

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

LPS-2i



USER MANUAL

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General

The LPS-2i instrument is designed to monitor 2 sections of a preinsulated district heating network with a pulse alarm system. The measurement cycle includes measurements of polyurethane insulation resistance, sensor loop resistance, voltage between the sensor wire and the carrier pipe and self-calibration of the instrument. **The maximum current for all measurement types (excluding voltage measurement) is 1 mA.** 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 16 character spaces. Every line is allocated to a single measurement channel (one sensor loop). Additionally, faults are indicated by a red LED. The user can set the threshold of polyurethane insulation resistance below which the device will indicate a fault. The selected value is displayed on the screen immediately after the device is connected to power supply.

Specifications of the instrument are included in section 5, “Technical specifications”, of this manual.

1. Comments to the technical specifications of the LPS-2i instrument

The technical requirements for pulse alarm systems specify the minimum polyurethane insulation resistance for the maximum length of the sensor loop (section of the district heating network). For shorter sections, this value should be determined using the following formula:

$$R = \frac{R_{\min}}{L / L_{\max}}$$

R [MΩ]	– smallest permissible polyurethane insulation resistance for a section of the district heating network with length $L \neq L_{\max}$
R_{\min} [MΩ]	– minimum polyurethane insulation resistance specified in the technical requirements for maximum district heating network section length L_{\max}
L [km]	– length of the monitored district heating network section, $L \neq L_{\max}$
L_{\max} [km]	– maximum length of the section of a district heating network with a pulse alarm system specified in the technical requirements.

Indications of the instrument and the specified formula may be used in the construction and potential extension of the district heating network. The instrument can be used to determine polyurethane insulation resistance so that the resultant resistance is greater than the minimum resistance specified in the technical requirements for the alarm system.

The wide range of measured polyurethane insulation resistance enables fairly accurate monitoring of the rate and direction of changes of moisture between the carrier pipe and the casing pipe. This helps in distinguishing a leak from moisture trapped in the fittings of the district heating network. It can also be used to estimate when to commence repair works.

Interpretation of “ $L > L_{\max}$ ” and “PRZERWA” (BREAK) messages

As indicated by the technical specifications of the instrument, the $L > L_{\max}$ message appears when the measured resistance of the alarm loop is within the range of $350 \Omega \div 100 \text{ k}\Omega$. The lower limit corresponds to a sensor loop with a length of over 14 500 m and characteristic impedance of

	2
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0.012 Ω /m. 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 “ $L > L_{max}$ ” message. In the second of the specified cases, the instrument will indicate relatively low values of polyurethane insulation resistance.

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 is characterised by a relatively low resistance measured between the carrier pipe and the alarm loop wire. Existence of moisture is indicated by the presence of galvanic voltage. It is important for the persons who monitor the district heating network 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.

2. Description of the operating environment of the LPS-2i 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.

3. Maintenance of the LPS-2i 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.

4. Disposal of the LPS-2i instrument

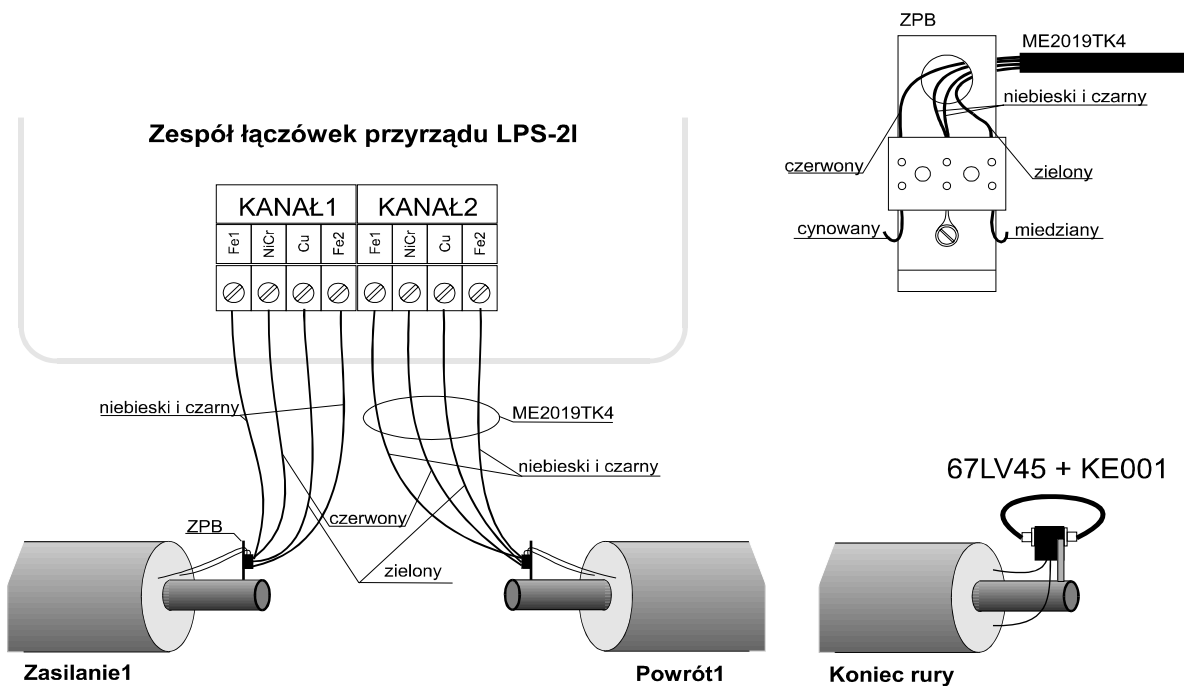
In accordance with the Act of 29/07/2005 on waste electrical and electronic equipment (Journal of Laws, item 1495), the following symbol has been placed on the instrument:



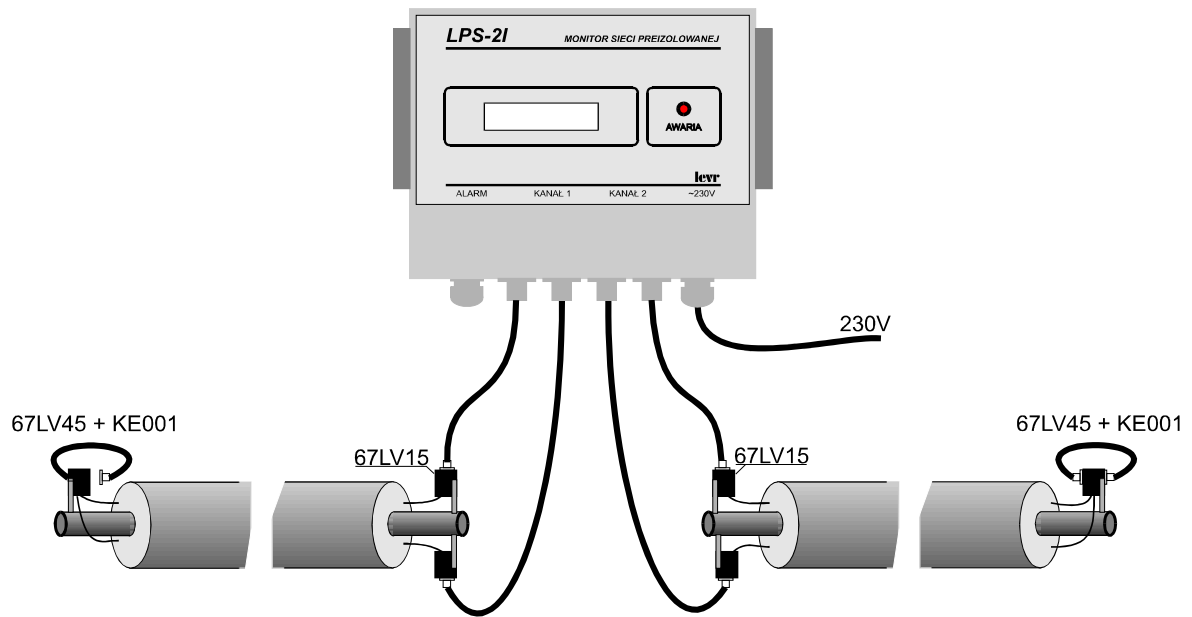
This symbol means that it is prohibited to discard waste equipment together with any other waste. Users of equipment marked with this symbol are obliged to transfer it to dedicated companies that collect waste equipment. These obligations arise from Articles 35 and 36 of the above-mentioned act.

5. Methods of connection the LPS-2i instrument to the alarm system

Method 1



Method 2



All connections should be made using coaxial cables of the 67LVxx type and 67LV15 and 67LV45 junction boxes. As a last resort, the ends of the copper wires of the alarm system can be directly shorted together.

LPS-2i
(pulse alarm system)

6. TECHNICAL SPECIFICATIONS

1. Number of monitored sections of the preinsulated district heating network.....2
2. Maximum length of monitored sections of the district heating network.....7000 m)¹
3. Method of displaying measurement information.....alphanumeric LCD screen, 2x16 characters,
with backlighting;
red LED with the “AWARIA” (FAULT) description
4. Measurement voltage..... ±15 V
5. Maximum measurement current for all measurement types.....up to 1 mA
6. Polyurethane insulation resistance measuring range0.1 kΩ÷200 MΩ
Polyurethane insulation resistance measuring accuracy.....±5% of the reading ±2 digits
7. Alarm loop resistance measuring range0–350Ω)¹
Measuring resolution.....0.1 Ω
Alarm loop resistance measuring accuracy.....±1% of the measured value
8. District heating network length measuring range0–7000 m)¹
9. Measuring range for voltage between the sensor loop and the carrier pipe.....0–14 V)²
Voltage measurement error.....±1% of the measured value
10. The measuring ranges are indicated by the lighting of the red LED with the “AWARIA” (FAULT) description:
 - Range of settings of leak (moisture) resistance threshold0.1 kΩ–1 MΩ)¹
 - The value is selected using the switch in accordance with the following sequence: 1;2;5.
Examples (high-resistance system): 2 kΩ; 10 kΩ; 500 kΩ.
 - Range of resistance of direct contact between the alarm loop and the carrier pipe.....1 Ω–0.45 MΩ
 - Maximum alarm loop resistance for the “L>Lmax” message< 100 kΩ
 - Minimum alarm loop resistance for the “Przerwa” (Break) message.....≥ 100 kΩ
11. Contents and meaning of text messages and symbols:
 - encoded polyurethane insulation threshold resistanceXY kΩ
 - symbols of measurement channels (sections of the district heating network)..... 1;2
 - polyurethane insulation resistance is greater than 200 MΩ.....Sucho (Dry)
 - symbol of district heating network section resistance.....r
 - symbol of direct contact between the wire of the sensor loop and the carrier pipe.....*
 - symbols of resistance unitsΩ, kΩ, MΩ
 - voltage unit symbol.....V
 - no connection of the instrument to the carrier pipeDołącz Rurę (Connect pipe)
 - measuring range exceeded for the measurement of district heating network section lengthL>Lmax
 - electrical break in the sensor loop.....Przerwa (Break)
12. 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-RTU or TRACON 1.2 (integration with CONTROL) digital data transmission module
 - LPS-GSM external radio data transmission module
11. Operating temperature range0–50°C
12. Relative humidity.....up to 80%
13. Housing protection rating.....IP65
14. Supply voltage.....230 V 50 Hz
15. Instrument dimensions.....210x200x120

¹ Standard settings. The settings are changed in accordance with the requirements specified by the manufacturer of preinsulated pipes. These requirements relate to the maximum length of the district heating network (alarm loop length) and permissible minimum polyurethane insulation resistance. Maximum loop length and minimum polyurethane insulation resistance are programmed, and they can be greater than indicated in the TECHNICAL SPECIFICATIONS.

² Voltage may be generated by various sources, e.g. welding machine. It may also be galvanic voltage, where there is moisture between the sensor wire and the carrier pipe.