

Resistance Thermometer Model TR10-H without Thermowell

WIKA Data Sheet TE 60.08



Applications

- For direct process connection
- Machine building
- Motors
- Storage
- Pipelines and tanks

Special Features

- Application ranges from -200 °C to +600 °C
- For inserting, screwing-in with an optional process connection
- Connection head Form B or JS
- Explosion-protected versions Ex-i, Ex-n and NAMUR NE24

Description

Resistance thermometers without a thermowell are especially suitable for applications which have metallic sensor tips mounted directly into the drilling holes, e.g. of machine parts or in the process, thus, for all applications without chemically aggressive media and abrasion. For mounting into a thermowell provide a spring-loaded compression fitting because only the fitting can press on the sensor tip to the bottom of the thermowell.

Mounting is usually carried out directly in the process. Fastening elements such as threads, union nuts etc. can be used optionally.

The flexible sensor part is a mineral insulated cable (sheathed cable).

It consists of a stainless steel outer sheath with an inner lead inside of it insulated and pressed into a highly compressed ceramic mass.

The measured resistance is directly connected to the inner leads of the sheathed cable and is, therefore, suitable for use with higher temperatures.

Due to their flexibility and the small diameters in which they



Resistance Thermometers without Thermowell,
Model TR10-H

are available, sheathed resistance thermometers can be used in locations that are not easily accessible, because except for the sensor tip and the collet of the connection cable the sheath can be bent with a radius that's at least three times larger than the diameter of the cable.

Please note:

The flexibility of the sheathed resistance thermometer has to be taken into account, especially when the flow rates are relatively high.

Optionally analogue or digital transmitters from the WIKA range can be fitted into the connection head.

Sensor

The sensor is located in the tip of the measuring insert.

Sensor method of connection

- 2-wire The lead resistance of the measuring insert compounds the error.
- 3-wire With a cable length of approx. 30 m or longer measuring deviations can occur.
- 4-wire The inner lead resistance of the connecting wires is negligible.

Sensor limiting error

- Class B per DIN EN 60 751
- Class A per DIN EN 60 751
- 1/3 DIN B at 0 °C

It makes no sense to combine 2-wire connection with class A or 2-wire connection with 1/3 DIN B, because the lead resistance of the cable overrides the higher sensor accuracy.

Basic values and limiting errors

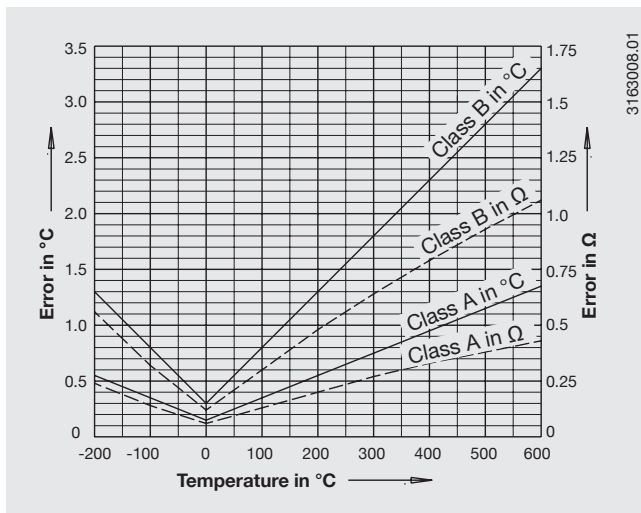
Basic values and limiting errors for the platinum measurement resistances are laid down in DIN EN 60 751. The nominal value of Pt100 sensors is 100 Ω at 0 °C. The temperature coefficient α can be stated simply to be between 0 °C and 100 °C with:

$$\alpha = 3.85 \cdot 10^{-3} \text{ }^{\circ}\text{C}^{-1}$$

The relationship between the temperature and the electrical resistance is characterised by polynomials which are defined in DIN EN 60 751. Furthermore, this standard lays down the basic values in °C stages.

Class	Limiting error in °C
A	$0.15 + 0.002 \cdot t $ ¹⁾
B	$0.3 + 0.005 \cdot t $

1) |t| is the value of the temperature in °C without consideration of the sign



Temperature (ITS 90) °C	Basic value Ω	Limiting error DIN EN 60 751			
		Class A		Class B	
°C	Ω	°C	Ω	°C	Ω
-50	80.31	± 0.25	± 0.10	± 0.55	± 0.22
0	100	± 0.15	± 0.06	± 0.3	± 0.12
50	119.40	± 0.25	± 0.10	± 0.55	± 0.21
100	138.51	± 0.35	± 0.13	± 0.8	± 0.30
150	157.33	± 0.45	± 0.17	± 1.05	± 0.39
200	175.86	± 0.55	± 0.2	± 1.3	± 0.48
250	194.1	± 0.65	± 0.24	± 1.55	± 0.56

Possible measuring ranges are:

- 50 ... +250 °C
- 50 ... +450 °C
- 200 ... +250 °C
- 50 ... +400 °C (only class A)
- 200 ... +450 °C
- 200 ... +600 °C (from 450 °C class B)
- 200 ... +400 °C
- 50 ... +600 °C (only class B)

Metallic sensor

Material: stainless steel

Diameter: 2 mm, 3 mm, 6 mm or 8 mm

Length: selectable

The sensor tip must not be bent over the length of 60 mm regardless of the design.

During temperature measurement in a solid-state body the diameter of the drilling in which the sensor is supposed to be inserted, should be max. 1 mm larger than the sensor diameter.

Maximum working temperatures

The maximum temperatures of this thermometer are limited by different parameters:

■ Sensor

The temperature range is limited by the sensor itself. Depending on the accuracy class and use conditions the optimum choice is made.

Outside of the defined measuring range the measurement is not accurate anymore and the sensor can be damaged.

■ Connection head

Admissible ambient temperature of the connection head:
120 °C for versions without a transmitter,
85 °C for versions with a transmitter

■ Working temperature

If the measured temperature is higher than the admissible temperature at the connection head, the metallic part of the sensor has to be long enough to emerge from the hot zone.

IP protection

The standard protection class of the TR10-H is IP65.

Explosion protection (option)

Resistance thermometers from the TR10-H series are available with a prototype test certificate for the type of protection Ex-i and Ex-n (directive 94/9/EG and NAMUR NE24).

The devices comply with the requirements of the directive 94/9/EG (ATEX), EEx-i, for gases and dust. Manufacturer's declarations according to EN 50 020 are also possible. The assignment or suitability of the device (approved power P_{max} , minimum distances from hot surfaces as well as the approved ambient temperature) for the appropriate category is to be noted from the prototype test certificate or operating instructions.

Process connections

The sheathed resistance thermometers TR10-H can be optionally equipped with the process connections shown below. The mounting length A (U_1 or U_2) can be customized. The N length (M_H) depends on the type of the selected process connection.

To minimise heat dissipation errors via the thread the mounting length A should be at least 25 mm long. The position of the thread is specified regardless of the connection type by means of the N dimension.

Please note:

- For cylindrical threads (e.g. G 1/2) the dimensioning always refers to the sealing collar of the thread on the side of the process.
- In conical threads the measurement plane is located approx. in the centre of the thread.

Without process connection

This version is designed mainly for mounting in one of the available compression fittings. All heads of the size form B and KN can be used.

The N length describes in this case only the height of the hexagon on the head of the thermowell. N is always 10 mm.

Version of the sensor tip

Standard version

In the standard version an appropriate for the selected measuring range sensor is mounted.

This sensor is applicable with acceleration loads of up to 30 m/s². (Test according to DIN EN 60751)

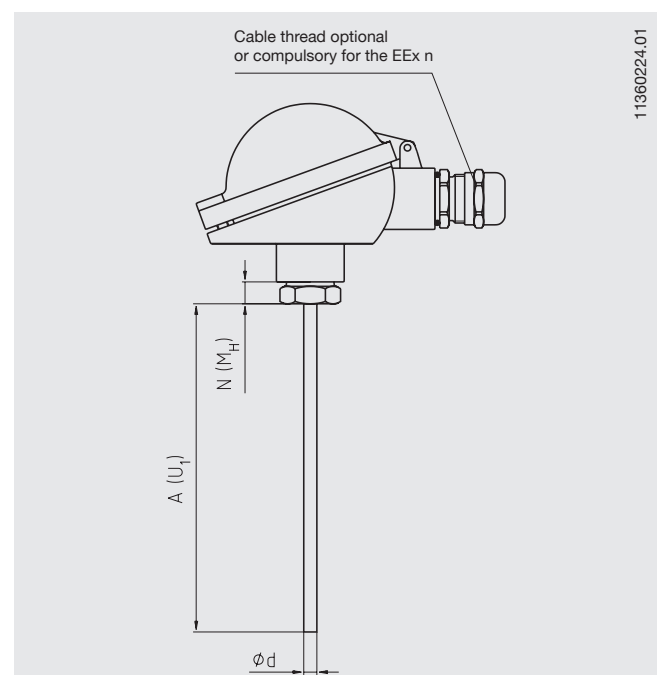
Susceptible to current peaks (thin-film sensor)

A special measuring resistor is connected to the sensor tip. Due to direct contact to the tip this version cannot be used as an intrinsically safe thermometer.

Not susceptible to vibrations sensor tip (max. 10 g)

Special resistors are used for this extremely robust version. In addition special inner design is chosen which permanently resists these high loads (100 m/s²).

(The test is based on DIN EN 60751)



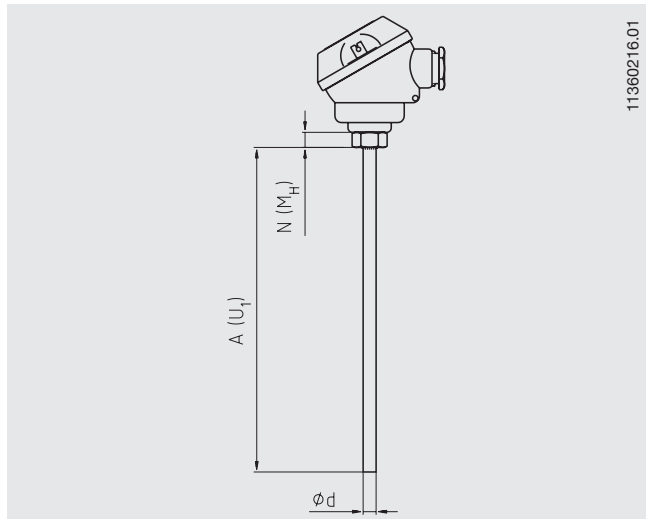
Without process connection (basic version)

This version is designed mainly for mounting in one of the available compression fittings.

Only connection heads of the design JS can be used.

The N length describes in this case only the height of the hexagon on the head of the thermowell.

N is always 7 mm.



Protruded fixed thread

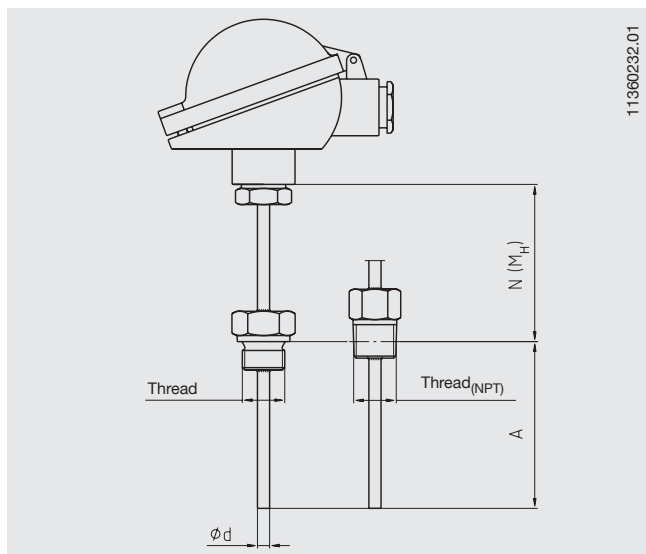
serves for mounting of thermometers into threaded couplings with a female thread.

Mounting length A: according to customer specification

Material: CrNi steel, other on request

For screwing in the sensor must be turned in the process.

Therefore, this design has to be assembled mechanically first and then it can be electrically connected.



Compression fitting

allows simple adaptation to the required insertion length at the installation point.

Since the compression fitting on the sensor can be shifted, the A and N dimensions define the ex works condition. The length of the compression fitting determines the smallest possible length N of approx. 40 mm.

Material: stainless steel

Sealing ring material: stainless steel or Teflon®

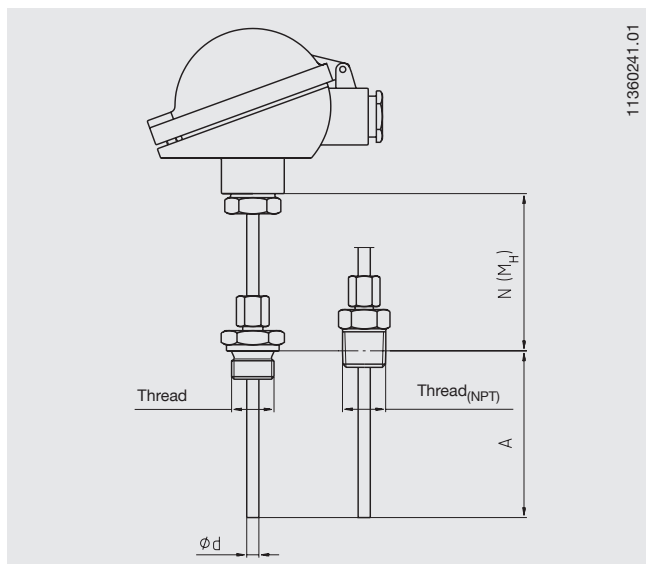
Sealing rings of stainless steel can be adjusted once, after unscrewing, sliding along the sheath is no longer possible.

- Max. temperature at process connection 500 °C
- Max. pressure load 40 bar

Sealing rings of Teflon® can be adjusted several times, after unscrewing, repeated sliding along the sheath is still possible.

- Max. temperature at process connection 150 °C
- Max. pressure load 25 bar

Only sealing rings of Teflon® are approved for sheathed resistance thermometers with a Ø of 2 mm.



Spring-loaded compression fitting

allows easy adjustment to the desired mounting length at the mounting site while at the same time sustaining the spring pre-tension

Since the compression fitting on the sensor can be shifted, the A and N dimensions define the ex works condition. The length of the compression fitting determines the smallest possible length X of approx. 80 mm.

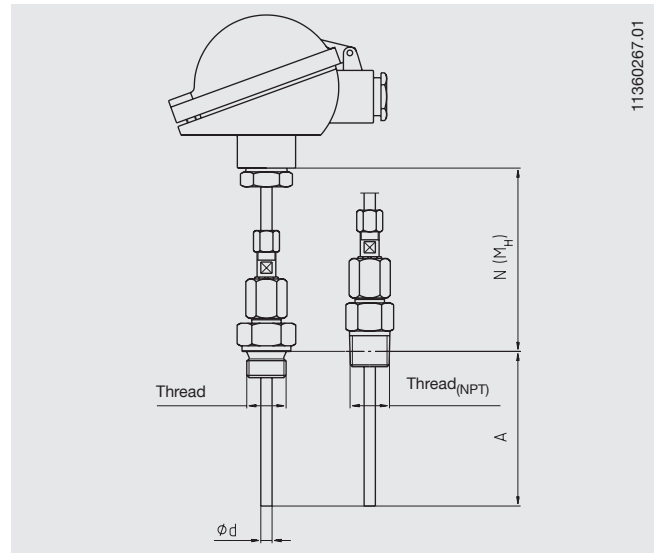
Material: CrNi steel

Sealing ring material: CrNi steel

The sealing rings made of CrNi steel can be adjusted once, shifting on the sheathed cable after loosening is not possible anymore.

Max. temperature on the process connection 500 °C

Pressure load of the spring-loaded compression fitting is not allowed.

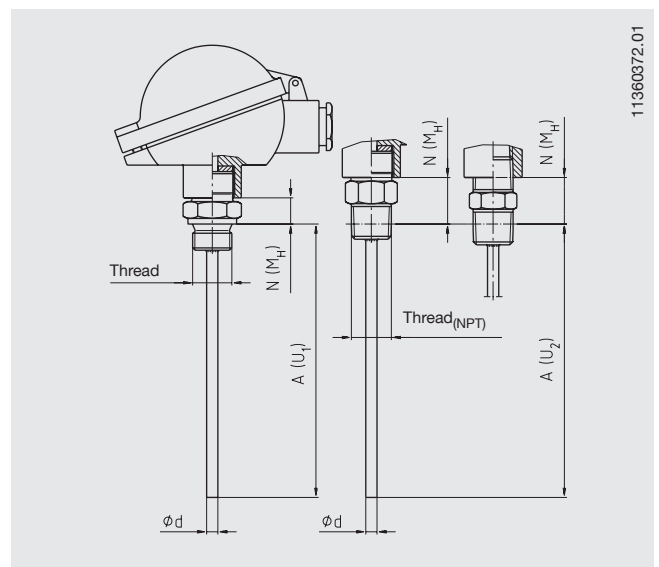


Double nipple

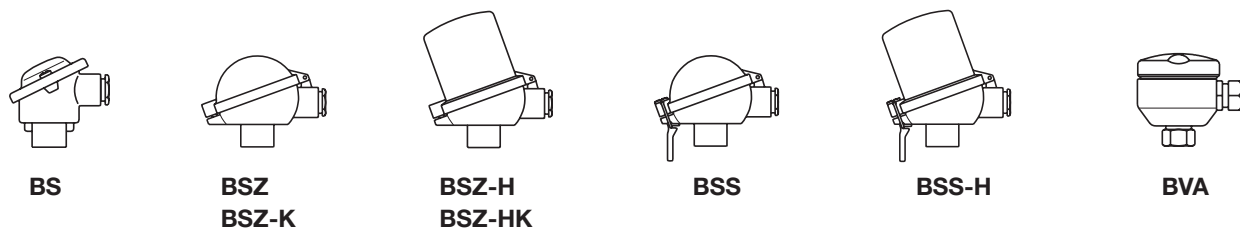
Thermometer can be screwed in directly in the process by means of a bilateral threaded nipple. Here you have to observe the approved temperature ranges.

The N length (M_H) of cylindrical threads depends on the height of the hexagon. It is 10 mm.

The N length of the NPT threads is made up not only of the hexagon height but also by the half of the thread height. This gives us the neck length N (MH) of approx. 19 mm.



Connection head



Model	Material	Cable entry	Ingress protection	Cap	Surface finish
BS	Aluminium	M20 x 1.5 ¹⁾	IP 65	Cap with 2 screws	blue, painted ²⁾
BSZ	Aluminium	M20 x 1.5 ¹⁾	IP 65	Flap cap with screw	blue, painted ²⁾
BSZ-K	Plastic	M20 x 1.5 ¹⁾	IP 65	Flap cap with screw	black
BSZ-H	Aluminium	M20 x 1.5 ¹⁾	IP 65	Flap cap with screw	blue, painted ²⁾
BSZ-HK	Plastic	M20 x 1.5 ¹⁾	IP 65	Flap cap with screw	black
BSS	Aluminium	M20 x 1.5 ¹⁾	IP 65	Flap cap with clip	blue, painted ²⁾
BSS-H	Aluminium	M20 x 1.5 ¹⁾	IP 65	Flap cap with clip	blue, painted ²⁾
BVA	Stainless steel	M20 x 1.5 ¹⁾	IP 65	Screw cover	blank

1) Standard

2) RAL5022, polyester paint saltwater-proof

Connection head with digital indicator (option)

As an optional alternative to the standard connection head the thermometer may be equipped with the digital indicator DIH10. The connection head used in this case is similar to the head model BSZ-H. For operation a 4 ... 20 mA transmitter is necessary, which is mounted to the measuring insert. The scale range of the indicator is configured identical to the measuring range of the transmitter.

For the versions with fixed protruded thread and double nipple the screwing-in stops at an unforeseeable position. So, the alignment of the digital indicator cannot be predefined.

To ensure safe reading of the display the DIH-10 can be delivered only with the ordering options:

- With a compression fitting or
- Without a process connection.

Transmitter (option)

Depending on used connection head a transmitter can be mounted into the thermometer.

- Mounted instead of terminal block
- Mounted within the cap of the connection head
- Mounting not possible

Mounting of two transmitters on request.

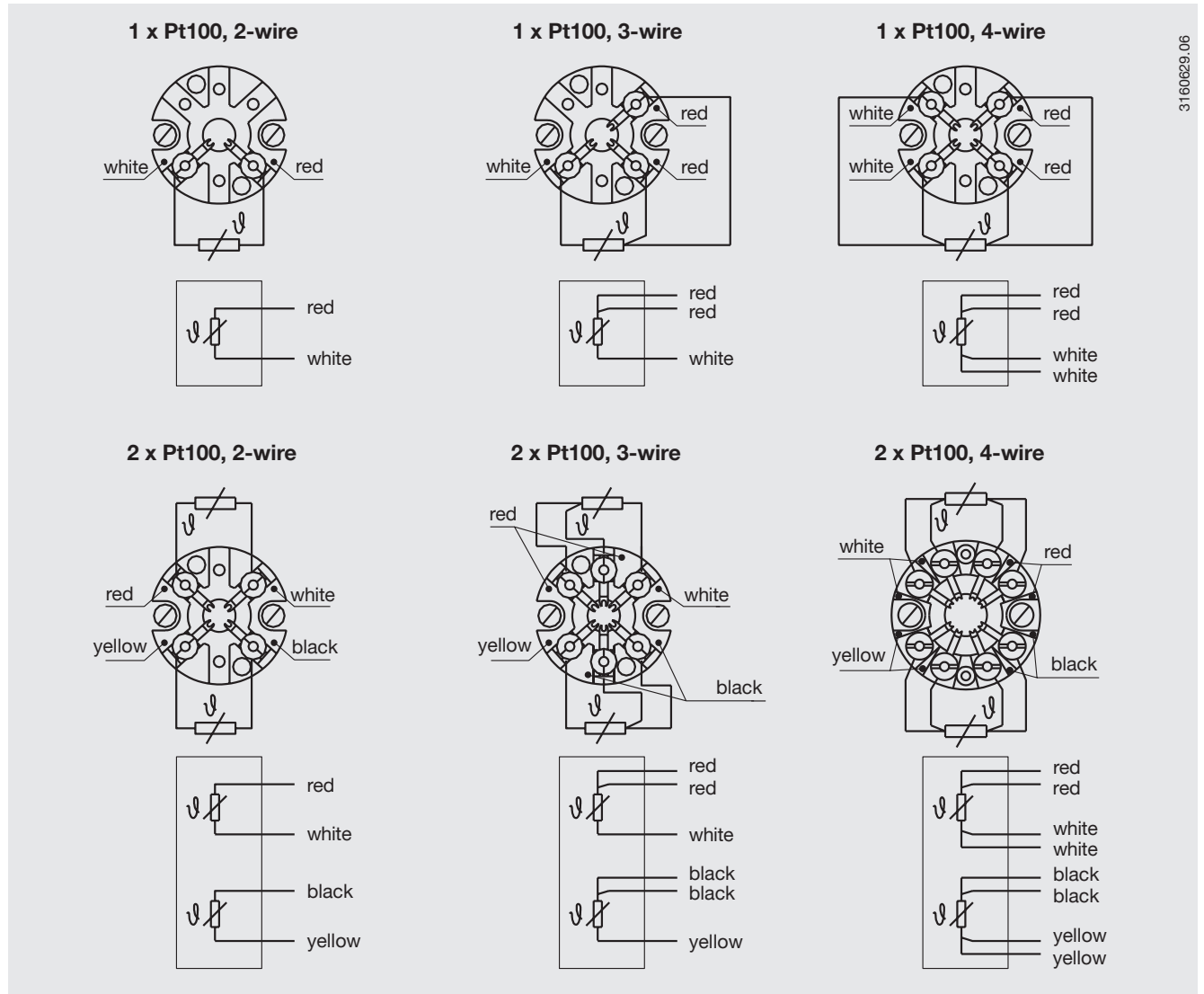


Fig. Connection head with digital indicator, Model DIH10

Connection head	Transmitter				
	T12	T19	T24	T32	T53
BS	-	○	○	-	○
BSZ / BSZ-K	○	○	○	○	○
BSZ-H / BSZ-HK	●	●	●	●	●
BSS	○	○	○	○	○
BSS-H	●	●	●	●	●
BVA	○	○	○	○	○

Model	Description	Explosion protection	Data sheet
T19	Analogue transmitter, configurable	without	TE 19.03
T24	Analogue transmitter, PC-configurable	optional	TE 24.01
T12	Digital transmitter, PC-configurable	optional	TE 12.01
T32	Digital transmitter, HART protocol	optional	TE 32.03
T53	Digital transmitter FOUNDATION Fieldbus and PROFIBUS PA	standard	TE 53.01

Electrical connection



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Modifications may take place and materials specified may be replaced by others without prior notice.
Specifications and dimensions given in this leaflet represent the state of engineering at the time of printing.



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