

Thermocouple Without thermowell Model TC10-H

WIKA data sheet TE 65.08



for further approvals
see page 2

Applications

- For direct installation into the process
- Machine building
- Motors
- Bearing
- Pipelines and vessels

Special features

- Sensor ranges from -40 ... +1,200 °C [-40 ... + 2,192 °F]
- For insertion, screw-in with optional process connection
- Connection head form B or JS
- Explosion-protected versions are available for many approval types (see page 2)

Description

Thermocouples without thermowell are particularly suitable for those applications in which the metal sensor tip is mounted directly into bored holes (e.g. in machine components) or directly into the process for any application with no chemically aggressive media or abrasion.

For mounting into a thermowell, a spring-loaded compression fitting should be provided, since only this can press the measuring tip into the bottom of the thermowell. Otherwise a - potentially critical - force could be exerted on the measuring tip. Mounting is usually made directly into the process. Fastening elements such as threaded fittings, union nuts, etc. can also be used.



Fig. left: Model TC10-H with connection head BSZ

Fig. right: Model TC10-H with connection head JS

The flexible part of the probe is a mineral-insulated cable (sheathed cable). It consists of a stainless steel outer sheath, which contains the insulated internal leads, embedded within a high-density ceramic compound and is also suitable for use at higher temperatures.








Optionally we can fit analogue or digital transmitters from the WIKA range into the connection head of the TC10-H.








Explosion protection (option)

The permissible power, P_{max} , as well as the permissible ambient temperature, for the respective category can be seen on the certificate for hazardous areas or in the operating instructions.

Transmitters have own certificates for hazardous areas. The permissible ambient temperature ranges of the built-in transmitters can be taken from the corresponding transmitter operating instructions and approvals.

Approvals (explosion protection, further approvals)

Logo	Description	Country
 	EU declaration of conformity <ul style="list-style-type: none"> ■ EMC directive ¹⁾ EN 61326 emission (group 1, class B) and immunity (industrial application) ■ RoHS directive ■ ATEX directive (option) Hazardous areas <ul style="list-style-type: none"> - Ex i Zone 0 gas II 1G Ex ia IIC T1 ... T6 Ga Zone 1 gas II 2G Ex ia IIC T1 ... T6 Gb Zone 20 dust II 1D Ex ia IIIC T125 ... T65 °C Da Zone 21 dust II 2D Ex ia IIIC T125 ... T65 °C Db - Ex e ²⁾ Zone 1 gas II 2G Ex eb IIC T1...T6 Gb ^{3) 4)} Zone 2 gas II 3G Ex ec IIC T1...T6 Gc Zone 21 dust II 2D Ex tb IIIC TX °C Db ^{3) 4)} Zone 22 dust II 3D Ex tc IIIC TX °C Dc - Ex n ²⁾ Zone 2 gas II 3G Ex nA IIC T1 ... T6 Gc X Zone 22 dust II 3D Ex tc IIIC T440 ... T80 °C Dc X 	European Union
 	IECEx (option) - in conjunction with ATEX Hazardous areas <ul style="list-style-type: none"> - Ex i Zone 0 gas Ex ia IIC T1 ... T6 Ga Zone 1 gas Ex ia IIC T1 ... T6 Gb Zone 20 dust Ex ia IIIC T125 ... T65 °C Da Zone 21 dust Ex ia IIIC T125 ... T65 °C Db 	International
	EAC (option) Hazardous areas <ul style="list-style-type: none"> - Ex i Zone 0 gas 0Ex ia IIC T3/T4/T5/T6 Zone 1 gas 1Ex ib IIC T3/T4/T5/T6 Zone 20 dust DIP A20 Ta 65 °C/Ta 95 °C/Ta 125 °C Zone 21 dust DIP A21 Ta 65 °C/Ta 95 °C/Ta 125 °C - Ex n ²⁾ Zone 2 Gas 2Ex nA IIC T6 ... T1 Gc X 	Eurasian Economic Community
	Ex Ukraine (option) Hazardous areas <ul style="list-style-type: none"> - Ex i Zone 0 gas II 1G Ex ia IIC T1...T6 Ga Zone 1 gas II 2G Ex ia IIC T1...T6 Gb Zone 20 dust II 1D Ex ia IIIC T65°C Da Zone 21 dust II 2D Ex ia IIIC T65°C Db 	Ukraine
	INMETRO (option) Hazardous areas <ul style="list-style-type: none"> - Ex i Zone 0 gas Ex ia IIC T3 ... T6 Ga Zone 20 dust Ex ia IIIC T125 ... T65 °C Da 	Brazil

Logo	Description	Country
	CCC (option) ⁴⁾ Hazardous areas - Ex i Zone 0 gas Ex ia IIC T1 ~ T6 Ga Zone 1 gas Ex ia IIC T1 ~ T6 Gb Zone 2 gas Ex ic IIC T1 ~ T6 Gc Zone 20 dust Ex iaD 20 T65/T95/T125°C Zone 21 dust Ex iaD 21 T65/T95/T125°C - Ex e ²⁾ Zone 1 gas Ex eb IIC T1 ~ T6 Gb ³⁾⁴⁾ Zone 2 gas Ex ec IIC T1 ~ T6 Gc - Ex n ²⁾ Zone 2 gas Ex nA IIC T1 ~ T6 Gc	China
	KCs - KOSHA (option) Hazardous areas - Ex i Zone 0 gas Ex ia IIC T4 ... T6 Zone 1 gas Ex ib IIC T4 ... T6	South Korea
-	PESO (option) Hazardous areas - Ex i Zone 0 gas Ex ia IIC T1 ... T6 Ga Zone 1 gas Ex ia IIC T1 ... T6 Gb	India
	GOST (option) Metrology, measurement technology	Russia
	KazInMetr (option) Metrology, measurement technology	Kazakhstan
-	MTSCHS (option) Permission for commissioning	Kazakhstan
	BelGIM (option) Metrology, measurement technology	Belarus
	UkrSEPRO (option) Metrology, measurement technology	Ukraine
	Uzstandard (option) Metrology, measurement technology	Uzbekistan

1) Only for built-in transmitter

2) Not with model JS connection head (see "Connection heads")

3) Only for ungrounded thermocouples

4) Without transmitter

Instruments marked with "ia" may also be used in areas only requiring instruments marked with "ib" or "ic".

If an instrument with "ia" marking has been used in an area with requirements in accordance with "ib" or "ic", it can no longer be operated in areas with requirements in accordance with "ia" afterwards.

Approvals and certificates, see website

Sensor

Thermocouple per IEC 60584-1 or ASTM E230

Types K, J, E, N, T (single or dual thermocouple)

Sensor types

Type	Validity limits of class accuracy			
	IEC 60584-1		ASTM E230	
	Class 2	Class 1	Standard	Special
K	-40 ... +1,200 °C	-40 ... +1,000 °C	0 ... 1,260 °C	
J	-40 ... +750 °C	-40 ... +750 °C	0 ... 760 °C	
E	-40 ... +900 °C	-40 ... +800 °C	0 ... 870 °C	
N	-40 ... +1,200 °C	-40 ... +1,000 °C	0 ... 1,260 °C	
T	-40 ... +350 °C		0 ... 370 °C	

The table shows the temperature ranges listed in the respective standards, in which the tolerance values (class accuracies) are valid.

The actual operating temperature of the thermometer is limited both by the maximum permissible operating temperature and the diameter of the thermocouple and the sheathed cable, as well as by the maximum permissible working temperature of the thermowell material.

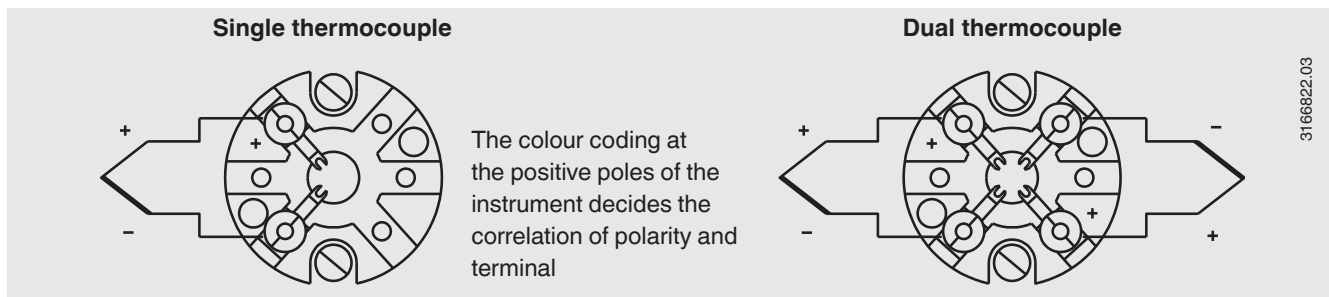
Listed models are available both as single or dual thermocouples. The thermocouple will be delivered with an ungrounded measuring point, unless explicitly specified otherwise.

For detailed specifications for thermocouples, see IEC 60584-1 or ASTM E230 and Technical information IN 00.23 at www.wika.com.

Tolerance value

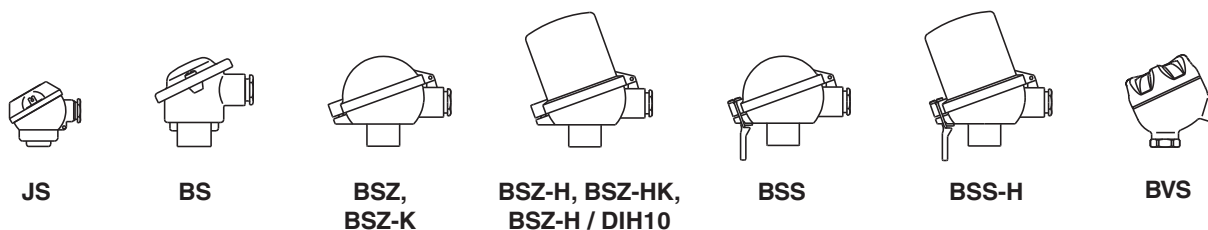
For the tolerance value of thermocouples, a cold junction temperature of 0 °C has been taken as the basis.

Electrical connection



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

Connection head



Model	Material	Cable entry thread size	Ingress protection (max.) ¹⁾ IEC/EN 60529	Cap	Surface	Connection to neck tube
JS	Aluminium	M16 x 1.5 ³⁾	IP65	Cover with 2 screws	Blue, lacquered ⁵⁾	M24 x 1.5, ½ NPT
BS	Aluminium	M20 x 1.5 or ½ NPT ³⁾	IP65 ⁴⁾	Flat cap with 2 screws	Blue, lacquered ⁵⁾	M24 x 1.5, ½ NPT
BSZ	Aluminium	M20 x 1.5 or ½ NPT ³⁾	IP65 ⁴⁾	Spherical hinged cover with cylinder head screw	Blue, lacquered ⁵⁾	M24 x 1.5, ½ NPT
BSZ-H	Aluminium	M20 x 1.5 or ½ NPT ³⁾	IP65 ⁴⁾	Raised hinged cover with cylinder head screw	Blue, lacquered ⁵⁾	M24 x 1.5, ½ NPT
BSZ-H (2x cable outlet)	Aluminium	2 x M20 x 1.5 or 2 x ½ NPT ³⁾	IP65 ⁴⁾	Raised hinged cover with cylinder head screw	Blue, lacquered ⁵⁾	M24 x 1.5
BSZ-H / DIH10 ²⁾	Aluminium	M20 x 1.5 or ½ NPT ³⁾	IP65	Raised hinged cover with cylinder head screw	Blue, lacquered ⁵⁾	M24 x 1.5, ½ NPT
BSS	Aluminium	M20 x 1.5 or ½ NPT ³⁾	IP65	Spherical hinged cover with clamping lever	Blue, lacquered ⁵⁾	M24 x 1.5, ½ NPT
BSS-H	Aluminium	M20 x 1.5 or ½ NPT ³⁾	IP65	Raised hinged cover with clamping lever	Blue, lacquered ⁵⁾	M24 x 1.5, ½ NPT
BVS	Stainless steel	M20 x 1.5 ³⁾	IP65	Precision-cast screw-on lid	Blank, electropolished	M24 x 1.5
BSZ-K	Plastic	M20 x 1.5 or ½ NPT ³⁾	IP65	Spherical hinged cover with cylinder head screw	Black	M24 x 1.5
BSZ-HK	Plastic	M20 x 1.5 or ½ NPT ³⁾	IP65	Raised hinged cover with cylinder head screw	Black	M24 x 1.5

Model	Explosion protection					
	Without	Ex i (gas) Zone 0, 1, 2	Ex i (dust) Zone 20, 21, 22	Ex e (gas) Zone 1, 2	Ex t (dust) Zone 21, 22	Ex nA (gas) Zone 2
JS	x	x	x	-	-	-
BS	x	x	x	-	-	-
BSZ	x	x	x	x ⁶⁾	x ⁶⁾	x ⁷⁾
BSZ-H	x	x	x	x ⁶⁾	x ⁶⁾	x ⁷⁾
BSZ-H (2x cable outlet)	x	x	x	x ⁶⁾	x ⁶⁾	x ⁷⁾
BSZ-H / DIH10 ²⁾	x	x	-	-	-	-
BSS	x	x	-	-	-	-
BSS-H	x	x	-	-	-	-
BVS	x	x	-	-	-	-
BSZ-K	x	x	-	-	-	-
BSZ-HK	x	x	-	-	-	-

1) IP ingress protection of the connection head. The IP ingress protections of the complete instrument TC10-H must not inevitably correspond to the connection head.

2) LED display DIH10

3) Standard (others on request)

4) Ingress protections, which describe temporary or lasting submersion, available on request

5) RAL 5022

6) Only ATEX

7) Only ATEX and EAC

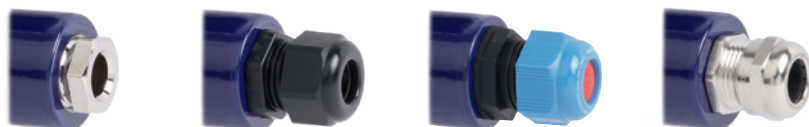
Connection head with digital display (option)



Connection head BSZ-H with LED display model DIH10
see data sheet AC 80.11

To operate the digital displays, a transmitter with a 4 ... 20 mA output is always required.

Cable entry



Standard

Plastic

**Brass,
nickel-plated**

The figures show examples of connection heads.

Cable entry	Cable entry thread size	Min./max. ambient temperature
Standard cable entry ¹⁾	M20 x 1.5 or ½ NPT	-40 ... +80 °C
Plastic cable gland (cable Ø 6 ... 10 mm) ¹⁾	M20 x 1.5 or ½ NPT	-40 ... +80 °C
Plastic cable gland (cable Ø 6 ... 10 mm), Ex e ¹⁾	M20 x 1.5 or ½ NPT	-20 ... +80 °C (standard) -40 ... +70 °C (option)
Nickel-plated brass cable gland (cable Ø 6 ... 12 mm)	M20 x 1.5 or ½ NPT	-60 ²⁾ / -40 ... +80 °C

Cable entry	Colour	Ingress protection (max.) ³⁾ IEC/EN 60529	Explosion protection					
			without	Ex i (gas) Zone 0, 1, 2	Ex i (dust) Zone 20, 21, 22	Ex e (gas) Zone 1, 2	Ex t (dust) Zone 21, 22	Ex nA (gas) Zone 2
Standard cable entry ¹⁾	Blank	IP65	x	x	-	-	-	-
Plastic cable gland ¹⁾	Black or grey	IP66 ⁴⁾	x	x	-	-	-	-
Plastic cable gland, Ex e ¹⁾	Light blue	IP66 ⁴⁾	x	x	x	-	-	-
Plastic cable gland, Ex e ¹⁾	Black	IP66 ⁴⁾	x	x	x	x	x	x
Nickel-plated brass cable gland	Blank	IP66 ⁴⁾	x	x	x	-	-	-
Nickel-plated brass cable gland, Ex e	Blank	IP66 ⁴⁾	x	x	x	x	x	x

1) Not available for BVS connection head

2) Special version on request (only available with selected approvals), other temperatures on request

3) IP ingress protection of the connection head. The IP ingress protections of the cable entry must not inevitably correspond to the IP ingress protections of the complete instrument TC10-H.

4) Ingress protections, which describe temporary or lasting submersion, available on request

Ingress protection per IEC/EN 60529

Degrees of protection against solid foreign bodies (defined by the first index number)

First index number	Degree of protection / short description	Test parameter
5	Dust-protected	per IEC/EN 60529
6	Dust-tight	per IEC/EN 60529

Degrees of protection against water (defined by the second index number)

Second index number	Degree of protection / short description	Test parameter
4	Protected against splash water	per IEC/EN 60529
5	Protected against water jets	per IEC/EN 60529
6	Protected against strong water jets	per IEC/EN 60529
7 ¹⁾	Protected against the effects of temporary immersion in water	per IEC/EN 60529
8 ¹⁾	Protected against the effects of continuous immersion in water	by agreement

1) Ingress protections, describing temporary or permanent immersion, on request

Standard ingress protection of model TC10-H is IP65.

The stated degrees of protection apply under the following conditions:

- Use of a suitable cable gland
- Use of a cable cross-section appropriate for the gland or select the appropriate cable gland for the available cable
- Adhere to the tightening torques for all threaded connections

Transmitter

Mounting on the terminal plate

With mounting on the terminal plate, the transmitter replaces the terminal block.

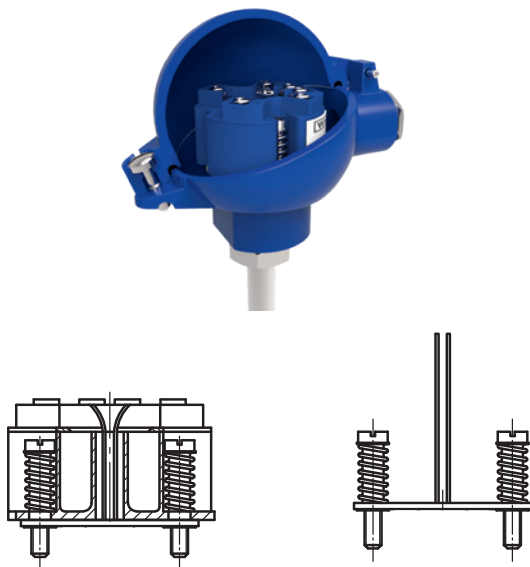


Fig. left: Terminal plate with mounted transmitter (here: model T32)
Fig. right: Terminal plate prepared for transmitter mounting

Mounted within the cap of the connection head

Mounting the transmitter in the cap of the connection head is preferable to mounting it on the terminal plate. With this type of mounting, for one, a better thermal insulation is ensured, and in addition, exchange and mounting for servicing is simplified.



Transmitter models



HART
COMMUNICATION PROTOCOL

Output signal 4 ... 20 mA, HART® protocol

Transmitter (selectable versions)	Model T16	Model T32	Model T91.20
Data sheet	TE 16.01	TE 32.04	TE 91.01
Output			
4 ... 20 mA	x	x	x
HART® protocol	-	x	-
Input			
Thermocouples IEC 60584-1	K, J, E, N, T	K, J, E, N, T	K, J, T
Explosion protection	Optional	Optional	-

Possible mounting positions for transmitters

Connection head	T16	T32	T91.20
JS	-	-	○
BS	○	-	-
BSZ, BSZ-K	○	○	-
BSZ-H, BSZ-HK	●	●	-
BSZ-H (2x cable outlet)	●	●	-
BSZ-H / DIH10	○	○	-
BSS	○	○	-
BSS-H	●	●	-
BVS	○	○	-

○ Mounted instead of terminal block ● Mounted within the cap of the connection head – Mounting not possible

The mounting of a transmitter on the terminal plate is possible with all the connection heads listed here. The fitting of a transmitter in the (screw) cap is not possible.

Mounting of 2 transmitters on request.

For a correct determination of the overall measuring deviation, the sensor and transmitter measuring deviations must be added.

Functional safety (option) with temperature transmitter model T32



In safety-critical applications, the entire measuring chain must be taken into consideration in terms of the safety parameters. The SIL classification allows the assessment of the risk reduction reached by the safety installations.

Selected TC10-F thermocouples, in combination with a suitable temperature transmitter (e.g. model T32.1S, TÜV certified SIL version for protection systems developed in

accordance with IEC 61508), are suitable as sensors for safety functions to SIL 2.

For detailed specifications, see Technical information IN 00.19 at www.wika.com.

Process connections

The TC10-H sheathed thermocouples can be fitted optionally with the process connections shown below. The insertion length A (U_1 or U_2) can be customised. The neck length, N (M_H), depends on the type of the process connection selected.

To minimise heat dissipation errors via the threaded connection, the insertion length, A , should be at least 25 mm long. The position of the threaded connection is specified by the dimension N (M_H), and is not dependent on the connection type.

■ 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 neck length N (M_H) here is only the height of the hexagon at the top of the thermowell.
 N (M_H) is always 10 mm.

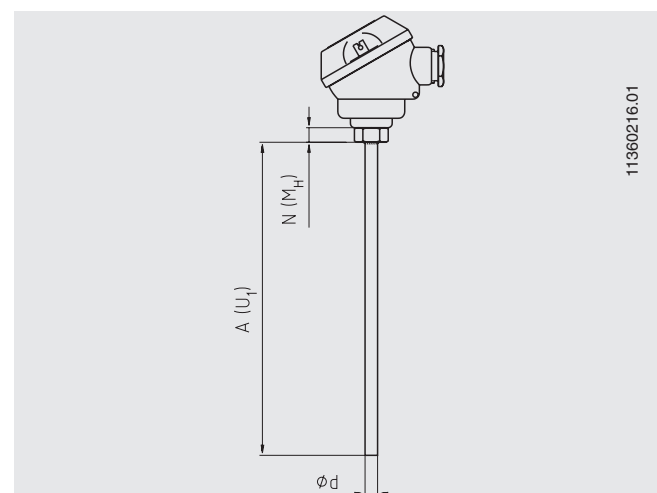
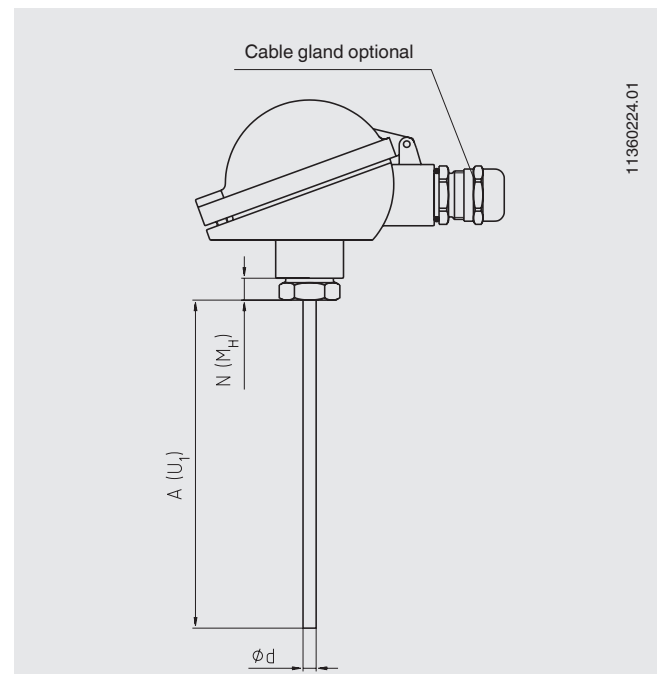
■ Without process connection (miniature version)

This version is designed mainly for mounting in one of the available compression fittings. Only connection heads of the JS design can be used.

The neck length N (M_H) here is only the height of the hexagon at the top of the thermowell.
 N (M_H) is always 7 mm.

Please note:

- For parallel threads (e.g. G ½) the dimensioning always refers to the sealing collar of the threaded connector nearest the process.
- For tapered threads (e.g. NPT) the measurement plane is located approx. in the centre of the thread.



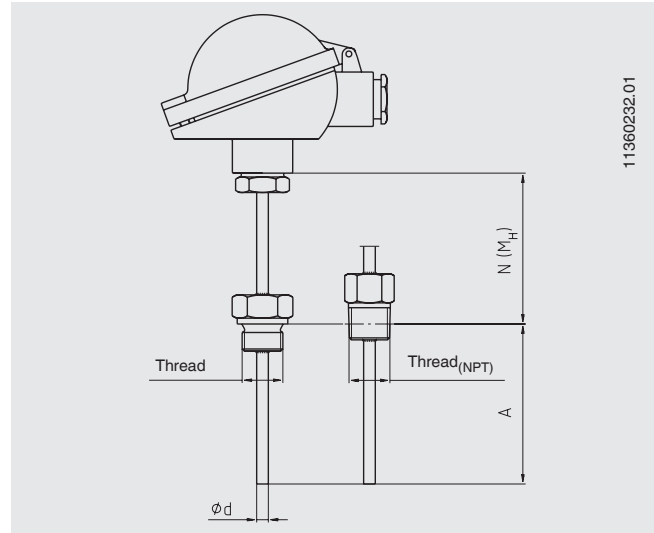
■ **Protruded fixed thread**

This version is used for the mounting of thermometers into threaded couplings with female threads.

Insertion length A: In accordance with customer specification

Material: stainless steel, others on request

The probe must be rotated in order to screw it into the process. Therefore, this design must first be mounted mechanically and it can then be electrically connected.



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■ **Compression fitting**

This version allows simple adjustment to the required insertion length at the mounting point.

Since the compression fitting is movable on the probe, the A and N (M_H) dimensions define the as-delivered condition. The length of the compression fitting determines the smallest possible neck length N (M_H) of approx. 40 mm.

Material: Stainless steel

Ferrule material: Stainless steel or PTFE

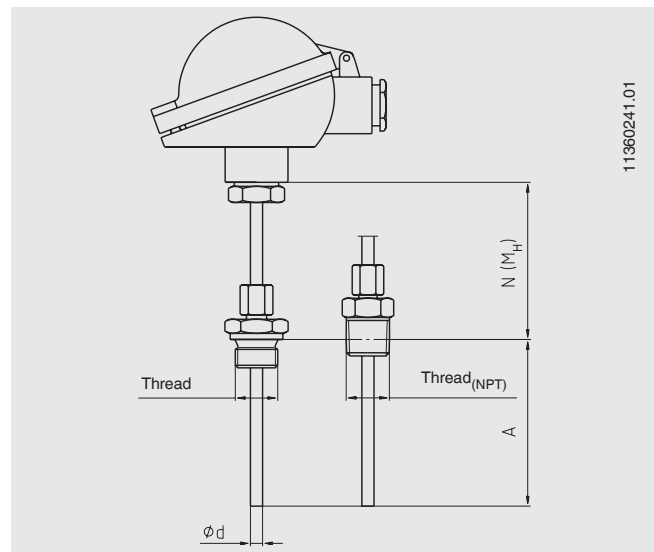
Stainless steel ferrules can be adjusted once; once they have been unscrewed, sliding along the sheath is no longer possible.

- Max. temperature at process connection 500 °C (unpressurised)
- Max. pressure load 20 bar (at max. 150 °C, Ø 6 mm)

PTFE ferrules can be adjusted several times, after unscrewing, repeated sliding along the sheath is still possible.

- Max. temperature at process connection 150 °C
- For use without pressure

For sheathed thermocouples with a Ø of 2 mm, only PTFE ferrules are approved.



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■ **Spring-loaded compression fitting**

This version allows easy adjustment to the desired insertion length at the mounting point, while at the same time sustaining the spring pre-tension

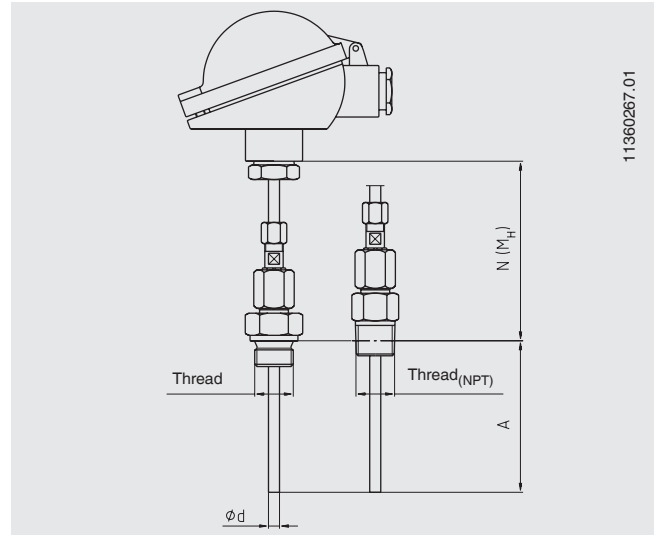
Since the compression fitting is movable on the probe, the A and N (M_H) dimensions define the as-delivered condition. The length of the compression fitting determines the smallest possible neck length N (M_H) of approx. 100 mm.

Material: Stainless steel

Ferrule material: Stainless steel

Stainless steel ferrules can be adjusted once; once they have been unscrewed, sliding along the sheath is no longer possible.

- Max. temperature at process connection 150 °C
- For use without pressure

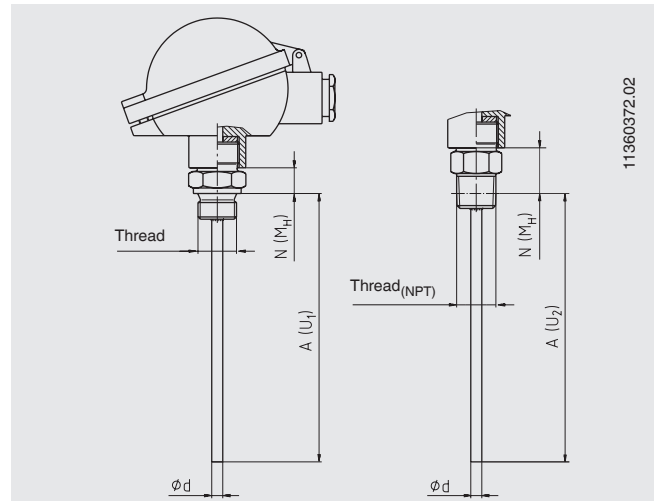


■ **Double threaded hex bushing**

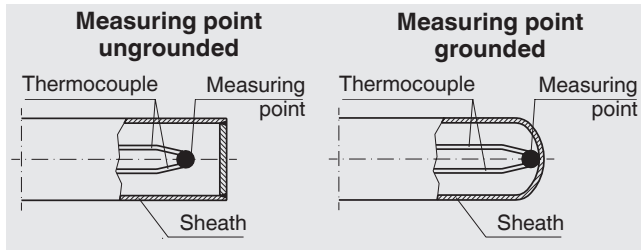
Using a double-sided threaded nipple, the thermometer can be screwed directly into the process. In this case the permissible temperature ranges must be observed.

The neck length, N (M_H), for parallel threads depends on the height of the hexagon. This is 13 mm.

The neck length, N (M_H), of NPT threads not only includes the hexagon height but also half of the thread height. This gives us a neck length, N (M_H), of approx. 25 mm.



Probe tip designs



For temperature measurement in a solid body, the diameter of the bore into which the probe should be inserted, should be no more than 1 mm larger than the probe diameter.

Sheathed thermocouples may be flexed with a radius 3-times of the sheath diameter.

Sheath diameter:

- 3.0 mm
- 4.5 mm
- 6.0 mm
- 8.0 mm

Others on request

Please note:

The flexibility of the sheathed thermocouple must be considered, especially when the flow rates are relatively high. Designs in which the process connection is not located directly at the connection head should be considered critical in applications where vibratory or oscillating stresses occur.

Ordering information

Model / Explosion protection / Connection head / Cable outlet / Terminal block, transmitter / Version of the threaded connection / Measuring element / Temperature range / Probe diameter / Materials / Thread size / Neck length / Insertion length / Certificates / Options

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The specifications given in this document represent the state of engineering at the time of publishing.
We reserve the right to make modifications to the specifications and materials.

Sheath material

- Ni alloy: Alloy 600
 - up to 1,200 °C (air)
 - standard material for applications which require specific corrosion-resistant properties under exposure to high temperatures, resistant to induced stress corrosion cracking and pitting corrosion in media containing chloride
 - resistant to corrosion caused by aqueous ammonia in all temperatures and concentrations
 - highly resistant to halogens, chlorine, hydrogen chloride
- Stainless steel
 - up to 850 °C (air)
 - good resistance against aggressive media and also against vapour and combustion gases in chemical media

Others on request

Operating conditions

Ambient and storage temperature

-40 ... +80 °C

Other ambient and storage temperatures on request

Certificates (option)

Certification type	Measurement accuracy	Material certificate
2.2 test report	x	x
3.1 inspection certificate	x	x
DKD/DAkkS calibration certificate	x	-

The different certifications can be combined with each other.

The minimum length (metal part of the probe or the length of the probe below the process connection) for carrying out a measurement accuracy test 3.1 or DKD/DAkkS is 100 mm. Calibration of shorter lengths on request.

