Technical Information
TI 251T/02/en
60018853

# *Thermocouple (TC) Thermometer omnigrad S TAF 11, TAF 12x, TAF 16*

*High temperature thermocouples for industrial furnaces with metal and/or ceramic sheath thermowells*
*Sliding process connection*
*TC type J, K, R, S, B*

The TAF thermocouple thermometer assemblies are specifically designed for high temperature applications such as industrial furnaces.

- The TAF 11 includes a single or double TC inset (type J or K) made from TC-wires inserted in ceramic insulators and a ceramic process protection sheath (type KER 610).
- The TAF 12 includes a single or double TC inset (type R, S or B) made from noble metal alloys (Pt-Rh) wires inserted in ceramic insulators and one or more ceramic process protection sheaths (type KER 530, KER 610 or KER 710).
- The TAF 16 includes a single or double TC inset (type J or K) made from rod TC-wires inserted in ceramic insulators and a metal process protection sheath (AISI 310, AISI 316, AISI 446, Inconel® 600).

The process connection is obtained by means of a stop flange or a compression fitting, which assures a gas tight pipe coupling.
All TAF assemblies include an aluminium connection head (DIN standard), a metal sleeve (to install the sensor into the process) and are available with both terminal block or flying leads for the connection to a temperature transmitter of the iTEMP® family, in order to provide different types of signal output.

*Features and benefits*

- Customized immersion length
- Replaceable insert; when installed inside the thermowell, it avoids plant shutdown during the substitution or verification of the instrument
- Internal ceramic protective sheaths
- Several TC conductor diameters
- PCP (4...20 mA), HART® and Profibus-PA® 2-wire transmitters
- Double sensing element
- EA calibration certificate

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# Areas of application

The TAF TC range of thermometer products caters to a wide variety of temperature measurement applications and a large range of temperatures.
The TAF 11 is a type J or type K ceramic sheath thermocouple suitable for steel treatment (annealing) applications and concrete furnaces and primaries of up to 1100°C.
The TAF 12S/D/T are single/double/triple ceramic sheath Platinum thermocouples (type R, S, B) designed specifically to cater for high temperature applications such as ceramic baking ovens, brickworks, porcelain production and glass industries where temperatures normally exceed the 1200°C.
The TAF 16 is a type J or type K thermocouple with metal sheath pipe thermowell suitable for applications in cement and rotary kilns, steel treatment and incinerators (waste burning) where temperatures range from 600 to 1100°C.
The main feature of all these thermocouples is their durability, which makes them suitable for the most common high-temperature ambience conditions.

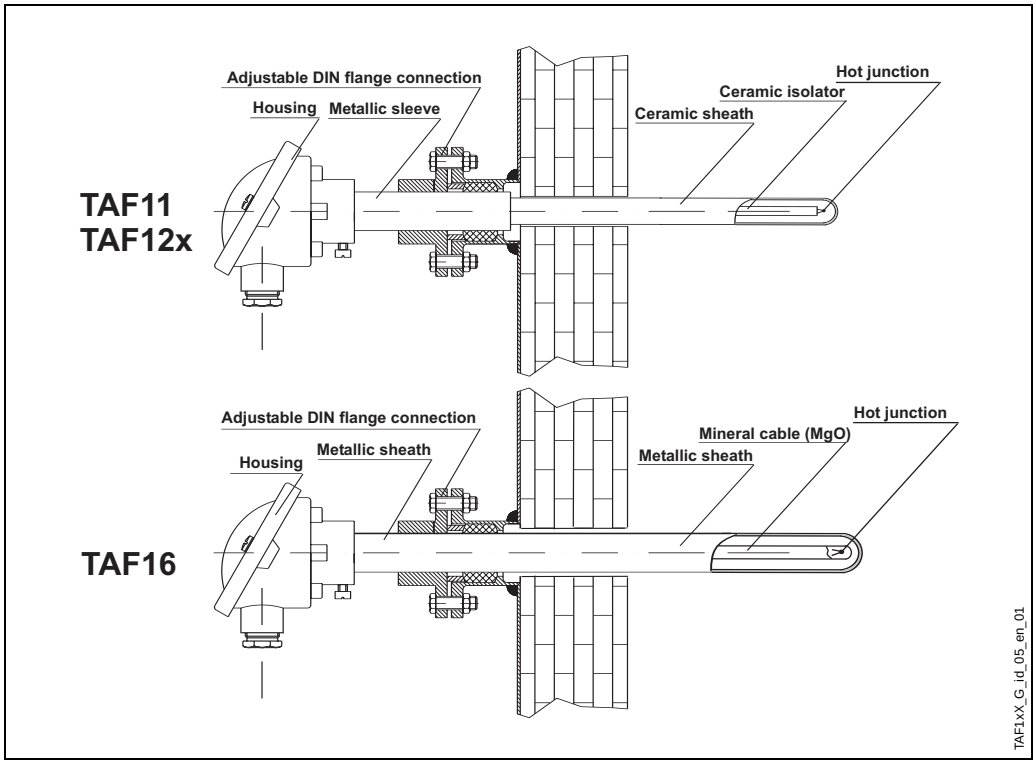



*Fig. 1: TAF 11, TAF 12x and TAF 16*

# Function and system design

*Measuring principle*

A thermocouple (TC) consists of two wires of different conductive material, which are connected to each other by two junctions and form an electrical circuit.
When one junction is at T 1 temperature and the other at T 2, an electromotive force is generated in the circuit, which depends on the materials used and the degree of T1 and T2 temperatures. This effect, which is the basis of thermoelectric temperature measurement, is called the *Seebeck effect*.
In an industrial TC thermometer one junction is the measuring joint, and the other is a reference point, the location of which usually corresponds to the conversion electronics (transmitter).

*Equipment architecture*

TAF series thermocouple thermometers are manufactured according to international DIN EN 60584 standards.
These products are made up of a measuring inset, a protection thermowell, a metal sleeve and a connection head (housing), which contains a transmitter or the electrical connection terminals.

**Measuring insets**
The inset in the TAF 11 and TAF 16 is a junction couple made up of type J or type K rod wires inserted in appropriate high-temperature-resistant ceramic isolators or in a mineral insulated insert (TAF 16).
The TAF 12S/D/T inset is a junction couple made up of type R, S or B flexible wires inserted in appropriate high-temperature-resistant ceramic isolators.
The ceramic isolators (capillaries) are specifically chosen to suit the temperature of the working application and to keep a more effective electrical isolation between the wire couplings.

**Protection thermowell sheaths**
Two types of sheath are commonly used in this type of thermocouple:
- metallic sheath, usually machined from tubes
- ceramic protection tubes.

Depending on temperature and the more or less heavy nature of the applications, the metallic sheaths are manufactured in all types of steel and special alloys, such as steel series AISI 300, AISI 446 and Inconel® 600 and in the widest variety of diameters and thicknesses:
- for air temperatures of up to 800°C, the AISI 310 and AISI 316 are standard
- for air temperatures from 800° to 1100°C, the Inconel® 600 is standard
- precious metal TC's with ceramic sheaths are available for temperatures exceeding 1100°C.

Ceramic sheaths are mainly utilised for high-temperature (>1200°C) applications or where gases that may contaminate the thermoelements are present.
The TAF 11 protection thermowell is a single ceramic sheath pipe, which is closed on the process side and suited to the TAF 11 temperature range and applications.
The TAF 12S/D/T protection thermowell is made up of one or more ceramic pipes of various sizes and materials, which enable it to withstand higher temperatures and harsh process conditions (TAF 12S = single, TAF 12D = double, TAF 12T = triple sheath).
The TAF 16 sensor protection thermowell is a metallic pipe in various sizes (diameters) and materials (AISI 310, AISI 316, AISI 446 and Inconel® 600), which make it suitable for various process conditions.
The process side of the pipe thermowell is closed by utilising a special welding/closing procedure. This guarantees optimum mechanical resistance and provides an effective measurement response time.

**Metallic sleeve and process connection**
The TAF 11 and TAF 12 ceramic sheath thermocouples are fitted with a metal sleeve on the cold section of the measuring sensor, just below the connection head. This permits the actual sensor to be mounted onto the equipment.
The ceramic sheath thermocouple can be installed onto the equipment via the adjustable stop flange (see Fig.1) or a compression fitting, which enables the fixing of the metallic sleeve to the process flange.
For installation, the metallic sleeve achieves a stronger mechanical fix, compared to the less sturdy ceramic sheath.
In order to determine the appropriate adaptation to the ceramic sheath and the correct distance between the connection head and the hot plant, metallic sleeve dimensions, materials and length (Lm) may be selected directly from the sales structure.
Special lengths, materials and dimensions may be ordered in accordance with process specifications.

**Connection head (housing)**
The TAF TC-thermometers feature DIN B (TA20A) or DIN A aluminium connection heads as standard (see Fig.1).
Other connection heads may be ordered to specification.

**Length**
All TAF sensors may be ordered by specifying the required length.
Lengths under 1500 mm are considered as standard.
Longer sensor lengths may be ordered in accordance with process specifications and technical feasibility.

*Material*

Standard materials and dimensions for TC wires:

| TC type | Metallic wires materials | Wire diameters (mm) |
|---|---|---|
| J | (+) Fe / (-) CuNi | 1.63 - 2.30 - 3.26 |
| K | (+) NiCr / (-) Ni | 1.63 - 2.30 - 3.26 |
| S | (+) PtRh10% / (-) Pt | 0.35 - 0.50 |
| R | (+) PtRh13% / (-) Pt | 0.50 |
| B | (+) PtRh30% / (-) PtRh6% | 0.50 |

Standard materials and combinations for TC-thermowells:

| TC name | Metallic sleeve (*) material | Sleeve diam. | External sheath | Sheath diam. | Ceramic intermediate sheath | Sheath diam. | Ceramic internal sheath | Sheath diam. | Max. temp. |
|---|---|---|---|---|---|---|---|---|---|
| | | mm | | mm | | mm | | mm | °C |
| TAF 11 | ASTM A106 AISI 304 | 22 | Ker 610 (Pytagoras) | 14 | | | | | 1500 |
| | ASTM A106 AISI 304 | 22 | Ker 610 (Pytagoras) | 17 | | | | | 1500 |
| | ASTM A106 AISI 304 | 33 | Ker 610 (Pytagoras) | 24 | | | Ker 610 (Pytagoras) | 17 | 1500 |
| TAF 12S | ASTM A106 AISI 304 | 13.7 | Ker 610 (Pytagoras) | 9 | | | | | 1500 |
| | ASTM A106 AISI 304 | 13.7 | Ker 710 (Alsint 99.7) | 9 | | | | | 1800 |
| TAF 12D | ASTM A106 AISI 304 | 22 | Ker 610 (Pytagoras) | 14 | | | Ker 610 (Pytagoras) | 9 | 1500 |
| | ASTM A106 AISI 304 | 22 | Ker 710 (Alsint 99.7) | 15 | | | Ker 710 (Alsint 99.7) | 9 | 1800 |
| TAF 12T | ASTM A106 AISI 304 | 33 | Ker 530 (Sillimantin 60) | 26 | Ker 610 (Pytagoras) | 14 | Ker 610 (Pytagoras) | 9 | 1400 |
| | ASTM A106 AISI 304 | 33 | Ker 610 (Pytagoras) | 26 | Ker 710 (Alsint 99.7) | 15 | Ker 710 (Alsint 99.7) | 9 | 1500 |
| | ASTM A106 AISI 304 | 33 | Ker 710 (Alsint 99.7) | 24 | Ker 710 (Alsint 99.7) | 15 | Ker 710 (Alsint 99.7) | 9 | 1800 |
| TAF 16 | - | | AISI 310 | 14<br>17<br>21.3<br>26.7 | | | | | 1100 |
| | - | | AISI 316 | 21.3<br>26.7 | | | | | 800 |
| | - | | AISI 446 | 21.3<br>26.7 | | | | | 1100 |
| | - | | Inconel® 600 | 15<br>17.2<br>21.3<br>26.7 | | | | | 1100 |

*(*) The metallic sleeve functions as a support tube only.*

**AISI 316/316L (1.4404 / X2 CrNiMo 17 12 2)**
This is an austenitic stainless steel with features of improved corrosion resistance in acid ambiences but not in oxidising (such as phosphoric and sulphuric acid at low concentration and temperatures) ambiences. It is not resistant to high-temperature chloride ambiences.
Maximum temperature: 800°C.

**AISI 310 (1.4841/ X15 CrNiSi 25 20)**
This is a good thermal, mechanical and corrosion resistant metal. It is similar to and at the same time better than the AISI 316L but it is not as resistant to sulfurous gases.
Maximum temperature: 1100°C.

**AISI 446 (1.4749 / X18 CrNi 28)**
This is a stainless steel ferroalloy with good resistance to the reduction of gases containing sulphur and to air oxidation and/or oil combustion.
Maximum temperature: 1100°C.

**Inconel® 600 (2.4816 / NiCr 15 Fe)**
This product is effectively resistant to high temperatures, chloride-ion stress corrosion, cracking and is oxidation resistant to high temperatures. It also performs well in nitride environments (do not use in sulfur bearing environments). Maximum temperature: 1100°C.

**SILLIMANTIN 60 or KER 530 (Al2O3 content approx. 73-75%)**
This is the least expensive amongst the porous ceramic materials. It is normally employed in the manufacture of external protective tubes since it has very good resistance to thermal shocks.
Maximum temperature: 1400°C.

**PYTAGORAS or KER 610 (Al2O3 content approx. 60%, Alkali content 3%)**
This is the least expensive amongst the non-porous ceramic materials. It is normally employed in the production of internal and external protection tubes as well as insulators since it's very resistant to hydrofluoric acid, thermal shocks and mechanical agents.
Maximum temperature: 1500°C.

**ALSINT 99.7 or KER 710 (Al2O3 content approx. 99.7%)**
This is the best material employed in the manufacture of internal and external protection tubes as well as insulators since it is resistant to gases containing hydrofluoric acid, to alkaline vapours, in oxidation-reduction and neutral atmospheres and moreover, to temperature changes.
Compared to all other types of ceramics, it is the most pure and has the lowest porosity (gas-tight).
Maximum temperature: 1800°C.

*Weight*

The following weights are provided as examples.

- TAF 11, length 1000 mm, metallic sleeve 100 mm, connection head DIN B 2 kg
- TAF 12S, length 1000 mm, metallic sleeve 100 mm, connection head DIN B 2 kg
- TAF 12D, length 1000 mm, metallic sleeve 100 mm, connection head DIN B 2.5 kg
- TAF 12T, length 1000 mm, metallic sleeve 100 mm, connection head DIN B 3 kg
- TAF 16, length 1000 mm, tube A106 , D=22 mm, connection head DIN B 3 kg

# Electronics

The desired type of output signal can be obtained by choosing the correct head-mounted 2-wire transmitter.
Endress + Hauser supplies state-of-the-art transmitters (iTEMP® series) built in 2-wire technology and with 4...20 mA, HART® or Profibus-PA® output signal. All the transmitters are easily programmable with a personal computer through the utilisation of ReadWin® 2000 public domain software (for 4...20 mA and HART® transmitters) or Commuwin II software (Profibus-PA® transmitters).
The HART® transmitters can also be programmed by the DXR 275 (Universal HART® Communicator) hand-held operating module.
A PCP (4...20 mA) model (TMT 181) is available with galvanic isolation.
In the case of Profibus-PA® transmitters, E+H recommends the use of Profibus® dedicated connectors. The Weidmuller type (Pg 13.5 - M12) is usually provided as standard.
For detailed information about transmitters, please refer to the specific document concerned (see TI codes at the end of this document).
If a head-mounted transmitter is not employed, the sensor probe can be connected through the terminal block to a remote converter (i.e. DIN rail transmitter).

# Performance

*Operating conditions*

Operating conditions for the connection heads:

- Ambient temperature (housing without head-mounted transmitter) -40 to 130°C
- Ambient temperature (housing with head-mounted transmitter) -40 to 85°C.

**Process temperature**
The operating range is defined by the combinations of materials utilised for the TC-wires and the relevant sheaths.

**Maximum process pressure**
This kind of straight thermocouples are used for a process pressure of about 1 bar.

*Accuracy*

**Probe maximum error**
The DIN EN 60584 standard defines standard values and tolerances for the thermocouple combinations to be used.
The DIN EN 60584 standard corresponds to the old DIN 43710 norm, with the exception of Fe-CuNi sensors (type L sensors) that can be supplied on demand.
Standard tolerances for TAF 11, TAF 12, TAF 16 thermocouples are Class 2 (thermocouple type J, K, R, S) or Class 3 (thermocouple type B).
Reduced tolerance sensors can be ordered by using the 99 digits at the option “TC Type conductors”.

| Type | Standard tolerance (DIN EN 60584) | | Reduced tolerance (DIN EN 60584) | |
|---|---|---|---|---|
| | Class | Deviation | Class | Deviation |
| **Base metal thermocouples** | | | | |
| J (Fe-CuNi) | 2 | +/-2.5°C (-40...333°C)<br>+/-0.0075\|t\| (333...750°C) | 1 | +/-1.5°C (-40...375°C)<br>+/-0.004\|t\| (375...750°C) |
| K (NiCr-Ni) | 2 | +/-2.5°C (-40...333°C)<br>+/-0.0075\|t\| (333...1200°C) | 1 | +/-1.5°C (-40...375°C)<br>+/-0.004\|t\| (375...1000°C) |
| **Precius metal thermocouples** | | | | |
| S (PtRh10%-Pt) | 2 | +/-1.5°C (0...600°C)<br>+/-0.0025\|t\| (600...1600°C) | 1 | +/-1°C (0...1100°C)<br>+/-[1+0.003(t-1100)] (1100...1600°C) |
| R (PtRh13%-Pt) | 2 | +/-1.5°C (0...600°C)<br>+/-0.0025\|t\| (600...1600°C) | 1 | +/-1°C (0...1100°C)<br>+/-[1+0.003(t-1100)] (1100...1600°C) |
| B (PtRh30%-PtRh6%) | 3 | +/-4°C (600...800°C)<br>+/-0.005\|t\| (800...1700°C) | 2 | +/-0.0025\|t\| (600...1700°C) |

The transmitter error must be added to the probe error, including the reference junction compensation (refer to specific details at the end of this document).

*Measurement range*

The standard (according to DIN EN 60584) measurement range of the thermocouples is:

- termocouple J type -40...750°C
- termocouple K type -40...1200°C
- termocouple R type 0...1600°C
- termocouple S type 0...1600°C
- termocouple B type 600...1700°C.

The practical upper limit of the application range is:

| TC type | Wires and sheath material | Wire size (mm) | Maximum temperature (°C) | Standard wire colours (DIN EN 60584) |
|---|---|---|---|---|
| J (***) | Fe-CuNi | 1.63 | 590 | (+)black / (-)white |
| J (***) | Fe-CuNi | 2.30 | 650 | (+)black / (-)white |
| J (***) | Fe-CuNi | 3.26 | 760 | (+)black / (-)white |
| K (***) | NiCr-Ni | 1.63 | 1090 | (+)green / (-)white |
| K (***) | NiCr-Ni | 2.30 | 1150 | (+)green / (-)white |
| K (***) | NiCr-Ni | 3.26 | 1260 | (+)green / (-)white |
| K (*) | NiCr-Ni<br>Inconel® 600 | mineral insulated cable diam. 6 | 1100 | (+)green / (-)white |
| S (**) | PtRh10%-Pt | 0.35<br>0.50 | 1300<br>1480 | (+)orange / (-)white |
| R (**) | PtRh13%-Pt | 0.50 | 1480 | (+)orange / (-)white |
| B (**) | PtRh30%-PtRh6% | 0.50 | 1700 | (+)grey / (-)white |

Warning!(*) For TAF 16 only.
Warning!(**) For TAF 12x only.
Warning!(***) For TAF 11 only.

*Response time*

Response time for this kind of thermocouple is normally not a crucial parameter. Should information be required, please contact the E+H Service Department.

*Insulation*

Insulation resistance between the terminals and the probe sheath is fully guaranteed by its manufacturing methods.
For the TAF 16, with 6 mm mineral insulated insert versions, the IEC 1515 standard is applied.
Insulation resistance between the terminals and the probe sheath is:

- at 25°C, test at 500 Vdc > 1 GOhm
- at 500°C, test at 500 Vdc > 5 MOhm.

*Self heating*

Nil.

# Installation

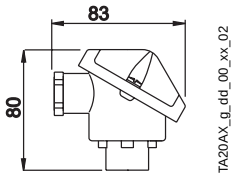
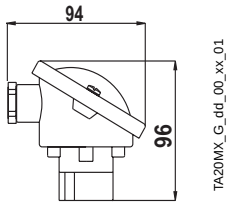
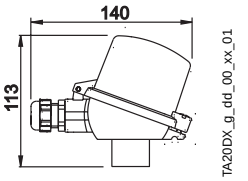
The Omnigrad S TAF thermocouple thermometer assemblies are specifically designed for installation in high-temperature industrial furnaces. Platinum wire with a diameter of 0.5 mm is suitable for high-temperature applications and provides for better long-term stability.
In many cases it is important to maintain control over the installation and ejection of these thermocouples in the plant when temperatures are high, in order to avoid thermal shocks and the possibility of ceramic sheath damage. Should the working condition temperature approach the maximum prescribed limit for the thermowell material, vertical installation is recommended in order to avoid a weight-bearing mechanical action, which could cause the sensor stem to bend.
Preferential oxidation (green rot) is an oxidation process that occurs in nickel-based thermocouples, type K in particular. This condition is caused by a limited supply of oxygen surrounding the thermocouple elements, type K in particular. The limited oxygen reacts with the more active chromium in the conductor alloy, creating a green scale. As the chromium is transformed into chromium-oxide, a growing residue of nickel skin is left behind and causes de-calibration. De-calibration is caused by the negative thermo-element being paired against a nickel skin, rather than the

original homogeneous nickel-chromium alloy. Preferential oxidation will not occur where there is an abundant supply, or total absence, of oxygen.

# System components

*Housing*

According to DIN 43729, the housing that contains the electric terminals or the transmitter can be of different types and materials (i.e., painted aluminium, cast iron or stainless steel).
Head type TA20A (DIN B) is the basic E+H aluminium housing for temperature sensors. It is supplied in the E+H corporate colours, at no extra charge.
The TA20A may be used with tubes that have an external diameter of up to 21.3 mm.
The TA20M, DIN A aluminium Head is the connection housing to be used in conjunction with tubes that have a diameter larger than 21.3 mm. It may contain either a terminal block or a transmitter from the iTEMP® range of products.
The TA20D type aluminium Head (also referred to as BUZH) is capable of containing a terminal block and a transmitter or two transmitters at the same time.

| Husing type | IP | Husing type | IP | Housing type | IP |
|---|---|---|---|---|---|
| TA20A (DIN B)   | 54 (*) | TA20M (DIN A)   | 54 (*) | TA20D   | 54 (*) |

(*) Worst case scenario, in the configuration of some sensors, the IP can even reach 66 grade.

*Transmitter*

The following transmitters are available (also refer to "Electronics" section):

- TMT 181 PCP 4…20 mA (with galvanic isolation)
- TMT 182 Smart HART® (with galvanic isolation)
- TMT 184 Profibus-PA® (with galvanic isolation).

TMT 181 is a PC Programmable transmitter.
TMT 182 output consists of 4…20 mA and HART® superposed signals.
In the TMT 184 with Profibus-PA® output signal, the communication address can be set through appropriate software or by means of a mechanical dip-switch. The user may request the desired configuration during the ordering process. Head transmitters may be ordered separately through the THT1 sales structure (refer to relevant table at the end of this brochure).

If TAF thermocouples are ordered fitted with an electrical terminal block, they can be connected to an external E+H DIN rail transmitter as the:

- TMT 121 PCP 4…20 mA (with galvanic isolation)
- TMT 122 Smart HART® (with galvanic isolation).

In this case, extension or compensation wires are required when making the connection.

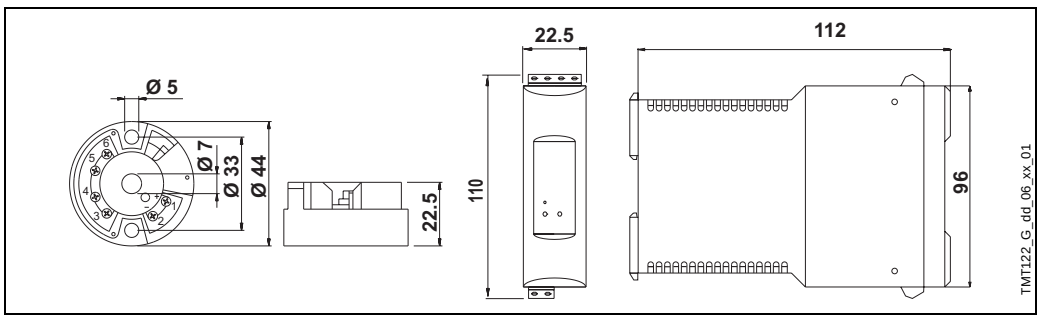
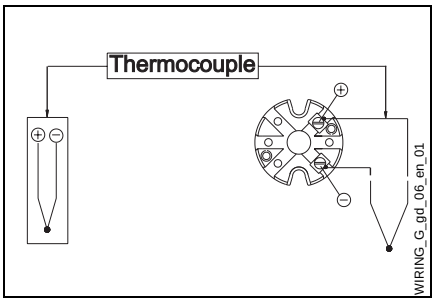



*Fig. 2: TMT 181, TMT 121*

*Probe*




In TAF sensors, the measuring probe is made up of:

- TAF 16 a mineral insulated insert positioned inside the metallic thermowell or J / K wires inserted in suitable high temperature resistant ceramic isolators
- TAF 12x two or more PtRh-Pt wires inserted in suitable high temperature resistant ceramic isolator, insert positioned inside the ceramic thermowell
- TAF 11 two or more J or K wires inserted in suitable high temperature resistant ceramic isolator, insert positioned inside the ceramic thermowell.

*Fig. 3: Standard wiring*

When replacing the probe, the insert length (IL) depends on the length of the thermowell.

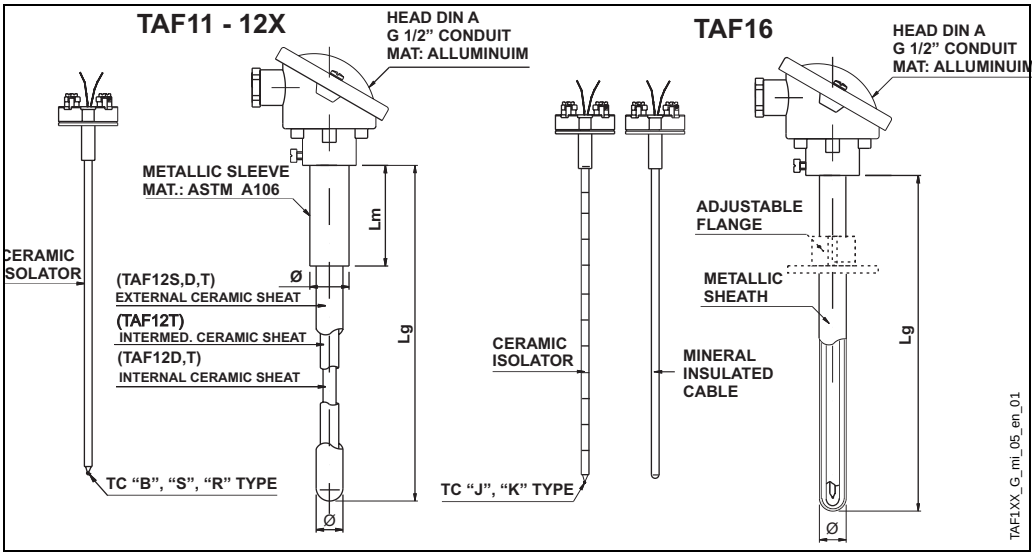



*Fig. 4: Sensing parts*

# Certificates & approvals

*Ex-approval*

TAF thermocouples can be used in hazardous atmospheres if connected to Ex-certified conversion electronics (e.g., iTEMP® transmitters). The permissible zone type depends on the installation method and therefore the customer is responsible.

*Test report & calibration*

The customer may request a calibration of the sensors. The "Factory calibration" is carried out in the E+H European Accreditation (EA) laboratory for Temperature calibrations and follows an internal procedure. A calibration performed according to an EA accredited procedure (SIT calibration) can also be requested. The calibration is executed on the thermometer insert. A minimum immersion length is required for correct calibration.

# Further details

*Maintenance*

Omnigrad S TAF sensors don't require specific maintenance.
The only recommendation is to check sensor integrity periodically, especially in the ceramic sheath thermocouple, where mechanical strikes and shocks can damage the actual ceramic sheaths. Furthermore, as a general rule for all Temperature measurement devices, we recommend the verification of calibration integrity with the installation of another thermometer in the same plant position (if possible) or an annual demounting of the sensor from the equipment in order to verify its accuracy with a reference instrument or at an external laboratory.

*Delivery time*

Normal delivery time for TAF sensors is 20 working days. If a shorter delivery lead time is required, an agreement can be reached with the E+H Sales Department.

# Ordering information

*Product structure*

| TAF11 | **TC type, conductors diam.** | | | |
|---|---|---|---|---|
| | *(TC K up to1260°C - TC J up to760°C)* | | | |
| | 12 | 1xType K | conductors diam. | 2.3 mm |
| | 13 | 1xType K | conductors diam. | 3.26 mm |
| | 15 | 2xType K | conductors diam. | 2.3 mm |
| | 16 | 2xType K | conductors diam. | 3.26 mm |
| | 21 | 1xType J | conductors diam. | 2.3 mm |
| | 22 | 1xType J | conductors diam. | 3.26 mm |
| | 24 | 2xType J | conductors diam. | 2.3 mm |
| | 25 | 2xType J | conductors diam. | 3.26 mm |
| | 99 | TC type and conductors diam. to spec. | | |

| | | **Material and diameter sheath** (utilization pipe) | | |
|---|---|---|---|---|
| | AA | DIN 610, diam. 14 | (pipe to 600 mm) | no internal sheath |
| | AB | DIN 610, diam. 14 | (pipe from 601 mm to 1000 mm) | no internal sheath |
| | AC | DIN 610, diam. 14 | (pipe from 1001 mm to 1500 mm) | no internal sheath |
| | AD | DIN 610, diam. 17 | (pipe to 600 mm) | no internal sheath |
| | AE | DIN 610, diam. 17 | (pipe from 601 mm to 1000 mm) | no internal sheath |
| | AF | DIN 610, diam. 17 | (pipe from 1001 mm to 1500 mm) | no internal sheath |
| | AG | DIN 610, diam. 24 | (pipe to 600 mm) | int. sheath DIN 610 diam.17 mm |
| | AH | DIN 610, diam. 24 | (pipe from 601 mm to 1000 mm) | int. sheath DIN 610 diam.17 mm |
| | AJ | DIN 610, diam. 24 | (pipe from 1001 mm to 1500 mm) | int. sheath DIN 610 diam.17 mm |
| | YY | Meterial/diameter external and internal sheath to specification | | |

| | | | **Immersion length Lg** (400 - 1500 mm) |
|---|---|---|---|
| | | X | ... mm immersion length Lg to specification |
| | | Y | ... mm special immersion length Lg |

| | | | **Type of terminal** |
|---|---|---|---|
| | | 3 | Terminal block DIN B |
| | | 4 | Terminal block DIN A |

| | | | **Metallic sleeve: Lm length, diameter and material** | | |
|---|---|---|---|---|---|
| | A | 185 | mm Lm diam. 33 mm | ASTM A106 |
| | B | 80 | mm Lm diam. 22 mm | ASTM A106 |
| | C | 200 | mm Lm diam. 22 mm | ASTM A106 |
| | D | 100 | mm Lm diam. 22 mm | zinc plated steel |
| | E | 150 | mm Lm diam. 22 mm | zinc plated steel |
| | F | 100 | mm Lm diam. 22 mm | AISI 304 |
| | G | 150 | mm Lm diam. 22 mm | AISI 304 |
| | H | 200 | mm Lm diam. 22 mm | AISI 304 |
| | J | 185 | mm Lm diam. 33 mm | AISI 304 |
| | Y | ... | mm Lm diam. and material to specification | |

| | | | **Process connection** |
|---|---|---|---|
| | 0 | | Without adj. flanged connection |
| | 1 | | Adjustable flanged diam. 70 mm |
| | 9 | | Process connection to specification |

| | | | **Head type** |
|---|---|---|---|
| | A | | Head DIN B; G1/2, G1/2 conduit |
| | D | | TA20D Aluminium, high lid, M24x1.5, Pg 16, IP66 |
| | R | | Head DIN A; G1/2 conduit |
| | Y | | Head to specification |

| | | | **Built-in head transmitter** |
|---|---|---|---|
| | 0 | | Without transmitter |
| | P | | Programmable TMT181-A, from ... to ...°C, PCP, 2-wires, isolated |
| | R | | Programmable TMT182-A, from ... to ...°C, HART®, 2-wires, isolated |
| | S | | Programmable TMT184-A, from ... to ...°C, Profibus-PA®, 2-wires, isolated |
| | 1 | | Built-in transmitter THT1, separate position |

| TAF11- | | | | | | | | | Complete order code |
|---|---|---|---|---|---|---|---|---|---|

# Ordering information

*Product structure*

| TAF12S | | | | | | | | | **TC type, conductors diam.** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | *(TC S up to1600°C - TC B up to1800°C - TC R up to 1600°C)* |
| | | | | | | | | | 31 1xType S conductors diam. 0.35 mm |
| | | | | | | | | | 32 2xType S conductors diam. 0.35 mm |
| | | | | | | | | | 33 1xType S conductors diam. 0.5 mm |
| | | | | | | | | | 34 2xType S conductors diam. 0.5 mm |
| | | | | | | | | | 41 1xType R conductors diam. 0.5 mm |
| | | | | | | | | | 42 2xType R conductors diam. 0.5 mm |
| | | | | | | | | | 51 1xType B conductors diam. 0.5 mm |
| | | | | | | | | | 52 2xType B conductors diam. 0.5 mm |
| | | **Material and diameter sheath** (utilization pipe) | | | | | | | |
| | | SA DIN 610, diam. 9 Lg (pipe to 600 mm) | | | | | | | |
| | | SB DIN 610, diam. 9 Lg (pipe from 601 mm to 1000 mm) | | | | | | | |
| | | SC DIN 610, diam. 9 Lg (pipe from 1001 mm to 1500 mm) | | | | | | | |
| | | SD DIN 710, diam. 9 Lg (pipe to 600 mm) | | | | | | | |
| | | SE DIN 710, diam. 9 Lg (pipe from 601 mm to 1000 mm) | | | | | | | |
| | | SF DIN 710, diam. 9 Lg (pipe from 1001 mm to 1500 mm) | | | | | | | |
| | | YY Meterial and sheath to specification | | | | | | | |
| | | | **Immersion length Lg** (300 - 1500 mm) | | | | | | |
| | | | X ... mm immersion length Lg to specification | | | | | | |
| | | | Y ... mm special immersion length Lg | | | | | | |
| | | | | **Type of terminal** | | | | | |
| | | | | 2 Flying leads | | | | | |
| | | | | 3 Terminal block | | | | | |
| | | | | | **Metallic sleeve: Lm length, diameter and material** | | | | |
| | | | | | A 100 mm Lm diam. 13,7 mm AISI 304 | | | | |
| | | | | | Y ... mm Lm diam. and material to specification | | | | |
| | | | | | | **Process connection** | | | |
| | | | | | | 0 Without adj. flanged connection | | | |
| | | | | | | 1 Adjustable flanged diam. 70 mm in aluminium | | | |
| | | | | | | 9 Process connection to specification | | | |
| | | | | | | | **Head type** | | |
| | | | | | | | A Head DIN B; G1/2, G1/2 conduit | | |
| | | | | | | | D TA20D Aluminium, high lid, M24x1.5, Pg16, IP66 | | |
| | | | | | | | Y Head to specification | | |
| | | | | | | | | **Built-in head transmitter** | |
| | | | | | | | | 0 Without transmitter | |
| | | | | | | | | P Programmable TMT181-A, from ... to ...°C, PCP, 2-wires, isolated | |
| | | | | | | | | R Programmable TMT182-A, from ... to ...°C, HART®, 2-wires, isolated | |
| | | | | | | | | S Programmable TMT184-A, from ... to ...°C, Profibus-PA®, 2-wires, isolated | |
| | | | | | | | | 1 Built-in transmitter THT1, separate position | |
| TAF12S- | | | | | | | | | Complete order code |

# Ordering information

*Product structure*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **TAF12D** | **TC type, conductors diam.** | | | | | | | | |
| | *(TC S up to1600°C - TC B up to1800°C - TC R up to 1600°C)* | | | | | | | | |
| | 31 | 1xType S | conductors diam. | 0.35 mm | | | | | |
| | 32 | 2xType S | conductors diam. | 0.35 mm | | | | | |
| | 33 | 1xType S | conductors diam. | 0.5 mm | | | | | |
| | 34 | 2xType S | conductors diam. | 0.5 mm | | | | | |
| | 41 | 1xType R | conductors diam. | 0.5 mm | | | | | |
| | 42 | 2xType R | conductors diam. | 0.5 mm | | | | | |
| | 51 | 1xType B | conductors diam. | 0.5 mm | | | | | |
| | 52 | 2xType B | conductors diam. | 0.5 mm | | | | | |
| | | **Material and diameter ext./int. sheath** (utilization pipe) | | | | | | | |
| | | DA | DIN 610, diam. 14 Lg | (pipe to 600 mm) | int. DIN 610 diam. 9 mm | | | | |
| | | DB | DIN 610, diam. 14 Lg | (pipe from 601 mm to 1000 mm) | int. DIN 610 diam. 9 mm | | | | |
| | | DC | DIN 610, diam. 14 Lg | (pipe from 1001 mm to 1500 mm) | int. DIN 610 diam. 9 mm | | | | |
| | | DD | DIN 710, diam. 15 Lg | (pipe to 600 mm) | int. DIN 710 diam. 9 mm | | | | |
| | | DE | DIN 710, diam. 15 Lg | (pipe from 601 mm to 1000 mm) | int. DIN 710 diam. 9 mm | | | | |
| | | DF | DIN 710, diam. 15 Lg | (pipe from 1001 mm to 1500 mm) | int. DIN 710 diam. 9 mm | | | | |
| | | YY | Meterial and diameter external/internal sheath to specification | | | | | | |
| | | | **Immersion length Lg** (300 - 1500 mm) | | | | | | |
| | | | X | ... mm immersion length Lg to specification | | | | | |
| | | | Y | ... mm special immersion length Lg | | | | | |
| | | | | **Type of terminal** | | | | | |
| | | | | 2 | Flying leads | | | | |
| | | | | 3 | Terminal block | | | | |
| | | | | | **Metallic sleeve: Lm length, diameter and material** | | | | |
| | | | | | B | 80 | mm Lm diam. 22 mm | ASTM A106 | |
| | | | | | C | 200 | mm Lm diam. 22 mm | ASTM A106 | |
| | | | | | F | 100 | mm Lm diam. 22 mm | AISI 304 | |
| | | | | | G | 150 | mm Lm diam. 22 mm | AISI 304 | |
| | | | | | H | 200 | mm Lm diam. 22 mm | AISI 304 | |
| | | | | | Y | ... | mm Lm diameter and material to specification | | |
| | | | | | | **Process connection** | | | |
| | | | | | | 0 | Without adj. flanged connection | | |
| | | | | | | 1 | Adjustable flanged diam. 70 mm in aluminium | | |
| | | | | | | 9 | Process connection to specification | | |
| | | | | | | | **Head type** | | |
| | | | | | | | A | Head DIN B; G1/2, G1/2 conduit | |
| | | | | | | | D | TA20D Aluminium, high lid, M24x1.5, Pg16, IP66 | |
| | | | | | | | Y | Head to specification | |
| | | | | | | | | **Built-in head transmitter** | |
| | | | | | | | | 0 | Without transmitter |
| | | | | | | | | P | Programmable TMT181-A, from ... to ...°C, PCP, 2-wires, isolated |
| | | | | | | | | R | Programmable TMT182-A, from ... to ...°C, HART®, 2-wires, isolated |
| | | | | | | | | S | Programmable TMT184-A, from ... to ...°C, Profibus-PA®, 2-wires, isolated |
| | | | | | | | | 1 | Built-in transmitter THT1, separate position |
| TAF12D- | | | | | | | | | Complete order code |

# Ordering information

*Product structure*

| TAF12T | | | | | | | | | **TC type, conductors diam., price 10 mm Lg** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | *(TC S up to1600°C - TC B up to1800°C - TC R up to 1600°C)* |
| | | | | | | | | | 31 1xType S conductors diam. 0.35 mm |
| | | | | | | | | | 32 2xType S conductors diam. 0.35 mm |
| | | | | | | | | | 33 1xType S conductors diam. 0.5 mm |
| | | | | | | | | | 34 2xType S conductors diam. 0.5 mm |
| | | | | | | | | | 41 1xType R conductors diam. 0.5 mm |
| | | | | | | | | | 42 2xType R conductors diam. 0.5 mm |
| | | | | | | | | | 51 1xType B conductors diam. 0.5 mm |
| | | | | | | | | | 52 2xType B conductors diam. 0.5 mm |
| | | | | | | | | | **Material and diameter ext./intermed./internal sheath Lg** (utilization pipe) |
| | | | | | | | | | TA DIN 530, diam. 26 Lg (pipe to 600 mm) -intermediate DIN 610 diam. 14 mm; -int. DIN 610 diam. 9 mm |
| | | | | | | | | | TB DIN 530, diam. 26 Lg (pipe from 601 mm to 1000 mm) -intermediate DIN 610 diam. 14 mm; -internal DIN 610 diam. 9 mm |
| | | | | | | | | | TC DIN 530, diam. 26 Lg (pipe from 1001 mm to 1500 mm) -intermediate DIN 610 diam. 14 mm; -internal DIN 610 diam. 9 mm |
| | | | | | | | | | TD DIN 530, diam. 26 Lg (pipe to 600 mm) -intermediate DIN 710 diam. 15 mm; -internal DIN 710 diam. 9 mm |
| | | | | | | | | | TE DIN 530, diam. 26 Lg (pipe from 601 mm to 1000 mm) -intermediate DIN 710 diam. 15 mm; -internal DIN 710 diam. 9 mm |
| | | | | | | | | | TF DIN 530, diam. 26 Lg (pipe from 1001 mm to 1500 mm) -intermediate DIN 710 diam. 15 mm; -internal DIN 710 diam. 9 mm |
| | | | | | | | | | TG DIN 710, diam. 24 Lg (pipe to 600 mm) -intermediate DIN 710 diam. 15 mm; -internal DIN 710 diam. 9 mm |
| | | | | | | | | | TH DIN 710, diam. 24 Lg (pipe from 601 mm to 1000 mm) -intermediate DIN 710 diam. 15 mm; -internal DIN 710 diam. 9 mm |
| | | | | | | | | | TJ DIN 710, diam. 24 Lg (pipe from 1001 mm to 1500 mm) -intermediate DIN 710 diam. 15 mm; -internal DIN 710 diam. 9 mm |
| | | | | | | | | | YY Meterial and diameter external/internal sheath to specification |
| | | | | | | | | | **Immersion length Lg** (300 - 1500 mm) |
| | | | | | | | | | X ... mm immersion length Lg to specification |
| | | | | | | | | | Y ... mm special immersion length Lg |
| | | | | | | | | | **Type of terminal** |
| | | | | | | | | | 2 Flying leads |
| | | | | | | | | | 4 Terminal block DIN A |
| | | | | | | | | | **Metallic sleeve: Lm length, diameter and material** |
| | | | | | | | | | A 185 mm Lm diam. 33 mm ASTM A106 |
| | | | | | | | | | Y ... mm Lm diam. and material to specification |
| | | | | | | | | | **Process connection** |
| | | | | | | | | | 0 Without adj. flanged connection |
| | | | | | | | | | 9 Process connection to specification |
| | | | | | | | | | **Head type** |
| | | | | | | | | | D TA20D Aluminium, high lid, M24x1.5, Pg16, IP66 |
| | | | | | | | | | P Head DIN A; G1/2" conduit |
| | | | | | | | | | Y Head to specification |
| | | | | | | | | | **Built-in head transmitter** |
| | | | | | | | | | 0 Without transmitter |
| | | | | | | | | | P Programmable TMT181-A, from ... to ...°C, PCP, 2-wires, isolated |
| | | | | | | | | | R Programmable TMT182-A, from ... to ...°C, HART®, 2-wires, isolated |
| | | | | | | | | | S Programmable TMT184-A, from ... to ...°C, Profibus-PA®, 2-wires, isolated |
| | | | | | | | | | 1 Built-in transmitter THT1, separate position |
| TAF12T- | | | | | | | | | Complete order code |

# Ordering information

*Product structure*

| TAF16 | | | | | | | | | **TC type, conductors diam.** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | *(TC K up to1260°C - TC J up to760°C)* |
| | | | | | | | | 11 | 1xType K conductors diam. 1.63 mm |
| | | | | | | | | 12 | 1xType K conductors diam. 2.30 mm |
| | | | | | | | | 13 | 1xType K conductors diam. 3.26 mm |
| | | | | | | | | 14 | 2xType K conductors diam. 1.63 mm |
| | | | | | | | | 15 | 2xType K conductors diam. 2.30 mm |
| | | | | | | | | 16 | 2xType K conductors diam. 3.26 mm |
| | | | | | | | | 17 | 1xType K MgO insulation, sheath diam. 6 mm Inconel® 600 |
| | | | | | | | | 18 | 2xType K MgO insulation, sheath diam. 6 mm Inconel® 600 |
| | | | | | | | | 20 | 1xType J conductors diam. 1.63 mm |
| | | | | | | | | 21 | 1xType J conductors diam. 2.30 mm |
| | | | | | | | | 22 | 1xType J conductors diam. 3.26 mm |
| | | | | | | | | 23 | 2xType J conductors diam. 1.63 mm |
| | | | | | | | | 24 | 2xType J conductors diam. 2.30 mm |
| | | | | | | | | 25 | 2xType J conductors diam. 3.26 mm |
| | | | | | | | | 99 | TC type and conductors diam. to spec. |
| | | | | | | | | | **Insertion length He** (480-1580 mm - Lg+80 mm) |
| | | | | | | | | X | ... mm insertion length to specification |
| | | | | | | | | Y | ... mm special insertion length |
| | | | | | | | | | **Material, size pipe** |
| | | | | | | | | A | Pipe AISI 310, diam. 14x11 mm |
| | | | | | | | | B | Pipe AISI 310, diam. 17.2x14.2 mm |
| | | | | | | | | C | Pipe AISI 310, diam. 21.3x19.3 mm |
| | | | | | | | | D | Pipe AISI 310, diam. 26.7x23.7 mm |
| | | | | | | | | E | Pipe AISI 316, diam. 21.3x15.76 mm |
| | | | | | | | | F | Pipe AISI 316, diam. 26.7x20.96 mm |
| | | | | | | | | G | Pipe AISI 446, diam. 21.3x15.76 mm |
| | | | | | | | | H | Pipe AISI 446, diam. 26.7x20.96 mm |
| | | | | | | | | J | Pipe Inconel® 600, diam. 15x12 mm |
| | | | | | | | | K | Pipe Inconel® 600, diam. 17.2x13.2 mm |
| | | | | | | | | L | Pipe Inconel® 600, diam. 21.3x15.76 mm |
| | | | | | | | | M | Pipe Inconel® 600, diam. 26.7x20.96 mm |
| | | | | | | | | Y | Material and size pipe to specification |
| | | | | | | | | | **Immersion length Lg** (400 - 1500 mm) |
| | | | | | | | | X | ... mm immersion length Lg to specification |
| | | | | | | | | Y | ... mm special immersion length L g |
| | | | | | | | | | **Internal protective sheath in DIN 610** |
| | | | | | | | | 0 | Without internal protective sheath |
| | | | | | | | | 9 | Special internal ceramic sheath |
| | | | | | | | | | **Type of terminal** |
| | | | | | | | | 3 | Terminal block DIN B |
| | | | | | | | | 4 | Terminal block DIN A |
| | | | | | | | | | **Process connection** |
| | | | | | | | | 0 | Without adjustable process connection |
| | | | | | | | | 1 | Adjustable flanged diam. 70 mm in aluminium |
| | | | | | | | | 9 | Process connection to specification |
| | | | | | | | | | **Head type** |
| | | | | | | | | A | Head DIN B; G1/2, G1/2 conduit |
| | | | | | | | | D | TA20D Aluminium, high lid, M24x1.5, Pg 16, IP66 |
| | | | | | | | | R | Head DIN A; G1/2 conduit |
| | | | | | | | | Y | Head to specification |
| | | | | | | | | | **Built-in head transmitter** |
| | | | | | | | | 0 | Without transmitter |
| | | | | | | | | P | Programmable TMT181-A, from ... to ...°C, PCP, 2-wires, isolated |
| | | | | | | | | R | Programmable TMT182-A, from ... to ...°C, HART®, 2-wires, isolated |
| | | | | | | | | S | Programmable TMT184-A, from ... to ...°C, Profibus-PA®, 2-wires, isolated |
| | | | | | | | | 1 | Built-in transmitter THT1, separate position |
| TAF16- | | | | | | | | | Complete order code |

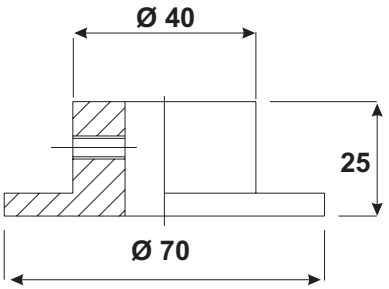
# Ordering information

*Product structure*

| | | | |
|---|---|---|---|
| **THT1** | **Head transmitter integrated** | | |
| | *To be ordered separately* | | |
| | F11 | | Programmable TMT181-A, from... to ...°C, PCP, 2-wire, isolated |
| | F21 | | Programmable TMT181-B, from... to ...°C, PCP ATEX, 2-wire, isolated |
| | F22 | | Programmable TMT181-C, from... to ...°C, PCP FM IS, 2-wire, isolated |
| | F23 | | Programmable TMT181-D, from... to ...°C, PCP CSA, 2-wire, isolated |
| | L11 | | Programmable TMT182-A, from... to ...°C, HART®, 2-wire, isolated |
| | L21 | | Programmable TMT182-B, from... to ...°C, HART® ATEX, 2-wire, isolated |
| | L22 | | Programmable TMT182-C, from... to ...°C, HART® FM IS, 2-wire, isolated |
| | L23 | | Programmable TMT182-D, from... to ...°C, HART® CSA, isolated |
| | K11 | | Programmable TMT184-A, from ...to ...°C, Profibus PA®, 2-wire |
| | K21 | | Programmable TMT184-B, from ...to ...°C, Profibus PA® ATEX, 2-wire |
| | K22 | | Programmable TMT184-C, from ...to ...°C, Profibus PA® FM IS, 2-wire |
| | K23 | | Programmable TMT184-D, from ...to ...°C, Profibus PA® CSA, 2-wire |
| | YYY | | Transmitter as specified |
| | | **Application and service** | |
| | | 1 | Built-in position |
| | | 9 | Special as specified |
| THT1- | | | Complete order code |

*Accessories*

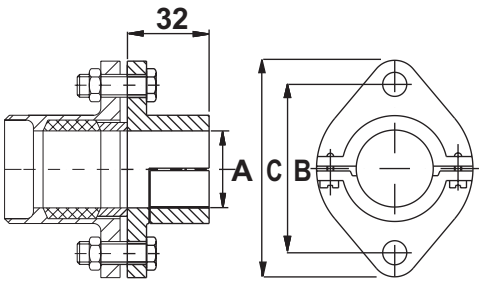
**Adjustable flange process connection**




ADJFLG_G_dd_09_xx_02

Maximum temperature 350°C, material aluminium.
No gas-tight connection.
Selectable from ordering structure.

**Adjustable DIN 43734 flanged process connection**

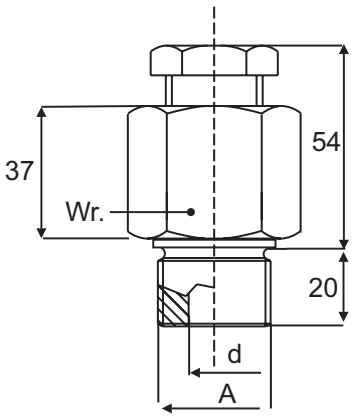



ADJFLG_G_dd_09_xx_01

Maximum temperature 400°C, material cast iron.
No gas-tight connection.
Mating flange and gasket are not provided.
To be included in the special option of product structure. See material number in the table.

| | A=16 | A=23 | A=33 |
|---|---|---|---|
| C/B 75/55 | 60008385 | | |
| C/B 90/70 | | 60000516 | 60000517 |

**Adjustable threaded process connection**




ADJPRO_G_dd_09_xx_01

Maximum process temperature 350°C for all versions, material SS 316Ti.
Maximum allowable process pressure 1 bar.
Packing gland included.
To be included in the special option of product structure. See material number in the table.

| A | d=14.5 | d=17.5 | d=22 | d=27 | d=34 | Wr |
|---|---|---|---|---|---|---|
| G 1/2” | 60019126 | 60019129 | | | | Wr.36 |
| G 3/4” | 60019127 | 60019130 | | | | Wr.36 |
| | | | 60020836 | | | Wr.41 |
| G 1” | 60019128 | 60021758 | 60021757 | | | Wr.41 |
| | | | | 60019134 | | Wr.46 |
| G 1 1/2” | | | 60021425 | | 60022497 | Wr.55 |
| G 1 1/4” | | | | | 60019264 | Wr.55 |

Note!-Other process connections are available on request.

# Supplementary documentation

| | |
|---|---|
| ❑ Temperature head transmitter iTEMP® PCP TMT 181 | TI 070R/09/en |
| ❑ Temperature head transmitter iTEMP® HART® TMT 182 | TI 078R/09/en |
| ❑ Temperature head transmitter iTEMP® PA TMT 184 | TI 079R/09/en |
| ❑ Temperature DIN rail transmitter iTEMP® PCP TMT 121 | TI 087R/09/en |
| ❑ Temperature DIN rail transmitter iTEMP® HART® TMT 122 | TI 090R/09/en |
| ❑ Thermocouple inset - Omnigrad TEC 100 | TI 103T/02/en |
| ❑ E+H Thermolab - Calibration certificates for industrial thermometers and working standards *RTD's and thermocouples* | TI 236T/02/en |

**Subject to modification**

Endress+Hauser
Gmbh+Co.
Instruments International
P.O. Box 2222
D-79574 Weil am Rhein
Germany

Tel. (07621) 975-02
Tx 773926
Fax (07621) 975 345
http://www.endress.com
info@ii.endress.com

Endress + Hauser
The Power of Know How

TI 251T/02/en/09.04
60018853
FrameMaker 6.0