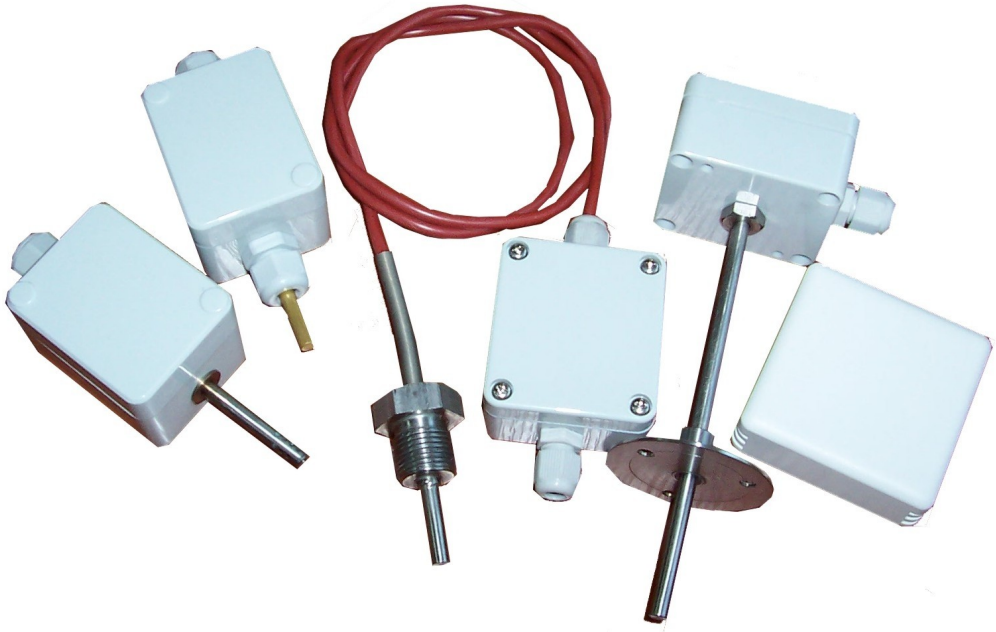
OPERATION MANUAL	**Temperature sensors for air conditioning and ventilating systems**



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Temperature Sensors for Air Conditioning & Ventilating Systems

In this Operation Manual, there are described series of temperature sensors usually applied to air conditioning and ventilating systems, such as:
TO...O-831, TO...K-832, TO...O-833, TOPZ-840, TO...K-849, TO...K-850, TOPM-5, TOPW-1, PTRW-1, TOP-565.

The sensors described are placed in an aesthetically pleasing plastic housing or in a metallic sheath with a connection head of aluminium; they have either a resistance of a 4...20 mA current output.

The sensors represented in this Operation Manual comply with the Polish Standard PN-EN 60751.

1. Construction and principle of operation

A Printed-Circuit Resistor is a principal element of the sensors represented in this Manual. It is placed in a plastic casing or extended by wires; the whole device is additionally placed in a housing connected with casing or connection head. Instead of a terminal strip and terminal block, a transmitter can be mounted to converse a resistance signal into a 4..20 mA current signal. The sensors of these series can be mounted directly on the wall of the unit (air conditioner or fan) or can be fixed in ventilating ducts using threaded and flanged holders/fixtures.

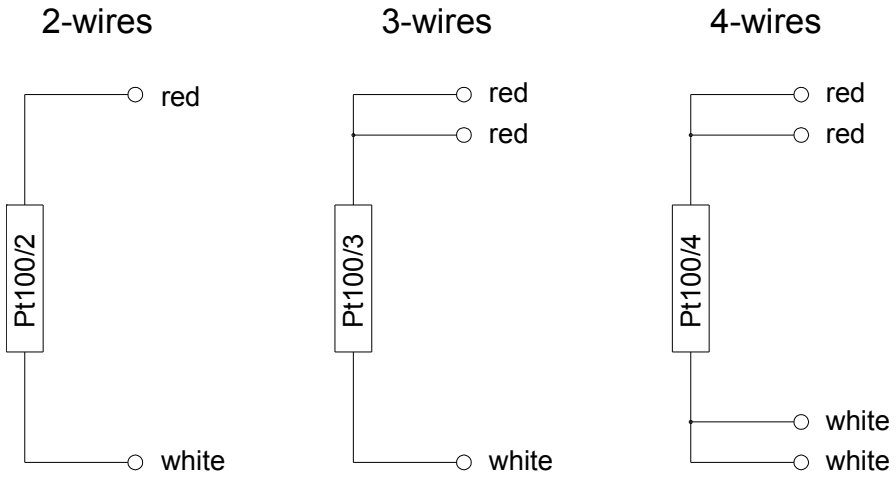
The measuring element of sensor responds to a change in temperature of a medium by changing the resistance of the measuring element. The changes correspond to their thermometric characteristics as defined in relevant engineering standards.

2. Specification:

Resistor .....1 x Pt 100; 500; 1000 Class A, B according to PN-EN 60751
1 x Ni 100, 1000 according to PN-83/M-53849
Connection Line….....2-, 3-, and 4-wires
Measurement Range.....as set forth in pertinent Catalogue Cards
Allowable Working Temperature of Casing ..... from -40 to +60 ºC (ABS)
from -40 to +100 ºC (MA)
Protection Degree provided by the case .....IP- 54 as for MA head
IP-67 as for ABS casing
Cable Gland…… .....PG-9 as for MA head
PG 7 as for ABS casing
Transmitters.....APAQ-HRF; LTT-03B; LTT-03J; LTT-01
FLEX TOP 2201; FLEX TOP 2211; TxBlock

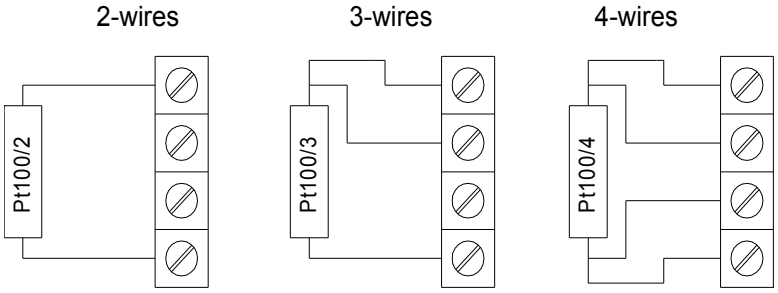
3. Connecting the sensors – diagram of wiring

terminal block – designation of terminal clamps:



with 2 wires, with 3 wires, with 4 wires czerwony – red biały – white

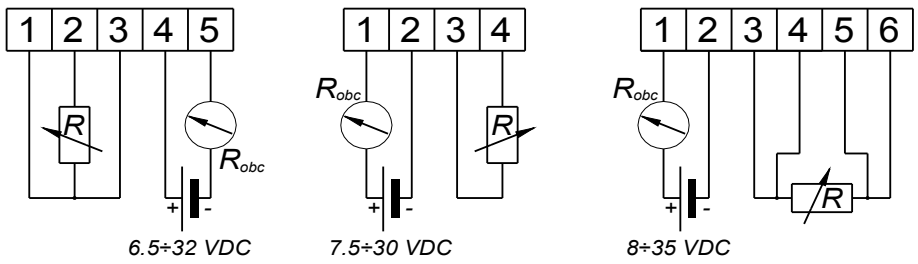
printed circuit:



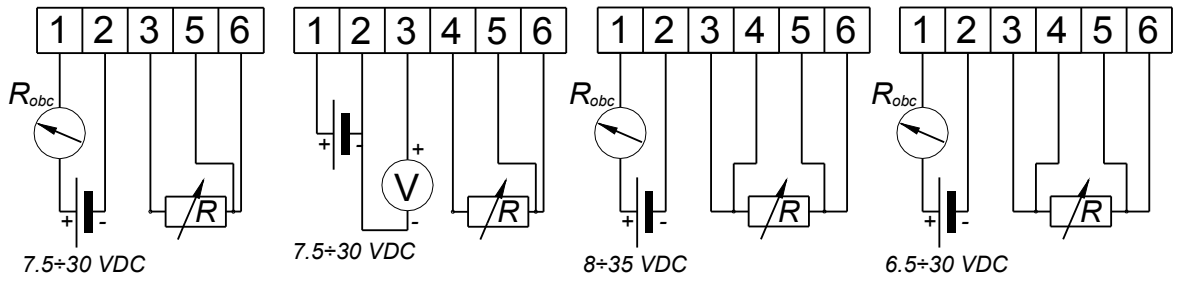
with 2 wires with 3 wires with 4 wires

- transmitters 4-20 mA

APAQ-HRF LTT-03J LTT-01



LTT-03B LTT-03BU FLEX TOP 2201 FLEX TOP 2211



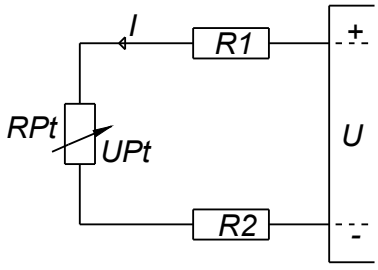
4. Arranging Connection Line

2-wire connection line

Resistance of 1 m wire:

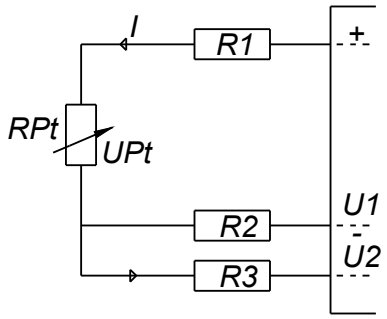
2x0.22 mm² - 0.175 Ω/m
2x0.25 mm² - 0.165 Ω/m
2x0.35 mm² - 0.105 Ω/m
2x0.50 mm² - 0.036 Ω/m

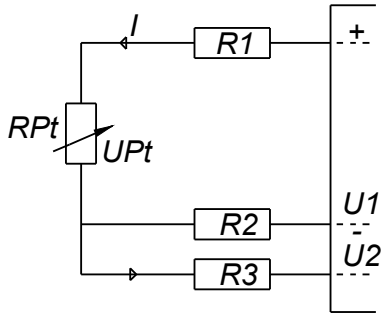
A sensor's 2-wire connection line is applied when it is sufficient to obtain temperature measurements with an average (not high) accuracy. The resistance of R1 + R2 connection line causes the following error in the temperature measurement: as for Pt 100, the error is about 2.6 ºC per one Ω of the wire resistance, and as for Pt 1000: 0.26°C per one Ω of the wire resistance.



3-wire connection line

A 3-wire connection line between the resistor and devices is the most commonly used connection line in industrial applications since temperature-depending changes in the resistance are automatically compensated, and the resistance of the connection line is also compensated.



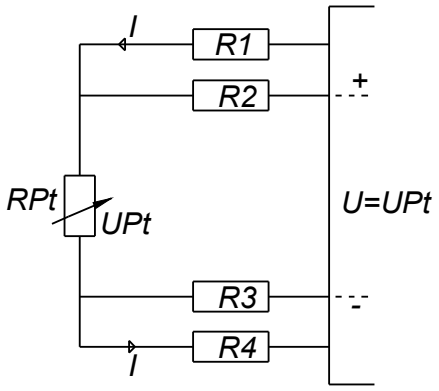


The resistance of all the connection wires must be identical, i.e. $R_1=R_2=R_3$. In the Table below, there are shown examples of errors caused by the resistance difference of 0.1Ω and of 1.0 Ω between the wires of a 3-wire connection line for Pt 100 and Pt 1000.

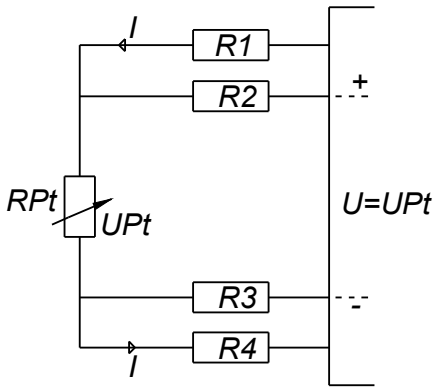
	Difference in the resistance of wires	
	0.1Ω	***1Ω***
Pt100	0.26°C	2.6°C
Pt1000	0.03°C	0.26°C

For practical reasons, the resistance of a single wire of RTD input circuit not be higher than 11 Ω.

4-wire connection line



This connection line is used when a very high accuracy of temperature measurements is required. In the case of a 4-wire connection line, the impact of resistor's wires resistance is totally eliminated.



$R_1=R_2=R_3=R_4$

For practical reasons, the resistance of a single wire input circuit of RTD should not be higher than 11 Ω.

5. Recommended outer diameters of cables for cable glands

Cable Gland type Pg 9 cable diameter /Ø4-6 mm/
Cable gland type Pg 7 cable diameter /Ø4-6 mm/

6. Packing and storing instructions, transportation

The sensors to be transported must always be properly packed in order to avoid any damage during the transportation. It is recommended to place the sensors to be transported either in one general, shared package or in individual unit packages. The sensors should be stored in their packages in indoor storage spaces: the indoor air must contain **no traces of vapours and/or aggressive substances**, the indoor air temperatures must range from +5 ºC to 50 ºC, and the relative humidity **must not exceed 85%**. Whilst being transported, the sensors must be protected against shifting inside the packagings. The sensors manufactured by 'Limatherm Sensor' can be transported using maritime, rail, road, or air modes of transport, in all cased provided that the direct impact of

atmospheric factors on the sensors during the transportation it totally eliminated. The detailed transportation conditions are specified in the Polish Standard PN-81/M-42009.

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;
- Also, the Manufacturer provides the original purchaser of the sensors with a post-warranty service;
- The warranty voids in the case of any changes in and repairs of the instrument performed by the user;
- 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.

8. Recommended examples of assembling the sensors

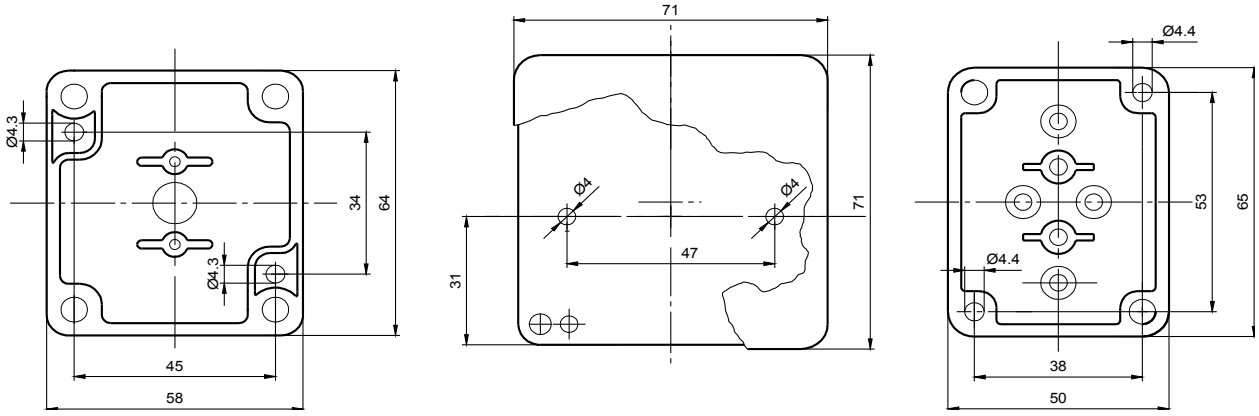


Fig. 2. Dimension and spacing of mounting holes in casings of sensors to be fixed directly on a wall of a room/unit