

**STATIONARY FAULT DETECTOR  
FOR PREINSULATED DISTRICT HEATING  
PIPELINES  
(RESISTANCE ALARM SYSTEM)**

# LPS-2r



## USER MANUAL

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Ver. 17.12

## 1. General

The LPS-2r instrument is designed to monitor 2 sections of a preinsulated district heating pipeline with a resistance alarm system. Every measurement cycle includes measurements of polyurethane insulation resistance, MH moisture content level, district heating pipeline length, voltage in the alarm system, distance between the measurement station and the location of the leak or direct contact of the sensor wire with the carrier pipe and instrument self-calibration. The resistance of polyurethane insulation is measured with two polarisations of measurement voltage. The accuracy of the measurements is unaffected by changes in ambient temperature and interference caused by electrical physical phenomena occurring on the carrier pipe. The measurement information is presented by an alphanumeric display in the form of numerical measurement results and text messages. The backlighted screen of the indicator consists of two lines containing 20 character spaces. Every line is allocated to a single measurement channel (one sensor loop).

## 2. Comments to the technical specifications of the LPS-2r instrument

The LPS-2r instrument measures resistance of the polyurethane insulation and the alarm loop. The insulation resistance is converted into MH moisture content level or C level of direct contact of the alarm wire with the steel pipe. The relationships between insulation resistance and parameters MH or C are indicated in table 1. The resistance of the alarm loop, in turn, is automatically converted into the length of the monitored district heating pipeline section.

MH polyurethane insulation moisture content level	Level C of direct contact between the alarm wire and the steel pipe	Polyurethane resistance range
1	1	100 Ω–500 Ω
2	2	500 Ω–1.2 kΩ
3	3	1.2 kΩ–5 kΩ
4	4	5 kΩ–20 kΩ
5	5	20 kΩ–65 kΩ
6	6	65 kΩ–200 kΩ
7	7	200 kΩ–300 kΩ
8	8	300 kΩ–450 kΩ
9	—	450 kΩ–1 MΩ
10	—	1 MΩ–3 MΩ
11	—	3 MΩ–10 MΩ
12	—	10 MΩ–20 MΩ
13	—	20 MΩ–30 MΩ
14	—	30 MΩ–50 MΩ
0	—	> 50 MΩ

table 1

The technical requirements for the resistance alarm system specify that the maximum length of a resistance alarm loop is 1000 m. For this length, the level of moisture content of the polyurethane insulation should meet the following condition:  $MH \geq 12$ .

The LPS-2r instrument is manufactured in two versions: with automatic detection of leak/moisture location or without this feature. Location detection is performed when polyurethane insulation resistance is lower than 1 MΩ.

### **Interpretation of “L>Lmax” and “PRZERWA” (BREAK) messages**

As indicated by the technical specifications of the instrument, the L>Lmax message appears when the measured resistance of the alarm loop is within the range of 12051  $\Omega$ –100 k $\Omega$ . The bottom limit correspond to a length of the sensor loop of 2000 m assuming that the NiCr8020 resistance wire has been manufactured with a tolerance of  $\pm 3\%$ . In practice, connections of alarm loop sections are sometimes incorrectly made. Resistance of the connection increases the resistance of the loop and artificially extends it. A similar effect occurs when moisture is present between the broken ends of the wire forming the alarm loop. These two situations are indicated by the Zakres (Range) message. In the second of the indicated cases, the instrument will indicate a low MH level (high moisture).

The “Przerwa” (Break) message indicates the absence of electrical contact between the ends of the wires forming the alarm loop.

### **Reasons to distinguish between a leak and a short circuit**

A leak and direct contact of the sensor loop wire with the steel pipe are characterised by a relatively low resistance measured between the carrier pipe and the alarm loop wire. The LPS-2R instrument automatically locates each of these cases. However, there are important reasons why the persons who monitor the district heating pipeline have to be able to distinguish between the two events. Each of these events requires different technical preparations to rectify the fault, and their severity and required speed of response will be different as well.

## **3. Description of the operating environment of the LPS-2r instrument**

The instrument is designed for indoor operation. The instrument operates correctly within an ambient temperature range of +5°C to +50°C, and relative humidity should not exceed 80%. During storage of the instrument, the ambient temperature should be within the range of –40°C to +70°C.

If the instrument was stored or transported at a temperature of less than +5°C, it should not be connected to power supply for at least 3 hours. After this time, the instrument should reach the operating temperature.

The instrument cannot be used in dusty areas and in atmospheres containing explosive or corrosive gases.

The accuracy of measurements of parameters and quantities indicated in the technical specifications is reached after 30 minutes of instrument operation in suitable environmental conditions.

## **4. Maintenance of the LPS-2r instrument**

A clean, dry cloth should be used to remove dust from the housing of the instrument. Other dirt should be removed with a cloth dampened with a 1% detergent solution. Greasy impurities can be removed with special products used to clean computer hardware. Transparent parts of the housing should be washed with soft cloths or with dedicated cloths for washing computer screens. Using spirit, petroleum naphtha or other solvents is not allowed. Such cleaning agents may cause surface damage to the housing of the instrument. After cleaning, the instrument should be wiped dry with a soft cloth. Care should be taken during cleaning to prevent large amounts of the cleaning liquids from getting inside the instrument.

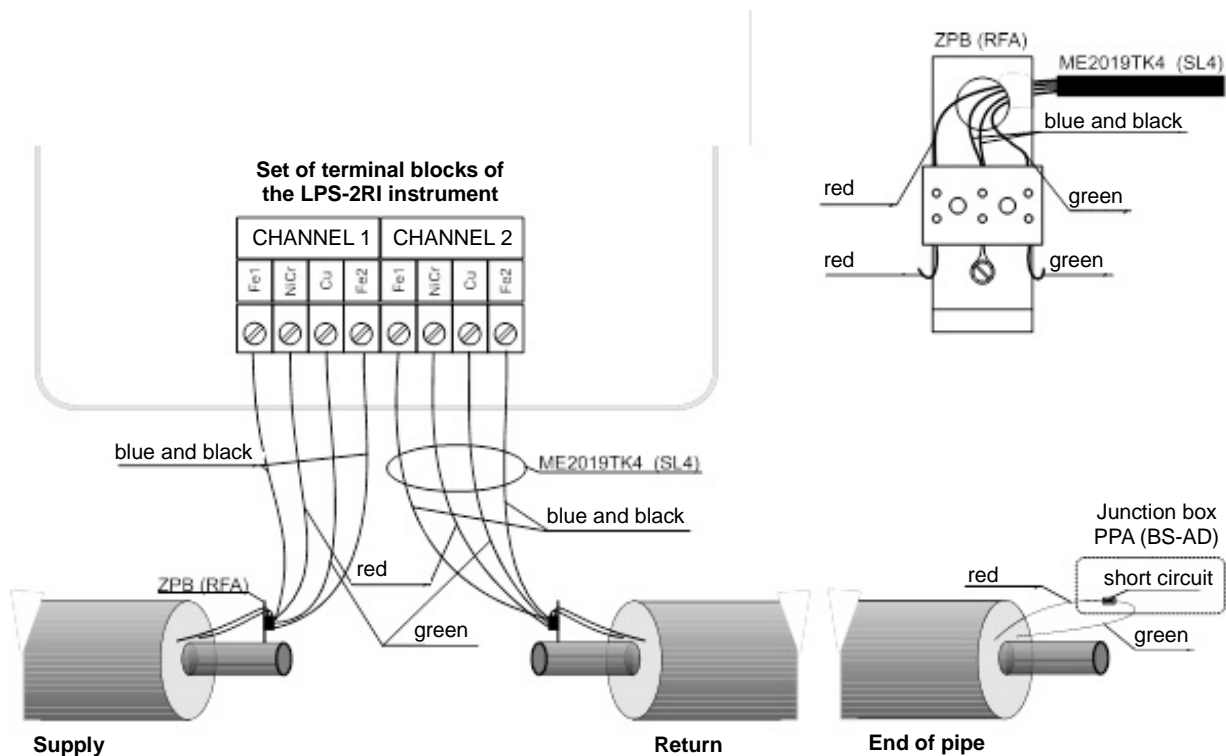
## 5. Disposal of the LPS-2r instrument

In accordance with the Act of 29/7/2005 on waste electrical and electronic equipment (Journal of Laws, item 1495), the following symbol has been placed on the instrument:



This symbol means that it is prohibited to discard waste equipment together with any other waste. Users of equipment marked with this symbol are obliged to transfer it to dedicated companies that collect waste equipment. These obligations arise from Articles 35 and 36 of the above-mentioned act.

## 6. Method of connection of the LPS-2r instrument to the alarm system of the preinsulated district heating pipeline



**LPS-2r**

(resistance alarm system)

**7. TECHNICAL SPECIFICATIONS**

1. Number of monitored sections of the preinsulated district heating pipeline ..... 2
  2. Maximum length of monitored sections of the district heating pipeline ..... 2000 m
  3. Method of displaying measurement information .....backlighted alphanumeric display  
2x20 characters, red LED  
with the "AWARIA" (FAULT) description
  4. Polyurethane insulation resistance measuring range ..... 0.1 k $\Omega$ –200 M $\Omega$ 
    - Measuring range of polyurethane insulation moisture content level ..... MH 1–14 and 0
    - Polyurethane insulation resistance measurement voltage .....  $\pm 15$  V
    - Accuracy of polyurethane insulation resistance measurement .....  $\pm 5\% \pm 2$  digits regarding the MH level
  5. District heating pipeline length measuring range ..... 0–2000 m
    - District heating pipeline length measuring accuracy .....  $\pm 2$  m)<sup>1</sup>
    - Measuring accuracy ..... 1 m
    - Maximum alarm loop resistance for the "Zakres" (Range) message ..... < 100 k $\Omega$
    - Minimum alarm loop resistance for the "Przerwa" (Break) message .....  $\geq 100$  k $\Omega$
  6. Measuring range for detection of the location of a leak (moisture) or contact of the alarm wire with the carrier pipe ..... 0–2000 m
    - Leak resistance range ..... 0.1 k $\Omega$  – 0.9 M $\Omega$  (MH = 1–9)
    - Range of resistance of direct contact between the alarm loop and the carrier pipe ..... 1  $\Omega$ –450 k $\Omega$
    - Accuracy of detection of the location of a leak (moisture) or direct contact of the alarm wire with the carrier pipe .....  $\pm 2$  m  $\pm 0.2\%$  of length  
of the monitored district heating pipeline
    - Measuring accuracy ..... 1 m
    - ..... Measuring range for voltage between the sensor wire and the steel pipe ..... 0–14 V
      - Accuracy of voltage measurement .....  $\pm 1\%$  of the measured value
  7. Contents and meaning of text messages and symbols
    - Symbols of measurement channels (sections of the district heating pipeline) ..... 1;2
    - Symbol of the level of polyurethane insulation moisture content ..... MH
    - Polyurethane insulation resistance is greater than 200 M $\Omega$  ..... Sucho (Dry)
    - Symbol of district heating pipeline section length ..... L
    - Symbol of leak (moisture) ..... W
    - Symbol of direct contact between the wire of the sensor loop and the carrier pipe ..... C
    - Symbol of the unit of length (metre) ..... m
    - ..... Voltage unit symbol ..... V
    - No connection of the instrument to the carrier pipe ..... Dołącz Rurę (Connect pipe)
    - Measuring range exceeded for the measurement of district heating pipeline section length ..... L>Lmax
    - Electrical break in the sensor loop ..... Przerwa (Break)
  8. Method of transmitting information to the data acquisition system:
    - status of contacts (closed/open) of the ALARM connector
    - LPS-RS232 digital data transmission module
    - LPS-MBus digital data transmission module
    - LPS-Modbus or TRACON 1.2 (integration with CONTROL) digital data transmission module
    - LPS-GSM external radio data transmission module
  9. Supply voltage ..... 230 V 50 Hz
  10. Operating temperature range ..... 0 to +50°C
  11. Relative humidity ..... up to 80%
  11. Housing protection rating ..... IP65
  12. Instrument dimensions ..... 210x200x120
- <sup>1</sup> Accuracy of the measurement of district heating pipeline section length depends primarily on the resistance of the NiCr8020 wire per linear metre (manufacturing tolerance).