

# Electrical Temperature Measurement

Thermocouples  
Model TC10-B, for Additional Thermowell



## Applications

- Machinery, plant and tank construction
- Energy and power plant technology
- Chemical industry
- Food and beverage industry
- Sanitary, heating and air-conditioning technology

## Special Features

- Application ranges from 0 °C to +1200 °C
- Suitable to assemble with all standard thermowell designs
- Spring-loaded measuring insert (exchangeable)
- Explosion-protected versions Ex-i, Ex-n and NAMUR NE24

## Description

Thermocouples in this series can be combined with a large number of thermowell designs. Operation without thermowell is only recommended for specific applications.

An extensive range of sensors, connection heads, insertion lengths, neck lengths, thermowell connections etc. are available for these thermometers, so that they are suitable for all thermowell dimensions and applications.

Intrinsically safe designs are available for applications in hazardous areas. The models of the TC10-B series are provided with a type-examination certificate for 'intrinsically safe' type of protection according to directive 94/9/EC (ATEX) for gases and dust. Manufacturer's Declarations in accordance with NAMUR NE24 are also available.



Thermocouple for Additional Thermowell, Model TC10-B



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



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## Sensor

### Sensor type

#### Order chart 1

Type	Recommended max. operating temperature
<b>K (NiCr-Ni)</b>	1200 °C
<b>J (Fe-CuNi)</b>	800 °C
<b>E (NiCr-CuNi)</b>	800 °C
<b>T (Cu-CuNi)</b>	400 °C
<b>N (NiCrSi-NiSi)</b>	1200 °C

In the case of type K there is a risk of blue mould between 850 °C and 950 °C. We recommend the use of a sensor type N, if the working temperature fluctuates continuously in this range.

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

Listed sensor types are available both as simplex or duplex thermocouples.

The measuring point (hot junction) of the probe is supplied as ungrounded unless specified otherwise.

### Sensor limiting error

A cold junction temperature of 0 °C is taken as basis with the definition of the sensor limiting error of thermocouples.

### Type K

Class	Temperature range	Limiting error
<b>DIN EN 60 584 part 2</b>		
<b>1</b>	-40 °C ... +375 °C	± 1.5 °C
<b>1</b>	+375 °C ... +1000 °C	± 0.0040 ·  t  <sup>1)</sup>
<b>2</b>	-40 °C ... +333 °C	± 2.5 °C
<b>2</b>	+333 °C ... +1200 °C	± 0.0075 ·  t  <sup>1)</sup>
<b>ISA (ANSI) MC96.1-1982</b>		
<b>Standard</b>	0 °C ... +1250 °C	± 2.2 °C or <sup>2)</sup> ± 0.75 %
<b>Special</b>	0 °C ... +1250 °C	± 1.1 °C or <sup>2)</sup> ± 0.4 %

### Type J

Class	Temperature range	Limiting error
<b>DIN EN 60 584 part 2</b>		
<b>1</b>	-40 °C ... +375 °C	± 1.5 °C
<b>1</b>	+375 °C ... +750 °C	± 0.0040 ·  t  <sup>1)</sup>
<b>2</b>	-40 °C ... +333 °C	± 2.5 °C
<b>2</b>	+333 °C ... +750 °C	± 0.0075 ·  t  <sup>1)</sup>
<b>ISA (ANSI) MC96.1-1982</b>		
<b>Standard</b>	0 °C ... +750 °C	± 2.2 °C or <sup>2)</sup> ± 0.75 %
<b>Special</b>	0 °C ... +750 °C	± 1.1 °C or <sup>2)</sup> ± 0.4 %

### Type E

Class	Temperature range	Limiting error
<b>DIN EN 60 584 part 2</b>		
<b>1</b>	-40 °C ... +375 °C	± 1.5 °C
<b>1</b>	+375 °C ... +800 °C	± 0.0040 ·  t  <sup>1)</sup>
<b>2</b>	-40 °C ... +333 °C	± 2.5 °C
<b>2</b>	+333 °C ... +900 °C	± 0.0075 ·  t  <sup>1)</sup>

### Type T

Class	Temperature range	Limiting error
<b>DIN EN 60 584 part 2</b>		
<b>1</b>	-40 °C ... +125 °C	± 0.5 °C
<b>1</b>	+125 °C ... +350 °C	± 0.0040 ·  t  <sup>1)</sup>
<b>2</b>	-40 °C ... +133 °C	± 1.0 °C
<b>2</b>	+133 °C ... +350 °C	± 0.0075 ·  t  <sup>1)</sup>

### Type N

Class	Temperature range	Limiting error
<b>DIN EN 60 584 part 2</b>		
<b>1</b>	-40 °C ... +375 °C	± 1.5 °C
<b>1</b>	+375 °C ... +1000 °C	± 0.0040 ·  t  <sup>1)</sup>
<b>2</b>	-40 °C ... +333 °C	± 2.5 °C
<b>2</b>	+333 °C ... +1200 °C	± 0.0075 ·  t  <sup>1)</sup>

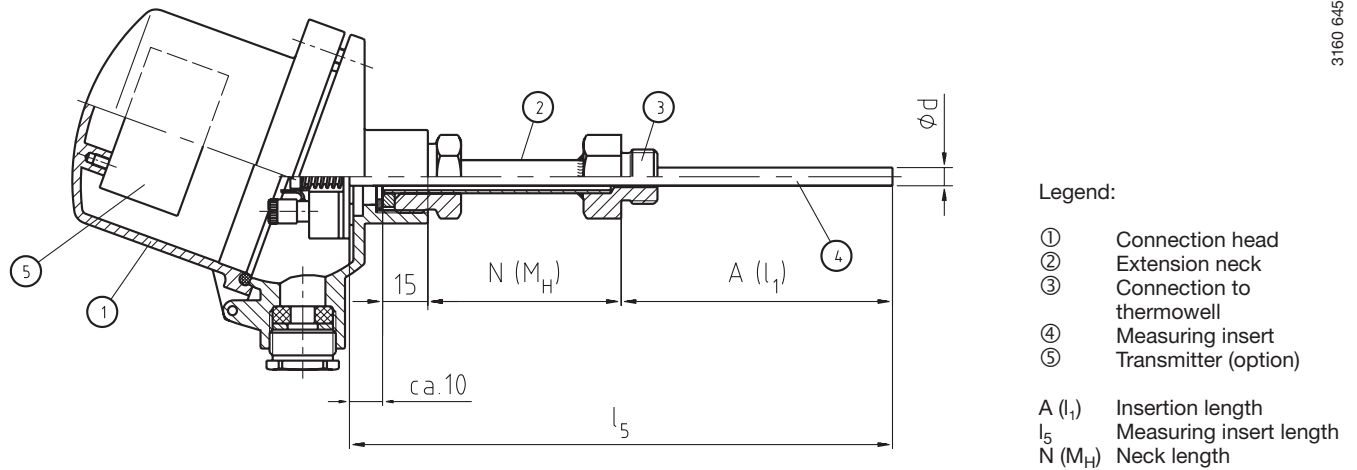
1) |t| is the value of the temperature in °C without consideration of the sign  
2) Whichever is larger.

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

Temperature (ITS 90) °C	Limiting error DIN EN 60 751	
	Class 1 °C	Class 2 °C
<b>0</b>	± 1.5	± 2.5
<b>100</b>	± 1.5	± 2.5
<b>200</b>	± 1.5	± 2.5
<b>300</b>	± 1.5	± 2.5
<b>400</b>	± 1.6	± 3
<b>500</b>	± 2	± 3.75
<b>600</b>	± 2.4	± 4.5
<b>700</b>	± 2.8	± 5.25
<b>800</b>	± 3.2	± 6
<b>900</b>	± 3.6	± 6.75
<b>1000</b>	± 4	± 7.5
<b>1100</b>	± 4.4	± 8.25
<b>1200</b>	± 4.8	± 9

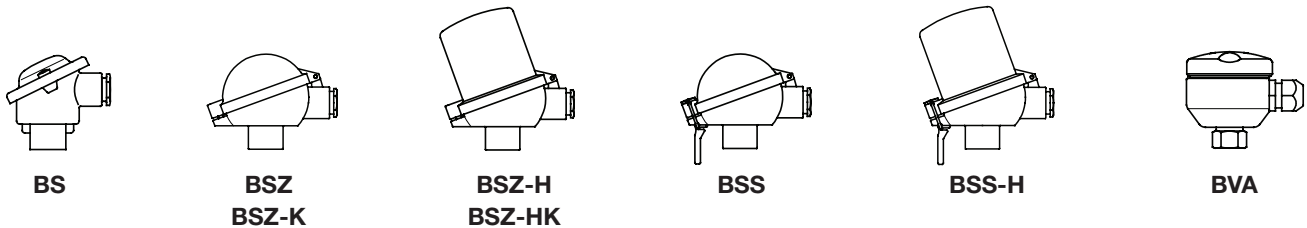
## TC10-B components

Fig. with parallel thread, conical thread see page 5



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## Connection head / connector plugs



Model	Material	Cable entry	Ingress protection	Cap	Surface finish
BS	Aluminium	M20 x 1.5 <sup>1)</sup>	IP 65	Cap with 2 screws	blue, painted <sup>2)</sup>
BSZ	Aluminium	M20 x 1.5 <sup>1)</sup>	IP 65	Flap cap with screw	blue, painted <sup>2)</sup>
BSZ-K	Plastic	M20 x 1.5 <sup>1)</sup>	IP 65	Flap cap with screw	black
BSZ-H	Aluminium	M20 x 1.5 <sup>1)</sup>	IP 65	Flap cap with screw	blue, painted <sup>2)</sup>
BSZ-HK	Plastic	M20 x 1.5 <sup>1)</sup>	IP 65	Flap cap with screw	black
BSS	Aluminium	M20 x 1.5 <sup>1)</sup>	IP 65	Flap cap with clip	blue, painted <sup>2)</sup>
BSS-H	Aluminium	M20 x 1.5 <sup>1)</sup>	IP 65	Flap cap with clip	blue, painted <sup>2)</sup>
BVA	Stainless steel	M20 x 1.5 <sup>1)</sup>	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. Intrinsically safe versions, explosion protection type EEx (i), are also available.



Fig. Connection head with digital indicator, Model DIH10

## 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 2 transmitters on request.

### Order chart 3

Model	Description	Explosion protection	Data sheet
T19	Analogue transmitter, configurable	without	TE 19.03
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

## Extension neck

The extension neck is screwed to the connection head. The usual size to industrial standards is M24 x 1.5 mm. The length of the extension neck depends on the application. Generally the extension neck serves for the bridging of an insulation. In many applications it is also used as a part cooling element between connection head and medium in order to protect any head mount transmitters from high medium temperatures. Standard material of the extension neck is stainless steel.

### Order chart 4: Standard measuring insert length

Measuring insert Ø in mm	Standard measuring insert length in mm											
	275	315	345	375	405	435	525	555	585	655	735	
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	

The lengths specified in this table correspond to the standard lengths. Intermediate lengths or excess lengths are possible without any problems.

### Order chart 5: Possible combinations of design, extension neck diameter -and connection thread

Design of the screw connection at the extension neck	Connection thread at extension neck				Connection thread to the head
	Ø 12 mm	Order No	Ø 14 mm	Order No	
Male thread	G ½ B	1	G ½ B	11	M24 x 1.5
	G ¾ B	2	G ¾ B	12	M24 x 1.5
	M14 x 1.5	3	-		M24 x 1.5
	M18 x 1.5	4	M18 x 1.5	13	M24 x 1.5
	½ NPT	5	½ NPT	14	M24 x 1.5
	¾ NPT	6	¾ NPT	15	M24 x 1.5
Union nut	G ½ B	7	G ½ B	16	M24 x 1.5
	M27 x 2	8	M27 x 2	17	M24 x 1.5
Male nut	G ½ B	9	G ½ B	18	M24 x 1.5
Extension neck without thread	-		-		M24 x 1.5
Extension neck with compression fitting	G ½ B	10	G ½ B	19	M24 x 1.5
	M27 x 2	11	M27 x 2	20	M24 x 1.5

### Order chart 2

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

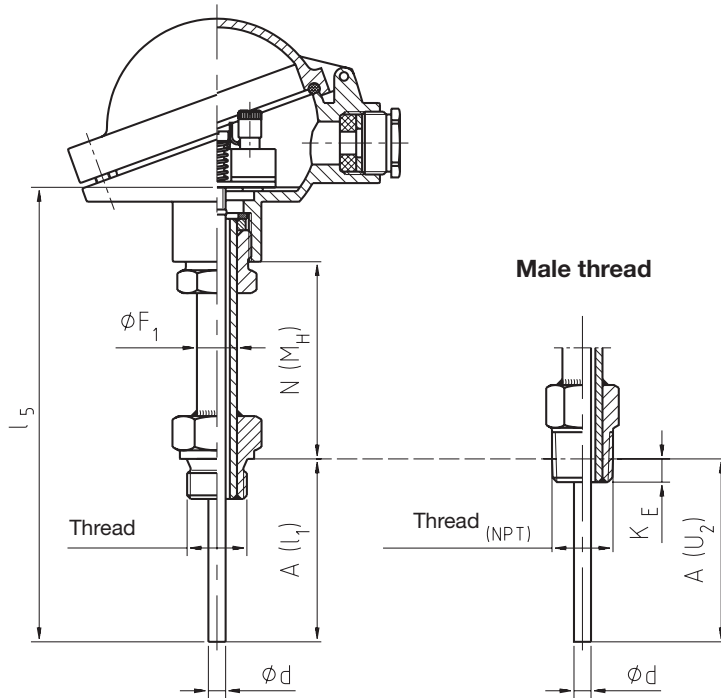
## Measuring insert

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

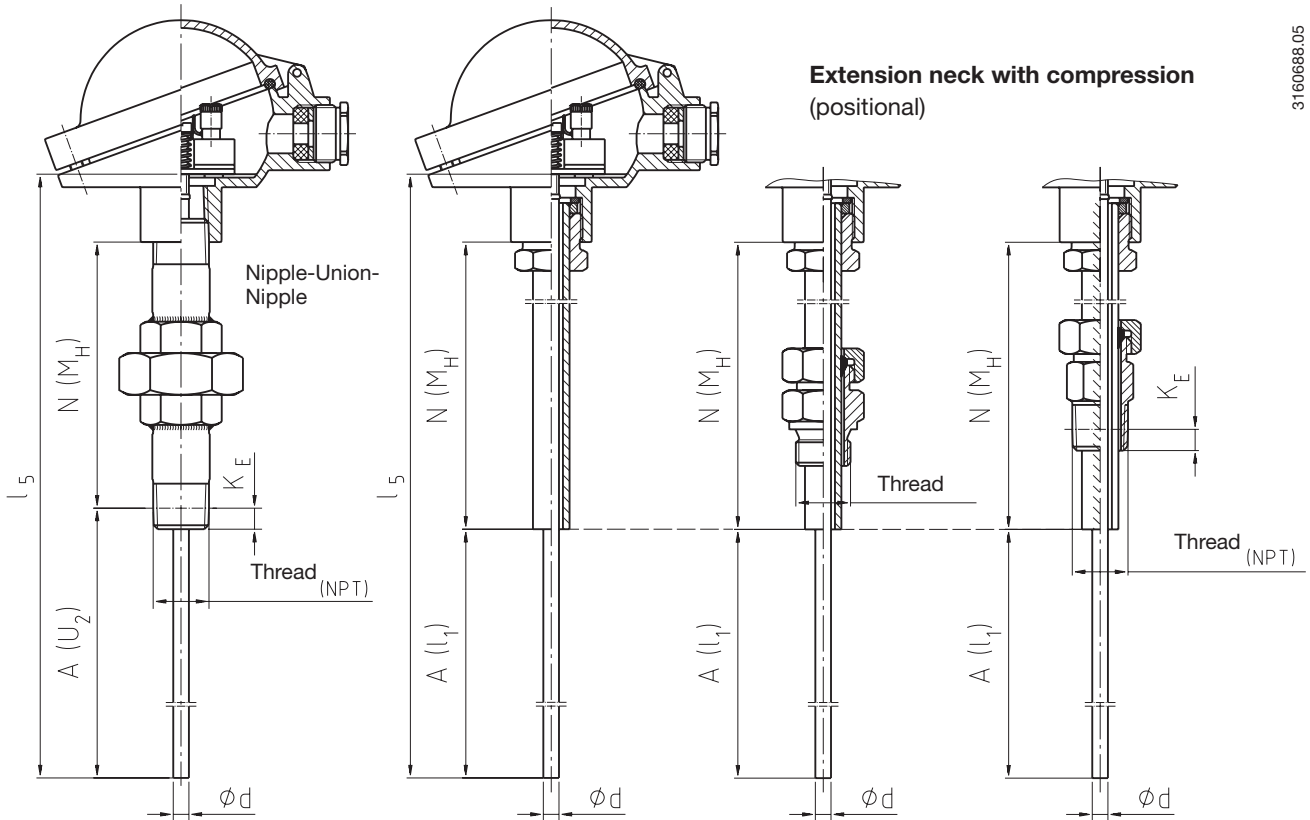
When fitting the measuring insert with a thermowell, it is very important to determine the correct insertion length (= thermowell length with bottom thicknesses of 5.5 mm). In this connection the fact that the measuring insert is spring-loaded (spring travel: max. 10 mm) has to be taken into account in order to ensure that the measuring insert presses against the bottom of the thermowell. Furthermore we recommend that a neck length be selected to give a standard length for the thermometer's measuring insert. This has the advantage that a measuring insert of the standard series can be used.

## Connection to thermowell

The many possible designs ensure that the thermocouple, Model TC10-B, can be combined with almost all feasible thermowells. The most usual designs of connection are shown in the following drawings. Others are available on request.



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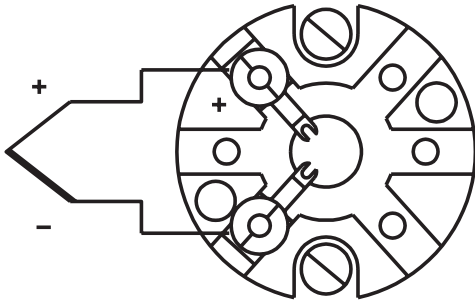
### Legend:

A (l<sub>1</sub>) Insertion length  
(with cylindrical threads)  
A (U<sub>2</sub>) Insertion length  
(with conical threads)  
l<sub>5</sub> Measuring insert length

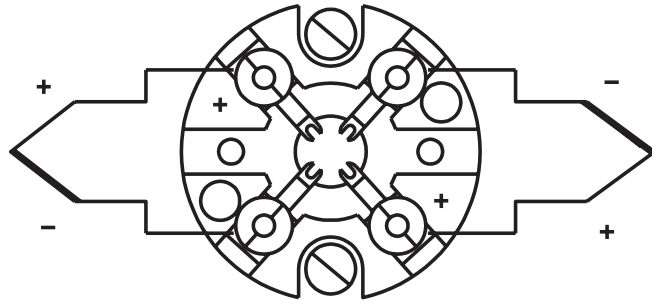
N (M<sub>H</sub>) Neck length  
Ø F<sub>1</sub> Extension neck Ø  
Ø d Measuring inser Ø  
K<sub>E</sub> Screw-in length by hand,  
- with ½ NPT approx. 8.1 mm  
- with ¾ NPT approx. 8.6 mm

## Electrical connection

Simplex thermocouple



Duplex thermocouple



The colour coding at the plus pole of the device is always deciding the correlation of polarity and connection terminal.

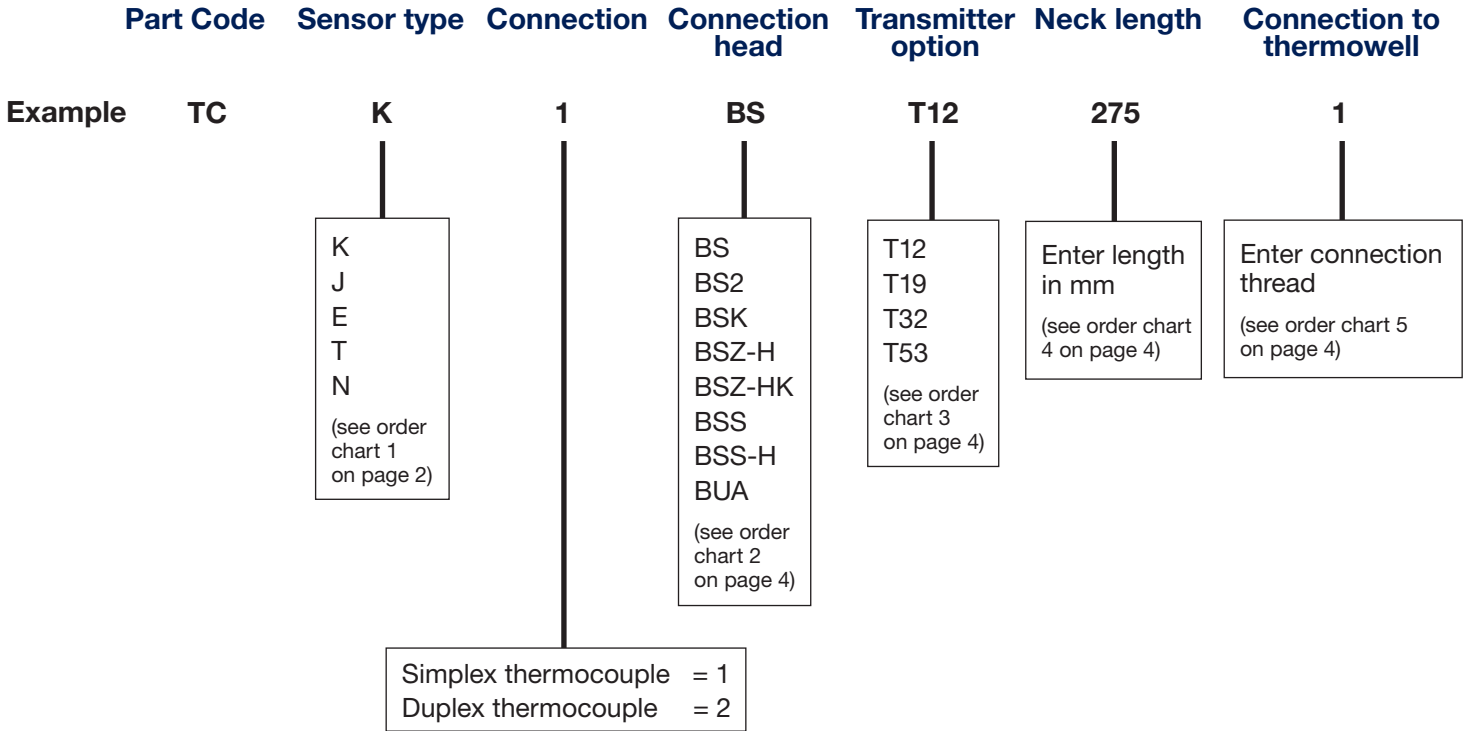
## Explosion protection (option)

Thermocouples of the model series TC10-B are available with a type-examination certificate for 'intrinsically safe' ignition protection (TÜV 02 ATEX 1793 X). These thermometers comply with the requirements of directive 94/9/EC (ATEX), EEx-i, for gases and dust. Manufacturer's Declarations in accordance with NAMUR NE24 are also available.

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

The responsibility for using suitable thermowells rests with the user. The permissible ambient temperature ranges of the built-in transmitters can be taken from the corresponding transmitter approval. The responsibility for using suitable thermowells rests with the user.

# Ordering information - Part Number Configurator



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.

