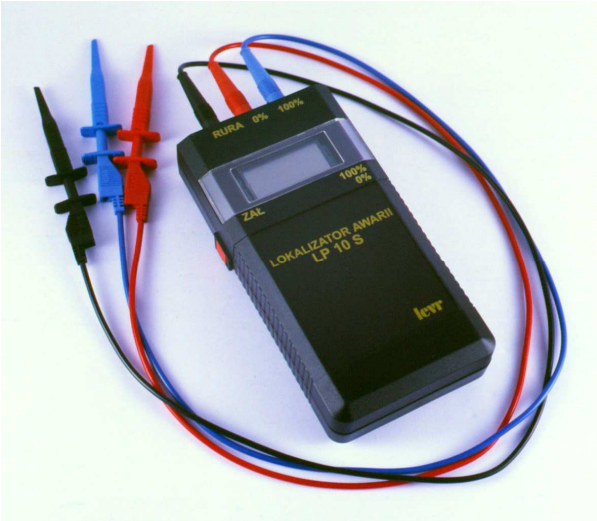
PORTABLE FAULT LOCATOR

LP-10S

(RESISTANCE ALARM SYSTEM)



USER MANUAL

levr

Ver. 2.6

1. General

The LP-10S device is designed to locate moisture in pre-insulated pipelines with resistance alarm systems. The standard version of the fault locator is intended for alarm loops in which the resistance of the resistance wire is equal to 5,7Ω/m. The device, however, can easily be adapted to work with other resistance wires, as long as their resistance is not lower than 0,5Ω/m.

The fault locator is easy to use and allows objective interpretation of measurement results, due to the digital display and to the automatic calibration feature of the device.

2. Measurements

The alarm system consists of the: resistance wire, copper wire, carrier pipe, casing pipe and polyurethane insulation. In order to connect the fault locator to the alarm system and perform the measurement cycle:

1. Plug the locator wires into the sockets of the device according to the colour scheme. E.g. plug the red locator wire into the red socket.
2. Connect the green (blue) locator wire with the copper wire (green insulation) of the alarm system.
3. Connect the red locator wire with the resistance wire (red insulation) of the alarm system.
4. Connect the fault locator with the carrier pipe using the black locator wire and the magnetic connector.
5. Set the fault locator switch marked with the 0% / 100% symbol in the 0% position.
6. Press the START button and write down the measurement results.
7. Set the fault locator switch marked with the 0% / 100% symbol in the 100% position.
8. Press the START button and write down the measurement results.
9. Perform the same actions at the other end of the alarm loop. Before heading to the next measurement point, connect the resistance wire with the copper wire.

One measurement cycle of the LP-10S device takes several dozen seconds. At the end of each cycle, the digital display displays a new measurement result. The appearance of new results is signalled by the appearance or disappearance of the "**:**" symbol. In other words, if one measurement result is preceded by the "**:**" symbol, then the next result will be displayed without it.

Results displayed by the fault locator are given in percentage of the length of the tested pipeline, not in meters. Depending on the position of the 100% / 0% switch, the distance to the location of the moisture is counted from the measurement point (0% position) or from the opposite end of the pipeline (100% position). Consequently, the sum of the results achieved in both switch positions should add up to exactly 100%. In reality, the sum is slightly different from 100% due to the measurement error of the device and extent of the moisture. Measurement results may be fixed or changing and the result changes may be oscillatory or continuous (systematic increase or decrease). Oscillatory changes usually occur when the tested pipelines are no longer than 100m. In such cases, however, measurement results are altered only by tenths of percents, causing a location error of less than 1m. Such measurement accuracy is completely sufficient.

If measurement results systematically increase or decrease, then moisture exists in at least two locations in the pipeline section. In such case, use the fault location methods described in the user manual of the LH-20S device.

When locating a leakage (moisture) in pre-insulated pipelines **longer than 200m**, it is important to account for the influence of the copper wire resistance on measurement results. The influence increases with the length of the pipeline section. Example method of calculating the real distance to the leakage location is given below:

Data:

- pipeline length L=500m
- measurement correction parameter k=1,0063

Measurement results:

- switch in the 0% position W_1=89,4%
- switch in the 100% position W_2=10,6%

W1,W2 – symbols of measurement results

Approximate distance to the leakage location from the measurement point and from the opposite end of the pipeline is calculated on the basis of the achieved measurement results.

Calculations:

1. Approximate distance to leakage location from the measurement point (switch in the 0% position).

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

Note: convert the W1 value into a decimal before substituting it into the formula.

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

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

Using the correction parameter, calculate real distances to leakage location from both ends of the pipeline. Use the following formula:

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

L_1 – *exact distance to the leakage location from the measurement point*

l_1 – *distance to the leakage location from the measurement point, altered by the measurement error (influence of the copper wire on measurement results)*

k – *measurement correction parameter (*k=1,0063)

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

Δ – *absolute measurement error caused by the influence of the copper wire on measurement results*

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

L_2 – *exact distance to the leakage location from the opposite end of the pipeline.*

In an ideal case, the following should be true:

$$L_1 + L_2 = L$$

L – length of the tested pipeline

The above equation is true if the leakage location “divides” the tested pipeline into two parts. In practice, however, this is seldom the case, due to measurement errors or extent of the moisture.

Accurate location of a leakage may be difficult when the level of moisture is too low (high polyurethane insulation resistance). The fault locator is most accurate when polyurethane insulation resistance is lower than 1MΩ (9 MH level), although, in favourable conditions (one moisture location, no electrical interference), accurate leakage location is possible for MH levels as high as 11 (polyurethane insulation resistance 3 ÷ 10MΩ).

When the fault locator is used to locate moisture with MH levels higher than 9, then the displayed measurement results are blinking – an important signal for the user of the device. The blinking of measurement results can also be caused by the: lack of contact between the locator and the carrier pipe, lack of connection between the locator and the alarm wire(s), break in the alarm loop. Whenever measurement results are blinking, check the moisture level, condition of the alarm loop and connections between the fault locator and the alarm loop.

Battery level is also an important factor affecting measurement accuracy. If the batteries are low, the **LOBAT** message appears, together with the **L** (left battery) and **P** (right battery) symbols.

3. Practical Advice

Detecting and measuring the moisture level in a pre-insulated pipeline does not provide complete information about the condition of the alarm system. To obtain more data, measure the moisture level separately for each wire of the alarm loop. The measurement method is described in the LH-20S detector user manual. The most common moisture locations are the following:

- moisture between the resistance wire and the carrier pipe,
- moisture between the copper wire and the carrier pipe,
- moisture between the resistance wire, copper wire and carrier pipe.

The first of the above cases is fairly easy to locate and requires no additional instructions or advice unless the MH moisture level is lower than 11.

It is impossible, however, to locate the second type of moisture with standard methods and equipment. In such cases, ask for assistance, e.g. from the LEVR company.

The third of the listed moisture types can be located with standard methods by forming an alarm loop in which the “wet” copper wire is replaced with a “dry” copper wire from the twin (feed or return) pipeline. It is also possible to use a twin resistance wire, but in such case additional calculations are needed to locate the leakage. In most cases, the location of moisture between the copper wire and the carrier pipe is the same as the location of moisture between the resistance wire and the carrier pipe. Therefore, finding either of them makes it possible to eliminate moisture around both wires. If this is not the case, contact the LEVR company.

Remember that it is impossible to locate the leakage if there is moisture between the copper wire and the carrier pipe. Unless, of course, one of the above-described solutions is implemented.

If any of the above faults occur after correct installation of a pre-insulated heating pipeline section:

- try to locate the fault with the fault locator,
- inspect the pipeline to ensure that no earthworks were performed in the meantime,
- see if the location indicated by the fault locator corresponds with the area of the performed earthworks.

The above actions can help in validating the measurement results.

LP-10S

(resistance alarm systems)

4. Technical Specifications:

1. Measurement conditions:
   - alarm loop length ..... 3 ÷ 2000m
   - alarm loop resistance ..... 16 ÷ 12000Ω
   - polyurethane insulation resistance ..... <10MΩ (MH≤11)
2. Measurement results display ..... 3,5-digits LCD display
3. Measurement range ..... 0 ÷ 100% of the alarm loop length
4. Measurement resolution 0,1%
5. Measurement accuracy:
   - in alarm loops shorter than 500m ..... <1m ± 0,1% of the loop length
   - in alarm loops between 500m and 2000m ..... <2m ± 0,1% of the loop length
6. Power supply ..... 2 x 6F22
7. Working and storage temperature range ..... 5 ÷ 50℃
8. Casing tightness class IP40
9. Dimensions 196x100x40mm
10. Weight with batteries 425g