

1 - GENERAL

1.1 FOREWORD

The wrong choice of a models or a version, as well as the incorrect installation, lead to malfunction and reduce instrument life. Failure to follow the indications given in this manual can cause damage to the instrument, the environment and persons.

1.2 ALLOWED OVERRANGES

Temperature exceeding the working range can be **allowed only for testing proposal** up to the proof temperature. **Continuous** temperature exceeding the (adjustable) "RANGE*" (see fig 1) can be applied to the instrument, provided they are clearly stated in the instrument features (see fig.1, "MAX TEMPERATURE").

The current and voltage values stated in the technical specifications and data plate must **not** be exceeded: transitory overranges can have a destructive effect on the switch.

1.3 TEMPERATURES

The temperature of the instrument is influenced by the environmental and process temperature. Special attention must be taken to avoid the exceeding of the limits specified in table 1 and 2.

For the instrument version TX**B* (stem for direct mounting) the following table is applicable

Table 1 – Temperature conditions

Temp. Classification	Ambient temperature range (Tamb)	Max working temperature (T max.)	Max electrical rating (resistive load)
T6	-50 ... +85 °C	Shall not exceed the maximum temperature specified on the nameplate (see fig.1 item 5).	5A@24V d.c.; 5A@250V a.c. See nameplate of the instrument (electrical rating)
T5			
T4			
T3			
T2			
T1			

For the instrument versions TX**C*, TX**Q*, TX**R* (stem for remote mounting) and TX**S* (helical bulb for ambient temperature) the following table is applicable

Table 2 – Temperature conditions

Temperature Classification	Ambient temperature range (Tamb)	Max electrical rating (resistive load)
T6	-50...+60 °C	5A@24V d.c.; 5A@250V a.c. See nameplate of the instrument (electrical rating)
T5		
T4		
T3		
T2	-50...+85 °C	
T1		

2 - OPERATING PRINCIPLE

The operating principle is based on a pressure measuring element, connected via a capillary tube to a bulb. This system is partially filled with a volatile liquid, the residual free volume being filled by its saturated vapour. In this system a pressure is generated which is a non-linear function of bulb temperature; this pressure acts on a stainless steel diaphragm which applies a force to a stiff disc; this force is directly proportional to the temperature value to which the bulb is submitted and is contrasted by an compression spring charged by a suitable bush. When the force balance point is exceeded, the stiff disc shifts and, by means of a rigid rod, **activates one or two simultaneous release electric microswitches**. The microswitches are of the rapid release type with automatic rearm. When the temperature moves away from the set values, returning towards the normal values, the switch is rearmed.

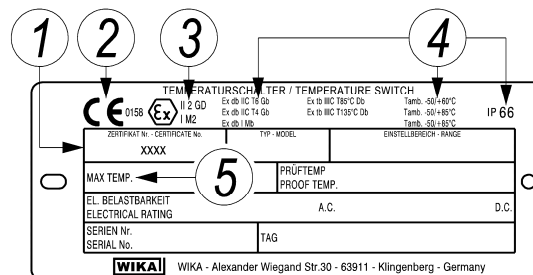
3 - MODEL CODE

See Annex 1

4 - NAMEPLATE AND MARKINGS

The instrument is fitted with a metal plate bearing all its functional characteristics and in case of flameproof or intrinsic safety execution, also the markings prescribed by standard IEC/EN 60079-0. Fig.1 shows the plate mounted on flameproof instruments.

Fig. 1 - Flameproof instruments plate



- 1 Notified body that issued the type certificate and number of said certificate.
- 2 CE marking and identification number of the notified body responsible for production surveillance.
- 3 Apparatus classification according to ATEX 2014/34/EU directive.
- 4 Type of protection and ambient temperature limits of operation.
- 5 Max working temperature

The following table gives the relationship between hazardous areas, ATEX Categories and Equipment Protection Level (EPL) listed on the flameproof instrument nameplate.

Hazardous area		Categories according to 2014/34/EU Directive (ATEX)	EPL
Gas, vapours, fog	Zone 0	1G	Ga
Gas, vapours, fog	Zone 1	2G or 1G	Gb or Ga
Gas, vapours, fog	Zone 2	3G, 2G or 1G	Gc, Gb or Ga
Dust	Zone 20	1D	Da
Dust	Zone 21	2D or 1D	Db or Da
Dust	Zone 22	3D, 2D or 1D	Dc, Db or Da

5 - SPECIAL CONDITIONS FOR SAFE USE (X)

The instrument cannot be repaired (see also troubleshooting). Should the instrument be installed without a junction box require an electric connection suitable for the mode of protection chosen at the free end of the cable.

Should the instrument be installed in mines (Group I) the electrical connection has require to be protected by chemical agents. Therefore a mounting with cable protected by tubing is mandatory.

6 - SET POINT ADJUSTMENT

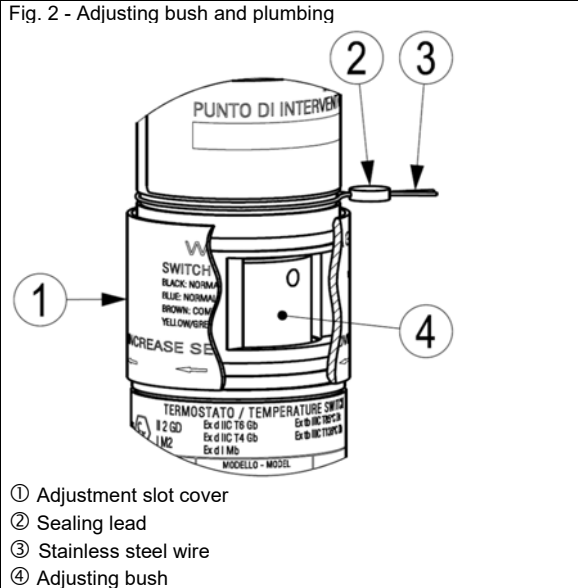
The compression of the spring can be regulated by means of the bush (for adjustment) in such a way that the switch is released when the temperature reaches (either increasing or decreasing) the desired value (set point). The instrument is usually supplied with the switches set at 0°C or at the lowest setting range value if this is higher than 0°C (**factory calibration**).

The instrument is supplied with an adhesive label showing the set point calibration value. With **factory calibration** the values are not indicated on the label as these are temporary and will be modified with the definitive values. Prior to installation the instrument **must be calibrated** and the definitive calibration values written on the label.

If the instrument has been ordered with a **specific calibration**, it is a good rule to check the calibration values marked on the relevant adhesive label, prior to installation.



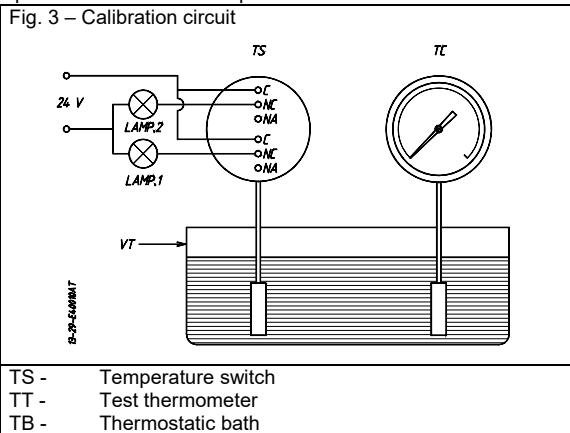
The position of the adjusting bush is given in Fig. 2.



The effect of the sense of rotation of the adjusting bush is shown on the slot cover. Rotate the bush by inserting a 3mm dia. rod or drill into the holes on the bush itself (It recommends using a drill bit on the side of the shank).

7 - SET POINT CALIBRATION

In order to proceed with the calibration and the periodical functional verification of the instrument a suitable **calibration circuit** (Fig. 3) and of an adequate source of heat are required. The test instrument should have a measurement range approximately equal to or slightly wider than the pressure switch range and should have an accuracy consistent with the accuracy required to calibrate the set point.



7.1 PRELIMINARY OPERATIONS

Slide up the adjustment cover (Fig. 2 item 1).

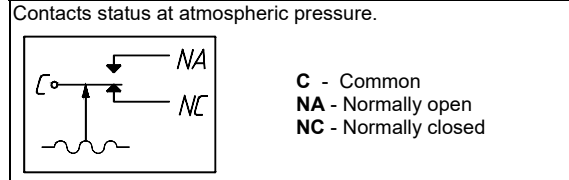
7.2 CALIBRATION CIRCUIT AND OPERATIONS

Prepare the control circuit as indicated in Fig.3.

If the instrument is equipped with two contacts, remember that they are released simultaneously but within the specification tolerance.

The warning lamps should be connected to the terminals NA or NC according to the required contact action.

Fig. 4 – Color of wires and function	
GDN-Internal grounding connection: color yellow/green	
C-Common: color brown NO-Normally open: color blue NC-Normally closed: color black	Micro 1
C-Common: color gray NO-Normally open: color red NC-Normally closed: color white	Micro 2



Connection between C and NA

- If the circuit is open at the working temperature, the instrument **closes** the circuit when the set point is reached with temperature **on rise (closure on rise)**.
- If the circuit is closed at the working temperature, the instrument **opens** the circuit when the set point is reached with temperature **on fall (opening on fall)**.

Connection between C and NC

- If the circuit is closed at the working temperature, the instrument **opens** the circuit when the set point is reached with temperature **on rise (opening on rise)**.
- If the circuit is open at the working temperature, the instrument **closes** the circuit when the set point is reached with temperature **on fall (closure on fall)**.

The temperature switch must be kept in the normal installation position, i.e. with the temperature connection downwards.

Modify the temperature in the circuit up to the desired microswitch set point value.

Using a 3mm dia. rod drill into the holes on the bush (It recommends using a drill bit on the side of the shank).

Adjust its position until the relative lamp turns on (or turns off); then turn it in the opposite direction until the lamp turns off (or on). Slowly turn the bush again until the lamp turns on (or off)

7.3 SET POINT VERIFICATION

Increase the temperature up to the normal working temperature (Tw), wait the stabilization of the temperature. Modify, slowly the temperature up to the set value (Ti) and record the set point value. Write the set point value on the adhesive label.

Note: the verification of the repeatability have to be tested checking the set point (Ti) three times approaching the set point from the same starting point (Tw). The temperature cycles have to be performed slowly.

7.4 FINAL OPERATIONS

Disconnect the instrument from the calibration circuit. Close the adjustment slot by sliding down the slot cover (Fig. 2, 1), then seal with lead the instrument.

Mount on pressure connection the protecting cap supplied with the instrument. It should be definitively removed only **during** the connection steps.



8 - INSTRUMENT PLUMBING

The plumbing (see Fig. 2), aimed as a guarantee against possible tampering of the calibration, can be carried out using a flexible steel wire (2), 1 mm² in section, wound up around the case in the groove purposely provided.

9 - MOUNTING AND CONNECTIONS

9.1 MOUNTING

Mount instruments with capillary either on pipe or surface by means of the proper bracket (see Fig. 9 and 10) or direct on plant. Select a location where possible shocks and temperature variations remain within tolerable limits.

For the instrument with capillary the difference in height between bulb and case have not exceeding two meters (fig 11 and 12 distance h).

9.2 INSTALLATION OF TEMPERATURE SWITCH WITH DIFFERENCE IN HEIGHT BETWEEN BULB AND INSTRUMENT ENCLOSURE GREATER THAN 2 METERS

9.2.1 TEMPERATURE SWITCHES CLASS SAMA II A

Difference in height between bulb and instrument enclosure causes a systematic error of set point calibrated value ("bulb elevation error"). This error can be corrected during calibration using the table attached to our technical instruction **IS-TC.401E**, available on request.



9.2.2 TEMPERATURE SWITCHES CLASS SAMA II C

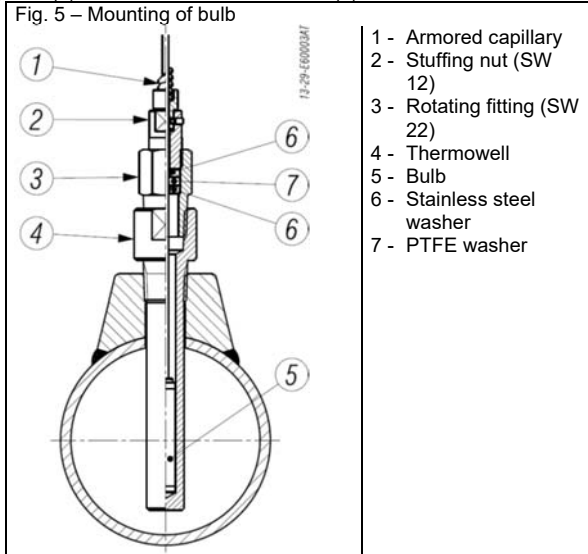


Difference in height between bulb and instrument enclosure when installed **must not exceed** two meters.

With a difference of two meters the set point value fixed during the calibration may be affected by a maximum error of 1.5°C. This error depending on the normal reference temperature, the working temperature and the set point. For further clarification request **IS-TC.401E**.

9.3 BULB AND CAPILLARY

With reference to figure 5 unscrew the fitting (3) from the seal press (2) and slide it off from the bulb (5).



Mount the fitting (3) on the thermowell (4) and tighten it using the appropriate key. Rid the capillary from the armored by pulling the bulb (5) with one hand while holding the stuffing nut with the other (2).

Insert the bulb (5) into the thermowell (4) after covering it with the paste to improve the transmission of heat.

Verify that the bulb touches the bottom.

Insert the PTFE seal with the relative stainless steel washers into the fitting (3).

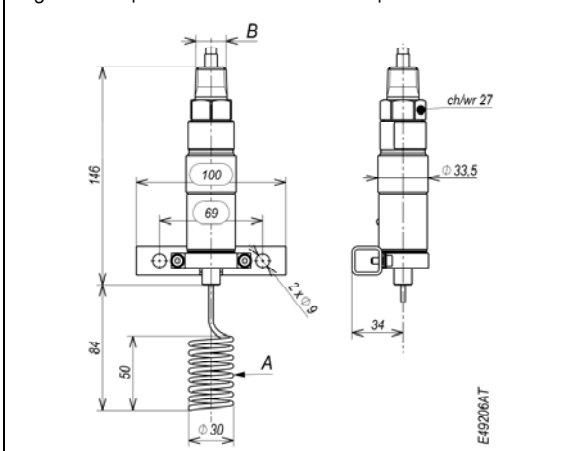
Screw the seal press (2) onto the fitting (3) taking care not to bend the capillary and relative sheath and tighten until the PTFE seal is tight on the capillary tube.

Run the capillary protected by the armor in the established direction, avoiding tight bends, and block using the stainless steel bands. If a large amount of capillary remains this should be rolled up and fixed tightly. The coil must not have a diameter of less than 200 mm.

9.4 TEMPERATURE SWITCHES WITH HELICAL BULB

The temperature switch has to be installed protecting the sensing element (bulb) against heat radiation and accidental bumps .

Fig. 6 - Temperature switch for ambient temperature measurement



9.5 ELECTRICAL CONNECTIONS

It is recommended to carry out the electrical connections according to the applicable standards. In case of flameproof or intrinsic safety instruments see also the standards IEC/EN-60079-14. The following mounting arrangements are possible.

9.5.1 MOUNTING WITH CORD CABLE

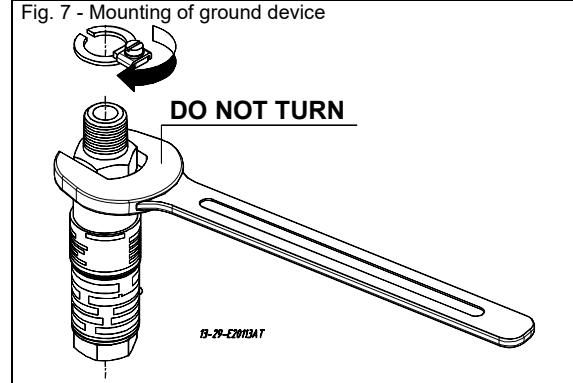
Run the cable so that it cannot be easily damaged (e.g. due to too narrow bends, heat sources) and strain it.

Mount, if provided, the external ground device on the electrical connection of the instrument.

The external ground screw is obligatory for flameproof constructions.



This device is to be threaded on while holding the electrical connection steady with a 27 mm wrench on hex, until it reaches the bottom of the thread (Fig. 7).



9.5.2 MOUNTING WITH CABLE PROTECTED BY FLEXIBLE TUBING

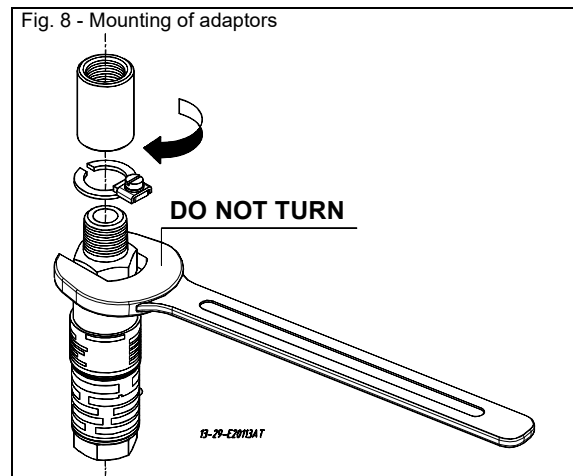
Mount, if provided, the external ground device on the electrical connection of the instrument. This device is to be threaded on, while holding the electrical connection steady with a 27 mm wrench on hex, until it reaches the bottom of the thread (fig. 8).

The external ground screw is obligatory for flameproof constructions.



If the flexible tubing is fitted with a male thread, apply a nipple to the electrical connection.

CAUTION: the adaptor is to be threaded on while holding the electrical connection steady with a 27 mm wrench on hex (fig.8)



9.5.3 MOUNTING WITH CABLE PROTECTED BY METAL TUBING

CAUTION: mounting with cable protected by metal tubing is to be carried out avoiding any torque on the electrical connection while assembling the various fittings.



In order to make easier the instrument removal for check and calibration it is advisable to apply on the instrument a junction box provided with terminals.

CAUTION: accessories used for installation have to be certified according to standards EN or IEC



9.5.4 MOUNTING INSTRUMENT WITH JUNCTION BOX

Versions with junction box have three cable entries, a terminal block with three/six terminals, a terminals identification plate, an internal and external grounding connections.

The terminals are identified as follows:

Identification No.	Function	Micro No.
1	Common	1
2	Normally Open	
3	Normally Closed	
4	Common	2
5	Normally Open	
6	Normally Closed	



Mounting with cable protected in metal tube is to be carried out so as to prevent possible condensate from entering the junction box.

The junction box is to be surface mounted using the bracket supplied with it.



Warning: Instruments with aluminium enclosure. The instrument must be protected against accidental impacts of the housing.

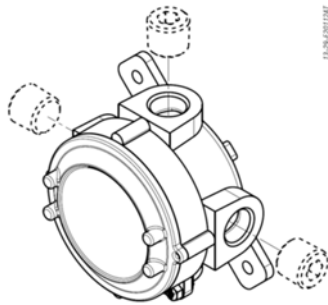
The instrument is supplied with two protective earthing connections, one inside and one outside the enclosure.

The connection provide effective connection of a conductor with a cross-sectional area of at least 4 mm²

CAUTION: fittings used for the electrical connection of the flameproof instruments shall be certified according the IEC or EN standards and shall guarantee instrument degree of protection (IP66)



CAUTION: cable entries not used **must** be plugged and sealed with the plugs provided so as to prevent raining water or other from entering the junction box. **In case of flameproof instruments these plugs, if not correctly mounted and blocked to prevent their removal, do NOT guarantee the mode of protection Ex-d.** Furthermore, in order to guarantee the degree of protection IP65 and the non-loosening of Conduit Seal or packing gland, it is **prescribed** to seal the threads of connection with the same anaerobic sealant used for the plugs. For instance, a sealant like Loctite ® 648 can be applied on the thread of plugs, Conduit Seal or packing gland before screwing them on the box.



9.6 WIRING

The multicore cable used for electric wiring has a 7 mm OD silicone sheat for one contact versions, 8 mm OD for two contact versions. Each wire has a section of 0,5 mm² (20 AWG) and is silicone insulated. Wires ends are factory tinned. The colour of insulator defines the contact function (see Fig. 4 and stampings on slot cover).

Before starting wiring, check that electric lines are not powered.



The instrument is to be grounded **according to applicable electrical codes**. Make use of the internal yellow-green wire and, if the cable is not protected by metal tubing, connect the external screw of the groundig device supplied with the instrument.

Should the instrument be fitted with junction box, make sure that no deposits or wire ends remain inside the box. Tightening and blocking the cover as the wiring of the junction box is finish.



Warning: The intrinsic safety instrument may be equipped with micro switches SPDT or DPDT. All the electrical connection must be part of intrinsically safe circuits. The entry parameters relevant for intrinsic safety are listed on the nameplate of the instrument.

10 - PUTTING INTO OPERATION

The instrument starts operating as soon as is energized.

11 - VISUAL INSPECTION

Periodically check the external condition of the enclosure. In case of flameproof or intrinsic safety instruments, inspections of the electrical installation are to be carried out also according to customer procedures and at least in accordance with Standard IEC/EN-60079-17.

The flameproof and the intrinsic safety instruments, installed in explosive atmospheres for the combustible dust presence, must be periodically cleaned up externally in order to avoid dust accumulating.



12 - FUNCTIONAL VERIFICATION

This will be carried out according to the Customer's control procedures and as minimum yearly if used as an alarm of max temperature.

The instruments can be verified on the plant if installed as illustrated in Fig. 11,12 and 13.

To avoid any risk it is recommended check the set point on site without open the cover of the junction box, without dismount the cable gland, without unplugging the power cable.

The flameproof or intrinsic safety instruments may be checked on site only if apparatus suitable for explosive atmosphere are used.



If this is not the case it is necessary remove the instrument from the plant and carry out the verification in a testing room. If the verification of the set point is performed unplugging the power cable from the terminal block it is recommended power off the instrument to avoid any electrical hazard

WARNING: Instrument models TXA, flameproof.

Before open the cover of the junction box or the cable gland check the absence of explosive atmosphere and check that the instrument is **de energized**



Verification consists in **check the calibration value** and possibly regulating the adjustment bush (see §6) that is separate from the electrical compartment.

13 - STOPPING AND DISMOUNTING

Before starting the following operations, **ensure** that plant and equipment have been put in **conditions** allowing to carry out them safely



Remove the power supply (signal) from the electrical line.

With reference to Fig 5,11 and 12.

Loosen and remove the seal press being careful not to bend the capillary and protective sheath (Fig.4).

Warning: Do not touch the bulb and the parts in contact with the thermowell if hot.



Loosen and remove the fitting (3) then extract the bulb (5) from the thermowell (4) holding it by the capillary tube (1), without bending it.

WARNING: Instrument series TXA, flameproof.

Before open the cover or the cable gland of the junction box check the absence of explosive atmosphere and check that the instrument is **de energized**.



Unscrew the swivel (3) (electric cable tubing).

Remove cover from junction box and disconnect wires from terminals and grounding screws.

Remove the screws fixing the box to the panel (or pipe) and remove the instrument taking care to slide electric conductors out from the case

Mount the cover of the junction box. Insulate and protect cables around, if any. Temporarily plug the thermowell

In case of flameproof or intrinsic safety instruments, it is recommended to follow, at least, the standard IEC/EN-60079-17 for the withdrawal from service of electrical apparatus.



14 - DISPOSAL

The instruments are mainly made of stainless steel and aluminium and therefore, once the electrical parts have been dismantled and the parts coming into contact with fluids which could be harmful to people or to environment have been properly dealt with, they can be scrapped.

15 - TROUBLE SHOOTING



IMPORTANT NOTE: operations involving replacement of essential components must be carried out at our workshop, especially for instruments with flameproof certificate; this is to guarantee the user the total and correct restoration of the product original characteristics.



MALFUNCTION	PROBABLE CAUSE	REMEDY
Set point shift	<ul style="list-style-type: none"> ■ Deposits on thermowell or bulb ■ Filling fluid leakage 	<ul style="list-style-type: none"> ■ Check and clean surfaces ■ Replace the instrument
Slow response	<ul style="list-style-type: none"> ■ Deposits on thermowell or bulb 	<ul style="list-style-type: none"> ■ Check and clean surfaces
No actuation	<ul style="list-style-type: none"> ■ Loosened electrical joints ■ Interrupted or short-circuited electrical line ■ Microswitch contacts damaged ■ Filling fluid leakage 	<ul style="list-style-type: none"> ■ Check all electrical joints ■ Check the conditions of the electrical line ■ Replace the instrument ■ Replace the instrument
Undue actuation	<ul style="list-style-type: none"> ■ Accidental shocks ■ Interrupted or short-circuited electrical line 	<ul style="list-style-type: none"> ■ Modify the mounting ■ Check the conditions of the electrical line

Fig. 9 – Bracket for wall mounting

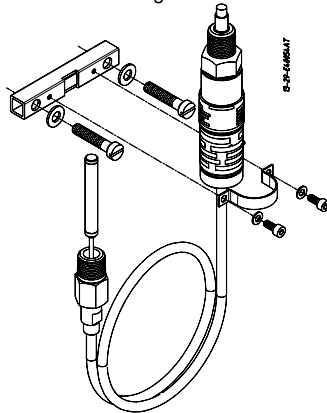


Fig. 10 - Bracket for 2 pipe"

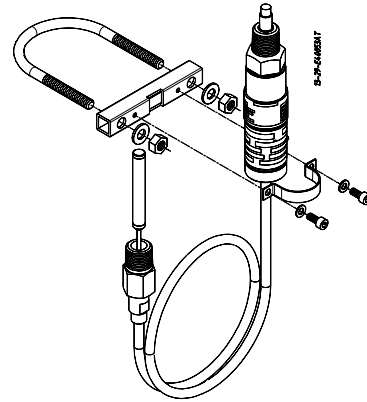


Fig. 11 - Surface or 2" pipe mounting

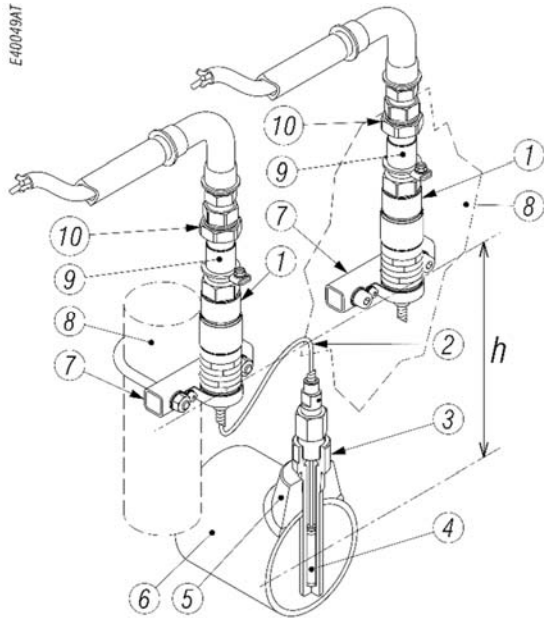
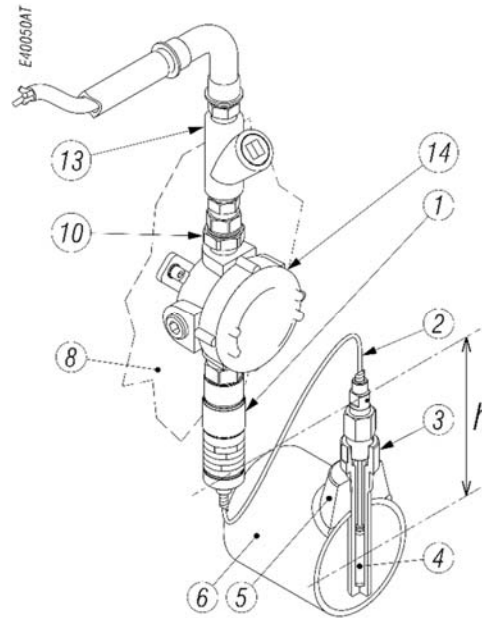


Fig. 12 - Surface mounting with Junction Box



- | | | | |
|-----------------------|-------------------------------|-----------------------------------|------------------|
| 1) Temperature switch | 5) Branch Connection Fittings | 9) Fitting | 13) Conduit Seal |
| 2) Capillary | 6) Process line | 10) Swivel adapter or cable gland | 14) Junction box |
| 3) Thermowell | 7) Mounting bracket | 11) Junction Box (see fig 12) | |
| 4) Bulb | 8) 2" pipe / Surface | 12) Stem (see fig 12) | |

Fig. 13 – Mounting with cord cable

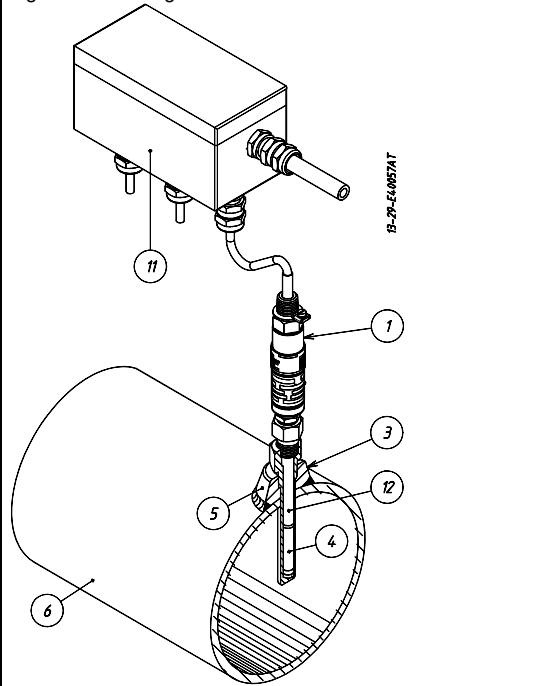


Fig. 14 – Mounting in a junction box

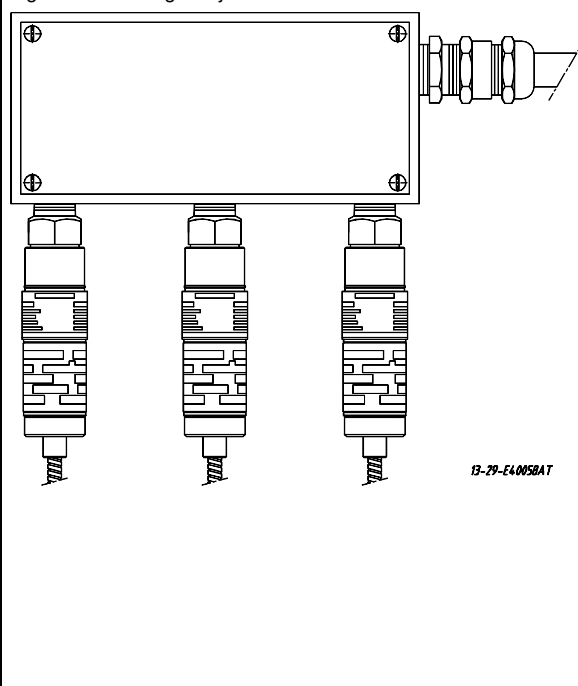
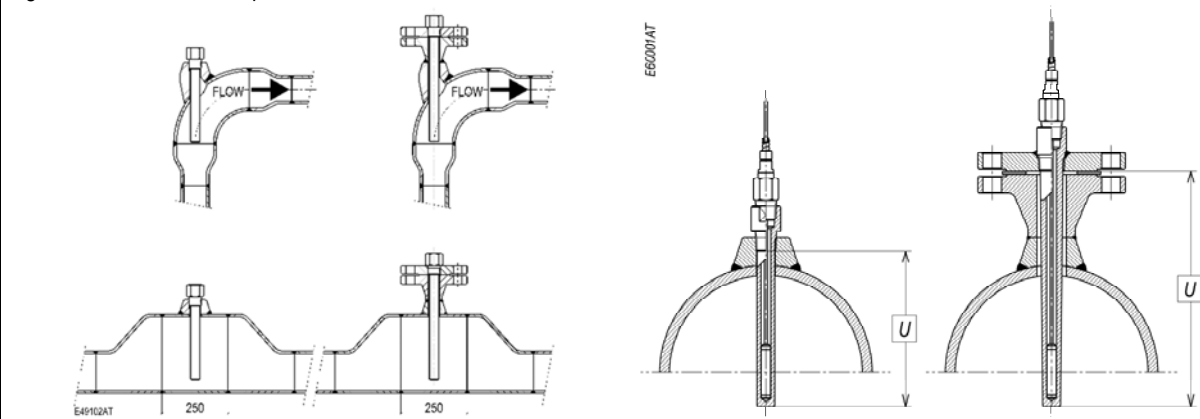


Fig. 15 - Thermowell: examples of installation



Annex 1 – Model code

