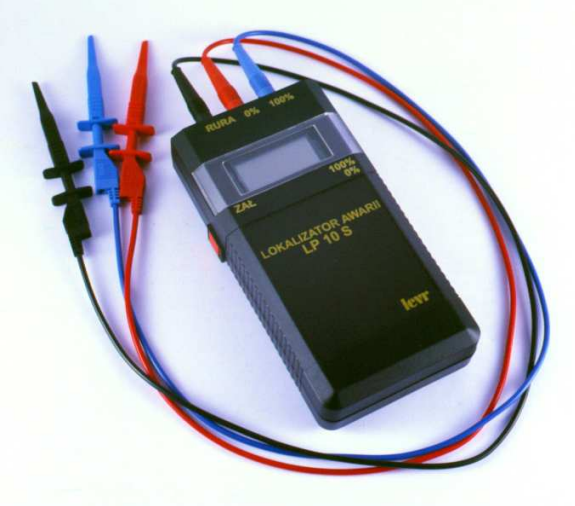
FAILURE LOCATOR

LP10S

(RESISTANCE ALARM SYSTEM)



OPERATING MANUAL

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1. GENERAL INFORMATION

The LP10S device is designed for localizing moisture in pre-insulated heating pipelines with resistance alarm systems. The standard version of the meter is adapted for sensor loops with the resistance wire with a characteristic resistance of 5.7Ω/m. There is a possibility of easy adaptation of the device to resistive systems with other characteristic resistances, however not smaller than 0.5Ω/m.
Ease of use and objective interpretation of measurement results are very important features of the meter. They arise from the numerical manner of presenting measurement result values and the use of automatic calibration of the device.

2. MEASUREMENTS AND RESULT INTERPRETATION

The elements of the alarm system include: a resistance wire, a copper wire, a line pipe, a protective pipe, polyurethane insulation. The connection of the device and the alarm system and the execution of a measurement cycle consist of the following actions:

- Plug in the measuring leads to the sockets of an LP10S device, matching the colours. For example, the red measuring lead shall be plugged in to the red measuring socket.
- Add the green (blue) measuring lead to the copper wire (green insulation) of the alarm system.
- Connect the red measuring lead with the resistance wire (red insulation) of the alarm system.
- Connect the LP10S with a steel pipe using the black measuring lead and a magnetic coupling.
- Set the meter switch labelled with the 0%/100% symbol in the 0% position.
- Press the START button and after setting of the indication, record the measurement result value.
- Set the meter switch labelled with the 0%/100% symbol in the 100% position.
- Press the START button and after obtaining an indication, record the measurement result value.
- Repeat the same steps on the other end of the alarm system. Prior to moving onto a new measuring station, short the resistance and copper wires.

One measuring cycle of an LP10S locator lasts several dozen seconds. Each cycle ends with a new measurement result value shown on the digital display. Reading changes are indicated by the appearance or fading of a "**:**" symbol. In other words, if a measurement result value is preceded by a "**:**" symbol, the next one will be displayed without it, etc.
The indication of an instrument, which specify the moistness location are given a length percentage of the tested network, and not in meters. Setting a switch with marked 0% and 100% positions enables the determination of a distance to the moistness location from the measurement position (position 0%) or from the opposite end of a pipeline (100%). It follows that the sum of the obtained results for two switch positions should be exactly 100%. In practice it amounts to about 100% due to a measurement error of the meter or extensive moisture. The result values may be fixed or variable during the measurements. The variability may be of oscillating or constant nature (systematic increasing or diminishing). Result oscillation is present mainly when measuring heating pipelines with a length not smaller than 100m. However, in such cases,

changes in the measurement result values by tenths of a percent result in a localization error not larger than 1m. It seems that such accuracy is completely satisfactory.
The cause of systematic increasing or diminishing of measurement result values obtained during a measuring process is the presence of moisture in at least two locations of the tested heating pipelines. In such a case, apply the identification manners described in the manual of an LH20S device.

When locating a leak (moistness) in pre-insulated heating pipelines **over 200m long**, one should take into account the impact of a copper wire resistance on the measurement result value. The impact is larger, the longer the section of the tested heating pipelines. The localization should be performed on both ends of a tested pipeline (four results). The obtained measurement pair results must indicate the same moistness/leak location. If the locations are different for each end of a heating pipelines, it means that there is more than one moistness/leak. Below you can find an example of a correct calculation of the actual distance to the leak location for a network longer than 200m.

Data:

- pre-insulated heating pipelines length L=500m
- result correction coefficient k=1.0063

Measurement result values:

- switch position 0% W_1=89.4%
- switch position 100% W_2=10.6%

W1,W2 - measurement result value symbols.

(In practice, six consecutive measurements are performed for the switch in the 0% position, and five for the switch in the 100% position. The first in a series of six measurements shall be discarded)
Based on the achieved indication, the approximate distance from the measurement position to the leak location and from the opposite end of the heating pipelines are calculated.

Calculations:

1. Approximate distance from the measurement position to the leak location (switch position 0%).

$$l_1 = L - W_1 = 500m - 0{,}894 = 447m$$

Note: The W1 measurement result value converted into a decimal fraction is inserted into the formula.

2. Approximate distance from the opposite end of the pipeline to the leak location (switch position 100%).

$$l_2 = L - W_2 = 500m - 0{,}106 = 53m$$

By applying the correction coefficient, calculate the actual distances of the leak location from both ends of a pre-insulated heating pipelines. The calculations are performed in the following manner:

$$L_1 = l_1 \cdot k = 447m \cdot 1{,}0063 = 449{,}8 \cong 450m$$

L_1 - *corrected, exact distance from the leak location to the measurement position.*
l_1 - *distance to the leak location from the measurement position encumbered with a measuring system error (impact of the copper wire on the measurement result value).*
k - result correction coefficient k=1.0063.

$$\Delta = L_1 - l_1 = 450 - 447 = 3m$$

Δ - *absolute measurement error resulting from the impact of a copper wire on the measurement result.*

$$L_2 = l_2 - \Delta = 53m - 3m = 50m$$

L_2 - *corrected, exact distance from the leak location to the opposite end of the heating pipelines.*

Similar measurements shall be performed on the other end of a heating pipelines.
In an ideal scenario, each measurement pair (0%, 100%) should exhibit an equality:

$$L_1 + L_2 = L$$

L - length of the tested heating pipelines

In addition, both locations should indicate the same moisture/leak location.
The above equality is obvious, since the leak location “divides” the tested heating pipelines into two parts. However, in practice, such an equality appears rather rarely due to the measuring accuracy of the meter or the presence of extensive moistness.
A significant restriction in obtaining accurate measurement results might be a too low level of located moisture (high resistance of polyurethane resistance). The most accurate determination concerns moistness locations with polyurethane insulation resistance lower than 1MΩ (9 MH degree). Although practice proves that in favourable measurement conditions (one moistness location, no electrical interference in the alarm loop wires) it is possible to very accurately determine a leak location even for MH of the 11th degree (polyurethane insulation resistance 3 ÷ 10MΩ).
When locating moistness with a 9th degree MH, measurement result value displays are of pulsating nature. It is an important signal for an LP10S user. The reasons for measurement results pulsation may also be: no contact between a meter and a line pipe, no connection of the instrument with alarm loop wire/s, interference (break) in an alarm loop circuit. These few last bits of information induce to draw a conclusion than every time measurement values pulsate

during a measurement, one needs to verify the degree of identified moisture, condition of the alarm loop, correctness of connections between an LP10S instrument and alarm circuit elements. The condition of the batteries supplying the meter is an important factor affecting the measurement accuracy. In an extreme case, discharged power supply batteries are signalled by displaying a **LOBAT** text and the following symbols: **L** (left battery), **P** (right battery).
In an LP10S device, the "right" battery is slightly less load with power. After the LOBAT and L messages are displayed, the "left" and "right" batteries can be swapped. This action should enable taking measurements for some time more.
Flat batteries shall be placed in used battery containers.

3. PRACTICAL REMARKS.

Detecting and measuring the moistness degree in a pre-insulated heating pipelines does not provide complete information on the condition of an alarm circuit. More data are obtained by measuring the moistness level separately for each wire forming an alarm loop. The measurement method is described in the manual of the LH20S meter. The following combinations of moistness between alarm system elements are seen in practice:

- moistness between a resistance wire and a line pipe;
- moistness between a copper wire and a line pipe;
- moistness between a resistance wire, copper wire, steel pipe.

The first of the aforementioned cases is rather simple to locate, provided that the moistness level is higher than 11 MH. Therefore, there is no need for additional advice or special manners of operation.
The localization of the second of the aforementioned conditions is impossible with commonly known methods and devices used for measuring resistance alarm systems. However, if the situation is not hopeless, one can approach, e.g. LEVR for help.
The third of the distinguished conditions can be usually identified with typical methods. For this purpose, construct an alarm loop replacing a "moist" copper wire with a "dry" copper wire from a twin (power supply, return) pipe. It is also possible to use a twin resistance wire, but it requires changing the method of calculations needed for the determination of a leak localization. Given the gained experience, it can be concluded that in most cases, moisture between a cooper lead and a steel pipe appears in the same location, as the moistness between a resistance wire and a steel pipe. Therefore, locating one of these locations enables removing moistness around both wires. However, in the event of a failure to do so, one of the advices is to ask LEVR for help.
To end the consideration, it should be emphatically stressed that the presence of moistness between a copper wire and a steel pipe completely prevents locating a leak. Of course, only in the case, in which the aforementioned actions are not taken.
A general advice shall be given as a summary of this section of the manual. Namely, if after handing a correctly executed section of a pre-insulated heating pipelines over to operation any of the aforementioned failures appear, you should:

- attempt to locate a failure position using the instruments;
- perform a visual inspection of the set out pipeline route checking whether there were any earthwork conducted in the meantime;
- compare whether the failure location determined with the instruments coincides with the location of conducted earthwork.

It happens that such a course of actions completely authenticates the obtained measurement results.

4. Decommissioning of an LP-10S device.

Pursuant to the provisions of the Act of 29 July 2005 on used electrical and electronic equipment (Journal of Laws, item 1495), the device bears a following symbol:

It means that it is forbidden to place used equipment with any waste. A user of the equipment marked in this manner is obliged to hand the equipment over to relevant companies dealing with collecting used equipment. The obligations arise from art. 35 and 36 of the aforementioned act.

LP-10S

(resistance alarm system)

TECHNICAL DATA:

1. Characteristics of measurement conditions:
   - Length of tested alarm loop .....3 ÷ 2000m
   - Resistance of tested alarm loop.....16 ÷ 12000Ω
   - Polyurethane insulation resistance ..... <10MΩ (MH≤11)

2. Measurement result presentation manner .....3.5 dgt LCD display

3. Measurement range.....0 ÷ 100% of the tested alarm loop length

4. Measurement resolution 0,1%

5. Leak localization determination error:
   - In a measurement loop up to 500m ..... <1m ± 0.1% of the tested loop length
   - In a measurement loop from 500m to 2000m..... <2m ± 0.1% of the tested loop length

6. Text messages:
   - "Left" battery discharged, replace.....**LOBAT L**
   - "Right" battery discharged, replace.....**LOBAT P**

6. Power supply ..... 2 x 6F22

7. Operating and storage temperature range.....5 ÷ 50°C

8. Casing tightness class.....IP40

9. Meter dimensions ..... 196 x 100 x 40mm

10. Weight with batteries 425g