



TEMPERATURE MEASUREMENT Catalogue

Resistance sensors and thermocouple assemblies

- Temperature assemblies with various process connections
- Standard and customised thermowells
- Temperature transmitters for all applications


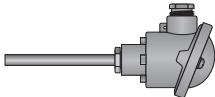

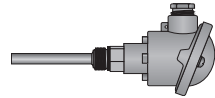

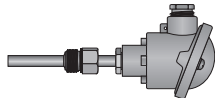

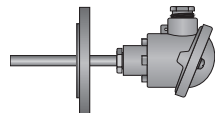

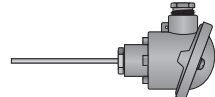
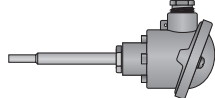
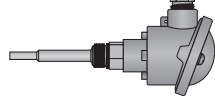
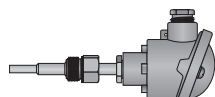
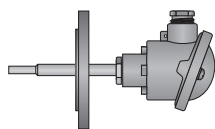
ЕЛЕКТРОЛУКС
Electrolux
SERVICE FACTORY EXPORT-IMPORT

1 Theory

Resistance sensor - RTD's	10
Thermocouples	14
SmartSense	16
Thermowell material	18
Structure of temperature assemblies	20
Installation	21
Explosive atmosphere	22
Dimensions for temperature assemblies	24

2 Industrial temperature assemblies (VTS1)


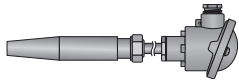

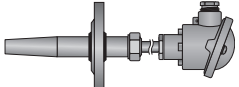

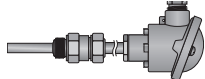

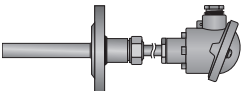

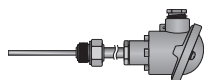

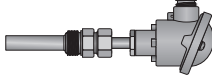



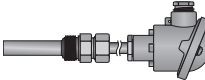
For temperature measurement in gases and liquids, in pipes and tanks at medium pressure and flow.

Temperature assembly for compression fitting Welded multipart thermowell, form 2		TRA/TCA-P10		28
Temperature assembly for screw-in Welded multipart thermowell, form 8		TRA/TCA-S11		29
Temperature assembly for screw-in Welded multipart thermowell, form 2G		TRA/TCA-S12		30
Temperature assembly with process flange Welded multipart thermowell, form 2F		TRA/TCA-F13		31
Temperature assembly without thermowell		TRA/TCA-P14		32
Temperature assembly for compression fitting Welded multipart thermowell with reduced tip		TRA/TCA-P20		33
Temperature assembly for screw-in Welded multipart thermowell with reduced tip		TRA/TCA-S21		34
Temperature assembly for screw-in Welded multipart thermowell with reduced tip		TRA/TCA-S22		35
Temperature assembly with process flange Welded multipart thermowell with reduced tip		TRA/TCA-F23		36
Complete ordering code				37

CONTENTS


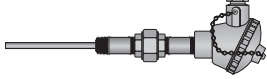

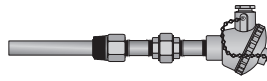

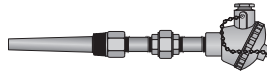

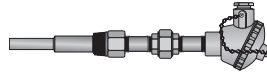
3 Temperature assemblies for advanced requirements (VTS2)

For temperature measurement in gases and liquids in pipes and tanks at high pressure and flow.
Designed in accordance to DIN standard.

Temperature assembly for weld-in Barstock thermowell, form 4		TRA/TCA-T30		39
Temperature assembly with process flange Barstock thermowell, form 4F		TRA/TCA-TF31		40
Temperature assembly for screw-in Welded multipart thermowell, form 5		TRA/TCA-TS32		41
Temperature assembly with process flange Welded multipart thermowell		TRA/TCA-TF33		42
Temperature assembly without thermowell		TRA/TCA-S34		43
Temperature assembly for screw-in Welded multipart thermowell, form 8 for union nut		TRA/TCA-TS35		44
Temperature assembly for screw-in Barstock thermowell, form 6 and 7		TRA/TCA-TS36		45
Temperature assembly for screw-in Barstock thermowell, form 9 for union nut		TRA/TCA-TS37		46
Complete ordering code				47

4 Temperature assemblies for advanced requirements (VTS3)

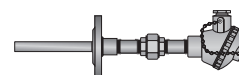
For temperature measurement in gases and liquids in pipes and tanks at high pressure and flow.
Designed in accordance with ASME standards.

Temperature assembly without thermowell		TRA/TCA-S50		49
Temperature assembly for screw-in Straight barstock thermowell		TRA/TCA-TS52		50
Temperature assembly for screw-in Tapered barstock thermowell		TRA/TCA-TS53		51
Temperature assembly for screw-in Reduced barstock thermowell		TRA/TCA-TS54		52

Temperature assembly with process flange
Straight barstock thermowell



TRA/TCA-TF55

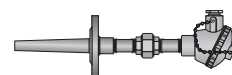


53

Temperature assembly with process flange
Tapered barstock thermowell



TRA/TCA-TF56

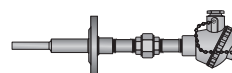


54

Temperature assembly with process flange
Reduced barstock thermowell



TRA/TCA-TF57

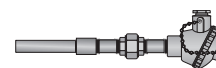


55

Temperature assembly for weld-in
Straight barstock thermowell



TRA/TCA-TW58

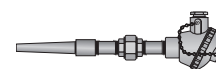


56

Temperature assembly for weld-in
Tapered barstock thermowell



TRA/TCA-TW59



57

Complete ordering code

58

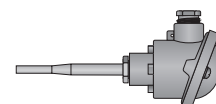
5 Industrial temperature assemblies (VTS4)

For temperature measurement in gases and liquids in pipes and tanks at medium pressure and medium flow.
Tapered tip in accordance with NAMUR.

Temperature assembly for compression fitting
Welded multipart thermowell, form 3



TRA/TCA-P40

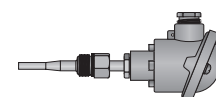


60

Temperature assembly for screw-in
Welded multipart thermowell, form 3G



TRA/TCA-S41

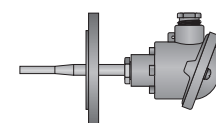


61

Temperature assembly with process flange
Welded multipart thermowell, form 3F



TRA/TCA-F42



62

Complete ordering code

63

6 Measuring inserts (VTS9)

Spring-loaded measuring inserts



TR/TC 100



65

Complete ordering code

66

CONTENTS

7 High temperature assemblies (VTC1)

For measurement of high temperatures.

High temperature assembly for plug-in
Metal, welded multipart thermowell, $t \leq 1150\text{ }^{\circ}\text{C}$

TCA-P60



67

High temperature assembly for plug-in
Metal, welded multipart thermowell with barstock tip,
 $t \leq 1150\text{ }^{\circ}\text{C}$

TCA-P61



68

High temperature assembly for plug-in
Metal, welded multipart thermowell, $t \leq 1150\text{ }^{\circ}\text{C}$

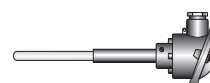
TCA-P62



69

High temperature assembly for plug-in
Ceramic thermowell, $t \leq 1600\text{ }^{\circ}\text{C}$

TCA-P63



70

High temperature assembly for plug-in
Ceramic thermowell, $t \leq 1600\text{ }^{\circ}\text{C}$

TCA-P64



71

High temperature assembly for plug-in
Double ceramic thermowell, $t \leq 1600\text{ }^{\circ}\text{C}$

TCA-P65



72

Complete ordering code

73

8 Mineral insulated thermocouples (VTC2)

Mineral insulated thermocouple with flying wires

TCA-M10



75

Mineral insulated thermocouple with insulated flying wires

TCA-M20



76

Mineral insulated thermocouple for compression fitting
Connection head type MA

TCA-M30



77

Mineral insulated thermocouple for compression fitting
Connection head type BA

TCA-M40



78

Mineral insulated thermocouple
with mini thermo plug

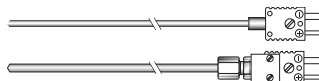
TCA-M50



79

Mineral insulated thermocouple
with standard thermo plug

TCA-M60



80

Mineral insulated cable thermocouple

TCA-M70

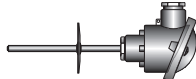
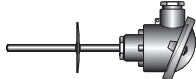
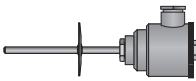


81

Complete ordering code

82

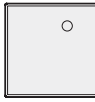
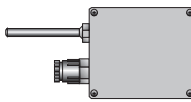
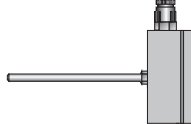
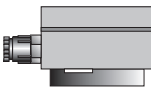
9 Hygienic temperature assemblies (VTH1)

Hygienic temperature assembly	TRA-H10		84
Hygienic temperature assembly with replaceable insert	TRA-H20		85
Hygienic temperature assembly for on-site calibration	TRA-H30		86
Complete ordering code			87

10 Compact sensors




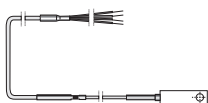





Hygienic compact sensor with flange	TRA-C10		89
Compact sensor for screw-in	TRA-C20		90
Compact sensor for screw-in	TRA-C30		91

11 HVAC temperature sensor (VTE1)

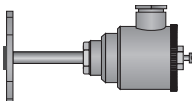
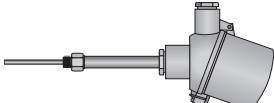
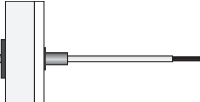
HVAC temperature sensor for indoor applications	TRA-V10		92
HVAC temperature sensor for outdoor applications	TRA-V20		93
HVAC temperature sensor for air ducts/pipes applications	TRA-V30		94
HVAC temperature sensor for clamp-on applications	TRA-V40		95
Complete ordering code			96

CONTENTS

12 Cable sensors (VTE2)

Cable sensor for plug-in	TRA-W10		98
Cable sensor for screw-on Surface temperature $t \leq 150\text{ }^{\circ}\text{C}$	TRA-W20		99
Cable sensor for clamp-on Surface temperature $t \leq 200\text{ }^{\circ}\text{C}$	TRA-W30		100
Cable sensor for screw-on Surface temperature $t \leq 300\text{ }^{\circ}\text{C}$	TRA-W40		101
Cable sensor for screw-in M6 or M8 bolt	TRA-W50		102
Oil-tight cable sensor for plug-in	TRA-W60		103
Cable sensor with bayonet fitting	TRA-W70		104
Cable sensor for harsh environments	TRA-W80		105
High temperature cable sensor	TRA-W90		106
Complete ordering code			107

13 Temperature assemblies for advanced requirements (VTE3)

Temperature assembly for surface measuring Spring-loaded tip	TRA-G10		109
Temperature assembly for surface measuring Spring-loaded tip	TRA-G20		110
Cable sensor for surface measuring Spring-loaded tip	TRA-G30		111
Complete ordering code			112

14 Temperature transmitters

114

15 Services	116
16 Accessories - VTA	
Connection heads	117
Thermowells	120
Compression fittings	124
Other accessories	126
Extention and compensation cables	128
17 Technical data	
Electrical connections for resistance sensor terminal block	129
Electrical connections for thermocouple sensor terminal block	129
Permissible insulation resistance	129
Electrical connection for resistance cable sensor	130
Electrical connection for thermocouple extension and compensation cables	130
Thermowell material	131
Thermal stress on the connection heads	131
Data for resistance sensors	132
Tolerances for resistance sensors	135
Temperature charts for thermocouples	137
Thermocouple accuracy	141
Load diagrams for standardized thermowells	142
RFQ questionnaire	146
18 Colour codes for cable	147

General information about Resistance Temperature Sensors (RTD's)

The RTD is a temperature sensor containing a resistive temperature sensitive element. The resistance of the element changes with the temperature. For measuring within a range of -200 °C...+850 °C, the platinum sensors are the most common RTD sensors. Sensor elements made of platinum are normally produced for 100 Ohm at 0 °C, described as Pt100. Other types are Pt500 and Pt1000. Besides platinum, nickel and copper are also used. Sensor elements made from nickel are produced for 100 Ohm at 0 °C, described as Ni100.

Sensor elements made of platinum are either wire-wound or thin film, the later is more common in current applications. Platinum sensors used in Europe comply with IEC60751, which describes both resistance/temperature characteristics and allowed tolerances. In some cases the tolerance of Class B is insufficient, therefore other classes like A, AA (1/3 DIN), 1/10 DIN or Premium Grade are delivered instead. A close tolerance is difficult to achieve within the entire measuring range for the sensor element, -200 °C...+850 °C. Therefore the tolerance is specified for a specific temperature point or a range. For more information see "Tolerances for resistance sensors".

Resistance/temperature characteristics for Pt100 and Ni100

The resistance/temperature curve for Pt100, according to temperature scale ITS-90, is defined in a standard equation according to IEC 60751 (the Callendar- Van Dusen equation). For more information see section "Data for resistance sensors".

Pt100 range -200 °C to 0 °C

$$R_t = 100 \cdot [1 + 3.9083 \cdot 10^{-3}t - 5.775 \cdot 10^{-7}t^2 - 4.183 \cdot 10^{-12}(t - 100)t^3]$$

Pt100 range 0 °C to +850 °C

$$R_t = 100 \cdot [1 + 3.9083 \cdot 10^{-3}t - 5.775 \cdot 10^{-7}t^2]$$

Four classes of tolerance exist according to IEC 60751

Class AA: $\pm [0.1 \text{ °C} + 0.0017 |t|]$ -50 °C...+250 °C

Class A: $\pm [0.15 \text{ °C} + 0.002 |t|]$ -100 °C...+450 °C

Class B: $\pm [0.3 \text{ °C} + 0.005 |t|]$ -196 °C...+600 °C

Class C: $\pm [0.6 \text{ °C} + 0.01 |t|]$ -196 °C...+600 °C

where $|t|$ = absolute value for the actual temperature.

The resistance/temperature curve for Ni100 is defined in equation C. See section "Data for resistance sensors" for more information.

Ni100 range -60 °C to +250 °C

Equation C :

$$R_t = 100 + 0.5485 t + 0.665 \cdot 10^{-3} t^2 + 2.805 \cdot 10^{-9} t^4 - 2 \cdot 10^{-15} t^6$$

Two classes of tolerance exist

Range 0 °C to +250 °C: $\pm [0.4 \text{ °C} + 0.007 |t|]$

Range -60 °C to 0 °C: $\pm [0.4 \text{ °C} + 0.028 |t|]$

Where $|t|$ = absolute value for the actual temperature.

Measuring uncertainty and measuring deviation

Measuring errors always occur in temperature measurement. In order to minimize these errors it is important to know what factors are important:

1. Response time *
2. Insertion length
3. Deviation from prescribed mounting
4. Self heating
5. Vibration and other mechanical stresses *
6. Ambient temperature/Thermal dissipation *
7. Deviations from the basic values for the sensor element
8. Chemical reactions *
9. Radioactive radiation
10. Inner isolation resistance of the sensor
11. Induced thermo voltage
12. Electrical and magnetic interference fields
13. Thermal stress *
14. Friction from the media flow
15. Heat radiation

* see more detailed information below:

As shown above, many different factors affect correct temperature measurement. This makes it particularly important to carefully analyze the conditions that apply for each individual measurement. Specialists from ... have extensive experience and are able to give practical advice concerning both basic and complicated measurements.

Error influence by mechanical stress

Pressure, vibrations and bending are the most common types of mechanical stress a sensor is exposed to. Sensor elements exposed to pressure or bending changes its resistance value more or less depending on the construction.

The more rigid the connection between the wires and the base of the sensor element, the worse are the changes. When designing a temperature sensor it is important that the mechanical stress is not transmitted to the sensor element. Another common type of mechanical stress is vibration, which can cause disruption to the internal conductors. For vibration resistant RTDs, it is important that the conductors have as little freedom of movement as possible. The opposite applies to sensors which are exposed to pressure and bending. The conductors should then have as much freedom of movement as possible.

Errors due to chemical reactions

Corrosion resistance in the protection well for a RTD is the most decisive factor when exposed to chemical influences. It is very important that the protection well is constructed in a material that is suitable for both the process medium and the highest attainable medium temperature. The sensor designer must also insure that the insert is sealed to prevent moisture penetration. At high temperatures there is the risk that severe lack of oxygen at the sensor element creates a reaction process in the ceramic base of the sensor element which causes metal to diffuse into the measuring wire. As a result of this, the electrical characteristics may change.

Influence by thermal stresses

Pt100 elements have almost no oxidation tendency. On the contrary, the electrical values can drift depending on both the construction of the sensor element and how close to the temperature limit you are. Changes are often caused by impurities in the metal and in the surrounding isolating material. Thermal stresses can also reduce isolation resistance, which can considerably affect the measuring result.

Thermal response times

The response time is the time the sensor needs to change the output value when it has been affected by an instantaneous temperature change. In this catalog the response time is specified as T0.5 and T0.9. This is the time it takes for sensor to reach 50% and 90% of the final value.

In a temperature sensor, different materials have different response times. These depend on coefficients of thermal conductivity, air gaps, isolation materials etc. Since it is very difficult to compile mathematical formulas to calculate response times, especially since there are several theories, the best way to proceed is by making practical measurements. Most common are measurements in air and water. In this catalog, response times are specified for most of the sensors where it is valid. When measuring response time in air, the starting point for the temperature should be between 15 °C and 30 °C with a maximum temperature change of 20 °C. The immersion should be at least the length of the temperature sensitive sensor element + 15x diameter of the sensor. It is important that air can circulate around the sensor. According to the standards the air speed should be 1 m/s.

When measuring response time in water the starting point for the temperature should be between 15 °C and 25 °C with a maximum temperature change of 10 °C. The immersion should be at least the length of the temperature sensitive sensor element + 5x diameter of the sensor. According to standards the speed of the water should be 0.4 m/s. To measure response times correctly, special measuring equipment should be used, which guarantee temperature stability and the speed of air and water.

Errors caused by thermal dissipation

Temperature measurement with contact sensors assumes that the sensor is in direct contact with the medium. This can be achieved by dipping the sensor into the medium or by placing the sensor on the surface of an object. In both cases the existing heat flow is influenced because the sensor conducts energy from the medium to the surroundings.

The error is especially large when measuring surface temperature, due to the dissipation of heat. Around the measuring point the surface radiation changes, and consequently the temperature profile also changes. The measurement accuracy will increase if the sensor has:

- small mass and volume
- good heat contact
- low thermal conductivity to the surroundings

Temperature transmitters for RTD sensors

Temperature transmitters are used for transmitting a sensor's resistance value into a standard process signal. RTDs are connected to the transmitters using three different connection types: 2, 3 and 4-wire connection. In all three connection types the transmitter sends out a constant measuring current, which generates a voltage drop over the sensor element that is measured. It is important that the current stays low to minimize self heating. A transmitter should use a measuring current below 1 mA. Transmitters are designed as 2 and 4-wire transmitters (not the same as 2- and 4-wire connection). In the 4-wire transmitter the power is supplied through two conductors, which are separate from the two output conductors. In the 2-wire transmitter the power is supplied through the two output conductors, which thus fulfil a dual function. An output from a 2-wire transmitter is unable to reach 0 mA due to internal consumption. The lowest value is 4 mA. The standardized output range is 4-20 mA. The output from a 4-wire transmitter is, however, able to reach arbitrary output values.

Sensor break

Temperature sensors that are exposed to stresses are at greater risk of an electrical break inside the sensor. The break could occur in the conductors or the sensor element could be damaged. All of these failures are known as sensor breaks. The most common reason for a sensor break is vibration in or around the critical frequency. When a sensor break is detected, a modern transmitter issues an output signal with a preset value, often over 20 mA. Consistent sensor break protection means that the transmitter forces the signal to a preset value irrespective of which conductors the break occurs in (important to know for 3 or 4-wire connection). Programmable transmitters are designed to let the user set the output value for sensor breaks.

NOTE! If the isolation resistance of the sensor falls below a certain level, the transmitter could detect the low isolation resistance as a measured value instead of the resistance for the sensor element. The transmitter will then react as if the measuring chain is intact, even if a sensor break has occurred. Most transmitters have a "Low Isolation Detection" function, which continuously monitors the isolation level of the sensor and indicates when it is too low.

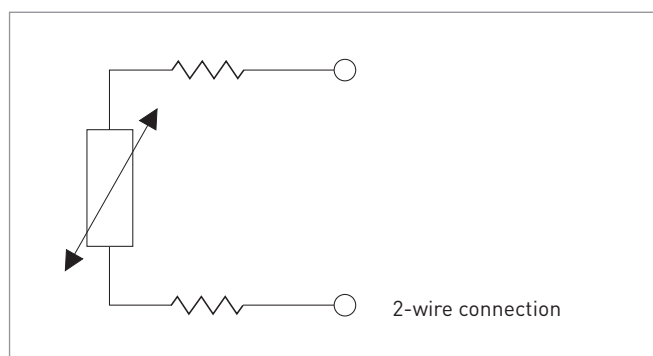
Linearization

Temperature linearization means that the output signal of the transmitter always changes by an equal amount for a specific input temperature change, irrespective of where in the range the change takes place. The relationship between the temperature and the output signal becomes a straight line. A resistance linear transmitter is, on the contrary, not linear in terms of temperature. The output will give different temperature changes depending on where in the range the measurement takes place. In a digital transmitter it is easy to change between resistance linear and temperature linear output.

2-wire sensor connection

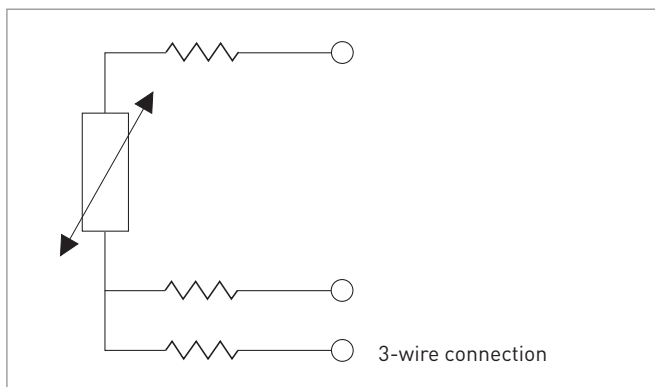
In a 2-wire connection the resistance of the wires is connected in series with the sensor element.

This resistance and changes in the resistance of the wires will affect the measurement. Because of the accuracy problem, the 2-wire connection is seldom used. The 2-wire connection should be used with care. As a rule of thumb, the error due to the lead resistance is approximately 2.6 °C (4.7 °F) per ohm for a Pt100 sensor and 10 times less for a Pt1000 sensor. If the lead resistance is known, the transmitter can be manually adjusted to compensate for the lead resistance. Since this is a fixed compensation, changes in the lead resistance, due to temperature variations, will not be taken care of.



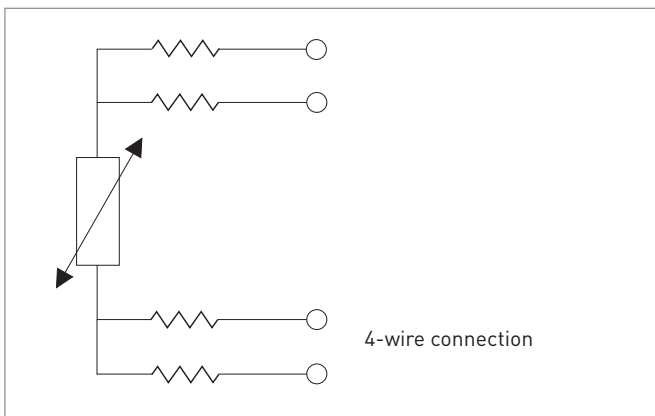
3-wire sensor connection

3-wire is the most common connection. It requires that the resistances in the 3 wires are equal. The 3-wire connection will eliminate the effect of the wire resistances and any changes in the resistances as long as these changes are equal in the three wires. 3-wire connection is the most common connection for industrial use, especially for head mounted transmitters.



4-wire sensor connection

4-wire connection is used for very accurate measurements. The measuring current is sent through two wires and the voltage drop over the sensor element is measured via the two remaining wires. The effect of the wire resistances and any changes in the resistances are completely eliminated with a 4-wire connection. Most modern transmitters are supporting this recommended connection.



Transmitter design

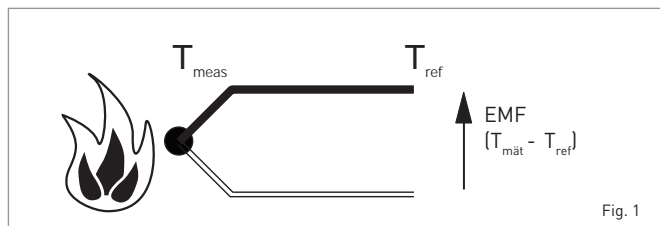
Transmitters used for temperature measurements are designed to fit inside a sensor connection head or to be mounted on an external wall or a DIN rail.

In-head transmitters

These transmitters are always 2-wire, loop-powered transmitters. Being affected by large environmental stresses, they have to resist high ambient temperature, large temperature variations, vibrations, chemical attacks and pollution. Modern transmitters should also be EMC-marked, i.e. be insensitive to disturbance in all respects and not effect the surroundings. The transmitters are often difficult to access and the long term stability is therefore very important when choosing an in-head transmitter.

1. Thermocouple

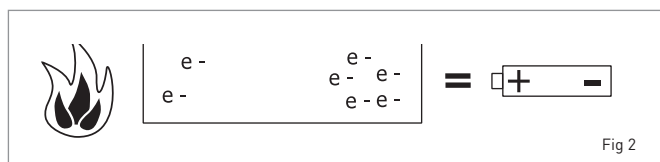
One common way of measuring temperature in industry is to use thermocouple wires of different materials united at one point. That point, the measuring point, is placed where the temperature is to be measured. The thermocouple generates thermoelectric voltage (also known as EMF, electromotive force), which depends on the difference in temperature between the measuring point, T_{meas} , and the so-called cold junction, T_{ref} .



There are different material combinations that are defined, for example, in IEC 60584. The norm defines the relationship between the measuring point temperature, T_{meas} , in °C and the output voltage, EMF, in mV, but does not go into detail regarding the material composition. In the standard it is assumed that the cold junction temperature, T_{ref} , is 0 °C. IEC 60584 describes eight types of thermocouple, of which types J, K and S are the most common. For new installations, type N is recommended for use over type K. Type S is used for higher temperatures. The maximum temperature for use depends on the diameter of the wire, the environment and the expected durability. Thermocouples as per IEC 60584 cover the temperature range from -270 °C to 1820 °C. In addition, thermocouples are also available for even higher temperatures up to 2315 °C, e. g. Wolfram rhenium- Wolfram rhenium thermocouples W5%Re - W26%Re.

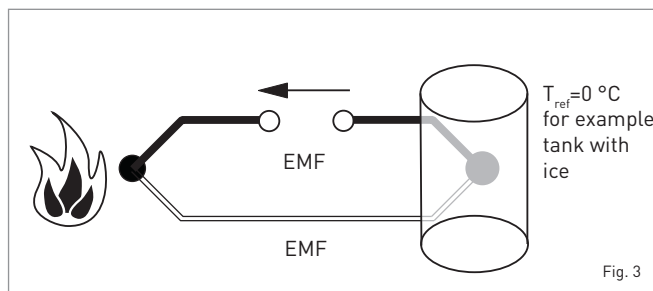
2. Operation mode

Thermocouples are based upon the fact that conductors have lower electron density at the hot end, see Fig. 2. The result is different potentials at the hot end than at the cold end.



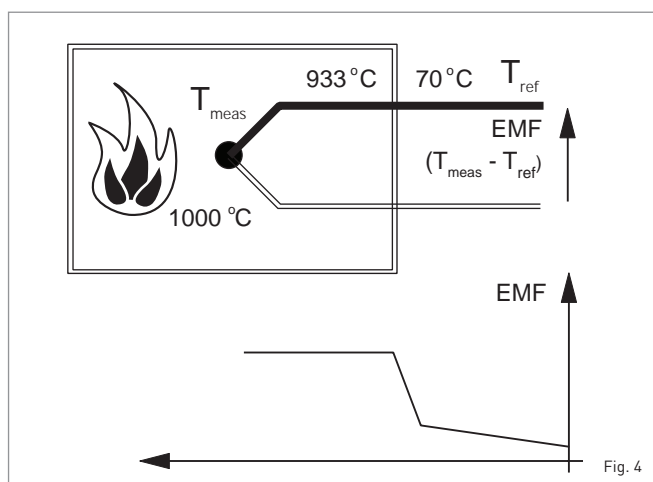
With two equal conductors the same difference of potential is reached along the conductors and there is no thermoelectric voltage between the two cold ends.

Because of that, thermocouples are designed using two different materials, which are combined to get the highest output signal possible and long durability. The two ends are either welded or soldered together. Figure 3 below depicts a thermocouple made out of two different conductors, soldered together at the ends. To be able to connect a measuring device to measure the thermoelectric voltage EMF, one of the conductors has been cut.



Thermocouples measure the difference in temperature. That is why it is necessary to know the cold junction temperature to determine the temperature at the hot end. This happens in Fig. 3, where the cold junction (cold end) is exposed to a known temperature, here 0 °C. The measured EMF is then a measure of the temperature in the hot junction, i. e. at the measuring point. The temperature for the specific EMF can be found in a base value chart for the thermocouple in question.

Another method is to measure the temperature of the connection terminals of the reader - T_{ref} of the cold junction temperature - to which the thermocouple is connected. This enables the cold junction compensation necessary when the cold junction temperature deviates from 0 °C. The missing mV-value that corresponds to the cold junction temperature is added to the measured value in the device (EMF for T_{ref} in accordance with the corresponding type of thermocouple). With this method of cold junction compensation (CJC), the right part of the thermocouple in Fig. 3 can be removed and we get the simple arrangement shown in Fig. 4.



Since the output signal of the thermocouple depends on the temperature difference between the measuring point and the cold junction, it consists of contributions from all parts of the conductor exposed to a temperature gradient. That means that a thermocouple measuring the temperature in an oven is getting the greatest part of the signal from the part of the thermocouple positioned through the wall of the oven, the place with the largest temperature gradient (e. g. 933 °C to 70 °C).

A thermocouple must always be guided right to the connection terminals of the measuring device. In other words it may only be extended using suitable thermocouple or compensation cables. Otherwise its output signal is distorted. For reasons of cost, the thermocouple is usually lengthened using the cost-effective compensation cable. In a limited temperature range, the compensation cable has the same thermoelectric properties as the corresponding thermocouple. The difference in temperature along this cable creates thermoelectric voltage that is then added to the voltage generated by the thermocouple.

Compensation cables may only be used up to an ambient temperature of 200 °C. Beyond that their accuracy drops dramatically. For higher ambient temperatures the only option is to use a thermoelectric cable with temperature-resistant isolation.

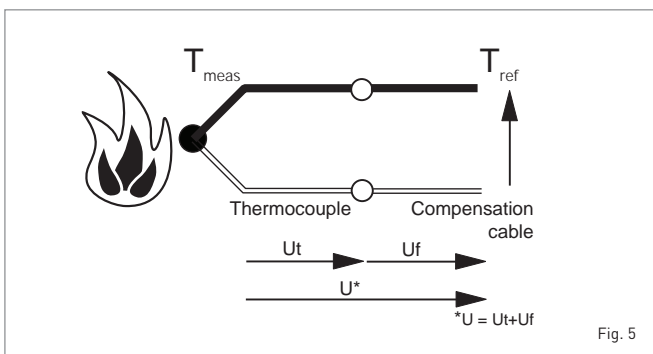


Fig. 5

3. Choice of thermocouple

Metals used for thermocouples need to be stable and may not change over time. Materials must be manufactured with good repeatability and able to withstand high temperatures. Special metal alloys and precious metals are often used. The NiCr-Ni type K thermocouple is very popular. It is relatively inexpensive, generates a high thermoelectric voltage and resists high temperatures (about 1200 °C). Unfortunately there are also disadvantages to type K. In the event of quick temperature changes there can be a change in the output signal due to hysteresis. At high temperatures and low oxygen content in the surrounding atmosphere, the chrome oxidises in the thermocouple but not the nickel. This decreases the thermoelectric voltage. So-called "green rot" is produced which later destroys the thermocouple.

For new installations, the type K thermocouple is often replaced by type N because type N has better properties in these aspects. The two types cover almost the same temperature ranges. They are available in the same dimensions and have a similar relationship between temperature and thermoelectric voltage. With most measuring devices it is easy to change between type K and type N. Type N is a little more expensive than type K. In many cases it is the changing of compensation cable that is the most expensive part when changing in an existing plant.

For more information on the different types of thermocouple in our product range see the section entitled "Temperature charts for thermocouples".

4. Thermocouple sensors

To measure the temperature reliably and efficiently, a thermocouple must be in direct contact with the product to be measured as well as fulfil other requirements:

- The thermocouple should be durable over a long period.
- The sensor must not affect the process or its temperature.
- The measurement should meet all accuracy requirements.
- The sensor should be easy to mount and to maintain.

It is difficult to meet these requirements all at the same time so it falls to the technician to make a good compromise.

In industrial use the thermocouples are protected by thermowells, which transfer the temperature from the process to the thermocouple while keeping harmful environmental influences out. The most common materials used for thermowells are metals and ceramics but other materials can be used when required by the measurement. The protection can consist of several layers. A replaceable measuring insert with a 6mm diameter is often used as an inner part. An outer thermowell consists, for example, of stainless steel. The thermowell is designed to resist the stresses that the temperature sensor is exposed to, such as temperature, pressure and corrosion.

A special variant is the mineral insulated sheath thermocouple (MI) that consists of thermocouple wires hermetically sealed in a thin-walled, heat-resistant stainless steel sheath. The wires are embedded firmly in metal oxide powder, often magnesium oxide, and they are insulated from one another as well as against the sheath. During the manufacturing process the magnesium oxide powder is compressed. For this reason, the sheath can be bent without the wires coming in contact with each other or with the sheath.

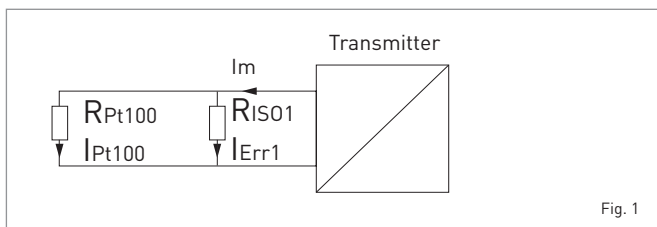
How to get an early warning for isolation errors

This section describes how isolation influences the measurements with RTDs and thermocouples – irrespective of the manufacturer – and how to get an early warning for measurement errors due to low isolation.

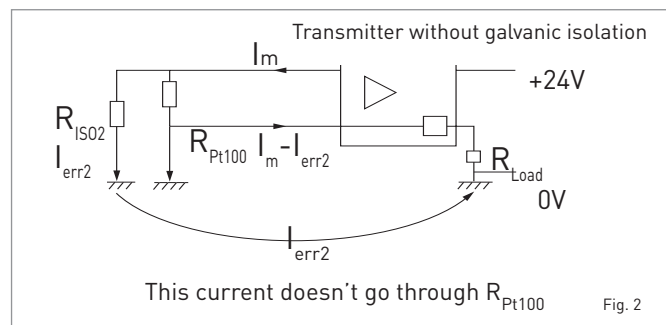
The structure of Pt100 and thermocouple sensors has characteristics that in itself can lead to inaccurate measurements. This applies regardless of brand and type. One of these often neglected sources of error is the isolation in the sensor, which, if too low, can significantly degrade the measuring result. The isolation can be impaired by heat, contamination, vibration, physical or chemical influences or radioactive influences. This section explain the importance of monitoring the isolation resistance and how that can be done.

Pt100

The Pt100 element is a low-resistance sensor. A low isolation resistance will influence the measurement. Figure 1 shows the electrical diagram for a Pt100 sensor in 2-wire connection with a temperature transmitter. The isolation resistance between the sensor leads is symbolized by R_{IS01} . See Figure 1.

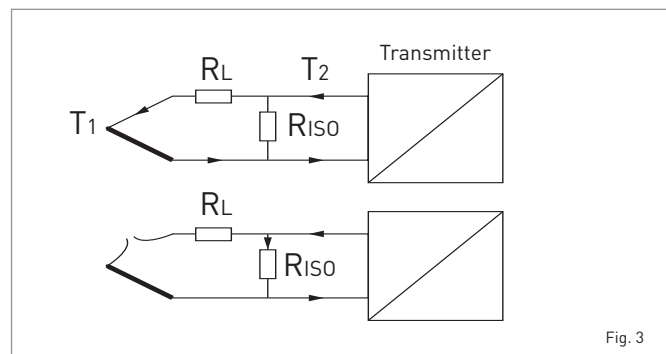


The measuring current I_m goes through the Pt100 element, but a negligible fraction I_{Err1} normally passes through the high isolation resistance R_{IS01} . When the isolation is lowered, a greater fraction of the current will pass through the isolation resistance. As a result of this, the measured voltage over the combined resistance of Pt100 and isolation resistance will be lower than if the isolation resistance was sufficiently high. This means that the indicated too low- temperature value will be lower than the actual temperature. This applies whether the connected transmitter is isolated or not. If the transmitter is without galvanic isolation between the input and output, a low isolation resistance between the sensor and ground R_{IS02} can carry a significant part I_{Err2} of the measuring current. This so called “ground current” will result in a temperature indication that is too low. With an isolated transmitter, this will not happen, because the isolation will cut off the loop, where the ground current flows. See Figure 2.



Thermocouples

Low isolation in thermocouple sensors will give other errors. The EMF from a thermocouple is not particularly sensitive for low isolation. The problem is rather that a low isolation will give a new measuring point in the vicinity of the low isolation. If this location is near the real measuring point, the error will be negligible. Figure 3 shows a thermocouple connected to a temperature transmitter. If the low isolation R_{IS0} is at a location where temperature T_2 differs from the temperature at measuring point T_1 , there is the possibility of a significant error. The measured temperature will correspond to an intermediate value of T_1 and T_2 . Low isolation in thermocouple sensors can also cause the sensor break detection to fail, because the monitoring current can still pass through R_{IS0} . See Figure 3.

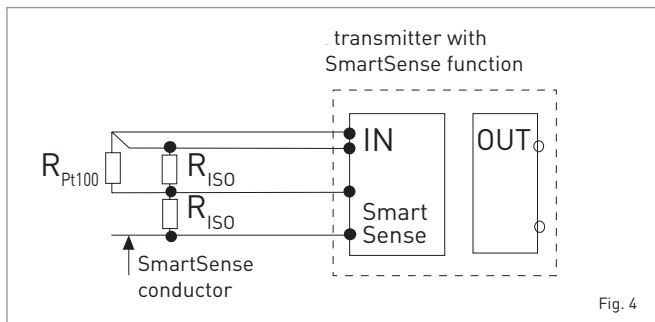


Isolation monitoring with SmartSense

Most of transmitters are microprocessor-based and offer several measurements and controls beyond the standard measurements. One of these controls is to monitor the isolation resistance of the sensor and the sensor leads. This function, known as SmartSense, is available for Pt100 and thermocouple sensors. To accomplish the monitoring, the sensor must be equipped with an extra conductor. When the isolation resistance is too low the output signal will go to a pre-programmed value.

Pt100

For a Pt100 the detection limit for “low isolation” is adjustable between 50 kΩ and 500 kΩ. The error due to the isolation value R_{ISO} has to be added to other measurement errors. At 400 °C/752 °F the added error is 0.4 °C/0.7 °F for 500 kΩ and 3.1 °C/5.6 °F for 50 kΩ isolation. See Fig. 4.

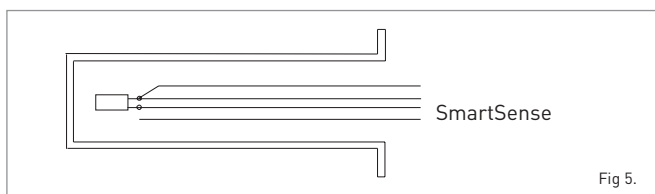


Thermocouples

For thermocouples the detection limit for “low isolation” can be adjusted between 20 kΩ and 200 kΩ. The added error depends on the relation between the lead resistance R_L and the isolation resistance R_{ISO} (see fig. 3). The error is also dependent on the temperature difference between the measuring point and the location of the low isolation. Under the following circumstances: measuring temperature 1000 °C/1832 °F, ambient temperature 25 °C/77 °F and wire resistance 50Ω, there will be an error of 1% if the isolation resistance in the ambient temperature area is 5 kΩ. This equals 10 °C for type K.

Sensor solution

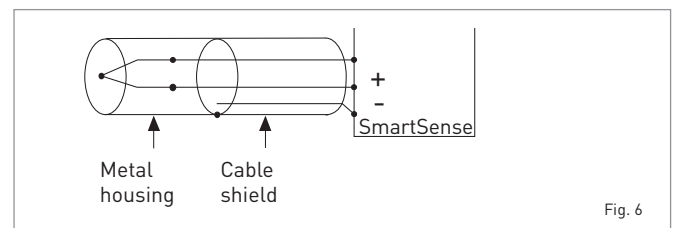
The SmartSense function in the transmitters is applicable for a Pt100 with a 3-wire connection, and thermocouples. For correct usage of the SmartSense, the sensor must have an extra conductor. This conductor will have a separate terminal and go through the sensor all the way to the sensor element. See Figure 5. Mineral isolated Pt100 sensors and thermocouples uses an unconnected conductor.



Note! Due to the normally low isolation in mineral isolated thermocouples at high temperatures, it is not worthwhile monitoring the high temperature end above 500-600 °C / 900-1100 °F depending on the application.

Instead, it is important to monitor connections and cables from the sensor to the transmitter.

It is not recommended to use the sheath of the sensor or a cable shield as the monitoring conductor. One task of the sheath is to eliminate interference from the measurements. Connecting the sheath to the SmartSense terminal can lead to erroneous measurements. This also applies to the shield of cable sensors. See Figure 6.



Conclusion

Full control over sensor and connection

If the isolation resistance is too low in temperature sensors, it can produce erroneous measurements irrespective of the brand and type. SmartSense offers the possibility of monitoring a Pt100 (3-wire connected) or thermocouple sensor with a low isolation resistance. SmartSense not only monitors the sensor but also the conductors from the sensor terminals to the transmitter terminals. This gives full control over the condition of the measuring chain from the measuring point to the transmitter.

Reasons for low isolation:

- Contamination
- Physical influence (wear, jamming)
- Chemical influence (corrosion)
- Vibration
- Radioactive radiation
- Humidity

Examples of errors:

Pt100 at 400 °C, Isolation R_{ISO}	
500k	0,4 °C
100kΩ	1,6 °C
50kΩ	3,1 °C
10kΩ	15,0 °C

Thermocouple type K at 1000 °C

$R_L = 50 \Omega$, $T_{OMG} = 25 \text{ °C}$	
50kΩ	1 °C
20kΩ	3 °C
5kΩ	10 °C

Stainless steel of type 1.4404/316L or 1.4571/316Ti is standard. For applications with special requirements has experience in supplying thermowells in different materials. Some of them are presented below.

Normal temperatures, corrosive environment

Corrosion depends on many factors. Medium, temperature, flow, mechanical influence, and many other factors have to be put together to make the right decision.

- 1.4404/316 Stainless steel has best corrosion resistance of the austenitic stainless steel grades and works up to 900°C. Good corrosion resistance in Hydrogen Sulphide.
- Thermowell made of PTFE (for example Teflon®). The sensor will withstand an aggressive environment, like sulphuric acid. Gives a long response time, because of poor heat conduction. It has a limited temperature range.
- PTFE-coated thermowell in stainless steel. Quicker response than thermowell of solid PTFE. Demands care when installed and maintained, because the PTFE layer could get scratched.
- Tantalum, very expensive, but combines corrosion resistance with good thermal conductivity. Good mechanical strength compared to PTFE-coated thermowell. Normally not used above 250°C.
- Hastelloy and titanium, responds more quickly than thermowells made of solid PTFE, but poorer corrosion resistance. The titanium works up to 400-500°C and the Hastelloy version more than twice that level. Not as expensive as tantalum.
- Enamelled steel, St35.8, max 600 °C.

High temperature, metallic thermowells

- 2.4816/Inconel 600, max 1150 °C in oxidizing environment. Max 850 °C if sulphur exists. Works well in chlorine content environment and in nitric acid HNO₃.
- Chrome steel 1.4749 /446 SS. Ferrite stainless chrome steel for high temperatures. Contains no nickel, which gives good corrosion resistance in sulphated gases and salts. Good resistance against oxidation in air. For temperatures up to 1100°C.

- Chrome steel 1.4762. Maximum temperature in air 1150 °C. Limited durability in a nitrogen atmosphere with low level of oxygen. An alternative for such situations could be 1.4841 /314 SS, max 1200 °C.
- High temperature 1.4835/253MA austenite steel has high resistance against oxidation in air and high shape retention in high temperatures. Due to its high nickel content, the material works well for oxidizing environment, but not in a reducing environment or one that contains elementary sulphur. Good characteristics in environments where the medium exposes the sensor material to great mechanical abrasion.
- Thermalloys CMA in melts of aluminium, copper, lead and zinc over 450 °C. Made of a metal tube isolated with ceramic material.
- Kanthal AF, max 1300 °C and Super Kanthal max 1700 °C. Used in ovens for both heaters and sensors. Can be isolated with a thicker oxide to improve the resistance even further in high temperatures. This is done by heating the tube over 1100 °C in an oxidizing atmosphere.
- Kanthal A-1, max 1400 °C
- Kanthal APM, max 1425 °C, greater heat resistance than Kanthal A-1

High temperature, ceramic thermowells

- C799 is a common material containing more than 99.7% aluminium oxide. Is often used in thermocouple sensors with type S, R and B thermocouples, since it contains low levels of the substances that deteriorate the thermocouple properties. Maximum temperature depends on the application but could reach up to 1500-1600 °C.
- C610, is used primarily for thermocouple type K and N. Max temperature is 1500-1600 °C. At high temperatures, C610 has slightly poorer isolation than C799 due to lower content of aluminum oxide and more alkali content. Its strength is about half of C799, and its hardness and thermal conductivity slightly lower. The price is instead significantly lower compared to C799. 610 cannot be used for thermocouple types S, R and B.
- Silicon nitride, excellent for metal melts, especially aluminium. The durability is specified in years instead of weeks.

Note: The process owner are fully responsible for defining thermowell material for their process.

Ordinary industry standard

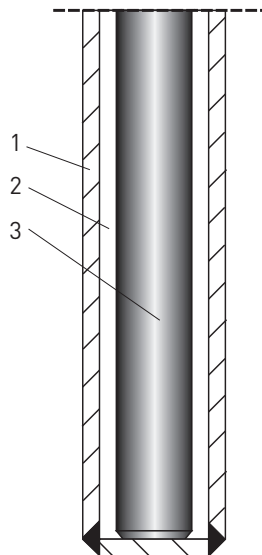


Fig. 1

1. Thermowell 9 x 1 mm, 11 x 2 mm or 12 x 2.5 mm
2. Air gap
3. Measuring insert Ø 6mm

Special design

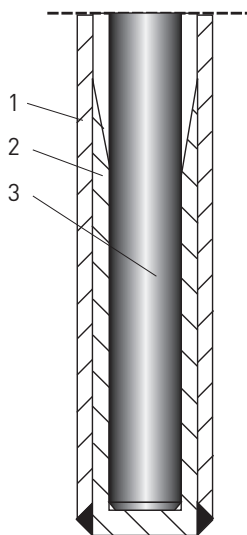


Fig. 2

1. Thermowell 10 x 1 mm or 12 x 1 mm in stainless steel.
2. Bottom sleeve in stainless steel, inner diameter Ø 6.1 mm
3. Measuring insert Ø 6 mm

Based on several international standards, thermowells have dimensions 9x1, 11x2, 12x2.5 mm for 1.4571 / 316Ti and 10x1, 12x2 mm for 1.4404 / 316L mm as standard. The type of application and choice of material controls what dimensions to use. The air gap between the thermowell and the measuring insert is normally 0,1-1 mm. Depending on the physical properties of the gap, the response time can be relatively long.

Reduced response times with special design

a special design with a bottom sleeve between the thermowell and measuring insert (See Fig. 2). This design reduces the response time significantly, especially in liquids where the response time is reduced to half. The bottom sleeve is only suitable for straight thermowells with diameters of 10 and 12 mm in 1.4404 / 316L material.

Reduced error of immersion

Short insert lengths can lead to inaccurate measurements due to heat dissipation in the thermowell. Tests made in the laboratory shows that the sensors with bottom sleeve have reduced error of immersion compared to sensors with air gap. Shown below are typical errors of immersion in circulating water, 70 ° C. The lengths of the sensors were identical in the test.

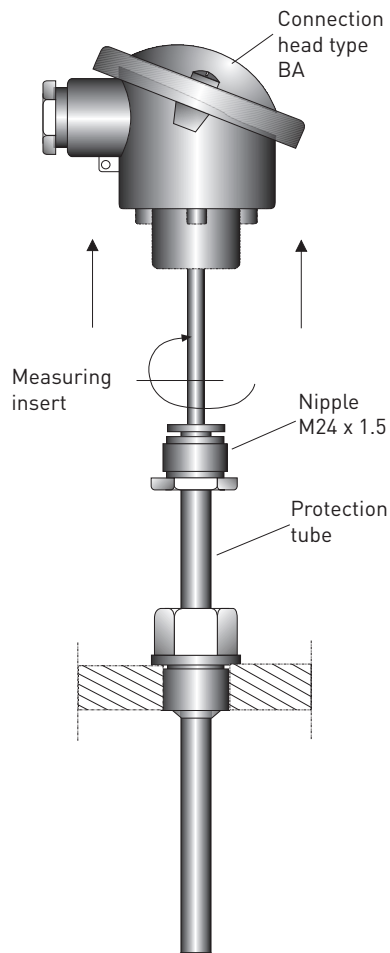
Insert length	design	Other sensor	
25 mm		-1.1 °C	-3.3 °C
50 mm		-0.4 °C	-1.1 °C
75 mm		-0.1 °C	-0.5 °C
100 mm		0.0 °C	-0.2 °C
125 mm		0.0 °C	-0.1 °C
150 mm		0.0 °C	0.0 °C

Full compatibility

sensor design with faster response times and reduced error of immersion is compatible with existing standards on the market. A measuring insert made according to DIN standard from other manufacturers can easily be installed in a thermowell from . measuring inserts are designed to provide the best possible response time. It's recommended that both measuring insert and thermowell are from .

Improved vibration resistance thanks to fixed measuring insert

If strong vibrations exist, the spring load is not strong enough to hold the measuring insert fixed and it will hit against the interior wall of the thermowell, which could cause a break in the sensor conductors. design with bottom sleeve provides a significantly improved resistance to vibration. The measuring insert is fixed and effectively prevented from hitting against the interior walls of the thermowell. The durability of the sensor is improved and the measuring accuracy increases.



The connection head Form B is defined in the industrial standard DIN EN 50446.

More space with connection head type BA

Standard sensors produced by are made with connection head type BA, which is a development of form B. The advantages are:

- More space when mounting/connecting, because the connection head is higher.
- All transmitters that are intended for connection head form B fit the connection head.
- Aluminium powder painted for better protection against corrosion.
- Protection class IP65

Depending on application can offer a variety of connection heads and in material like stainless steel or Polyamid PA.

Flexible handling in field

The connection head is mounted with a compression fitting that moves freely in the extension. The advantages are:

- The connection head can be turned in the desired direction after mounting by loosening the fitting. Just tighten the fitting to secure it.
- The measuring insert and the connection head can be removed during operation without disconnecting external cables.

Accuracy – standard

highly recommends using Class A for RTD sensor and Class 1 for Thermocouple. This ensures excellent performance for you as a customer. Most RTD sensors are calibrated as standard free of charge before delivery and a calibration record is archived and can be issued if requested. The calibration record is traceable to the production batch by the individual number of the sensor. For more information, see "Tolerances for resistance sensors".

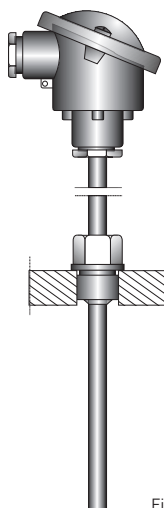


Fig. 3

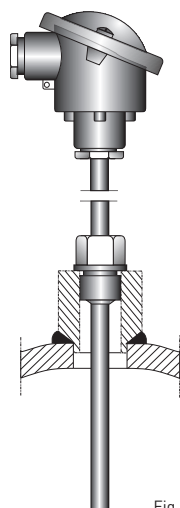


Fig. 4

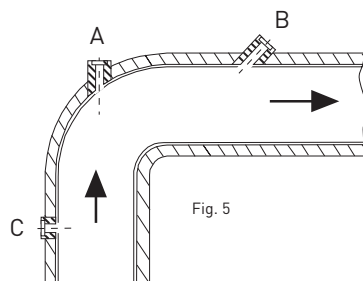


Fig. 5

- A: Mounted in a curve against the flow direction.
 B: Mounted obliquely in weak tube against the flow direction
 C: Mounted perpendicular to the flow direction.

Temperature assembly for screw-in

For screw-in sensors the threads are either screwed directly into the process (see fig. 3) or through a welded fitting (see fig. 4). A welded fitting should be used when the material wall is not thick enough for threads. The temperature sensor should, if possible, be mounted obliquely against the direction of flow, because the temperature sensitive point should be the first part that hits the flowing media (see fig 5). If this is not possible, the sensor could be mounted perpendicularly to the direction of flow. It could also be mounted in a curve. To avoid stress corrosion, the material in the welded fitting and the vessel should be identical.

Temperature assembly for weld-in

In processes where high pressure and flow rates exist, it is necessary, for durability reasons, to use tapered thermowells according to DIN-standard form D1-D6 (choice of type depends on process parameters, more information in this catalog). It is recommended that the tapered thermowell is welded in a welded fitting. The materials of the thermowell, the welded fitting and the process vessel should be of the same type. The cut-out for the welded fitting is described in fig 6.

General installation instructions

Vibration and oscillations

When measuring the temperature in a flowing medium the shape of the flow changes when a temperature sensor is placed in it. This creates a wake. Oscillations may occur in the inserted object and the risk is that the oscillations coincide with the resonant frequency. If this happens, it could quickly result in a break in the thermowell. The resonant frequency can be avoided by adjusting the insertion length or the dimensions of the sensor. No general rules exist, calculations have to be done for each case. Resonant frequency oscillations could also arise if temperature sensors are mounted close to each other in the same tube. can serve with wake frequency calculation according to ASME 19.3 2010.

Measurement errors

Measurement errors are avoided by preventing heat dissipation from the measuring point. The task for the measurement technician is to mount the temperature sensor so that it does not affect the media temperature. Two common methods to achieve this are:

- The process vessel is insulated around the measuring point. Above all non-insulated tubes should be insulated in a proper way. The insulation is satisfactory if no temperature increase can be measured on the outside of the isolation.
- The insertion length of the sensor should be long enough to minimize the error due to thermal dissipation (called error of immersion). For more information see "Structure of temperature assemblies".

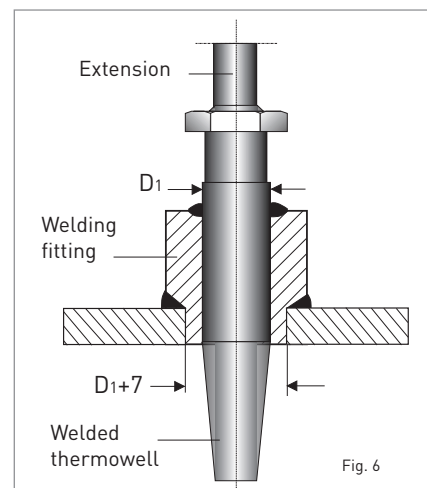


Fig. 6

ATEX

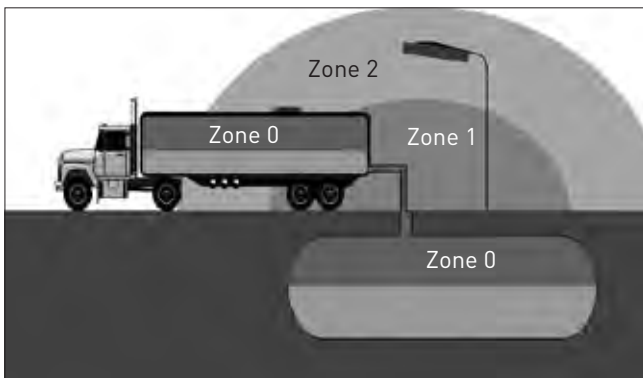
Background ATEX

Explosive atmospheres can be caused by flammable gases, mists, vapors or combustible dust. If there are enough of any of the substances mixed with air, a source of ignition is all it takes to cause an explosion. Explosions can cause loss of life and serious injuries. The two most common methods to prevent an explosion is to prevent the release of hazardous substances that can create an explosive atmosphere and prevent ignition. This sets high demands on the instruments installed or connected in an explosive atmosphere.

The international IECEx certification system regulates equipment and protective systems for potentially explosive atmospheres. In Europe, there are two EU directives for ATEX. Similar systems exist in the rest of the world, such as FM, UL or CSA for North America and NEPSI for China and so on.

Classification of areas

In order to facilitate the definition of explosion protected equipment the risk areas are classified as below.

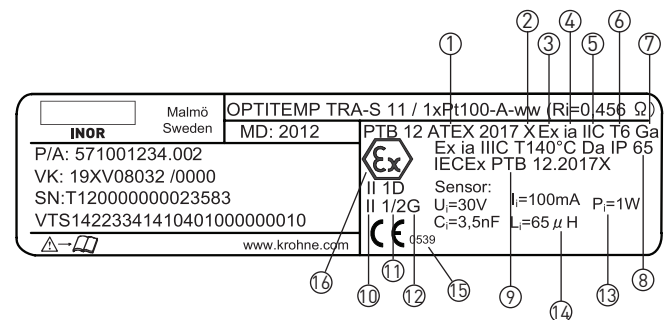


- Zone 0 - Explosive gas mixtures are present continuously or for long periods.
- Zone 1 - Explosive gas mixture is expected to occur during normal handling.
- Zone 2 - Explosive gas mixture is not expected to occur during normal handling. If it should occur, then only rarely and briefly.

Similar definitions exist for areas with combustible dust (Zone 20, 21 and 22)

Instrument markings

To ensure that qualified equipment is installed in hazardous areas, a regulatory framework has been developed to mark these. Below is a sample of a product label with ATEX.



- ① Specifies the agency issuing the certificate and the year it was made for the product, in this case German PTB. Followed by certificate number.
- ② X = Terms and conditions for Safe Use
U = Ex component that requires additional certification
- ③ Ex = Ex-protected equipment
- ④ Specifies the protection concept. Below are the types relevant for temperature assemblies.

Code	Protection	Zone
d	Flameproof enclosure	1, 2
e	Increased Safety	1, 2
ia	Intrinsic Safety	0, 1, 2
ib	Intrinsic Safety	1, 2
ic	Intrinsic Safety	2
n	Non Sparking	2

5

- ☐ Explosive groups

Group	Area	Gas
I	Mines	Methane
IIA	Other areas Gas	Propane
IIB		Ethylene
IIC		Hydrogen, acetylene
IIIA	Other areas dust	Combustible dust
IIIB		Non-conductive dust
IIIC		Conductive dust

- ⑥ Temperature classes – define ignition temperature of flammable gases.

T1	450°C
T2	300°C
T3	200°C
T4	135°C
T5	100°C
T6	85°C

The surface temperature of the equipment must be lower than the corresponding temperature class.

For dust is the maximum surface temperature always specified on the product.

- ☐ 8 G for gas and D for dust. Then a, b or c depending on which zones it applies to (see point 4.)

- ☐ Enclosure protection according to IEC 60529 for example:

- 9 IP 54 – Dust protected - splash proof
IP 65 – Dustproof - protection against water jets
IP 68 – Dust-tight - Watertight

- ⑩ Certificate IECEx Ex with certifying agencies, year and certificate number

- ☐ Equipment group
I = Mining equipment
II = Other

11

- ☐ Category
1 – Zone 0, 1, 2
12 2 – Zone 0, 2
3 – Zone 2

- ⑬ G = Gas
D = Dust

- ☐ ⑭ Maximum power that the equipment may be supplied with where the voltage, current and power are specified.

15

- ☐ The maximum internal capacitance and inductance.

- ☐ ⑮ The certifying agency that has revised the manufacturing process of the instruments, in this case DEMKO.

- ☐ The Ex-symbol

When replacing a measuring insert, the inserts are marked with its length. Tolerances for the insertion length is $+2/-0$ mm and for length more than 800 mm, $+3/-0$ mm. The dimension of a NPT-thread is based on 2/3 of the thread.

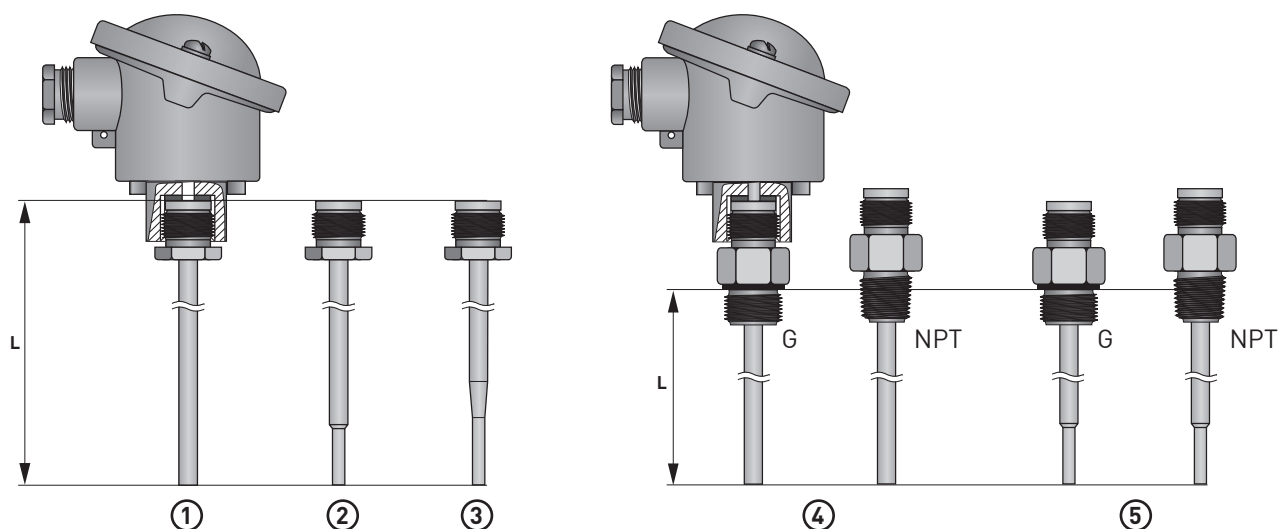
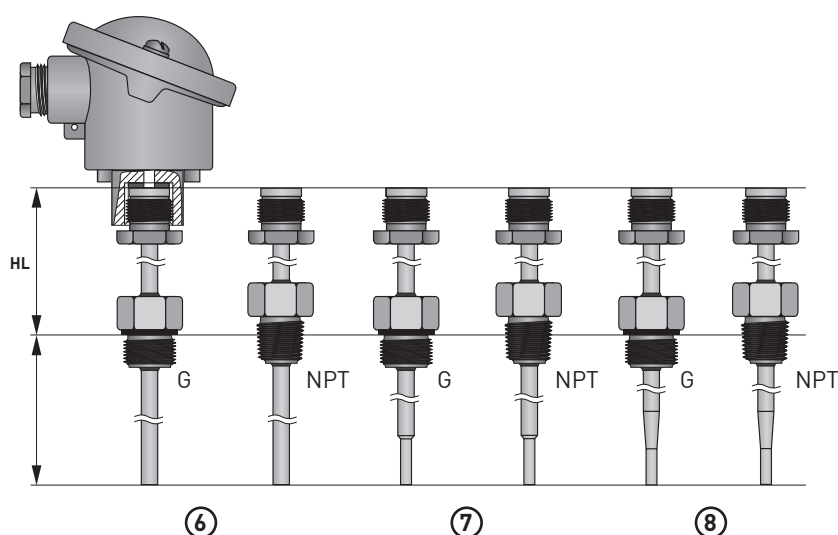


Figure	Length L	Insert length	Product
1	Immersion length	$L + 10$ mm	TRA/TCA-P10
2	Immersion length	$L + 10$ mm	TRA/TCA-P20
3	Immersion length	$L + 10$ mm	TRA/TCA-P40
4	Immersion length	$L + 45$ mm	TRA/TCA-S11
5	Immersion length	$L + 45$ mm	TRA/TCA-S21



G = Gas proof thread
NPT = Tapered thread

Figure	Length HL	Length L	Insert length	Product
6	Neck tube length	Immersion length	$HL + L + 10$ mm	TRA/TCA-S12
7	Neck tube length	Immersion length	$HL + L + 10$ mm	TRA/TCA-S22
8	Neck tube length	Immersion length	$HL + L + 10$ mm	TRA/TCA-S41

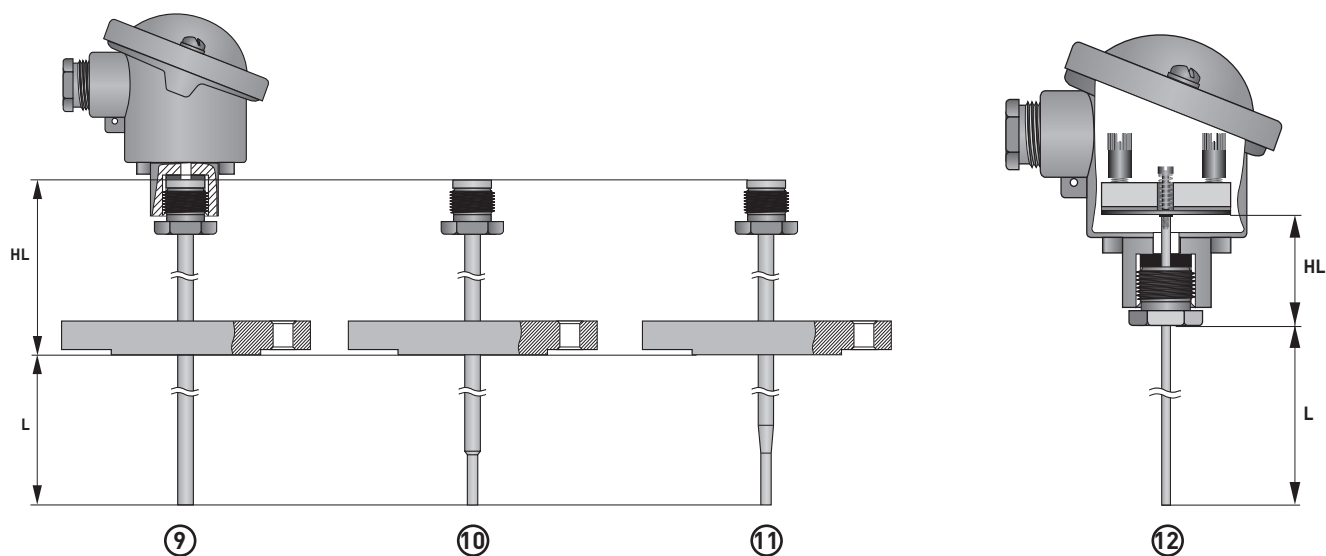


Figure	Length HL	Length L	Insert length	Product
9	Neck tube length	Immersion length	$HL + L + 10 \text{ mm}$	TRA/TCA-F13
10	Neck tube length	Immersion length	$HL + L + 10 \text{ mm}$	TRA/TCA-F23
11	Neck tube length	Immersion length	$HL + L + 10 \text{ mm}$	TRA/TCA-F42
12	35 mm	Immersion length	$L + 35 \text{ mm}$	TRA/TCA-P14

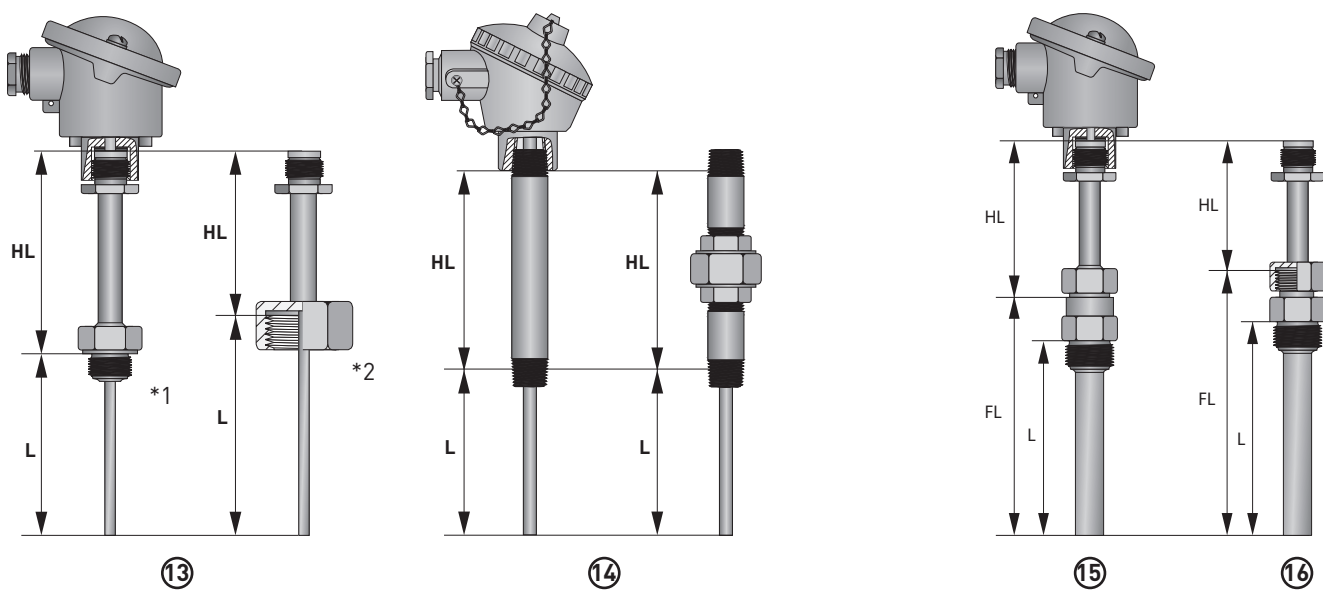


Figure	Length HL	Length L	Length FL	Insert length	Product
13	Neck tube length	Immersion length	n/a	$HL + L + 13 \text{ mm}$	TRA/TCA-S34
14	Neck tube length	Immersion length	n/a	$HL + L + 29 \text{ mm}$	TRA/TCA-S50
15	Neck tube length	Immersion length	$L + 28 \text{ mm}$	$HL + L + 40 \text{ mm}$	TRA/TCA-TS32
	Neck tube length	Immersion length	$L + 28 \text{ mm}$	$HL + L + 40 \text{ mm}$	TRA/TCA-TS36
16	Neck tube length	Immersion length	$L + 28 \text{ mm}$	$HL + L + 39 \text{ mm}$	TRA/TCA-TS35
	Neck tube length	Immersion length	$L + 28 \text{ mm}$	$HL + L + 36 \text{ mm}$	TRA/TCA-TS37

*1) Threading

*2) Union nut

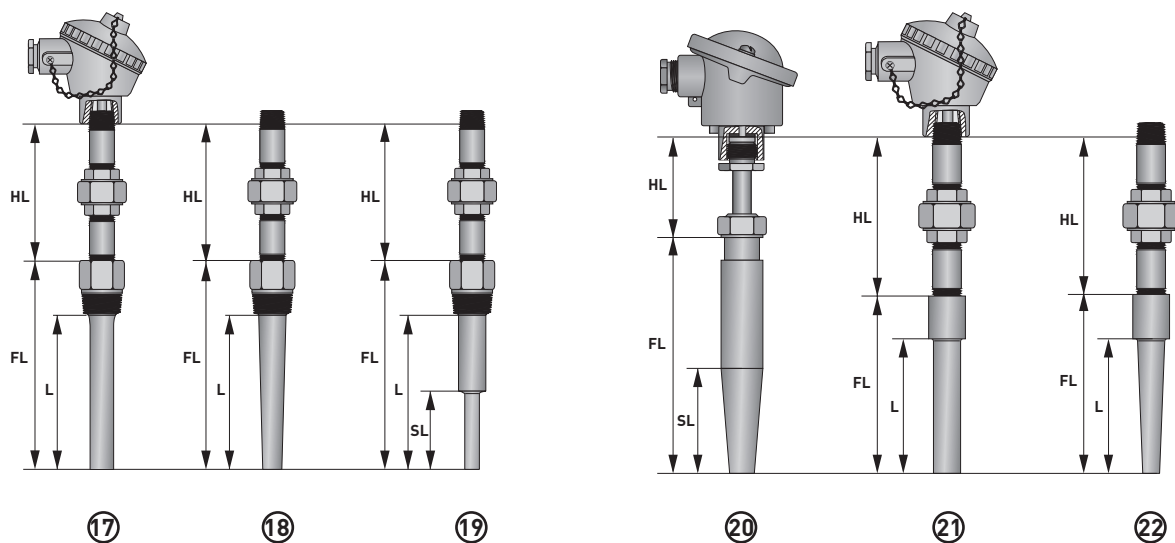


Figure	Length HL	Length L	Length FL	Length SL	Insert length	Product
17	Neck tube length	Immersion length	$L + 45 \text{ mm}$	n/a	$HL + L + 53 \text{ mm}$	TRA/TCA-TS52
18	Neck tube length	Immersion length	$L + 45 \text{ mm}$	n/a	$HL + L + 67 \text{ mm}$	TRA/TCA-TS53
19	Neck tube length	Immersion length	$L + 45 \text{ mm}$	65 mm	$HL + L + 67 \text{ mm}$	TRA/TCA-TS54
20	Neck tube length	Depends on welding point	n/a	65 / 125 mm	$HL + FL + 10 \text{ mm}$	TRA/TCA-T30
21	Neck tube length	Immersion length	$L + 45 \text{ mm}$	n/a	$HL + L + 67 \text{ mm}$	TRA/TCA-TW58
22	Neck tube length	Immersion length	$L + 45 \text{ mm}$	n/a	$HL + L + 67 \text{ mm}$	TRA/TCA-TW59

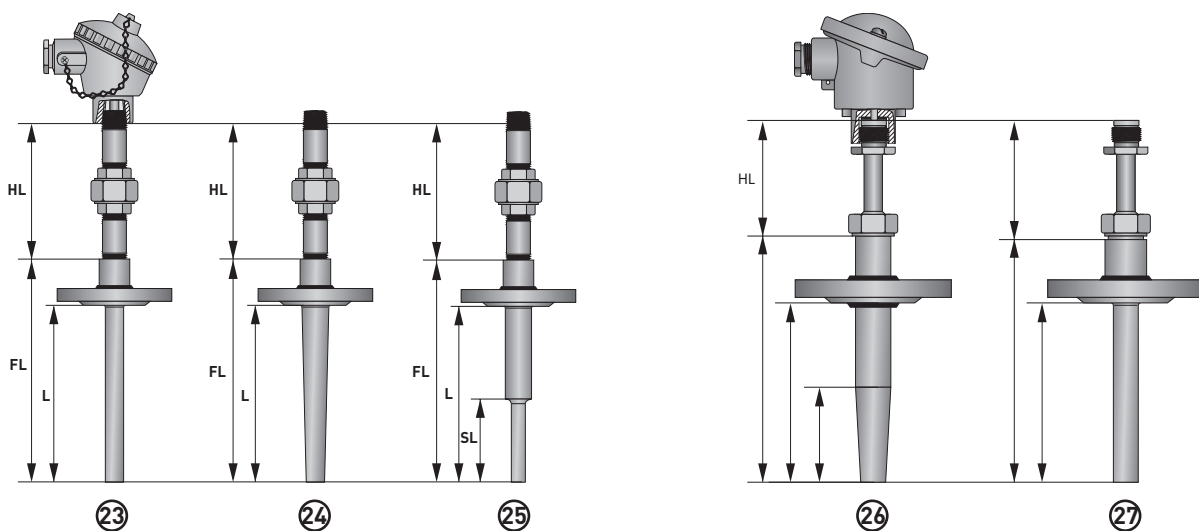


Figure	Length HL	Length L	Length FL	Length SL	Insert length	Product
23	Neck tube length	Immersion length	$L + 57 \text{ mm}$	n/a	$HL + L + 79 \text{ mm}$	TRA/TCA-TF55
24	Neck tube length	Immersion length	$L + 57 \text{ mm}$	n/a	$HL + L + 79 \text{ mm}$	TRA/TCA-TF56
25	Neck tube length	Immersion length	$L + 57 \text{ mm}$	65 mm	$HL + L + 79 \text{ mm}$	TRA/TCA-TF57
26	Neck tube length	Immersion length	$L + 70 \text{ mm}$	65 / 125 mm	$HL + L + 80 \text{ mm}$	TRA/TCA-TF31
27	Neck tube length	Immersion length	$L + 70 \text{ mm}$	n/a	$HL + L + 47 \text{ mm}$	TRA/TCA-TF33

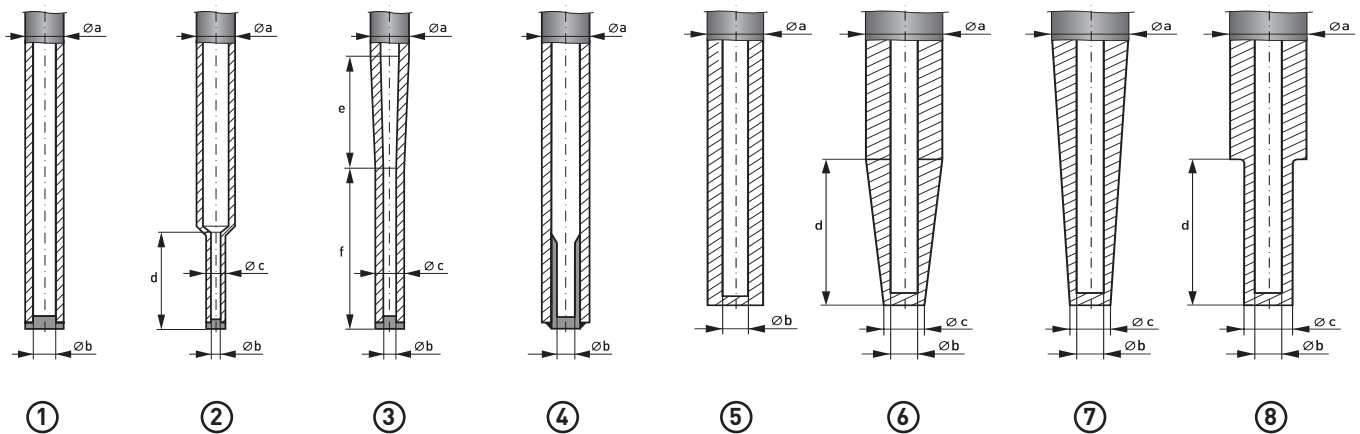


Figure	Diameter a	Diameter b	Diameter c	Length d	Length e	Length f	Product
1	9 / 11 / 12 mm	7 mm	n/a	n/a	n/a	n/a	TRA/TCA -P10, -S11, -S12, -F13 TRA/TCA-TS32,-TF33,-TS35
2	11 / 12 mm	3.1 mm	6 mm	30 mm	n/a	n/a	TRA/TCA -P20, -S21, -S22, -F23
3	12 mm	6.1 mm	9 mm	n/a	35 mm	50 mm	TRA/TCA -P40, -S41, -F42
4	10 / 12 mm	6.1 mm	n/a	n/a	n/a	n/a	TRA/TCA -P10, -S11, -S12, -F13 TRA/TCA -TS32, -TF33, -TS35
5	17 mm	7 mm	n/a	n/a	n/a	n/a	TRA/TCA -TS36, -TS37
	16 mm	6.5 mm	n/a	n/a	n/a	n/a	TRA/TCA -TS52
	19 mm	6.5 mm	n/a	n/a	n/a	n/a	TRA/TCA -TF55
	19 / 23 mm	6.5 mm	6 mm	n/a	n/a	n/a	TRA/TCA -TW58
6	24 mm (h7)	7 mm	12.5	65 / 125 mm	n/a	n/a	TRA/TCA -T30, -TF31
7	16 / 22 mm	6.5 mm	13 / 16 mm	n/a	n/a	n/a	TRA/TCA -TS53
	22 / 25 mm	6.5 mm	16 / 19 mm	n/a	n/a	n/a	TRA/TCA -TF56
	19 / 25 mm	6.5 mm	16 / 19 mm	n/a	n/a	n/a	TRA/TCA -TW59
8	16 / 19 / 22 mm	6.5 mm	13 mm	65 mm	n/a	n/a	TRA/TCA -TS54
	12 / 19 / 23 mm	6.5 mm	9 / 13 mm	65 mm	n/a	n/a	TRA/TCA -TF57

Recommended diameter of the insert is 6 mm except for Figure 2, where the recommended diameter is 3 mm.

Temperature assembly for screw-in Welded multipart thermowell, form 8

Application

For temperature measurement in gases and fluids, in pipes and tanks at medium pressure and medium flow. Mounted either by direct screw-in to the process or via welding sleeve. See section "Accessories".

Temperature assembly

Material in stainless steel, 1.4404 or equivalent approved material, Ø 9, 10, 11 or 12 mm. Depending on material and diameter, a bottom sleeve or a bottom plug are used in the measuring tip. For detailed information, see "Theory" section.

Measuring insert

Replaceable measuring insert in stainless steel D = Ø6 mm.

Insert length = $L + 45$ mm. For detailed information about the measuring insert see TR/TC 100.

Approvals

The temperature assembly is available with ATEX approval (with some limitations in the ordering options). For more information about the options see the list below.

Process temperature

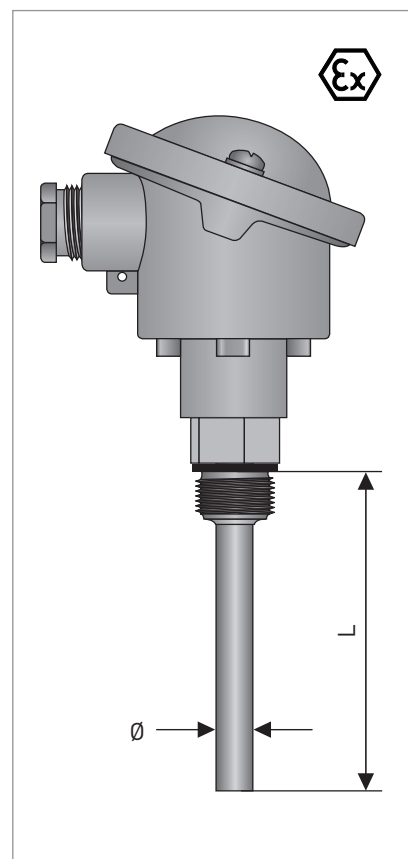
TRA	-200...+600 °C
TCA	-40...+600 °C*

Protection class

See section connection heads on page 117.

Response time

Type	Water 0.4 m/s	
	t 0.5	t 0.9
TRA-S11, Ø 9	17 s	52 s
TRA-S11, Ø 11	21 s	58 s
TRA-S11, Ø 12	22 s	66 s
TCA-S11, Ø 9	14 s	42 s
TCA-S11, Ø 11	17 s	46 s
TCA-S11, Ø 12	18 s	54 s



Dimensions in mm

For detailed dimensions see chapter
"Dimensions for temperature assemblies"

**Ordering code
for TRA-S11 with
standard settings**

V T S 1 0 2 0 1 3 2 1 3 1 0 4 0 1 0 0 0 0 0 0 0 0 0 0

1 2 4 5 7 8

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 37.

1. TYPE

2	Resistance sensor	TRA-S11
B	Thermocouple	TCA-S11

2. APPROVALS

0	Without
1	ATEX II 1G Ex ia IIC T6 Ga
3	ATEX II 1/2G Ex ia IIC T6 Ga/Gb

4. MEASURING INSERT

4. MENSURING INERT		
0	Without	
2	1x Pt100 3-wire	(Ex)
3	1x Pt100 4-wire	(Ex)
4	2x Pt100 3-wire	(Ex)
5	2x Pt100 4-wire	(Ex)
6	2x Pt100 2-wire	(Ex)
8	1x 3-wire + SmartSense	
A	1x Thermocouple Type J	(Ex)
B	1x Thermocouple Type K	(Ex)
D	2x Thermocouple Type J	(Ex)
E	2x Thermocouple Type K	(Ex)

5. TOLERANCE CLASS

1	Class B	Mi, TF
2	Class A	Mi, TF
3	Class A	Mi, TF, vibration-proof
4	Class A	Mi, WW
5	1/3 DIN B	Mi, TF
7	1/10 DIN B	Mi, WW
A	Class 1	Mi, Thermocouple

7. THERMOWELL DIAMETER (\emptyset)

1	9 mm
2	10 mm
3	11 mm
4	12 mm

8. PROCESS CONNECTION

1	G 1/2 A
2	G 3/4 A
3	G 1 A
5	1/2" NPT
6	3/4" NPT

*Temperature range can be extended with other materials in the thermowell.

Temperature assembly with process flange
Welded mulitpart thermowell, form 2F

Application

For temperature measurement in gases and fluids, in pipes and tanks at medium pressure and medium flow. Mounted with bolts on flange DN25 or DN50.

Temperature assembly

Material in stainless steel, 1.4404 or equivalent approved material, Ø 9, 10, 11 or 12 mm. Standard neck tube length HL = 80 mm. Depending on material and diameter, a bottom sleeve or a bottom plug are used in the measuring tip. For detailed information, see "Theory" section.

Measuring insert

Replaceable measuring insert in stainless steel $D = \varnothing 6 \text{ mm}$.
Insert length = $L + H_L + 10 \text{ mm}$. For detailed information about the measuring insert see TR/TC 100

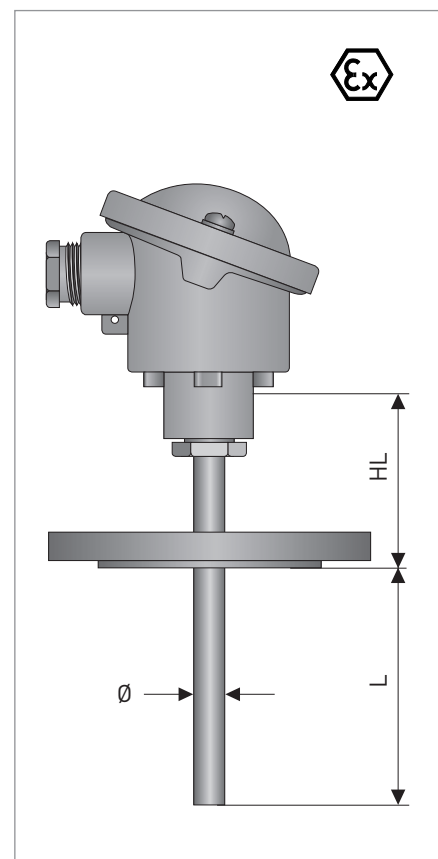
Approvals

The temperature assembly is available with ATEX approval (with some limitations in the ordering options). For more information about the options see the list below.

Process temperature	TRA	-200...+600 °C
	TCA	-40...+600 °C*

Protection class See section connection heads on page 117

Response time	Type	Water 0.4 m/s	
		t 0.5	t 0.9
	TRA-F13, Ø 9	17 s	52 s
	TRA-F13, Ø 11	21 s	58 s
	TRA-F13, Ø 12	22 s	66 s
	TCA-F13, Ø 9	14 s	42 s
	TCA-F13, Ø 11	17 s	46 s
	TCA-F13, Ø 12	18 s	54 s



Dimensions in mm

For detailed dimensions see chapter
"Dimensions for temperature assemblies"

Ordering code
for TRA-F13 with
standard settings

V T S 1 0 4 0 1 3 2 1 3 B 1 4 3 1 0 0 0 0 0 0 0 0 0 0

1 2 4 5 7 8 9

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 37.

1. TYPE	
4 Resistance sensor	TRA-F13
D Thermocouple	TCA-F13
2. APPROVALS	
0 Without	
1 ATEX II 1G Ex ia IIC T6 Ga	
3 ATEX II 1/2G Ex ia IIC T6 Ga/Gb	

4. MEASURING INSERT		
0	Without	
2	1x Pt100 3-wire	(Ex)
3	1x Pt100 4-wire	(Ex)
4	2x Pt100 3-wire	(Ex)
5	2x Pt100 4-wire	(Ex)
6	2x Pt100 2-wire	(Ex)
8	1x 3-wire + SmartSense	
A	1x Thermocouple Type J	(Ex)
B	1x Thermocouple Type K	(Ex)
D	2x Thermocouple Type J	(Ex)
E	2x Thermocouple Type K	(Ex)

5. TOLERANCE CLASS	
1 Class B	Mi, TF
2 Class A	Mi, TF
3 Class A	Mi, TF, vibration-proof
4 Class A	Mi, WW
5 1/3 DIN B	Mi, TF
7 1/10 DIN B	Mi, WW
A Class 1	Mi, Thermocouple

7. THERMOWELL DIAMETER (Ø)	
1 9 mm	
2 10 mm	
3 11 mm	
4 12 mm	

8. PROCESS CONNECTION	
B Flange DN25	EN 1092-1
D Flange DN50	EN 1092-1
H Flange 1"	ASME
L Flange 1 1/2"	ASME
9. PRESSURE RATING	
1 PN 40 Form B1	
A	150 lbs RF
B	300 lbs RF

*Temperature range can be extended with other materials in the thermowell.

Temperature assembly for screw-in Welded multipart thermowell with reduced tip

Application

For temperature measurement in gases and fluids, in pipes and tanks at medium pressure and medium flow where fast response time is required. Mounted either by direct screw-in to the process or by a welding sleeves. See section "Accessories".

Temperature assembly

Material in stainless steel, 1.4571 material, Ø 11 or 12 mm.

Measuring tip reduced to Ø 6 mm.

Standard neck tube length HL = 145 mm.

Measuring insert

Replaceable measuring insert in stainless steel D = Ø 3 mm.

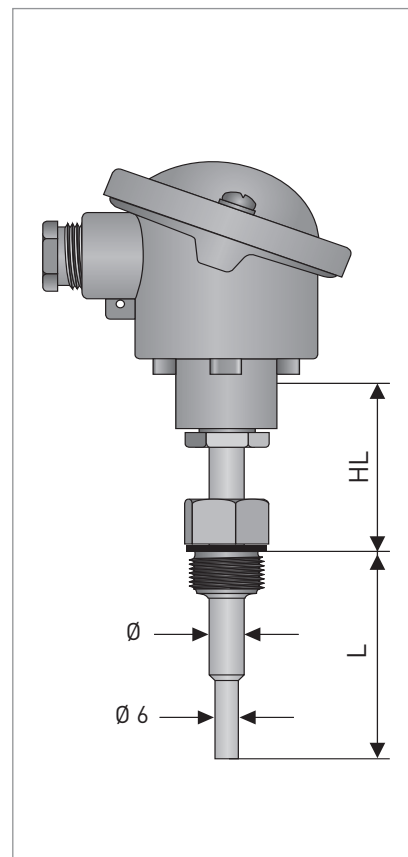
Insert length = $L + HL + 10 \text{ mm}$. For detailed information about the measuring insert see TR/TC 100.

Process temperature	TRA	-200...+600 °C
	TCA	-40...+600 °C*

Protection class

See section connection heads on page 117.

Response time	Type	Water 0.4 m/s	
		t 0.5	t 0.9
	TRA-S22, Ø11	8 s	22 s
	TCA-S22, Ø11	7 s	18 s



Dimensions in mm

For detailed dimensions see chapter
"Dimensions for temperature assemblies"

Ordering code
for TRA-S22 with
standard settings

V T S 1 0 7 0 1 3 2 1 3 1 0 4 3 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0

1 4 5 7 8

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 37.

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 37.

1. TYPE		4. MEASURING INSERT		5. TOLERANCE CLASS		7. THERMOWELL DIAMETER [Ø]
7 Resistance sensor	TRA-S22	0 Without		1 Class B	Mi, TF	3 11 mm
G Thermocouple	TCA-S22	2 1x Pt100 3-wire		2 Class A	Mi, TF	4 12 mm
		3 1x Pt100 4-wire		3 Class A	Mi, TF, vibration-proof	
		8 1x 3-wire + SmartSense		4 Class A	Mi, WW	8. PROCESS CONNECTION
		A 1x Thermocouple Type J		5 1/3 DIN B	Mi, TF	1 G 1/2 A
		B 1x Thermocouple Type K		7 1/10 DIN B	Mi, WW	2 G 3/4 A
		D 2x Thermocouple Type J		A Class 1	Mi, Thermocouple	3 G 1 A
		E 2x Thermocouple Type K				5 1/2" NPT
						6 3/4" NPT

*Temperature range can be extended with other materials in the thermowell.

[illegible]

4 = extended standard selection

* Standard

Temperature assembly for weld-in Barstock thermowell, form 4

Application

For temperature measurement in steam and fluids, in pipes and tanks at high pressure and high flow. Adapted to DIN 43772 standard. Mounted in a tapered barstock Form 4 thermowell to be welded-in. Available in various materials.

Temperature assembly

Neck tube in stainless steel / 1.4571 or equivalent, 12 mm;
standard neck tube length = 165 mm.

Measuring insert

Replaceable measuring insert of stainless steel $D = \varnothing 6 \text{ mm}$.
Insert length = FL + HL + 10 mm. For detailed information about the
measuring insert see TR/TC 100.

Approvals

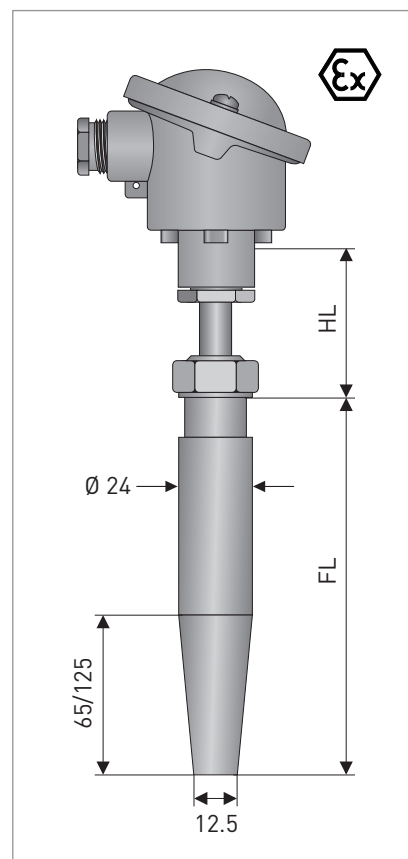
The temperature assembly is available with ATEX approval (with some limitations in the ordering options). For more information about the options see the list below.

Process temperature

TRA	-200...+600 °C
TCA	-40...+600 °C*

Protection class

See section connection heads on page 117.



Dimensions in mm

For detailed dimensions see chapter
"Dimensions for temperature assemblies"

Response time thermowell

Type	Water 0.4 m/s		Air 1 m/s	
	t 0.5	t 0.9	t 0.5	t 0.9
140/65 (D1)	40 s	2.3 min	5.8 min	21.7 min
200/125 (D2)	40 s	2.3 min	5.8 min	21.7 min
200/65 (D4)	40 s	2.3 min	5.8 min	21.7 min
260/125 (D5)	40 s	2.3 min	5.8 min	21.7 min

Ordering code
for TRA-T30 with
standard settings

V T S 2 0 1 0 1 3 1 1 B 0 0 P 6 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0

1 2 4 5 6 7 8

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 47.

1. TYPE

1	Resistance sensor	TRA-T30
A	Thermocouple	TCA-T30

2. APPROVALS

0	Without
1	ATEX II 1G Ex ia IIC T6 Ga
3	ATEX II 1/2G Ex ia IIC T6 Ga/Gb

4. MEASURING INSERT

0	Without	
2	1x Pt100 3-wire	(Ex)
3	1x Pt100 4-wire	(Ex)
4	2x Pt100 3-wire	(Ex)
5	2x Pt100 4-wire	(Ex)
8	1x 3-wire + SmartSense	
A	1x Thermocouple Type J	(Ex)
B	1x Thermocouple Type K	(Ex)
D	2x Thermocouple Type J	(Ex)
E	2x Thermocouple Type K	(Ex)

5. TOLERANCE CLASS

1	Class B	-70...+500 °C
2	Class A	-50...+300 °C
3	Class A, vibration-proof	-20...+200 °C
4	Class A	-200...+500 °C
5	1/3 DIN B	0...+150 °C
7	1/10 DIN B	0 °C
A	Class 1	

6. THERMOWELL MATERIAL

1	1.4571 / 316Ti	up to 600 °C
3	1.4404 / 316 L	up to 600 °C
5	1.7335 / 13CrMo44	up to 550 °C
7	1.0460 / C22.8	up to 550 °C

7. THERMOWELL DIAMETER (\emptyset)

A	D1 / Form 4, Ø24 mm, FL=140 / U1 = 65 mm
B	D2 / Form 4, Ø24 mm, FL=200 / U1 = 125 mm
C	D4 / Form 4, Ø24 mm, FL=200 / U1 = 65 mm
D	D5 / Form 4, Ø24 mm, FL=260 / U1 = 125 mm

8. PROCESS CONNECTION

0	Without
X	Weld-in fitting Ø 48 x 50. 1.4571

*Temperature range can be extended with other materials in the thermowell.

Temperature assembly for screw-in Welded multipart thermowell, form 5

Application

For temperature measurement in gases and fluids, in pipes and tanks at high pressure and high flow. Adapted to DIN standard. Mounted in a straight Form 5 thermowell for screw-in.

Temperature assembly

Neck tube in stainless steel / 1.4571 or equivalent, 12 mm;
standard neck tube length = 165 mm.

Measuring insert

Replaceable measuring insert in stainless steel D = Ø 6 mm.
Insert length = L + HL + 40 mm. For detailed information about the measuring insert see TR/TC 100.

Approvals

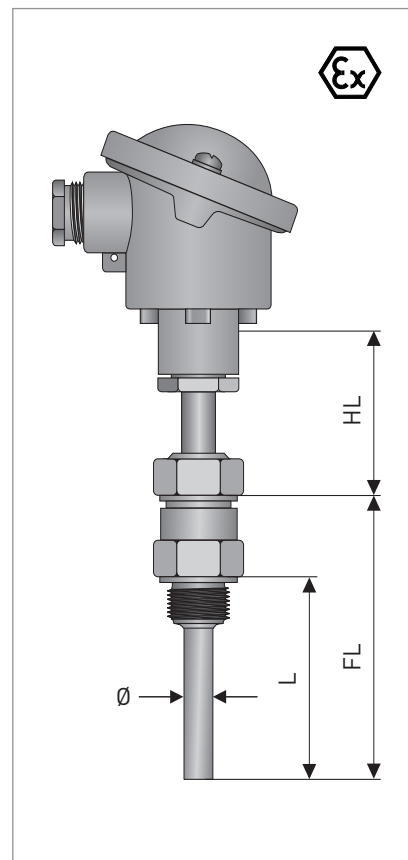
The temperature assembly is available with ATEX approval (with some limitations in the ordering options). For more information about the options see the list below.

Process temperature	TRA	-200...+600 °C
	TCA	-40...+600 °C*

Protection class

See section connection heads on page 117.

Response time thermowell	Type	Water 0.4 m/s	
		t 0.5	t 0.9
	TRA-TS32, Ø 9	17 s	52 s
	TRA-TS32, Ø 11	21 s	58 s
	TRA-TS32, Ø 12	22 s	66 s
	TCA-TS32, Ø 9	14 s	42 s
	TCA-TS32, Ø 11	17 s	46 s
	TCA-TS32, Ø 12	18 s	54 s



Dimensions in mm

For detailed dimensions see chapter
"Dimensions for temperature assemblies"

Ordering code
for TRA-TS32 with
standard settings

V T S 2 0 3 0 1 3 1 1 4 1 0 2 6 1 1 0 0 0 0 0 0 0 0 0

1 2 4 5 6 7 8 12

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 47.

1. TYPE	
3 Resistance sensor	TRA-TS32
C Thermocouple	TCA-TS32
2. APPROVALS	
0 Without	
1 ATEX II 1G Ex ia IIC T6 Ga	
3 ATEX II 1/2G Ex ia IIC T6 Ga/Gb	

4. MEASURING INSERT

0	Without	
2	1x Pt100 3-wire	(Ex)
3	1x Pt100 4-wire	(Ex)
4	2x Pt100 3-wire	(Ex)
5	2x Pt100 4-wire	(Ex)
8	1x 3-wire + SmartSense	
A	1x Thermocouple Type J	(Ex)
B	1x Thermocouple Type K	(Ex)
D	2x Thermocouple Type J	(Ex)
E	2x Thermocouple Type K	(Ex)

5. TOLERANCE CLASS

1	Class B	-70...+500 °C
2	Class A	-50...+300 °C
3	Class A, vibration-proof	-20...+200 °C
4	Class A	-200...+600 °C
5	1/3 DIN B	0...+150 °C
	1/10 DIN B	0 °C
A	Class 1	

6. THERMOWELL MATERIAL

1	1.4571 / 316Ti	up to 600 °C
3	1.4404 / 316 L	up to 600 °C

7. THERMOWELL DIAMETER (Ø)

1	9 mm
2	10 mm
3	11 mm
4	12 mm

8. PROCESS CONNECTION

1	G 1/2 A
2	G 3/4 A
3	G 1 A
5	1/2" NPT
6	3/4" NPT

12. NECK TUBE CONNECTION

1	M18 x 1.5
3	G 1/2
4	G 3/4

*Temperature range can be extended with other materials in the thermowell.

Temperature assembly for screw-in
Welded multipart thermowell, form 8 for union nut

Application

For temperature measurement in gases and fluids, in pipes and tanks at high pressure and high flow. Adapted according to DIN standard 43772. Mounted in a straight barstock Form 8 thermowell for screw-in.

Temperature assembly

Neck tube in stainless steel / 1.4571 or equivalent, 12 mm;
standard neck tube length = 165 mm.

Measuring insert

Replaceable measuring insert in stainless steel D = Ø 6 mm.
Insert length = L + HL + 39 mm. For detailed information about the measuring insert see TR/TC 100.

Approvals

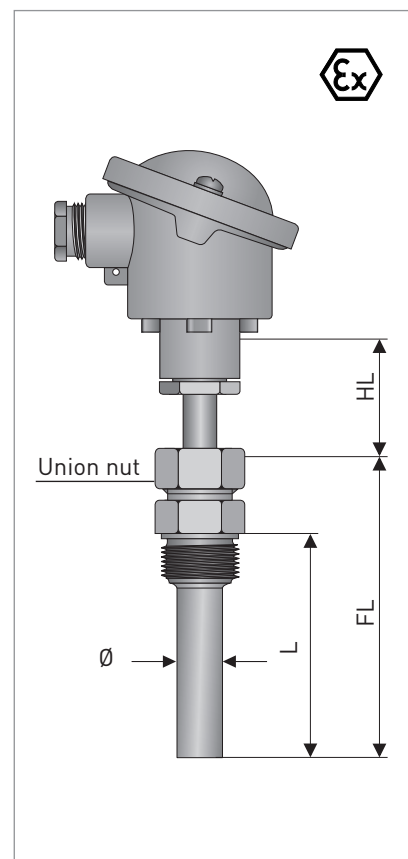
The temperature assembly is available with ATEX approval (with some limitations in the ordering options). For more information about the options see the list below.

Process temperature	TRA	-200...+600 °C
	TCA	-40...+600 °C*

Protection class

See section connection heads on page 117.

Response time thermowells	Type	Water 0.4 m/s	
		t 0.5	t 0.9
	TRA-TS35, Ø 9	17 s	52 s
	TRA-TS35, Ø 11	21 s	58 s
	TRA-TS35, Ø 12	22 s	66 s
	TCA-TS35, Ø 9	14 s	42 s
	TCA-TS35, Ø 11	17 s	46 s
	TCA-TS35, Ø 12	18 s	54 s



Dimensions in mm

For detailed dimensions see chapter
"Dimensions for temperature assemblies"

Ordering code
for TRA-TS35 with
standard settings

V T S 2 0 6 0 1 3 1 1 4 1 0 2 6 D 1 0 0 0 0 0 0 0 0 0 0 0

1 2 4 5 6 7 8 12

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 47.

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 47.					
1. TYPE			4. MEASURING INSERT		
6	Resistance sensor	TRA-TS35	0	Without	
F	Thermocouple	TCA-TS35	2	1x Pt100 3-wire	(Ex)
			3	1x Pt100 4-wire	(Ex)
			4	2x Pt100 3-wire	(Ex)
			5	2x Pt100 4-wire	(Ex)
			8	1x 3-wire + SmartSense	
			A	1x Thermocouple Type J	(Ex)
			B	1x Thermocouple Type K	(Ex)
			D	2x Thermocouple Type J	(Ex)
			E	2x Thermocouple Type K	(Ex)
2. APPROVALS			5. TOLERANCE CLASS		
0	Without		1	Class B	-70...+500 °C
1	ATEX II 1G Ex ia IIC T6 Ga		2	Class A	-50...+300 °C
3	ATEX II 1/2G Ex ia IIC T6 Ga/Gb		3	Class A, vibration-proof	-20...+200 °C
			4	Class A	-200...+600 °C
			5	1/3 DIN B	0...+150 °C
			7	1/10 DIN B	0 °C
			A	Class 1	
			6. THERMOWELL MATERIAL		
			1	1.4571 / 316Ti	up to 600 °C
			3	1.4404 / 316 L	up to 600 °C
			7. THERMOWELL DIAMETER (Ø)		
			1	9 mm	
			2	10 mm	
			3	11 mm	
			4	12 mm	
			8. PROCESS CONNECTION		
			1	G 1/2 A	
			2	G 3/4 A	
			3	G 1 A	
			5	1/2" NPT	
			6	3/4" NPT	
			12. NECK TUBE CONNECTION		
			D	Union nut G 1/2	
			E	Union nut G 3/4	

*Temperature range can be extended with other materials in the thermowell.

Temperature assembly for screw-in Barstock thermowell, form 6 and 7

Application

For temperature measurement in gases and fluids, in pipes and tanks at high pressure and high flow. Adapted according to DIN standard 43772. Mounted in a straight barstock Form 7 thermowell for screw-in.

Temperature assembly

Neck tube in stainless steel / 1.4571 or equivalent, 12 mm;
standard neck tube tube length = 165 mm.

Measuring insert

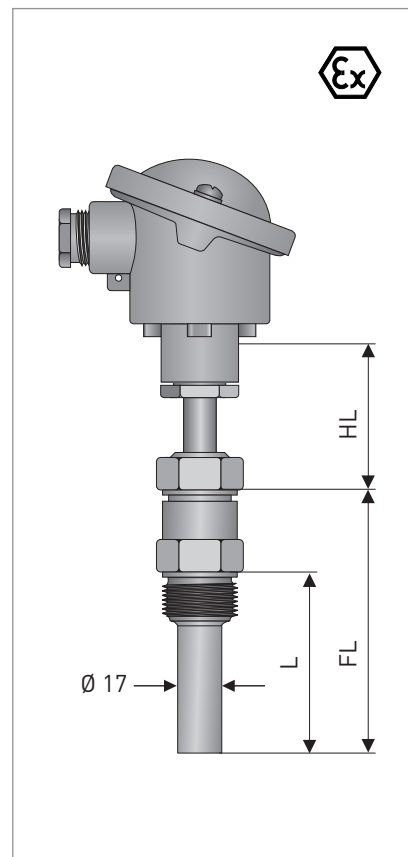
Replaceable measuring insert in stainless steel D = Ø 6 mm.
Insert length = L + HL + 40 mm. For detailed information about the measuring insert see TR/TC 100.

Approvals

The temperature assembly is available with ATEX approval (with some limitations in the ordering options). For more information about the options see the list below.

Process temperature	TRA	-200...+600 °C
	TCA	-40...+600 °C*

Protection class See section connection heads on page 117.



Dimensions in mm

For detailed dimensions see chapter
"Dimensions for temperature assemblies"

Ordering code
for TRA-T36 with
standard settings

V T S 2 0 7 0 1 3 1 1 7 1 0 2 6 1 1 0 0 0 0 0 0 0 0

1 2 4 5 6 8 12

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 47.

1. TYPE	
7 Resistance sensor	TRA-TS36
G Thermocouple	TCA-TS36
2. APPROVALS	
0 Without	
1 ATEX II 1G Ex ia IIC T6 Ga	
3 ATEX II 1/2G Ex ia IIC T6 Ga/Gb	

4. MEASURING INSERT	
0	Without
2	1x Pt100 3-wire (Ex)
3	1x Pt100 4-wire (Ex)
4	2x Pt100 3-wire (Ex)
5	2x Pt100 4-wire (Ex)
8	1x 3-wire + SmartSense
A	1x Thermocouple Type J (Ex)
B	1x Thermocouple Type K (Ex)
D	2x Thermocouple Type J (Ex)
E	2x Thermocouple Type K (Ex)

5. TOLERANCE CLASS	
1 Class B	-70...+500 °C
2 Class A	-50...+300 °C
3 Class A, vibration-proof	-20...+200 °C
4 Class A	-200...+600 °C
5 1/3 DIN B	0...+150 °C
7 1/10 DIN B	0 °C
A Class 1	

6. THERMOWELL MATERIAL		
1	1.4571 / 316Ti	up to 600 °C
3	1.4404 / 316 L	up to 600 °C

8. PROCESS CONNECTION

1	G 1/2 A
2	G 3/4 A
3	G 1 A
5	1/2" NPT
6	3/4" NPT

12. NECK TUBE CONNECTION

1	M18 x 1.5
3	G 1/2
4	G 3/4

*Temperature range can be extended with other materials in the thermowell.

Temperature assembly for screw-in Barstock thermowell, form 9 for union nut

Application

For temperature measurement in gases and fluids, in pipes and tanks at high pressure and high flow. Adapted according to DIN standard 43772. Mounted in a straight barstock Form 9 thermowell for screw-in.

Temperature assembly

Neck tube in stainless steel / 1.4571 or equivalent, 12 mm;
standard neck tube length = 165 mm.

Measuring insert

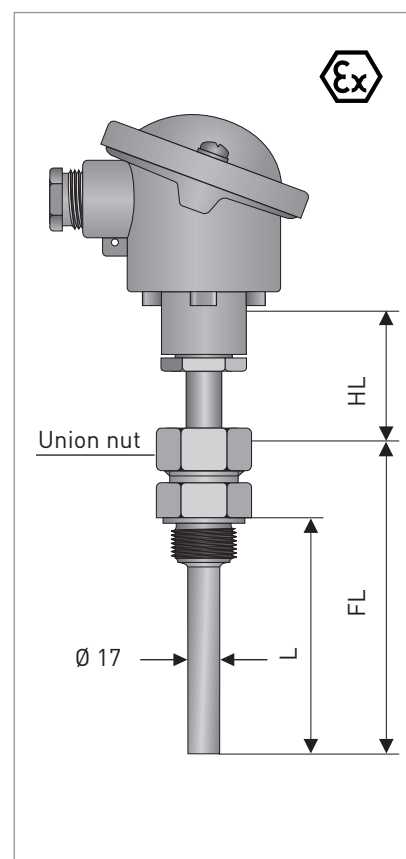
Replaceable measuring insert in stainless steel D = Ø 6 mm.
Insert length = L + HL + 36 mm. For detailed information about the measuring insert see TR/TC 100.

Approvals

The temperature assembly is available with ATEX approval (with some limitations in the ordering options). For more information about the options see the list below.

Process temperature	TRA	-200...+600 °C
	TCA	-40...+600 °C*

Protection class See section connection heads on page 117.



Dimensions in mm

For detailed dimensions see chapter
"Dimensions for temperature assemblies"

**Ordering code for
TRA-TS37 with
standard settings**

V T S 2 0 8 0 1 3 1 1 7 1 0 2 6 1 1 0 0 0 0 0 0 0 0

1 2 4 5 6 8 12

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 47.

1. TYPE	
8 Resistance sensor	TRA-TS37
H Thermocouple	TCA-TS37
2. APPROVALS	
0 Without	
1 ATEX II 1G Ex ia IIC T6 Ga	
3 ATEX II 1/2G Ex ia IIC T6 Ga/Gb	

4. MEASURING INSERT		
0	Without	
2	1xPt100 3-wire	(Ex)
3	1xPt100 4-wire	(Ex)
4	2xPt100 3-wire	(Ex)
5	2xPt100 4-wire	(Ex)
8	1x3-wire + SmartSense	
A	1x Thermocouple Type J	(Ex)
B	1x Thermocouple Type K	(Ex)
D	2x Thermocouple Type J	(Ex)
E	2x Thermocouple Type K	(Ex)

5. TOLERANCE CLASS	
1 Class B	-70...+500 °C
2 Class A	-50...+300 °C
3 Class A, vibration-proof	-20...+200 °C
4 Class A	-200...+600 °C
5 1/3 DIN B	0...+150 °C
7 1/10 DIN B	0 °C
A Class 1	

6. THERMOWELL MATERIAL	
1 1.4571 / 316Ti	up to 600 °C
3 1.4404 / 316 L	up to 600 °C

8. PROCESS CONNECTION

1	G 1/2 A
2	G 3/4 A
3	G 1 A
5	1/2" NPT
6	3/4" NPT

12. NECK TUBE CONNECTION

1	M18 x 1.5
3	G 1/2
D	Union nut G1/2
E	Union nut G3/4

*Temperature range can be extended with other materials in the thermowell.

1. Type		version							
1*	TRA-T30	"Weld-in"		TRA/TCA-T30	TRA/TCA-T31	TRA/TCA-T32/36	TRA/TCA-TF33	TRA/TCA-S34	TRA/TCA-TS35/37
2	TRA-TF31	"Flange"							
3	TRA-TS32	"Screw-in"							
4	TRA-TF33	"Flange"							
5	TRA-S34	"Screw-in, without thermowell"							
6	TRA-TS35	"Screw-in"							
7	TRA-TS36	"Screw-in"							
8	TRA-TS37	"Screw-in"							
A	TCA-T30	"Weld-in"							
B	TCA-TF31	"Flange"							
C	TCA-TS32	"Screw-in"							
D	TCA-TF33	"Flange"							
E	TCA-S34	"Screw-in, without thermowell"							
F	TCA-TS35	"Screw-in"							
G	TCA-TS36	"Screw-in"							
H	TCA-TS37	"Screw-in"							
2. Approvals				type					
0* without									
1 ATEX II 1G Ex ia IIC T6 Ga / II 1D Ex ia IIIC T145°C Da IP 65				(30-33/35-37)					
2 ATEX II 1G Ex ia IIC T6 Ga / II 1D Ex ia IIIC Txxx°C Da IP 65 TC xxx=146°C, RTD WW xxx=175°C, RTD TF xxx=185°C				(34)					
3 ATEX II 1/2G Ex ia IIC T6 Ga/Gb / 1D Ex ia IIIC T145°C Da IP 65				(30-33/35-37)					
3. Connection head				Connection head					
0 without				6 BUZ-HW hinged cover with display Alu, M20 x 1.5, IP 65					
1* BA Alu, M20 x 1.5, IP 65				7 BBK screw cover PA, M20 x 1.5, IP 54					
2 BUZ-S (snap) hinged cover Alu, M20 x 1.5, IP 65				8 BVA screw cover SS, M20 x 1.5, IP 65					
3 BUZ-T (screw) hinged cover Alu, M20 x 1.5, IP 65 [Ex]				A AXD screw cover Alu, M20 x 1.5, IP 68 [Ex]					
4 BGK screw cover Alu, M20 x 1.5, IP 67				B BUZ-HK hinge cover PA, M20 x 1.5, IP 65					
5 BUZ-H hinged cover Alu, M20 x 1.5, IP 65 [Ex]									
4. Measuring insert = sensor / wiring				Measuring insert = sensor / wiring					
0 without				8 1x 3-wire + Smart Sense					
2 1x Pt100 3-wire [Ex]				A 1x Thermocouple Type J (Fe-CuNi) [Ex]					
3* 1x Pt100 4-wire [Ex]				B 1x Thermocouple Type K (NiCr-Ni) [Ex]					
4 2x Pt100 3-wire (Cl.A, WW) [Ex]				D 2x Thermocouple Type J (Fe-CuNi) [Ex]					
5 2x Pt100 4-wire (Cl.A, WW) [Ex]				E 2x Thermocouple Type K (NiCr-Ni) [Ex]					
5. Measuring insert / tolerance class									
0 without									
1* Cl. B MI, TF (tolerance class -70...+500°C) [Ex]									
2 Cl. A MI, TF (tolerance class -50...+300°C) [Ex]									
3 Cl. A, vibration-proof MI, TF (tolerance class -20...+200°C) [Ex]									
4 Cl. A MI, WW (tolerance class -200...+600°C) [Ex]									
5 1/3 DIN B MI, TF (tolerance class 0...+150°C) [Ex]									
7 1/10 DIN B MI, WW (tolerance class at 0°C) [Ex]									
A Cl.1 MI, Thermocouple [Ex]									
6. Thermowell material				type					
0 without				(34)					
1* 1.4571 / 316Ti up to 600°C				(30-33/35-37)					
3 1.4404 / 316 L up to 600°C				(30-33/35-37)					
4 1.7335 / 13CrMo44 up to 550°C				(30/31)					
5 1.0460 / C22.8 up to 550°C				(30/31)					
7. Thermowell diameter				type					
0 without				(34)					
1 9 mm 1.4571 (32/33/35)				7 17x5 mm, Form 7 and 9 (36/37)					
2 10 mm 1.4404 (32/33/35)				A D1/Form 4, 24 mm, L=140 / U1 = 65 mm (30)					
3 11 mm 1.4571 (32/33/35)				B* D2/Form 4, 24 mm, L=200 / U1 = 125 mm (30)					
4 12 mm 1.4571/1.4404 (32/33/35)				C D4/Form 4, 24 mm, L=200 / U1 = 65 mm (30/31)					
				D D5/Form 4, 24 mm, L=260 / U1 = 125 mm (30/31)					
8. Process connection				type					
0* without / Thread				(34)					
1 G 1/2 A (32/35/36/37)				B Flange DN25 DIN 1092-1 (31/33)					
2 G 3/4 A (32/35/36/37)				D Flange DN50 DIN 1092-1 (31/33)					
3 G 1 A (32/35/36/37)				H Flange ASME 1" (31/33)					
5 1/2" NPT (32/35/36/37)				L Flange ASME 1 1/2" (31/33)					
6 3/4" NPT (32/35/36/37)				X Weld-in fitting Ø 48 x 50, 1.4571 (30)					
9. Pressure rating				type					
0* without / Thread				(30/32/34/35)					
1 PN 40 Form B1				(31/33)					
A 150 lbs RF				(31/33)					
B 300 lbs RF				(31/33)					
10. Insert length				type					
0 without									
1 80 mm (32, 36)				8 260 mm (33-35, 37)					
2* 100 mm (34)				A 300 mm (34)					
3 110 mm (33, 35, 37)				B 350 mm (34)					
4 140 mm (32, 34, 36)				C 380 mm (32, 36)					
5 170 mm (33, 35, 37)				D 400 mm (34)					
6 200 mm (34)				E 410 mm (33, 35, 37)					
7 230 mm (32, 36)				Z Customized length					
				P Form 4, D1...5 (30, 31)					
11. Neck tube length				type					
0 without									
1 80 mm [Std-length] (31/33/34)				D 140 mm					
2 90 mm				E 150 mm					
4 110 mm				F 160 mm					
5 145 mm				G 170 mm					
6* 165 mm [Std-length] (30/32/35)				H 180 mm					
A 70 mm				K 190 mm					
B 100 mm				L 200 mm					
C 120 mm				Z Customized length					

4 = extended standard selection

* *Standard*

Temperature assembly without thermowell

Application

For temperature measurement in pipes and tanks. Adapted according to ASME-standard. For screw-in to thermowell with NPT thread.

Temperature assembly

Material in Stainless steel, 1.4404 or equivalent approved material, 1/2" neck tube. Available with a standard tube with NPT (NN) or with an union neck tube (NUN).

Measuring insert

Replaceable measuring insert in stainless steel D = Ø 6 mm.
For detailed information about the measuring insert see TR/TC 100.

Approvals

The temperature assembly is available with ATEX approval (with some limitations in the ordering options). For more information about the options see the list below.

Process temperature

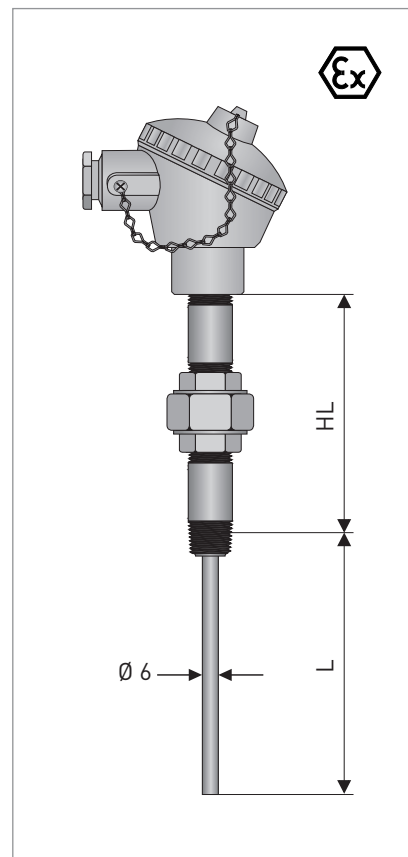
TRA	-200...+600 °C
TCA	-40...+600 °C*

Protection class

See section connection heads on page 117.

Response time

Type	Water 0.4 m/s		Air 1 m/s	
	t 0.5	t 0.9	t 0.5	t 0.9
TRA-S50	3.5 s	8 s	24 s	54 s
TCA-S50	2.5 s	7 s	21 s	50 s



Dimensions in mm

For detailed dimensions see chapter
"Dimensions for temperature assemblies"

Ordering code for TRA-S50 with standard settings

V	T	S	3	0	0	0	K	3	1	3	0	0	0	0	5	6	2	0	1	0	0	0	0	0	0	0	0	0	0
				1	2			4	5							12													

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 58.

1. TYPE

0 Resistance sensor	TRA-S50
E Thermocouple	TCA-S50

2. APPROVALS

0 Without
2 ATEX II 1G Ex ia IIC T6 Ga

4. MEASURING INSERT

0 Without
2 1x Pt100 3-wire (Ex)
3 1x Pt100 4-wire (Ex)
4 2x Pt100 3-wire (Ex)
5 2x Pt100 4-wire (Ex)
8 1x 3-wire + SmartSense
A 1x Thermocouple Type J (Ex)
B 1x Thermocouple Type K (Ex)
D 2x Thermocouple Type J (Ex)
E 2x Thermocouple Type K (Ex)

5. TOLERANCE CLASS

1 Class B	-70...+500 °C
2 Class A	-50...+300 °C
3 Class A, vibration-proof	-20...+200 °C
4 Class A	-200...+600 °C
5 1/3 DIN B	0...+150 °C
7 1/10 DIN B	0 °C
A Class 1	

12. NECK TUBE CONNECTION

2 G 1/2
6 1/2" NPT

*Temperature range can be extended with other materials in the thermowell.

Temperature assembly for screw-in Straight barstock thermowell

Application

For temperature measurement in gases and fluids, in pipes and tanks at high pressure and high flow. Adapted according to ASME B16.5 standard. Mounted in a straight barstock thermowell for screw-in.

Temperature assembly

Material in Stainless steel, 1.4404 or equivalent approved material.

Available with a standard tube with NPT (NN) or with an union neck tube (NUN).

Measuring insert

Replaceable measuring insert in stainless steel $D = \varnothing 6$ mm.

For detailed information about the measuring insert see TR/TC 100.

Approvals

The temperature assembly is available with ATEX approval (with some limitations in the ordering options). For more information about the options see the list below.

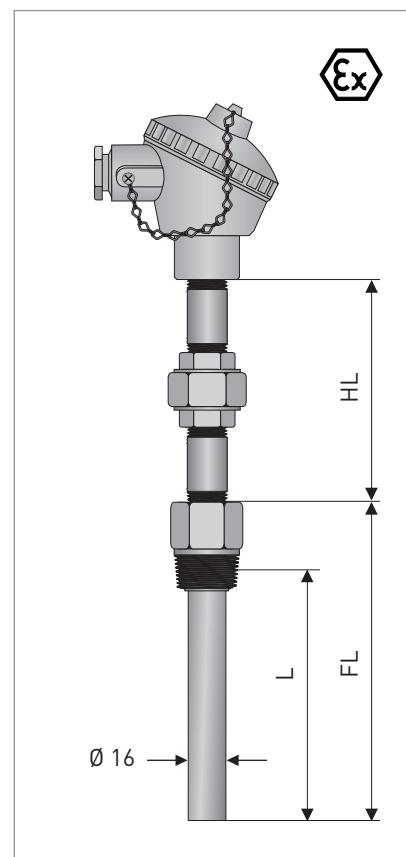
Process temperature

TRA -200...+600 °C

TCA -40...+600 °C*

Protection class

See section connection heads on page 117.



Dimensions in mm

For detailed dimensions see chapter
"Dimensions for temperature assemblies"

Ordering code for TRA-TS52 with standard settings

V	T	S	3	0	2	0	K	3	1	3	8	5	0	0	5	6	2	0	1	0	0	0	0	0	0	0	0	0	0
				1	2			4	5	6		8			12														

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 58.

1. TYPE

2 Resistance sensor	TRA-TS52
G Thermocouple	TCA-TS52

2. APPROVALS

0 Without	
1 ATEX II 1G Ex ia IIC T6 Ga	
3 ATEX II 1/2G Ex ia IIC T6 Ga/Gb	

4. MEASURING INSERT

0 Without	
2 1x Pt100 3-wire	(Ex)
3 1x Pt100 4-wire	(Ex)
4 2x Pt100 3-wire	(Ex)
5 2x Pt100 4-wire	(Ex)
6 2x Pt100 2-wire	(Ex)
8 1x 3-wire + SmartSense	
A 1x Thermocouple Type J	(Ex)
B 1x Thermocouple Type K	(Ex)
D 2x Thermocouple Type J	(Ex)
E 2x Thermocouple Type K	(Ex)

5. TOLERANCE CLASS

1 Class B	Mi, TF
2 Class A	Mi, TF
3 Class A	Mi, TF, vibration-proof
4 Class A	Mi, WW
5 1/3 DIN B	Mi, TF
7 1/10 DIN B	Mi, WW
A Class 1	Mi, Thermocouple

6. THERMOWELL MATERIAL

1 1.4571 / 316Ti	up to 600 °C
3 1.4404 / 316 L	up to 600 °C

8. PROCESS CONNECTION

1 G 1/2 A
2 G 3/4 A
3 G 1 A
5 1/2" NPT
6 3/4" NPT

12. NECK TUBE CONNECTION

3 G 1/2
6 1/2" NPT

*Temperature range can be extended with other materials in the thermowell.

Temperature assembly for screw-in Tapered barstock thermowell

Application

For temperature measurement in gases and fluids, in pipes and tanks at high pressure and high flow. Adapted according to ASME B16.5 standard. Mounted in a tapered barstock thermowell for screw-in.

Temperature assembly

Material in Stainless steel, 1.4404 or equivalent approved material.
Available with a standard tube with NPT (NN) or with an union neck tube (NUN).

Measuring insert

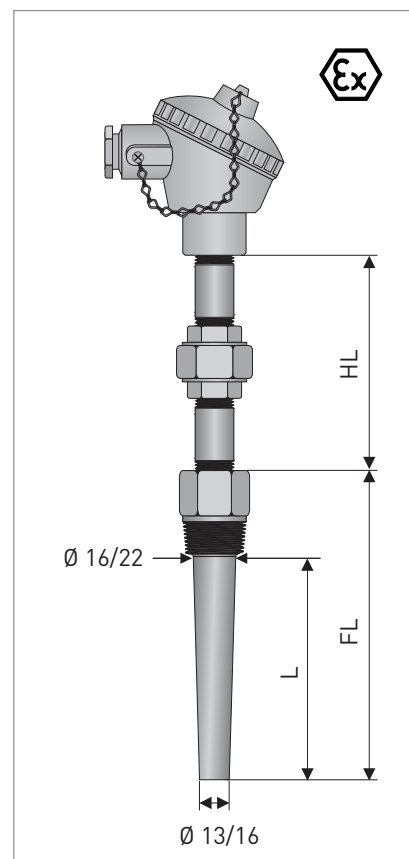
Replaceable measuring insert in stainless steel D = Ø 6 mm.
For detailed information about the measuring insert see TR/TC 100.

Approvals

The temperature assembly is available with ATEX approval (with some limitations in the ordering options). For more information about the options see the list below.

Process temperature	TRA	-200...+600 °C
	TCA	-40...+600 °C*

Protection class See section connection heads on page 117.



Dimensions in mm

For detailed dimensions see chapter
"Dimensions for temperature assemblies"

Ordering code
for TRA-TS53 with
standard settings

V T S 3 0 3 0 K 3 1 3 8 5 0 0 5 6 2 0 1 0 0 0 0 0 0 0 0 0 0

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 58.

1. TYPE	
3 Resistance sensor	TRA-TS53
H Thermocouple	TCA-TS53
2. APPROVALS	
0 Without	
1 ATEX II 1G Ex ia IIC T6 Ga	
3 ATEX II 1/2G Ex ia IIC T6 Ga/Gb	

4. MEASURING INSERT

0	Without	
2	1x Pt100 3-wire	(Ex)
3	1x Pt100 4-wire	(Ex)
4	2x Pt100 3-wire	(Ex)
5	2x Pt100 4-wire	(Ex)
8	1x 3 wire + SmartSense	
A	1x Thermocouple Type J	(Ex)
B	1x Thermocouple Type K	(Ex)
D	2x Thermocouple Type J	(Ex)
E	2x Thermocouple Type K	(Ex)

5. TOLERANCE CLASS

1	Class B	Mi, TF
2	Class A	Mi, TF

3	Class A	Mi, TF, vibration-proof
4	Class A	Mi, WW
5	1/3 DIN B	Mi, TF
7	1/10 DIN B	Mi, WW
A	Class 1	Mi, Thermocouple

6. THERMOWELL MATERIAL

1	1.4571 / 316Ti	up to 600°C
3	1.4404 / 316 L	up to 600°C

7. THERMOWELL DIAMETER (Ø)

8	16 mm	0.63 "
F	22 mm	0.87 "

8. PROCESS CONNECTION

1	G 1/2 A
2	G 3/4 A
3	G 1 A
5	1/2" NPT
6	3/4" NPT

12. NECK TUBE CONNECTION

3	G 1/2
6	1/2" NPT

*Temperature range can be extended with other materials in the thermowell.

Temperature assembly for screw-in Reduced barstock thermowell

Application

For temperature measurement in gases and fluids, in pipes and tanks at high pressure and high flow. Adapted according to ASME B16.5 standard. Mounted in a barstock thermowell with a reduced tip for screw-in.

Temperature assembly

Material in Stainless steel, 1.4404 or equivalent approved material.
Available with a standard tube with NPT (NN) or with an union neck tube (NUN).

Measuring insert

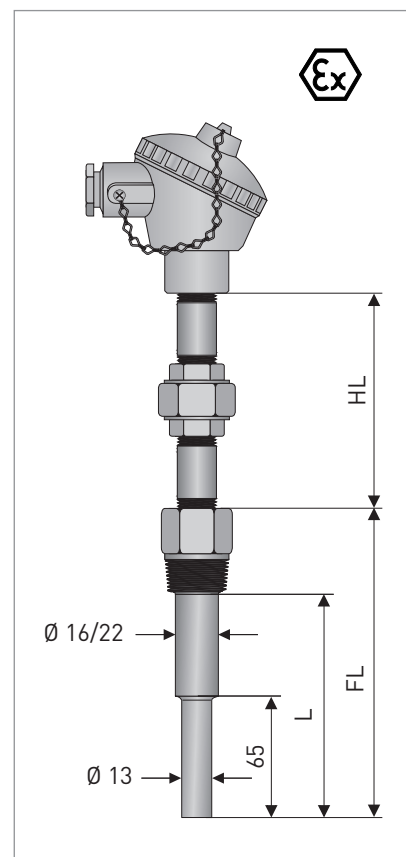
Replaceable measuring insert in stainless steel $D = \varnothing 6$ mm.
For detailed information about the measuring insert see TR/TC 100.

Approvals

The temperature assembly is available with ATEX approval (with some limitations in the ordering options). For more information about the options see the list below.

Process temperature	TRA	-200...+600 °C
	TCA	-40...+600 °C*

Protection class See section connection heads on page 117.



Dimensions in mm

For detailed dimensions see chapter
"Dimensions for temperature assemblies"

Ordering code for TRA-TS54 with standard settings

V	T	S	3	0	4	0	K	3	1	3	8	5	0	0	5	6	2	0	1	0	0	0	0	0	0	0	0	0	0

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 58.

1. TYPE

4	Resistance sensor	TRA-TS54
K	Thermocouple	TCA-TS54

2. APPROVALS

0	Without
1	ATEX II 1G Ex ia IIC T6 Ga
3	ATEX II 1/2G Ex ia IIC T6 Ga/Gb

4. MEASURING INSERT

0	Without
2	1x Pt100 3-wire (Ex)
3	1x Pt100 4-wire (Ex)
4	2x Pt100 3-wire (Ex)
5	2x Pt100 4-wire (Ex)
8	1x 3-wire + SmartSense
A	1x Thermocouple Type J (Ex)
B	1x Thermocouple Type K (Ex)
D	2x Thermocouple Type J (Ex)
E	2x Thermocouple Type K (Ex)

5. TOLERANCE CLASS

1	Class B	Mi, TF
2	Class A	Mi, TF
3	Class A	Mi, TF, vibration-proof
4	Class A	Mi, WW
5	1/3 DIN B	Mi, TF
7	1/10 DIN B	Mi, WW
A	Class 1	Mi, Thermocouple

6. THERMOWELL MATERIAL

1	1.4571 / 316Ti	up to 600°C
3	1.4404 / 316 L	up to 600°C

7. THERMOWELL DIAMETER (Ø)

8	16 mm	0.63"
F	22 mm	0.87"

8. PROCESS CONNECTION

1	G 1/2 A
2	G 3/4 A
3	G 1 A
5	1/2" NPT
6	3/4" NPT

12. NECK TUBE CONNECTION

3	G 1/2
6	1/2" NPT

*Temperature range can be extended with other materials in the thermowell.

Temperature assembly with process flange Straight barstock thermowell

Application

For temperature measurement in gases and fluids, in pipes and tanks at high pressure and high flow. Adapted according to ASME B16.5 standard. Mounted in a straight barstock thermowell to be bolted on a ASME 1 to 2" flange.

Temperature assembly

Material in Stainless steel, 1.4404 or equivalent approved material.
Available with a standard tube with NPT (NN) or with an union neck tube (NUN).

Measuring insert

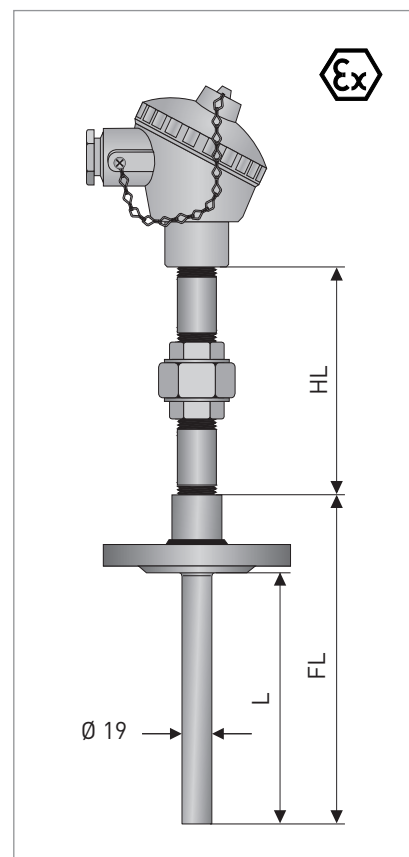
Replaceable measuring insert in stainless steel $D = \varnothing 6$ mm.
For detailed information about the measuring insert see TR/TC 100.

Approvals

The temperature assembly is available with ATEX approval (with some limitations in the ordering options). For more information about the options see the list below.

Process temperature	TRA	-200...+600 °C
	TCA	-40...+600 °C*

Protection class	See section connection heads on page 117.
------------------	---



Dimensions in mm

For detailed dimensions see chapter
"Dimensions for temperature assemblies"

Ordering code for TRA-TF55 with standard settings

V	T	S	3	0	5	0	K	3	1	3	C	K	A	1	5	6	2	0	1	0	0	0	0	0	0	0	0	0	0	0	
			1	2				4	5			8	9	10		12															

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 58.

1. TYPE

5 Resistance sensor	TRA-TF55
L Thermocouple	TCA-TF55

2. APPROVALS

0 Without	
1 ATEX II 1G Ex ia IIC T6 Ga	
3 ATEX II 1/2G Ex ia IIC T6 Ga/Gb	

4. MEASURING INSERT

0 Without	
2 1x Pt100 3-wire	(Ex)
3 1x Pt100 4-wire	(Ex)
4 2x Pt100 3-wire	(Ex)
5 2x Pt100 4-wire	(Ex)
8 1x 3-wire + SmartSense	

A 1x Thermocouple Type J	(Ex)
B 1x Thermocouple Type K	(Ex)
D 2x Thermocouple Type J	(Ex)
E 2x Thermocouple Type K	(Ex)

5. TOLERANCE CLASS

1 Class B	Mi, TF
2 Class A	Mi, TF

3 Class A	Mi, TF, vibration-proof
4 Class A	Mi, WW
5 1/3 DIN B	Mi, TF
7 1/10 DIN B	Mi, WW
A Class 1	Mi, Thermocouple

8. PROCESS CONNECTION

B Flange	DN25/PN40 (DIN)
D Flange	DN50/PN40 (DIN)
H Flange	ASME 1"
K Flange	ASME 1 1/2"
L Flange	ASME 2"

9. PRESSURE RATING

1 PN 40 Form B1	
A ASME 150 lb.	RF
B ASME 300 lb.	RF
C ASME 600 lb.	RF
F ASME 300 lb.	RTJ
G ASME 600 lb.	RTJ

10. FLANGE

1 Double side welded, 3 mm	
2 Double side welded, 6 mm	
4 Full penetration welding	
A Threaded, 1/2" NPT	
B Threaded, 3/4" NPT	

12. NECK TUBE CONNECTION

3 G 1/2	
6 1/2" NPT	

*Temperature range can be extended with other materials in the thermowell.

Temperature assembly with process flange Reduced barstock thermowell

Application

For temperature measurement in gases and fluids, in pipes and tanks at high pressure and high flow. Adapted according to ASME B16.5 standard. Mounted in a barstock thermowell with reduced tip to be bolted on a ASME 1 to 2" flange.

Temperature assembly

Material in Stainless steel, 1.4404 or equivalent approved material.
Available with a standard tube with NPT (NN) or with an union neck tube (NUN).

Measuring insert

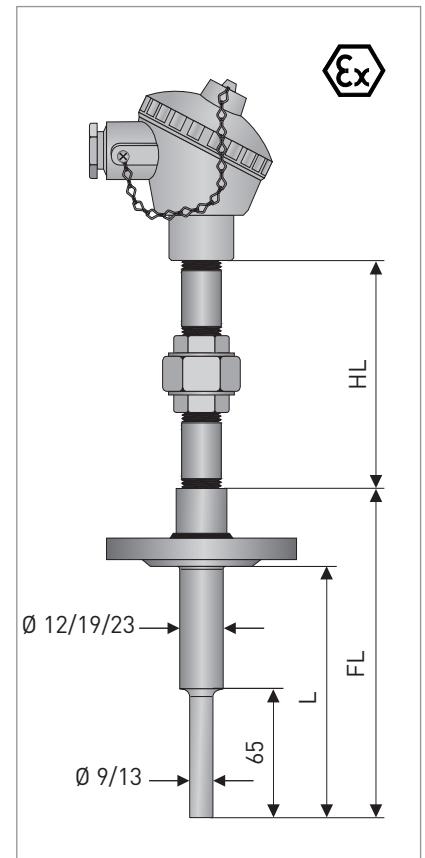
Replaceable measuring insert in stainless steel $D = \varnothing 6$ mm.
For detailed information about the measuring insert see TR/TC 100.

Approvals

The temperature assembly is available with ATEX approval (with some limitations in the ordering options). For more information about the options see the list below.

Process temperature	TRA	-200...+600 °C
	TCA	-40...+600 °C*

Protection class See section connection heads on page 117.



Dimensions in mm

For detailed dimensions see chapter
"Dimensions for temperature assemblies"

**Ordering code
for TRA-TF57 with
standard settings**

V	T	S	3	0	7	0	K	3	1	3	C	K	A	1	5	6	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 58.

1. TYPE

7 Resistance sensor	TRA-TF57
N Thermocouple	TCA-TF57

2. APPROVALS

0 Without	
1 ATEX II 1G Ex ia IIC T6 Ga	
3 ATEX II 1/2G Ex ia IIC T6 Ga/Gb	

4. MEASURING INSERT

0 Without	
2 1x Pt100 3-wire	(Ex)
3 1x Pt100 4-wire	(Ex)
4 2x Pt100 3-wire	(Ex)
5 2x Pt100 4-wire	(Ex)
8 1x 3-wire + SmartSense	
A 1x Thermocouple Type J	(Ex)
B 1x Thermocouple Type K	(Ex)
D 2x Thermocouple Type J	(Ex)
E 2x Thermocouple Type K	(Ex)

5. TOLERANCE CLASS

1 Class B	Mi, TF
2 Class A	Mi, TF
3 Class A	Mi, TF, vibration-proof

4 Class A	Mi, WW
5 1/3 DIN B	Mi, TF
7 1/10 DIN B	Mi, WW
A Class 1	Mi, Thermocouple

7. THERMOWELL DIAMETER (Ø)

4 12 mm	0.47"
C 19 mm	0.75"
G 23 mm	0.91"

8. PROCESS CONNECTION

B Flange	DN25/PN40	(DIN)
D Flange	DN50/PN40	(DIN)
H Flange	ASME 1"	
K Flange	ASME 1 1/2"	
L Flange	ASME 2"	

9. PRESSURE RATING

1 PN 40 Form B1	
A ASME 150 lb. RF	
B ASME 300 lb. RF	
C ASME 600 lb. RF	
F ASME 300 lb. RTJ	
G ASME 600 lb. RTJ	

10. FLANGE

1 Double side welded, 3 mm	
2 Double side welded, 6 mm	
4 Full penetration welding	
A Threaded, 1/2" NPT	
B Threaded, 3/4" NPT	

12. NECK TUBE CONNECTION

3 G 1/2	
6 1/2" NPT	

*Temperature range can be extended with other materials in the thermowell.

Temperature assembly for weld-in Straight barstock thermowell

Application

For temperature measurement in gases and fluids, in pipes and tanks at high pressure and high flow. Adapted according to ASME B16.5 standard. Mounted in a straight barstock thermowell for weld-in.

Temperature assembly

Material in Stainless steel, 1.4404 or equivalent approved material.
Available with a standard tube with NPT (NN) or with an union neck tube (NUN).

Measuring insert

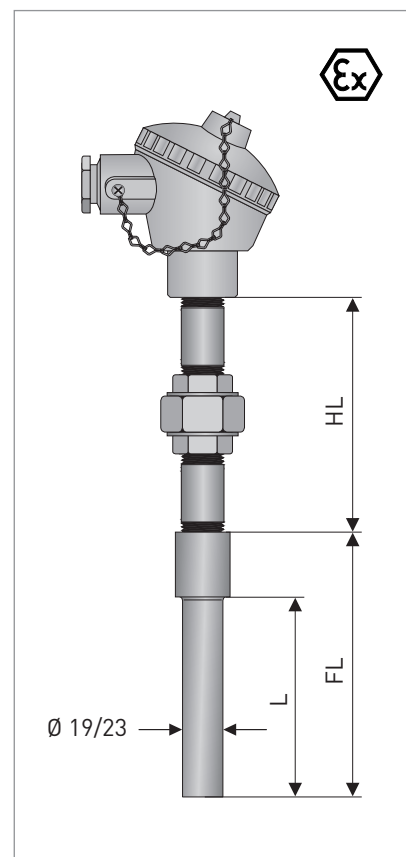
Replaceable measuring insert in stainless steel $D = \varnothing 6$ mm.
For detailed information about the measuring insert see TR/TC 100.

Approvals

The temperature assembly is available with ATEX approval (with some limitations in the ordering options). For more information about the options see the list below.

Process temperature	TRA	-200...+600 °C
	TCA	-40...+600 °C*

Protection class See section connection heads on page 117.



Dimensions in mm

For detailed dimensions see chapter
"Dimensions for temperature assemblies"

Ordering code for TRA-TW58 with standard settings

V	T	S	3	0	8	0	K	3	1	3	C	0	0	0	5	6	2	0	1	0	0	0	0	0	0	0	0	0	0

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 58.

1. TYPE

8 Resistance sensor	TRA-TW58
P Thermocouple	TCA-TW58

2. APPROVALS

0 Without	
1 ATEX II 1G Ex ia IIC T6 Ga	
3 ATEX II 1/2G Ex ia IIC T6 Ga/Gb	

4. MEASURING INSERT

0 Without	
2 1x Pt100 3-wire	(Ex)
3 1x Pt100 4-wire	(Ex)
4 2x Pt100 3-wire	(Ex)
5 2x Pt100 4-wire	(Ex)
8 1x 3-wire + SmartSense	
A 1x Thermocouple Type J	(Ex)
B 1x Thermocouple Type K	(Ex)
D 2x Thermocouple Type J	(Ex)
E 2x Thermocouple Type K	(Ex)

5. TOLERANCE CLASS

1 Class B	Mi, TF
2 Class A	Mi, TF
3 Class A	Mi, TF, vibration-proof
4 Class A	Mi, WW
5 1/3 DIN B	Mi, TF
7 1/10 DIN B	Mi, WW
A Class 1	Mi, Thermocouple

6. THERMOWELL MATERIAL

1 1.4571 / 316Ti	up to 600 °C
3 1.4404 / 316 L	up to 600 °C

7. THERMOWELL DIAMETER (Ø)

C 19 mm	0.75"
G 23 mm	0.91"

8. PROCESS CONNECTION

0 Without	
V Weld-in variant Ø 26.7 mm	
W Weld-in variant Ø 33.4 mm	

12. NECK TUBE CONNECTION

3 G 1/2	
6 1/2" NPT	

*Temperature range can be extended with other materials in the thermowell.

1. Type	version	TRA/TCA-S50	TRA/TCA-TS52	TRA/TCA-TS53	TRA/TCA-TS54	TRA/TCA-TF55
0	TRA-S 50	Screw-in with neck tube, without thermowell				
2	TRA-TS 52	Screw-in with neck tube, straight thermowell				
3	TRA-TS 53	Screw-in with neck tube, conical thermowell				
4	TRA-TS 54	Screw-in with neck tube, reduced thermowell				
5	TRA-TF 55	Flange with neck tube, straight thermowell				
6	TRA-TF 56	Flange with neck tube, conical thermowell				
7	TRA-TF 57	Flange with neck tube, reduced thermowell				
8	TRA-TW 58	Weld-in with neck tube, straight thermowell				
A	TRA-TW 59	Weld-in with neck tube, conical thermowell				
E	TCA-S 50	Screw-in with neck tube, without thermowell				
G	TCA-TS 52	Screw-in with neck tube, straight thermowell				
H	TCA-TS 53	Screw-in with neck tube, conical thermowell				
K	TCA-TS 54	Screw-in with neck tube, reduced thermowell				
L	TCA-TF 55	Flange with neck tube, straight thermowell				
M	TCA-TF 56	Flange with neck tube, conical thermowell				
N	TCA-TF 57	Flange with neck tube, reduced thermowell				
P	TCA-TW 58	Weld-in with neck tube, straight thermowell				
R	TCA-TW 59	Weld-in with neck tube, conical thermowell				
2. Approvals						
0* without						
1 ATEX II 1G Ex ia IIC T6 Ga / II 1D Ex ia IIIC T145°C Da IP65						
2 ATEX II 1G Ex ia IIC T6 Ga / II 1D Ex ia IIIC Txxx°C Da IP65 TC xxx=146°C, RTD WW xxx=175°C, RTD TF xxx=185°C						
3 ATEX II 1/2G Ex ia IIC T6 Ga/Gb / 1D Ex ia IIIC T145°C Da IP65						
3. Connection head						
conduit thread - neck pipe thread						
1	BA	M20 x 1.5 M24, AI	IP 65			
2	BUZ-S	hinged cover (snap)	M20 x 1.5 M24, AI	IP 65		
3	BUZ-T	hinged cover	M20 x 1.5 M24, AI	IP 65 [Ex]		
4	BGK	screw cover	M20 x 1.5 M24, AI	IP 67		
5	BUZ-H	heightened cover	M20 x 1.5 M24, AI	IP 65 [Ex]		
6	BUZ-HW	cover with display	M20 x 1.5 M24, AI	IP 65		
7	BBK	screw cover	M20 x 1.5 M24, PA	IP 54		
8	BVA	screw cover	M20 x 1.5 M24, SS	IP 65		
A	AXD	screw cover	M20 x 1.5 M24, AI	IP 68 [Ex]		
B	BUZ-HK	heightened cover	M20 x 1.5 M24, PA	IP 54 [Ex]		
C	SXD	screw cover	M20 x 1.5 M24, SS	IP 68 [Ex]		
Connection head						
cable gland thread - neck pipe thread						
E	BUZ-T	heightened cover	1/2" NPT - 1/2" NPT, AI	IP 65 [Ex]		
F	BGK	screw cover	1/2" NPT - 1/2" NPT, AI	IP 67		
G	BUZ-H	heightened cover	1/2" NPT - 1/2" NPT, AI	IP 65 [Ex]		
H	BUZ-HW	cover with display	1/2" NPT - 1/2" NPT, AI	IP 65		
K	AXD	screw cover	1/2" NPT - 1/2" NPT, AI	IP 68 [Ex]		
L	SXD	screw cover	1/2" NPT - 1/2" NPT, SS	IP 68 [Ex]		
P	AXD-W	screw cover	M20 x 1.5 M24, AI	IP 68 [Ex]		
R	SXD-W	screw cover	M20 x 1.5 M24, SS	IP 68 [Ex]		
S	AXD-W	screw cover	1/2" NPT - 1/2" NPT, AI	IP 68 [Ex]		
T	SXD-W	screw cover	1/2" NPT - 1/2" NPT, SS	IP 68 [Ex]		
4. Measuring insert = sensor / wiring						
Measuring insert = sensor / wiring						
2	1x Pt100	3-wire	[Ex]			
3*	1x Pt100	4-wire	[Ex]			
4	2x Pt100	3-wire	(CI.A, WW)	[Ex]		
5	2x Pt100	4-wire	(CI.A, WW)	[Ex]		
8	1x 3-wire	+ Smart Sense				
5. Measuring insert / tolerance class						
1*	CI. B	Mi, TF	(tolerance class -70...+500°C)	[Ex]		
2	CI. A	Mi, TF	(tolerance class -50...+300°C)	[Ex]		
3	CI. A, vibration-proof	Mi, TF	(tolerance class -20...+200°C)	[Ex]		
4	CI. A	Mi, WW	(tolerance class -200...+600°C)	[Ex]		
5	1/3 DIN B	Mi, TF	(tolerance class 0...+150°C)	[Ex]		
7	1/10 DIN B	Mi, WW	(tolerance class at 0°C)	[Ex]		
A	CI.1	Mi, Thermocouple		[Ex]		
6. Thermowell material						
0* without						
1	1.4571 / 316Ti		to 600°C			
3*	1.4404 / 316 L		to 600°C			
7. Thermowell diameter						
0* without						
4	12 mm	0,47 "	(57)			
8*	16 mm	0,63 "	(52-54)			
C	19 mm	0,75 "	(53-55, 57-59)			
8. Process connection						
0* without						
1	G 1/2 A		(52-54)			
2	G 3/4 A		(52-54)			
3	G 1 A		(52-54)			
5*	1/2" NPT		(52-54)			
6	3/4" NPT		(52-54)			
B	Flange	DN25/PN40 (DIN)	(55-57)			
9. Pressure rating						
0* Screw-in/Weld-in variant						
1	PN 40 Form B1		(55-57)			
A	ASME 150 lb.	RF	(55-57)			
B	ASME 300 lb.	RF	(55-57)			
10. Flange - well connection						
0* without						
1	double side welded, 3 mm		(55-57)			
11. Immersion length						
2 100 mm, 3,9 "						
3 150 mm, 5,9 "						
4 200 mm, 7,9 "						
5* 250 mm, 9,8 "						
12. Neck tube connection - thermowell						
6* 1/2" NPT - 1/2" NPT						
3 G 1/2 - M24 x 1,5 mm						

4 = extended standard selection

[illegible]

Temperature assembly for screw-in Welded multipart thermowell, form 3G

Application

For temperature measurement in gases and fluids, in pipes and tanks at medium pressure and medium flow. Tapered tip in accordance with NAMUR. Mounted either by direct screw-in to the goods or by a welding sleeve. See section "Accessories".

Temperature assembly

Material in Stainless steel, 1.4571 material, 12 mm.
Reduced tip to Ø 9 mm for fast response time.

Measuring insert

Replaceable measuring insert type TR/TC 100 in stainless steel D = Ø 6 mm.
Insert length = L + HL + 10 mm. For detailed information about the measuring insert
see TR/TC 100.

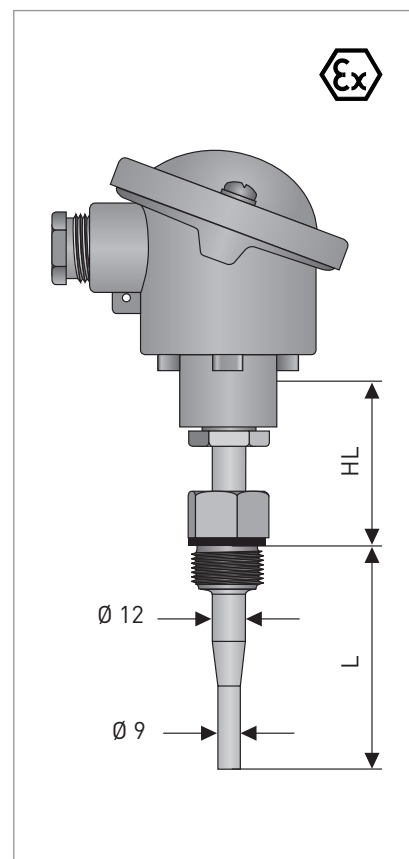
Approvals

The temperature assembly is available with ATEX approval (with some limitations in the ordering options). For more information about the options see the list below.

Process temperature	TRA	-200...+600 °C
	TCA	-40...+600 °C*

Protection class See section connection heads on page 117.

Response time	Type	Water 0.4 m/s	
		t 0.5	t 0.9
	TRA-S41, Ø 12	12 s	30 s
	TCA-S41, Ø 12	10 s	24 s



Dimensions in mm

For detailed dimensions see chapter
"Dimensions for temperature assemblies"

Ordering code
for TRA-S41 with
standard settings

V T S 4 0 2 0 1 3 2 1 4 1 0 2 4 1 0 0 0 0 0 0 0 0 0

1 2 4 5 8

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 63.

1. TYPE		
2	Resistance sensor	TRA-S41
B	Thermocouple	TCA-S41

2. APPROVALS

0	Without
1	ATEX II 1G Ex ia IIC T6 Ga
3	ATEX II 1/2G Ex ia IIC T6 Ga/Gb

4. MEASURING INSERT

0	Without	
2	1x Pt100 3-wire	(Ex)
3	1x Pt100 4-wire	(Ex)
4	2x Pt100 3-wire	(Ex)
5	2x Pt100 4-wire	(Ex)
8	1x Pt100 3-wire + SmartSense	
A	1x Thermocouple Type J	(Ex)

B	1x Thermocouple Type K	(Ex)
D	2x Thermocouple Type J	(Ex)
E	2x Thermocouple Type K	(Ex)

5. TOLERANCE CLASS

1	Class B	Mi, TF
2	Class A	Mi, TF
3	Class A	Mi, TF vibration-proof
4	Class A	Mi, WW
5	1/3 DIN B	Mi, TF
7	1/10 DIN B	Mi, WW
A	Class 1	Mi, Thermocouple

8. PROCESS CONNECTION

1	G 1/2 A
2	G 3/4 A
3	G 1 A
5	1/2" NPT
6	3/4" NPT

*Temperature range can be extended with other materials in the thermowell.

Temperature assembly with process flange
Welded multipart thermowell, form 3F

Application

For temperature measurement in gases and fluids, in pipes and tanks at medium pressure and medium flow. Tapered tip in accordance with NAMUR. Mounted with bolts on flange DN25 or DN50.

Temperature assembly

Material in Stainless steel, 1.4571 material, 12 mm.
Reduced tip to Ø 9 mm for fast response time.

Measuring insert

Replaceable measuring insert type TR/TC 100 in stainless steel D = Ø 6 mm.
Insert length = L + HL + 10 mm. For detailed information about the measuring insert
see TR/TC 100.

Approvals

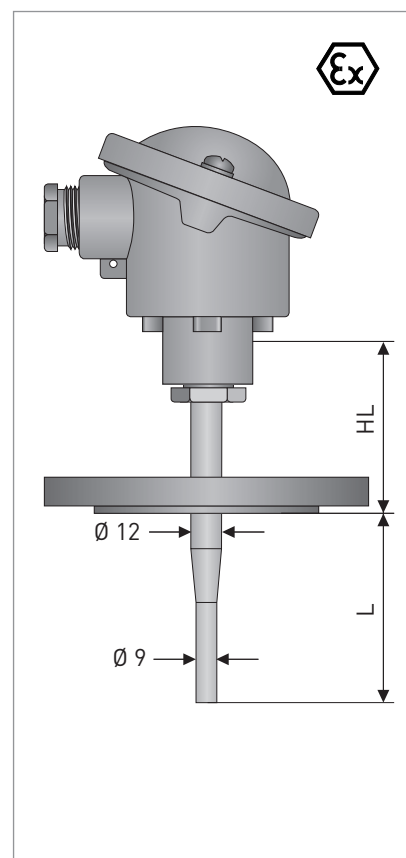
The temperature assembly is available with ATEX approval (with some limitations in the ordering options). For more information about the options see the list below

Process temperature	TRA	-200...+600 °C
	TCA	-40...+600 °C*

Protection class

See section connection heads on page 117.

Response time	Type	Water 0.4 m/s	
		t 0.5	t 0.9
	TRA-F42, Ø 12	12 s	30 s
	TCA-F42, Ø 12	10 s	24 s



Dimensions in mm

For detailed dimensions see chapter
"Dimensions for temperature assemblies"

Ordering code
for TRA-F42 with
standard settings

V T S 4 0 3 0 1 3 2 1 4 B 1 2 2 1 0 0 0 0 0 0 0 0 0 0

1 2 4 5 8 9

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 63.

1. TYPE

3	Resistance sensor	TRA-F42
C	Thermocouple	TCA-F42

2. APPROVALS

0	Without
1	ATEX II 1G Ex ia IIC T6 Ga
3	ATEX II 1/2G Ex ia IIC T6 Ga/Gb

4. MEASURING INSERT

0	Without	
2	1x Pt100 3-wire	(Ex)
3	1x Pt100 4-wire	(Ex)
4	2x Pt100 3-wire	(Ex)
5	2x Pt100 4-wire	(Ex)
8	1x Pt100 3-wire + SmartSense	
A	1x Thermocouple Type J	(Ex)
B	1x Thermocouple Type K	(Ex)
2	2x Thermocouple Type J	(Ex)
E	2x Thermocouple Type K	(Ex)

5. TOLERANCE CLASS

0	Without	
1	Class B	Mi, TF
2	Class A	Mi, TF
3	Class A	Mi, TF vibration-proof
4	Class A	Mi, WW
5	1/3 DIN B	Mi, TF
7	1/10 DIN B	Mi, WW
A	Class 1	Mi, Thermocouple

8. PROCESS CONNECTION

B Flange	DN25
D Flange	DN50
H Flange	ASME 1"
L Flange	ASME 1 1/2"

9. PRESSURE RANGE

1 PN 40 Form B1	
A 150 lbs	RF
B 300 lbs	RF

*Temperature range can be extended with other materials in the thermowell.

VTS4	0	1. Type	version	TRA/TCA-P40	TRA/TCA-S41	TRA/TCA-F42
		1 TRA-P 40	"plug-in" [Ex]			
		2* TRA-S 41	"screw-in + neck tube length" [Ex]			
		3 TRA-F 42	"flange + neck tube length" [Ex]			
		A TCA-P 40	"plug-in" [Ex]			
		B TCA-P 41	"screw-in + neck tube length" [Ex]			
		C TCA-P 42	"flange + neck tube length" [Ex]			
		2. Approvals				
		0* without				
		1 ATEX II 1G Ex ia IIC T6 Ga / II 1D Ex ia IIIC T145°C Da IP65	(40-42)			
		3 ATEX II 1/2G Ex ia IIC T6 Ga/Gb / 1D Ex ia IIIC T145°C Da IP65	(40-42)			
		3. Connection heads				
		1* BA	Alu, M20 x 1.5, IP 65			
		2 BUZ-S (snap)	hinged cover Alu, M20 x 1.5, IP 65			
		3 BUZ-T (screw)	hinged cover Alu, M20 x 1.5, IP 65 [Ex]			
		4 BGK	screw cover Alu, M20 x 1.5, IP 67			
		5 BUZ-H	heightened cover Alu, M20 x 1.5, IP 65 [Ex]			
		6 BUZ-HW	with display Alu, M20 x 1.5, IP 65			
		7 BBK	screw cover PA, M20 x 1.5, IP 54			
		8 BVA	screw cover SS, M20 x 1.5, IP 65			
		B BUZ-HK	hinged cover PA, M20 x 1.5, IP 54 [Ex]			
		4. Measuring insert = sensor / wiring				
		0 without				
		2 1x Pt100 3-wire	[Ex]			
		3* 1x Pt100 4-wire	[Ex]			
		4 2x Pt100 3-wire	(Cl.A, WW) [Ex]			
		5 2x Pt100 4-wire	(Cl.A, WW) [Ex]			
		5. Measuring insert / tolerance class				
		0 without				
		1* Cl. B	Mi, TF (tolerance class -70...+500°C) [Ex]			
		2 Cl. A	Mi, TF (tolerance class -50...+300°C) [Ex]			
		3 Cl. A, vibration-proof	Mi, TF (tolerance class -20...+200°C) [Ex]			
		4 Cl. A	Mi, WW (tolerance class -200...+600°C) [Ex]			
		5 1/3 DIN B	Mi, TF (tolerance class 0...+150°C) [Ex]			
		7 1/10 DIN B	Mi, WW (tolerance class at 0°C) [Ex]			
		A Cl.1	Mi, Thermocouple [Ex]			
		6. Thermowell material				
		1* 1.4571 316Ti (600°C)				
		7. Thermowell diameter				
		4* 12 x 2.5 mm				
		8. Process connection	type			
		0 without	(40)			
		1* G 1/2 A	(41)			
		2 G 3/4 A	(41)			
		3 G 1 A	(41)			
		5 1/2" NPT	(41)			
		6 3/4" NPT	(41)			
		B Flange DN25	(42) EN 1092-1			
		D Flange DN50	(42) EN 1092-1			
		9. Pressure rating	type			
		0* without	(40-41)			
		1 PN 40 Form B1	(42)			
		10. Immersion length (U1/L)				
		0 without				
		1 160 mm				
		2* 220 mm				
		3 225 mm				
		4 280 mm (max.41)				
		5 285 mm				
		11. Neck tube length				
		0 without				
		1 80 mm (Std. length 42)				
		2 82 mm				
		3* 145 mm (Std. length 41)				
		4 147 mm				
		A 70 mm				
		B 90 mm				
		C 100 mm				
		D 110 mm				
		E 120 mm				
		12. Type of connection / head mounted transmitter				
		0 with flying leads for transmitter mounting				
		1 Standard version with ceramic terminal block				
		2 with head mounted transmitter TT 10 C	analog [Ex]			
		3 with head mounted transmitter TT 11 C	analog, 0-10V			
		5 with head mounted transmitter TT 20 C	analog, programmable			
		6 with head mounted transmitter TT 21 C	digital, programmable			
		7* with head mounted transmitter TT 30 C	digital, standard [Ex]			
		A with head mounted transmitter TT 40 C	digital, precise			
		D with head mounted transmitter TT 50 C	digital, HART [Ex]			
		E with head mounted transmitter TT 51 C	digital, HART/SIL2 [Ex]			
		F with head mounted transmitter TT 60 C	digital, Profibus [Ex]			
		13. Type of connection / rail mounted transmitter				
		0* without				
		1 with rail mounted transmitter TT 10 R	analog			
		2 with rail mounted transmitter TT 11 R	analog, 0-10 V, only Pt100			
		5 with rail mounted transmitter TT 21 R	digital, without galvanic isolation			
		6 with rail mounted transmitter TT 30 R	digital, standard [Ex]			
		7 with rail mounted transmitter TT 31 R	1 channel [Ex]			
		8 with rail mounted transmitter TT 31 R	2 channel [Ex]			
		A with rail mounted transmitter TT 32 R	90 - 250 VAC			
		B with rail mounted transmitter TT 32 R	20 - 30 VDC			
		D with rail mounted transmitter TT 40 R	digital, precise			
		G with rail mounted transmitter TT 50 R	digital, HART			
		H with rail mounted transmitter TT 51 R	digital, HART/SIL2 [Ex]			
		K with rail mounted transmitter TT 60 R	digital, Profibus-PA			

4 = extended standard selection

* *Standard*

4 = extended standard selection

Spring-loaded measuring inserts

Application

Normally, with a diameter of 6 mm, but for reduced thermowell 3 mm.

Insert assembly

Flexible stainless steel MI-cable with laser welded bottom plug. The options for electrical connection are isolated flying wires, ceramic connection block or head-mounted transmitter. Spring loaded design.

Vibration proof

Type tested according to IEC 60751 but with acceleration increased to 10 g in 150 hours. Max temperature range 0...200 °C.

Installation limits

Bend radius min 3 x cable diameter and not closer then 50 mm from the tip.

Approvals

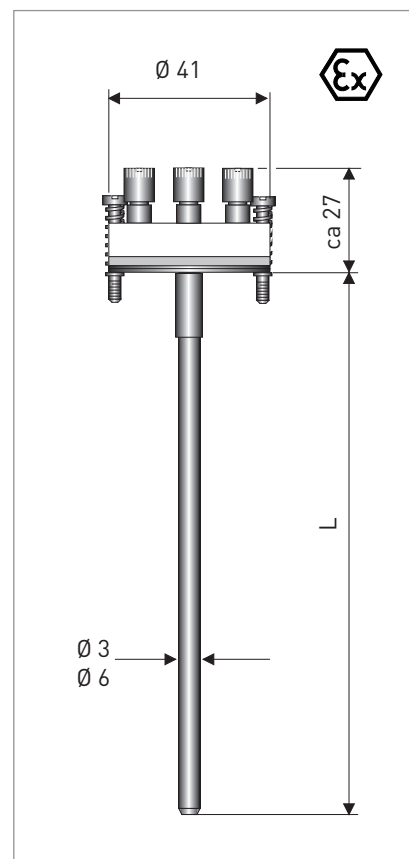
The measuring insert is available with ATEX approval (with some limitations in the ordering options). For more information about the options see the list below.

Process temperature

TRA	-200...+600 °C (Standard, class A)
TCA	max. +1150 °C (AISI310, typ K)

Response time

Type	Water 0.4 m/s	
	t 0.5	t 0.9
TR 100, Ø 3	2 s	5 s
TR 100, Ø 6	3.5 s	8 s
TC 100, Ø 3	1 s	2.5 s
TC 100, Ø 6	2.5 s	7 s



Dimensions in mm

Ordering code for TR 100 with standard settings

V	T	S	9	0	R	0	6	3	1	7	1	0	0	0	0	0	0

This is a selection of the options available for this measuring insert. For the complete ordering code see page 66.

1. TYPE	3. INSERT DIAMETER	5. TOLERANCE CLASS	6. INSERTS LENGTH
C Thermocouple TC 100	3 3 mm	1 Class B Mi, TF	1 120 mm
R Resistance sensor TR 100	6 6 mm (Ex)	2 Class A Mi, TF	2 145 mm
	8 8 mm	3 Class A Mi, TF vibration-proof	3 160 mm
		4 Class A Mi, WW	4 205 mm
		5 1/3 DIN B Mi, TF	5 255 mm
		7 1/10 DIN B Mi, WW	6 275 mm
		A Class 1 Mi, Thermocouple	7 315 mm
		Type J -40...750 °C	8 345 mm
		Type K -40...1000 °C	A 375 mm
			B 405 mm
			C 435 mm
			D 525 mm
			E 555 mm
			F 585 mm
			G 655 mm
			H 735 mm
			Z Customized length

2. APPROVALS	4. SENSOR/WIRING
0 Without	2 1x Pt100 3-wire (Ex)
1 ATEX II 1G Ex ia IIC T6 Ga	3 1x Pt100 4-wire (Ex)
	4 2x Pt100 3-wire (Ex)
	5 2x Pt100 4-wire (Ex)
	6 2x Pt100 2-wire (Ex)
	8 1x 3-wire + SmartSense
	A 1x Thermocouple Type J (Ex)
	B 1x Thermocouple Type K (Ex)
	D 2x Thermocouple Type J (Ex)
	E 2x Thermocouple Type K (Ex)

COMPLETE ORDERING CODE

VT99	0	1. Type		
		C	TC100: Thermocouple measuring inserts	
		R*	TR100: Pt100-measuring inserts	
		2. Approvals		
		0*	without	
		1	ATEX II 1G Ex ia IIC T6 Ga	
		3. Measuring inserts diameter		
		3	3 mm	
		6*	6 mm [Ex]	
		8	8 mm	
		4. Sensor / wiring		
		2	1x Pt100 3-wire [Ex]	A 1x Thermocouple Type J (Fe-CuNi) [Ex]
		3*	1x Pt100 4-wire [Ex]	B 1x Thermocouple Type K (NiCr-Ni) [Ex]
		4	2x Pt100 3-wire (Cl.A, WW) (only Ø 6 mm) [Ex]	D 2x Thermocouple Type J (Fe-CuNi) [Ex]
		5	2x Pt100 4-wire (Cl.A, WW) (only Ø 6 mm) [Ex]	E 2x Thermocouple Type K (NiCr-Ni) [Ex]
		8	1x 3-wire + Smart Sense (only Ø 6 mm)	
		5. Measuring insert / tolerance class		
		1*	Cl. B; Mi, TF (tolerance class -70...+500°C) [Ex]	
		2	Cl. A; Mi, TF (tolerance class -50...+300°C) [Ex]	
		3	Cl. A; vibration-proof; Mi, TF (tolerance class -20...+200°C) [Ex]	
		4	Cl. A; Mi, WW (tolerance class -200...+600°C) [Ex]	
		5	1/3 DIN B; Mi, TF (tolerance class 0...+150°C) [Ex]	
		7	1/10 DIN B; Mi, WW (tolerance class at 0°C) [Ex]	
		A	Cl. 1; Mi, Thermocouple [Ex]	
		6. Measuring inserts length		
		1	120 mm	B 405 mm
		2	145 mm	C 435 mm
		3	160 mm	D 525 mm
		4	205 mm	E 555 mm
		5	255 mm	F 585 mm
		6	275 mm	G 655 mm
		7*	315 mm	H 735 mm
		8	345 mm	Z customized length
		A	375 mm	
		7. Type of connection / head mounted transmitter		
		0	with flying leads for transmitter mounting	
		1*	Standard version with ceramic terminal block	
		2	with head mounted transmitter TT 10 C analog [Ex]	
		3	with head mounted transmitter TT 11 C analog, 0-10V	
		5	with head mounted transmitter TT 20 C analog, programmable	
		6	with head mounted transmitter TT 21 C digital, programmable	
		7	with head mounted transmitter TT 30 C digital, standard [Ex]	
		A	with head mounted transmitter TT 40 C digital, precise	
		D	with head mounted transmitter TT 50 C digital, HART [Ex]	
		E	with head mounted transmitter TT 51 C digital, HART, SIL 2 [Ex]	
		F	with head mounted transmitter TT 60 C digital, PROFIBUS [Ex]	
		8. Measuring range		
		0*	factory default	6* 0...+100°C
		1	customized	7 0...+150°C
		2	-50...+50°C	8 0...+200°C
		3	-50...+100°C	A 0...+250°C
		4	-50...+150°C	B 0...+300°C
		5	0...+50°C	C 0...+350°C
				D 0...+400°C
				E 0...+450°C
				F 0...+500°C
				G 0...+600°C
				H 0...+800°C
				K 0...+1000°C
		9. Calibration report		
		0*	without	
		1	1 sensor, room temperature (single- or double-sensor)	
		2	2 points: 0% and 100% (single-sensor)	
		3	2 points: 0% and 100% (double-sensor)	
		4	3 points: 0%, 50% and 100% (single-sensor)	
		5	3 points: 0%, 50% and 100% (double-sensor)	
		6	acc. to customer (single-sensor)	
		7	acc. to customer (double-sensor)	
		A	2 points: 0% and 100% (single-sensor & transmitter)	
		B	3 points: 0%, 50% and 100 % (single-sensor & transmitter)	
		C	5 points: 0%, 25%, 50%, 75%, 100% (single-sensor & transmitter)	
		E	2 points: 0% and 100 % (single-sensor & transmitter) incl. adjustment	
		F	3 points: 0%, 50% and 100% (single-sensor & transmitter) incl. adjustment	
		G	5 points: 0%, 25%, 50%, 75%, 100% (single-sensor & transmitter) incl. adjustment	
		H	acc. to customer (single-sensor & transmitter) incl. adjustment	
		10. Operating instructions		
		0*	without	
		1	German	
		3	English	
		4	French	
		5	Spanish	
		7	Italian	
		G	German/English	
		11. Marking		
		0*	without	
		1	Stainless steel tag plate (40 x 20 mm)	
		2	Stainless steel tag plate (120 x 46 mm)	
		6	PVF- tag plate (45 x 15 mm)	
		A	Cardboard tag plate (95 x 45 mm)	
		B	Stainless and cardboard tag plate (40 x 20 mm)	
		C	Stainless and cardboard tag plate (120 x 46 mm)	
		12. Private Label		
		0*	standard version	
		13. Version		
		0*	without	
		1	SIL2, EU- Manufacturer's declaration [TT51]	
VT99	0			Order code

* Standard

High temperature assembly for plug-in
Metal, welded multipart thermowell, $t \leq 1150\text{ °C}$

Application

For measuring high temperature in low pressurized applications up to 1 bar, in pipes, stacks and ducts for flue and combustion gas measurements up to 1150 °C. Mounted with either sliding flange according to DIN EN 50446 or with gas-tight compression fitting. See section "Accessories".

Temperature assembly

Thermowell diameter Ø 15 x 1.5 mm in Kanthal AF /1.4767, Ø 15 x 2 mm.
For more information about the materials performance see page 18.

Measuring insert

Replaceable measuring insert type TC 100 in Inconel 600 / 2.4816, Ø 6 mm. Isolated measuring point. Insert length = 25 mm + L. Measuring insert type J or type K. For detailed information about the measuring insert see TR/TC 100.

Process temperature

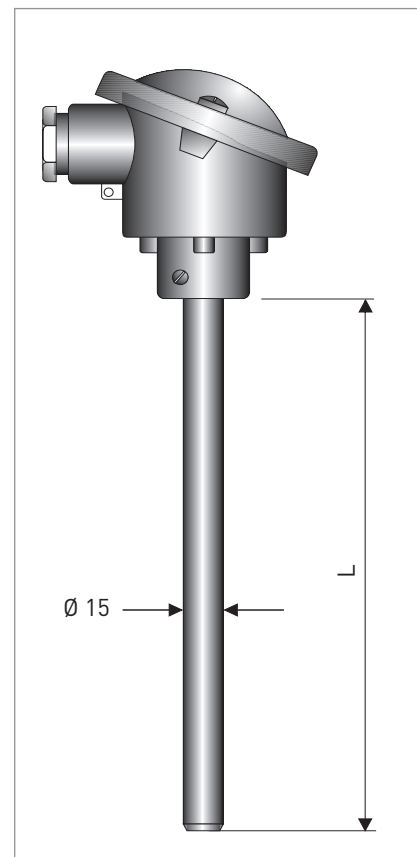
	J	K
Kanthal AF	750 °C	1150 °C

Protection class

See section connection heads on page 117.

Response time

Type	Water 0.4 m/s		Air 1 m/s	
	t 0.5	t 0.9	t 0.5	t 0.9
TCA-P60, Ø 15	36 s	118 s	2.2 min	7.6 min



Dimensions in mm

Ordering code
for TCA-P60 with
standard settings

V T C 1 0 0 0 1 B A 1 1 0 0 5 0 1 0 0 0 0 0 0 0 0 0

3 4 8 10

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 73.

3. CONNECTION HEADS

1	BA	
2	BUZ-T	Hinged cover
3	BUZ-S	Hinged cover

4. MEASURING INSERT

A	1x Thermocouple Type J
B	1x Thermocouple Type K
D	2x Thermocouple Type J
E	2x Thermocouple Type K

8. PROCESS CONNECTION

0	Without
1	Compression fitting G 1/2
2	Compression fitting G 3/4
3	Compression fitting G 1
A	Mounting bracket

10. IMMERSION LENGTH

4	500 mm
5	710 mm
6	1000 mm
7	1400 mm
8	2000 mm
Z	Customized length

High temperature assembly for plug-in
Metal, welded multipart thermowell with barstock tip, t ≤ 1150 °C

Application

For measuring high temperature in low pressurized applications up to 1 bar.
Suitable in pipes, stacks and ducts for flue and combustion gas measurements where the thermowell is exposed to mechanical abrasion. Mounted with either sliding flange according to DIN EN 50446 or with gas-tight compression fitting. See section "Accessories".

Temperature assembly

Material in high temperature steel 253MA / 1.4835, thermowell diameter Ø 21.3 x 2.8 mm. For more information about the materials performance see page 18. Solid measuring tip with inner diameter 7 mm.

Measuring insert

Replaceable measuring insert type TC 100 in Inconel 600 / 2.4816, Ø 6 mm. Isolated measuring point. Insert length = 40 mm + L. Measuring insert type J or type K. For detailed information about the measuring insert see TR/TC 100.

Process temperature

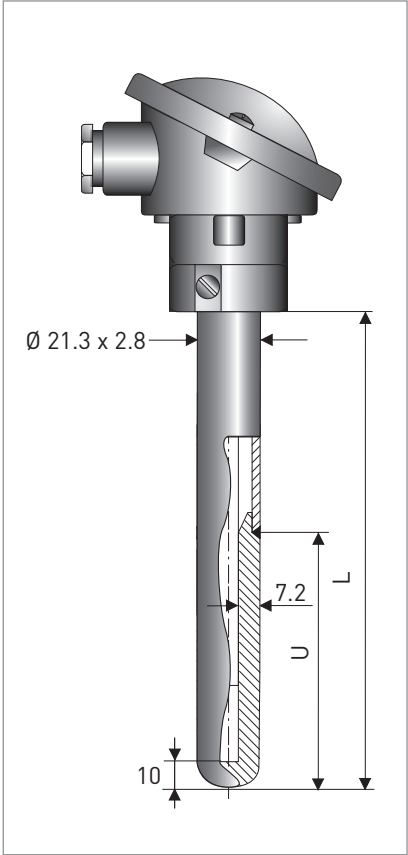
	J	K
253MA	750 °C	1150 °C

Protection class

See section connection heads on page 117.

Response time

Type	Air 1 m/s	
	t 0.5	t 0.9
TCA-P61, Ø 21.3	3 min	10.4 min



Dimensions in mm

Ordering code

V	T	C	1	0	1	0	2	B	A	2	8	0	0	A	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
							3	4			6			8			10												

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 73.

3. CONNECTION HEADS	
2 BUZ-T	Hinged cover
A AA	

4. MEASURING INSERT	
A	1x Thermocouple Type J
B	1x Thermocouple Type K
D	2x Thermocouple Type J
E	2x Thermocouple Type K

6. THERMOWELL MATERIAL	
2	1.4835 / 253 MA

8. PROCESS CONNECTION	
0	Without
3	Compression fitting G 1
A	Mounting bracket

10. IMMERSION LENGTH		
A	710 mm	L/U (U=200)
B	1000 mm	L/U (U=200)
C	1400 mm	L/U (U=200)
E	710 mm	L/U (U=300)
F	1000 mm	L/U (U=300)
G	1400 mm	L/U (U=300)
L	1000 mm	L/U (U=500)
M	1400 mm	L/U (U=500)
N	2000 mm	L/U (U=500)
Z	Customized length	

High temperature assembly for plug-in
Metal, welded multipart thermowell, $t \leq 1150\text{ }^{\circ}\text{C}$

Application

For measuring high temperature in low pressurized applications up to 1 bar, in pipes, stacks and ducts for flue and combustion gas measurements. Mounted with either sliding flange according to DIN EN 50446 or with gas-tight compression fitting. See section "Accessories".

Temperature assembly

Material in chrome steel / 1.4762, 22 x 2 mm or Kanthal AF / 1.4767, thermowell diameter Ø 19 x 1.3 mm or Ø 22 x 1.3 mm. For more information about the materials performance see page 18.

Measuring insert

Replaceable measuring insert type TC 100 in Inconel 600 / 2.4816, Ø 6 mm. Isolated measuring point. Insert length = 40 mm + L. Measuring insert type J or type K. For detailed information about the measuring insert see TR/TC 100.

Temperature

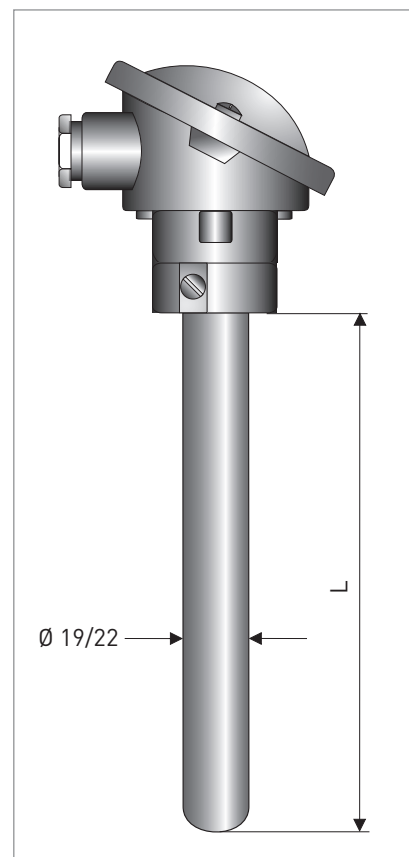
	J	K
Chrome steel	750 °C	1150 °C
Kanthal AF	750 °C	1150 °C

Protection class

See section connection heads on page 117.

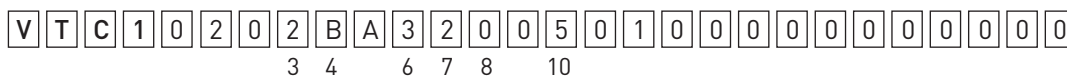
Response time

Type	Air 1 m/s	
	t 0.5	t 0.9
TCA-P62, Ø 19	3 min	10.4 min
TCA-P62, Ø 22	3.2 min	10.6 min



Dimensions in mm

Ordering code
for TCA-P62 with
standard settings



This is a selection of the options available for this temperature assembly. For the complete ordering code see page 73.

3. CONNECTION HEADS

2	BUZ-T	Hinged cover
A	AA	

4. MEASURING INSERT

A	1x Thermocouple Type J
B	1x Thermocouple Type K
D	2x Thermocouple Type J
E	2x Thermocouple Type K

6. THERMOWELL MATERIAL

1	1.4767 Kanthal AF	(Ø 19, 22)
3	1.4762, Chrome steel	(Ø 22)

7. THERMOWELL DIAMETER (Ø)

2	19 x 1.3 mm	(Kanthal)
3	22 x 1.3 mm	(Kanthal)
5	22 x 2 mm	(1.4762)

8. PROCESS CONNECTION

0	Without
2	Compression fitting G 3/4
3	Compression fitting G 1
A	Mounting bracket

10. IMMERSION LENGTH

4	500 mm
5	710 mm
6	1000 mm
7	1400 mm
8	2000 mm
Z	Customized length

High temperature assembly for plug-in
Ceramic thermowell, $t \leq 1600\text{ }^{\circ}\text{C}$

Application

For measurement of high temperatures in gases, ovens, in non-pressurized and low flow applications. Designed with a ceramic tip. Mounted with either sliding flange or with compression fitting. See section "Accessories".

Temperature assembly

Thermowell in ceramic C610 Ø 15 x 2 mm.

Thermowell in ceramic C799 Ø 15 x 2.5 mm.

Support tube in stainless steel Ø 22 x 1.5 mm.

For more information about the materials performance see page 18.

Measuring insert

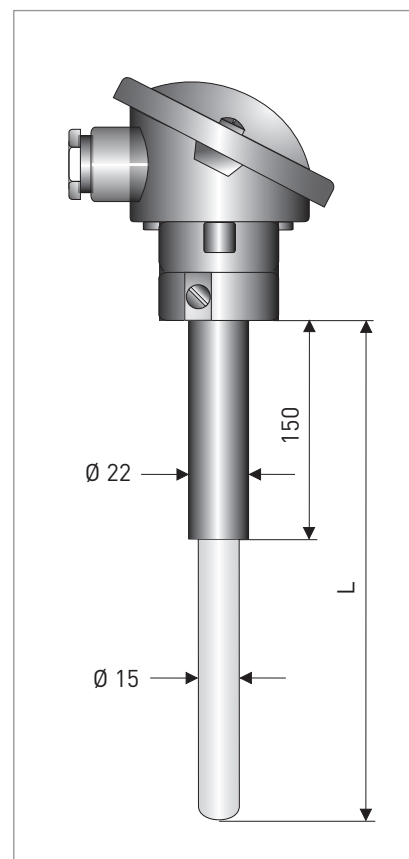
Measuring element type K: Replaceable measuring insert TC 100 in Inconel 600 / 2.4816, Ø 6 mm. Isolated measuring point. Insert length = 40 mm + L. For detailed information about the measuring insert see OPTITEMP TC 100. Measuring element type S: Thermocouples mounted in ceramic isolators. Insert length = 30 mm .

type S: Thermocouples mounted in ceramic isolators. Insert length = 30 mm.

Temperature	K	S (0.35 mm)	S (0.5 mm)
C610	1000 °C	-	-
C799	1000 °C	1380 °C	1600 °C

Protection class

See section connection heads on page 117.



Dimensions in mm

Ordering code
for TCA-P64 with
standard settings

V T C 1 0 B 0 A G A B E 0 0 5 3 1 0 0 0 0 0 0 0 0 0 0 0

3 4 6 7 8 10 11

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 73.

3. CONNECTION HEADS

3	BUZ-T	Hinged cover
A	AA	

4. MEASURING INSERT

B	1x Thermocouple Type K
E	2x Thermocouple Type K
G	1x Thermocouple Type S Ø 0.35 mm
H	1x Thermocouple Type S Ø 0.5 mm
K	2x Thermocouple Type S Ø 0.35 mm
L	2x Thermocouple Type S Ø 0.5 mm

6. THERMOWELL MATERIAL

A	C610 ceramic	(Ø 15)
B	C799 ceramic	(Ø 15)

7. THERMOWELL DIAMETER (\emptyset)

B	15 x 2 mm	(C610)
E	15 x 2.5 mm	(C799)

8. PROCESS CONNECTION

0	Without
3	Compression fitting G 1
A	Mounting bracket

10. IMMERSION LENGTH

4	500 mm
5	710 mm
6	1000 mm
7	1400 mm
8	2000 mm
Z	Customized length

11. SUPPORT TUBE LENGTH

2	150 mm
Z	Customized length

S	200 mm
Z	Customized length

VTC1	0	1. Type	version	TCA-P60	TCA-P61	TCA-P62	TCA-P63	TCA-P64	TCA-P65
	0*	TCA-P 60	plug-in						
	1	TCA-P 61	plug-in						
	2	TCA-P 62	plug-in						
	A	TCA-P 63	plug-in ceramic						
	B	TCA-P 64	plug-in ceramic						
	C	TCA-P 65	plug-in ceramic						
		2. Approvals							
	0*	without							
		3. Connection heads							
	1*	BA	Alu, M20 x 1.5, IP 54						
	2	BUZ-T (screw)	hinged cover Alu, M20 x 1.5, IP 54						
	3	BUZ-S (snap)	hinged cover Alu, M20 x 1.5, IP 54						
	A	AA	Alu, M20 x 1.5, IP 54						
		4. Measuring insert = sensor / wiring							
	A	1x Thermocouple Type J (Fe-CuNi)							
	B*	1x Thermocouple Type K (NiCr-Ni)							
	D	2x Thermocouple Type J (Fe-CuNi)							
	E	2x Thermocouple Type K (NiCr-Ni)							
	G	1x Thermocouple Type S Ø 0.35 mm (RhPt-Pt)							
	H	1x Thermocouple Type S Ø 0.5 mm (RhPt-Pt)							
	K	2x Thermocouple Type S Ø 0.35 mm (RhPt-Pt)							
	L	2x Thermocouple Type S Ø 0.5 mm (RhPt-Pt)							
		5. Measuring insert / tolerance class							
	A*	CL1	Thermocouple						
		6. Thermowell material							
	1*	1.4767, Kanthal AF (Ø 15, 19, 22)							
	2	1.4835, 253Ma (Ø 21,3)							
	3	1.4762, Chrome steel (Ø 22)							
	4	1.4841 (Ø 21,3)							
	A	C610 ceramic (Ø 10, 15)							
	B	C799 ceramic (Ø 10, 15, 24)							
		7. Thermowell diameter							
	1*	15 x 1.3 mm (Kanthal)							
	2	19 x 1.3 mm (Kanthal)							
	3	22 x 1.3 mm (Kanthal)							
	5	22 x 2 mm (1.4762)							
	8	21.3 x 7.2 mm (1.4841 or 1.4835)							
	A	10 x 1.5 mm (C610)							
	B	15 x 2 mm (C610)							
	D	10 x 2 mm (C799)							
	E	15 x 2.5 mm (C799)							
	F	24 x 3/15 x 2.5 mm (C799)							
		8. Process connection							
	0*	without							
	1	Compression fitting G1/2							
	2	Compression fitting G3/4							
	3	Compression fitting G1							
	A	Sliding flange							
		10. Immersion length (U1/L)							
	1	180 mm L							
	2	250 mm L							
	3	355 mm L							
	4	500 mm L							
	5*	710 mm L							
	6	1000 mm L							
	7	1400 mm L							
	8	2000 mm L							
	A	710 mm L/U (U=200)							
		11. Support tube length							
	0	without							
	1	80 mm							
	2*	150 mm							
	3	200 mm							
	Z	customized length							
		12. Type of connection / head mounted transmitter							
	0	with flying leads for transmitter mounting							
	1*	Standard version with ceramic terminal block							
	2	with head mounted transmitter TT 10 C	analog						
	6	with head mounted transmitter TT 21 C	digital, programmable						
	7	with head mounted transmitter TT 30 C	digital, standard						
	A	with head mounted transmitter TT 40 C	digital, precise						
	D	with head mounted transmitter TT 50 C	digital, HART						
	E	with head mounted transmitter TT 51 C	digital, HART, SIL2						
	F	with head mounted transmitter TT 60 C	digital, PROFIBUS						
		13. Type of connection / rail mounted transmitter							
	0*	without							
	1	with rail mounted transmitter TT 10 R	analog						
	5	with rail mounted transmitter TT 21 R	digital, without galvanic isolation						
	6	with rail mounted transmitter TT 30 R	digital, standard						
	7	with rail mounted transmitter TT 31 R	1 channel						
	8	with rail mounted transmitter TT 31 R	2 channel						
	A	with rail mounted transmitter TT 32 R	90 - 250 VAC						
	B	with rail mounted transmitter TT 32 R	20 - 30 VDC						
	D	with rail mounted transmitter TT 40 R	digital, precise						
	G	with rail mounted transmitter TT 50 R	digital, HART						
	H	with rail mounted transmitter TT 51 R	digital, HART, SIL2						
	K	with rail mounted transmitter TT 60 R	digital, PROFIBUS-PA						

4 = extended standard selection

Some combinations are not possible. Please contact KROHNE for more information.

COMPLETE ORDERING CODE

**Standard*

Mineral insulated thermocouple with flying wires

Application

For measurement of high temperatures in applications with low flows. The sensor is made of a flexible MI cable, which makes it possible to form the sensor to fit into tight applications. With the thin diameter the sensor is suitable for applications requiring fast response times.

Design

The sensor is designed with uninsulated flying wires for installation in applications where connection terminals already exist. For measuring insert diameter $\leq 3\text{mm}$ the connection wires must be handled carefully to avoid to be broken.

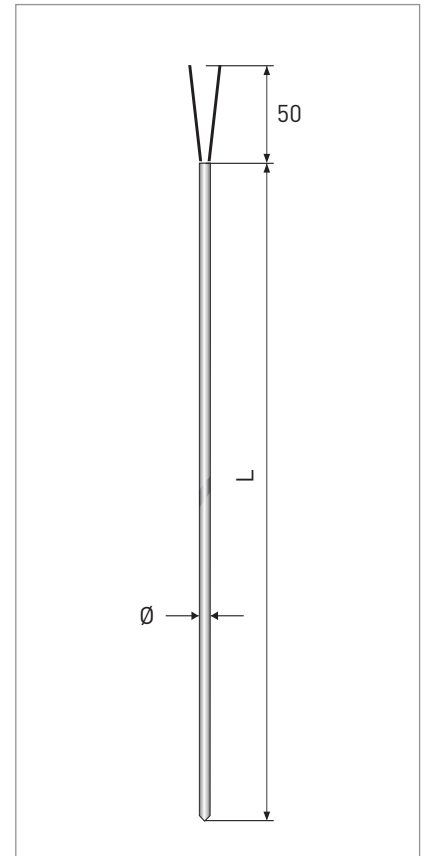
TCA-M10 is available with measuring element type J, type K or type N, single** or double, according to IEC 60584 class 1. The measuring point can be ordered as isolated* or grounded.

* Isolated is standard

** Single is standard

Temperature

	J	K	N
AlSi310	750 °C	1150 °C	-
Pyrosil	-	-	1250 °C
Inconel 600	750 °C	1150 °C	1150 °C



Dimensions in mm

Ordering code for TCA-M10 with standard settings

V T C 2 0 1 0 1 2 A 1 5 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0
4 6 7 8

This is a selection of the options
available for this sensor.

For the complete ordering code
see page 82.

4. MEASURING INSERT

- 1 1x Thermocouple Type J (Fe-CuNi) isolated
- 2 1x Thermocouple Type K (NiCr-Ni) isolated
- 3 1x Thermocouple Type N (NiCrSi-NiSi) isolated
- 5 2x Thermocouple Type J (Fe-CuNi) isolated

- 6 2x Thermocouple Type K (NiCr-Ni) isolated

- 7 2x Thermocouple Type N (NiCrSi-NiSi) isolated

- A 1x Thermocouple Type J (Fe-CuNi) grounded

- B 1x Thermocouple Type K (NiCr-Ni) grounded

- C 1x Thermocouple Type N (NiCrSi-NiSi) grounded

- E 2x Thermocouple Type J (Fe-CuNi) grounded

- F 2x Thermocouple Type K (NiCr-Ni) grounded

- G 2x Thermocouple Type N (NiCrSi-NiSi) grounded

6. SHEATH MATERIAL

- 1 ASIS 310/ 1.4841
- 2 Inconel 600/ 2.4816
- 3 Pyrosil

7. SHEATH DIAMETER (Ø)

- 1 Ø 1 mm
- 2 Ø 1.5 mm
- 3 Ø 3 mm
- 4 Ø 4.5 mm
- 5 Ø 6 mm

8. PROCESS CONNECTION

- 0 Without
- 1 Compression fitting M8 (SS)
- 2 Compression fitting G 1/8 (SS)
- 3 Compression fitting G 1/4 (SS)
- 4 Compression fitting G 1/2 (PTFE)
- C Compression fitting G 1/4 Brass

Mineral insulated thermocouple for compression fitting Connection head type MA

Application

For measurement of high temperatures in applications with low flows. The sensor is made of a flexible MI cable, which makes it possible to form the sensor to fit into tight applications. With the thin diameter the sensor is suitable for applications requiring fast response times.

Design

The sensor is designed with a mini connection head type MA, protection class IP53. When diameter ≤ 3 mm, the connection head must be supported to reduce the load of the MI-cable.

TCA-M30 is available with measuring element type J, type K or type N, single** or double, according to IEC 60584 class 1. The measuring point can be ordered as isolated* or grounded. The connection wires are color coded according to IEC 60 584.

* Isolated is standard

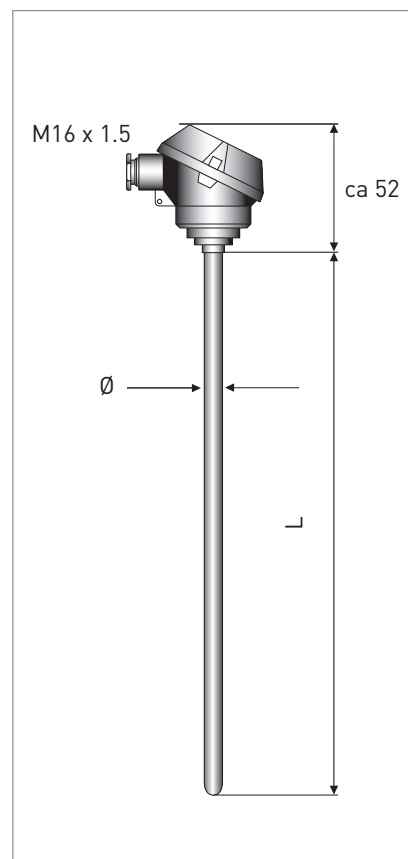
** Single is standard

Temperature

	J	K	N
AISI310	750 °C	1150 °C	-
Pyrosil	-	-	1250 °C
Inconel 600	750 °C	1150 °C	1150 °C

Protection class

See section connection heads on page 117.



Dimensions in mm

Ordering code
for TCA-M30 with
standard settings

V T C 2 0 3 0 D 2 A 1 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

4 6 7 8

This is a selection of the options available for this sensor. For the complete ordering code see page 82.

4. MEASURING INSERT

1	1x Thermocouple Type J (Fe-CuNi) isolated
2	1x Thermocouple Type K (NiCr-Ni) isolated
3	1x Thermocouple Type N (NiCrSi-NiSi) isolated

5 2x Thermocouple Type J
(Fe-CuNi) isolated

6 2x Thermocouple Type K
(NiCr-Ni) isolated

7 2x Thermocouple Type N
(NiCrSi-NiSi) isolated

A 1x Thermocouple Type J
(Fe-CuNi) grounded

B 1x Thermocouple Type K
(NiCr-Ni) grounded

C 1x Thermocouple Type N
(NiCrSi-NiSi) grounded

E 2x Thermocouple Type J
(Fe-CuNi) grounded

F 2x Thermocouple Type K
(NiCr-Ni) grounded

G 2x Thermocouple Type N
(NiCrSi-NiSi) grounded

6. SHEATH MATERIAL

1 ASIS 310/ 1.48412 Inconel 600/ 2.48163 Pyrosil

7. SHEATH DIAMETER (Ø)

1 Ø 1 mm

2 Ø 1.5 mm

3 Ø 3 mm4 Ø 4.5 mm5 Ø 6 mm

8. PROCESS CONNECTION

0 Without

1	Compression fitting M8	(SS)
---	------------------------	------

2	Compression fitting G 1/8	(SS)
---	---------------------------	------

3	Compression fitting G 1/4	(SS)
---	---------------------------	------

4	Compression fitting G 1/2	(PTFE)
---	---------------------------	--------

C	Compression fitting G 1/4	Brass
---	---------------------------	-------

Usage

For measurement of high temperatures in applications with low flows. The sensor is made of a flexible MI cable, which makes it possible to form the sensor to fit into tight applications. With the thin diameter the sensor is suitable for applications requiring fast response times.

The sensor is designed with a connection head type BA, protection class IP53. When diameter ≤ 3 mm, the connection head must be supported to reduce the load of the MI-cable.

TCA-M40 is available with measuring element type J, type K or type N, single** or double, according to IEC 60584 class 1. The measuring point can be ordered as isolated* or grounded. The connection wires are color coded according to IEC 60 584.

* Isolated is standard

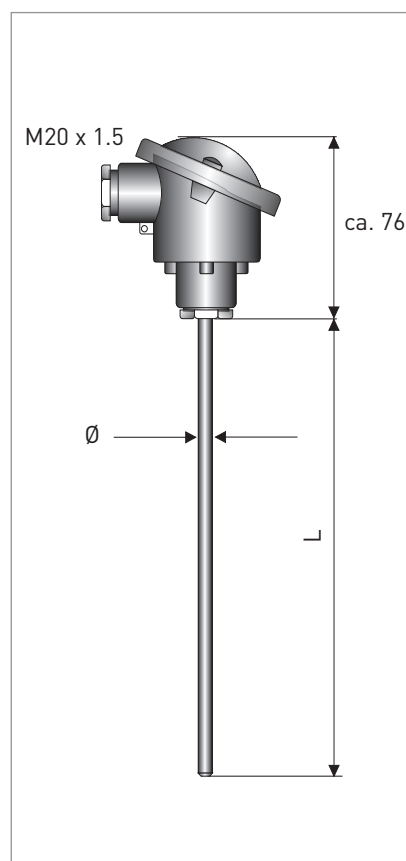
**** Single is standard**

Temperature

	J	K	N
AISI310	750 °C	1150 °C	-
Pyrosil	-	-	1250 °C
Inconel 600	750 °C	1150 °C	1150 °C

Protection class

See section connection heads on page 117.



Dimensions in mm

Ordering code
for TCA-M40 with
standard settings

V T C 2 0 4 0 E 2 A 1 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

4 6 7 8

This is a selection of the options available for this sensor.
For the complete ordering code see page 82.

4. MEASURING INSERT

1	1x Thermocouple Type J (Fe-CuNi) isolated
2	1x Thermocouple Type K (NiCr-Ni) isolated
3	1x Thermocouple Type N (NiCrSi-NiSi) isolated
5	2x Thermocouple Type J (Fe-CuNi) isolated

6	2x Thermocouple Type K (NiCr-Ni) isolated
7	2x Thermocouple Type N (NiCrSi-NiSi) isolated
A	1x Thermocouple Type J (Fe-CuNi) grounded
B	1x Thermocouple Type K (NiCr-Ni) grounded
C	1x Thermocouple Type N (NiCrSi-NiSi) grounded
E	2x Thermocouple Type J (Fe-CuNi) grounded
F	2x Thermocouple Type K (NiCr-Ni) grounded
G	2x Thermocouple Type N (NiCrSi-NiSi) grounded

6. SHEATH MATERIAL

1	ASIS 310/ 1.4841
2	Inconel 600/ 2.4816
3	Pyrosil

7. SHEATH DIAMETER (Ø)

2	Ø 1.5 mm
3	Ø 3 mm
4	Ø 4.5 mm
5	Ø 6 mm

8. PROCESS CONNECTION

0 Without		
1	Compression fitting M8	(SS)
2	Compression fitting G 1/8	(SS)
3	Compression fitting G 1/4	(SS)
4	Compression fitting G 1/2	(PTFE)
C	Compression fitting G 1/4	Brass

Mineral insulated thermocouple with mini thermo plug

Application

For measurement of high temperatures in applications with low flows. The sensor is made of a flexible MI cable, which makes it possible to form the sensor to fit into tight applications. With the thin diameter the sensor is suitable for applications requiring fast response times.

Design

The sensor is equipped with a mini thermo plug for an easier installation. For suitable thermo contacts see accessories.

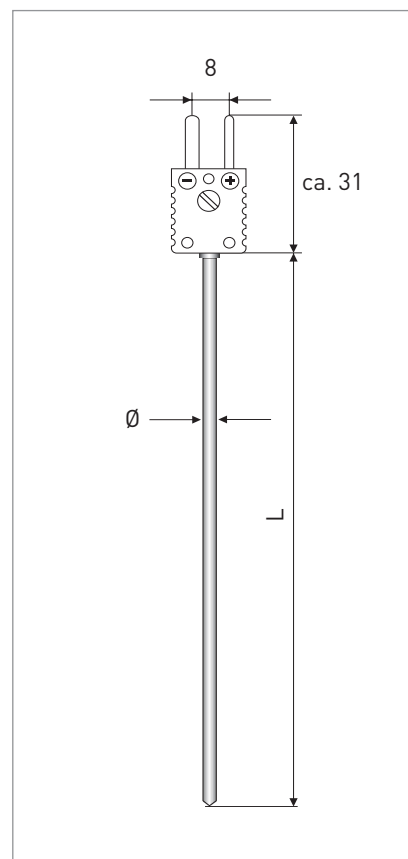
TCA-M50 is available with measuring element type J, type K or type N, single** or double, according to IEC 60584 class 1. The measuring point can be ordered as isolated* or grounded.

* Isolated is standard

** Single is standard

Temperature

	J	K	N
AISI310	750 °C	1150 °C	-
Pyrosil	-	-	1250 °C
Inconel 600	750 °C	1150 °C	1150 °C



Dimensions in mm

Ordering code
for TCA-M50 with
standard settings



This is a selection of the options available for this sensor.
For the complete ordering code see page 82.

4. MEASURING INSERT

- | | |
|---|--|
| 1 | 1x Thermocouple Type J
(Fe-CuNi) isolated |
| 2 | 1x Thermocouple Type K
(NiCr-Ni) isolated |
| 3 | 1x Thermocouple Type N
(NiCrSi-NiSi) isolated |
| 5 | 2x Thermocouple Type J
(Fe-CuNi) isolated |

6 2x Thermocouple Type K
(NiCr-Ni) isolated

7 2x Thermocouple Type N
(NiCrSi-NiSi) isolated

A 1x Thermocouple Type J
(Fe-CuNi) grounded

B 1x Thermocouple Type K
(NiCr-Ni) grounded

C 1x Thermocouple Type N
(NiCrSi-NiSi) grounded

E 2x Thermocouple Type J
(Fe-CuNi) grounded

F 2x Thermocouple Type K
(NiCr-Ni) grounded

G 2x Thermocouple Type N
(NiCrSi-NiSi) grounded

6. SHEATH MATERIAL

- | | |
|---|---------------------|
| 1 | ASIS 310/ 1.4841 |
| 2 | Inconel 600/ 2.4816 |
| 3 | Pyrosil |

7. SHEATH DIAMETER (Ø)

- | | |
|---|----------|
| 1 | Ø 1 mm |
| 2 | Ø 1.5 mm |
| 3 | Ø 3 mm |
| 4 | Ø 4.5 mm |
| 5 | Ø 6 mm |

8. PROCESS CONNECTION

- | | | |
|---|---------------------------|--------|
| 0 | Without | |
| 1 | Compression fitting M8 | (SS) |
| 2 | Compression fitting G 1/8 | (SS) |
| 3 | Compression fitting G 1/4 | (SS) |
| 4 | Compression fitting G 1/2 | (PTFE) |
| C | Compression fitting G 1/4 | Brass |

COMPLETE ORDERING CODE

VTC2	0	1. Type	version	TCA-M10	TCA-M20	TCA-M30	TCA-M40	TCA-M50	TCA-M60	TCA-M70
		1*	TCA-M10	plug-in						
		2	TCA-M20	plug-in						
		3	TCA-M30	plug-in						
		4	TCA-M40	plug-in						
		5	TCA-M50	plug-in						
		6	TCA-M60	plug-in						
		7	TCA-M70	plug-in						
		2. Approvals:								
		0* without								
		3. Electrical connection/ Connection heads:				Electrical connection/ Connection heads:				
		0 Without				7 Standard thermo plug 600°C				
		1* Unisolated flying wires				A Compensation cable				
		2 Isolated flying wires				B Compensation cable + thermo plug				
		4 Mini thermo plug				D MA, Alu, Pg9 IP 53				
		6 Standard thermo plug 120°C				E BA, Alu, M20 x 1.5, IP 65				
		4. Measuring insert = sensor / wiring:				Measuring insert = sensor / wiring:				
		1 1x Thermocouple Type J (Fe-CuNi) isolated				A 1x Thermocouple Type J (Fe-CuNi) grounded				
		2* 1x Thermocouple Type K (NiCr-Ni) isolated				B 1x Thermocouple Type K (NiCr-Ni) grounded				
		3 1x Thermocouple Type N (NiCrSi-NiSi) isolated				C 1x Thermocouple Type N (NiCrSi-NiSi) grounded				
		5 2x Thermocouple Type J (Fe-CuNi) isolated				E 2x Thermocouple Type J (Fe-CuNi) grounded				
		6 2x Thermocouple Type K (NiCr-Ni) isolated				F 2x Thermocouple Type K (NiCr-Ni) grounded				
		7 2x Thermocouple Type N (NiCrSi-NiSi) isolated				G 2x Thermocouple Type N (NiCrSi-NiSi) grounded				
		5. Measuring insert / tolerance class:								
		A* Class 1 Thermocouple								
		6. Thermowell material:								
		1* AISI310/1.4841								
		2 Inconel600/2.4816								
		3 Pyrosil								
		7. Thermowell diameter:				Thermowell diameter:				
		1 Ø 1 mm				4 Ø 4.5 mm				
		2 Ø 1.5 mm				5* Ø 6.0 mm				
		3 Ø 3.0 mm								
		8. Process connection:				Process connection:				
		0* without				3 Compression fitting G1/4 SS				
		1 Compression fitting M8 SS				4 Compression fitting G1/2 SS				
		2 Compression fitting G1/8 SS				C Compression fitting G1/4 Brass				
		9. Immersion length				Immersion length				
		0 500 mm				5 3000 mm				
		1 1000 mm				6 5000 mm				
		2 1500 mm				7 7500 mm				
		3 2000 mm				8 10000 mm				
		4 2500 mm				Z customized length				
		10. Cable length				Cable length				
		0* without				C 9 m				
		1 0.5 m				D 10 m				
		2 1 m				E 12 m				
		3 1.5 m				F 15 m				
		4 2 m				G 20 m				
		5 3 m				H 25 m				
		6 4 m				I 30 m				
		7 5 m				J 40 m				
		8 6 m				K 50 m				
		A 7 m				L customized length				
		B 8 m								
		11. Cable material								
		0* Without								
		1 Silicone								
		2 PVC								
		12. Type of connection / head mounted transmitter:								
		0* without								
		13. Type of connection / rail mounted transmitter:								
		0* without								
		1 with rail mounted transmitter TT 10 R analog								
		5 with rail mounted transmitter TT 21 R digital, without galvanic isolation								
		6 with rail mounted transmitter TT 30 R digital, standard [Ex]								
		7 with rail mounted transmitter TT 31 R 1 channel [Ex]								
		8 with rail mounted transmitter TT 31 R 2 channel [Ex]								
		A with rail mounted transmitter TT 32 R 90 - 250 VAC								
		B with rail mounted transmitter TT 32 R 20 - 30 VDC								
		D with rail mounted transmitter TT 40 R digital, precise								
		G with rail mounted transmitter TT 50 R digital, HART								
		H with rail mounted transmitter TT 51 R digital, HART, SIL2 [Ex]								
		K with rail mounted transmitter TT 60 R digital, Profibus-PA								
		14. Transmitter configuration:								
		0* without								
		1 Configuration								

COMPLETE ORDERING CODE

[illegible]

*standard

*Note	Type	Diameter	Material
*1	J/K	Ø1/Ø1.5	Inconel/AISI310
*1	N	Ø3	Inconel
*2	J/K	Ø4.5-Ø6	Inconel/AISI310
*3	N	Ø6	Inconel
*3	N	Ø3	Pyrosil
*4	N	Ø6	Pyrosil

Hygienic temperature assembly

Application

RTD sensor with flange for ISO 2852 DN25/38 connection for hygienic applications.

Temperature assembly

Material in stainless steel 1.4404 / AISI 316L, 6 x 1 mm, 10 x 1 mm.

Surface finish: Ra = 0.5 μ m (parts connecting to media)

Measuring insert

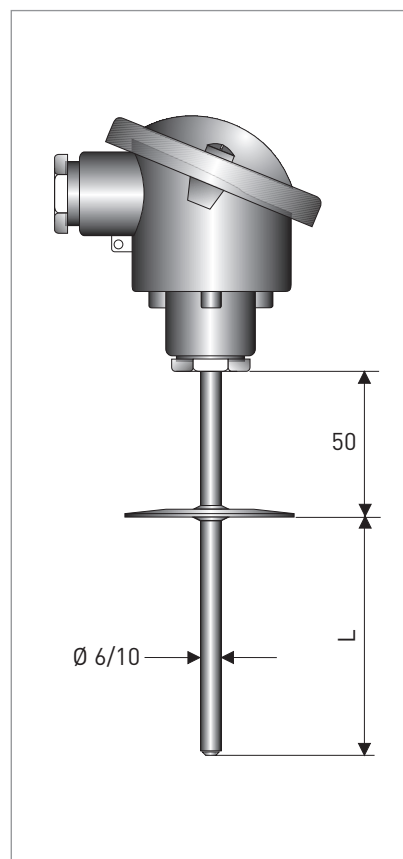
The measuring element with accuracy according to IEC 60751 is placed in the tip of the tube which is filled with heat transfer compound for fast response time and vibration-proof design. The insert with Teflon insulated wires is not replaceable.

Process temperature	TRA-H10	-50...+200 °C
---------------------	---------	---------------

Protection class IP 65

Response time

Type	Water 0.4 m/s		Air 1 m/s	
	t 0.5	t 0.9	t 0.5	t 0.9
TRA-H10, Ø 6	3 s	7 s	50 s	2.5 min
TRA-H10, Ø10	5 s	15 s	1.1 min	3.3 min



Dimensions in mm

Ordering code
for TRA-H10 with
standard settings

V T H 1 0 1 0 1 3 4 1 1 1 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0

3 4 5 7 9 10

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 87.

3. CONNECTION HEADS

1	BA	Alu, M20x 1.5, IP 65
8	BVA Screw cover	VA, M20x 1.5, IP 65

4. MEASURING INSERT

2	1x Pt100	3-wire
3	1x Pt100	4-wire
4	2x Pt100	3-wire
5	2x Pt100	4-wire

5. TOLERANCE CLASS

2	Class A	Mi, TF	(-50 °C...+300 °C)
4	Class A	Mi, WW	(-200 °C...+600 °C)

7. THERMOWELL DIAMETER (\emptyset)

1	10 x 1 mm
2	6 x 1 mm

9. SURFACE FINISH

0	Without
1	Ra 0.5 μm

10. IMMERSION LENGTH

1	50 mm
2	100 mm
Z	Customized length

Hygienic temperature assembly with replaceable insert

Application

RTD sensor with flange for ISO 2852 DN25/38 connection for hygienic application.
The measuring insert is replaceable.

Temperature assembly

Material in stainless steel 1.4404 / AISI 316L, 6 x 1 mm, 10 x 1 mm.
Surface fineness: Ra = 0.5 µm (parts connecting to media).

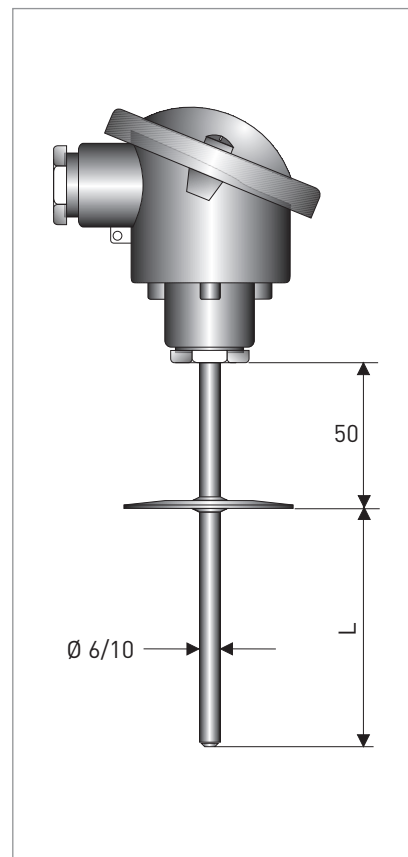
Measuring insert

For thermowell with diameter Ø 6 mm, the measuring insert TR100 is Ø 3 mm.
For thermowell with diameter Ø 10 mm, the measuring insert TR100 is Ø 6 mm.
For detailed information about the measuring insert see TR 100.

Process temperature	TRA-H2O	-200...+600 °C
---------------------	---------	----------------

Protection class	IP 65
------------------	-------

Response time	Type	Water 0.4 m/s		Air 1 m/s	
		t 0.5	t 0.9	t 0.5	t 0.9
	TRA-H2O, Ø 6	8 s	20 s	1.2 min	3.7 min
	TRA-H2O, Ø10	17 s	52 s	2 min	6.2 min



Dimensions in mm

Ordering code
for TRA-H20 with
standard settings

V T H 1 0 2 0 1 3 4 1 1 1 0 1 1 1 0 0 0 0 0 0 0 0 0 0

3 4 5 7 9 10

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 87.

3. CONNECTION HEADS	
1 BA	Alu, M20x 1.5, IP 65
8 BVA Screw cover	VA, M20x 1.5, IP 65

4. MEASURING INSERT	
2 1x Pt100	3-wire
3 1x Pt100	4-wire
4 2x Pt100	3-wire
5 2x Pt100	4-wire

5. TOLERANCE CLASS		
2	Class A	Mi, TF (-50 °C...+300 °C)
4	Class A	Mi, WW (-200 °C...+600 °C)

7. THERMOWELL DIAMETER (Ø)	
1	10 x 1 mm
2	6 x 1 mm

9. SURFACE FINISH	
0	Without
1	Ra 0.5 µm

10. IMMERSION LENGTH

1	50 mm
2	100 mm
Z	Customized length

Hygienic temperature assembly for on-site calibration

Application

RTD temperature assembly for hygienic applications requiring on-site calibration without disturbing the process.

Sensor assembly

Material in stainless steel 1.4404 / ASIS 316L, Ø 6/10 mm.
Surface fineness: Ra <0.8 µm (parts connecting to media).

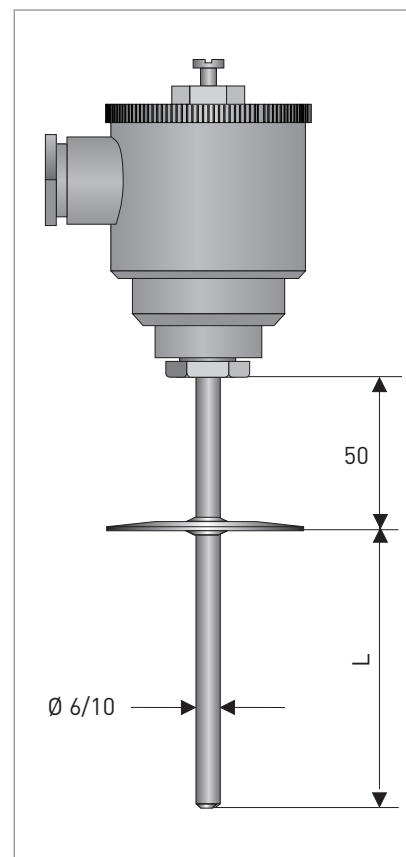
Measuring insert

Thermowell of Ø 6-10 mm with a non-replaceable RTD sensor. Inner tube for a calibration probe 2-3 mm to measure the temperature around the RTD sensor. Access to the inner tube by open up the connection head lid. Accessible even if a standard transmitter is installed. Various process connections available on request.

Process temperature TRA-H30 -40...+150 °C

Protection class IP 65

Available in mid-2014.



Dimensions in mm

Ordering code for TRA-H30 with standard settings

V	T	H	1	0	3	0	2	3	2	1	A	0	2	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
							3	4	5		7	8	9	10																		

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 87.

3. CONNECTION HEADS

1	BA	Alu, M20x 1.5, IP 65
2	BUZ-S	Alu, M20x 1.5, IP 65
8	BVA Screw cover	VA, M20x 1.5, IP 65

4. MEASURING INSERT

2	1x Pt100	3-wire
3	1x Pt100	4-wire

5. TOLERANCE CLASS

2	Class A	Mi, TF	-50 °C...+300 °C
---	---------	--------	------------------

7. THERMOWELL DIAMETER (Ø)

1	10 mm
2	6 mm

8. PROCESS CONNECTION

0	Without
1	Clamp DN25/28 ISO 2852
Z	Customized process connection

9. SURFACE FINISH

0	Without
1	Ra 0.5 µm
2	Ra <0.8 µm

10. IMMERSION LENGTH

1	50 mm
2	100 mm
3	150 mm
4	200 mm
Z	Customized length

VTH1		0		1. Type		version				TRA-H10		TRA-H20		TRA-H30	
				1*		TRA-H10		"flange"		not exchangeable insert, teflon wires					
				2		TRA-H20		"flange"		exchangeable insert, MI-cable					
				3		TRA-H30		"plug-in"		not exchangeable insert, teflon wires					
				2. Approvals											
				0*		without									
				3. Connection heads											
				1*		BA				Alu, M20 x 1,5, IP 65					
				2		BUZ-S		(snap)		hinged cover		Alu, M20 x 1,5, IP 65			
				8		BVA				screw cover		VA, M20 x 1,5, IP 65			
				4. Measuring insert = sensor / wiring											
				2		1x Pt100		3-wire							
				3*		1x Pt100		4-wire							
				4		2x Pt100		3-wire		(Cl.A, WW)		(10, 20)			
				5		2x Pt100		4-wire		(Cl.A, WW)		(10, 20)			
				5. Measuring insert / tolerance class											
				2*		Cl. A				Mi, TF		(tolerance class -50...+300°C)		(30)	
				4		Cl. A				Mi, WW		(tolerance class -200...+600°C)		(10, 20)	
				6. Thermowell material											
				1*		1.4404/ 316L									
				7. Thermowell diameter											
				1*		10 x 1 mm									
				2		6 x 1 mm									
				8. Process connection											
				0		without									
				1*		Clamp DN25/38 ISO 2852									
				Z		Customized process connection									
				9. Surface finish											
				0*		without									
				1		Ra 0.5 µm									
				2		Ra <0.8 µm						(30)			
				10. Immersion length											
				1*		50 mm									
				2		100 mm									
				3		150 mm						(30)			
				4		200 mm						(30)			
				Z		Customized length									
				11. Neck tube length											
				0		without									
				1*		50 mm									
				Z		Customized length									
				12. Type of connection / head mounted transmitter											
				0		with flying leads for transmitter mounting									
				1*		Standard version with ceramic terminal block									
				2		with head mounted transmitter TT 10 C		analog						[Ex]	
				3		with head mounted transmitter TT 11 C		analog, 0-10V, only Pt100							
				5		with head mounted transmitter TT 20 C		analog, programmable							
				6		with head mounted transmitter TT 21 C		digital, programmable							
				7		with head mounted transmitter TT 30 C		digital, standard						[Ex]	
				A		with head mounted transmitter TT 40 C		digital, precise							
				D		with head mounted transmitter TT 50 C		digital, HART						[Ex]	
				E		with head mounted transmitter TT 51 C		digital, HART, SIL2						[Ex]	
				F		with head mounted transmitter TT 60 C		digital, Profibus PA						[Ex]	
				13. Type of connection / rail mounted transmitter											
				0*		without									
				1		with rail mounted transmitter TT 10 R		analog							
				2		with rail mounted transmitter TT 11 R		analog, 0-10 V, only Pt100							
				5		with rail mounted transmitter TT 21 R		digital, without galvanic isolation							
				6		with rail mounted transmitter TT 30 R		digital, standard						[Ex]	
				7		with rail mounted transmitter TT 31 R		1 channel						[Ex]	
				8		with rail mounted transmitter TT 31 R		2 channel						[Ex]	
				A		with rail mounted transmitter TT 32 R		90 - 250 VAC							
				B		with rail mounted transmitter TT 32 R		20 - 30 VDC							
				D		with rail mounted transmitter TT 40 R		digital, precise							
				G		with rail mounted transmitter TT 50 R		digital, HART							
				H		with rail mounted transmitter TT 51 R		digital, HART, SIL2						[Ex]	
				K		with rail mounted transmitter TT 60 R		digital, Profibus-PA							
				14. Measuring range											
				0*		without									
				1		Configuration									

* *Standard*

Hygienic compact sensor with flange

Application

For measuring the temperature of gases, liquids and vapour from -50 °C to +200 °C. Especially suited for industrial applications with hygienic requirements and limited space.

Sensor assembly

The compact sensor is made of stainless steel 1.4404 / 316L and has a surface fineness of $R_a \leq 0.8 \mu\text{m}$ for the wetted parts. It is connected to the process by using a ISO 2852 Clamp DN25/38. The sensor element is a Pt100 RTD Thin film according to DIN EN 60751. The compact sensor electrical connection is made via a M12 connector.

Built in Transmitter

The sensor is available with a built-in transmitter.

Fixed temperature range 0...+100 °C or -50... +150 °C

Accuracy $\pm 0.15\%$ of the measuring range

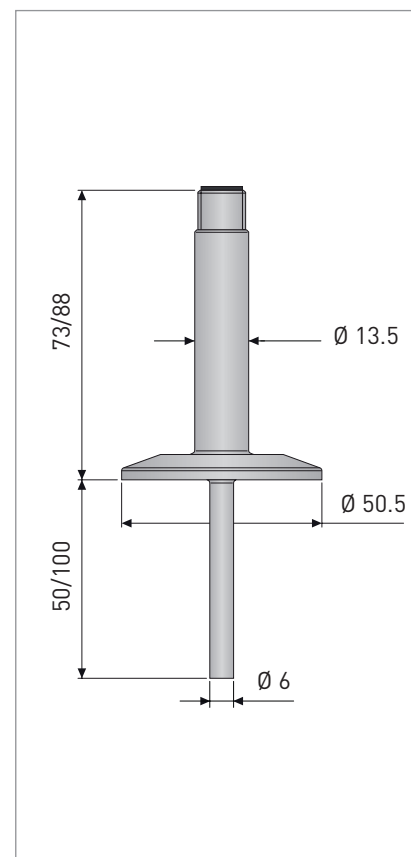
Output Sensor Signal or 4...20 mA

Power supply 7.5 to 32 VDC

Process temperature TRA-C10 -50...+200 °C

Protection class IP 67

Response time	Type	Water 0.4 m/s	
		t 0.5	t 0.9
	TCA-C10, Ø 6	3.2 s	9.0 s



Dimensions in mm

Ordering Codes for TRA-C10 with pre-configured standard settings

ORDERING NUMBER	INSERTION LENGTH	HOUSING LENGTH	CONFIGURATION	BUILT-IN-TRANSMITTER
4002906801	50 mm	73 mm	-50...+200 °C	Without
4002906802	100 mm	73 mm	-50...+200 °C	Without
4002906803	50 mm	73 mm	0...+100 °C	With
4002906804	100 mm	73 mm	0...+100 °C	With
4002906805	50 mm	88 mm	-50...+150 °C	With
4002906806	100 mm	88 mm	-50...+150 °C	With

Other options are available on request.

Compact sensor for screw-in

Application

For measuring the temperature of gases, liquids, vapour and solids from -50 °C to +200 °C. Especially suited for industrial applications with limited space.

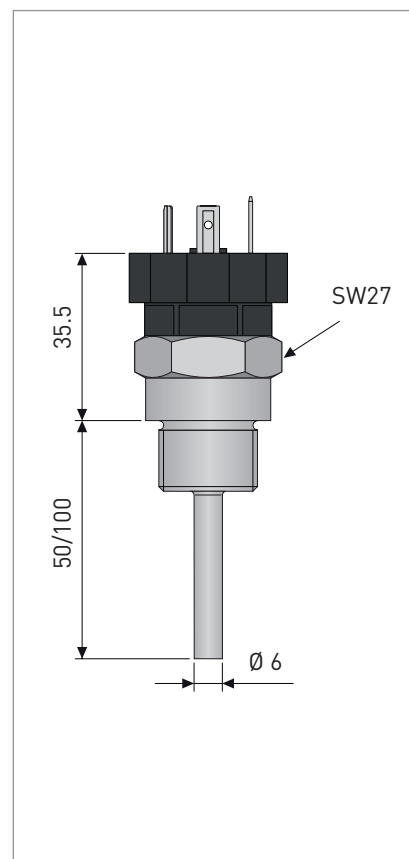
Sensor assembly

The compact sensor is made of stainless steel 1.4404 / 316L and is connected to the process by a G1/2 thread. The sensor element is a Pt100 RTD Thin film according to DIN EN 60751 and the electrical connection is made via a Valve EN 175301-803 connector.

Built in Transmitter

The sensor is available with a built-in transmitter.

Fixed temperature range	0...+100 °C or -50... +150 °C	
Accuracy	±0.15% of the measuring range	
Output	Sensor Signal or 4...20 mA	
Power supply	7.5 to 32 VDC	
Process temperature	TRA-C20	-50...+200 °C
Protection class	IP 65	
Response time	Type	Water 0.4 m/s
		t 0.5 t 0.9
	TCA-C20, Ø 6	3.2 s 9.0 s



Dimensions in mm

Ordering Codes for TRA-C20 with pre-configured standard settings

ORDERING NUMBER	IMMERSION LENGTH	CONFIGURATION	BUILT-IN-TRANSMITTER
4002907601	50 mm	-50...+200 °C	Without
4002907602	100 mm	-50...+200 °C	Without
4002907603	50 mm	0...+100 °C	With
4002907604	50 mm	-50...+150 °C	With
4002907605	100 mm	0...+100 °C	With
4002907606	100 mm	-50...+150 °C	With

Other options are available on request.

Compact sensor for screw-in

Application

For measuring the temperature of gases, liquids, vapour and solids from -50 °C to +200 °C. Especially suited for industrial applications with limited space.

Sensor assembly

The compact sensor is made of stainless steel 1.4404 / 316L and is connected to the process by a G1/2 thread. The sensor element is a Pt100 RTD Thin film according to DIN EN 60751 and the electrical connection is made via a M12 connector.

Built in Transmitter

The sensor is available with a built-in transmitter.

Fixed temperature range 0...+100 °C or -50... +150 °C

Accuracy ±0.15% of the measuring range

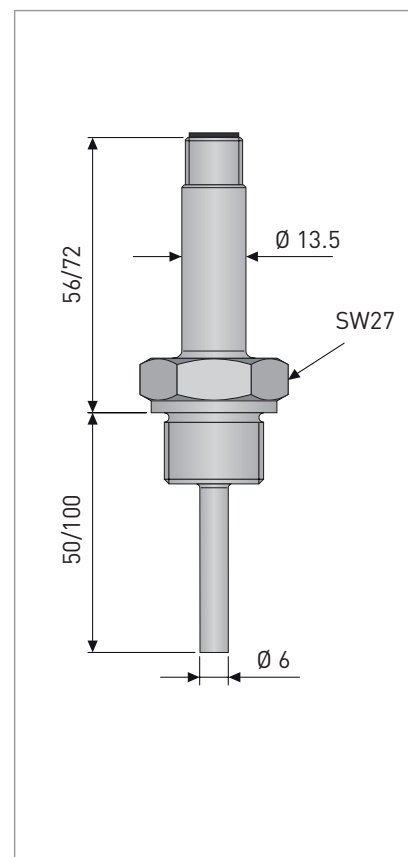
Output Sensor Signal or 4...20 mA

Power supply 7.5 to 32 VDC

Process temperature TRA-C30 -50...+200 °C

Protection class IP 67

Response time	Type	Water 0.4 m/s	
		t 0.5	t 0.9
	TCA-C30, Ø 6	3.2 s	9.0 s



Dimensions in mm

Ordering Codes for TRA-C30 with pre-configured standard settings

ORDERING NUMBER	IMMERSION LENGTH	CONFIGURATION	BUILT-IN-TRANSMITTER
4002908901	50 mm	-50...+200 °C	Without
4002908902	100 mm	-50...+200 °C	Without
4002908903	50 mm	0...+100 °C	With
4002908904	50 mm	-50...+150 °C	With
4002908905	100 mm	0...+100 °C	With
4002908906	100 mm	-50...+150 °C	With

Other options are available on request.

HVAC temperature sensor for outdoor applications

Application

The sensor is used for measuring air temperature outdoors or in industrial areas with high demands on enclosure class. The sensor should be mounted on the north facade about 2.5 m above ground level where water and hot air from the house is avoided.

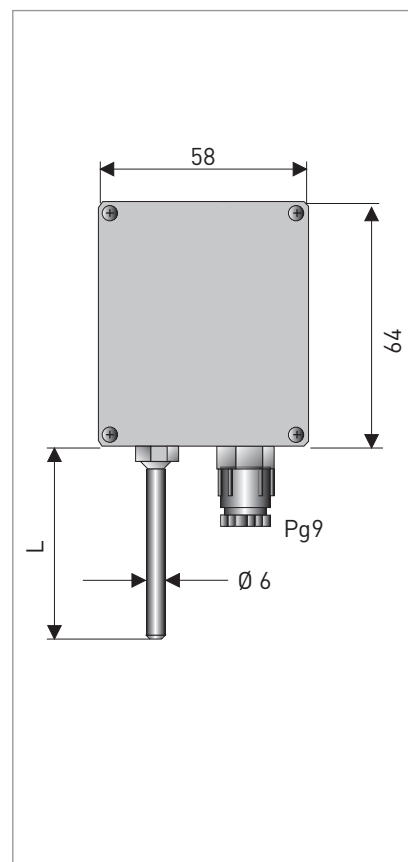
Measuring insert

The measuring element 1x Pt100 acc. IEC 60751 is placed in the tip of the Ø 6 x 0.5 mm brass tube which is filled with heat transfer compound for fast response time and vibration-proof design. Junction Box of gray aluminum 64 x 58 x 34 mm. Output: Pt100 (Ω) or with integrated transmitter that provides 4-20 mA or 0-10 V for the selected measuring range.

Temperature range	Storage temperature	-25...+75 °C
	Measuring range	-50...+100 °C

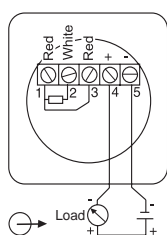
Protection class	IP 65
------------------	-------

Response time	Type	Air 1 m/s	
		t 0.5	t 0.9
	TRA-V20	40 s	2 min

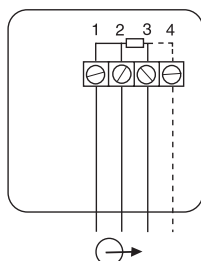


Dimensions in mm

Electrical connection



with
transmitter



without
transmitter

Ordering code
for TRA-V20 with
standard settings

V T E 1 0 2 0 E 2 2 D 1 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

2 4 7 8 10

This is a selection of the options available for this sensor.
For the complete ordering code see page 96.

2. APPROVALS	
0	Without
1	Simple apparatus

4. MEASURING INSERT		
2	1x Pt100	3-wire
7	1x Pt1000	3-wire

7. THERMOWELL DIAMETER	
1	6x 0.5
2	6x 0.5 perforated

8. PROCESS CONNECTION		
0	Without / wire	
1	Compression fitting	G 1/4
2	Thermowell	G 1/4 - G1/2
3	Bushing	G 1/4 - G1/2
4	Mounting flange	

10. IMMERSION LENGTH	
1	50 mm
3	150 mm (not perforated)
Z	Customized

HVAC temperature sensor for air ducts/pipes applications

Application

The sensor is used for measuring the temperature in air ducts and pipes. When measured in air ducts the sensor is mounted with flange and rubber gasket. When measured in pipes the sensor is mounted with compression fitting and thermowell. (See section "Accessories").

Sensor assembly

Brass 6 x 0.5 mm, pressure class PN10. Thermowell Ø 8 mm with process connection G 1/2 or 50 mm sliding flange are available as accessories. See section "Accessories".

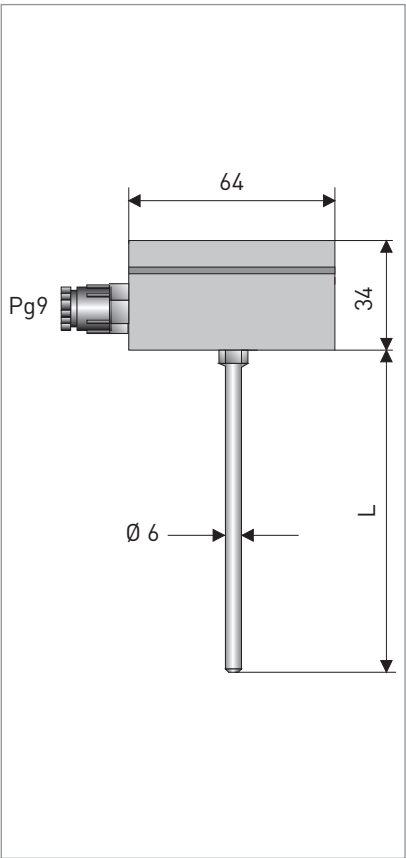
Measuring insert

The measuring element 1x Pt100 acc. IEC 60751 is placed in the tip of the tube which is filled with heat transfer compound for fast response time and vibration-proof design. Junction Box of gray aluminum 64 x 58 x 34 mm. Output: Pt100 (Ω) or with integrated transmitter that provides 4-20 mA or 0-10 V for the selected measuring range.

Temperature range	Storage temperature	-25...+75 °C
	Measuring range	-25...+200 °C

Thermowell	IP 65 (thermowell IP 68)
------------	--------------------------

Response time	Type	Water 0.4 m/s		Air 1 m/s	
		t 0.5	t 0.9	t 0.5	t 0.9
	TRA-V30	2 s	6 s	40 s	2 min
	TRA-V30, in thermowell	18 s	1.1 min	1.2 min	4.2 min



Dimensions in mm

For electrical connection, see page 93.

Ordering code for TRA-V30 with standard settings

VTE1030E22D1001010000000000000000

24810

This is a selection of the options available for this sensor. For the complete ordering code see page 96.	4. MEASURING INSERT		10. IMMERSION LENGTH	
	2	1x Pt100 3-wire	0	Without
	7	1x Pt1000 3-wire	1	50 mm
2. APPROVAL	8. PROCESS CONNECTION		2	100 mm
	0	Without / wire	3	150 mm
	1	Compression fitting G 1/4	4	200 mm
	2	Thermowell G 1/4 - G1/2	5	300 mm
	3	Bushing G 1/4 - G1/2	Z	Customized
1	4		Mounting flange	

HVAC temperature sensor for clamp-on applications

Application

The sensor is used for measuring surface temperature on pipes. The sensor is mounted on the coldest part of pipe system or on the return pipe as a freeze protection. The sensor is clamped to the pipe with a hose clamp. (See section "Accessories"). For optimal heat transfer the contact surface should be coated with heat transfer compound.

Measuring block

Aluminum 12 x 12 x 55 mm.

Sensor assembly

The measuring element 1x Pt100 acc. IEC 60751 is placed in the measuring tip which is filled with heat transfer compound for fast response time and vibration-proof design. Junction Box of gray aluminum 64 x 58 x 34 mm. Output: Pt100 (Ω) or with integrated transmitter that provides 4-20 mA or 0-10 V for the selected measuring range.

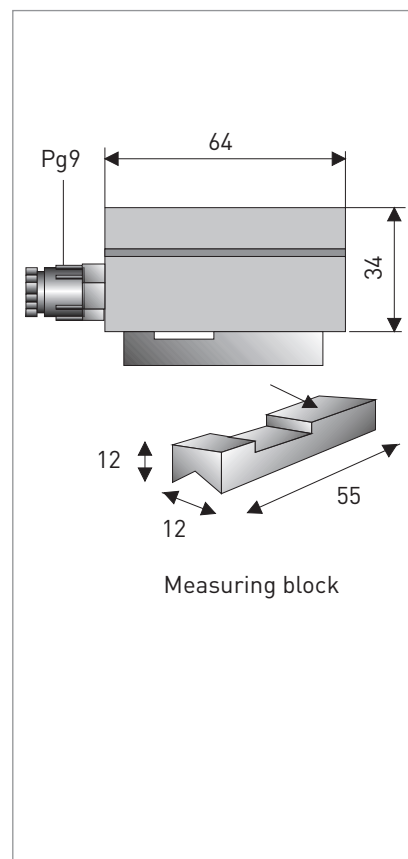
Temperature range

Storage temperature	-40...+75 °C
Measuring range:	
- ambient	-25...+75 °C
- contact surface	-25...+80 °C
(without transmitter)	-25...+100 °C

Protection class

IP 65

For electrical connection, see page 93.



Dimensions in mm

Ordering code for TRA-V40 with standard settings

V	T	E	1	0	4	0	E	2	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
								2	4																				

This is a selection of the options available for this sensor. For the complete ordering code see page 96.

2. APPROVALS

0	Without
1	Simple apparatus

4. MEASURING INSERT

2	1x Pt100	3-wire
7	1x Pt1000	3-wire

4 = extended standard selection

*Standard

Cable sensor for screw-on
Surface temperature $t \leq 150\text{ }^{\circ}\text{C}$

Application

For measurement of surface temperature on pipes, tanks or similar. To be mounted with M3 bolts or with hose clamp. See "Accessories" for more information.

Design

Material in Brass, 5 x 5 x 25 mm.

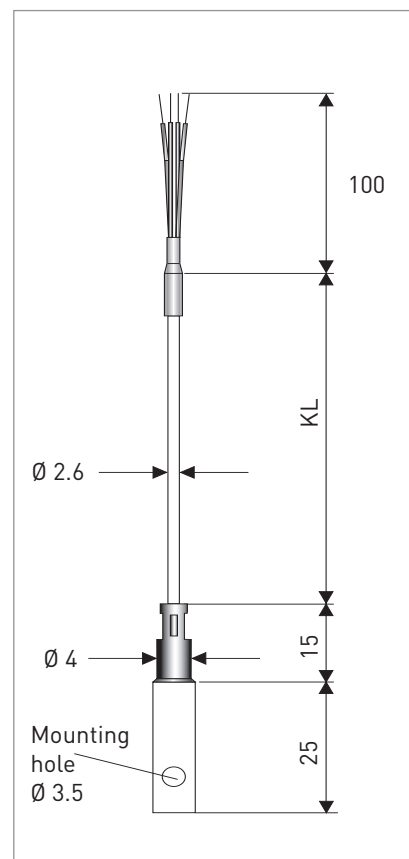
Measuring element

Measuring element with accuracy according to IEC 60751 placed in the measuring tip which is filled with heat transfer compound for fast response time and vibration-proof design. Connection cable with Tefzel insulation, 4 x 0.25 mm² as standard.

Process temperature -50...+150 °C

Protection class	IP 54
------------------	-------

For connection, see page 130.



Dimensions in mm

Ordering code
for TRA-W20 with
standard settings



This is a selection of the options available for this sensor.
For the complete ordering code see page 107.

8. PROCESS CONNECTION

0	Without
5	Mounting band

4. MEASURING ELEMENT

3	1x Pt100	4-wire
N	1x Pt1000	4-wire

Cable sensor for screw-on
Surface temperature $t \leq 300\text{ °C}$

Application

For measurement of surface temperature on pipes, tanks or similar. To be mounted with M5 bolts or with hose clamp. See "Accessories" for more information.

Design

Material in copper 8 x 10 x 40 mm with one side machined for increased surface contact.

Measuring element

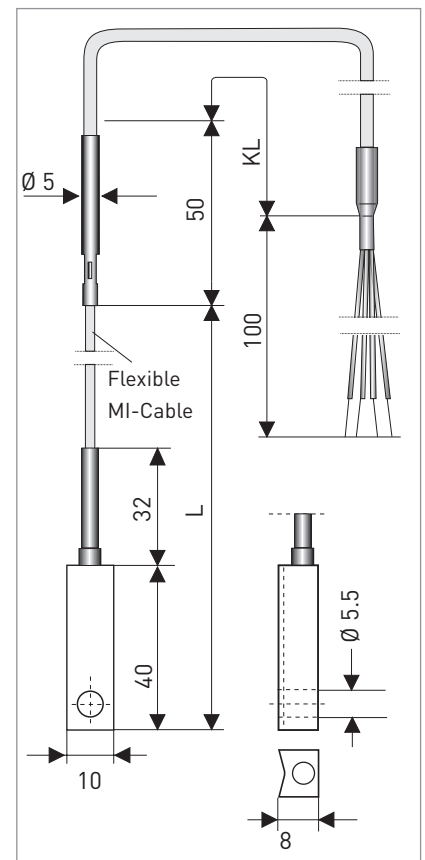
Measuring element with accuracy according to IEC 60751. Vibration proof mineral isolated RTD sensor mounted in a sensor body of copper. Connection cable of Elexar 4 x 0.25 mm² as standard.

Process temperature -50...+300 °C (surface temperature)
-20...+105 °C (connection cable)

Materials	
Copper (sensor body)	
Stainless steel (flexible MI-cable and jointing sleeve)	

Protection class IP 54

For connection, see page 130.



Dimensions in mm

Ordering code
for TRA-W40 with
standard settings



This is a selection of the options available for this sensor.
For the complete ordering code see page 107.

8. PROCESS CONNECTION

0	Without
5	Mounting band

4. MEASURING ELEMENT

3	1x Pt100	4-wire
N	1x Pt1000	4-wire

Oil-tight cable sensor for plug-in

Application

For measurement of bearing temperature or similar, with oil-tight and vibration-proof design.

Design

Measuring element according to IEC 60751 placed in the tip of the sensor body in material 1.4404 which is filled with heat transfer compound for fast response time and vibration-proof design. Connection cable with silicone insulation, 4 x 0.25 mm² as standard.

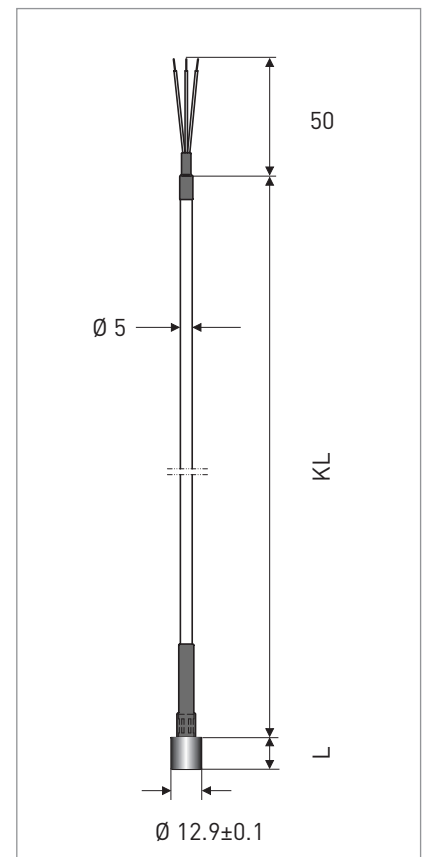
Process temperature

-40...+150 °C (standard)

Protection class

IP 67

For connection, see page 130.



Dimensions in mm

Ordering code for TRA-W60 with standard settings

V T E 2 0 6 0 2 3 2 A 0 0 3 1 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0
4

This is a selection of the options available for this sensor. For the complete ordering code see page 107.

4. MEASURING ELEMENT

1	1x Pt100	2-wire
2	1x Pt100	3-wire
3	1x Pt100	4-wire
4	2x Pt100	2-wire
M	1x Pt1000	3-wire
N	1x Pt1000	4-wire

Cable sensor for harsh environments

Application

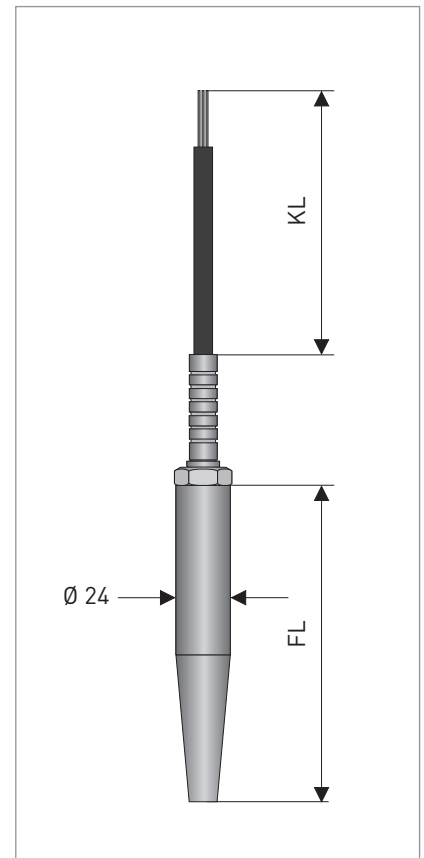
For temperature measurement in soil, grain or other media with high density. Can be welded through a tank or into any metal constructions. Designed to withstand high pressure and harsh environments. The robust cable can withstand a maximum tensile load of 900N which means that you can pull the cable to move the sensor even if it is buried.

Design

Measuring element according to IEC 60751 placed in the tip of the sensor body that is filled with heat transfer compound for fast response time and vibration-proof design. Connection cable with Hytrel® insulation, oil and UV proof, 4 x 0.25 mm² as standard.

Process temperature -40...+115 °C (standard)

Protection class	IP 68
------------------	-------



Dimensions in mm

Ordering code
for TRA-W80 with
standard settings

V T E 2 0 8 0 6 3 4 1 P 0 0 M K 0 0 0 0 0 0 0 0 0 0 0 0 0 0

This is a selection of the options available for this sensor.
For the complete ordering code see page 107.

2. APPROVALS

0	Without
1	Simple Apparatus

4. MEASURING INSERT

3	1x Pt100	4-wire
4	2x Pt100	2-wire

10. IMMERSION LENGTH

M	D1 / Form 4,	140/65 mm
N	D2 / Form 4,	200/125 mm
P	D4 / Form 4,	200/65 mm
R	D5 / Form 4,	200/125 mm

VTE2		0		1. Type		version		TRA-W10	TRA-W20	TRA-W30	TRA-W40	TRA-W50	TRA-W60	TRA-W70	TRA-W80	TRA-W90	
1	TRA-W10	"cable, plug-in"															
2	TRA-W20	"cable, surface"															
3	TRA-W30	"cable, surface"															
4	TRA-W40	"cable, surface"															
5	TRA-W50	"cable, screw-in"															
6	TRA-W60	"cable"															
7	TRA-W70	"cable, bayonet"															
8	TRA-W80	"cable"															
9	TRA-W90	"cable"															
2. Approvals																	
0* without																	
1 Simple apparatus																	
3. Cable material																	
1*	PVC	(10, 50)															
2	Silicon	(10, 50, 60)															
3	Teflon	(10, 30, 50, 70)															
4	Tefzel	(20)															
5	Elexar	(40)															
6	Hytrel	(80)															
4. Measuring insert = sensor / wiring																	
1	1x Pt100	2-wire	(10, 50, 60)														
2	1x Pt100	3-wire	(10, 30, 50-70, 90)														
3*	1x Pt100	4-wire	(10-60, 80, 90)														
4	2x Pt100	2-wire	(10, 50, 60, 80, 90)														
5	2x Pt100	3-wire	(10, 50)														
6	1x Pt1000	3-wire	(10, 30, 50, 60)														
7	1x Pt1000	4-wire	(10-60)														
5. Measuring insert / tolerance class																	
2*	Cl. A	Mi, TF	(tolerance class -50...+300°C)	(10-80)													
4	Cl. A	Mi, WW	(tolerance class -200...+600°C)	(90)													
6. Thermowell material																	
1*	1.4404	316L	(10, 50-90)														
2	Brass	(20)															
3	Copper	(40)															
4	PTFE/Copper	(30)															
7. Protection tube size																	
0	3 mm	(10-90)															
1*	6 mm	(10, 60, 90)															
2	8 mm	(10, 90)															
4	Block 5 x 5 x 25	(20)															
5	Block 26 x 18 x 50	(30)															
8. Process connection																	
0* without																	
1	Compression fitting G1/8 SS	(10, 90)															
2	Compression fitting G1/4 SS	(10, 90)															
3	Compression fitting G1/2 SS	(10, 90)															
4	Compression fitting G1/4 Brass	(10)															
9. Thermowell																	
0* without																	
1	tube G1/2 Ø 8 x 1 mm	L= 75 mm	(10)														
2	tube G1/2 Ø 8 x 1 mm	L= 175 mm	(10)														
3	tube G1/2 Ø 8 x 1 mm	L= 275 mm	(10)														
10. Immersion length																	
1	13.5 mm	(60)															
2	15 mm	(50)															
3	20.2 mm	(60)															
4	25 mm	(20, 50, 70)															
5	30 mm	(50)															
6*	50 mm	(10, 30)															
A	100 mm	(10, 40, 90)															
B	150 mm	(10, 90)															
C	200 mm	(10, 90)															
Immersion length (U1/L)																	
D	300 mm	(10, 40, 90)															
E	400 mm	(10, 90)															
F	500 mm	(40, 90)															
M	D1/ Form 4	140/65 mm	(80)														
N	D2/ Form 4	200/125 mm	(80)														
P	D4/ Form 4	200/65 mm	(80)														
R	D5/ Form 4	260/125 mm	(80)														
Z	customized length																
11. Cable length																	
1*	0.5 m																
2	1 m																
3	1.5 m																
4	2 m																
5	3 m																
6	4 m																
7	5 m																
8	6 m																
A	7 m																
Cable length																	
B	8 m																
C	9 m																
D	10 m																
E	12 m																
F	15 m																
G	20 m																
H	25 m																
K	30 m																
Z	customized length																
12. Type of connection / head mounted transmitter																	
0* with flying leads for transmitter mounting																	
13. Type of connection / rail mounted transmitter																	
0* without																	
1	with rail mounted transmitter TT 10 R	analog															
2	with rail mounted transmitter TT 11 R	analog, 0-10 V, only Pt100															
5	with rail mounted transmitter TT 21 R	digital, without galvanic isolation															
6	with rail mounted transmitter TT 30 R	digital, standard	[Ex]														
7	with rail mounted transmitter TT 31 R	1 channel	[Ex]														
8	with rail mounted transmitter TT 31 R	2 channel	[Ex]														
A	with rail mounted transmitter TT 32 R	90 - 250 VAC															
B	with rail mounted transmitter TT 32 R	20 - 30 VDC															
D	with rail mounted transmitter TT 40 R	digital, precise															
G	with rail mounted transmitter TT 50 R	digital, HART															
H	with rail mounted transmitter TT 51 R	digital, HART, SIL2	[Ex]														
K	with rail mounted transmitter TT 60 R	digital, Profibus-PA															

4 = extended standard selection

*Standard

4 = extended standard selection

Temperature assembly for surface measuring Spring-loaded tip

Application

Surface RTD temperature assembly for temperature measurement on pipes, storage tanks, or any application where non penetrative sensing is wanted or necessary.

Temperature assembly

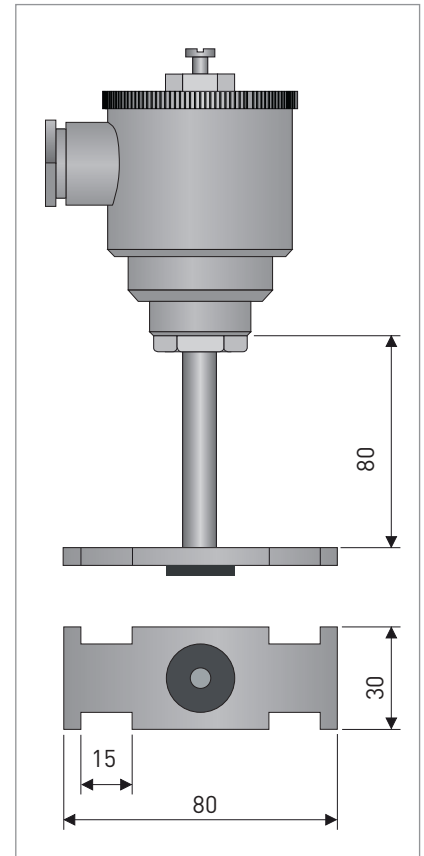
The temperature assembly is made of material 1.4404. The extension tube is Ø 10mm.

Measuring insert

The temperature assembly is equipped with a spring-loaded measuring tip, which guarantees contact at all times. The tip is Ø 6mm and on request be made of silver for faster response. Around tip is a gasket to protect the tip from the ambient environment.

Process temperature -50...+200 °C

Protection class IP 65 (IP 68 is available as option)



Dimensions in mm

Ordering code for TRA-G10 with standard settings

V T E 3 4 1 0 1 2 2 3 5 0 0 1 1 0 0 0 0 0 0 0 0 1 1 0 0
3 4 8

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 112.

3. CONNECTION HEADS

1 BA, (Alu)	M20; IP65
5 BUZ-H, High cap, (Alu)	(Ex)
8 BVA, Hinged cover. (SS)	M20, IP65

4. MEASURING INSERT

2 1x Pt100	3-wire
3 1x Pt100	4-wire

8. PROCESS CONNECTION

0	Without
A	2x Mounting band

Temperature assembly for surface measuring

Spring-loaded tip

Application

For temperature measurement on double walled pipes, storage tanks or any application where non penetrative sensing is wanted or necessary.

Designed with an extra long spring loaded tip, makes it ideal for industries having the same instrument for different surface measuring distance. The temperature assembly is also suitable for vibrating measuring surface or surfaces moving up and down.

Temperature assembly

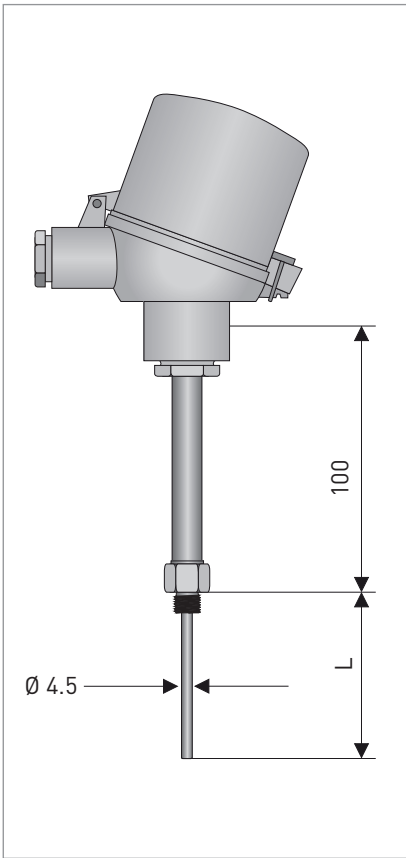
The thermowell is made of stainless steel 1.4404 materials in IP65 classification. The extention tube is Ø 12 x 100 mm with a 1/8 NPT process connection.

Measuring insert

Spring loaded measuring mechanism able to move up to 40 mm to guarantee surface contact at all times.

Process temperature -50...+150 °C

Protection class IP 65



Dimensions in mm

Ordering code
for TRA-G20 with
standard settings

V	T	E	3	0	2	0	5	2	2	3	4	4	0	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0
							3	4																				

This is a selection of the options available for this temperature assembly. For the complete ordering code see page 112.

4. MEASURING INSERT	
2	1x Pt100 3-wire
3	1x Pt100 4-wire

3. CONNECTION HEADS*	
4	BGK, Hinged cover (Alu) IP67
5	BUZ-H, High cover (Alu) (Ex)

* Transmitter cannot be built into the connection head.

Cable sensor for surface measuring

Spring-loaded tip

Application

Surface RTD Sensor for temperature measurement, on pipes, storage tank or any application where non penetrative sensing is wanted or necessary. The sensor has a small form factor and is designed to be placed underneath isolation but can also be placed in open environment.

Sensor assembly

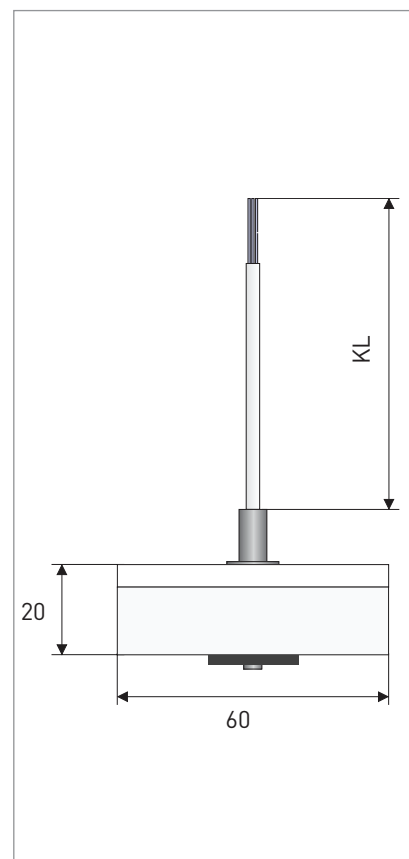
The sensor is made of PTFE plastic and the thermowell in stainless steel EN 1.4404. The sensor size is 60 x 30 x 20 mm. When sensor is clamped the PTFE isolates the measuring element from ambient environment.

Measuring insert

The spring loaded measuring mechanism guarantees surface contact at all times, and on request a silver tip for faster response. The TRA-G30 has a Pt100 element.

Process temperature -50...+200 °C

Protection class IP 65



Dimensions in mm

**Ordering code
for TRA-G30 with
standard settings**

V	T	E	3	0	3	0	A	3	2	5	5	0	0	0	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0
									3	4																			

This is a selection of the options
available for this sensor.
For the complete ordering code
see page 112.

3. CABLE

- A PVC cable
- B Silicon cable
- C Teflon cable

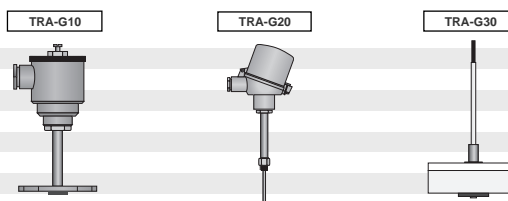
4. MEASURING INSERT

- | | | |
|---|----------|--------|
| 2 | 1x Pt100 | 3-wire |
| 3 | 1x Pt100 | 4-wire |

8. PROCESS CONNECTION

- | | |
|---|---------------|
| 0 | Without |
| A | 2x Hose clamp |

COMPLETE ORDERING CODE



VTE3	0	1. Type	version
		1*	TRA-G 10 for rough environments
		2	TRA-G 20 for special applications
		3	TRA-G 30 for placement underneath pipe isolation

2. Approvals

0* without

3. Connection head	type	Cable	type
0 without		A PVC cable	(30)
1* BA	Alu, M20 x 1.5, IP 65 (10)	B Silicone cable	(30)
4 BGK screw cover	Alu, M20 x 1.5, IP 67 (20)	C Teflon cable	(30)
5 BUZ-H heightened cover	Alu, M20 x 1.5, IP 65 (10, 20)		
8 BVA screw cover	VA, M20 x 1.5, IP 65 (10)		

4. Measuring insert = sensor / wiring

0 without	
2 1x Pt100 3-wire, thin film	(10-30)
3* 1x Pt100 4-wire, thin film	(10-30)

5. Measuring insert / tolerance class

2 Class A	Mi, TF	-50...+300°C
-----------	--------	--------------

6. Material	type
3 1.4404 / Silver	(10, 20)
5 Teflon / Silver	(30)

7. Thermowell diameter	type
0 without	
1 4.5 mm	(20)
2 6.0 mm	(10, 30)

8. Process connection	type
0 without	
1* 1/8" NPT	(10, 20)
A 2x Hose clamp	(30)

10. Immersion length

0* without	(10, 30)
1 50 mm	(20)
2 65 mm	(20)
3 85 mm	(20)
4 110 mm	(20)
5 140 mm	(20)

11. Neck tube / Cable length	type
1* 50 mm	(10)
2 100 mm	(10-20)
3 150 mm	(10)
4 200 mm	(10)
A 0.5 m	(30)
B 1.0 m	(30)
C 2.0 m	(30)
D 5.0 m	(30)
E 10.0 m	(30)
Z Customized	

12. Type of connection / head mounted transmitter

0 with flying leads for transmitter mounting	
1* Standard version with ceramic terminal block	
2 with head mounted transmitter TT 10 C	analog [Ex]
3 with head mounted transmitter TT 11 C	analog, 0-10V
5 with head mounted transmitter TT 20 C	analog, programmable
6 with head mounted transmitter TT 21 C	digital, programmable
7* with head mounted transmitter TT 30 C	digital, standard [Ex]
A with head mounted transmitter TT 40 C	digital, precise
D with head mounted transmitter TT 50 C	digital, HART [Ex]
E with head mounted transmitter TT 51 C	digital, HART, SIL2 [Ex]
F with head mounted transmitter TT 60 C	digital, PROFIBUS [Ex]

13. Type of connection / rail mounted transmitter

0* without	
1 with rail mounted transmitter TT 10 R	analog
2 with rail mounted transmitter TT 11 R	analog, 0-10 V, only Pt100
5 with rail mounted transmitter TT 21 R	digital, without galvanic isolation
6 with rail mounted transmitter TT 30 R	digital, standard [Ex]
7 with rail mounted transmitter TT 31 R	1 channel [Ex]
8 with rail mounted transmitter TT 31 R	2 channel [Ex]
A with rail mounted transmitter TT 32 R	90 - 250 VAC
B with rail mounted transmitter TT 32 R	20 - 30 VDC
D with rail mounted transmitter TT 40 R	digital, precise
G with rail mounted transmitter TT 50 R	digital, HART
H with rail mounted transmitter TT 51 R	digital, HART, SIL2 [Ex]
K with rail mounted transmitter TT 60 R	digital, PROFIBUS-PA

VTE3 0







[illegible]

* *Standard*






4 = extended standard selection

Temperature transmitter selection list

These tables will help you to select the right transmitter for your application.

	Conventional		Programmable			
						
	TT10	TT11	TT20	TT21***	TT30	TT31
Design (powered by)						
Head-mounted transmitter	x	x	x	x	x	–
Intrinsically-safe head-mounted transmitter, Ex	x	–	–	–	x	–
Rail-mounted transmitter,	x	x	–	x	x	x
Intrinsically-safe rail-mounted transmitter, Ex	–	–	–	–	x	x
SIL2	–	–	–	–	–	–
Input						
Resistance thermometer	3-wire	3-wire	3-wire	3- or 4-wire	3- or 4-wire	3- or 4-wire
Thermocouples	J,L,T,K,N	–	–	x	B, C, E, J, K, L, N, R, S, T, U	B, C, E, J, K, L, N, R, S, T, U
Other	–	–	–	–	mV, Ω	mV, Ω
Channels/inputs						
1 Measuring channel	x	x	x	x	x	x
2 Measuring channels	–	–	–	–	–	x
2 Inputs	–	–	–	–	–	x
Output						
4–20 mA	x	–	x	x	x	x
0–10 V	–	x	–	–	–	–
Profibus-PA	–	–	–	–	–	–
HART®	–	–	–	–	–	–
Accuracy						
Accuracy classes	±0.15%	±0.15%	±0.10%	±0.15%	±0.10%	±0.10%
Circuit design						
Galvanic isolation	–	–	–	–	1500 VAC	1500 VAC
Power supply						
24 VDC	x	x	x	x	x	x
230 VAC	–	–	–	–	–	–
Accessories						
Loop powered LED und LCD display, loop powered isolator and repeaters, transmitter configuration kit	–	–	x	x	x	x

x = available, – = not available, *** can be ordered as INOR branded MinIPAQ until TT21 is released

	Programmable		Smart		
					
	TT32	TT40	TT50	TT51	TT60
Design (powered by)					
Head-mounted transmitter	–	x	x	x	x
Intrinsically-safe head-mounted transmitter, Ex	–	–	x	x	x
Rail-mounted transmitter	x	x	x	x	x
Intrinsically-safe rail-mounted transmitter, Ex	–	–	–	x	–
SIL2	–	–	–	x	–
Input					
Resistance thermometer	3- or 4-wire	3- or 4-wire	3- or 4-wire	2/3/4-wire	2/3/4-wire
Thermocouples	B, C, E, J, K, L, N, R, S, T, U	B, C, E, J, K, L, N, R, S, T, U	B, C, E, J, K, L, N, R, S, T, U	B, C, D, E, J, K, N, R, S, T	B, C, D, E, J, K, L, N, R, S, T, U
Other	mV, Ω	mV, Ω	mV, Ω	mV, Ω	mV, Ω
Channels/inputs					
1 Measuring channel	x	x	x	x	x
2 Measuring channels	–	–	–	x **	x ****
2 Inputs	–	–	–	x	x
Output					
4–20 mA	x	x	x	x	–
0–10 V	x	–	–	–	–
Profibus-PA	–	–	–	–	x
HART®	–	–	x	x	–
Accuracy					
Accuracy classes	$\pm 0.10\%$	$\pm 0.05\%$	$\pm 0.10\%$	$\pm 0.05\%$	$\pm 0.10\%$
Circuit design					
Galvanic isolation	4000 VAC	3750 VAC	1500 VAC	1500 VAC	1500 VAC
Power supply					
24 VDC	x	x	x	x	– *
230 VAC	x	–	–	–	– *
Accessories					
Loop powered LED und LCD display, loop powered isolator and repeaters, transmitter configuration kit	x	x	x	x	x

x = available, – = not available, *Profibus power supply, ** able to read 2 channels via HART® **** able to read 2 channels via Profibus

Services

In our laboratory, we perform temperature calibrations traceable to the international temperature scale ITS-90 in the temperature range -80...+1200 °C.

Our reference sensors are sent annually to national laboratory for calibration. This ensures our measurements are always accurate.

Why calibrate?

For all temperature measurement, it is crucial to know how well the measurement results reflect the reality. By regularly calibration of the sensors you will both get the answer as to how accurate the temperature measurement is and the annual drifting in the application.

Comparison calibration

The calibration object together with a reference sensor is calibrated in a liquid bath or in an oven at selected calibration points in the temperature range -80...1200°C.

System error calibration

The sensor and transmitter is calibrated together as one unit with adjustment in two points (endpoints of the configured temperature range). If you like you can also add an additional number of calibration points in between, and thereby obtain a better control on the linearity within the selected range.

Ordering

The following options can be selected when ordering the instrument:

- 1-point measurement at room temperature
- 2-point measuring 0% and 100% of the measuring range
- 3-point measuring 0%, 50% and 100% of the measuring range
- 5-point measurement at 0%, 25%, 50%, 75% and 100% of the measuring range
- Customized measurements and calibrations

These options can also be selected for dual sensors.

Correction of measured value

Some of our transmitters have a correction function for sensor deviation, for example TT51 which corrects the endpoints of the specified measuring range.

Furthermore, an additional control measurement can be ordered. A protocol with all measured data will be supplied with the instrument and a copy of the protocol archived for 2 years. This gives the opportunity to obtain a copy even in retrospect.

Additional certificates that can be ordered:

- Certificate of compliance with the order according to EN 10204 2.1 (Declaration of Compliance)
- Pressure test certificate according to EN 10204 3.1
- Material certificate according to EN 10204 3.1
- PMI (Material Analysis) Analysis method to determine the chemical composition of various metals

TAG plate

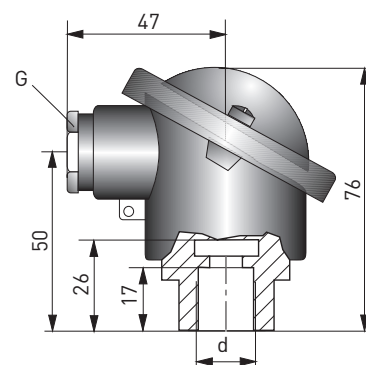
TAG plates are available in different sizes and materials such as stainless steel, PVF and paper. The serial number of the instruments are tied to a TAG number in the sequence the TAG numbers are shown in the order.

The inner dimensions of the connection heads comply with DIN EN 50446, Form B except for the MA version.

BA

Material: Coated aluminum

Connection (d)	G	IP-class	Ordernr.
Ø 15.5	M20 x 1.5	IP 53	68KPH00306
M24 x 1.5	M20 x 1.5	IP 66	68KPH00307



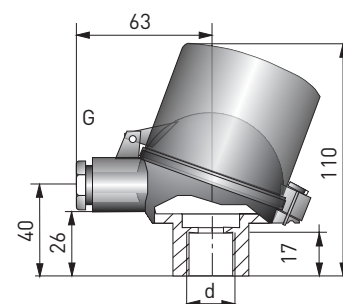
BUZ-H

Material: Coated aluminum



Connection (d)	G	IP-class	Ordernr.	
M24 x 1.5	M20 x 1.5	IP 67	68KPH00111*	EX
M24 x 1.5	M20 x 1.5	IP 67	4000866401	

* For mounting 2 transmitters

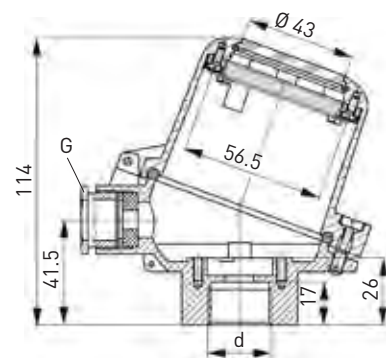


BUZ-HW with integrated indicator type LCD H20

Material: Coated aluminum

Connection (d)	G	IP-class	Ordernr.
M24 x 1.5	M20 x 1.5	IP 67	70LCDH2011

See separate datasheet for LCD-H20



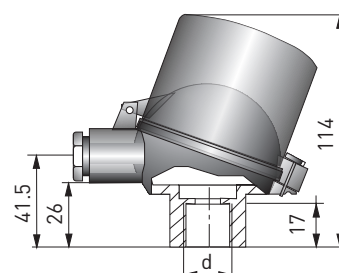
BUZ-HK

Material: Polyamid PA



Connection (d)	G	IP-class	Ordernr.	
M24 x 1.5	M20 x 1.5	IP 65	68KPH00111*	EX

* For mounting 2 transmitters



Dimensions in mm

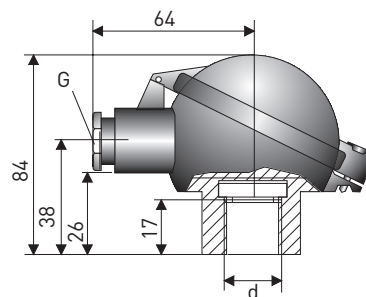
BUZ-T with screw cover

Material: Coated aluminum



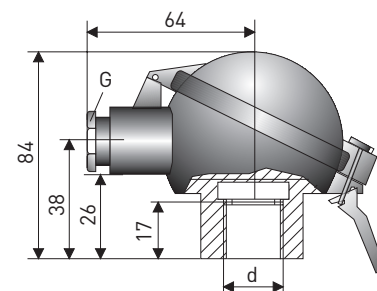
Connection (d)	G	IP-class	Ordernr.
Ø 22.3	M20 x 1.5	IP 54	68KPH00302
M24 x 1.5	M20 x 1.5	IP 67	68KPH00321
Ø 15.3	M20 x 1.5	IP 54	68KPH00326
M24 x 1.5	M20 x 1.5	IP 67	4000866402

EX

**BUZ-S with snap cover**

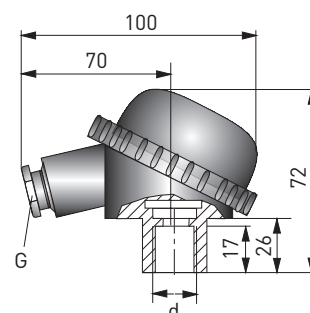
Material: Coated aluminum

Connection (d)	G	IP-class	Ordernr.
Ø 15.5	M20 x 1.5	IP 53	68KPH00317
M24 x 1.5	M20 x 1.5	IP 65	68KPH00118

**BBK**

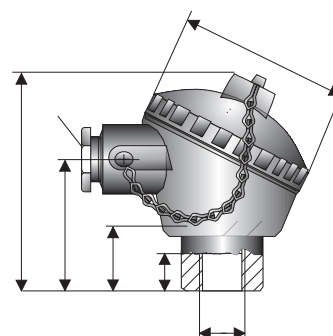
Material: Polyamid PA

Connection (d)	G	IP-class	Ordernr.
M24 x 1.5	M20 x 1.5	IP 54	68KPH00105

**BGK**

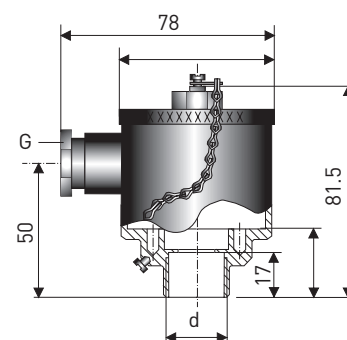
Material: Coated aluminum

Connection (d)	G	IP-class	Ordernr.
M24 x 1.5	M20 x 1.5	IP 67	68KPH00129
1/2" NPT	1/2" NPT	IP 67	4002610301

**BVA**

Material: Stainless steel

Connection (d)	G	IP-class	Ordernr.
M24 x 1.5	M20 x 1.5	IP 65	68KPH00124



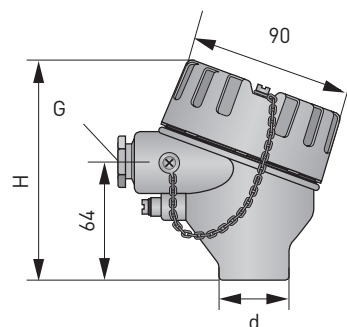
Dimensions in mm

AXD with ATEX EX d IIC**Material:** Coated aluminum IP68

AXD connection head without window, h=115mm

AXD-W connection head with window, h=130mm

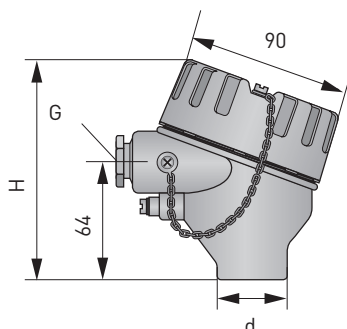
Connection (d)	G	Material	Version	Ordernr.	
M24 x 1.5	M20 x 1.5	Coated Al	Without window	4002154201	EX
1/2" NPT	1/2" NPT	Coated Al	Without window	4002154203	EX
M24 x 1.5	M20 x 1.5	Coated Al	With window	4002154209	EX
1/2" NPT	1/2" NPT	Coated Al	With window	4002154211	EX

**SXD/SXD-W with ATEX EX d IIC****Material:** Stainless steel IP68

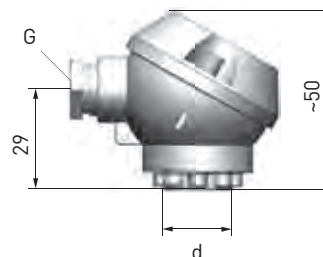
SXD connection head without window, h=115mm

SXD-W connection head with window, h=130mm

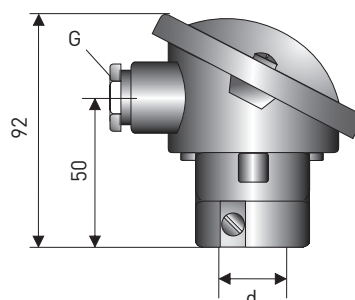
Connection (d)	G	Material	Version	Ordernr.	
M24 x 1.5	M20 x 1.5	SS	Without window	4002154205	EX
1/2" NPT	1/2" NPT	SS	Without window	4002154207	EX
M24 x 1.5	M20 x 1.5	SS	With window	4002154213	EX
1/2" NPT	1/2" NPT	SS	With window	4002154215	EX

**MA****Material:** Coated aluminum

Connection (d)	G	IP-class	Ordernr.
M10 x 1	M16 x 1.5	IP 53	68KPH00115

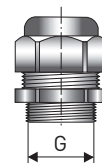
**AA****Material:** Coated aluminum

Connection (d)	G	IP-class	Ordernr.
Ø 22.3	M20 x 1.5	IP 53	68KPH00300
Ø 32.5	M20 x 1.5	IP 53	68KPH00301

**Cable gland for connection heads****IP-class:** IP68 *)**Temperature range:** -40...+100 °C

G	Cable diameter	Material	Ordernr.
M20 x 1.5	6...12 mm	Black polyamide	68FSK00104
M20 x 1.5	6...12 mm	Nickel plated brass	68FSK00115
M20 x 1.5	6...12 mm	Red polyamide	5302608000
M20 x 1.5	6...12 mm	ATEX nickel plated brass	530260510
M20 x 1.5	6...12 mm	ATEX blue polyamide	68FSK00107

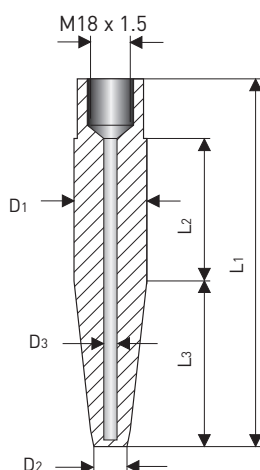
*) with O-ring



Dimensions in mm

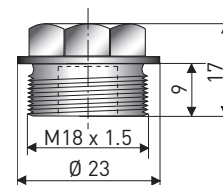
Tapered thermowell form 4, DIN 43772

Form	Dimensions								Measuring insert	Ordernr.	Ordernr.	Ordernr.	Ordernr.
	L ₁	L ₂	L ₃	D ₁	D ₂	D ₃	L	Ø		C 22.8 /1.0460	13CrMo44 /1.7335	Stainless steel /1.4404*	Stainless steel /1.4571
										68FIK-	68FIK-	68FIK-	4000-
D1	140	50	65	24	12.5	7	315	6	10002	10003	10005	1090201	
D2	200	50	125	24	12.5	7	375	6	20002	20003	20005	1090202	
D4	200	110	65	24	12.5	7	375	6	40002	40003	40005	1090203	
D5	260	110	125	24	12.5	7	435	6	50002	50003	50005	1090204	



Plug for thermowell form 4

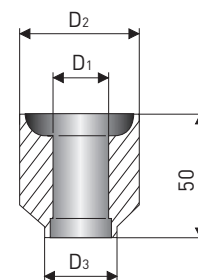
Material	Ordernr.
Stainless steel	680SD00010



Weld-in sleeve for tapered thermowell

Dimensions			Ordernr.	Ordernr.	Ordernr.	Ordernr.
D1	D2	D3	C 22.8 /1.0460	13CrMo44 /1.7335	Stainless steel /1.4404*	Stainless steel /1.4571
24	48	30	68SVS20002	68SVS20003	68SVS20005	4000110401
30	60	36	68SVS30002	68SVS30003	68SVS30005	-

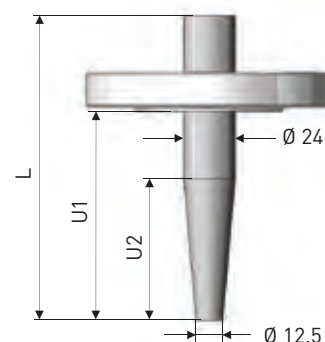
PED-inspected by Inspecta
* Or other PED-inspected material



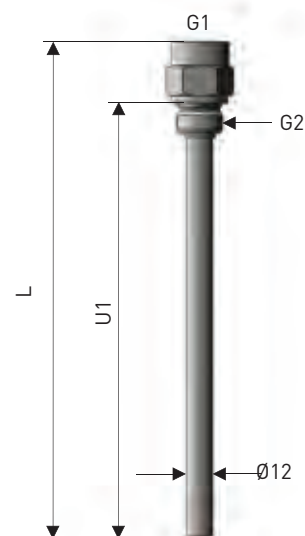
Dimensions in mm

Tapered thermowell for flange mounting, form 4F, DIN 43772

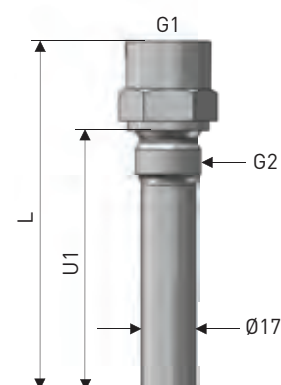
L	U2	U1	Flansch	Material	Article number
200	65	130	DN25/PN40	1.4571/AISI316Ti	4000654302
200	65	130	DN50/PN40	1.4571/AISI316Ti	4000654303
260	125	190	DN25/PN40	1.4571/AISI316Ti	4000654304
260	125	190	DN50/PN40	1.4571/AISI316Ti	4000654305

**Welded straight thermowell for screw-in, form 5, DIN 43772**

L	U1	G1	G2	Material	Article number
110	82	M18	G1/2	1.4571/AISI316Ti	4000209602
170	142	M18	G1/2	1.4571/AISI316Ti	4000209603
260	232	M18	G1/2	1.4571/AISI316Ti	4000209604
410	382	M18	G1/2	1.4571/AISI316Ti	4000209605
110	82	M18	G3/4	1.4571/AISI316Ti	4000209606
170	142	M18	G3/4	1.4571/AISI316Ti	4000209607
260	232	M18	G3/4	1.4571/AISI316Ti	4000209608
410	382	M18	G3/4	1.4571/AISI316Ti	4000209609
110	82	G1/2	G1/2	1.4571/AISI316Ti	4000209610
170	142	G1/2	G1/2	1.4571/AISI316Ti	4000209611
260	232	G1/2	G1/2	1.4571/AISI316Ti	4000209612
410	382	G1/2	G1/2	1.4571/AISI316Ti	4000209613
110	82	G1/2	G3/4	1.4571/AISI316Ti	4000209614
170	142	G1/2	G3/4	1.4571/AISI316Ti	4000209615
260	232	G1/2	G3/4	1.4571/AISI316Ti	4000209616
410	382	G1/2	G3/4	1.4571/AISI316Ti	4000209617

**Barstock straight thermowell for screw-in, form 6, DIN 43772**

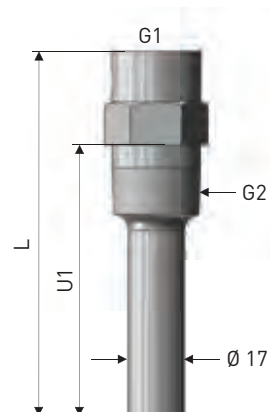
L	U1	G1	G2	Material	Article number
110	82	G1/2	G1/2	1.4571/AISI316Ti	4001034701
170	142	G1/2	G1/2	1.4571/AISI316Ti	4001034702
260	232	G1/2	G1/2	1.4571/AISI316Ti	4001034703
410	382	G1/2	G1/2	1.4571/AISI316Ti	4001034704
110	82	G1/2	G3/4	1.4571/AISI316Ti	4001034801
170	142	G1/2	G3/4	1.4571/AISI316Ti	4001034802
260	232	G1/2	G3/4	1.4571/AISI316Ti	4001034803
410	382	G1/2	G3/4	1.4571/AISI316Ti	4001034804
110	82	M18	G1/2	1.4571/AISI316Ti	4001034901
170	142	M18	G1/2	1.4571/AISI316Ti	4001034902
260	232	M18	G1/2	1.4571/AISI316Ti	4001034903
410	382	M18	G1/2	1.4571/AISI316Ti	4001034904



Dimensions in mm

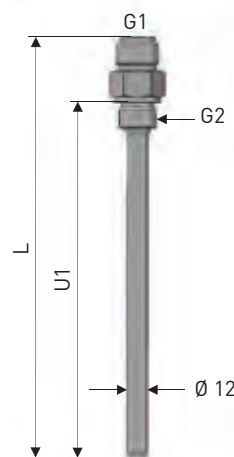
Barstock straight thermowell for screw-in NPT, form 7, DIN 43772

L	U1	G1	G2	Material	Article number
110	82	G1/2	1/2" NPT	1.4571/AISI316Ti	4001050401
170	142	G1/2	1/2" NPT	1.4571/AISI316Ti	4001050402
260	232	G1/2	1/2" NPT	1.4571/AISI316Ti	4001050403
410	382	G1/2	1/2" NPT	1.4571/AISI316Ti	4001050404
110	82	G1/2	3/4" NPT	1.4571/AISI316Ti	4001050501
170	142	G1/2	3/4" NPT	1.4571/AISI316Ti	4001050502
260	232	G1/2	3/4" NPT	1.4571/AISI316Ti	4001050503
410	382	G1/2	3/4" NPT	1.4571/AISI316Ti	4001050504
110	82	M18	1/2" NPT	1.4571/AISI316Ti	4001050601
170	142	M18	1/2" NPT	1.4571/AISI316Ti	4001050602
260	232	M18	1/2" NPT	1.4571/AISI316Ti	4001050603
410	382	M18	1/2" NPT	1.4571/AISI316Ti	4001050604



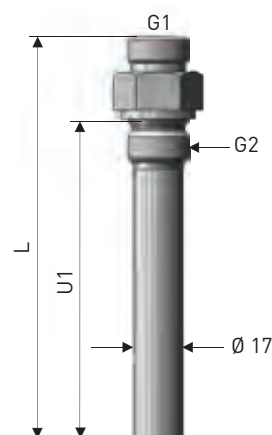
Welded straight thermowell for screw-in for union nut, form 8, DIN 43772

L	U1	G1	G2	Material	Article number
138	110	G1/2	G1/2	1.4571/AISI316Ti	4000604002
198	170	G1/2	G1/2	1.4571/AISI316Ti	4000604003
288	260	G1/2	G1/2	1.4571/AISI316Ti	4000604004
438	410	G1/2	G1/2	1.4571/AISI316Ti	4000604005
138	110	G3/4	G3/4	1.4571/AISI316Ti	4000604006
198	170	G3/4	G3/4	1.4571/AISI316Ti	4000604007
288	260	G3/4	G3/4	1.4571/AISI316Ti	4000604008
438	410	G3/4	G3/4	1.4571/AISI316Ti	4000604009



Barstock straight thermowell for screw-in for union nut, form 9, DIN 43772

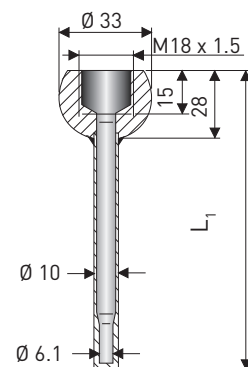
L	U1	G1	G2	Material	Article number
138	110	G1/2	G1/2	1.4571/AISI316Ti	4001034401
198	170	G1/2	G1/2	1.4571/AISI316Ti	4001034402
288	260	G1/2	G1/2	1.4571/AISI316Ti	4001034403
438	410	G1/2	G1/2	1.4571/AISI316Ti	4001034404
138	110	G3/4	G3/4	1.4571/AISI316Ti	4001034501
198	170	G3/4	G3/4	1.4571/AISI316Ti	4001034502
288	260	G3/4	G3/4	1.4571/AISI316Ti	4001034503
438	410	G3/4	G3/4	1.4571/AISI316Ti	4001034504



Dimensions in mm

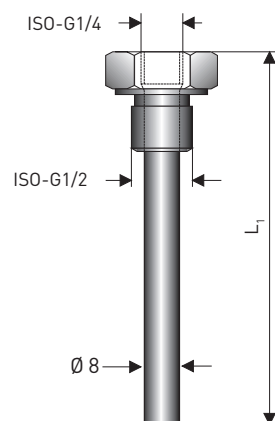
Turnable thermowell form K for mounting by welding

Material: Stainless steel / 1.4404 ^{*)}				
Form	Length L_1	Measuring insert L \varnothing		Ordernr.
K1	140	315	6	68FIK00115
K2	200	375	6	68FIK00116
K3	260	435	6	68FIK00117
PED-inspected by Inspecta Pressure resistance, see "Technical data"				^{*)} Or other PED-inspected material



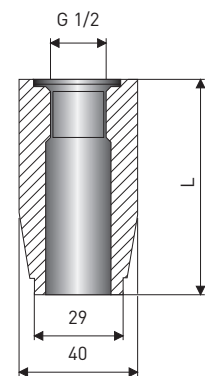
Thermowell (PN40)

[Used together with compression fitting, see below]				
TRA-V30 L	Diving pocket L_1	Material	Ordernr.	
100	75	Stainless steel	66VSR00107	
200	175	Stainless steel	66VSR00117	
300	275	Stainless steel	66VSR00127	



Weld-in sleeve for temperature assembly with thread

Material: Stainless steel / 1.4436 or similar PED-inspected material	
L	Ordernr.
50	68SVS10505
100	68SVS11005
PED-inspected by Inspecta	



Dimensions in mm

Compression fitting G1

Tube Ø	G	L ₁	L ₂	Ordernr.	Max.pressure	Material	Outline
15	G1	70	20	68FSK00238	1 bar	Steel	2
21/22	G1	70	20	68FSK00239	1 bar	Steel	2

Compression fitting G3/4

Tube Ø	G	L ₁	L ₂	Ordernr.	Max.pressure	Material	Outline
15	G3/4	60	20	68FSK00237	1 bar	Steel	2
19	G3/4	60	20	68FSK00245	1 bar	Steel	2

Compression fitting G1/2

Tube Ø	G	L	Ordernr.	Max. pressure	Material	Outline
3	G1/2	-	4002008102	450 bar	1.4404	-
6	G1/2	45	68FSK00241	-	1.4404	1
6	G1/2	35	4000612001	-	1.4571	1
9	G1/2	40	4000612002	-	1.4571	4
11	G1/2	40	4000612003	-	1.4571	3
12	G1/2	40	4000612004	-	1.4571	5
12	G1/2	50	68FSK00240	450 bar	1.4404	5
15	G1/2	50	68FSK00215	450 bar	1.4404	5

Compression fitting G1/4

Tube Ø	G	L	Ordernr.	Material	Outline
3	G1/4	35	68FSK00243	1.4436	1
6	G1/4	40	68FSK00235	1.4436	1
6	G1/4	36	68FSK00248	1.4436	5
6	G1/4	32	68FSK00242	Brass	3
8	G1/4	40	68FSK00210	1.4436	5

Compression fitting G1/8

Tube Ø	G	L	Ordernr.	Material	Outline
1.5	G1/8	-	68MTG00116	1.4436	-
3	G1/8	30	68FSK00219	1.4436	5
6	G1/8	33	68FSK00220	1.4436	5

Compression fitting 1/2" NPT

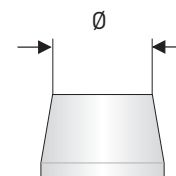
Tube Ø	G	L	Ordernr.	Material	Outline
6	1/2" NPT	45	4000612201	1.4571	4
12	1/2" NPT	48	4000612202	1.4571	4

Compression fitting M8

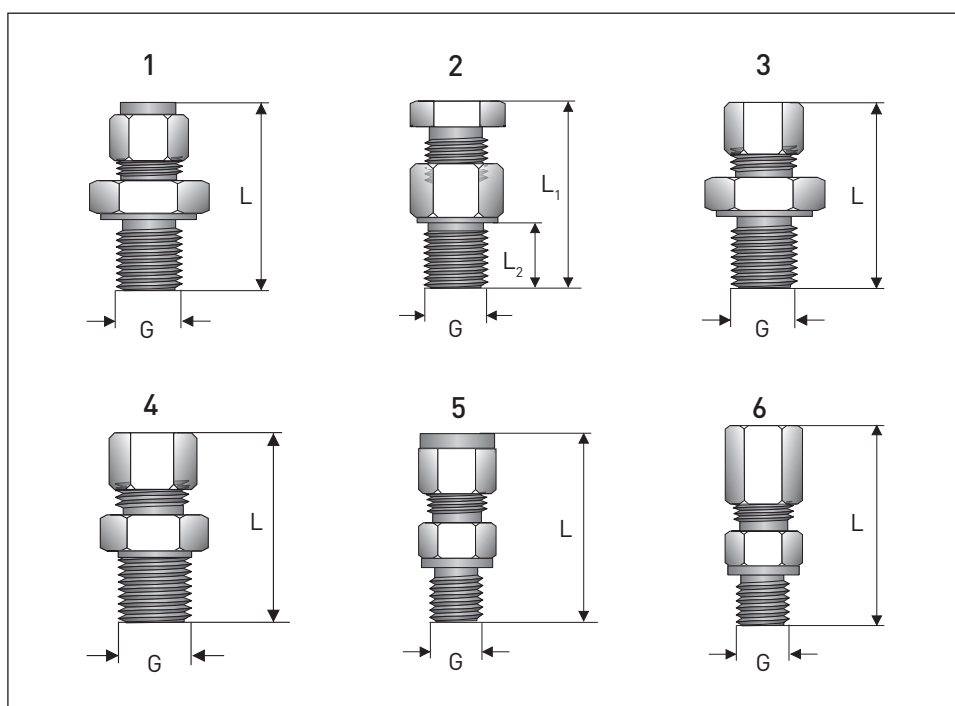
Tube Ø	G	L	Ordernr.	Material	Outline
3	M8	35	68FSK00236	1.4404	6

Sealing for compression fitting

Tube Ø	Ordernr.	Material
1.5	680LV00015	PTFE Teflon Oliv
3	680LV00030	PTFE Teflon Oliv
4.5	680LV00045	PTFE Teflon Oliv
6	680LV00060	PTFE Teflon Oliv
8	680LV00080	PTFE Teflon Oliv
10	680LV00100	PTFE Teflon Oliv
12	680LV00120	PTFE Teflon Oliv

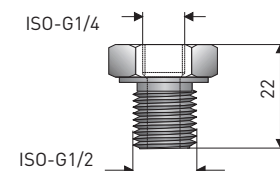


Compression fittings outline



Bushing

	Material	Ordernr.
G 1/4 - G1/2	Brass	68BSG00307

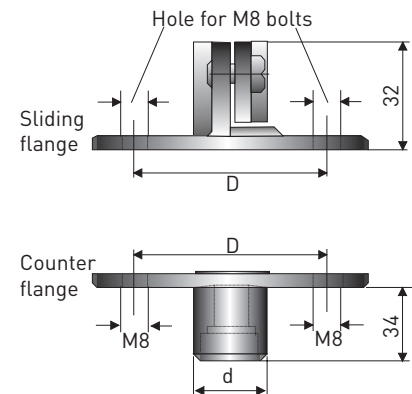


Sliding flange according to DIN EN 50446

Type	Tube Ø	D	d	Ordernr.	Seal
Sliding flange	15	55	-	68FLS00118	None
Complete with counter flange	15	55	35	68FLS00115	1 bar
Complete with counter flange	21/22	70	40	68FLS00116	1 bar
Complete with counter flange	32	70	50	68FLS00117	1 bar

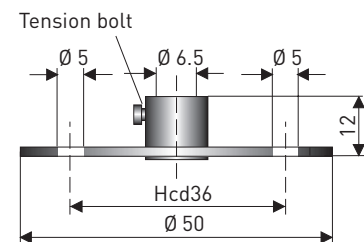
The flanges are mounted together with 2 M8 bolts
(Only delivered with complete flange package)

Material
Sliding flange: Lacquered cast iron
Counter flange: Lacquered steel 1.0401



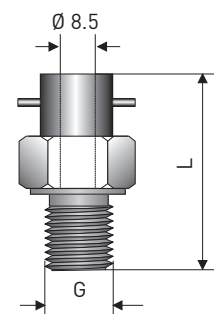
Flange for mounting

Ø	Material	Ordernr.
50	Brass	66VMF00001



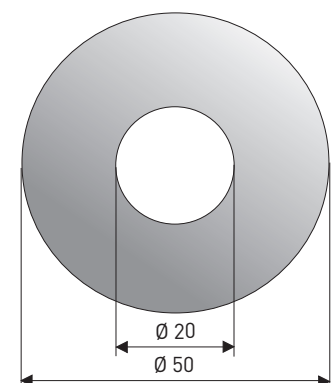
Bayonet Nipple

G	L	Ordernr.	Material
M12 x 1	30	68BAJ00102	Nickel-plated brass
M12 x 1.75	30	68BAJ00108	Nickel-plated brass



Rubber packing

(For sealing between air duct and sensor)		Ordernr.
Dimension		
50 x 20 x 2		68PAK00303

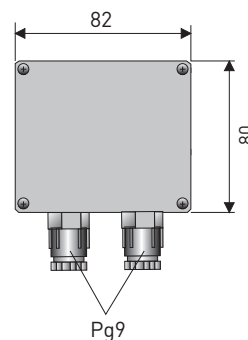


Dimensions in mm

Connection box

Connection box is used together with sensors with cable connection.
Material: grey plastic, 82 x 80 x 55. Transmitter can be mounted.

Mounting	IP-class	Temperature	Ordernr.
Wall mounting	IP 65	-40...100 °C	70ADA00008
Rail mounting	IP 65	-40...100 °C	70ADA00009



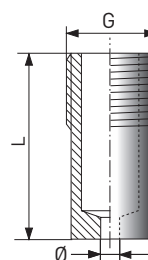
Heat transfer compound

Packaging	Temperature range	Thermal conductivity	Ordernr.
Tube 10 ml	-100...+135 °C	0.84 W/mxK	68FBR00352



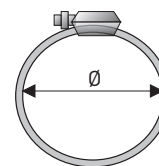
Weld-in sleeve for union nut

G	Ø	L	Material	Ordernr.
G 1/4	3.1	25	AISI316	68SVS00108



Hose clamp

Description	Ordernr.	Width
Sealing band, L=5000 mm (Max Ø =1500 mm)	68SKL00106	8
Lock	68SKL00107	



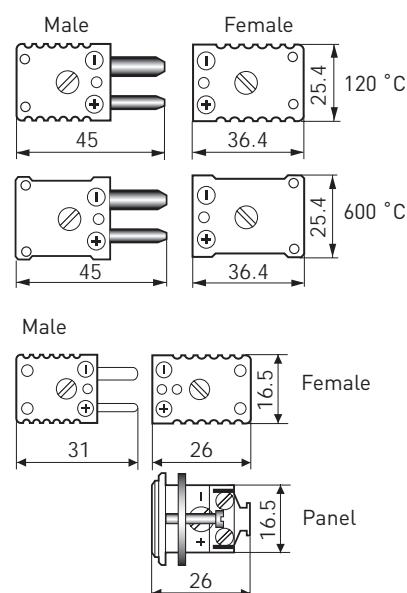
Thermo plug

Standard

Type	Max.temp.	Male	Female
J	120 °C	68MTK01112	68MTK01111
K	120 °C	68MTK02112	68MTK02111
S	120 °C	68MTK03112	68MTK03111
N	120 °C	68MTK08112	68MTK08111
K	600 °C	68MTK02132	68MTK02131
S	600 °C	68MTK03132	68MTK03131
N	600 °C	68MTK08132	68MTK08131

Mini (120 °C)

Type	Male	Female	Panel
J	68MTK01122	68MTK01121	68MTK01221
K	68MTK02122	68MTK02121	68MTK02221
S	68MTK03122	68MTK03121	68MTK03221
N	68MTK08122	68MTK08121	68MTK08221



Dimensions in mm

Multi wired conductors. Delivered in length of 100 meters. Color codes according to IEC 60584.

**GLGL, oval**

Glass fibre insulated, max 400 °C Type N: Silicone/Glass fibre, max 200 °C

Ordering chart

Description		Conductor area	Outer dimensions	Article number
KCA	Type K	2 x 1.5 mm ²	3 x 5 mm	68KAB00431
SCB	Type S	2 x 1.5 mm ²	3.3 x 5 mm	68KAB00444
NC, SLGL	Type N	2 x 1.5 mm ²	3.5 x 5.1 mm	68KAB00469

**GLGLP, oval**

Glass fibre insulation with steel braid, max 200 °C

Ordering chart

Description		Conductor area	Outer dimensions	Article number
KCA	Type K	2 x 1.5 mm ²	6.6 x 7.8 mm	68KAB00432
SCB	Type S	2 x 1.5 mm ²	4.0 x 5.8 mm	68KAB00443

**JJ, oval**

PVC insulated, max 105 °C

Ordering chart

Description		Conductor area	Outer dimensions	Article number
KCA	Type K	2 x 1.5 mm ²	4.1 x 7 mm	68KAB00418
SCB	Type S	2 x 1.5 mm ²	4.5 x 7 mm	68KAB00448
JX	Type J	2 x 1.5 mm ²	4.5 x 6.5 mm	68KAB00404

**JFJ, round**

PVC insulated with electromagnetic shield, and grounded conductor, max 105 °C

Ordering chart

Description		Conductor area	Outer dimensions	Article number
KCA	Type K	2 x 1.5 mm ²	Ø =7.3 mm	68KAB00434
SCB	Type S	2 x 1.5 mm ²	Ø =7.3 mm	68KAB00445
JX	Type J	2 x 1.5 mm ²	Ø =7.3 mm	68KAB00412

**SLSL, oval**

Silicone rubber insulated, max 200 °C

Ordering chart

Description		Conductor area	Outer dimensions	Article number
KCA	Type K	2 x 1.5 mm ²	5.0 x 7.1 mm	68KAB00435
SCB	Type S	2 x 1.5 mm ²	4.3 x 7.0 mm	68KAB00446

**SLFSL, round**

Silicone insulated with electromagnetic shield, and grounded conductor, max 200 °C

Ordering chart

Description		Conductor area	Outer dimensions	Article number
KCA	Type K	2 x 1.5 mm ²	Ø =7.8 mm	68KAB00436

**JJ, round**

PVC insulated, max 105 °C

Ordering chart

Description		Conductor area	Outer dimensions	Article number
KX	Type K	2 x 0.25 mm ²	Ø =4.0 mm	68KAB00423
JX	Type J	2 x 0.22 mm ²	Ø =4.0 mm	68KAB00400
NX	Type N	2 x 0.22 mm ²	Ø =4.0 mm	68KAB00450

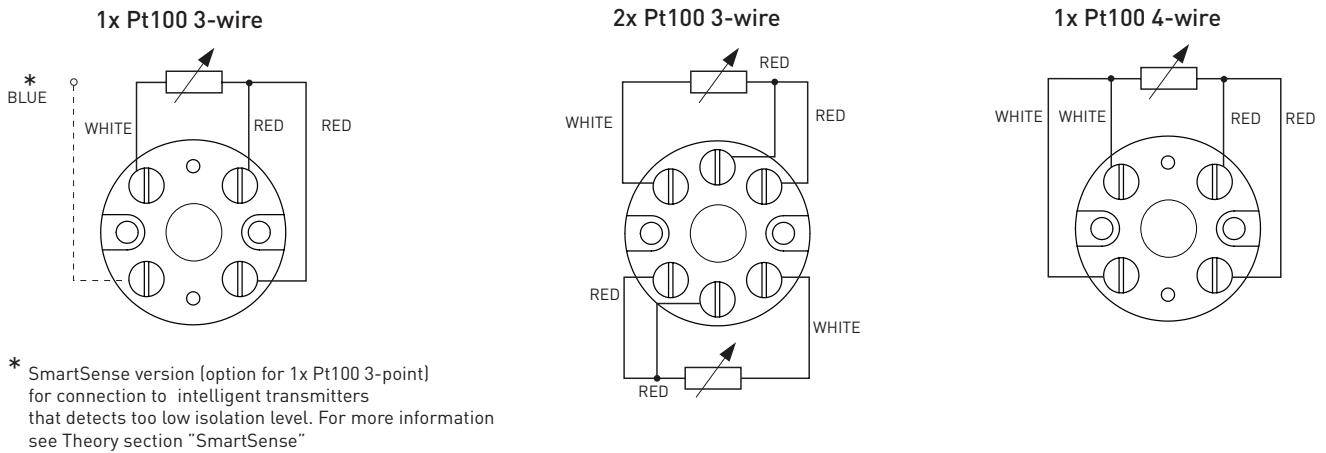
**SLSL, round**

Silicone insulated, max 200 °C

Ordering chart

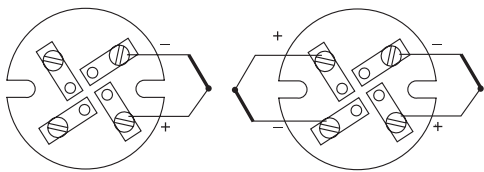
Description		Conductor area	Outer dimensions	Article number
KX	Type K	2 x 0.22 mm ²	Ø =4.0 mm	68KAB00455
JX	Type J	2 x 0.22 mm ²	Ø =4.2 mm	68KAB00408
NX	Type N	2 x 0.75 mm ²	Ø =6.0 mm	68KAB00457

Electrical connections for resistance sensor terminal block

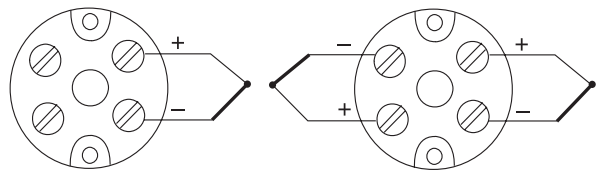


Electrical connections for thermocouple sensor block

Terminal block for connection head type A



Terminal block for connection head type B



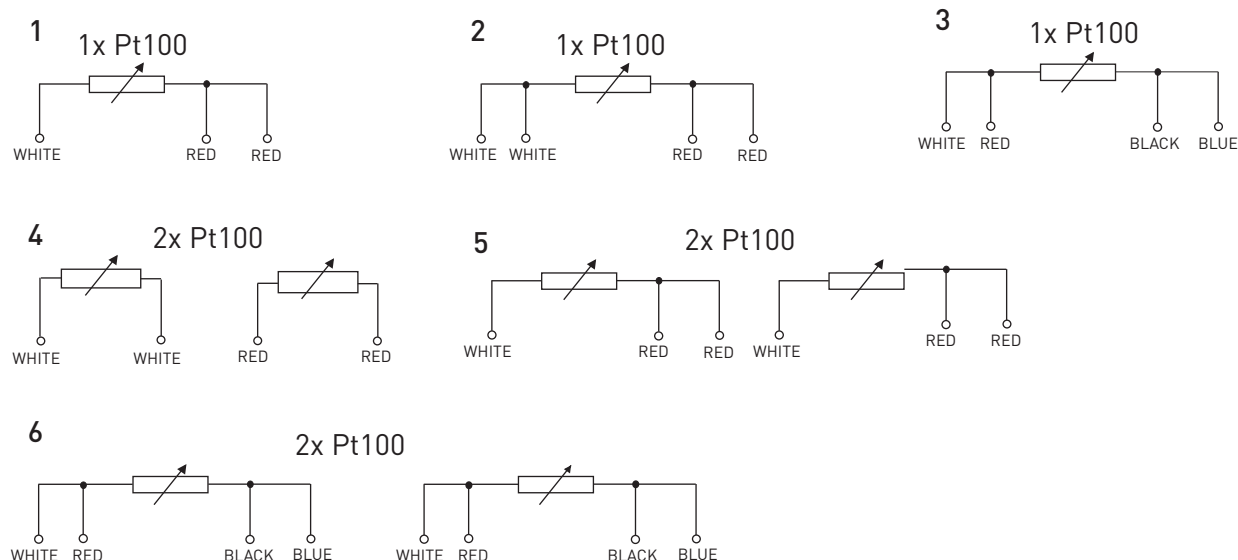
Permissible insulation resistance

Sensors with measuring insert:	Isolation values (250 VDC)	
	20 °C:	> 1 GΩ
	100 °C:	>500 MΩ
	500 °C:	>50 MΩ
Cable sensors (TRA-V30, TRA-V40):	Isolation values (250 VDC)	
	20 °C:	> 1 GΩ
	100 °C:	>500 MΩ
VVS sensors (TRA-V20):	Isolation values (250 VDC)	
	20 °C:	>1 GΩ

Electrical connection for resistance cable sensors

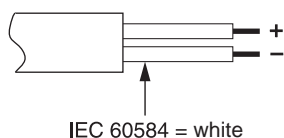
Material	1x Pt100 3-wire	1x Pt100 4-wire	2x Pt100 2-wire	2x Pt100 3-wire	2x Pt100 4-wire
Teflon	1	2	4	5*	6*
Silicone	1	2	4		
PVC	1				
Tefzel		2	4		
Elexar		3			

* For special applications



Electrical connection for thermocouple extension or compensation cables

Extension and compensation cables



More information about color codes, see inside back cover.

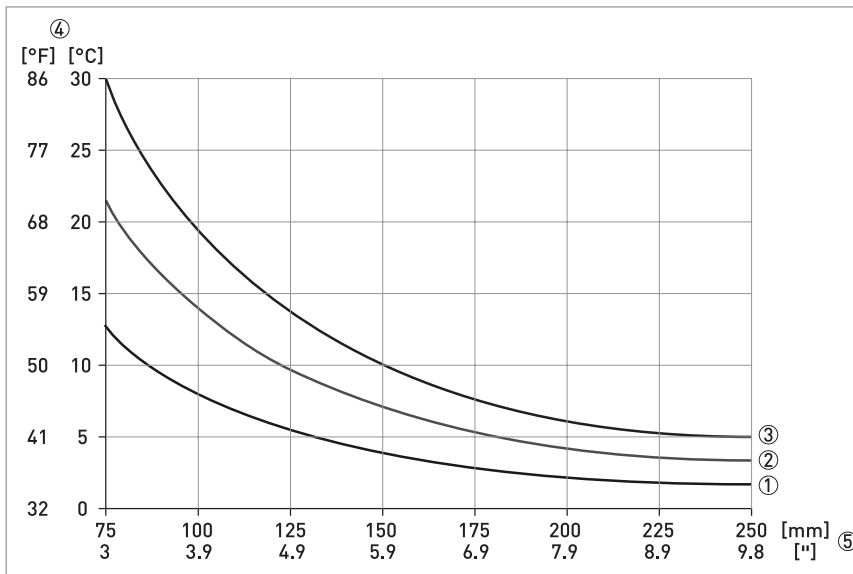
Thermowell material

The table below shows the steel types used , along with previously used designations.

Type	EN-10027-2	Corresponding designations		
	Europe	Sweden (SS)	USA (AISI)	Trade names
Pressure vessel steel	1.0460 1.7335 1.5415	C 22.8 2216 2912	- - F/P1	P250GH 13CrMo4-4 / 13CrMo4-5 15Mo3 / 16Mo3
Stainless steel	1.4301	2332/2333	304	X5CrNi18-10
Stainless steel	1.4404 1.4435 1.4436 1.4571	2348 2353 2343 2350	316L 316L 316 316Ti	X2CrNiMo17-12-2 X2CrNiMo18-14-3 X3CrNiMo17-13-3 X6CrNiMoTi17-12-2
High temperature	1.4841 2.4816 1.4767 1.4762 1.4835	- Inconel 600 Kanthal AF Chrome steel 2368	314 - - 446 S30815/253MA	X15CrNiSi25-21 NiCr15Fe CrAl 20 5 X10CrAlSi25 X9CrNiSiNc21-11-12

Thermal stress on the connection heads

High temperatures in the medium can partly be transferred to the connection head which can risk the connection head or transmitter to overheat. The diagram below shows some examples.



- 1) Process temperature +220°C
- 2) Process temperature +400°C
- 3) Process temperature +570°C
- 4) Temperature in connection head
- 5) Extension tube length

NOTE! The diagram only shows the increase in temperature. The ambient temperature must be added to this.

Pt100 according to IEC 60751 based on ITS-90

°C	Ohm	Ohm/°C	°C	Ohm	Ohm/°C	°C	Ohm	Ohm/°C	°C	Ohm	Ohm/°C
-200	18.52	0.44	70	127.08	0.38	330	222.68	0.35	+600	313.71	0.33
-190	22.83	0.43	80	130.90	0.38	340	226.21	0.35	610	316.92	0.32
-180	27.10	0.42	90	134.71	0.38	350	229.72	0.35	620	320.12	0.32
-170	31.34	0.42				360	233.21	0.35	630	323.30	0.31
-160	35.54	0.42	+100	138.51	0.38	370	236.70	0.35	640	326.48	0.31
-150	39.72	0.42	110	142.29	0.37	380	240.18	0.34	650	329.64	0.31
-140	43.88	0.41	120	146.07	0.38	390	243.64	0.34	660	332.79	0.31
-130	48.00	0.41	130	149.83	0.38				670	335.93	0.32
-120	52.11	0.41	140	153.58	0.37	+400	247.09	0.34	680	339.06	0.31
-110	56.19	0.41	150	157.33	0.38	410	250.53	0.34	690	342.18	0.31
			160	161.05	0.38	420	253.96	0.34			
-100	60.26	0.41	170	164.77	0.37	430	257.38	0.34	+700	345.28	0.31
-90	64.30	0.40	180	168.48	0.37	440	260.78	0.34	710	348.38	0.31
-80	68.33	0.40	190	172.17	0.37	450	264.18	0.34	720	351.46	0.31
-70	72.33	0.40				460	267.56	0.34	730	354.53	0.30
-60	76.33	0.40	+200	175.86	0.37	470	270.93	0.34	740	357.59	0.31
-50	80.31	0.39	210	179.53	0.37	480	274.29	0.33	750	360.64	0.30
-40	84.27	0.40	220	183.19	0.36	490	277.64	0.34	760	363.67	0.30
-30	88.22	0.40	230	186.84	0.36				770	366.70	0.30
-20	92.16	0.39	240	190.47	0.36	+500	280.98	0.33	780	369.71	0.30
-10	96.09	0.39	250	194.10	0.37	510	284.30	0.33	790	372.71	0.30
			260	197.71	0.36	520	287.62	0.33			
0	100.00	0.39	270	201.31	0.36	530	290.92	0.33	+800	375.70	0.30
10	103.90	0.39	280	204.90	0.35	540	294.21	0.33	810	378.68	0.30
20	107.79	0.39	290	208.48	0.36	550	297.49	0.33	820	381.65	0.29
30	111.67	0.39				560	300.75	0.33	830	384.60	0.29
40	115.54	0.39	+300	212.05	0.35	570	304.01	0.32	840	387.55	0.29
50	119.40	0.38	310	215.61	0.36	580	307.25	0.32	850	390.48	0.29
60	123.24	0.38	320	219.15	0.35	590	310.49	0.32			

Pt250 according to IEC 60751 (ITS-90)

°C	Ohm	°C	Ohm	°C	Ohm	°C	Ohm
-200	46.30	70	317.70	330	556.70	600	784.28
-190	57.08	80	327.25	340	565.53	610	792.30
-180	67.75	90	336.78	350	574.30	620	800.30
-170	78.35			360	583.03	630	808.25
-160	88.85	100	346.28	370	591.75	640	816.20
-150	99.30	110	355.73	380	600.45	650	824.10
-140	109.70	120	365.18	390	609.10	660	831.98
-130	120.00	130	374.58			670	839.83
-120	130.28	140	383.95	400	617.73	680	847.65
-110	140.48	150	393.33	410	626.33	690	855.45
		160	402.63	420	634.90		
-100	150.65	170	411.93	430	643.45	700	863.20
-90	160.75	180	421.20	440	651.95	710	870.95
-80	170.83	190	430.43	450	660.45	720	878.65
-70	180.83			460	668.90	730	886.33
-60	190.83	200	439.65	470	677.33	740	893.98
-50	200.78	210	448.83	480	685.73	750	901.60
-40	210.68	220	457.98	490	694.10	760	909.18
-30	220.55	230	467.10			770	916.75
-20	230.40	240	476.18	500	702.45	780	924.28
-10	240.23	250	485.25	510	710.75	790	931.78
		260	494.28	520	719.05		
0	250.00	270	503.28	530	727.30	800	939.25
10	259.75	280	512.25	540	735.53	810	946.70
20	269.48	290	521.20	550	743.73	820	954.13
30	279.18			560	751.88	830	961.50
40	288.85	300	530.13	570	760.03	840	968.88
50	298.50	310	539.03	580	768.13	850	976.20
60	308.10	320	547.88	590	776.23		

Pt500 according to IEC 60751 (ITS-90)

°C	Ohm	°C	Ohm	°C	Ohm	°C	Ohm
-200	92.60	70	635.40	330	1113.40	600	1568.55
-190	114.15	80	654.50	340	1131.05	610	1584.60
-180	135.50	90	673.55	350	1148.60	620	1600.60
-170	156.70			360	1166.05	630	1616.50
-160	177.70	100	692.55	370	1183.50	640	1632.40
-150	198.60	110	711.45	380	1200.90	650	1648.20
-140	219.40	120	730.35	390	1218.20	660	1663.95
-130	240.00	130	749.15			670	1679.65
-120	260.55	140	767.90	400	1235.45	680	1695.30
-110	280.95	150	786.65	410	1252.65	690	1710.90
		160	805.25	420	1269.80		
-100	301.30	170	823.85	430	1286.90	700	1726.40
-90	321.50	180	842.40	440	1303.90	710	1741.90
-80	341.65	190	860.85	450	1320.90	720	1757.30
-70	361.65			460	1337.80	730	1772.65
-60	381.65	200	879.30	470	1354.65	740	1787.95
-50	401.55	210	897.65	480	1371.45	750	1803.20
-40	421.35	220	915.95	490	1388.20	760	1818.35
-30	441.10	230	934.20			770	1833.50
-20	460.80	240	952.35	500	1404.90	780	1848.55
-10	480.45	250	970.50	510	1421.50	790	1863.55
		260	988.55	520	1438.10		
0	500.00	270	1006.55	530	1454.60	800	1878.50
10	519.50	280	1024.50	540	1471.05	810	1893.40
20	538.95	290	1042.40	550	1487.45	820	1908.25
30	558.35			560	1503.75	830	1923.00
40	577.70	300	1060.25	570	1520.05	840	1937.75
50	597.00	310	1078.05	580	1536.25	850	1952.40
60	616.20	320	1095.75	590	1552.45		

Pt1000 according to IEC 60751 (ITS-90)

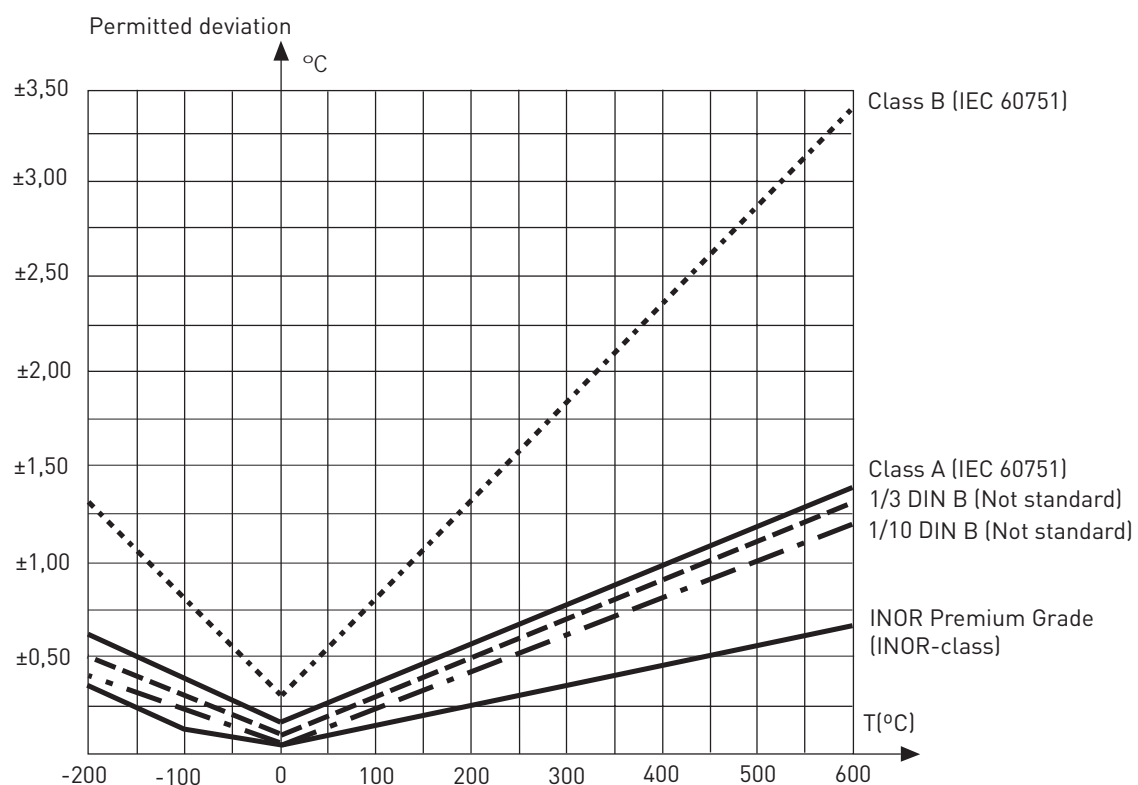
°C	Ohm	°C	Ohm	°C	Ohm	°C	Ohm
-200	185.20	70	1270.80	330	2226.80	600	3137.10
-190	228.30	80	1309.00	340	2262.10	610	3169.20
-180	271.00	90	1347.10	350	2297.20	620	3201.20
-170	313.40			360	2332.10	630	3233.00
-160	355.40	100	1385.10	370	2367.00	640	3264.80
-150	397.20	110	1422.90	380	2401.80	650	3296.40
-140	438.80	120	1460.70	390	2436.40	660	3327.90
-130	480.00	130	1498.30			670	3359.30
-120	521.10	140	1535.80	400	2470.90	680	3390.60
-110	561.90	150	1573.30	410	2505.30	690	3421.80
		160	1610.50	420	2539.60		
-100	602.60	170	1647.70	430	2573.80	700	3452.80
-90	643.00	180	1684.80	440	2607.80	710	3483.80
-80	683.30	190	1721.70	450	2641.80	720	3514.60
-70	723.30			460	2675.60	730	3545.30
-60	763.30	200	1758.60	470	2709.30	740	3575.90
-50	803.10	210	1795.30	480	2742.90	750	3606.40
-40	842.70	220	1831.90	490	2776.40	760	3636.70
-30	882.20	230	1868.40			770	3667.00
-20	921.60	240	1904.70	500	2809.80	780	3697.10
-10	960.90	250	1941.00	510	2843.00	790	3727.10
		260	1977.10	520	2876.20		
0	1000.00	270	2013.10	530	2909.20	800	3757.00
10	1039.00	280	2049.00	540	2942.10	810	3786.80
20	1077.90	290	2084.80	550	2974.90	820	3816.50
30	1116.70			560	3007.50	830	3846.00
40	1155.40	300	2120.50	570	3040.10	840	3875.50
50	1194.00	310	2156.10	580	3072.50	850	3904.80
60	1232.40	320	2191.50	590	3104.90		

Ni100 according to DIN 43760

°C	Ohm	°C	Ohm	°C	Ohm	°C	Ohm
-60	69.46	10	105.60	70	141.69	130	183.31
-50	74.24	20	111.30	80	148.21	140	190.90
-40	79.12	30	117.12	90	154.89	150	198.69
-30	84.12	40	123.07	100	161.73	160	206.68
-20	89.25	50	129.14	110	168.73	170	214.86
-10	94.54	60	135.34	120	175.92	180	223.10
0	100.00						

Ni1000 according to DIN 43760

°C	Ohm	°C	Ohm	°C	Ohm	°C	Ohm
-606	94,60	10	1056,00	70	1416,90	130	1833,10
-50	742.40	20	1113.00	80	1482.10	140	1909.00
-40	791.20	30	1171.20	90	1548.90	150	1986.90
-30	841.20	40	1230.70	100	1617.30	160	2066.80
-20	892.50	50	1291.40	110	1687.30	170	2148.60
-10	945.40	60	1353.40	120	1759.20	180	2231.00
0	1000.00						



Tolerances for Pt100- and Pt1000-sensor element

Temperature	Tolerances				
	Standardized according to IEC 60751		class	Older, non-standardized classes	
°C	Class B °C	Class A °C	INOR Premium Grade °C	1/3 DIN B °C	1/10 DIN B °C
-200	± 1.30	± 0.55	± 0.38	± 0.50	± 0.43
-100	± 0.80	± 0.35	± 0.12	± 0.30	± 0.23
0	± 0.30	± 0.15	± 0.03	± 0.10	± 0.03
100	± 0.80	± 0.35	± 0.12	± 0.30	± 0.23
200	± 1.30	± 0.55	± 0.22	± 0.50	± 0.43
300	± 1.80	± 0.75	± 0.33	± 0.70	± 0.63
400	± 2.30	± 0.95	± 0.45	± 0.90	± 0.83
500	± 2.80	± 1.15	± 0.58	± 1.10	± 1.03
600	± 3.30	± 1.35	± 0.73	± 1.30	± 1.23

Tolerances for Ni100 sensor element

Temperature	Tolerances
	Standardized according to DIN 43760
°C	°C
-60	± 2.10
0	± 0.40
100	± 1.10
180	± 1.70

Thermocouple types

Type	Composition	Range	Application
Low range			
T	Copper (+) Constantan (-)	-180...370 °C -300...700 °F	Useable in oxidizing, reducing, or inert atmospheres, as well as vacuum. Not subject to corrosion in moist atmospheres.
Standard range			
K	Chromel (+) Alumel (-)	95...1260 °C 200...2300 °F	Recommended for continuous oxidizing or neutral atmosphere. Mostly used above 540 °C/1000 °F. Subject to failure if exposed to sulphur. Preferential oxidation of chromium in positive leg at certain low oxygen concentrations causes "green rot" and large negative errors. Ventilation or inert-sealing of the thermowell can prevent it.
J	Iron (+) Constantan (-)	95...760 °C 200...1400 °F	Suitable for vacuum, reducing or inert atmospheres. Reduced life in oxidizing atmosphere. Iron oxidizes rapidly above 540 °C/1000 °F so only heavy gauge wire is recommended for high temperature. Bare elements should not be exposed to sulphurous atmospheres above 540 °C /1000 °F.
N	Nicrosil (+) Nisil (-)	650...1260 °C 1200...2300 °F	Nicrosil/Nisil nickel based thermocouple alloy used preliminary at high temperature up to 1260°C/2300 °F. While not a direct replacement for type K, Type N provides better resistance to oxidation at higher temperature and longer life in application where sulphur is present.
E	Chromel (+) Constantan (-)	95...900 °C 200...1650 °F	Recommended for continuously oxidizing or inert atmospheres. Highest thermoelectric output.
High temperature			
S	Platinum 10% Rhodium (+) Platinum (-)	980...1480 °C 1800...2700 °F	Recommended for high temperature. Must be protected with non metallic thermowell and ceramic insulators. Continued high temperature usage causes grain growth which can lead to mechanical failure. Negative calibration drift caused by rhodium diffusion to pure leg as well as from rhodium volatilization.
R	Platinum 13% Rhodium (+) Platinum (-)	870...1480 °C 1600...2700 °F	Same as for Type S
B	Platinum 30% Rhodium (+) Platinum 6% Rhodium (-)	1370...1800 °C 2500...3100 °F	Same as for type S and R but output is lower. Also less susceptible to grain growth and drift.
Very high temperature			
C	Tungsten 5% Rhenium (+) Tungsten 26% Rhenium (-)	1650...2300 °C 3000...4200 °F	This refractory metal thermocouple may be used at temperatures up to 2300°C/4200°F. As it has no oxidation resistance it's use is restricted to vacuum, hydrogen or inert atmospheres.
W	Tungsten 3% Rhenium (+) Tungsten 25% Rhenium (-)	1600...2300 °C 3000...4200 °F	The ductility of the W3Re leg is superior to pure Tungsten, but not as good as W5Re. This combination has highest output of the Tungsten Rhenium.

17 TEMPERATURE CHARTS FOR THERMOCOUPLES

Thermocouple type E

NiCr-CuNi according to IEC 60584-1. Output in mV. Reference temperature 0 °C

°C	0	-10	-20	-30	-40	-50	-60	-70	-80	-90	mV/°C*
-200	-8.825	-9.063	-9.274	-9.455	-9.604	-9.718	-9.797	-9.835			0.014
-100	-5.237	-5.681	-6.107	-6.516	-6.907	-7.279	-7.632	-7.963	-8.273	-8.561	0.036
0	0.000	-0.582	-1.152	-1.709	-2.255	-2.787	-3.306	-3.811	-4.302	-4.777	0.052
°C	0	10	20	30	40	50	60	70	80	90	
0	0.000	0.591	1.192	1.801	2.420	3.048	3.685	4.330	4.985	5.648	0.063
100	6.319	6.998	7.685	8.379	9.081	9.789	10.503	11.224	11.951	12.684	0.071
200	13.421	14.164	14.912	15.664	16.420	17.181	17.945	18.713	19.484	20.259	0.076
300	21.036	21.817	22.600	23.386	24.174	24.964	25.757	26.552	27.348	28.146	0.079
400	28.946	29.747	30.550	31.354	32.159	32.965	33.772	34.579	35.387	36.196	0.081
500	37.005	37.815	38.624	39.434	40.243	41.053	41.862	42.671	43.479	44.286	0.081
600	45.093	45.900	46.705	47.509	48.313	49.116	49.917	50.718	51.517	52.315	0.080
700	53.112	53.908	54.703	55.497	56.289	57.080	57.870	58.659	59.446	60.232	0.079
800	61.017	61.801	62.583	63.364	64.144	64.922	65.698	66.473	67.246	68.017	0.078
900	68.787	69.554	70.319	71.082	71.844	72.603	73.360	74.115	74.869	75.621	0.076
1000	76.373										

*Mean value

Thermocouple type J

Fe-CuNi according to IEC 60584-1. Output in mV. Reference temperature 0 °C

°C	0	-10	-20	-30	-40	-50	-60	-70	-80	-90	mV/°C*
-200	-7.890	-8.095									0.021
-100	-4.633	-5.037	-5.426	-5.801	-6.159	-6.500	-6.821	-7.123	-7.403	-7.659	0.033
0	0.000	-0.501	-0.995	-1.482	-1.961	-2.431	-2.893	-3.344	-3.786	-4.215	0.046
°C	0	10	20	30	40	50	60	70	80	90	
0	0.000	0.507	1.019	1.537	2.059	2.585	3.116	3.650	4.187	4.726	0.053
100	5.269	5.814	6.360	6.909	7.459	8.010	8.562	9.115	9.669	10.224	0.055
200	10.779	11.334	11.889	12.445	13.000	13.555	14.110	14.665	15.219	15.773	0.055
300	16.327	16.881	17.434	17.986	18.538	19.090	19.642	20.194	20.745	21.297	0.055
400	21.848	22.400	22.952	23.504	24.057	24.610	25.164	25.720	26.276	26.834	0.055
500	27.393	27.953	28.516	29.080	29.647	30.216	30.788	31.362	31.939	32.519	0.057
600	33.102	33.689	34.279	34.873	35.470	36.071	36.675	37.284	37.896	38.512	0.060
700	39.132	39.755	40.382	41.012	41.645	42.281	42.919	43.559	44.203	44.848	0.064
800	45.494	46.141	46.786	47.431	48.074	48.715	49.353	49.989	50.622	51.251	0.064
900	51.877	52.500	53.119	53.735	54.347	54.956	55.561	56.164	56.763	57.360	0.061
1000	57.953	58.545	59.134	59.721	60.307	60.890	61.473	62.054	62.634	63.214	0.058
1100	63.792	64.370	64.948	65.525	66.102	66.679	67.255	67.831	68.406	68.980	0.058
1200	69.553										

*Mean value

Thermocouple type K

NiCr-NiAl according to IEC 60584-1. Output in mV. Reference temperature 0 °C

°C	0	-10	-20	-30	-40	-50	-60	-70	-80	-90	mV/°C*
-200	-5.891	-6.035	-6.158	-6.262	-6.344	-6.404	-6.441	-6.458			0.008
-100	-3.554	-3.852	-4.138	-4.411	-4.669	-4.913	-5.141	-5.354	-5.550	-5.730	0.023
0	0.000	-0.392	-0.778	-1.156	-1.527	-1.889	-2.243	-2.587	-2.920	-3.243	0.036
°C	0	10	20	30	40	50	60	70	80	90	
0	0.000	0.397	0.789	1.203	1.612	2.023	2.436	2.851	3.267	3.682	0.041
100	4.096	4.509	4.920	5.328	5.735	6.138	6.540	6.941	7.340	7.739	0.040
200	8.138	8.539	8.940	9.343	9.747	10.153	10.561	10.971	11.382	11.795	0.041
300	12.209	12.624	13.040	13.457	13.874	14.293	14.713	15.133	15.554	15.975	0.042
400	16.397	16.820	17.243	17.667	18.091	18.516	18.941	19.366	19.792	20.218	0.042
500	20.644	21.071	21.497	21.924	22.350	22.776	23.203	23.629	24.055	24.480	0.043
600	24.905	25.330	25.755	26.179	26.602	27.025	27.447	27.869	28.289	28.710	0.042
700	29.129	29.548	29.965	30.382	30.798	31.213	31.628	32.041	32.453	32.865	0.041
800	33.275	33.685	34.093	34.501	34.908	35.313	35.718	36.121	36.524	36.925	0.041
900	37.326	37.725	38.124	38.522	38.918	39.314	39.708	40.101	40.494	40.885	0.040
1000	41.276	41.665	42.053	42.440	42.826	43.211	43.595	43.978	44.359	44.740	0.038
1100	45.119	45.497	45.873	46.249	46.623	46.995	47.367	47.737	48.105	48.473	0.037
1200	48.838	49.202	49.565	49.926	50.286	50.644	51.000	51.355	51.708	52.060	0.036
1300	52.410	52.759	53.106	53.451	53.795	54.138	54.479	54.819			0.034

*Mean value

Thermocouple type N

NiCrSi-NiSi according to IEC 60584-1. Output in mV. Reference temperature 0 °C

°C	0	-10	-20	-30	-40	-50	-60	-70	-80	-90	mV/°C*
-200	-3.990	-4.083	-4.162	-4.226	-4.277	-4.313	-4.336	-4.345			0.005
-100	-2.407	-2.612	-2.808	-2.994	-3.171	-3.336	-3.491	-3.634	-3.766	-3.884	0.016
0	0.000	-0.260	-0.518	-0.772	-1.023	-1.269	-1.509	-1.744	-1.972	-2.193	0.024
°C	0	10	20	30	40	50	60	70	80	90	
0	0.000	0.261	0.525	0.793	1.065	1.340	1.619	1.902	2.189	2.480	0.028
100	2.774	3.072	3.374	3.680	3.989	4.302	4.618	4.937	5.259	5.585	0.031
200	5.913	6.245	6.579	6.916	7.255	7.597	7.941	8.288	8.637	8.988	0.034
300	9.341	9.696	10.054	10.413	10.774	11.136	11.501	11.867	12.234	12.603	0.036
400	12.974	13.346	13.719	14.094	14.469	14.846	15.225	15.604	15.984	16.366	0.038
500	16.748	17.131	17.515	17.900	18.286	18.672	19.059	19.447	19.835	20.224	0.039
600	20.613	21.003	21.393	21.784	22.175	22.566	22.958	23.350	23.742	24.134	0.039
700	24.527	24.919	25.312	25.705	26.098	26.491	26.883	27.276	27.669	28.062	0.039
800	28.455	28.847	29.239	29.632	30.024	30.416	30.807	31.199	31.590	31.981	0.039
900	32.371	32.761	33.151	33.541	33.930	34.319	34.707	35.095	35.482	35.869	0.039
1000	36.256	36.641	37.027	37.411	37.795	38.179	38.562	38.944	39.326	39.706	0.038
1100	40.087	40.466	40.845	41.223	41.600	41.976	42.352	42.727	43.101	43.474	0.038
1200	43.846	44.218	44.588	44.958	45.326	45.694	46.060	46.425	46.789	47.152	0.037
1300	47.513										

*Mean value

Thermocouple type T

Cu-CuNi according to IEC 60584-1. Output in mV. Reference temperature 0 °C

°C	0	-10	-20	-30	-40	-50	-60	-70	-80	-90	mV/°C*
-200	-5.603	-5.753	-5.888	-6.007	-6.105	-6.180	-6.232	-6.258			0.009
-100	-3.379	-3.657	-3.923	-4.177	-4.419	-4.648	-4.865	-5.070	-5.261	-5.439	0.022
0	0.000	-0.383	-0.757	-1.121	-1.475	-1.819	-2.153	-2.476	-2.788	-3.089	0.034
°C	0	10	20	30	40	50	60	70	80	90	
0	0.000	0.391	0.790	1.196	1.612	2.036	2.468	2.909	3.358	3.814	0.043
100	4.279	4.750	5.228	5.714	6.206	6.704	7.209	7.720	8.237	8.759	0.050
200	9.288	9.822	10.362	10.907	11.458	12.013	12.574	13.139	13.709	14.283	0.056
300	14.862	15.445	16.032	16.624	17.219	17.819	18.422	19.030	19.641	20.255	0.060
400	20.872										

*Mean value

Thermocouple type R

Pt13%Rh-Pt according to IEC 60584-1. Output in mV. Reference temperature 0 °C

°C	0	10	20	30	40	50	60	70	80	90	mV/°C*
0	0.000	0.054	0.111	0.171	0.232	0.296	0.363	0.431	0.501	0.573	0.006
100	0.647	0.723	0.800	0.879	0.959	1.041	1.124	1.208	1.294	1.381	0.008
200	1.469	1.558	1.648	1.739	1.831	1.923	2.017	2.112	2.207	2.304	0.009
300	2.401	2.498	2.597	2.696	2.796	2.896	2.997	3.099	3.201	3.304	0.010
400	3.408	3.512	3.616	3.721	3.827	3.933	4.040	4.147	4.255	4.363	0.011
500	4.471	4.580	4.690	4.800	4.910	5.021	5.133	5.245	5.357	5.470	0.011
600	5.583	5.697	5.812	5.926	6.041	6.157	6.273	6.390	6.507	6.625	0.012
700	6.743	6.861	6.980	7.100	7.220	7.340	7.461	7.583	7.705	7.827	0.012
800	7.950	8.073	8.197	8.321	8.446	8.571	8.697	8.823	8.950	9.077	0.013
900	9.205	9.333	9.461	9.590	9.720	9.850	9.980	10.111	10.242	10.374	0.013
1000	10.506	10.638	10.771	10.905	11.039	11.173	11.307	11.442	11.578	11.714	0.013
1100	11.850	11.986	12.123	12.260	12.397	12.535	12.673	12.812	12.950	13.089	0.014
1200	13.228	13.367	13.507	13.646	13.786	13.926	14.066	14.207	14.347	14.488	0.014
1300	14.629	14.770	14.911	15.052	15.193	15.334	15.475	15.616	15.758	15.899	0.014
1400	16.040	16.181	16.323	16.464	16.605	16.746	16.887	17.028	17.169	17.310	0.014
1500	17.451	17.591	17.732	17.872	18.012	18.152	18.292	18.431	18.571	18.710	0.014
1600	18.849	18.988	19.126	19.264	19.402	19.540	19.677	19.814	19.951	20.087	0.014
1700	20.222	20.356	20.488	20.620	20.749	20.877	21.003				0.013

*Mean value

17 TEMPERATURE CHARTS FOR THERMOCOUPLES

Thermocouple type S

Pt10%Rh-Pt according to IEC 60584-1. Output in mV. Reference temperature 0 °C.

°C	0	10	20	30	40	50	60	70	80	90	mV/°C*
0	0.000	0.055	0.113	0.173	0.235	0.299	0.365	0.433	0.502	0.573	0.006
100	0.646	0.720	0.795	0.872	0.950	1.029	1.110	1.191	1.273	1.357	0.008
200	1.441	1.526	1.612	1.698	1.786	1.874	1.962	2.052	2.141	2.232	0.009
300	2.323	2.415	2.507	2.599	2.692	2.786	2.880	2.974	3.069	3.164	0.009
400	3.259	3.355	3.451	3.548	3.645	3.742	3.840	3.938	4.036	4.134	0.010
500	4.233	4.332	4.432	4.532	4.632	4.732	4.833	4.934	5.035	5.137	0.010
600	5.239	5.341	5.443	5.546	5.649	5.753	5.857	5.961	6.065	6.170	0.010
700	6.275	6.381	6.486	6.593	6.699	6.806	6.913	7.020	7.128	7.236	0.011
800	7.345	7.454	7.563	7.673	7.783	7.893	8.003	8.114	8.226	8.337	0.011
900	8.449	8.562	8.674	8.787	8.900	9.014	9.128	9.242	9.357	9.472	0.011
1000	9.587	9.703	9.819	9.935	10.051	10.168	10.285	10.403	10.520	10.638	0.012
1100	10.757	10.875	10.994	11.113	11.232	11.351	11.471	11.590	11.710	11.830	0.012
1200	11.951	12.071	12.191	12.312	12.433	12.554	12.675	12.796	12.917	13.038	0.012
1300	13.159	13.280	13.402	13.523	13.644	13.766	13.887	14.009	14.130	14.251	0.012
1400	14.373	14.494	14.615	14.736	14.857	14.978	15.099	15.220	15.341	15.461	0.012
1500	15.582	15.702	15.822	15.942	16.062	16.182	16.301	16.420	16.539	16.658	0.012
1600	16.777	16.895	17.013	17.131	17.249	17.366	17.483	17.600	17.717	17.832	0.012
1700	17.947	18.061	18.174	18.285	18.395	18.503	18.609				0.011

*Mean value

Thermocouple type B

Pt30%Rh-Pt6%Rh according to IEC 60584-1. Output in mV. Reference temperature 0 °C.

°C	0	10	20	30	40	50	60	70	80	90	mV/°C*
0	0.000	-0.002	-0.003	-0.002	0.000	0.002	0.006	0.011	0.017	0.025	0.000
100	0.033	0.043	0.053	0.065	0.078	0.092	0.107	0.123	0.141	0.159	0.001
200	0.178	0.199	0.220	0.243	0.267	0.291	0.317	0.344	0.372	0.401	0.003
300	0.431	0.462	0.494	0.527	0.561	0.596	0.632	0.669	0.707	0.746	0.004
400	0.787	0.828	0.870	0.913	0.957	1.002	1.048	1.095	1.143	1.192	0.005
500	1.241	1.293	1.344	1.397	1.451	1.505	1.561	1.617	1.675	1.733	0.006
600	1.792	1.852	1.913	1.975	2.037	2.101	2.165	2.230	2.296	2.363	0.006
700	2.431	2.499	2.569	2.639	2.710	2.782	2.854	2.928	3.002	3.078	0.007
800	3.154	3.230	3.308	3.386	3.466	3.546	3.626	3.708	3.790	3.873	0.008
900	3.957	4.041	4.127	4.213	4.299	4.387	4.475	4.564	4.653	4.743	0.009
1000	4.834	4.926	5.018	5.111	5.205	5.299	5.394	5.489	5.585	5.682	0.009
1100	5.780	5.878	5.976	6.075	6.175	6.276	6.377	6.478	6.580	6.683	0.010
1200	6.786	6.890	6.995	7.100	7.205	7.311	7.417	7.524	7.632	7.740	0.011
1300	7.848	7.957	8.066	8.176	8.286	8.397	8.508	8.620	8.731	8.844	0.011
1400	8.956	9.069	9.182	9.296	9.410	9.524	9.639	9.753	9.868	9.984	0.011
1500	10.099	10.215	10.331	10.447	10.563	10.679	10.796	10.913	11.029	11.146	0.012
1600	11.263	11.380	11.497	11.614	11.731	11.848	11.965	12.082	12.199	12.316	0.012
1700	12.433	12.549	12.666	12.782	12.898	13.014	13.130	13.246	13.361	13.476	0.012
1800	13.591	13.706	13.820								0.011

*Mean value

Tolerances according to IEC 60584-2

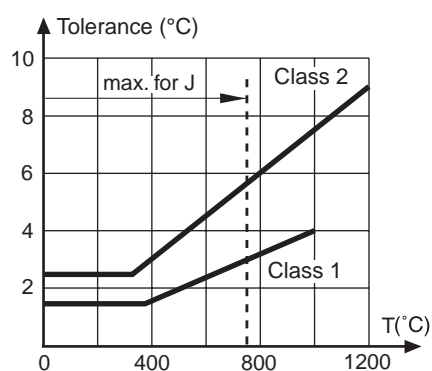
Thermocouple	Class 1	
	Temperature range °C	Tolerances
J Fe-CuNi	-40 to +375 +375 to +750	$\pm 1.5\text{ }^{\circ}\text{C}$ $\pm 0.4\text{ \%}$ ¹⁾
K NiCr-NiAl	-40 to +375 +375 to +1000	$\pm 1.5\text{ }^{\circ}\text{C}$ $\pm 0.4\text{ \%}$ ¹⁾
N NiCrSi-NiSi	-40 to +375 +375 to +1000	$\pm 1.5\text{ }^{\circ}\text{C}$ $\pm 0.4\text{ \%}$ ¹⁾
T Cu-CuNi	-40 to +125 +125 to +350	$\pm 0.5\text{ }^{\circ}\text{C}$ $\pm 0.4\text{ \%}$ ¹⁾
E NiCr-CuNi	-40 to +375 +375 to +800	$\pm 1.5\text{ }^{\circ}\text{C}$ $\pm 0.4\text{ \%}$ ¹⁾
R Pt13Rh-Pt	0 to +1100 +1100 to +1600	$\pm 1.0\text{ }^{\circ}\text{C}$ $\pm [1+0.003(t-1100)]^{\circ}\text{C}$
S Pt10Rh-Pt	0 to +1100 +1100 to +1600	$\pm 1.0\text{ }^{\circ}\text{C}$ $\pm [1+0.003(t-1100)]^{\circ}\text{C}$
B Pt30Rh-Pt6Rh	-	-

1) Of temperature reading

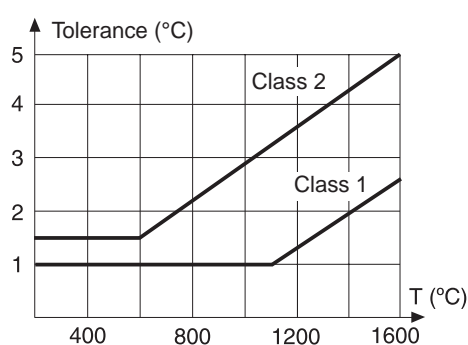
Thermocouple accuracy

Tolerance for type J, K, N and S according to IEC 60584-2
(for complete data, see table on page 134)

Tolerance for type J, K, N



Tolerance for type S

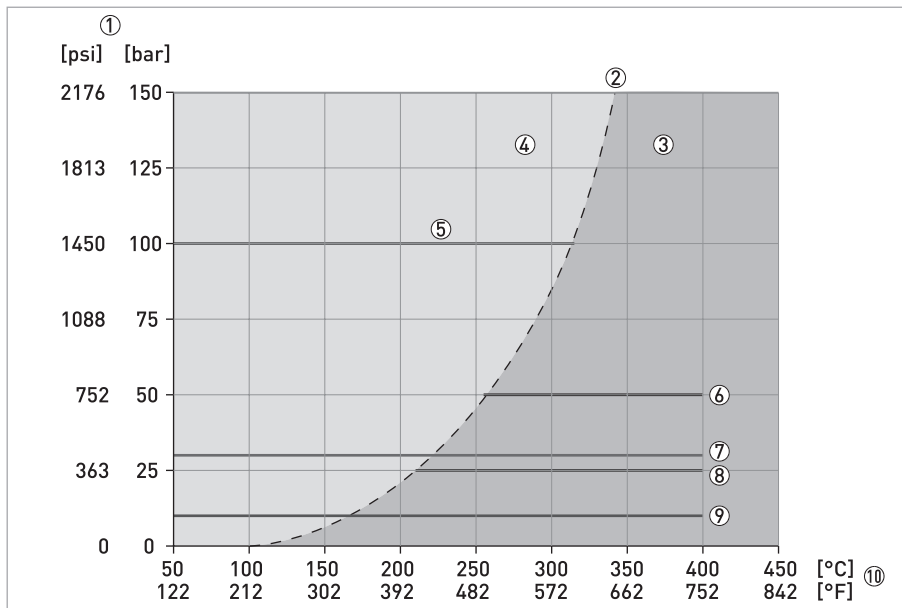


Load diagrams for standardized thermowells

The chart applies to the following temperature assemblies:

- TRA/TCA-P10, -S11, -F13
- Ø 11 x 2 mm / 0.43 x 0.08"
- Material 1.4571 / 316 Ti

Chart for straight thermowells according to DIN 43772 (Forms 2, 2G and 2F)

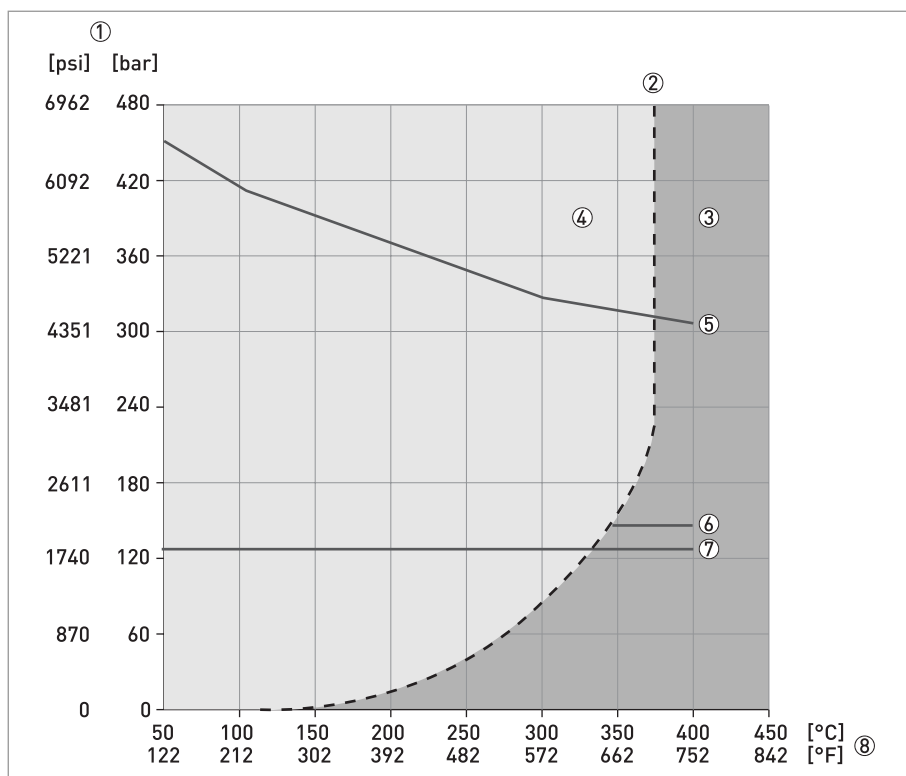


- 1) Pressure of the measured medium
- 2) Vapour pressure curve
- 3) Steam
- 4) Water
- 5) Insertion length 250...400 mm (9.84...15.75"), water with 3 m/s (9.8 ft/s)
- 6) Insertion length 250 mm (9.84"), steam with 40 m/s (131.2 ft/s)
- 7) Insertion length 250 mm (9.84"), air with 40 m/s (131.2 ft/s)
- 8) Insertion length 400 mm (15.75"), steam with 40 m/s (131.2 ft/s)
- 9) Insertion length 400 mm (15.75"), air with 40 m/s (131.2 ft/s)
- 10) Temperature of the measured medium

The chart applies to the following temperature assembly:

- TRA/TCA-T30 (Form 4)
- $\varnothing 24 \times 8.5 \text{ mm} / 0.94 \times 0.33''$
- Material 1.4571 / 316 Ti

Chart for straight thermowells with tapered tip according to DIN 43772 (Form 4)

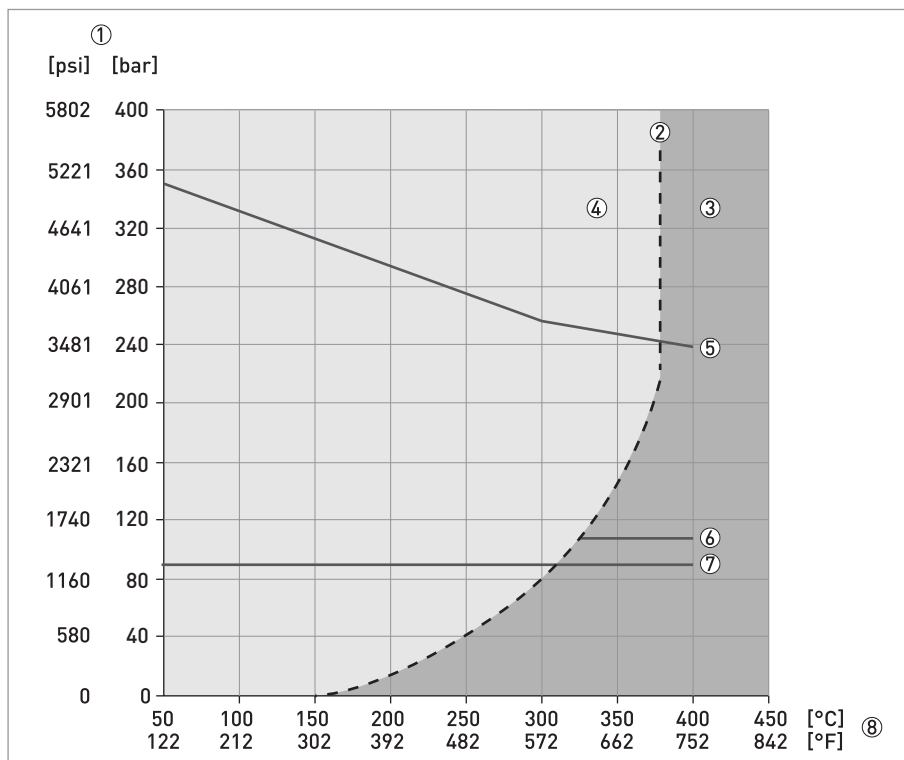


- 1) Pressure of the measured medium
- 2) Steam pressure curve
- 3) Steam
- 4) Water
- 5) Insertion length 125 mm or 4.92"; water with 5 m/s or 16.4 ft/s
- 6) Insertion length 125 mm or 4.92"; steam with 60 m/s or 196.9 ft/s
- 7) Insertion length 125 mm or 4.92"; air with 60 m/s or 196.9 ft/s
- 8) Temperature of the measured medium

The chart applies to the following temperature assembly:

- TRA/TCA-TS36 (Form 6 and 7)
- Ø 17 x 5 mm / 0.67 x 0.20"
- Material 1.4571 / 316 Ti

Chart for straight thermowells with tapered tip according to DIN 43772 (Form 6 and 7)



1) Pressure of the measured medium

2) Steam pressure curve

3) Steam

4) Water

5) Insertion length 230 mm or 9.06"; water with 3 m/s or 9.8 ft/s

6) Insertion length 230 mm or 9.06"; steam with 40 m/s or 131.2 ft/s

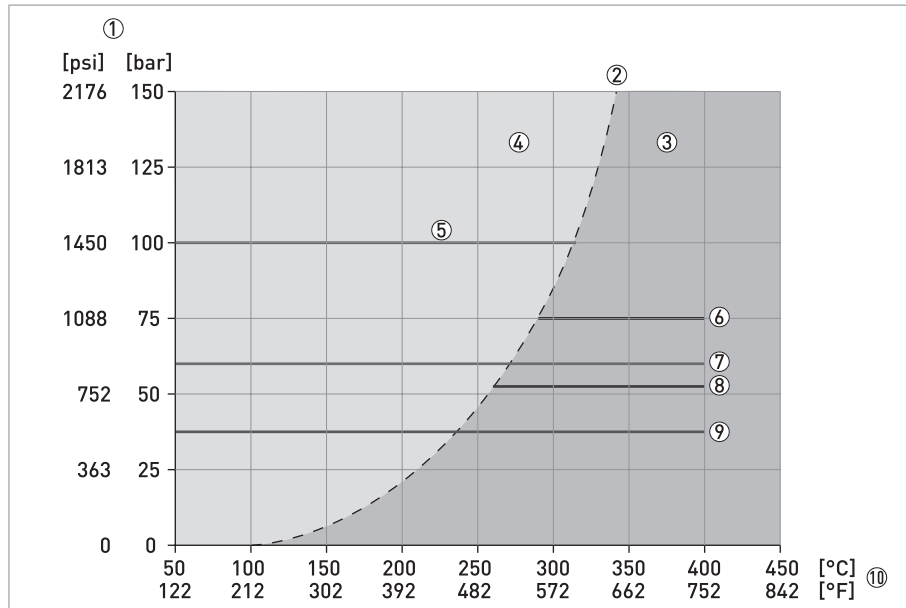
7) Insertion length 230 mm or 9.06"; air with 40 m/s or 131.2 ft/s

8) Temperature of the measured medium

The chart applies to the following temperature assemblies:

- TRA/TCA-P40, -S41, -F42
- Ø 12 x 2.5 mm / 0.47 x 0.1"
- Material 1.4571 / 316 Ti

Chart for thermowells with tapered tip according to DIN 43772 (Forms 3, 3G and 3F)



- 1) Pressure of the measured medium
- 2) Vapour pressure curve
- 3) Steam
- 4) Water
- 5) Insertion length 220...280 mm (8.66...11.02"), water with 3 m/s (9.8 ft/s)
- 6) Insertion length 220 mm (8.66"), steam with 40 m/s (131.2 ft/s)
- 7) Insertion length 220 mm (8.66"), air with 40 m/s (131.2 ft/s)
- 8) Insertion length 280 mm (11.02"), steam with 40 m/s (131.2 ft/s)
- 9) Insertion length 280 mm (11.02"), air with 40 m/s (131.2 ft/s)
- 10) Temperature of the measured medium

QUESTIONNAIRE

RFQ QUESTIONNAIRE OPTITEMP

Contact

Customer	Contact person	Date
Address	E-mail	Phone

Application

Type of application and media to measure	Temperature range
	Flow
	Pressure

Features

<input type="checkbox"/> EX iaZone	<input type="checkbox"/> (0-2)	<input type="checkbox"/> Dust (20-22)	<input type="checkbox"/> SIL	<input type="checkbox"/> Other certificates _____
<input type="checkbox"/> Single sensor element	<input type="checkbox"/> Dual sensor elements	<input type="checkbox"/> Typ K	<input type="checkbox"/> -200...1250 °C	
<input type="checkbox"/> Pt 100	<input type="checkbox"/> 2-wire connection	<input type="checkbox"/> Class A	<input type="checkbox"/> TC, class 1	<input type="checkbox"/> Typ J
<input type="checkbox"/> Pt 1000	<input type="checkbox"/> 3-wire connection	<input type="checkbox"/> AA (1/3 DIN B)		<input type="checkbox"/> Typ S
<input type="checkbox"/> Other	<input type="checkbox"/> 4-wire connection	<input type="checkbox"/> 1/10 DIN B		<input type="checkbox"/> Typ N
				<input type="checkbox"/> -200...1250 °C
<input type="checkbox"/> Other _____				
<input type="checkbox"/> Connection head _____	<input type="checkbox"/> Display	<input type="checkbox"/> Cable gland	<input type="checkbox"/> IP _____	<input type="checkbox"/> Other _____
		M20 x 1.5		
<input type="checkbox"/> With neck tube	<input type="checkbox"/> Straight tip	Thermowell: <input type="checkbox"/> 1.4404 (316L) up to 600 °C		
<input type="checkbox"/> Without neck tube	<input type="checkbox"/> Reduced tip	<input type="checkbox"/> 1.4571 (316Ti) up to 600 °C		
	<input type="checkbox"/> Tapered tip	<input type="checkbox"/> 1.4345 (C22.8)		
	<input type="checkbox"/> Other tip	<input type="checkbox"/> Ceramic up to 1600°C		
		<input type="checkbox"/> Other _____		

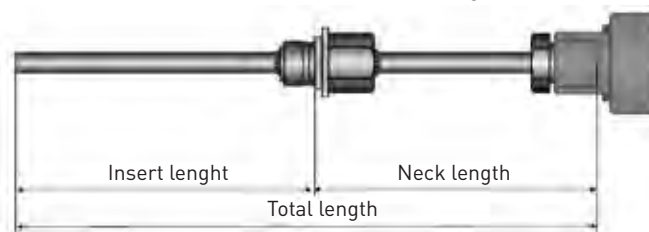
Process connection

<input type="checkbox"/> Screw in	<input type="checkbox"/> G1/2	<input type="checkbox"/> G3/4	<input type="checkbox"/> G1	<input type="checkbox"/> Other: _____
<input type="checkbox"/> Flange DIN	<input type="checkbox"/> DN25	<input type="checkbox"/> DN40	<input type="checkbox"/> DN50	<input type="checkbox"/> PN: _____
<input type="checkbox"/> ASME	<input type="checkbox"/> 1"	<input type="checkbox"/> 1 1/2"	<input type="checkbox"/> 2"	<input type="checkbox"/> lbs: _____
<input type="checkbox"/> Compress fitting _____	<input type="checkbox"/> Weldable _____	<input type="checkbox"/> Plug-in		

Insert length _____ mm

Neck tube length _____ mm

Total length _____ mm



Transmitter	<input type="checkbox"/> Head transmitter	<input type="checkbox"/> 4...20 mA	<input type="checkbox"/> Loop powered	<input type="checkbox"/> Non
	<input type="checkbox"/> DIN rail transmitter	<input type="checkbox"/> HART	<input type="checkbox"/> 24 VDC	Galvanic isolation <input type="checkbox"/> 1500 VAC
		<input type="checkbox"/> PROFIBUS PA	<input type="checkbox"/> 230 VDC	<input type="checkbox"/> 3750 VAC




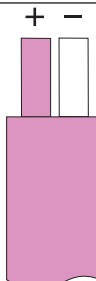




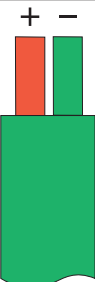
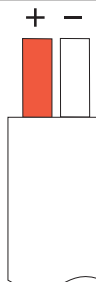
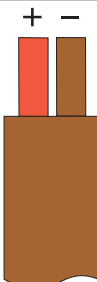


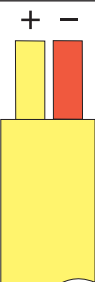
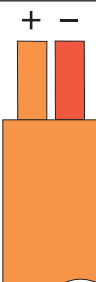








Request for Quotation

Volume scenarios	When to quote	First delivery
------------------	---------------	----------------

Miscellaneous

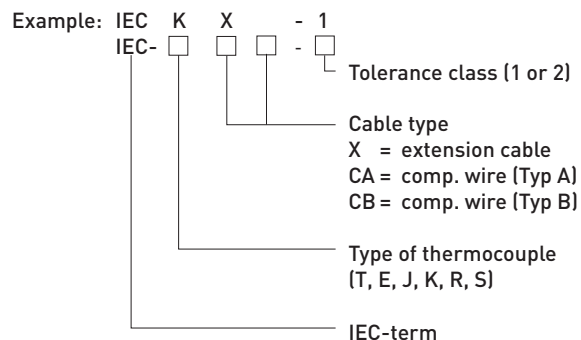
☐ Complete with personal notes, a sketch or pictures on special demands, installation or other important requirement in the RFQ

Color codes for extension and compensation cables

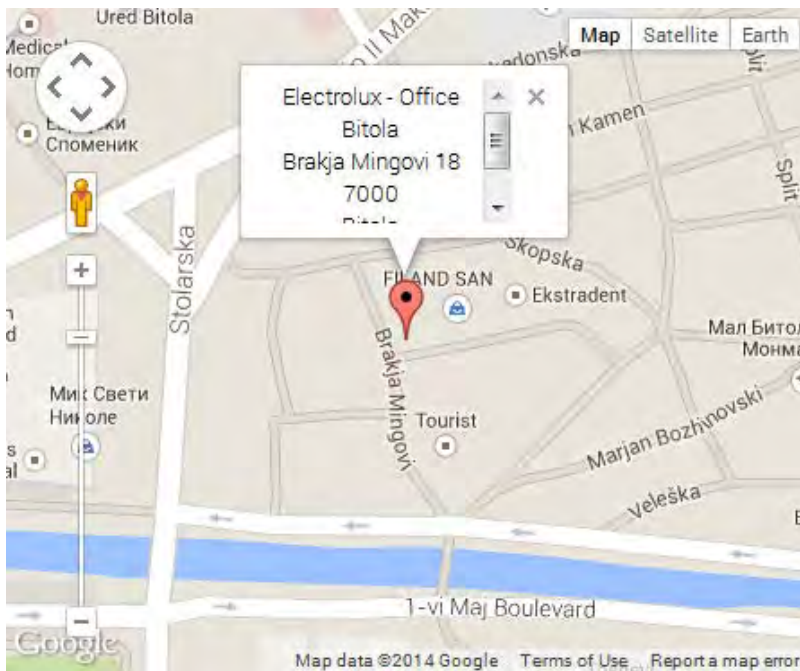
	Type J (Fe-CuNi)	Type L (Fe-CuNi)	Type K (NiCr-NiAl)	Type N (NiCrSi-NiSi)	Type S (PtRh-Pt)	Type T (Cu-CuNi)	Type U (Cu-CuNi)
 IEC 60584-3							
 DIN 43714 (replaced by IEC60584-3)							
 ANSI MC 96.1							
 BS1843 (replaced by IEC60584-3)							

Type	Tolerance class IEC60584-3		Cable temperature*
	1	2	
JX	±85 μV (±1,5 °C)	±140 μV (±2,5 °C)	-25 °C to +200 °C
TX	±30 μV (±0,5 °C)	±60 μV (±1,0 °C)	-25 °C to +100 °C
EX	±120 μV (±1,5 °C)	±200 μV (±2,5 °C)	-25 °C to +200 °C
KX	±60 μV (±1,5 °C)	±100 μV (±2,5 °C)	-25 °C to +200 °C
NX	±60 μV (±1,5 °C)	±100 μV (±2,5 °C)	-25 °C to +200 °C
KCA	-	±100 μV (±2,5 °C)	0 °C to +150 °C
KCB	-	±100 μV (±2,5 °C)	0 °C to +100 °C
NC	-	±100 μV (±2,5 °C)	0 °C to +150 °C
RCA	-	±30 μV (±2,5 °C)	0 °C to +100 °C
RCB	-	±60 μV (±5,0 °C)	0 °C to +200 °C
SCA	-	±30 μV (±2,5 °C)	0 °C to +100 °C
SCB	-	±60 μV (±5,0 °C)	0 °C to +200 °C

Terms according to IEC60584-3:



* Cable temperature can be restricted depending on the temperature resistance of the cable insulation.



_ product overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- Vortex flowmeters
- Flow controllers
- Level meters
- Temperature assemblies
- Pressure transmitters
- Analysis products
- Products and systems for the oil & gas industry
- Measuring systems for the marine industry

ЕЛЕКТРОЛУКС
Electrolux
 SERVICE FACTORY EXPORT-IMPORT