WEATHERPROOF AND INTRINSICALLY SAFE: SERIES TCS; FLAMEPROOF: SERIES TCA

Stem type B

Stem type C, Q, R

Y = 125 mm

Stem type C: K = 2m; Y max. = 350mm

Stem type Q: K = 4m; Y max. = 900mm

Stem type R: K = 10m; Y max. = 1800mm

For surface mounting use screws M5

NOTE: dimensions and weights are not binding unless released on certified drawings.

CAUTION
- Before installing, using or carrying out maintenance on the instrument it is necessary to read and understand the indications given in the attached Instruction Manual.
- The instrument must only be installed and maintained by qualified personnel in relation to working with instruments for hazardous areas.
- INSTALLATION IS TO BE CARRIED OUT ONLY AFTER CHECKING THAT INSTRUMENT CHARACTERISTICS ARE CONSISTENT WITH PROCESS AND PLANT REQUIREMENTS.
- The functional features of the instrument and its degree of protection are shown on the identification plate fixed to the case.

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2 - OPERATING PRINCIPLE
3 - MODEL CODE
4 - IDENTIFICATION PLATE AND MARKINGS
5 - SET POINT REGULATION
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7 - INSTRUMENT PLUMBING
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9 - SAFETY INTEGRITY LEVEL (SIL) INSTALLATION REQUIREMENTS
10 - PUTTING INTO OPERATION
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13 - STOPPING AND DISMOUNTING
14 - DISPOSAL
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SAFETY INSTRUCTIONS FOR USE IN HAZARDOUS ATMOSPHERES.

RECOMMENDATIONS FOR PRESSURE SWITCH SAFE USE.

All data, statements and recommendations supplied with this manual are based on information believed by us to be reliable. As the conditions of effective use are beyond our control, our products are sold under the condition that the user himself evaluates such conditions before following our recommendations for the purpose or use foreseen by him.

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1 - GENERAL NOTES

1.1 FOREWORD
The wrong choice of a series or a model, as well as the incorrect installation, lead to malfunction and reduce instrument life. Failure to abide by the indications given in this manual can cause damage to the instrument, the environment and persons.

1.2 ALLOWED OVERRANGE
Temperature exceeding the working range can be occasionally 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 T."). 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 TEMPERATURE
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 model TC**B* (stem for direct mounting) the following table is applicable

<table>
<thead>
<tr>
<th>Temperature classification</th>
<th>Ambient temperature (Tamb)</th>
<th>Max working temperature (T max.)</th>
<th>Max electrical rating (resistive load)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>60 ... +60 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T5</td>
<td>Shall not exceed the maximum temperature specified on the nameplate (see fig.1 item 5).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T4</td>
<td>-60 ... +85 °C</td>
<td>See nameplate of the instrument (electrical rating)</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Temperature classification</th>
<th>Ambient temperature range (Tamb)</th>
<th>Max electrical rating (resistive load)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>-60 ... 60 °C</td>
<td></td>
</tr>
<tr>
<td>T5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 a 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 - IDENTIFICATION PLATE 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.
The warning lamps can either be connected by means of a thimble with a maximum diameter of 2.5 mm to be inserted in the appropriate holes situated beside the terminal screw (see Fig. 2).

**Connection of C and NO terminals**
- If the circuit is open at the working temperature, the switch **closes** the circuit as the temperature **increases** when the desired value is reached.
- If the circuit is closed at the working temperature, the switch **opens** the circuit as the temperature **decreases** when the desired value is reached.

**Connection of C and NC terminals**
- If the circuit is closed at the working temperature, the switch **opens** the circuit as the temperature **increases** when the desired value is reached.
- If the circuit is open at the working temperature, the switch **closes** the circuit as the temperature **decreases** when the desired value is reached.

The temperature switch must be mounted in the normal installation position, i.e. with the stem or the capillary outlet downwards. Avoid forcing the microswitch by hand or with tools. This could affect the instrument functioning. With reference to Fig. 2, free the access to the adjustment bush by loosening the screw (4) which holds the closure plate (2). Increase the temperature in the circuit up to the desired microswitch set point value. Turn the adjustment screw by inserting a 3.0 mm dia. rod into the holes of adjustment screw 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).

**6.3 SET POINT VERIFICATION**
Generate the normal working temperature (Tw) and wait the stabilisation 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 repeatability should be checked verifying for three times the set point (Ti) starting always from the same temperature value (Tw). The temperature cycle should be slowly to give the possibility to record the set point with accuracy.

**6.4 FINAL OPERATIONS**
Disconnect the instrument from the control circuit.
With reference to Fig. 2 close the access to the adjustment bush by rotating the closure plate (2) and tighten the relative screw (4). Tighten the cover into the enclosure and lock it unscrewing the locking screw (6) using an 2.5 mm allen key.
Mount on the cable entry the protection caps supplied with the instrument.

**CAUTION:** the protection cap should only be definitively removed during the connection steps (see § 8).

**7 - INSTRUMENT PLUMBING**
The plumbing, aimed as a guarantee against possible tampering of the calibrations, can be carried our using a flexible steel wire (12) inserted into the holes in the screws (11 and 13) provided for this purpose (see Fig. 2).

**8 - MOUNTING AND CONNECTIONS**

**8.1 MOUNTING**
Surface mount the instrument by means of the holes provided, or pipe mount using the appropriate bracket or mount directly on process in a **vertical position** (with the stem or capillary outlet pointing downwards) (Fig.5,7,12 and Fig.13). In case of surface or panel or rack mounting the instruments can be mounted side by side (see Fig.14).

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

The chosen position must be such that vibrations, the possibility of shocks or temperature changes are within tolerable limits. The above also applies to direct mounting instrument (code B into the model code).

**CAUTION:** Positions other than vertical are allowed provided environmental conditions do not cause condensation to form or water to enter the instrument through the adjustment bush access plate (see Fig. 2).
8.2 INSTALLATION OF TEMPERATURE SWITCH WITH DIFFERENCE IN HEIGHT BETWEEN BULB AND INSTRUMENT ENCLOSURE GREATER THAN 2 METERS

8.2.1 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.

8.2.2 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.

8.3 BULB AND CAPILLARY
With reference to figure 4 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.

8.4 TEMPERATURE SWITCHES WITH CONTACT BULB.
The contact bulb is designed for mounting on pipes with external diameters greater than 50 mm. During the installation must be guaranteed that the contact bulb is in contact with measuring point over its complete length. To minimise errors in measuring of temperature, the insulation of the pipe must be applied where the contact bulb has been mounted. A heat conductive paste can be used to optimize the heat transmission (see fig.5).

8.5 TEMPERATURE SWITCHES WITH HELICAL BULB
The temperature switch has to be installed protecting the sensing element (bulb) against heat radiation and accidental bumps.

8.6 ELECTRICAL CONNECTIONS
It is recommended to carry out the electrical connections according to the applicable standards. In case of flameproof instruments or intrinsic safety instruments see also the Standard IEC/EN-60079-14. If the electrical connection is carried out in a protected tube, it shall be made so that condensate is prevented from entering instrument enclosure.

To guarantee the ingress protection IP66 and prevent loosening of the conduit seal or cable glands, it is prescribed to seal the threads with an anaerobic sealant. For example, use a sealant like Loctite ® 542.

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).

In the case of Gk threads, this is made in accordance with standard UNI-EN 60079-1 (Italian national variant).

It is recommended the installation according Fig. 12 o 13. The installation of the cable gland or swivel adapter should be as per fig.8.
The installation requirements, the useful life and the failure of the switch is discussed in the Failure Modes, Effects and Diagnostic Analysis Report.

10 - PUTTING INTO OPERATION

The instrument comes into operations as soon as the electrical line is energized (see fig.12, 13).

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

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

Flameproof and intrinsic safety instruments can be check 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 de-energize the instrument to avoid any electrical hazard.

WARNING: TCA model Instrument, flameproof.

Before open the cover or the cable gland check the absence of explosive atmosphere and check that the instrument is not energized.

Verification consists in check the calibration value and possibly regulating the adjustment bush (see §6).

13 - STOPPING AND DISMOUNTING

Before proceeding with these operations ensure that the plant or machines have been put into the conditions foreseen to allow these operations.

With reference to figures 4, 12 and 13

Remove the power supply (signal) from the electrical line. 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 model TCA, flameproof.

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

Unscrew the swivel adapter (8) (electrical cable tubing).

Remove the instrument cover and disconnect the electrical cables from the terminal block and earth screws. Remove the screws fixing the case to the panel (or pipe) and remove the instrument, taking care to slide the electrical conductors out from the case. Mount instrument cover. 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 EN-60079-17 for the withdrawal from service of electrical apparatus.

14 - DISPOSAL

The instruments are mainly made of stainless steel and aluminum and therefore, once the electrical parts have been dismantled and the parts being exposed to fluids that could be harmful to people or the environment have been properly dealt with, they can be scrapped.
**INSTRUCTION MANUAL**

**NI-491WE**

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**15 - TROUBLESHOOTING**

**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.

<table>
<thead>
<tr>
<th>MALFUNCTION</th>
<th>PROBABLE CAUSE</th>
<th>REMEDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set point shift</td>
<td>Deposits on thermowell or bulb.</td>
<td>Check and clean surfaces.</td>
</tr>
<tr>
<td></td>
<td>Deposits on thermowell or bulb.</td>
<td>Replace the instrument.</td>
</tr>
<tr>
<td>Slow response</td>
<td>Deposits on thermowell or bulb.</td>
<td>Check and clean surfaces.</td>
</tr>
<tr>
<td></td>
<td>Filling fluid leakage.</td>
<td>Check all electrical joints.</td>
</tr>
<tr>
<td></td>
<td>Deposits on thermowell or bulb.</td>
<td>Replace the instrument.</td>
</tr>
<tr>
<td></td>
<td>Filling fluid leakage.</td>
<td>Replace the instrument.</td>
</tr>
<tr>
<td>No actuation</td>
<td>Loosened electrical joints.</td>
<td>Modify the mounting.</td>
</tr>
<tr>
<td></td>
<td>Interrupted or short-circuited electrical line.</td>
<td>Check the conditions of the electrical line.</td>
</tr>
<tr>
<td></td>
<td>Microswitch contacts damaged.</td>
<td>Replace the instrument.</td>
</tr>
<tr>
<td>Undue actuation</td>
<td>Accidental shocks.</td>
<td>Modify the mounting.</td>
</tr>
<tr>
<td></td>
<td>Interrupted or short-circuited electrical line.</td>
<td>Check the conditions of the electrical line.</td>
</tr>
</tbody>
</table>

**Fig. 10 – Vertical 2” pipe**

**Fig. 11 – Horizontal 2” pipe**

**Fig. 12 – Direct mounting -**

**Fig. 13 - Surface mounting -**

**Fig. 14 – Rack / Wall mounting**

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**LEGEND**

1 - Temperature switch
2 - Capillary
3 - Thermowell
4 - Bulb
5 - Branch Connection Fittings
6 - Process piping
7 - Rack/Panel /Wall
8 - Swivel adapter or cable gland
9 - Conduit seal

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*Note: To install the instrument on the 2" pipe use the mounting brackets accessories supplied with the instrument. To mount the instrument on the brackets use the M5 screws supplied as per Fig. 10 or 11.*
Annex 1 – Model Code

1. **MODEL CODE**
   - **1.1 Ignition protection mode**
     - S: Ex d
   - **1.2 Enclosure code (Material)**
     - 2: Aluminium
       - B: Direct mounting
       - C: Remote mounting with 2m capillary
       - Q: Remote mounting with 5m capillary
       - R: Remote mounting with 10m capillary
       - S: Helical bulb
   - **1.3 Sensor code**
     - A: Silver SPDT
     - B: Silver SPDT + argon sealed
     - C: Gold SPDT + argon sealed
     - G: Silver DPDT
     - H: Silver sealed DPDT
   - **1.4 Electric Contacts**
     - A: Silver SPDT
     - B: Silver SPDT + argon sealed
     - C: Gold SPDT + argon sealed
     - G: Silver DPDT
     - H: Silver sealed DPDT

For further information see datasheet.