

**OPERATION**  
**MANUAL**

**Paired Temperature Sensors  
for Heating Systems**



Edition 03.2008



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## Paired Temperature Sensors for Heating Systems

The following Operation Manual provides information of temperature sensors suitable for application with heat meters:

- Head sensors: TOP-216 and TOP-226
- Cable sensors: TOP-172 and TOP-L0384.

These sensors are manufactured in compliance with PN-EN 60751:1997, PN-EN 1434-2:2001 and with the requirements of Ordinance by the Minister of Economy of 13 February 2004 regarding meteorological requirements of heat meters for water.

Compatibility with the mentioned norms and requirements is confirmed by the decision of the President of the Central Office of Measures (GUM) issuing type approval for the paired sensors acc. to the table below:

No.	Sensor type	Type approval	Decision No.	Date of issue	Period of validity
1	TOP-172	PLT 05304	ZT 353/2005	30.12.2005	30.12.2015
2	TOPE-L0384	PLT 05304	ZT 354/2005	30.12.2005	30.12.2015
3	TOP-216	RPT 03 37	ZT 141/2003* ZZT 18/2005** ZZT 64/2005***	12.03.2003 4.04.2005 30.12.2005	12.03.2013
4	TOP-226	RPT 03 38	ZT 142/2003* ZZT 19/2005** ZZT 65/2005***	12.03.2003 4.04.2005 30.12.2005	12.03.2013

\* decision bestowing type approval for LIMATHERM Sp. z o.o.

\*\* decision submitting the type approval for LIMATHERM SENSOR Sp. z o.o.

\*\*\* decision changing the legal basis and extending the period of validity

### ***1. Construction and principle of operation***

The basic element of temperature sensor is a resistor extended to terminal block, placed in the aluminium connection head, with the aid of silver plated copper wire in ceramic insulators or with the aid of copper stranded wire in double silicone insulation. Resistor is placed in acid-resistant steel or copper thermowell (TOP-172), joined tightly with the connection head or squeezed on the cable insulation. For Pt100, Pt500 or Pt1000 head sensors 2-, 3-, or 4-wire configurations are possible.

In case of cable sensors, signal from Pt100 or Pt500 resistor is sent through 2-wire configuration.

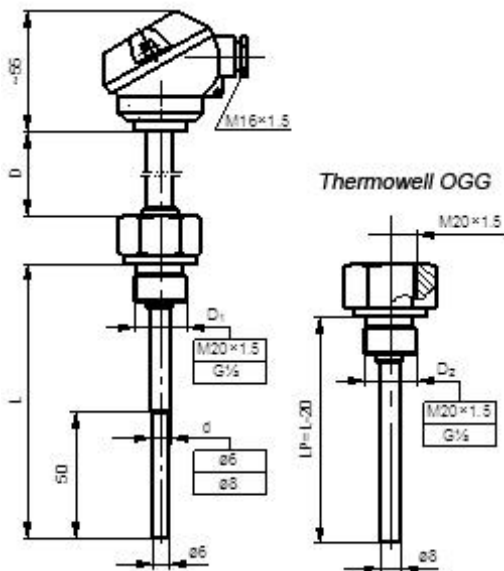
The sensors are installed in the following way:

- In a special mounting seat, with a moveable threaded connector – a part of TOPE-L0384 sensor
- In additional thermowell with thread - mounted with side screw (TOP-226, TOP-172),

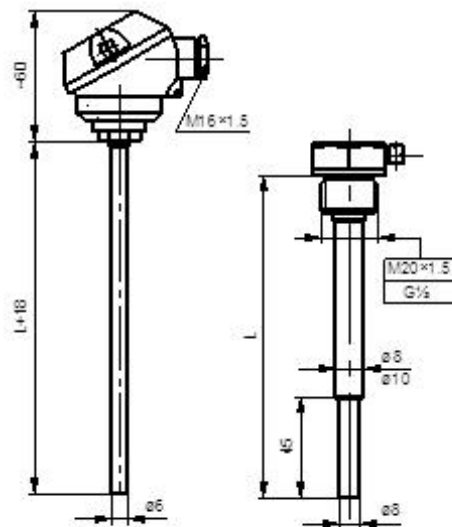
- through direct screwing (TOP-216).

## 2. Sensor types

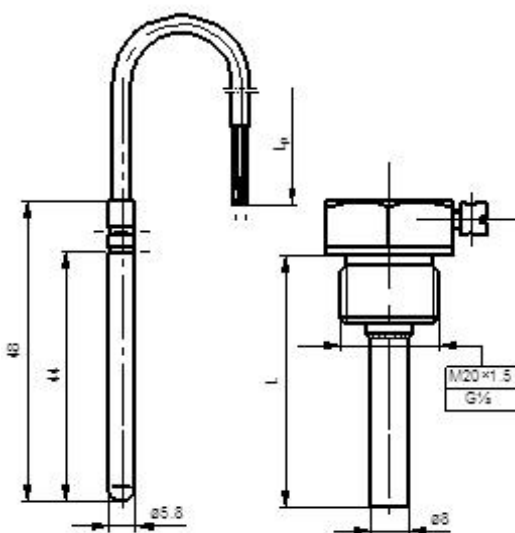
TOP-216



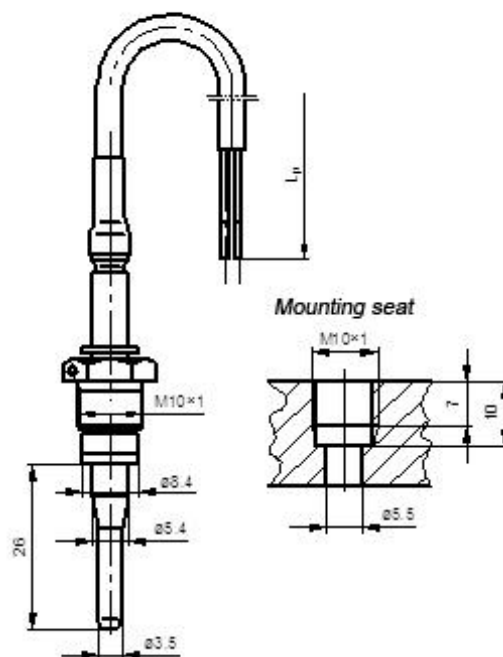
TOP-226



TOP-172



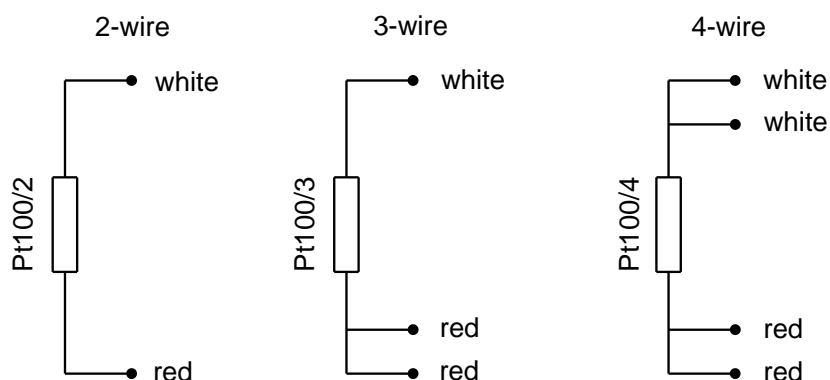
TOPE-L0384



**Specification:**

Resistor type (head sensors).....1 x Pt100, 500, 1000, class B acc. to PN-EN 60751:1997  
(cable sensors).....1 x Pt100, 500, class B acc. to PN-EN 60751:1997  
Connection type.....2-wire for cable sensors  
                              2-, 3-, 4-wire for head sensors  
Measuring range.....0...150°C  
Range of temperature difference.....3...150°C  
Acceptable error of sensor pair [%]..... $E_{T_d} = \pm (0,5 + 9/\Delta t)$ , where  $\Delta t$  - temperature difference  
Max. temperature of head operating...100°C  
Degree of protection .....IP54  
Cable gland dimensions .....M16x1,5  
Cable .....2x0,25 mm<sup>2</sup> with double silicone insulation  
  Standard length: 3 m

Type	Sheath material	L covered by the decision	Installation
TOP-172	Sensor – brass Thermowell – acid-resistant steel	30÷125 mm, 5 mm intervals	In additional thermowell
TOP-L0384	Stainless steel	27	Without additional thermowell, in special seat
TOP-216	Stainless steel	70÷700 mm, 5 mm intervals	Directly or in additional thermowell
TOP-226	Stainless steel	70÷700 mm, 5 mm intervals	In additional thermowell

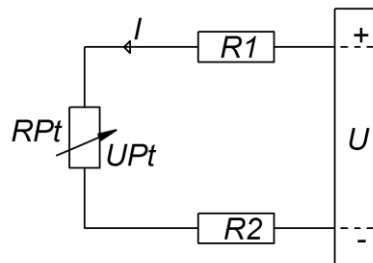
**3. Designation of the connection terminals**

#### 4. Sensor connection

- 2-wire connection

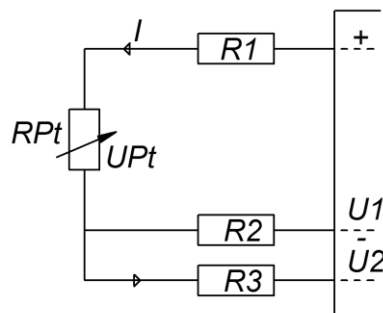
Wire cross-section	Max. wire length
0,22	2,5
0,25	3,0
0,50	5,0
0,75	7,5
1,00	10,0
1,50	15,0

2-wire connection is used when a high accuracy is not required. Wire resistance  $R_1 + R_2$  introduces an error  $2,6^{\circ}\text{C}$  for Pt100 per one  $\Omega$  of a wire; about  $0,26^{\circ}\text{C}$  for Pt 1000 per one  $\Omega$  of a wire.



- 3-wire connection

Connecting the resistor with 3-wire configuration is the most popular in industry because of the automatic compensation of resistance changes depending on a temperature and the compensation of wire resistance.



Connecting wires must have identical resistance  $R_1=R_2=R_3$ .

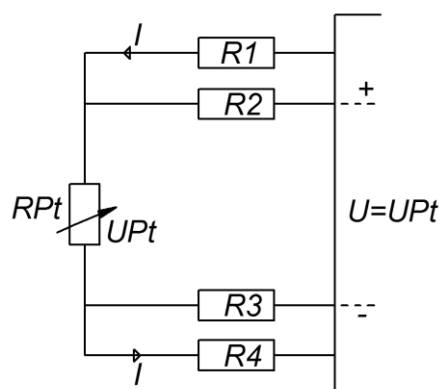
Examples of errors for 3-wire Pt 100 and Pt 1000 for different  $0.1\Omega$  i  $1\Omega$  are provided in the table below.

	<i>Difference of wire resistance</i>	
	<i><math>0.1\Omega</math></i>	<i><math>1\Omega</math></i>
Pt100	$0.26^\circ\text{C}$	$2.6^\circ\text{C}$
Pt1000	$0.03^\circ\text{C}$	$0.26^\circ\text{C}$

For practical reasons resistance of single wire of an input circuit shall not be higher than  $11\ \Omega$ .

- 4-wire connection

This connection is used in case of very high accuracy. In case of 4-wire configuration the influence of resistance is eliminated.



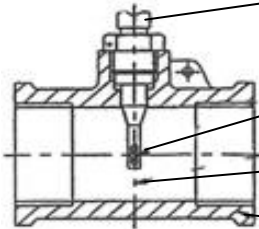
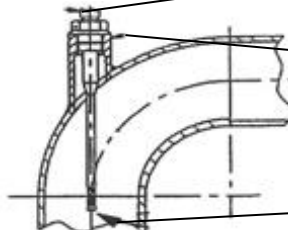
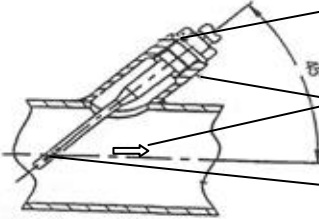
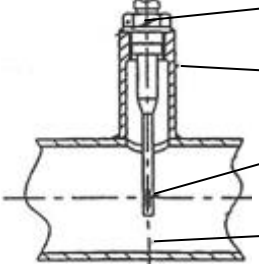
$$R_1=R_2=R_3=R_4$$

For practical reasons resistance of single wire of an input circuit shall not be higher than  $11\ \Omega$ .

### **5. Packing, storing and transportation instructions**

For the purpose of transportation temperature sensors should be properly packed (as multipacks and/or individual packages) in order to avoid any damage. They should be stored indoor in their original packages; the indoor air must be free of vapours and/or aggressive substances, the indoor air must range from  $+5^\circ\text{C}$  to  $50^\circ\text{C}$ , and the relative humidity must not exceed 85%. Whilst being transported, the sensors must be protected against shifting inside the packaging. Temperature sensors can be transported by air, by sea and road providing that the direct influence of atmospheric agents is eliminated. Transport conditions acc. to PN-81/M-42009.

## 6. Examples of sensor installation:

SENSOR INSTALLATION TYPE	PIPE DIMENSIONS	RECOMMENDATIONS
<p>A</p> <p>IN THREADED THREE-WAY PIPE</p>	<p>DN15 DN20 DN25</p>	 <p>Only for DS sensor type</p> <p>Resistor immersed to the three-way pipe axis or deeper</p> <p>Sensor axis perpendicular to the three-way pipe axis and on the same level</p> <p>Three-way pipe, see fig. A.7</p>
<p>B</p> <p>IN ELBOW</p>	<p>≤DN50</p>	 <p>DL sensor type or outer sheath plus PL sensor type</p> <p>Connector, see fig. A.6b</p> <p>Flow direction</p> <p>Sensor axis is the same as pipe axis</p>
<p>C</p> <p>SLANTED SENSOR</p>	<p>≤DN50</p>	 <p>DL sensor type or outer sheath plus PL sensor type</p> <p>Flow direction</p> <p>Connector, see fig. A.6b</p> <p>Resistor immersed to the pipe axis or deeper</p>
<p>D</p> <p>PERPENDICULAR SENSOR</p>	<p>From DN65 to DN250</p>	 <p>DL sensor type or outer sheath plus PL sensor type</p> <p>Connector, see fig. A.6b</p> <p>Resistor immersed to the pipe axis or deeper</p> <p>Sensor axis perpendicular to the pipe axis and on the same level.</p>

## 7. Warranty

- The Manufacturer provides the original purchaser of the sensor (sensors) with a twelve (12) month warranty and necessary service; for this period, the Manufacturer guarantees the uninterrupted and error free functioning of sensors;
- The twelve (12) month warranty begins on the day of purchase;
- The warranty voids in the case of any changes in and repairs of the instrument;

- This warranty does not cover damages resulting from improper transportation, nor defects and errors caused by bad handling or misuse which does not comply with the provisions as set forth in this Operation Manual.