



ALF SENSOR SPÓŁKA JAWNA



INSTRUCTION MANUAL
version 2.8

**RESISTANCE THERMOMETER
WITH CONNECTION HEAD**

TOP-PD-03-.../Exi
TOP-PKG-04-.../Exi
TOP-PKG-05-.../Exi
TOP-PF-06-.../Exi
TOP-W-12-.../Exi
TOP-Pm-26-.../Exi
TOP-PKGm-27-.../Exi
TOP-PGm-28-.../Exi
TOP-PF/DN-55-.../Exi
TOP-PD-71-.../Exi
TOP-PKG-79-.../Exi
TOP-PD-86-.../Exi
TOP-SpPKG-88-.../Exi
TOP-PKG-141-.../Exi
TOP-PKG-158-.../Exi
TOP-PKG-181-.../Exi
TOP-PF-194-.../Exi

1. CATALOGUE CARD

1.1 Technical parameters

1.2. Ordering information

(Space for a thermometer catalogue card)

2. APPLICATION

Resistance thermometers with connection head type: TOP-PD, TOP-PKG, TOP-PF, TOP-W has been designed, in connection with adequate instruments, for temperature measurement, record or control, in various machinery, pipelines, containers – both gases and liquids. Resistance thermometers have Al alloy connection heads, with terminal block inserted, for collaboration instrument connection. Other version offered is a thermometer with transmitter inserted, instead of terminal block. Construction and applied materials allow vibration environments applications and operation under high temperature.

In intrinsic safe version resistance thermometers type TOP-.../Exi can be installed in explosion danger zone and have designation Ex II 1/2 G Exia IIC T6 and Ex II 1D Ex iaD 20 T85°C–certification KDB 04 ATEX 037X. In zone 0 shall be only outer protection tube of sensor. A connection head shall be placed in zone 1 or 2 only. A limit between zones is a process connection (threaded or flanged) mounted on outer protection tube.

Thermometers should be installed following general instructions and remarks issued in paragraph MOUNTING.

3. PRINCIPLE OF OPERATION

Thermometers measuring elements are resistors. They respond to medium temperature change (resistance change), which comply with the measuring thermometric characteristics specified in the norm EN60751. Temperature measurement of the medium, where the thermometer is placed, is done by collaborating instruments. A transmitter, inserted in the connection head, is responsible for transforming resistance values into current signal 4-20 mA, proportional to measured temperature.

4. DESIGN

The resistance thermometer consists of a dust and splash-proof connection head, metal protection tube, where a measuring insert type WP-OP-01 or WP-OP-01ds1 is placed. The measuring insert is held down by springs (where holding screws are situated) to outer protection tube bottom, what makes a speed of response faster. Single or double measuring insert is a replaceable part of the thermometer and can be replaced in case of damage.

In intrinsic safe version of the thermometer (certification KDB04ATEX037X), a measuring insert type WP-OP-01 or WP-OP-01ds1 cannot be an independent instrument and has to be positioned in an outer protection tube with connection head.

Measuring inserts can be manufactured as single (one measuring circuit) or double (two measuring circuits). Inner connections between a thermometric resistor and a terminal block can be of 2, 3, or 4 wire configuration.

In basic execution, there is a thermometer resistor inside metal protection tube, with inner cables located in ceramic profile. Everything is fulfilled by quartz sand.

Metal protection tube can be straight, with threaded connection fitting, with flange or of design for high pressure applications. They are made of alloy steel, suitable for particular thermometer operating temperature and environment, where measure is taken.

Using sheathed cable Cu, thermometer resistor is connected with terminal block by this Cu cable, located in mineral pressing insulation made of Al oxide (MgO) and in metal sheath. Connection heads are made of light aluminium alloy or plastic. They are covered by protecting enamel and closed by cover with screw or fast lock.

Cables, connecting thermometer and cooperating instruments, are guided through a connection head using a cable entry.

5. COOPERATIVE INSTRUMENTS

Sensors can cooperate with any instruments adjusted to work with resistance thermometer, for intrinsic safe versions resistance thermometer must cooperate with intrinsic safe circuits. A receiver adjusted to current signal 4-20 mA must be used for resistance thermometers with installed transmitter.

6. EQUIPMENT

Basic equipment of thermometer consists of:

- Instruction manual
- Guarantee card
- Certification ATEX (for intrinsic safe version)
- Declaration of conformity (for intrinsic safe version)

7. TECHNICAL ACCEPTANCE

The approval and authorization for operation by Quality Control Department of manufacturer is done basing on control sensor conformity with standards EN 60079-0; EN 60079-11; EN 61241-11; EN 61241-0

8. GUARANTEE

Manufacturer guarantees proper operation of resistance thermometer and thermocouples under condition of operating instrument according to requirements issued in this instruction manual.

9. STORAGE AND TRANSPORTATION

Temperature sensors should be stored in closed rooms at temperature from +5°C to +50°C and humidity maximum 80%. Transport of goods should be done by canvas cover means of transport.

10. MOUNTING

Generally taking, all thermometers can be mounted in any operating position. Depending on the thermowell type, the places where measurement is to be performed as well as type of medium, the following guidelines should be consider:

- a) Temperature sensors should be mounted (if possible) in easy to access places, where the maintenance, as well as changing of measurement insert is facilitated and unrestricted.
- b) Thermometers of a bigger length (particularly at high temperatures) should be mounted in vertical position, to avoid bending them under their own weight.

- c) Mounting of thermometers in pipeline should be done this way, that temperature resistor is in the pipeline axis.
- d) When mounting thermometers with weld-in thermowells, thermometer should be unscrewed from the thermowell for the welding operation, while inside of the thermowell should be protected against dirt e.g. with a plug.
- e) To reduce meaningfully an error of the sensor immersed in medium, in particularly the error resulting from temperature distribution, e.g. in the pipeline:
 - I. Use sensor of such a length, that the immersed length is bigger than the length of the sensor above the pipeline. It can be done e.g. by a slant mounting of a bigger length sensor.
 - II. A part of thermowell protruding above the pipeline should be provided with thermal insulation,
 - III. When measuring temperature in pipelines with a low flow velocity, to increase the flow velocity necking should be used.

EXAMPLES OF THERMOMETERS MOUNTING

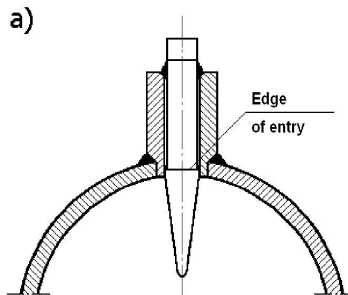


Figure 1 Example of thermometer mounting TYP TOP-W.

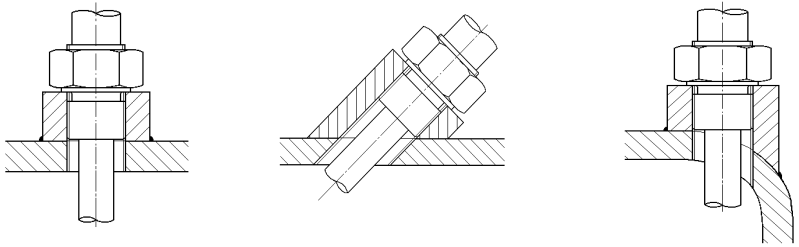


Figure 2 Examples of thermometers mounting TYP TOP-PKG.
 Edge of transition should be a little taken back to the hole.

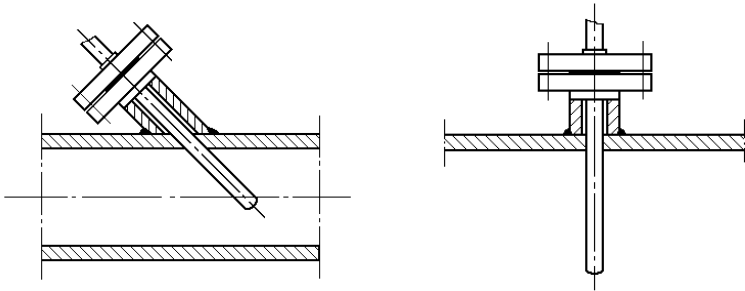


Figure 3 Example of thermometers mounting Type TOP-PF.

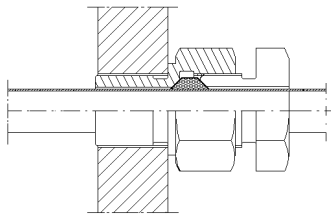


Figure 4 Examples of thermometers mounting TYP TOP-PD
 using straight connector pipe UZG-47.

EXAMPLES OF TEMPERATURE CONNECTION WITH BUILT-IN TRANSMITTER

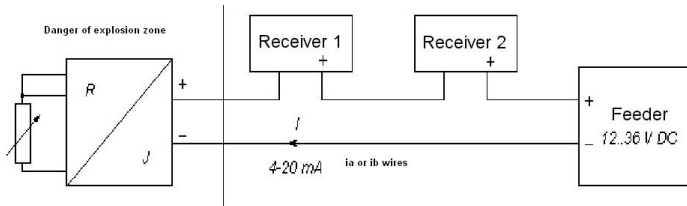


Figure 6 Examples of thermometer connections to receivers and feeders.

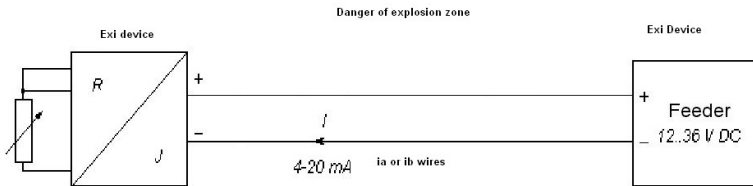


Figure 7 Example of thermometer connection to receivers and feeders in explosive atmosphere.

- f) When mounting explosion-proof sensor, the thermal conduction of the thermowell as well as ambient temperature "Ta" should be taken into consideration, to make provision for a suitable temperature class of the temperature sensor.

| Temperature clas | Max. surface temperature | Combustion temperature |
|------------------|--------------------------|------------------------|
| T1 | 450°C | >450°C |
| T2 | 300°C | >300°C<450°C |
| T3 | 200°C | >200°C<300°C |
| T4 | 135°C | >135°C<200°C |
| T5 | 100°C | >100°C<135°C |
| T6 | 85°C | >85°C<100°C |

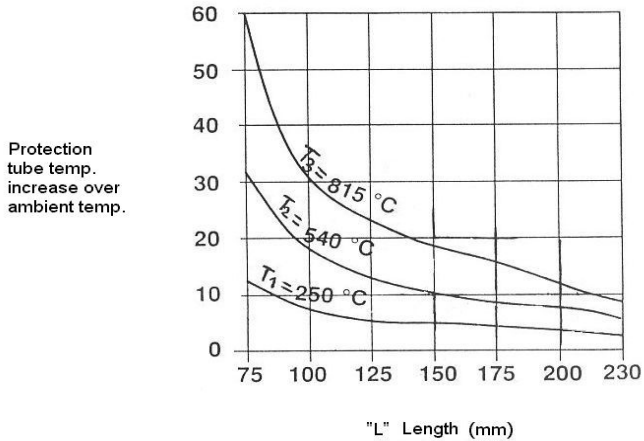


Figure 8 Protection tube temp. increase on its length „L” for a test installation

For the test installation Fig. 8 represents buildup of the sensor thermowell temperature above the ambient temperature "Ta" depending on its length "L" in the compartment $75\text{ mm} < "L" < 230\text{ mm}$ for different temperatures "T" of the measured medium . In the test installation measurements for $T_1 = 250^\circ\text{C}$; $T_2 = 540^\circ\text{C}$; $T_3 = 815^\circ\text{C}$ were performed. It has been assumed that for "L"= 0, the thermowell has got the measured medium temperature "T".

From the Fig. No 8 for "L"=90 mm: temperature of the thermowell will grow 22°C above the ambient temperature. We assume, that "L"=100mm, what will assure a safe increase of the thermowell temperature. Therefore, when we measure e.g. temperature of medium in the pipeline, this should have thermal insulation of minimum thickness 100 mm.

If we measure the temperature sensor with head mounted transmitter, the range should be matched to the ambient temperature T_a for a given temperature class, which is specified in the attached ATEX certificate of transmitter.

E.g. IPAQ – HX Type transmitter, has the following temperature classes:

T4 $-40^{\circ}\text{C} < T_a < 85^{\circ}\text{C}$

T5 $-40^{\circ}\text{C} < T_a < 65^{\circ}\text{C}$

T6 $-40^{\circ}\text{C} < T_a < 50^{\circ}\text{C}$

Mounting of the sensors in explosion risk area should be done in compliance with the operation rules for the explosion-proof devices to EN 60079-14. Electrical devices in explosion risk areas. Selection, installing, maintenance and repair of electrical devices intended to use in explosion risk areas.

g) **Temperature limitations in the presence of flammable dusts.**

The maximum temperature of a temperature sensor surface should not cross two thirds of the ignition temperature of dust mixture with air given in $^{\circ}\text{C}$.

The maximum temperature of the temperature sensor surface, should not cross the value lower by 75 K from the minimum temperature of ignition of layer of a given dust having the thickness from 5 mm to 50 mm. If the layer of dust can built-up on the sensor, having the thickness from 5 mm to 50 mm, then the maximum admissible temperature of the surface should be lowered adequately according to EN 61241-0.

10.1. Electrical parametres for intrinsically safe resistance thermometers

$C_i = 80\text{nF}$; $L_i = 400\mu\text{H}$; $U_i = 10\text{mV}$; $I_i = 10\text{mA}$; $P_i = 0,1\text{W}$

Electrical parameters for thermometers with temperature transmitter are shown in table below.

| Lp. | Transmitter type | Ci (nF) | Li (uH) | Ui (V) | Ii (mA) | Pi (W) |
|-----|-------------------------------|---------|---------|--------|---------|--------|
| 3 | APAQ-HRFX | 30 | 10 | 30 | 100 | 0,7 |
| 4 | IPAQ-HX | 0 | 0 | 30 | 100 | 0,9 |
| 5 | MESO-HX | 1 | 1000 | 30 | 100 | 0,9 |
| 6 | FLEX Top 2201 | 10 | 10 | 28 | 100 | 0,7 |
| 7 | FLEX Top 2211 ; FLEX Top 2221 | 5 | 15 | 30 | 100 | 0,75 |
| 8 | PR 5333B ; PR 5335B | 1 | 10 | 30 | 120 | 0,84 |
| 9 | PR 5334B | 1 | 10 | 28 | 120 | 0,84 |
| 10 | Model 144H | 1 | 10 | 28 | 120 | 0,84 |
| 11 | Model 244 ; Model 644 | 10 | 0 | 30 | 200 | 0,67 |
| 12 | Model 248 | 3,6 | 0 | 30 | 130 | 1 |
| 13 | TMT – 187 ; TMT – 188 | 0 | 0 | 30 | 100 | 0,75 |
| 14 | SEM 210X | 10 | 0 | 30 | 100 | 0,75 |
| 15 | Model 644H | 10 | 0 | 30 | 200 | 0,67 |

11. USE AND MAINTENANCE

When sensors operate according to the catalogue card conditions (vibrations, head operating temp.), they do not need any maintenance treatment. In case of suspicion that sensor do not operate properly, one should place a thermometer or thermocouple end in known temperature and measure its resistance and compare the results with corresponding value included in EN 60751.

When checking a transmitter decade resistor, one should connect a 3-wire line to its input terminals, and the resistance referred to the beginning and end of the measuring range, should be set in compliance with the a.m. standard, and then the output signals compared, that should be 4 mA and 20 mA accordingly.

12. OPERATING INSTRUCTION

12.1. Thermometers type TOP-.../Exi retain „ia” intrinsic safe category only by cooperation with approved intrinsic safe circuits of „ia” category acc. PN-EN 60079.

12.2. In case of cooperation with „ib” category circuits acc. EN 60079, the intrinsic safe category must be lowered to „ib”.

12.3. The maximum thermometer operating temperature depends on the way and place of their over-building. User, after over-building a place of work, should check if maximum outer temperature of thermometer, by maximum temperature measurement, do not exceed approved temperature values for steam and gases, specified in table 1 of the standards EN 60079-0.

FINAL REMARK

In case of any troubles in starting or operation of thermometers, our company will provide you technical information or advices related to the encountered problems.