

Safety regulations:	EN 61010-1
Overvoltage category:	CAT III: max. 300 V, CAT II: max.600 V
Degree of pollution:	2

10.6 Electromagnetic compatibility:

Emitted interference:	EN 500081-2
Immunity to interference:	EN 500082-2

10.7 Overload protection:

F 3.15 A 500 V (IEC127, ∅6.3 mm × 32 mm)

11 Maintenance

11.1 Cleaning:

The housing does not require particular maintenance. It can be cleaned by means of a piece of soft cloth slightly wetted with alcohol and a brush.

Potential electrostatic charges on the display window may have an influence on the measurements. The charges can be removed by means of a piece of soft cloth slightly wetted with alcohol.

11.2 Battery:

The condition of the battery should be checked from time to time. A discharged or decomposing battery must not remain in the battery compartment. If the multimeter is not used for a long period, the battery should be removed.

12 Meaning of the symbols

CE EU mark of conformity

CAT Measurement category according to IEC EN 61010-1

 Ground symbol

 Dangerous spot (observe the instruction sheet)

 Moving-coil element (core magnet) with rectification

⎓ DC current/voltage

~ AC current/voltage

2.5 Accuracy class 2.5

 Horizontal position of use

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