

Thermocouple measuring insert Model TC10-A, standard version Model TC10-K, for flameproof enclosure

WIKA data sheet TE 65.01



Applications

- For all industrial and laboratory applications
- Replacement measuring insert for servicing
Model TC10-A: standard version
Model TC10-K: for flameproof enclosure (model TC10-L)

Special features

- Application ranges from 0 ... +1200 °C
- Made of mineral-insulated sheathed cable
- For all standard thermowell designs
- Spring-loaded design
- Explosion-protected versions

Description

The measuring inserts per DIN 43735 for resistance thermometers described here are designed for installation in a protection assembly. Operation without thermowell is only recommended in certain applications. These measuring inserts are made from flexible, mineral insulated sheathed cable. The thermocouple is located at the tip of the measuring insert. This model is spring-loaded to ensure that the measuring insert is firmly pressed down on the thermowell bottom.

Apart from the DIN versions, customer specific versions are available, for example:

- with mounted sleeve to suit inner diameter of the thermowell
- without terminal block
- with transmitter

Sensor type, number of sensors and accuracy can each be selected to suit the respective application.



Thermocouple measuring inserts

Fig. left: model TC10-A

Fig. right: model TC10-K

Adequate heat transfer between thermowell and measuring insert is only ensured when the measuring insert is of correct length and diameter. Selection of standard lengths enables short delivery time and ensures a cost-effective storing as a replacement measuring insert for the corresponding standard dimension.

The range of applications is completed by designs without terminal block for direct transmitter installation. Optionally we can fit analogue or digital transmitters from the WIKA range.

Sensor

Sensor type

| Model | Recommended max. operating temperature |
|-----------------|--|
| K (NiCr-Ni) | 1200 °C |
| J (Fe-CuNi) | 800 °C |
| E (NiCr-CuNi) | 800 °C |
| T (Cu-CuNi) | 400 °C |
| N (NiCrSi-NiSi) | 1200 °C |

The actual application range of these thermometers is limited both by the permissible max. temperature of the thermocouple and the sheath material as well as by the permissible max. temperature of the thermowell material.

Listed thermocouples are available both as single or dual thermocouples. The thermocouple will be delivered with an insulated measuring point, unless explicitly specified otherwise.

Tolerance value

A cold junction temperature of 0 °C is taken as basis with the definition of the tolerance value of thermocouples.

Type K

| Class | Temperature range | Tolerance value |
|-------------------------------|-------------------|------------------------------------|
| DIN EN 60584 part 2 | | |
| 1 | -40 ... +375 °C | ± 1.5 °C |
| 1 | +375 ... +1000 °C | ± 0.0040 · t ¹⁾ |
| 2 | -40 ... +333 °C | ± 2.5 °C |
| 2 | +333 ... +1200 °C | ± 0.0075 · t ¹⁾ |
| ISA (ANSI) MC96.1-1982 | | |
| Standard | 0 ... +750 °C | ± 2.2 °C or ²⁾ ± 0.75 % |
| Special | 0 ... +750 °C | ± 1.1 °C or ²⁾ ± 0.4 % |

Type J

| Class | Temperature range | Tolerance value |
|-------------------------------|-------------------|------------------------------------|
| DIN EN 60584 part 2 | | |
| 1 | -40 ... +375 °C | ± 1.5 °C |
| 1 | +375 ... +750 °C | ± 0.0040 · t ¹⁾ |
| 2 | -40 ... +333 °C | ± 2.5 °C |
| 2 | +333 ... +750 °C | ± 0.0075 · t ¹⁾ |
| ISA (ANSI) MC96.1-1982 | | |
| Standard | 0 ... +750 °C | ± 2.2 °C or ²⁾ ± 0.75 % |
| Special | 0 ... +750 °C | ± 1.1 °C or ²⁾ ± 0.4 % |

Type E

| Class | Temperature range | Tolerance value |
|----------------------------|-------------------|------------------------------|
| DIN EN 60584 part 2 | | |
| 1 | -40 ... +375 °C | ± 1.5 °C |
| 1 | +375 ... +800 °C | ± 0.0040 · t ¹⁾ |
| 2 | -40 ... +333 °C | ± 2.5 °C |
| 2 | +333 ... +900 °C | ± 0.0075 · t ¹⁾ |

Type T

| Class | Temperature range | Tolerance value |
|----------------------------|-------------------|------------------------------|
| DIN EN 60584 part 2 | | |
| 1 | -40 ... +125 °C | ± 0.5 °C |
| 1 | +125 ... +350 °C | ± 0.0040 · t ¹⁾ |
| 2 | -40 ... +133 °C | ± 1.0 °C |
| 2 | +133 ... +350 °C | ± 0.0075 · t ¹⁾ |

Type N

| Class | Temperature range | Tolerance value |
|----------------------------|-------------------|------------------------------|
| DIN EN 60584 part 2 | | |
| 1 | -40 ... +375 °C | ± 1.5 °C |
| 1 | +375 ... +1000 °C | ± 0.0040 · t ¹⁾ |
| 2 | -40 ... +333 °C | ± 2.5 °C |
| 2 | +333 ... +1200 °C | ± 0.0075 · t ¹⁾ |

1) |t| is the value of the temperature in °C irrespective of the sign.
2) Whichever is the greater

Limited error with selected temperatures in °C for thermocouples type K and type J

| Temperature (ITS 90) °C | Tolerance value DIN EN 60584 part 2 | |
|-------------------------|-------------------------------------|------------|
| | Class 1 °C | Class 2 °C |
| 0 | ± 1.5 | ± 2.50 |
| 100 | ± 1.5 | ± 2.50 |
| 200 | ± 1.5 | ± 2.50 |
| 300 | ± 1.5 | ± 2.50 |
| 400 | ± 1.6 | ± 3.00 |
| 500 | ± 2.0 | ± 3.75 |
| 600 | ± 2.4 | ± 4.50 |
| 700 | ± 2.8 | ± 5.25 |
| 800 | ± 3.2 | ± 6.00 |
| 900 | ± 3.6 | ± 6.75 |
| 1000 | ± 4.0 | ± 7.50 |
| 1100 | ± 4.4 | ± 8.25 |
| 1200 | ± 4.8 | ± 9.00 |

Potential measuring uncertainties due to ageing effects

Thermocouples are subject to ageing and change their temperature/thermal voltage characteristic. Type J thermocouples of (Fe-Cu-Ni) age slightly due to oxidation of the pure metal leg. In types K and N thermocouples (NiCrSi-NiSi), high temperatures can result in substantial changes to the thermal voltage due to chrome depletion in the NiCr leg, leading to a lower thermal voltage.

This effect is accelerated if there is a shortage of oxygen, since a complete oxide layer, which would protect it from further oxidation, cannot be formed on the surface of the thermocouple. Chromium is oxidised, but nickel isn't. This results in the so-called "**green rot**", destroying the thermocouple. When NiCr-Ni thermocouples that have been operating above 700 °C are cooled quickly, this cooling causes certain states in the crystal structure (**short-range order**) to freeze, which in type K thermocouples can result in a change of the thermal voltage of up to 0.8 mV (K effect).

In Type N thermocouple (NiCrSi-NiSi), it has been possible to reduce the **short-range-order effect** by alloying both legs with silicon. The effect is reversible and is largely eliminated again by annealing above 700 °C, followed by slow cooling. Thin sheathed thermocouples are particularly sensitive. Cooling in still air can even result in deviations of more than 1 K.

Measuring insert

The measuring insert is made of a vibration-resistant, sheathed, mineral-insulated cable (MI cable). The diameter of the measuring insert should be approx. 1 mm smaller than the bore diameter of the thermowell. Gaps of more than 0.5 mm between thermowell and the measuring insert will have a negative effect on the heat transfer, and they will result in unfavourable response behaviour from the thermometer.

Using two screws and springs, the measuring insert can be mounted into a connection head (Form B), replaceable and mounted spring-loaded.

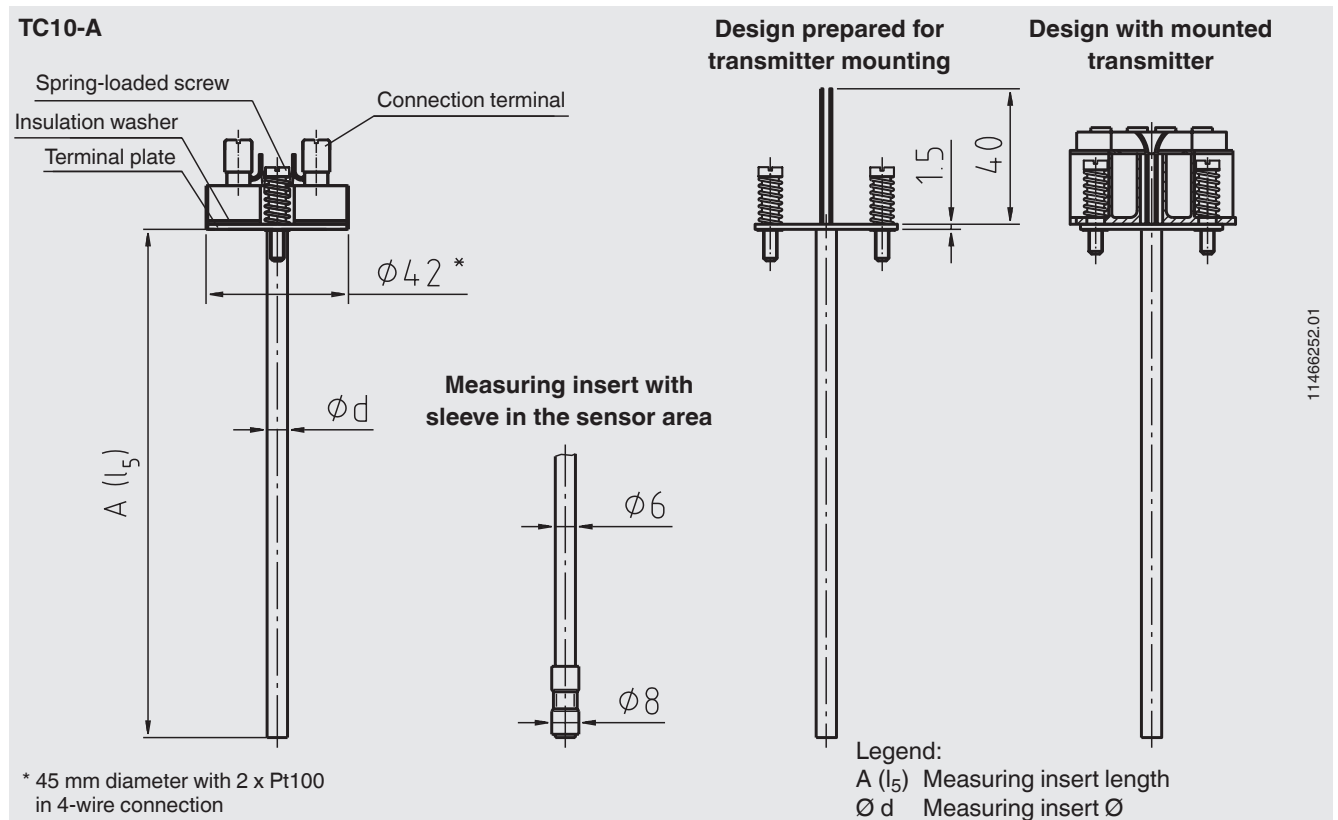
When fitting the measuring insert into a thermowell, it is very important to determine the correct insertion length (= thermowell length for bottom thicknesses of ≤ 5.5 mm). In order to ensure that the measuring insert is firmly pressed down onto the bottom of the thermowell, the insert must be spring-loaded (spring travel: max 10 mm).

The standard material used for the measuring insert sheath is stainless steel. Other materials are available on request.

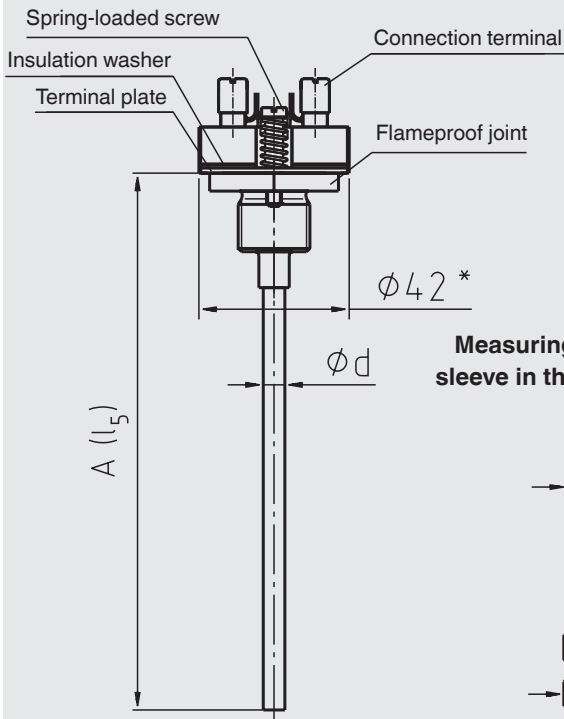
As well as its flexibility, this model has outstanding resistance to vibration (3 g, optionally 10 g¹⁾).

1) TC10-K: In combination with a TR10-L, the details regarding vibration resistance of the TR10-L are valid.

Dimensions in mm

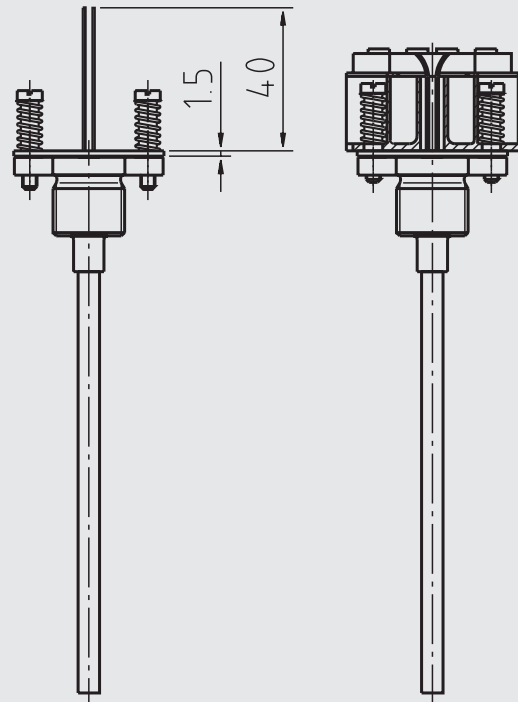


TC10-K (for flameproof enclosure)

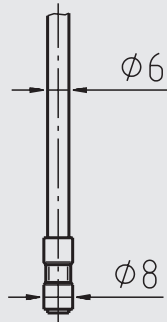


Design prepared for transmitter mounting

Design with mounted transmitter



Measuring insert with sleeve in the sensor area



* 45 mm diameter with 2 x Pt100 in 4-wire connection

Legend:

- A (l₅) Measuring insert length
- Ø d Measuring insert Ø

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Standard measuring insert lengths

| Measuring insert Ø in mm | Standard measuring insert lengths in mm | | | | | | | | | | |
|---------------------------------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 3 | 275 | 315 | | 375 | | 435 | | | | | |
| 6 | 275 | 315 | 345 | 375 | 405 | 435 | 525 | 555 | 585 | 655 | 735 |
| 8 | 275 | 315 | 345 | 375 | 405 | 435 | 525 | 555 | 585 | 655 | 735 |
| 8 (sleeve) ¹⁾ | 275 | 315 | 345 | 375 | 405 | 435 | 525 | 555 | 585 | 655 | 735 |

The lengths specified in this table correspond to the standard lengths. Intermediate lengths or greater lengths are possible without any difficulty.
 1) MI cable Ø 6 mm with sleeve Ø 8 mm in the sensor area

Transmitter (option)

It is possible to build a transmitter onto the measuring insert. Doing so, the transmitter replaces the terminal block and is directly attached to the terminal plate of the measuring insert.

| Model | Description | Explosion protection | Data sheet |
|---------------|---|----------------------|------------|
| T91.10 | Analogue transmitter, fixed measuring range | without | TE 91.01 |
| T12 | Digital transmitter, PC configurable | optional | TE 12.03 |
| T32 | Digital transmitter, HART® protocol | optional | TE 32.04 |
| T53 | Digital transmitter FOUNDATION™ Fieldbus and PROFIBUS® PA | standard | TE 53.01 |

Explosion protection (option)

■ Model TC10-A

For application in hazardous areas, intrinsically-safe versions are available.

These measuring inserts are suitable for mounting (replacement demand) in type-examined thermometers. Manufacturer's declarations in accordance with NAMUR NE24 are also available.

The classification/suitability of the instrument (permissible power P_{max} as well as the permissible ambient temperature) for the respective category can be seen on the type examination certificate and in the operating instructions.

Built-in transmitters have their own type-examination certificate. The permissible ambient temperature ranges of the built-in transmitters can be taken from the corresponding transmitter approval.

Attention:

In hazardous areas the use of a model TC10-A measuring insert without a suitable connection head (case) is not permissible!

Where required a suitable thermowell is to be used.

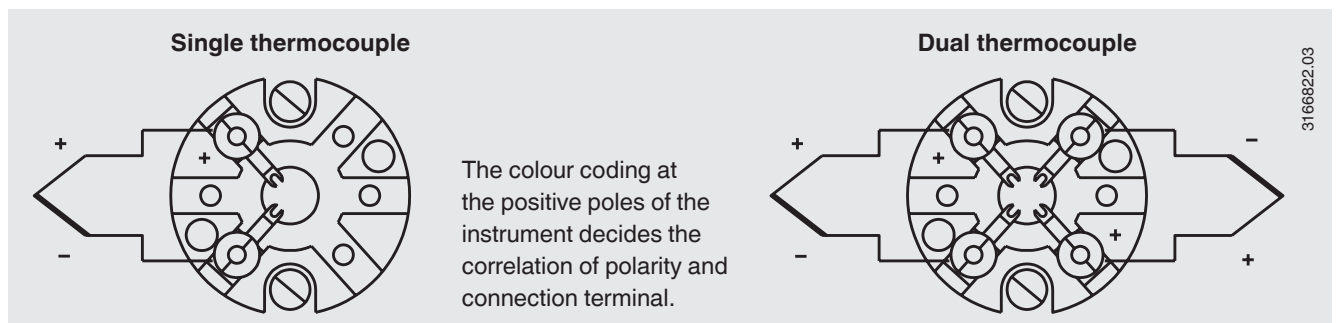
■ Model TC10-K

Attention:

The use of a model TR10-K measuring insert is exclusively allowed if assembled with a flame proof (Ex-d) resistance thermometer model TR10-L!

Only this combination guarantees the correct interaction of connection head, flameproof joint and a - highly precise manufactured - sleeve, which is part of the measuring insert.

Electrical connection



For the electrical connections of built-in temperature transmitters see the corresponding transmitter data sheets or operating instructions.

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