

Electrical Temperature Measurement

Resistance Thermometers
Model TR10-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 -200 °C ... +600 °C
- To assemble with all standard thermowell designs
- Spring-loaded measuring insert (exchangeable)
- Explosion-protected versions Ex-i, Ex-n and NAMUR NE24

Description

Resistance thermometers 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 TR10-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.



Resistance Thermometer for
Additional Thermowell,
Model TR10-B

Optionally we can fit analogue or digital transmitters from the Parker range into the connection head of the TR10-B.



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Sensor

The sensor is located in the measuring insert, which is exchangeable and spring-loaded.

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 to DIN EN 60 751
- Class A to 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 measuring insert, over-rides 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:

$$\alpha = 3,85 \cdot 10^{-3} \text{ } ^\circ\text{C}^{-1}$$

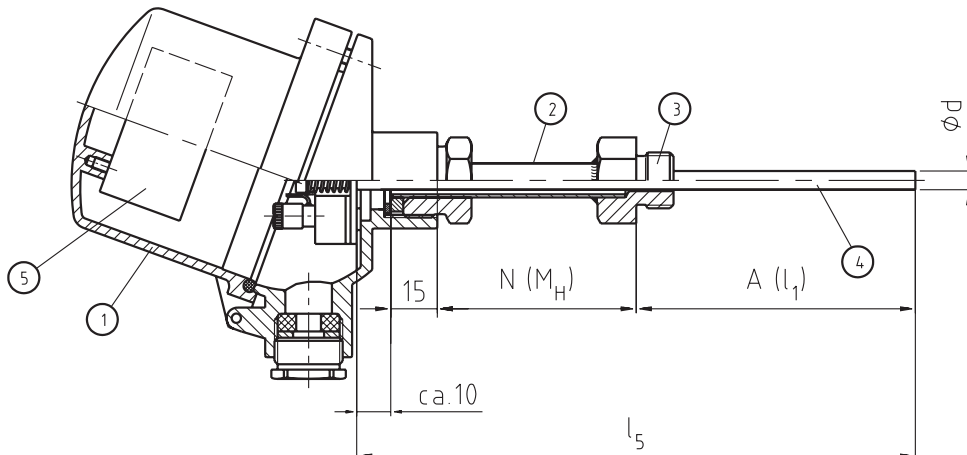
The relationship between the temperature and the electrical resistance is characterised by polynomials which are defined in DIN EN 60 751. Furthermore, this standard lays down the basic values in °C stages.

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

TR10-B components

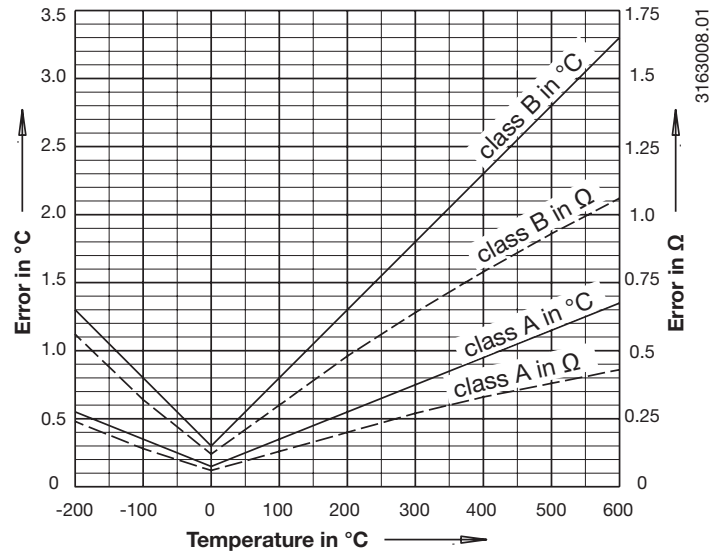
Fig. with parallel thread, conical thread see page 5



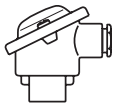
Legend:

- ① Connection head
 - ② Neck tube
 - ③ Connection to thermowell
 - ④ Measuring insert
 - ⑤ Transmitter (option)
- A (l1) Insertion length
 l5 Measuring insert length
 N (MH) Neck length

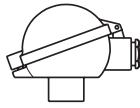
Temperature (ITS 90) °C	Basic value Ω	Limiting error Class A		DIN EN 60 751 Class B	
		°C	Ω	°C	Ω
-200	18.52	± 0.55	± 0.24	± 1.30	± 0.56
-100	60.26	± 0.35	± 0.14	± 0.80	± 0.32
-50	80.31	± 0.25	± 0.10	± 0.55	± 0.22
0	100.00	± 0.15	± 0.06	± 0.30	± 0.12
50	119.40	± 0.25	± 0.10	± 0.55	± 0.21
100	138.51	± 0.35	± 0.13	± 0.80	± 0.30
200	175.86	± 0.55	± 0.20	± 1.30	± 0.48
300	212.05	± 0.75	± 0.27	± 1.80	± 0.64
400	247.09	± 0.95	± 0.33	± 2.30	± 0.79
500	280.98	± 1.15	± 0.38	± 2.80	± 0.93
600	313.71	± 1.35	± 0.43	± 3.30	± 1.06



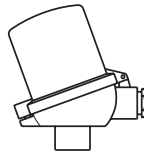
Connection head



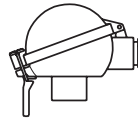
BS



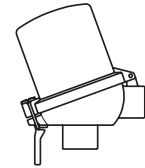
BSZ
BSZ-K



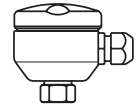
BSZ-H
BSZ-HK



BSS



BSS-HB



VA

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

Connection head	Transmitter Model				
	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 12.03
T32	Digital transmitter, HART protocol	optional	TE 32.03
T53	Digital transmitter FOUNDATION Fieldbus and PROFIBUS PA	standard	TE 53.01

Neck tube

The neck tube is screwed to the connection head. The usual size to industrial standards is M24 x 1.5 mm. The length of the neck tube depends on the application. Generally the neck tube 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 neck tube is stainless steel.

Measuring insert

The measuring insert is made of a vibration-resistant sheathed measuring cable (mineral-insulated 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

Order chart 2: Standard measuring insert lengths

Measuring insert Ø in mm	Standard measuring insert lengths 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.

Possible combinations of measuring insert diameter, number of sensors and sensor method of connection

Measuring insert Ø in mm	Sensor / method of connection 1 x Pt100			Sensor / method of connection 2 x Pt100		
	2-wire	3-wire	4-wire	2-wire	3-wire	4-wire
3	x	x	x	x	x	-
6	x	x	x	x	x	x
8	x	x	x	x	x	x

Order chart 3: Possible combinations of design, neck tube diameter and connection thread

Design of the screw connection at the neck tube	Connection thread at neck tube				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	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	7	G ½	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
Neck tube without thread	-		-		M24 x 1.5
Neck tube 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

Explosion protection (option)

Resistance thermometers of the Model series TR10-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.

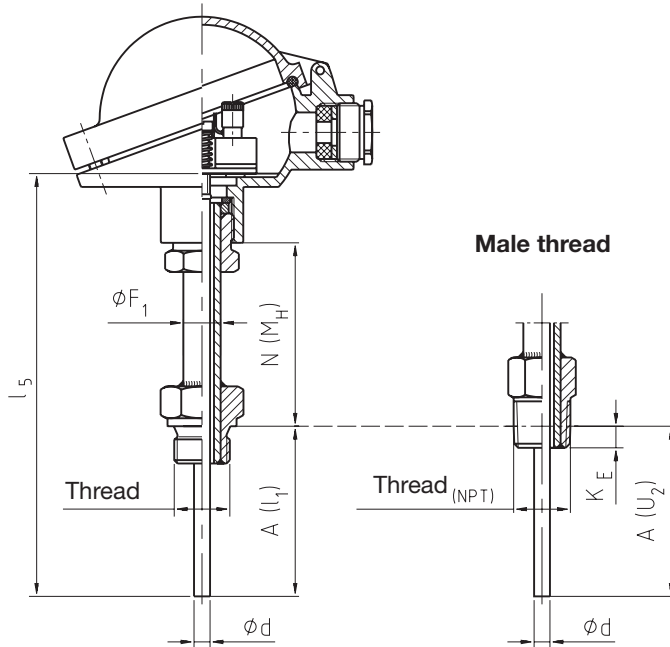
The classification / suitability of the instrument (permissible power Pmax., minimum neck length and permissible

ambient temperature) for the respective category can be seen on the type-examination certificate and in the operating instructions.

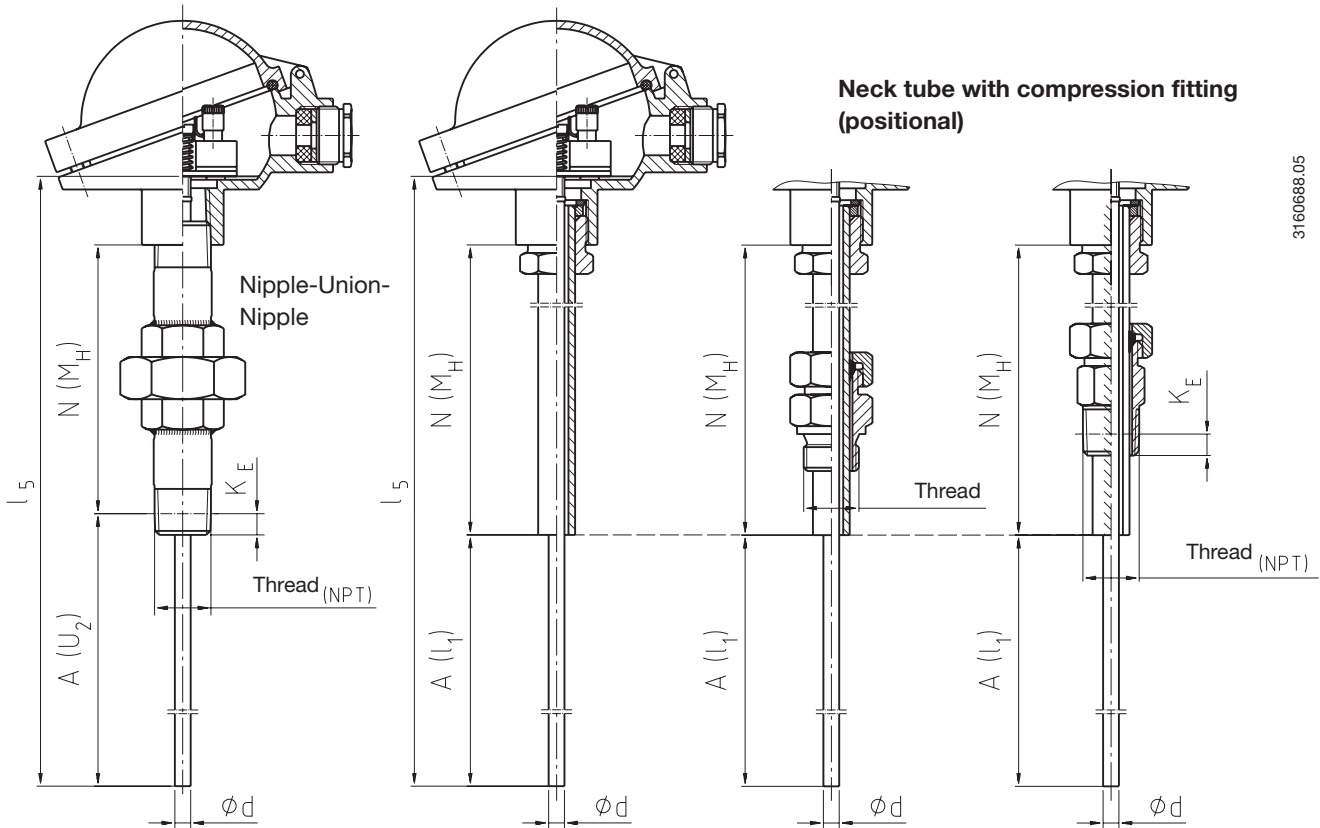
Built-in transmitters have their own approval. The permissible ambient temperature ranges of the built-in transmitters can be taken from the corresponding transmitter approval. The responsibility for using suitable thermowells rests with the user.

Connection to thermowell

The many possible designs ensure that the resistance thermometer, Model TR10-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.



3160670.05



3160688.05

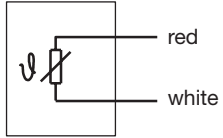
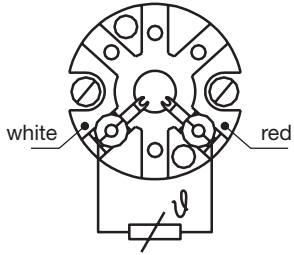
Legend:

$A (l_1)$ Insertion length
(with cylindrical threads)
 $A (U_2)$ Insertion length
(with conical threads)
 l_5 Measuring insert length

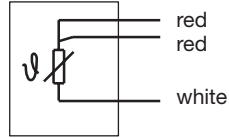
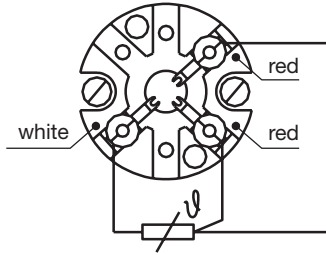
$N (M_H)$ Neck length
 ϕF_1 Neck tube ϕ
 ϕd Measuring insert ϕ
 KE Screw-in length by hand
- with $\frac{1}{2}$ NPT approx. 8.1 mm
- with $\frac{3}{4}$ NPT approx. 8.6 mm

Electrical connection

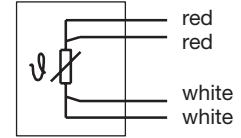
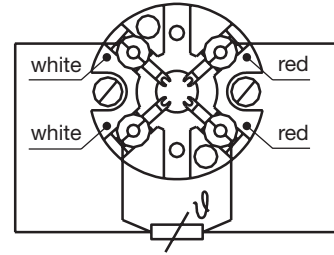
1 x Pt100, 2-wire



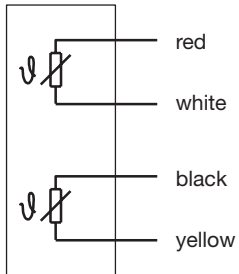
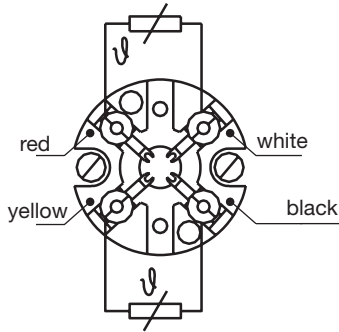
1 x Pt100, 3-wire



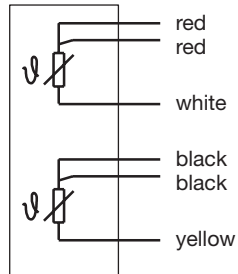
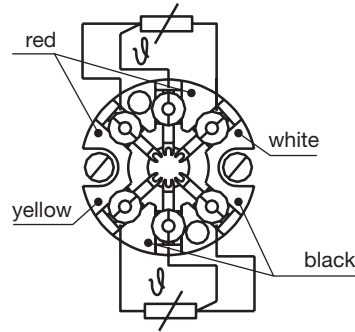
1 x Pt100, 4-wire



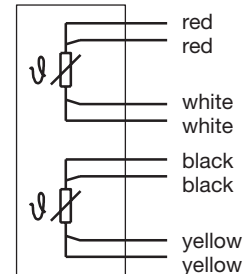
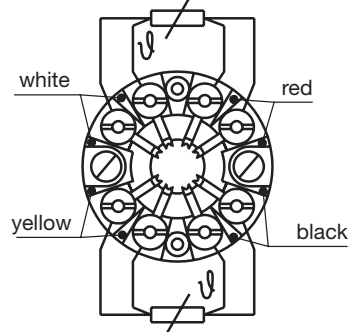
2 x Pt100, 2-wire



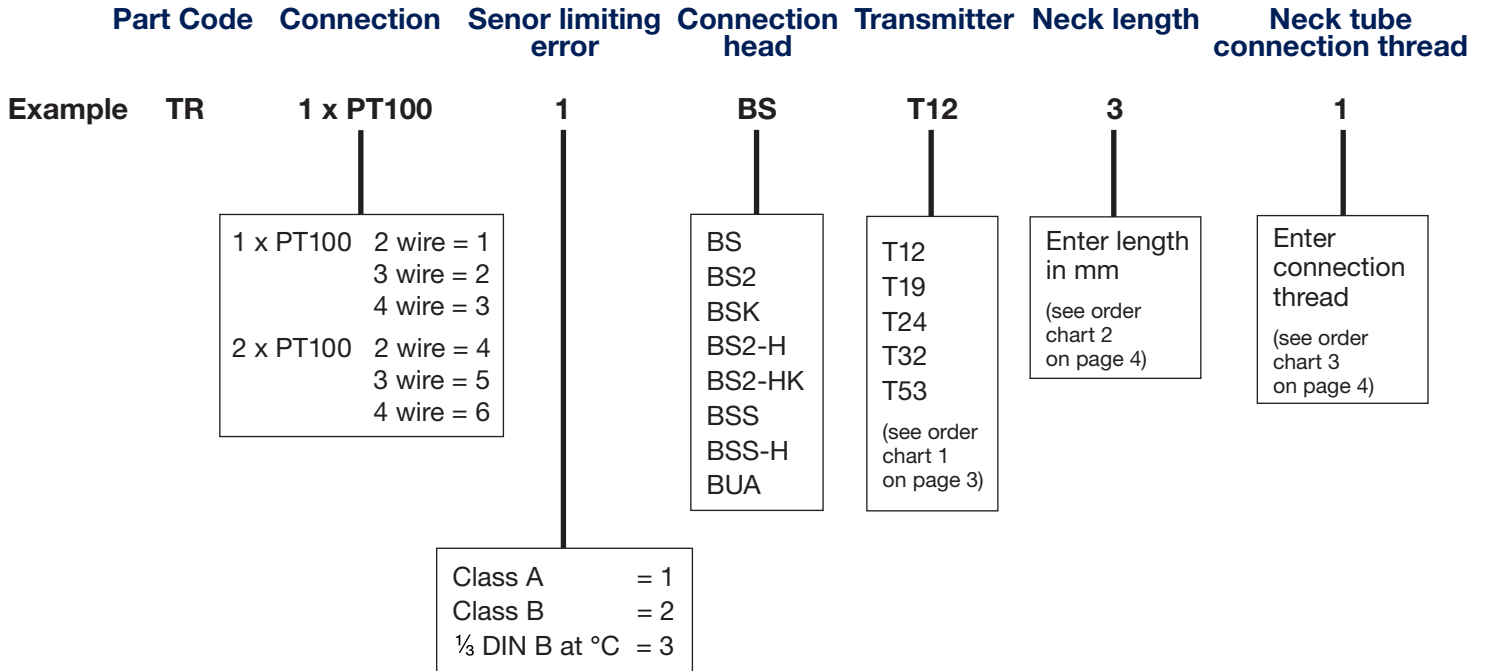
2 x Pt100, 3-wire



2 x Pt100, 4-wire



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.

