

Miniature resistance thermometer

For sanitary applications, with flange connection

Model TR21-A

WIKA data sheet TE 60.26



for further approvals
see page 6

Applications

- Sanitary applications
- Food and beverage industry
- Bio and pharmaceutical industry, production of active ingredients

Special features

- Sensor can be calibrated without having to open the process
- Compact design for space-saving mounting
- Simple and fast electrical connection using an M12 x 1 plug connection
- With direct sensor output (Pt100/Pt1000 in 3 or 4-wire version) or integrated transmitter with 4 ... 20 mA output signal, individually parameterisable with free-of-charge WIKAsoft-TT PC configuration software
- Materials and surface finish quality in accordance with standards of hygienic designs

Description

The model TR21-A resistance thermometer provides temperature measurement in sanitary applications and can be used for the measurement of liquid and gaseous media in the range of $-30 \dots +250 \text{ }^\circ\text{C}$ [$-22 \dots +482 \text{ }^\circ\text{F}$]. For use in hazardous areas, intrinsically safe versions are available.

These thermometers are fitted with protection tubes, whose process connections meet the stringent requirements, in terms of materials and design, of hygienic measuring points. All electrical components are protected against moisture (IP67 or IP69K).

The resistance thermometer is available with direct sensor output or integrated transmitter, which can be configured individually via the WIKAsoft-TT PC configuration software. Measuring range, dampening, error signalling per NAMUR NE 043 and tag no. can be adjusted.



Model TR21-A with VARINLINE® connection

For easy calibration or maintenance, the sensor is interchangeable without having to open the process. Thus hygiene risks can be minimised and downtimes can be reduced.

The spring loading, integrated into the union nut, guarantees the contact between the sensor tip and the bottom of the protection tube and thus ensures a short response time and lasting high accuracy. The welded junction between the protection tube and the flange makes the use of a sealing as additional material in those areas redundant which are in contact with the product. Insertion length, process connection, sensor and connection method can each be selected for the respective application within the ordering information. The electrical connection is made via an M12 x 1 circular connector.

For applications requiring the sterilisation of the instrument in autoclaves, an especially temperature-resistant instrument version is available.

Specifications

| Measuring element | | |
|--|--|---|
| Type of measuring element | | |
| 4 ... 20 mA version (models TR21-A-xTT, TR21-A-xTB) | <ul style="list-style-type: none"> ■ Pt1000 (measuring current < 0.3 mA; self-heating can be ignored) ■ Face-sensitive Pt1000 ¹⁾ (measuring current < 0.3 mA; self-heating can be ignored) | |
| Pt100 (model TR21-A-xPx)/Pt1000 (model TR21-A-xRx) version | <ul style="list-style-type: none"> ■ Pt100 (measuring current: 0.1 ... 1.0 mA) ■ Face-sensitive Pt100 (measuring current 0.1 ... 1.0 mA) ¹⁾ ■ Pt1000 (measuring current: 0.1 ... 0.3 mA) ■ Face-sensitive Pt1000 (measuring current 0.1 ... 0.3 mA) ¹⁾ | |
| → For detailed specifications for Pt sensors, see Technical information IN 00.17 at www.wika.com . | | |
| Connection method | | |
| 4 ... 20 mA version (models TR21-A-xTT, TR21-A-xTB) | 2-wire | |
| Pt100 (model TR21-A-xPx)/Pt1000 (model TR21-A-xRx) version | 3-wire | With a cable length of 30 m or longer, measuring deviations can occur |
| | 4-wire | The lead resistance can be ignored |
| Tolerance value of the measuring element ²⁾ per IEC 60751 | | |
| 4 ... 20 mA version (models TR21-A-xTT, TR21-A-xTB) | Class A | |
| Pt100 (model TR21-A-xPx)/Pt1000 (model TR21-A-xRx) version | <ul style="list-style-type: none"> ■ Class AA ■ Class A | |

- 1) Face-sensitive measuring resistors, through their small design they serve to reduce the heat dissipation with short insertion lengths. Available for the temperature range up to 150 °C [302 °F]. For protection tube insertion lengths of less than 50 mm, face-sensitive measuring resistors are recommended. For protection tube insertion lengths of less than 11 mm, face-sensitive measuring resistors are generally used.
- 2) Depending on the process connection, the deviation can be greater.

| Accuracy specifications (4 ... 20 mA version) | |
|---|--|
| Tolerance value of the measuring element ²⁾ per IEC 60751 | Class A |
| Measuring deviation of the transmitter per IEC 62828 | ±0.25 K |
| Total measuring deviation in accordance with IEC 62828 | Measuring deviation of the measuring element + transmitter |
| Influence of the ambient temperature | 0.1 % of the set measuring span / 10 K T _a |
| Influence of supply voltage | ±0.025 % of the set measuring span / V (depending on the supply voltage U _B) |
| Influence of the load | ±0.05 % of the set measuring span / 100 Ω |
| Linearisation | Linear to temperature per IEC 60751 |
| Output error | ±0.1 % ¹⁾ of the set measuring span |
| Reference conditions | |
| Ambient temperature T _a ref | 23 °C |
| Supply voltage U _B ref | DC 12 V |

- 1) ±0.2 % for start of measuring range less than 0 °C [32 °F]
- 2) Depending on the process connection, the deviation can be greater.

Example calculation: Total measuring deviation

(measuring range 0 ... 150 °C, load 200 Ω, supply voltage 16 V, ambient temperature 33 °C, process temperature 100 °C)

| | |
|---|----------|
| Sensor element (class A per IEC 60751: 0.15+ (0.0020(t))): | ±0.350 K |
| Measuring deviation of the transmitter ±0.25 K: | ±0.250 K |
| Output error ±(0.1 % of 150 K): | ±0.150 K |
| Effect of load ±(0.05 % / 100 Ω of 150 K): | ±0.150 K |
| Influence of supply voltage ±(0.025 % / V of 150 K): | ±0.150 K |
| Influence of the ambient temperature ±(0.1 % / 10 K T _a of 150 K): | ±0.150 K |

Measuring deviation (typical)

$$\sqrt{0.35 K^2 + 0.25 K^2 + 0.15 K^2 + 0.15 K^2 + 0.15 K^2}$$

$$\sqrt{0.275 K^2} = 0.524 K$$

Measuring deviation (maximum)

$$0.35 K + 0.25 K + 0.15 K + 0.15 K + 0.15 K = 1.2 K$$

| Measuring range | |
|---|---|
| Temperature range | |
| 4 ... 20 mA version (models TR21-A-xTT, TR21-A-xTB) | -30 ... +250 °C [-22 ... +482 °F] ¹⁾ |
| Pt100 (model TR21-A-xPx)/Pt1000 (model TR21-A-xRx) version | Class AA 0 ... 150 °C [32 ... 302 °F] |
| | Class A -30 ... +250 °C [-22 ... +482 °F] |
| Unit (4 ... 20 mA version) | Configurable °C, °F, K |
| Temperature at the connector (Pt100, Pt1000 version) | Max. 85 °C [185 °F] |
| Measuring span (4 ... 20 mA version) | Minimum 20 K, maximum 300 K |

1) The temperature transmitter should therefore be protected from temperatures over 85 °C [185 °F].

| Process connection | |
|---|---|
| Type of process connection | <ul style="list-style-type: none"> ■ Clamp ■ VARINLINE® ■ NEUMO BioControl® ■ Union nut DIN 11851 ■ Aseptic threaded pipe connection DIN 11864-1 ■ Aseptic flange DIN 11864-2 ■ Aseptic clamp connection DIN 11864-3 ■ Union nut SMS ■ Process connection, straight ■ Welding ball ■ Ball-type compression fitting ■ Collar-type compression fitting ■ Ingold connection |
| Protection tube | |
| Protection tube model | TW22 |
| Protection tube design | → see drawings from page 12 |
| Protection tube diameter | <ul style="list-style-type: none"> ■ 6 mm ■ Protection tube tip stepped down to 4.5 mm (from U₁ > 25 mm) |
| Surface roughness | <ul style="list-style-type: none"> ■ R_a ≤ 0.76 µm (SF3 per ASME BPE) ■ R_a ≤ 0.38 µm (SF4 per ASME BPE) ■ R_a ≤ 0.38 µm electropolished (SF4 per ASME BPE) |
| Connection to thermometer | G 3/8" |
| Insertion length U ₁ ¹⁾ | <ul style="list-style-type: none"> ■ 25 mm ■ 50 mm ■ 75 mm ■ 100 mm ■ 150 mm ■ 200 mm Other insertion lengths on request |
| Material (wetted) | Stainless steel 1.4435 (316L, UNS S31603) |

1) For the TR21-A design without protection tube, the insertion length is defined by the dimension l₁ (see "Dimensions in mm").
The thickness of bottom of the protection tube can be neglected for dimensioning. It is offset by the spring travel of the measuring insert.

→ For dimensions, see dimension tables from page 12

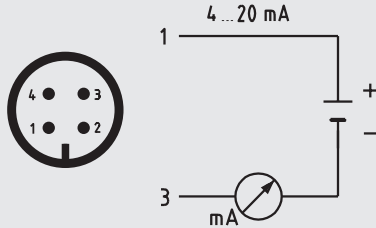
VARINLINE® is a registered trademark of the company GEA Tuchenhausen (former designation: VARIVENT®).
BioControl® is a registered trademark of the company NEUMO.

| Output signal (4 ... 20 mA version) | |
|---|--|
| Analogue output | 4 ... 20 mA, 2-wire |
| Load R_A | $R_A \leq (U_B - 10 \text{ V}) / 23 \text{ mA}$ with R_A in Ω and U_B in V The permissible load depends on the loop supply voltage. For communication with the instrument with programming unit PU-548, a max. load of 350 Ω is admissible. |
| Load diagram | |
| Factory configuration | |
| Measuring range | Measuring range 0 ... 150 °C [32 ... 302 °F] Other measuring ranges are adjustable |
| Current signals for error signalling | Configurable in accordance with NAMUR NE 043 downscale $\leq 3.6 \text{ mA}$ upscale $\geq 21.0 \text{ mA}$ |
| Current value for sensor short-circuit | Not configurable in accordance with NAMUR NE 043 downscale $\leq 3.6 \text{ mA}$ |
| Communication | |
| Info data | Tag no., description and user message can be stored in transmitter |
| Configuration and calibration data | Permanently stored |
| Configuration software | WIKAsoft-TT → Configuration software (multilingual) as a download from www.wika.com |
| Voltage supply | |
| Supply voltage U_B | DC 10 ... 30 V |
| Supply voltage input | Protected against reverse polarity |
| Permissible residual ripple of supply voltage | 10 % generated by $U_B < 3 \%$ ripple of the output current |
| Time response | |
| Switch-on delay, electrical | Max. 4 s (time before the first measured value) |
| Warm-up time | After approx. 4 minutes, the instrument will function to the specifications (accuracy) given in the data sheet. |
| Response time per IEC 60751 | $t_{50} < 4.7 \text{ s}$ $t_{90} < 12.15 \text{ s}$ |

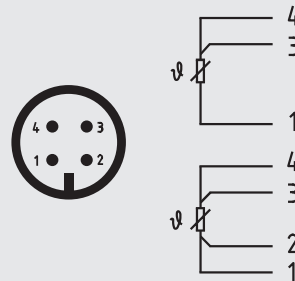
| Electrical connection | |
|-----------------------|------------------------------------|
| Connection type | M12 x 1 circular connector (4-pin) |
| Material | Stainless steel 1.4404 |

Pin assignment

Output signal 4 ... 20 mA
M12 x 1 circular connector (4-pin)



Output signal Pt100 sensor
M12 x 1 circular connector (4-pin)





| Pin | Signal | Description |
|-----|--------|---------------|
| 1 | L+ | 10 ... 30 V |
| 2 | VQ | not connected |
| 3 | L- | 0 V |
| 4 | C | not connected |







| Operating conditions | |
|---|---|
| Ambient temperature range | |
| 4 ... 20 mA version (models TR21-A-xTT, TR21-A-xTB) | -40 ... +85 °C [-40 ... +185 °F] |
| Pt100 (model TR21-A-xPx)/Pt1000 (model TR21-A-xRx) version | -50 ... +85 °C [-58 ... +185 °F] |
| Storage temperature range | |
| -40 ... +85 °C [-40 ... +185 °F] | |
| Climate class per IEC 60654-1 | |
| 4 ... 20 mA version (models TR21-A-xTT, TR21-A-xTB) | Cx (-40 ... +85 °C [-40 ... +185 °F], 5 ... 95 % r. h.) |
| Pt100 (model TR21-A-xPx)/Pt1000 (model TR21-A-xRx) version | Cx (-50 ... +85 °C [-58 ... +185 °F], 5 ... 95 % r. h.) |
| Maximum permissible humidity, condensation | |
| 100 % r. h., condensation allowed | |
| Max. operating pressure | |
| Dependent on particular process connection | |
| Salt fog | |
| IEC 60068-2-11 | |
| Shock resistance per IEC 60068-2-27 | |
| 50 g, 6 ms, 3 axes, 3 directions, three times per direction | |
| Maximum permissible autoclaving conditions | |
| Max. 134 °C, 3 bar abs., 100 % r. h., duration 20 min., max. 50 cycles | |
| Autoclavable with mounted protective cap at coupler connector | |
| Conditions for outdoor use (only applies to UL approval) | |
| <ul style="list-style-type: none"> ■ The instrument is suitable for applications with pollution degree 3. ■ The power supply must be suitable for operation above 2,000 m should the temperature transmitter be used at this altitude. ■ The instrument shall be installed in locations sheltered from the weather. ■ The instrument shall be installed sun/UV irradiation protected. | |
| Ingress protection (IP code) | |
| Case with connected connector ¹⁾ | <ul style="list-style-type: none"> ■ IP67 per IEC/EN 60529 ■ IP69 per IEC/EN 60529 ■ IP69K per ISO 20653 <p>The stated ingress protection only applies when plugged in using line connectors that have the appropriate ingress protection.</p> |
| Coupler connector, not connected | IP67 per IEC/EN 60529 |
| Weight in kg | approx. 0.3 ... 2.5 (depending on version) |









1) Not tested with UL

Approvals

| Logo | Description | Country |
|---|---|----------------|
|  | EU declaration of conformity | European Union |
| | EMC directive ^{1) 2)} EN 61326 emission (group 1, class B) and immunity (industrial application) Configuration at 20 % of the full measuring range | |
| | RoHS directive | |
| | | |
|  | UL - only for instrument version without explosion protection Safety (e.g. electr. safety, overpressure, ...) | USA and Canada |

Optional approvals

| Logo | Description | Country | | |
|---|---|----------------|--|-----------------------------|
|   | EU declaration of conformity | European Union | | |
| | ATEX directive Hazardous areas Zone 0 gas II 1G Ex ia IIC T1 ... T6 Ga Zone 1 mounting to zone 0 gas II 1/2G Ex ia IIC T1 ... T6 Ga/Gb Zone 1 gas II 2G Ex ia IIC T1 ... T6 Gb Zone 20 dust II 1D Ex ia IIIC T135 °C Da Zone 21 mounting to zone 20 dust II 1/2D Ex ia IIIC T135 °C Da/Db Zone 21 dust II 2D Ex ia IIIC T135 °C Db | | | |
| |  | | IECEx - in combination with ATEX Hazardous areas Zone 0 gas Ex ia IIC T1 ... T6 Ga Zone 1 mounting to zone 0 gas Ex ia IIC T1 ... T6 Ga/Gb Zone 1 gas Ex ia IIC T1 ... T6 Gb Zone 20 dust Ex ia IIIC T135 °C Da Zone 21 mounting to zone 20 dust Ex ia IIIC T135 °C Da/Db Zone 21 dust Ex ia IIIC T135 °C Db | |
| |  | | CSA | USA and Canada |
| | | | Safety (e.g. electr. safety, overpressure, ...) | |
| | | | Hazardous areas Class I, division 1 or 2, groups A, B, C, D T1 ... T6 Class I, zone 0 or 1, IIC Ex/AEx ia IIC T1 ... T6 Ga Class II / III, division 1 or 2, groups E, F, G T1 ... T6 / 135 °C Class II / III, zone 20 or 21, Ex/AEx ia IIIC T135 °C Da | |
| | | | | |
| |   | | EAC | Eurasian Economic Community |
| EMC directive ¹⁾ | | | | |
| Hazardous areas Zone 0 gas 0Ex ia IIC T6 ... T1 Ga X Zone 1 gas 1Ex ia IIC T6 ... T1 Gb X Zone 1 gas Ex ia IIIC T135°C Gb X Zone 1 mounting to zone 0 gas Ex ia IIC T6 ... T1 Ga/Gb X Zone 20 dust Ex ia IIIC T135°C Da X Zone 20 dust Ex ia IIIC T80 ... T440 Da X Zone 21 dust Ex ia IIIC T80 ... T440 Db X | | | | |

| Logo | Description | Country |
|---|---|----------------|
|  | Ex Ukraine Hazardous areas Zone 0 gas II 1G Ex ia IIC T6 ... T1 Ga Zone 20 dust II 1D Ex ia IIIC T135 °C Da Zone 1 mounting to zone 0 gas II 1/2G Ex ia IIC T6 ... T1 Ga/Gb Zone 21 mounting to zone 20 dust II 1/2D Ex ia IIIC T135 °C Da/Db Zone 1 gas II 2G Ex ia IIC T6 ... T1 Gb Zone 21 dust II 2D Ex ia IIIC T135 °C Db Zone 1 gas II 2G Ex ib IIC T6 ... T1 Gb Zone 21 dust II 2D Ex ib IIIC T135 °C Db Zone 1 mounting to zone 0 gas II 1/2G Ex ib IIC T6 ... T1 Ga/Gb Zone 21 mounting to zone 20 dust II 1/2D Ex ib IIIC T135 °C Da/Db | Ukraine |
|  | CCC ³⁾ Hazardous areas Zone 0 gas Ex ia IIC T1~T6 Ga Zone 1 gas Ex ia IIC T1~T6 Gb Zone 1 mounting to zone 0 gas Ex ia IIC T1~T6 Ga/Gb Zone 20 dust Ex iaD 20 T135 Zone 21 dust Ex iaD 21 T135 Zone 21 mounting to zone 20 dust Ex iaD 20/21 T135 | China |
|  | GOST Metrology, measurement technology | Russia |
|  | KazInMetr Metrology, measurement technology | Kazakhstan |
| - | MTSCHS Permission for commissioning | Kazakhstan |
|  | BelGIM Metrology, measurement technology | Belarus |
|  | Uzstandard Metrology, measurement technology | Uzbekistan |
|  | 3-A ⁴⁾ Sanitary Standard | USA |
|  | EHEDG ⁴⁾ Hygienic Equipment Design | European Union |

1) Only for built-in transmitter

2) During transient interferences (e.g. burst, surge, ESD) take into account an increased measuring deviation of up to 2 %.

3) Not for built-in transmitter

4) Confirmation of 3-A or EHEDG conformity only valid with separately selectable 2.2 test report

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.

Certificates (option)

| Certificates | | |
|------------------------------|---|-------------------|
| Certificates | <ul style="list-style-type: none"> ■ 2.2 test report ■ 3.1 inspection certificate ■ DKD/DAkkS calibration certificate ■ Manufacturer's declaration regarding regulation (EC) 1935/2004 and (EC) 2023/2006 ■ Certificate of the surface roughness of wetted parts | |
| Hygienic certificates | 3-A approval | EHEDG approval |
| Clamp | Yes | Yes ²⁾ |
| VARINLINE® | Yes | Yes |
| BioControl® | Yes | No |
| DIN 11851 | Yes ¹⁾ | Yes ²⁾ |
| DIN 11864-1 | Yes | Yes |
| DIN 11864-2 | Yes | Yes |
| DIN 11864-3 | Yes | Yes |
| Welding ball | Yes | No |
| Compression fitting | No | No |
| SMS | No | No |
| Ingold connection | No | No |

1) In combination with
 - ASEPTO-STAR k-flex upgrade gaskets from Kieselmann GmbH, Germany or
 - SKS gasket set DIN 11851 EHEDG from Siersema Componenten Service (S.K.S.) B.V., Netherlands

2) In combination with
 T-ring seals from Combifit International B. V., Netherlands

For calibration, the measuring insert is removed from the thermometer. The minimum length (metal part of the probe) for carrying out a measurement accuracy test 3.1 or DKD/DAkkS is 100 mm.

Calibration of shorter lengths on request.

Approvals and certificates, see website

Safety-relevant characteristic values for explosion-protected version (option)

Thermometer with transmitter and 4 ... 20 mA output signal (models TR21-A-xTT, TR21-A-xTB)

Marking:

| Hazardous gas atmosphere | Temperature class | Ambient temperature range (T_a) | Maximum surface temperature (T_{max}) at the tip of the probe or protection tube |
|---|-------------------|-------------------------------------|---|
| II 1G Ex ia IIC T1 - T6 Ga II 1/2G Ex ia IIC T1 - T6 Ga/Gb II 2G Ex ia IIC T1 - T6 Gb | T6 | -40 ... +45 °C | T_M (medium temperature) + self-heating (15 K) Pay attention to the special conditions for safe use. |
| | T5 | -40 ... +60 °C | |
| | T4 | -40 ... +85 °C | |
| | T3 | -40 ... +85 °C | |
| | T2 | -40 ... +85 °C | |
| | T1 | -40 ... +85 °C | |

| Hazardous dust atmosphere | Power P_i | Ambient temperature range (T_a) | Maximum surface temperature (T_{max}) at the tip of the probe or protection tube |
|--|-------------|-------------------------------------|---|
| II 1D Ex ia IIIC T135 °C Da II 1/2D Ex ia IIIC T135 °C Da/Db II 2D Ex ia IIIC T135 °C Db | 750 mW | -40 ... +40 °C | T_M (medium temperature) + self-heating (15 K) Pay attention to the special conditions for safe use. |
| | 650 mW | -40 ... +70 °C | |
| | 550 mW | -40 ... +85 °C | |

Safety-related maximum values for the current loop circuit (+ and - connections):

| Parameters | Hazardous gas atmosphere | Hazardous dust atmosphere |
|--|--------------------------|---------------------------|
| Terminals | + / - | + / - |
| Voltage U_i | DC 30 V | DC 30 V |
| Current I_i | 120 mA | 120 mA |
| Power P_i | 800 mW | 750/650/550 mW |
| Effective internal capacitance C_i | 29.7 nF | 29.7 nF |
| Effective internal inductance L_i | Negligible | Negligible |
| Maximum self-heating at the probe or protection tube tip | 15 K | 15 K |

Thermometer with direct sensor output with Pt100 (model TR21-A-xPx) or Pt1000 (model TR21-A-xRx)

Marking:

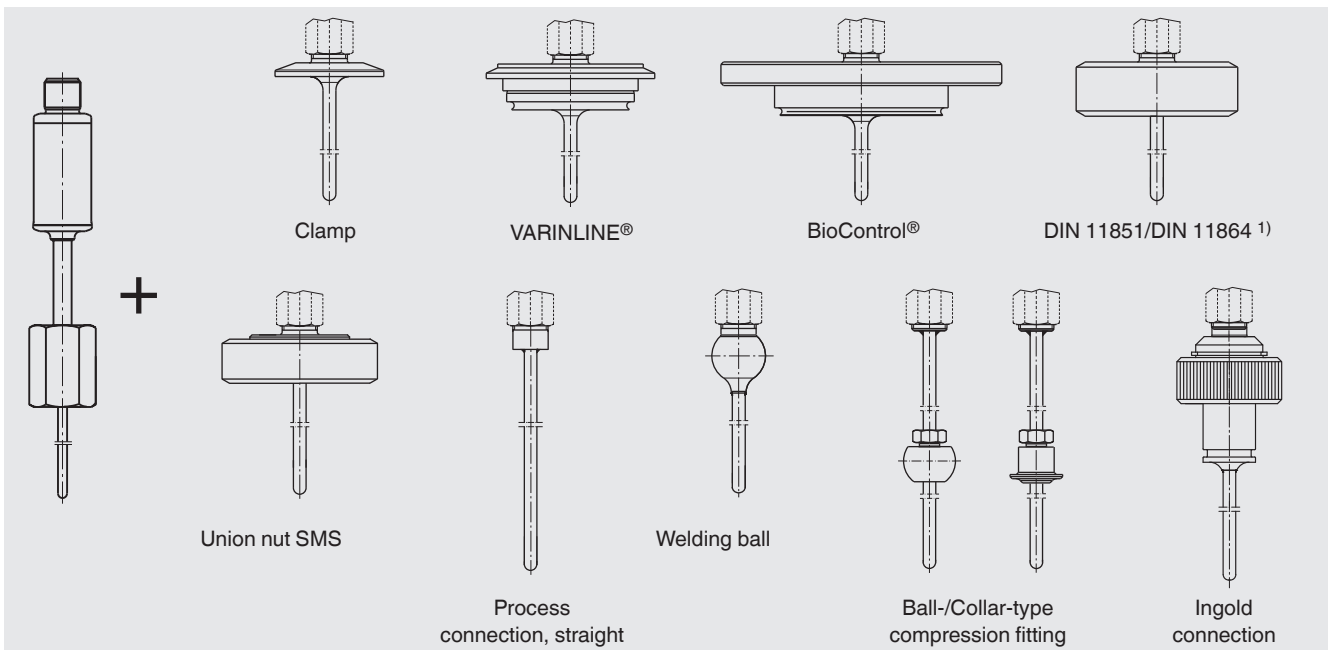
| Marking | Temperature class | Ambient temperature range (T_a) | Maximum surface temperature (T_{max}) at the tip of the probe or protection tube |
|---|-------------------|-------------------------------------|--|
| II 1G Ex ia IIC T1 - T6 Ga II 1/2G Ex ia IIC T1 - T6 Ga/Gb II 2G Ex ia IIC T1 - T6 Gb | T6 | -50 ... +80 °C | T_M (medium temperature) + self-heating Pay attention to the special conditions for safe use. |
| | T5 | -50 ... +85 °C | |
| | T4 | -50 ... +85 °C | |
| | T3 | -50 ... +85 °C | |
| | T2 | -50 ... +85 °C | |
| | T1 | -50 ... +85 °C | |

| Marking | Power P_i | Ambient temperature range (T_a) | Maximum surface temperature (T_{max}) at the tip of the probe or protection tube |
|--|-------------|-------------------------------------|--|
| II 1D Ex ia IIIC T135 °C Da II 1/2D Ex ia IIIC T135 °C Da/Db II 2D Ex ia IIIC T135 °C Db | 750 mW | -50 ... +40 °C | T_M (medium temperature) + self-heating Pay attention to the special conditions for safe use. |
| | 650 mW | -50 ... +70 °C | |
| | 550 mW | -50 ... +85 °C | |

Safety-related maximum values for the current loop circuit (connections in accordance with pin assignment 1 - 4):

| Parameters | Gas applications | Dust applications |
|--|------------------------------|------------------------------|
| Terminals | 1 - 4 | 1 - 4 |
| Voltage U_i | DC 30 V | DC 30 V |
| Current I_i | 550 mA | 250 mA |
| Power P_i | 1,500 mW | 750/650/550 mW |
| Effective internal capacitance C_i | Negligible | Negligible |
| Effective internal inductance L_i | Negligible | Negligible |
| Maximum self-heating at the probe or protection tube tip | $(R_{th}) = 335 \text{ K/W}$ | $(R_{th}) = 335 \text{ K/W}$ |

Overview of combinations

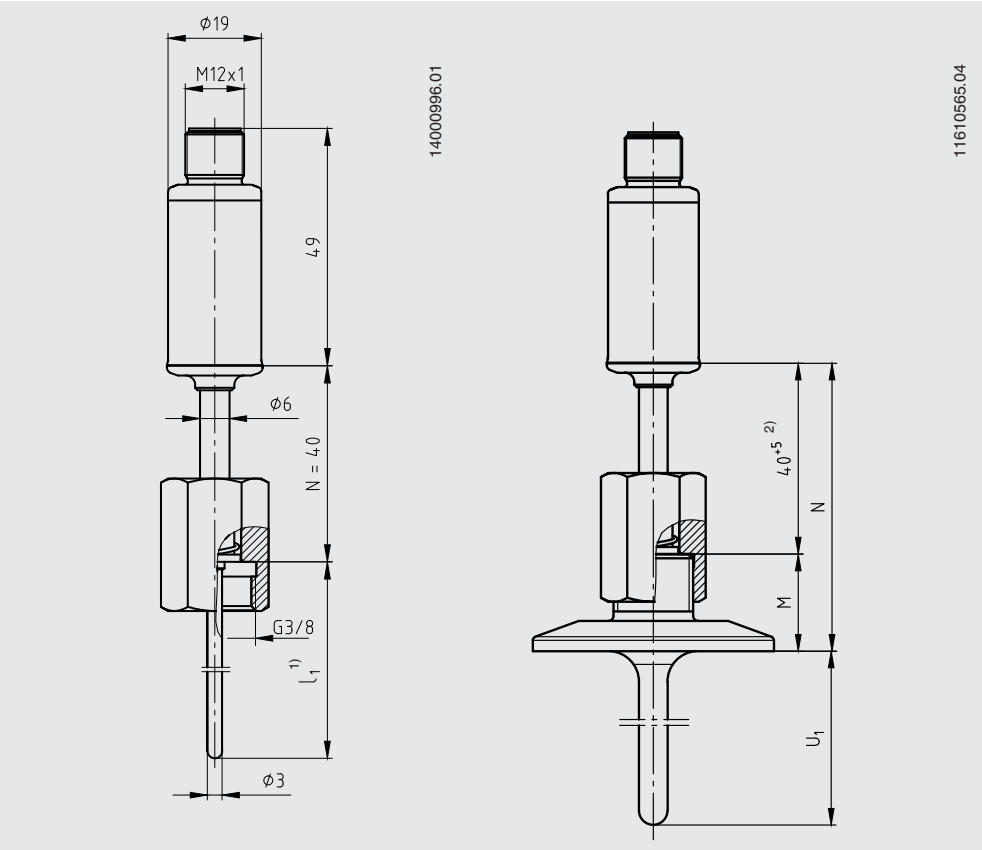


1) Process connections per DIN 11864-2 and DIN 11864-3, see "Dimensions of the process connections in mm"

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Dimensions in mm

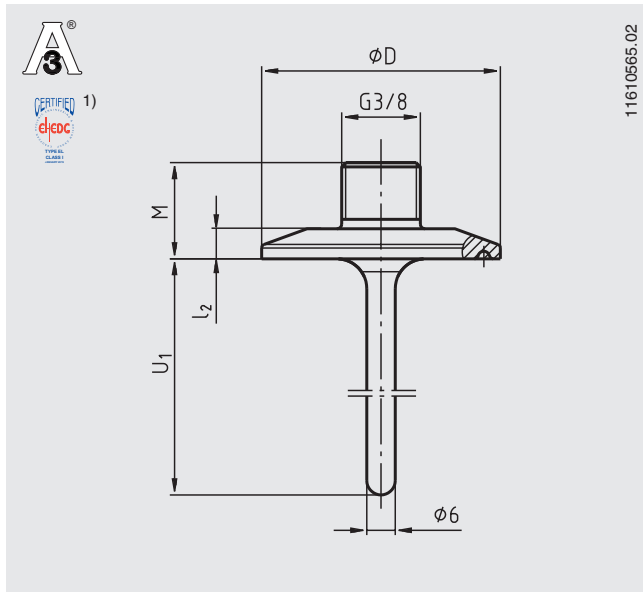


- 1) In the event of replacement, calculate the probe insertion length, I_1 , as follows: $I_1 (TR21-A) = U_1 + M$
- 2) The tolerance specification is dependent on the spring travel of the sensor/probe

Legend:
 I_1 Probe insertion length
 N Neck length
 M Neck tube length
 U_1 Insertion length

Dimensions of the process connections in mm (protection tube model TW22)

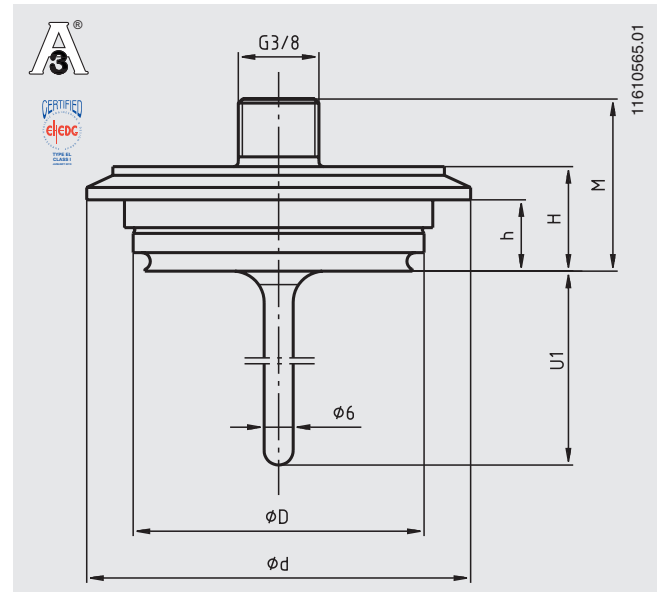
Clamp process connection



U_1 = variable insertion length

1) In combination with
T-ring seals from Combifit International B. V., Netherlands

VARINLINE® process connection



U_1 = variable insertion length

Dimensions for clamp process connection

| Process connection | Nominal width in mm/inch | PN in bar | Dimensions in mm | | | Weight in kg |
|---|-----------------------------|-----------|------------------|-------|-------|-----------------|
| | | | ϕD | M | l_2 | |
| DIN 32676 for pipes per DIN 11866 row A ¹⁾ | DN 10 ... 20 | 25 | 34.0 | 20.35 | 6.35 | 0.2 |
| | DN 25 ... 40 | 25 | 50.5 | 20.35 | 6.35 | 0.3 |
| | DN 50 | 16 | 64.0 | 20.35 | 6.35 | 0.4 |
| DIN 32676 for pipes per DIN 11866 row B | 13.5 ... 17.2 | 25 | 25.0 | 18.75 | 4.75 | 0.2 |
| | 21.3 ... 33.7 | 25 | 50.5 | 20.35 | 6.35 | 0.3 |
| | 42.4 ... 48.3 | 16 | 64.0 | 20.35 | 6.35 | 0.3 |
| DIN 32676 for pipes per DIN 11866 row C | 1/2" ... 3/4" | 25 | 25.0 | 18.75 | 4.75 | 0.2 |
| | 1" ... 1 1/2" | 25 | 50.5 | 20.35 | 6.35 | 0.3 |
| | 2" | 16 | 64.0 | 20.35 | 6.35 | 0.4 |
| TRI-CLAMP® per ASME BPE | 1/2" ... 3/4" | 13.8 | 25.0 | 18.75 | 4.75 | 0.2 |
| | 1" ... 1 1/2" | 13.8 | 50.5 | 20.35 | 6.35 | 0.3 |
| | 2" | 13.8 | 64.0 | 20.35 | 6.35 | 0.4 |
| | 2 1/2" | 13.8 | 77.5 | 20.35 | 6.35 | 0.5 |
| | 3" | 13.8 | 91.0 | 20.35 | 6.35 | 0.6 |
| 4" | 13.8 | 119.0 | 20.35 | 6.35 | 0.8 | |

1) Process connection identical in construction to ISO 2852

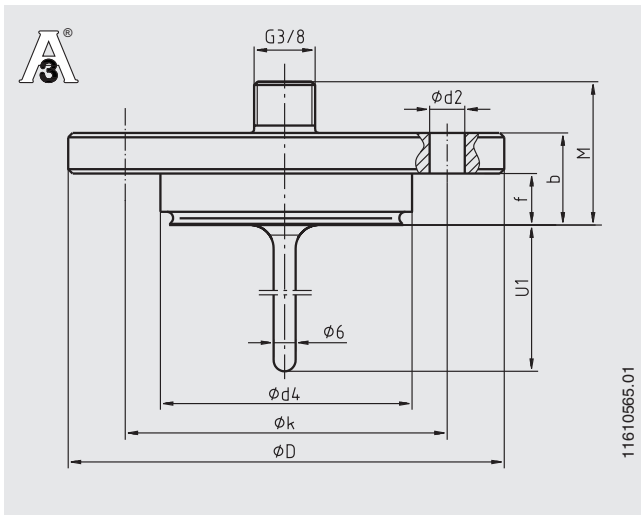
Dimensions for VARINLINE® process connection

| Process connection | Nominal width in mm | PN in bar | Dimensions in mm | | | | Weight in kg | |
|--------------------|------------------------|-----------|------------------|----|----------|----|--------------|-----|
| | | | ϕD | M | ϕd | H | | h |
| Form B | DN 10, DN 15 | 25 | 31 | 34 | 52.7 | 20 | 13.65 | 0.3 |
| Form F | DN 25, DN 32 | 25 | 50 | 32 | 66.0 | 18 | 12.30 | 0.4 |
| Form N | DN 40, DN 50 | 25 | 68 | 32 | 84.0 | 18 | 12.30 | 0.6 |

TRI-CLAMP® is a trademark of the company Alfa Laval AB SE.

VARINLINE® is a registered trademark of the company GEA Tuchenhagen (former designation: VARIVENT®).

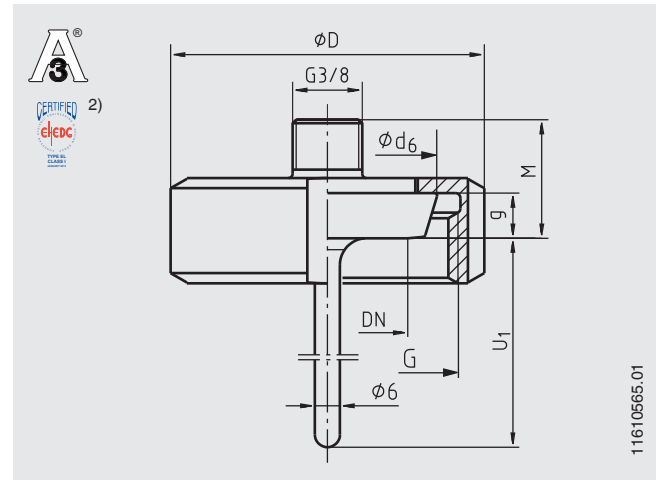
NEUMO BioControl® process connection



U_1 = variable insertion length

For fitting into a flow-through housing, the insertion length U_1 and the protection tube diameter must be matched. For angular housings, the insertion length U_1 must be specified by the customer. The cases are not part of the scope of delivery of the resistance thermometers and can be ordered as a separate item. For a detailed description of the BioControl® cases, see data sheet AC 09.14.

Union nut process connection DIN 11851 with conical coupling (milk thread fitting)



U_1 = variable insertion length

- 2) In combination with
 - ASEPTO-STAR k-flex upgrade gaskets from Kieselmann GmbH, Germany or
 - SKS gasket set DIN 11851 EHEDG from Siersema Komponenten

Dimensions for NEUMO BioControl® process connection

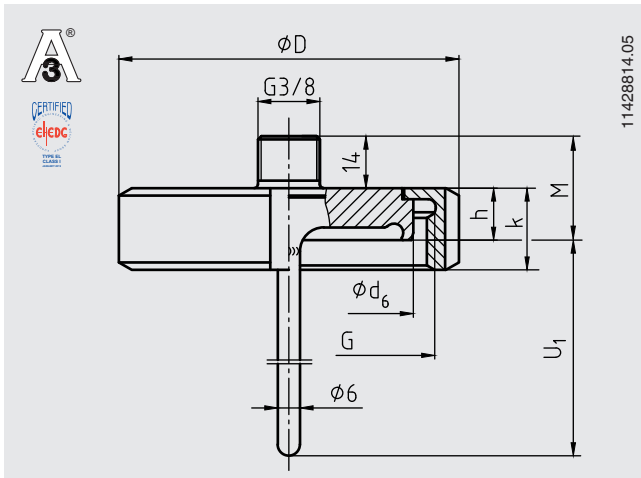
| Case size | Nominal width in mm | PN in bar | Dimensions in mm | | | | | | | | Weight in kg |
|-----------|---------------------|-----------|---------------------|------------|----------|----|----|----|----------|---------------|--------------|
| | | | U_1 ³⁾ | ϕd_4 | ϕD | M | f | b | ϕk | ϕd_2 | |
| Size 25 | DN 8 | 16 | 5 | 30.5 | 64 | 34 | 11 | 20 | 50 | 4 x $\phi 7$ | 0.4 |
| | DN 10 | 16 | 6 | 30.5 | 64 | 34 | 11 | 20 | 50 | 4 x $\phi 7$ | 0.4 |
| | DN 15 | 16 | 9 | 30.5 | 64 | 34 | 11 | 20 | 50 | 4 x $\phi 7$ | 0.4 |
| | DN 20 | 16 | 11 | 30.5 | 64 | 34 | 11 | 20 | 50 | 4 x $\phi 7$ | 0.4 |
| Size 50 | DN 25 | 16 | 15 | 50.0 | 90 | 41 | 17 | 27 | 70 | 4 x $\phi 9$ | 0.8 |
| | DN 40 | 16 | 20 | 50.0 | 90 | 41 | 17 | 27 | 70 | 4 x $\phi 9$ | 0.8 |
| | DN 50 | 16 | 25 | 50.0 | 90 | 41 | 17 | 27 | 70 | 4 x $\phi 9$ | 0.8 |
| | DN 65 | 16 | 35 | 50.0 | 90 | 41 | 17 | 27 | 70 | 4 x $\phi 9$ | 0.8 |
| | DN 80 | 16 | 45 | 50.0 | 90 | 41 | 17 | 27 | 70 | 4 x $\phi 9$ | 0.8 |
| | DN 100 | 16 | 55 | 50.0 | 90 | 41 | 17 | 27 | 70 | 4 x $\phi 9$ | 0.8 |
| Size 65 | DN 40 | 16 | 20 | 68.0 | 120 | 41 | 17 | 27 | 95 | 4 x $\phi 11$ | 1.4 |
| | DN 50 | 16 | 25 | 68.0 | 120 | 41 | 17 | 27 | 95 | 4 x $\phi 11$ | 1.4 |
| | DN 65 | 16 | 35 | 68.0 | 120 | 41 | 17 | 27 | 95 | 4 x $\phi 11$ | 1.4 |
| | DN 80 | 16 | 45 | 68.0 | 120 | 41 | 17 | 27 | 95 | 4 x $\phi 11$ | 1.4 |
| | DN 100 | 16 | 55 | 68.0 | 120 | 41 | 17 | 27 | 95 | 4 x $\phi 11$ | 1.4 |

Dimensions for union nut process connection DIN 11851 with conical coupling (milk thread fitting)

| Nominal width in mm | PN in bar | Dimensions in mm | | | | | Weight in kg |
|---------------------|-----------|------------------|-------------|----------|----|----|--------------|
| | | ϕd_6 | G | ϕD | M | g | |
| DN 20 | 40 | 36.5 | RD 44 x 1/6 | 54 | 25 | 8 | 0.4 |
| DN 25 | 40 | 44.0 | RD 52 x 1/6 | 63 | 27 | 10 | 0.5 |
| DN 32 | 40 | 50.0 | RD 58 x 1/6 | 70 | 27 | 10 | 0.6 |
| DN 40 | 40 | 56.0 | RD 65 x 1/6 | 78 | 27 | 10 | 0.8 |
| DN 50 | 25 | 68.5 | RD 78 x 1/6 | 92 | 28 | 11 | 0.9 |

3) Recommended insertion length for installation in BioControl® flow-through housing; other insertion lengths are possible

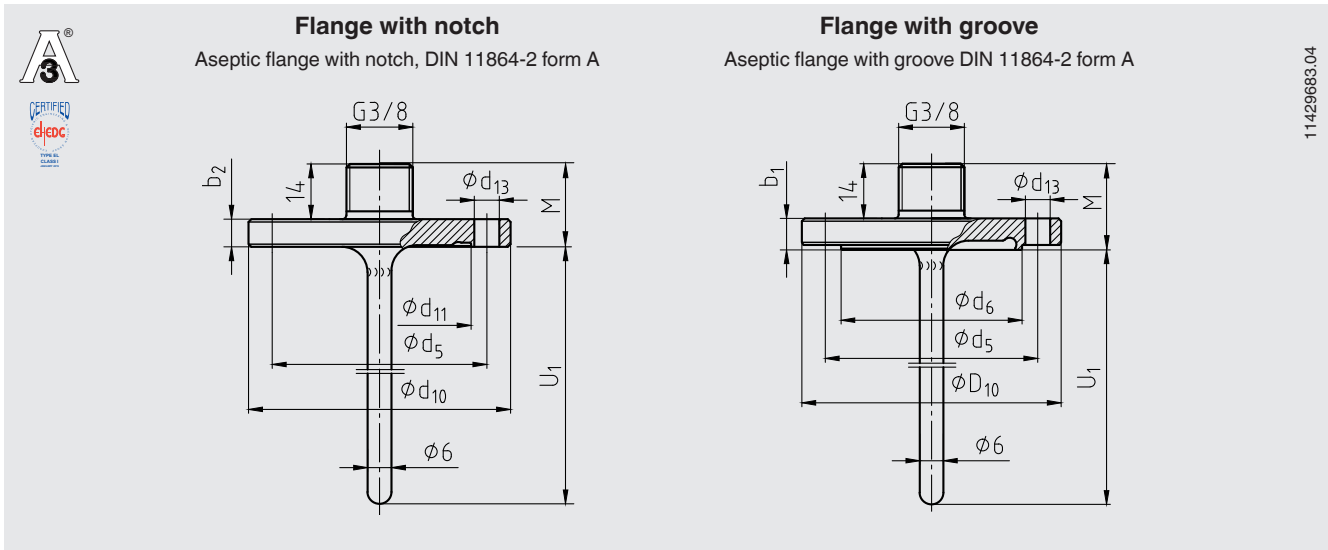
**Process connection, aseptic threaded pipe connection DIN 11864-1
with form A liner, for pipes in accordance with DIN 11866 row A, B and C**



U_1 = variable insertion length

| Nominal width of pipe DN / OD | Nominal pressure in bar PN | Outer diameter of pipe | Pipe schedule s | Inner diameter of pipe | Process connection | | | | | Aseptic O-ring | Weight in kg |
|------------------------------------|-------------------------------|------------------------|--------------------|------------------------|--------------------|----|-------------|----|----|----------------|--------------|
| | | | | | ϕD | M | G | h | k | | |
| DIN 11866 row A or metric | | | | | | | | | | | |
| 10 | 40 | 13 | 1.5 | 10 | 38 | 23 | RD 28 x 1/8 | 9 | 18 | 12 x 3.5 | 1.2 |
| 15 | 40 | 19 | 1.5 | 16 | 44 | 23 | RD 34 x 1/8 | 9 | 18 | 18 x 3.5 | 1.2 |
| 20 | 40 | 23 | 1.5 | 20 | 54 | 24 | RD 44 x 1/6 | 10 | 20 | 22 x 3.5 | 1.25 |
| 25 | 40 | 29 | 1.5 | 26 | 63 | 26 | RD 52 x 1/6 | 12 | 21 | 28 x 3.5 | 1.4 |
| 32 | 40 | 35 | 1.5 | 32 | 70 | 27 | RD 58 x 1/6 | 13 | 21 | 34 x 5 | 1.45 |
| 40 | 40 | 41 | 1.5 | 38 | 78 | 27 | RD 65 x 1/6 | 13 | 21 | 40 x 5 | 1.6 |
| 50 | 25 | 53 | 1.5 | 50 | 92 | 28 | RD 78 x 1/6 | 14 | 22 | 52 x 5 | 1.7 |
| DIN 11866 row B or ISO | | | | | | | | | | | |
| 8 (13.5) | 40 | 13.5 | 1.6 | 10.3 | 38 | 23 | RD 28 x 1/8 | 9 | 18 | 12 x 3.5 | 1.2 |
| 10 (17.2) | 40 | 17.2 | 1.6 | 14 | 44 | 23 | RD 34 x 1/8 | 9 | 18 | 16 x 3.5 | 1.2 |
| 15 (21.3) | 40 | 21.3 | 1.6 | 18.1 | 54 | 24 | RD 44 x 1/6 | 10 | 20 | 20 x 3.5 | 1.3 |
| 20 (26.9) | 40 | 26.9 | 1.6 | 23.7 | 63 | 26 | RD 52 x 1/6 | 12 | 21 | 26 x 3.5 | 1.4 |
| 25 (33.7) | 40 | 33.7 | 2 | 29.7 | 70 | 27 | RD 58 x 1/6 | 13 | 21 | 32 x 5 | 1.5 |
| 32 (42.4) | 25 | 42.4 | 2 | 38.4 | 78 | 27 | RD 65 x 1/6 | 13 | 21 | 40.5 x 5 | 1.6 |
| 40 (48.3) | 25 | 48.3 | 2 | 44.3 | 92 | 28 | RD 78 x 1/6 | 14 | 22 | 46.6 x 5 | 1.7 |
| DIN 11866 row C or ASME BPE | | | | | | | | | | | |
| 1/2" | 40 | 12.7 | 1.65 | 9.4 | 38 | 23 | RD 28 x 1/8 | 9 | 18 | 12 x 3.5 | 1.2 |
| 3/4" | 40 | 19.05 | 1.65 | 15.75 | 44 | 23 | RD 34 x 1/8 | 9 | 18 | 18 x 3.5 | 1.2 |
| 1" | 40 | 25.4 | 1.65 | 22.1 | 63 | 26 | RD 52 x 1/6 | 12 | 21 | 24 x 3.5 | 1.4 |
| 1 1/2" | 40 | 38.1 | 1.65 | 34.8 | 78 | 27 | RD 65 x 1/6 | 13 | 21 | 37 x 5 | 1.6 |
| 2" | 25 | 50.8 | 1.65 | 47.5 | 92 | 28 | RD 78 x 1/6 | 14 | 22 | 50 x 5 | 1.7 |

Aseptic flange process connection DIN 11864-2, form A for pipes in accordance with DIN 11866 row A

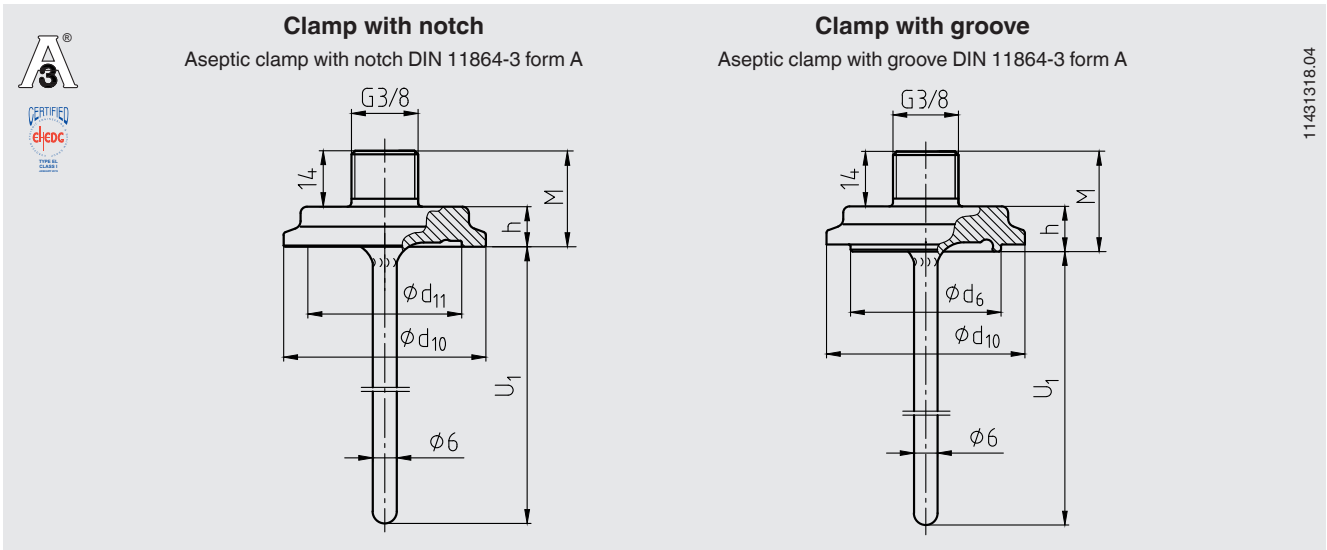


U₁ = variable insertion length

| Process connection | Nominal width in mm | PN in bar | Dimensions in mm | | | | | | | | | Weight in kg |
|--------------------|---------------------|-----------|------------------|----------------|----------------|------------------|------------------|-------------------|-------------------|-------------------|----------------|--------------|
| | | | M | b ₁ | b ₂ | Ø d ₅ | Ø d ₆ | Ø d ₁₀ | Ø d ₁₁ | Ø d ₁₃ | Aseptic O-ring | |
| Flange with notch | DN 10 | 25 | 24 | - | 10 | 37 | - | 54 | 22.4 | 4 x Ø 9 | 12 x 3.5 | 0.2 |
| | DN 15 | 25 | 24 | - | 10 | 42 | - | 59 | 28.4 | 4 x Ø 9 | 18 x 3.5 | 0.25 |
| | DN 20 | 25 | 24 | - | 10 | 47 | - | 64 | 32.4 | 4 x Ø 9 | 22 x 3.5 | 0.3 |
| | DN 25 | 25 | 24 | - | 10 | 53 | - | 70 | 38.4 | 4 x Ø 9 | 28 x 3.5 | 0.1 |
| | DN 32 | 25 | 24 | - | 10 | 59 | - | 76 | 47.7 | 4 x Ø 9 | 34 x 5 | 0.4 |
| | DN 40 | 25 | 24 | - | 10 | 65 | - | 82 | 53.7 | 4 x Ø 9 | 40 x 5 | 0.5 |
| | DN 50 | 16 | 24 | - | 10 | 77 | - | 94 | 65.7 | 4 x Ø 9 | 52 x 5 | 0.6 |
| Flange with groove | DN 10 | 25 | 25.5 | 11.5 | - | 37 | 22.3 | 54 | - | 4 x Ø 9 | 12 x 3.5 | 0.25 |
| | DN 15 | 25 | 25.5 | 11.5 | - | 42 | 28.3 | 59 | - | 4 x Ø 9 | 18 x 3.5 | 0.3 |
| | DN 20 | 25 | 25.5 | 11.5 | - | 47 | 32.3 | 64 | - | 4 x Ø 9 | 22 x 3.5 | 0.3 |
| | DN 25 | 25 | 25.5 | 11.5 | - | 53 | 38.3 | 70 | - | 4 x Ø 9 | 28 x 3.5 | 0.4 |
| | DN 32 | 25 | 25.5 | 11.5 | - | 59 | 47.6 | 76 | - | 4 x Ø 9 | 34 x 5 | 0.45 |
| | DN 40 | 25 | 25.5 | 11.5 | - | 65 | 56.6 | 82 | - | 4 x Ø 9 | 40 x 5 | 0.6 |
| | DN 50 | 16 | 25.5 | 11.5 | - | 77 | 65.6 | 94 | - | 4 x Ø 9 | 52 x 5 | 0.7 |

Connections for pipes in accordance with DIN 11866 row B (ISO pipes) and row C (ASME pipes) available on request.

Aseptic clamp process connection, DIN 11864-3, form A for pipes in accordance with DIN 11866 row A

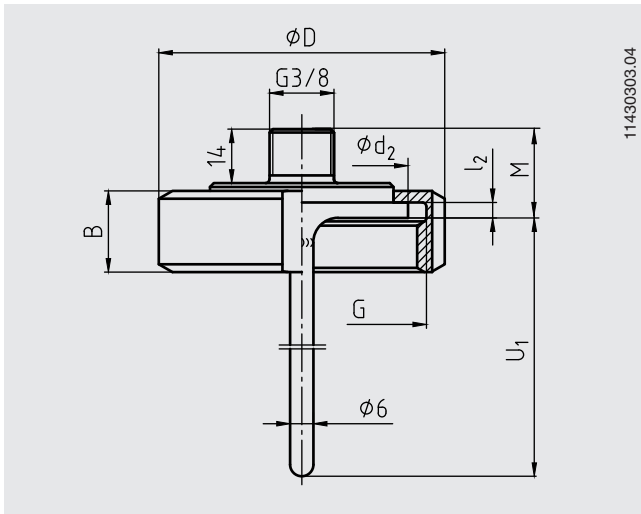


U₁ = variable insertion length

| Process connection | Nominal width in mm | PN in bar | Dimensions in mm | | | | | | Aseptic O-ring | Weight in kg |
|--------------------|---------------------|-----------|------------------|------------------|-------------------|-------------------|------|----------|----------------|--------------|
| | | | M | Ø d ₆ | Ø d ₁₀ | Ø d ₁₁ | h | | | |
| Clamp with notch | DN 10 | 40 | 25.5 | - | 34 | 22.4 | 11.5 | 12 x 3.5 | 0.2 | |
| | DN 15 | 40 | 25.5 | - | 34 | 28.4 | 11.5 | 18 x 3.5 | 0.2 | |
| | DN 20 | 40 | 25.5 | - | 50.5 | 32.4 | 11.5 | 22 x 3.5 | 0.3 | |
| | DN 25 | 40 | 25.5 | - | 50.5 | 38.4 | 11.5 | 28 x 3.5 | 0.3 | |
| | DN 32 | 40 | 25.5 | - | 50.5 | 47.7 | 11.5 | 34 x 5 | 0.3 | |
| | DN 40 | 40 | 25.5 | - | 64 | 53.7 | 11.5 | 40 x 5 | 0.4 | |
| | DN 50 | 25 | 27.5 | - | 77.5 | 65.7 | 13.5 | 52 x 5 | 0.5 | |
| Clamp with groove | DN 10 | 40 | 27 | 22.3 | 34 | - | 13 | 12 x 3.5 | 0.2 | |
| | DN 15 | 40 | 27 | 28.3 | 34 | - | 13 | 18 x 3.5 | 0.2 | |
| | DN 20 | 40 | 27 | 32.3 | 50.5 | - | 13 | 22 x 3.5 | 0.3 | |
| | DN 25 | 40 | 27 | 38.3 | 50.5 | - | 13 | 28 x 3.5 | 0.3 | |
| | DN 32 | 40 | 27 | 47.6 | 50.5 | - | 13 | 34 x 5 | 0.3 | |
| | DN 40 | 40 | 27 | 53.6 | 64 | - | 13 | 40 x 5 | 0.4 | |
| | DN 50 | 25 | 29 | 65.6 | 77.5 | - | 15 | 52 x 5 | 0.5 | |

Connections for pipes in accordance with DIN 11866 row B (ISO pipes) and row C (ASME pipes) available on request.

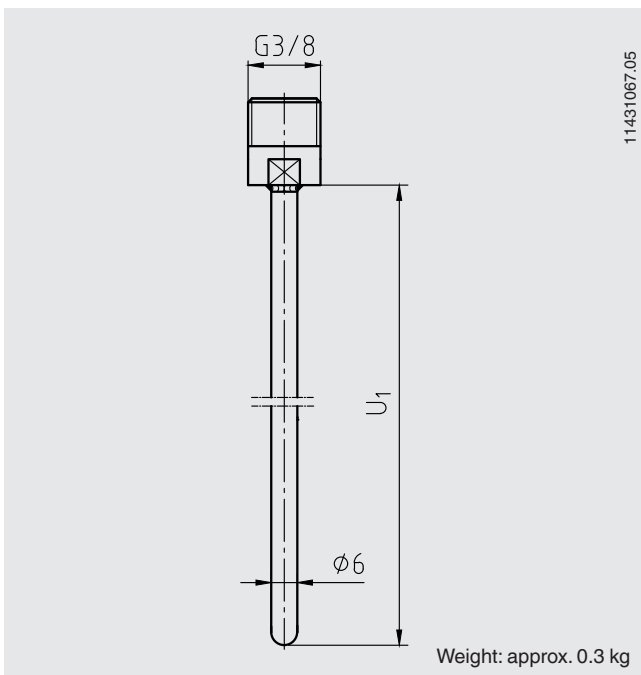
Union nut process connection SMS



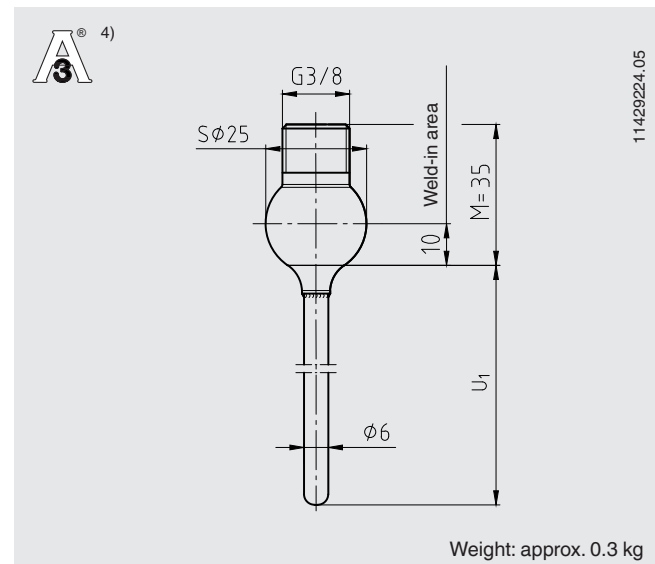
U_1 = variable insertion length

| Nominal width in inch | PN in bar | Dimensions in mm | | | | | | Weight in kg |
|-----------------------|-----------|------------------|----|------------|----|-------|-------------|--------------|
| | | ϕD | M | ϕd_2 | B | l_2 | G | |
| 1" | 40 | 51 | 22 | 35.5 | 25 | 3.5 | RD 40 x 1/6 | 0.4 |
| 1 1/2" | 40 | 74 | 23 | 55 | 25 | 4 | RD 60 x 1/6 | 0.8 |
| 2" | 40 | 84 | 23 | 65 | 26 | 4 | RD 70 x 1/6 | 1.0 |

Process connection, straight, $\phi 6$ mm, basic shape for compression fitting



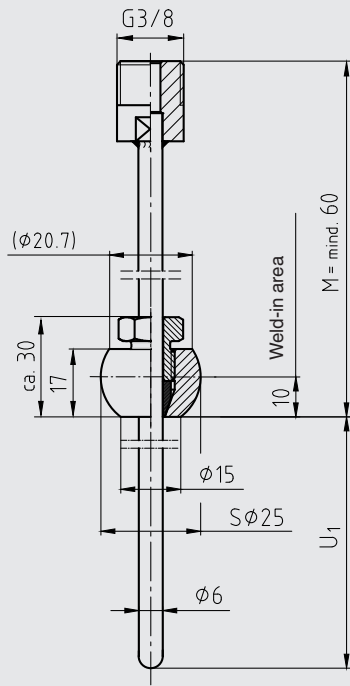
Welding ball process connection



4) In order to meet the 3-A standard, the weld seam must be finished with a minimum radius of 3.2 mm on the product side. In this way, no weld defects, such as recesses or gaps, remain.

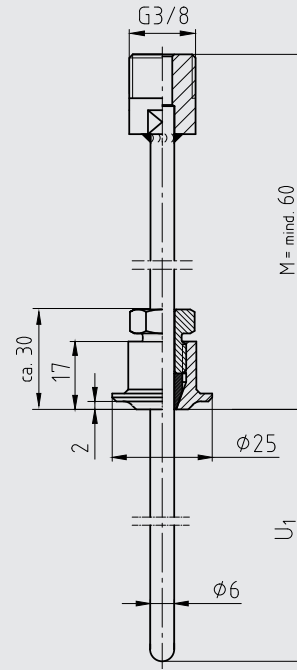
Compression fitting process connection

Ball-type compression fitting



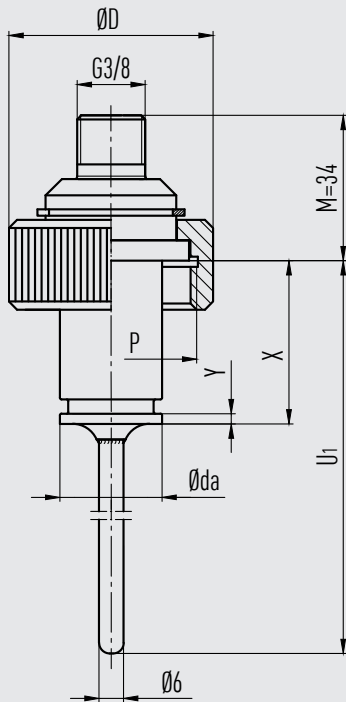
Weight: approx. 0.3 kg

Collar-type compression fitting



Weight: approx. 0.3 kg

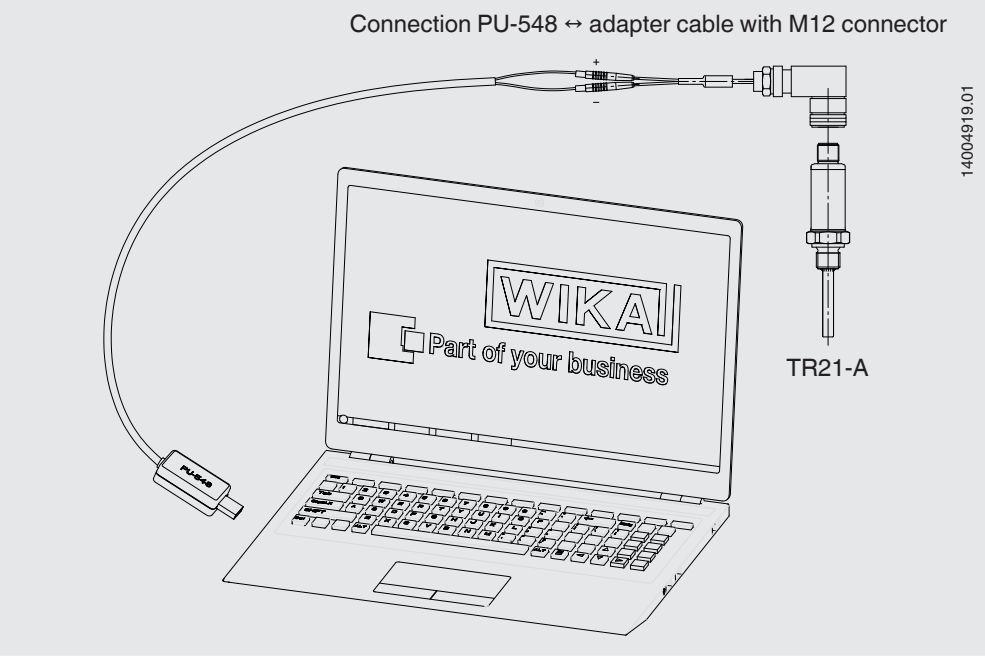
Process connection, Ingold connection



Weight: approx. 0.3 kg

Further process connections and nominal widths available on request.

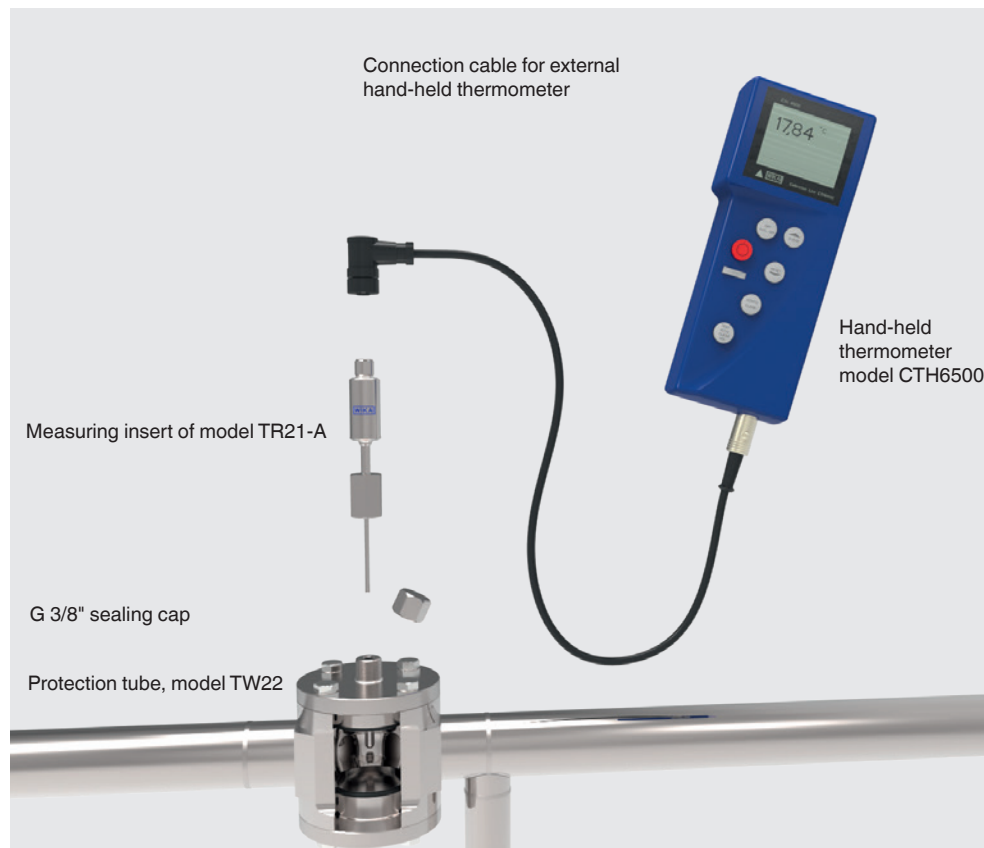
Connecting the PU-548 programming unit



(predecessor, programming unit model PU-448, also compatible)

Application example

Temperature measurement for plant or measuring point validation





The measuring insert of the model TR21-A resistance thermometer, in combination with the model CTH6500 hand-held thermometer and the model TW22 protection tube, offers a simple and effective possibility for sterile validation of a temperature measuring point. Here, in the design phase, a model TW22 protection tube must be integrated in the pipeline, which will serve as the measuring point at a later date. To validate this measuring point, a resistance thermometer measuring insert with a spring-loaded tip is screwed into the protection tube and the temperature read from the connected hand-held thermometer.

The measuring point already available for the validation ensures that the sterile boundaries remain intact. Due to the defined contact pressure of the spring-loaded probe and the predetermined immersion depth in the pipeline, the temperature measurement is reproducible at any time. The time needed for the measurement is low.

Further components

| Component | Order number |
|---|--------------|
| G 3/8" sealing cap | 14136849 |
| O-ring for use with G 3/8" sealing cap | 0478709 |
| Connection cable for the connection of the model TR21-A resistance thermometer to the model CTH6500 hand-held thermometer Cable length 2 m | 14131257 |
| Hand-held thermometer model CTH6500 (data sheet CT 55.10) | 14007838 |

Accessories

| Model | Description | Order no. | | | | | | | | | | | | | | | | | | | | | |
|--|--|---|--|------------------|----------|------------------|----------|--|------------------|----------|------------------|----------|--|------------------|----------|------------------|----------|---|------------------|----------|------------------|----------|--|
|  Programming unit Model PU-548 | <ul style="list-style-type: none"> ■ Easy to use ■ LED status display ■ Compact design ■ No further voltage supply needed, neither for the programming unit nor for the transmitter (replaces programming unit model PU-448) | 14231581 | | | | | | | | | | | | | | | | | | | | | |
|  Adapter cable M12 to PU-548 | Adapter cable for the connection of a model TR21-A resistance thermometer to the model PU-548 programming unit | 14003193 | | | | | | | | | | | | | | | | | | | | | |
| - | M12 sealing cap with mounted PTFE sealing | Sealing cap for protecting the resistance thermometer during sterilisation in autoclaves | 14113588 | | | | | | | | | | | | | | | | | | | | |
| - | M12 connection cable | <table border="1"> <tbody> <tr> <td rowspan="2"> Cable socket straight, 4-pin, ingress protection IP67 <ul style="list-style-type: none"> ■ Temperature range -20 ... +80 °C ■ Suitable for hazardous areas </td> <td>Cable length 2 m</td> <td>14086880</td> </tr> <tr> <td>Cable length 5 m</td> <td>14086883</td> </tr> <tr> <td rowspan="2"> Cable socket straight., 4-pin, ingress protection IP69K, hygienic design <ul style="list-style-type: none"> ■ Temperature range -40 ... +80 °C ■ Not for hazardous areas </td> <td>Cable length 3 m</td> <td>14137167</td> </tr> <tr> <td>Cable length 5 m</td> <td>14137168</td> </tr> <tr> <td rowspan="2"> Angled socket, 4-pin, ingress protection IP67 <ul style="list-style-type: none"> ■ Temperature range -20 ... +80 °C ■ Suitable for hazardous areas </td> <td>Cable length 2 m</td> <td>14086889</td> </tr> <tr> <td>Cable length 5 m</td> <td>14086891</td> </tr> <tr> <td rowspan="2"> Angled socket, 4-pin, ingress protection IP69K, hygienic design <ul style="list-style-type: none"> ■ Temperature range -40 ... +80 °C ■ Not for hazardous areas </td> <td>Cable length 3 m</td> <td>14137169</td> </tr> <tr> <td>Cable length 5 m</td> <td>14137170</td> </tr> </tbody> </table> | Cable socket straight, 4-pin, ingress protection IP67 <ul style="list-style-type: none"> ■ Temperature range -20 ... +80 °C ■ Suitable for hazardous areas | Cable length 2 m | 14086880 | Cable length 5 m | 14086883 | Cable socket straight., 4-pin, ingress protection IP69K, hygienic design <ul style="list-style-type: none"> ■ Temperature range -40 ... +80 °C ■ Not for hazardous areas | Cable length 3 m | 14137167 | Cable length 5 m | 14137168 | Angled socket, 4-pin, ingress protection IP67 <ul style="list-style-type: none"> ■ Temperature range -20 ... +80 °C ■ Suitable for hazardous areas | Cable length 2 m | 14086889 | Cable length 5 m | 14086891 | Angled socket, 4-pin, ingress protection IP69K, hygienic design <ul style="list-style-type: none"> ■ Temperature range -40 ... +80 °C ■ Not for hazardous areas | Cable length 3 m | 14137169 | Cable length 5 m | 14137170 | |
| Cable socket straight, 4-pin, ingress protection IP67 <ul style="list-style-type: none"> ■ Temperature range -20 ... +80 °C ■ Suitable for hazardous areas | Cable length 2 m | 14086880 | | | | | | | | | | | | | | | | | | | | | |
| | Cable length 5 m | 14086883 | | | | | | | | | | | | | | | | | | | | | |
| Cable socket straight., 4-pin, ingress protection IP69K, hygienic design <ul style="list-style-type: none"> ■ Temperature range -40 ... +80 °C ■ Not for hazardous areas | Cable length 3 m | 14137167 | | | | | | | | | | | | | | | | | | | | | |
| | Cable length 5 m | 14137168 | | | | | | | | | | | | | | | | | | | | | |
| Angled socket, 4-pin, ingress protection IP67 <ul style="list-style-type: none"> ■ Temperature range -20 ... +80 °C ■ Suitable for hazardous areas | Cable length 2 m | 14086889 | | | | | | | | | | | | | | | | | | | | | |
| | Cable length 5 m | 14086891 | | | | | | | | | | | | | | | | | | | | | |
| Angled socket, 4-pin, ingress protection IP69K, hygienic design <ul style="list-style-type: none"> ■ Temperature range -40 ... +80 °C ■ Not for hazardous areas | Cable length 3 m | 14137169 | | | | | | | | | | | | | | | | | | | | | |
| | Cable length 5 m | 14137170 | | | | | | | | | | | | | | | | | | | | | |

Ordering information

Model / Approval / Sensor or transmitter output / Sensor specification or transmitter configuration / Process temperature / Protection tube / Process connection / Protection tube diameter / Material of wetted parts / Insertion length U₁ / Electrical accessories / Certificates / Options

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 We reserve the right to make modifications to the specifications and materials.

