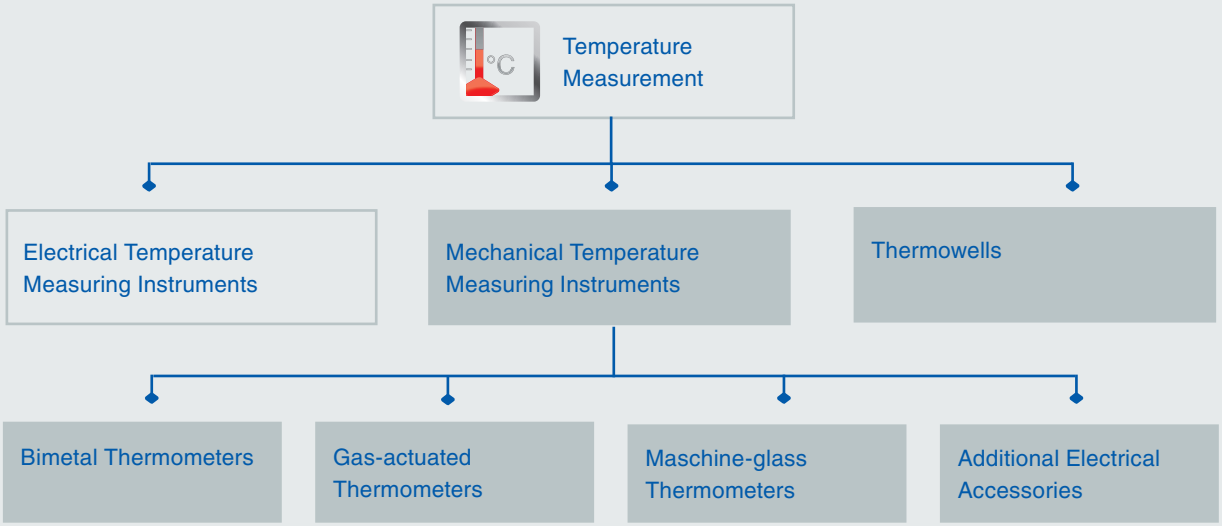
Heading 8

# Mechanical Temperature Measurement

ARMANO Messtechnik GmbH




# Quality Made in Germany

## Mechanical Temperature Measurement

The ARMANO Messtechnik GmbH represents tradition and innovation in the production and distribution of precision pressure and temperature measuring instruments, which have an excellent reputation worldwide – for more than 100 years.

We are continually developing customer-specific solutions for a variety of applications requiring pressure and temperature measuring technology. Their use is manifold and there are always new applications.

Our production range of the segment mechanical temperature measurement includes bimetal thermometers, gas-actuated thermometers as well as thermometer thermowells and other accessories.

In this brochure, you will find our range of temperature measuring instruments for the mechanical temperature measuring technology, including additional electrical accessories.

Your instrument is not listed here? Jointly, we will find a suitable solution for your application.
Do not hesitate to contact us!



## Our Products at a Glance

Mechanical Pressure Measurement

Electronic Pressure Measurement

Chemical Seal Mounting

Calibration Technology

Mechanical Temperature Measurement

Electrical Temperature Measurement

Thermowells & Accessories

# Certificates and Approvals

## Standards

Our company is certified according to the highest quality standards and our product portfolio meets the highest quality demands. We do not only manufacture according to product-specific instrument standards, we also offer versions with special approvals for application areas with specific requirements. The ARMANO Messtechnik GmbH is certified according to DIN EN ISO 9001.


SIL 2
SIL 3

# General Information Concerning the Selection

To select a suitable thermometer for a particular measuring task, the operating conditions prevailing on site have to be regarded. Important information on the optimal design of your thermometers can be found in our technical information sheet T08-000-031. We are pleased to help you selecting the suitable thermometer for your particular case of application.

## Analysis of the Operating Conditions

- Mechanical operating conditions, such as maximum process pressure, flow rate, occurring vibrations and shocks
- Thermal operating conditions: process and ambient temperature
- Data concerning the medium, important for the evaluation of the chemical resistance of the stem material
- Special process conditions or requirements, such as complicated installation conditions for the stem, no direct readability since the measuring point is hidden from view or difficult to access, the necessity to replace thermometers during ongoing processes

**Examples:**

The medium pressure is > 25 bar.
The application of a thermowell is required.

Vibrations or shocks do occur.
Thermometers with liquid case filling are favourable.

Strong ambient temperature variations do occur.
Bimetal thermometers work well.

**Disregarding the operating conditions may result in additional errors, malfunctions up to instrument failures!**

## Selection Criteria

| | | Bimetal | Gas-actuated |
|---|---|---|---|
| Temperature ranges | | from –50 °C up to +600 °C | from –100 °C up to +600 °C |
| Accuracy class | | class 1 | class 1 |
| Stem length | | up to 800 mm | up to 2.50 m |
| Version with | capillary line possible | no | yes, up to 15 m (>15 m upon request) |
| | limit switch contact assembly | no | yes |
| Influence of the ambient temperature | | no influence | yes |
| Compensation of the ambient temperature influence | on the case | not required | partial compensation |
| | on the capillary line | – | no |
| Vibration resistance | without case filling | no | limited |
| | with case filling | limited | good |
| Dependency on the position | | no | no |
| Environmental compatibility | | good | good |

# Technical Data

## Dial

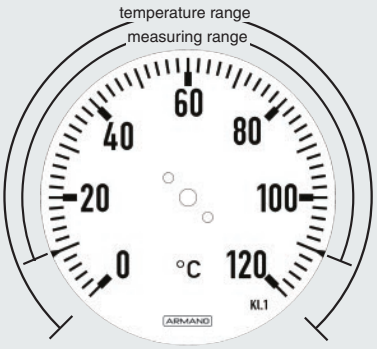
Dial inscriptions, temperature ranges, scale divisions and figures on the scale are designed according to DIN EN 13 190. The standard dial is white with a black inscription.
The scale angle is 270 ±20°. All pointer thermometers are provided with a clearly identifiable instrument number on the dial.

## Temperature Range / Measuring Range / Error Limits According to DIN EN 13 190

» The temperature range indicates the scale range of a thermometer. «

» The measuring range is equivalent to the range in which the error limits do apply. The measuring range is marked by arrows at the outer circumference of the scale. «

» The error limit of our thermometers corresponds to class 1 according to DIN EN 13 190 and is indicated by absolute values (see tables below), e.g. ±1 °C.
The information on the accuracy class is given on the bottom right of the dial. «




**Temperature range:** 0 °C to +120 °C
**Measuring range:** +10 °C to +110 °C
**Error limit** (permissible error)
according to DIN EN 13 190: ±2 °C

| Temperature range | Measuring range | Smallest subdivision °C | Error limits acc. to cl. 1 +/– °C | Available for measuring systems |
|---|---|---|---|---|
| 0 – 60 °C | 10 – 50 °C | 1 | 1 | bimetal |
| 0 – 80 °C | 10 – 70 °C | 1 | 1 | bimetal and gas-actuated |
| 0 – 100 °C | 10 – 90 °C | 1 | 1 | |
| 0 – 120 °C | 10 – 110 °C | 2 | 2 | |
| 0 – 160 °C | 20 – 140 °C | 2 | 2 | |
| 0 – 200 °C | 20 – 180 °C | 2 | 2 | |
| 0 – 250 °C | 30 – 220 °C | 5 | 2.5 | |
| 0 – 300 °C | 30 – 270 °C | 5 | 5 | |
| 0 – 400 °C | 50 – 350 °C | 10 | 5 | |
| 0 – 500 °C | 50 – 450 °C | 10 | 5 | |
| 0 – 600 °C | 100 – 500 °C | 10 | 10 | |
| –100 / +100 °C | –80 / +80 °C | 2 | 2 | gas-actuated |
| –50 / +50 °C | –40 / +40 °C | 1 | 1 | bimetal and gas-actuated |
| –40 / +40 °C | –30 / +30 °C | 1 | 1 | |
| –40 / +60 °C | –30 / +50 °C | 1 | 1 | |
| –30 / +50 °C | –20 / +40 °C | 1 | 1 | |
| –30 / +70 °C | –20 / +60 °C | 1 | 1 | bimetal |
| –20 / +40 °C | –10 / +30 °C | 1 | 1 | |
| –20 / +60 °C | –10 / +50 °C | 1 | 1 | bimetal and gas-actuated |
| –20 / +80 °C | –10 / +70 °C | 1 | 1 | |
| 50 – 300 °C | 80 – 270 °C | 5 | 2.5 | |
| 50 – 400 °C | 100 – 350 °C | 5 | 5 | gas-actuated |
| 100 – 500 °C | 150 – 450 °C | 10 | 5 | |

| Temperature range | Measuring range | Smallest subdivision °F | Error limits acc. to cl. 1 +/– °F | Available for measuring systems |
|---|---|---|---|---|
| 0 – 150 °F | 20 – 130 °F | 2 | 1.8 | bimetal and gas-actuated |
| 0 – 200 °F | 20 – 180 °F | 5 | 3.6 | |
| 0 – 250 °F | 20 – 230 °F | 5 | 3.6 | |
| 0 – 300 °F | 40 – 260 °F | 5 | 3.6 | |
| –50 / +130 °F | –30 / +110 °F | 2 | 1.8 | |
| –40 / +160 °F | –20 / +140 °F | 5 | 3.6 | |
| –30 / +120 °F | –10 / +100 °F | 2 | 1.8 | |
| –10 / +100 °F | 10 – 80 °F | 2 | 1.8 | bimetal |
| 20 – 240 °F | 40 – 220 °F | 5 | 3.6 | bimetal and gas-actuated |
| 30 – 140 °F | 50 – 120 °F | 2 | 1.8 | bimetal |
| 40 – 400 °F | 80 – 360 °F | 5 | 3.6 | bimetal and gas-actuated |
| 50 – 300 °F | 70 – 280 °F | 5 | 3.6 | |
| 50 – 500 °F | 100 – 450 °F | 5 | 4.5 | |
| 80 – 800 °F | 170 – 710 °F | 10 | 9.0 | bimetal |
| 100 – 800 °F | 150 – 750 °F | 10 | 9.0 | gas-actuated |
| 100 – 1000 °F | 190 – 910 °F | 10 | 9.0 | |
| 150 – 700 °F | 200 – 650 °F | 10 | 9.0 | bimetal and gas-actuated |

# Technical Data

## Case Filling

Pointer thermometers are filled with a damping fluid to protect them from vibrations and impacts. The damping prevents the sensitive mechanically moving parts from excessive wear and improves the readability.
Together with the case, also the stems of the bimetal thermometers are filled in order to protect the bimetal coil.
For this type, the temperature ranges are thus limited.

| Thermometer model | Damping fluid | Temperature ranges |
|---|---|---|
| Gas-actuated thermometer | silicone oil | all temperature ranges |
| Bimetal thermometer | glycerin (standard) | start of scale: ≥ –20 °C<br>and end of scale: ≤ +100 °C |
| | silicone oil<br>(use only outside of the application limits of glycerin) | start of scale: ≥ –40 °C to < –20 °C<br>and/or end of scale: > +100 °C to ≤ +250 °C |

## Temperature Resistance

- Storage temperature: –40 °C to +70 °C
  with glycerin filling –20 °C to +70 °C
- Ambient temperature:
  unfilled (dry) version –40 °C to +60 °C
  special version –60 °C to +60 °C
  filled version –20 °C to +60 °C
  special version –60 °C to +60 °C

  Please regard possible limitations of storage or ambient temperature in the respective data sheets. Please do not hesitate to contact us if you require instruments with a higher or lower storage/ambient temperature.

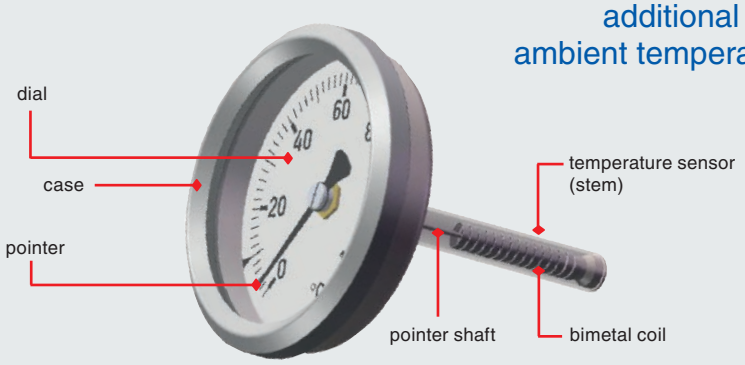
- Reference temperature: +23 °C ±2 °C
- Medium temperature: (temperature at the stem) needs to be within the measuring range limits of the respective thermometer. For some models, higher- or lower-temperature resistant versions are available upon request.

# Bimetal Thermometers

Bimetal thermometers according to DIN EN 13 190 are pointer thermometers, which are actuated by spiral or helical bimetallic strips. The temperature-dependent rotational movement of the bimetal is directly transferred to the pointer via the pointer shaft.

## Construction

» Bimetal thermometers do not have any additional errors due to ambient temperature deviations «




The active part of the stem La (bimetal coil) has to be immersed sufficiently into the medium. Please regard the information in our technical information sheet T08-000-031.

# Bimetal Thermometers – Standard Range

**Rigid Mount to the Stem**

| TBiSCh | |
|---|---|
| Case/ring | bayonet ring case stainless steel |
| Case filling | without |
| Nominal size | 63, 100, 160 mm |
| Stem | stainless steel 316Ti (1.4571) |
| Stem models | B1, B3, B4, B4.1, B5 or B6 |
| Data sheet | 8101 |

**Rigid Mount to the Stem**

| TBiSChg/TBiSChgG | |
|---|---|
| Case/ring | crimped-on ring case stainless steel |
| Case filling | without/with |
| Nominal size | 63, 80, 100, 125, 160 mm |
| Stem | stainless steel 316Ti (1.4571) |
| Stem models | B1, B3, B4, B4.1, B5 or B6 |
| Data sheet | 8102 |

**Every Angle Turnable and Adjustable**

| TBiGelCh | |
|---|---|
| Case/ring | bayonet ring case stainless steel |
| Case filling | without |
| Nominal size | 63, 100, 160 mm |
| Stem | stainless steel 316Ti (1.4571) |
| Stem models | B1, B3, B4, B4.1, B5 or B6 |
| Data sheet | 8111 |

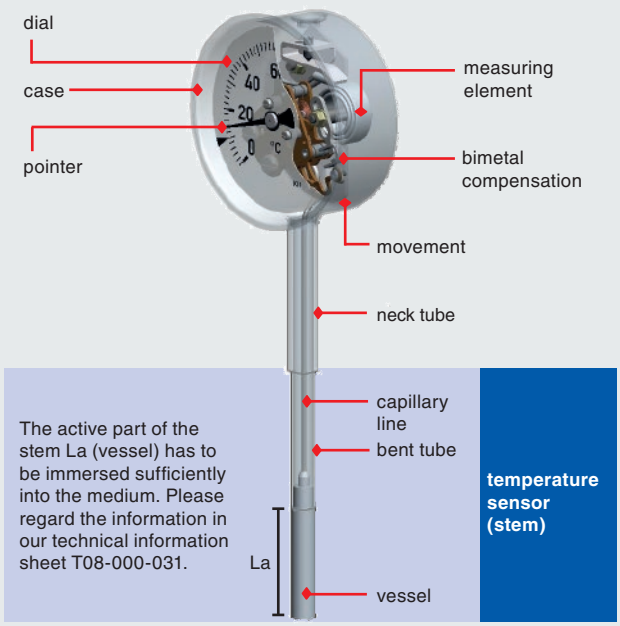
**Every Angle Turnable and Adjustable**

| TBiGelChg/TBiGelChgG | |
|---|---|
| Case/ring | crimped-on ring case stainless steel |
| Case filling | without/with |
| Nominal size | 63, 80, 100, 125, 160 mm |
| Stem | stainless steel 316Ti (1.4571) |
| Stem models | B1, B3, B4, B4.1, B5 or B6 |
| Data sheet | 8112 |

# Gas-actuated Thermometers

Gas-actuated thermometers according to DIN EN 13 190 use the temperature-dependent pressure of a spatially enclosed quantity of gas as measure for the temperature. The measuring system consists of vessel (active part of the stem), capillary line and measuring element. It is filled with an inert gas, usually nitrogen. The indication is realised via movement and pointer.

## Construction and Metrological Information




- If the temperature at the capillary line and/or case deviates from the reference temperature (23 °C ±2 °C), environmental additional errors occur due to the measuring principle of the gas-actuated thermometers.
- The ambient temperature influence on the measuring result can be kept small if the active gas volume (vessel content) is very large compared to the inactive gas volume (capillary line and measuring element). Upon request, we manufacture thermometer stems with a vessel volume adjusted to the specific case of application.
- The capillary line must be thermally insulated to avoid additional errors due to temperature influences on the capillary line.
- For application cases with constant ambient temperature, it is possible to design the measuring system for a certain capillary line temperature upon request.
- The additional error due to ambient temperature influence is for the majority of the measuring arrangements within the range <5 % of the span/10 K.

**Rigid Mount to the Stem**

| TSCh/TSChG | |
|---|---|
| Case/ring | bayonet ring case stainless steel |
| Case filling | without/with |
| Nominal size | 63, 100, 160, 250 (TSCh) mm |
| Stem | stainless steel 316Ti (1.4571) |
| Stem models | A1, A3, A4, A4.1, A5 or A6 |
| Data sheet | 8201 |

**Rigid Mount to the Stem**

| TSChg/TSChgG | |
|---|---|
| Case/ring | crimped-on ring case stainless steel |
| Case filling | without/with |
| Nominal size | 63, 80, 100, 125, 160 mm |
| Stem | stainless steel 316Ti (1.4571) |
| Stem models | A1, A3, A4, A4.1, A5 or A6 |
| Data sheet | 8202 |

# Gas-actuated Thermometers – Standard Range

**Every Angle Turnable and Adjustable**

**TGelCh/TGelChG**

| | |
|---|---|
| Case/ring | bayonet ring case stainless steel |
| Case filling | without/with |
| Nominal size | 63, 100, 160 mm |
| Stem | stainless steel 316Ti (1.4571) |
| Stem models | A1, A3, A4, A4.1, A5 or A6 |
| Data sheet | 8211 |

**Every Angle Turnable and Adjustable**

**TGelChg/TGelChgG**

| | |
|---|---|
| Case/ring | crimped-on ring case stainless steel |
| Case filling | without/with |
| Nominal size | 63, 80, 100, 160 mm |
| Stem | stainless steel 316Ti (1.4571) |
| Stem models | A1, A3, A4, A4.1, A5 or A6 |
| Data sheet | 8212 |

**With Capillary Line to the Stem**

**TFCh/TFChG**

| | |
|---|---|
| Case/ring | bayonet ring case stainless steel |
| Case filling | without/with |
| Nominal size | 63, 100, 160, 250 (TFCh) mm |
| Stem | stainless steel 316Ti (1.4571) |
| Stem models | A1, A3, A4, A5 or A6 |
| Data sheet | 8221 |

**With Capillary Line to the Stem**

**TFChg/TFChgG**

| | |
|---|---|
| Case/ring | crimped-on ring case stainless steel |
| Case filling | without/with |
| Nominal size | 63, 80, 100, 160 mm |
| Stem | stainless steel 316Ti (1.4571) |
| Stem models | A1, A3, A4, A5 or A6 |
| Data sheet | 8222 |

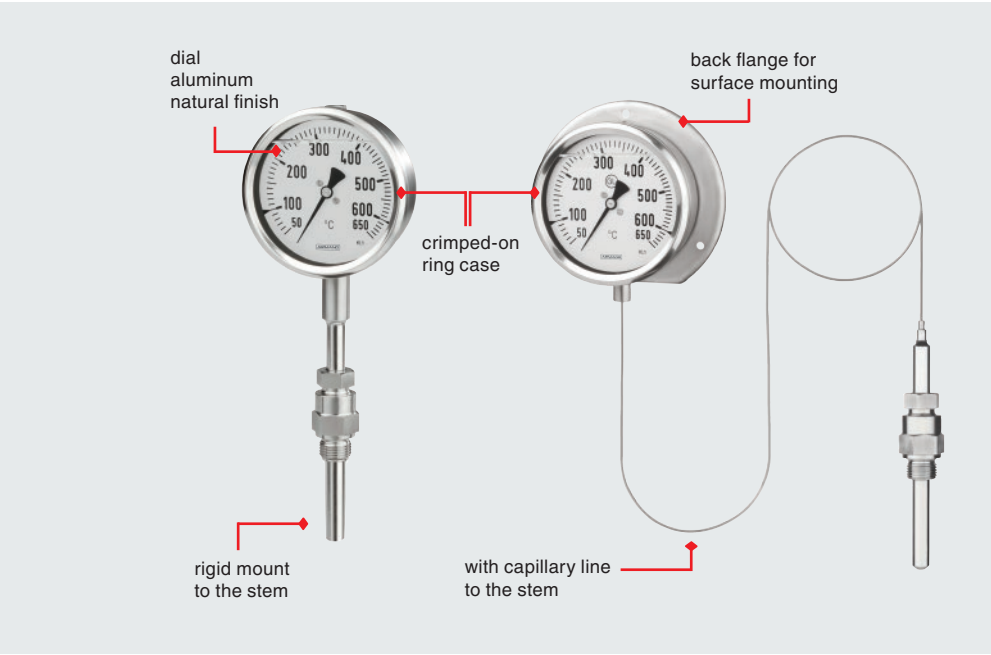
**Square Thermometer for Switch Panels**

**TFQS**

| | |
|---|---|
| Case/ring | square case, front narrow rim black, clamp for switch panel mounting |
| Case filling | – |
| Nominal size | 96x96, 144x144 mm |
| Stem | stainless steel 316Ti (1.4571) |
| Stem models | A1, A3, A4, A5 or A6 |
| Data sheet | 8225 |

# Diesel Exhaust Thermometers

Diesel exhaust thermometers are primarily used for the measurement of exhaust and cooling water temperatures at diesel engines. They are gas-actuated thermometers, specially designed for high mechanical loads, among others due to the “stem in jacket version” and the standard case filling with highly viscous silicone oil. To increase their durability, diesel exhaust thermometers should always be applied in combination with solid drilled thermowells.




| Diesel Exhaust Thermometer Rigid Mount to the Stem | |
|---|---|
| **TAS** | |
| Case/ring | crimped-on ring case stainless steel |
| Nominal size | 63, 80, 100 mm |
| Stem | stainless steel 316Ti (1.4571) |
| Stem models | A5.5, A1.5 or A3.5 |
| Temperature ranges | 0 – 120 °C<br>50 – 650 °C |
| Data sheet | 8291 |

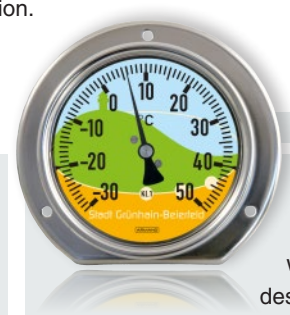
| Diesel Exhaust Thermometer With Capillary Line to the Stem | |
|---|---|
| **TAF** | |
| Case/ring | crimped-on ring case stainless steel |
| Nominal size | 63, 80, 100 mm |
| Stem | stainless steel 316Ti (1.4571) |
| Stem models | A5.5, A1.5 or A3.5 |
| Temperature ranges | 0 – 120 °C<br>50 – 650 °C |
| Data sheet | 8292 |

# Ambient Temperature Thermometers

Ambient temperature thermometers are gas-actuated thermometers according to DIN EN 13 190 and use the temperature-dependent pressure of a spatially enclosed quantity of gas as measure for the temperature. Our ambient thermometers are suitable for both indoor and outdoor application.

**Ambient Temperature Thermometer**

| TRCh | |
|---|---|
| Case/ring | bayonet ring case stainless steel |
| Nominal size | 100, 160 mm |
| Stem | stainless steel 316Ti (1.4571) |
| Temperature ranges | –40 / +40 °C<br>–30 / +50 °C<br>–20 / +60 °C |
| Data sheet | 8293 |



How about a thermometer with individual design?

The instrument with high-quality stainless steel case is weatherproof and reliably indicates the temperature both indoors and outdoors.

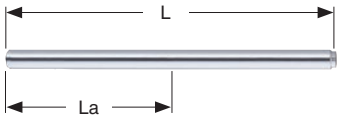
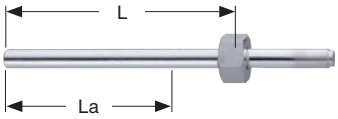
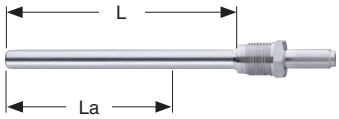
Due to the latest technology, we are able to design your customised thermometer. We can implement individual dials with your colour requests, also combined with your text elements.

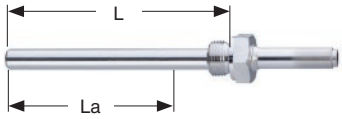
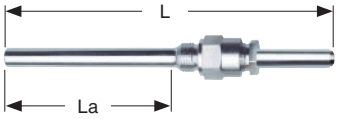
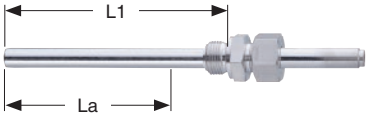
**Example for outdoor wall mounting**

# Temperature Sensors (Stems)

## Standard Stems for Gas-actuated and Bimetal Thermometers

A.. = stem for gas-actuated thermometers B.. = stem for bimetal thermometers
L, L1 = stem length La = active stem length
Specific values (see data sheets)
Information concerning the metrologically favourable selection can be found in the technical information sheet T08-000-031.

| Stem type | A1, A1.5, B1 | A3, A3.5, B3 | A4, B4 |
|---|---|---|---|
| Process connection | without screw fitting, plain stem | union nut | male thread, turnable thermowell required |
| |  |  |  |

| Stem type | A4.1, B4.1 | A5, A5.5, B5 | A6, B6 |
|---|---|---|---|
| Process connection | male thread, rigid | male thread, compression fitting adjustable at the plain stem | male thread, turnable/double male adapter |
| |  |  |  |

## Special Stems for Gas-actuated Thermometers

Stem without bent tube – for difficult installation conditions and overlong thermowells

| |  |  |  |  |  |  |
|---|---|---|---|---|---|---|
| **Stem type** | **A3.2** | **A4.2** | **A4.3** | **A2** | **A7** | **A7.1** |
| Construction type | **rigid mount with neck tube between thermometer and stem**, capillary line between connection screw fitting and vessel (active length), capillary line wetted, if applicable | | | **capillary line between thermometer and vessel (active stem length)**, compression fitting, turnable and movable at the capillary line, capillary line wetted, if applicable | | |
| Material | stainless steel 316Ti (1.4571) | | | stainless steel 316Ti (1.4571) | | |
| Vessel Ø | 8, 10 or 12 mm | | | 8, 10 or 12 mm | | |
| Stem length L / capillary line length $L_{FL}$ | L: 200 mm to 15 m | | | $L_{FL}$: 1 m to 15 m | | |
| Process connection | union nut | male thread turnable | male thread rigid | union nut | male thread, turnable/double male adapter | male thread, clamping ring fitting, clamping connection at capillary line |
| Capillary line | stainless steel, Ø 2 mm | | | 1 m, stainless steel, Ø 2 mm, buckle protection to thermometer case | | |
| Specifics | – | thermowell required | – | for application without thermowell not sealing, only for unpressurised media | | clamping ring FPM (Viton®) medium temperature: max. 180 °C |
| Data sheet | 8299.1 | | | 8299.2 | | |

# Temperature Sensors (Stems)

## Special Stems for Gas-actuated Thermometers

For the application in food/bio/pharmaceutical industries, rigid mount to the stem, up to 400 °C

| |  |  | | |  |
|---|---|---|---|---|---|
| **Stem type** | **A20.3** | **A20.1** | **A20.11** | **A20.12** | **A20.6** |
| Construction type | for thermometers with rigid mount to the stem or for capillary line | | | | |
| Material | stainless steel 316L (1.4435) | | | | |
| Vessel Ø | 10 or 12 mm | | | | 16 mm |
| Stem length L | 30 mm to 200 mm | | | | |
| Process connection[1] | conical coupling and groove nut, DIN 11 851 | Clamp | | Tri-Clamp | Varivent® for Varinline® case |
| | | ISO 2852, for tubes according to ISO 2037 and BS 4825 | DIN 32 676, series A, for tubes according to DIN 11 850 | for tubes according to BS 4825 and O.D.-Tube, ASME BPE and ISO 1127 | |
| Data sheet | 8299.3 | | | | |

Contact stem for temperature measurement at the outside of tanks and pipe barrels up to 300 °C

| |  |  |
|---|---|---|
| **Stem type** | **A1.1** | **A1.2** |
| Construction type | for thermometers with rigid mount to the stem or with max. 5 m capillary line | |
| Material | stainless steel 316Ti (1.4571) | |
| Stem length | 90 mm | |
| Stem width | approx. 20 mm | approx. 24 mm |
| Contact surface | plain | convex |
| Data sheet | 8299.4 | |

[1] other process connections, e.g. aseptic liner DIN 11 864-1, form A, stem type 20.2 upon request

# Thermowells

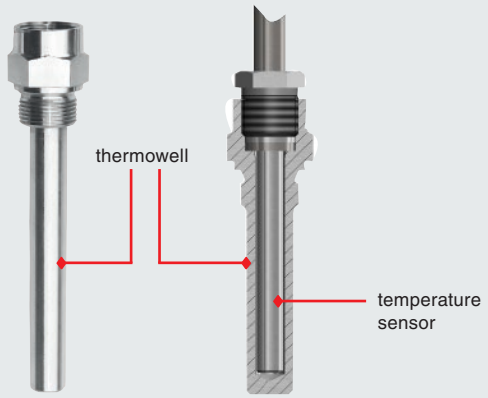
## Connection Between Thermometer and Process

Thermowells separate the temperature sensor from the medium and protect it against mechanical and corrosive stress. Depending on the construction type, they also allow a replacement of the thermometers during operation.

We provide thermowell solutions for almost all industries; from sterile process technologies to chemical as well as petrochemical industries to high-temperature applications in power stations or waste incineration plants – we will find the ideal solutions concerning material, construction type or coating.

Our standard range includes solid-drilled and fabricated thermowells according to DIN, fabricated thermowells for food/bio/pharmaceutical industries and versions with clamp fitting at the temperature sensor. Other versions and customer-specific solutions are available upon request.

## Construction and Metrological Information




- The application of thermowells increases the response time of thermometers, mainly due to the gap between thermowell and thermometer stem.
- For most of the application cases, this fact is not relevant since temperature processes usually proceed slowly. Only in case of sudden, abrupt temperature changes, the adjustment time to the medium temperature has to be increased accordingly.
- For the reduction of the response time, the application of heat transfer paste has proved to be successful.

We carry out a thermowell calculation for your specific case of application.

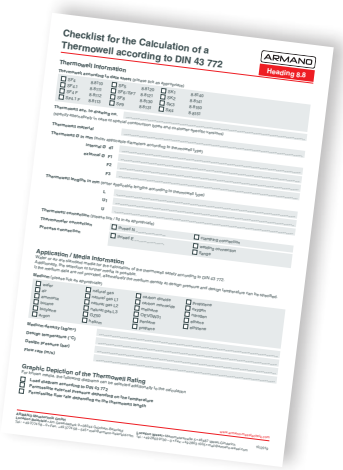
## More Safety with Calculation for Your Specific Case of Application

Thermowells are mechanically highly stressed components. With special calculations, we can determine whether the thermowell geometry and the material meet the specific operating conditions.

A completely filled in checklist for the thermowell calculation[1] with all necessary application data is required.

The certificate includes:

- Thermowell data
- Application and calculation data
- Calculation according to DIN 43 772 / ASME PTC 19.3 or according to DIN 43 772 with load diagram upon request


Checklist for the Calculation of a Thermowell according to DIN 43 772

ARMANO

Heading 8.8

Thermowell information

Application / Media information

Graphic Depiction of the Thermowell Rating

[1] The checklist is available for download on our website.

# Thermowells

## Materials and Coatings

### Materials

Depending on the process, a wide range of materials are applied to meet the demands on temperature resistance, mechanical strength and chemical resistance. Additionally, we provide particularly economic, material-saving construction types for special materials. There, only the wetted parts of the thermowell are made of the special material, e.g. tantalum coating sleeves or welded flange thermowells with sealing face insert.

### Coatings

A coating is a method to achieve an increased corrosion resistance. In special processes, the wetted part of the thermowell is coated, generally with polymers such as PTFE or ECTFE.

| Class of Materials for Thermometer Thermowells | |
|---|---|
| Standard | |
| stainless steel grades | e.g. 1.4571 or 1.4404 |
| creep-resistant steel grades | 13CrMo44 |
| Upon request | |
| duplex and super duplex steels | e.g. 1.4462, 1.4501 |
| heat-resistant steel grades | e.g. 1.4841, 1.4762, 1.4876 |
| creep-resistant steel grades | e.g. 16Mo3, 10CrMo9-10 |
| nickel-base alloys | e.g. various Monel, Hastelloy, Inconel grades |
| other materials | e.g. titanium or tantalum (as coating sleeve) |

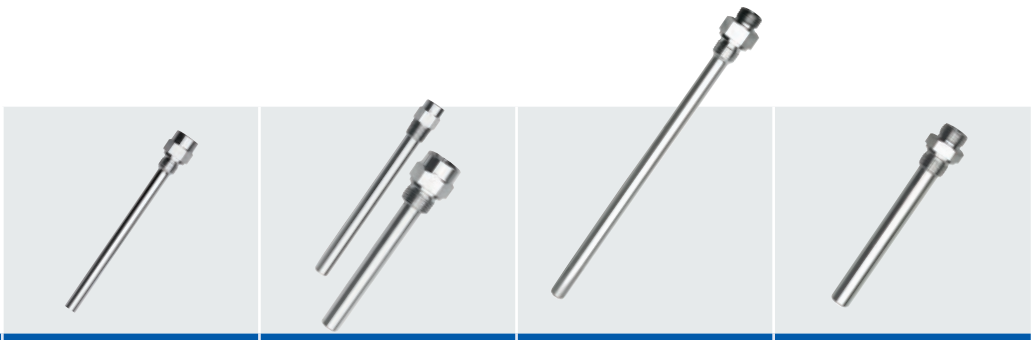
# Certificates

## We Issue the Following Certificates Upon Request

- Test certificate 2.1, 2.2 and 3.1 according to EN 10 204
- Special and material tests available upon request
- Non-destructive weld inspections
- Pressure tests
- Upon request, we issue the test certificate 3.2 according to EN 10 204

# Thermowells – according to DIN 43 772

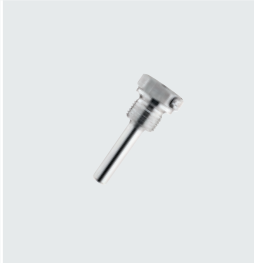
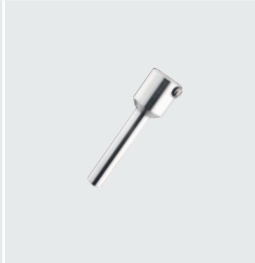
| Thermowell model | | SF4 | SF4.1 | SF4F | SF4.1F |
|---|---|---|---|---|---|
| Form (DIN 43 772) | | **4** | – | **4F** | – |
| Construction type | solid drilled[1] | ✓ | ✓ | ✓ | ✓ |
| | fabricated | – | – | – | – |
| Material (standard)[2] | | stainless steel 316Ti (1.4571), 1.7335 (13 CrMo 4-5) | | stainless steel 316Ti (1.4571) | |
| Process connection | | weld-in | | with flange | |
| Connection to the stem | | female thread | male thread | female thread | male thread |
| Suitable stem type | standard | A4, A4.1, A5, A5.5, A6, B4, B4.1, B5, B6 | A3, A3.5, B3 | A4, A4.1, A5, A5.5, A6, B4, B4.1, B5, B6 | A3, A3.5, B3 |
| | special | A4.2, A4.3, A7, A7.1 | A3.2, A2 | A4.2, A4.3, A7, A7.1 | |
| Data sheet | | 8.8110 | 8.8111 | 8.8112 | 8.8113 |

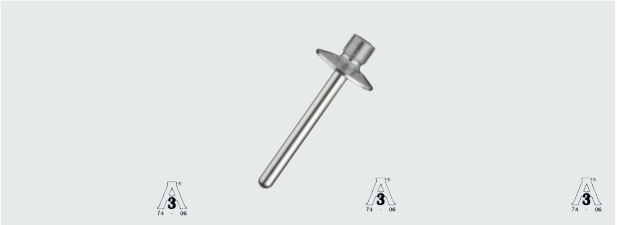
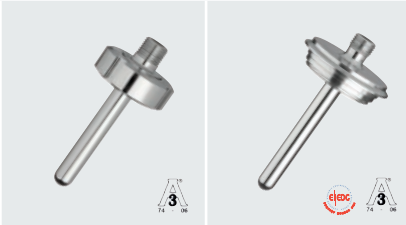


| Thermowell model | | SF5 | SF6/SF7 | SF8 | SF9 |
|---|---|---|---|---|---|
| Form (DIN 43 772) | | **5** | **6, 7** | **8** | **9** |
| Construction type | solid drilled[1] | – | ✓ | – | ✓ |
| | fabricated | ✓ | – | ✓ | – |
| Material (standard)[2] | | stainless steel 316Ti (1.4571), 2.0401 (brass) | stainless steel 316Ti (1.4571), 1.7335 (13 CrMo 4-5) | stainless steel 316Ti (1.4571) | stainless steel 316Ti (1.4571), 1.7335 (13 CrMo 4-5) |
| Process connection | | male thread | | | |
| Connection to the stem | | female thread | | male thread | |
| Suitable stem type | standard | A4, A4.1, A5, A5.5, A6, B4, B4.1, B5, B6 | | A3, A3.5, B3 | |
| | special | A4.2, A4.3, A7, A7.1 | | A3.2, A2 | |
| Data sheet | | 8.8120 | 8.8121 | 8.8130 | 8.8131 |

[1] thermowell and screw fitting made of solid; flanges are welded to the thermowell
[2] others upon request

# Thermowells – Special

| | |  |  |  |  |
|---|---|---|---|---|---|
| **Thermowell model** | | **SK1** | **SK2** | **SK3.B** | **SK4.B** |
| Form (DIN 43 772) | | based on DIN 42 772 form 5 | based on DIN 42 772 form 6, 7 | – | – |
| Construction type | solid drilled[1] | – | ✓ | – | ✓ |
| | fabricated | ✓ | – | ✓ | – |
| Material (standard)[2] | | stainless steel 316Ti (1.4571) | | | |
| Process connection | | male thread | | | weld-in |
| Connection to the stem | | clamping ring fitting for plain stems | | lateral retaining screw for plain stems | |
| Suitable stem type | standard | A1, A1.5<br>B1 | | B1 | |
| | special | – | | – | |
| Data sheet | | 8.8140 | 8.8141 | 8.8150 | 8.8151 |

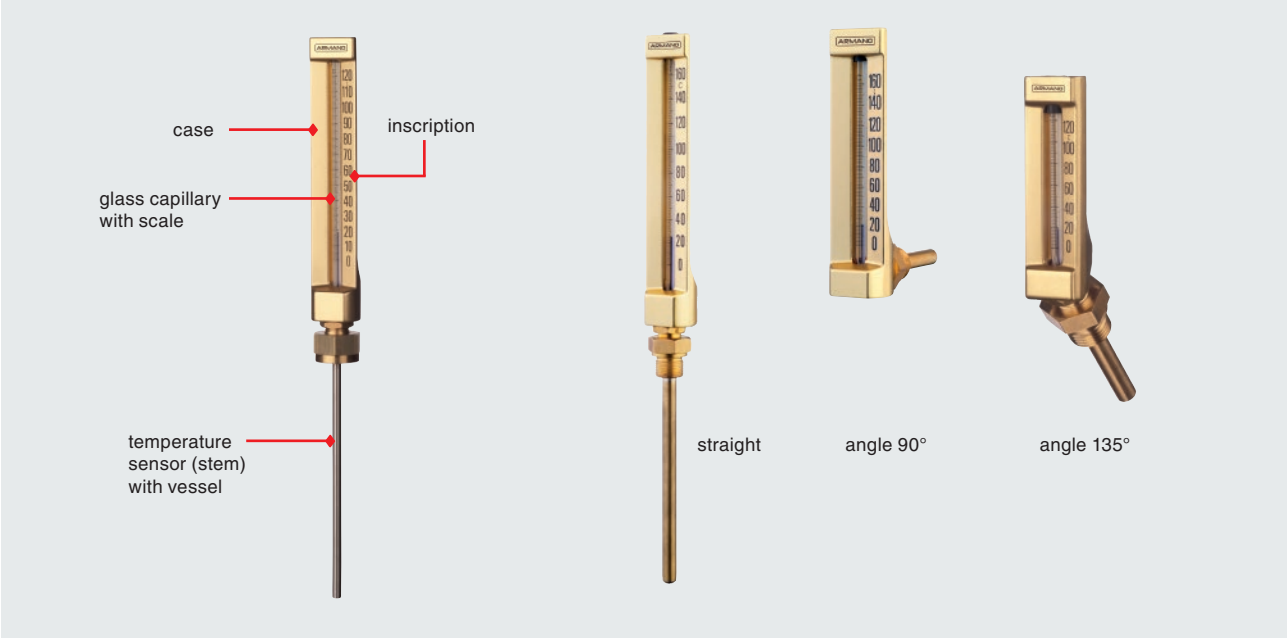
| | |  | | |  | |
|---|---|---|---|---|---|---|
| **Thermowell model** | | **SL1** | **SL11** | **SL12** | **SL3** | **SL6** |
| Form (DIN 43 772) | | – | | | – | – |
| Construction type | solid drilled[1] | – | | | – | – |
| | fabricated | ✓ | | | ✓ | ✓ |
| Material (standard)[2] | | stainless steel 316L (1.4435) | | | | |
| Process connection[3] | | Clamp connection<br>ISO 2852,<br>for tubes according to ISO 2037 and BS 4825 | DIN 32 676, series A, for tubes according to DIN 11 850 | Tri-Clamp for tubes according to BS 4825 and O.D.-Tube, ASME BPE and ISO 1127 | conical coupling and groove nut DIN 11 851 | Varivent® for Varinline® case |
| Connection to the stem | | male thread | | | | |
| Suitable stem type | standard | A3<br>B3 | | | | |
| | special | A2 | | | | |
| Data sheet | | 8.8160 | | | | |

[1] thermowell and screw fitting made of solid
[2] others upon request
[3] other process connections, e.g. SL2, aseptic liner DIN 11 864-1, form A upon request

# Machine-glass Thermometers

Machine-glass thermometers according to DIN EN 16 195 are based on the temperature-dependent expansion of a fluid. The measuring system is located in the robust metal case and consists of a liquid-filled vessel with connected glass capillary. The liquid level in the scaled glass capillary indicates the temperature.

## Construction and Versions




| Type | | A | B | C | C | C |
|---|---|---|---|---|---|---|
| Dimension | | 110 x 30 mm | 150 x 36 mm | 200 x 36 mm | 200 x 36 mm | 200 x 36 mm |
| Stem type | | 2 | 2 | 2 | 3 | 4 |
| Male thread[1)] | | ✓ | ✓ | ✓ | – | – |
| Union nut[1)] | | – | – | – | ✓ | ✓ (only M24x1.5) |
| Installation length L1 | | from 30 mm onwards | from 63 mm onwards | from 63 mm onwards | from 89 mm onwards | from 155 mm onwards |
| Stem material | | brass | brass | brass | St 35, fitting brass | St 35, fitting brass |
| Stem Ø | | 10 mm | 10 mm | 10 mm | 10 mm | 6.5 mm |
| Con-struction type | V (straight) | VA2 | VB2 | VC2 | VC3 | VC4 |
| | H (angle 90°) | HA2 | HB2 | HC2 | HC3 | HC4 |
| | S (angle 135°) | SA2 | SB2 | SC2 | SC3 | SC4 |
| T-sheet | | T08-000-020 | T08-000-026 | T08-000-027 | T08-000-028 | T08-000-029 |

[1)] available threads see T-sheet

# Additional Electrical Accessories

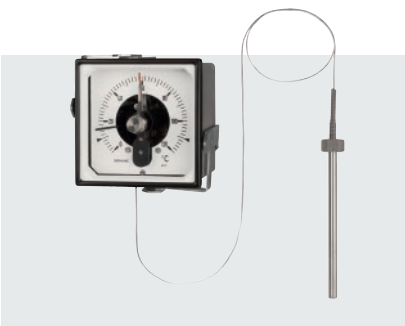
## Available Thermometers with Additional Electrical Accessory

Additional electrical accessories can be integrated in temperature measuring instruments. Limit switch contact assemblies close or open electric or pneumatic circuits. The limit setting pointers can be adjusted to the required value on the entire range of the scale. When exceeding or falling below the adjusted reference value, the actual value pointer triggers the switch.

| TSCh/TSChOe[1)] | |
|---|---|
| Case/ring | bayonet ring case stainless steel |
| Nominal size | 100, 160 mm |
| Additional electrical accessory type | M, I, E |
| Data sheet | 8201.90 |

| TGelCh | |
|---|---|
| Case/ring | bayonet ring case stainless steel |
| Nominal size | 100, 160 mm |
| Additional electrical accessory type | S/M, I, E, P |
| Data sheet | 8211.90 |

| TFCh/TFChOe[1)] | |
|---|---|
| Case/ring | bayonet ring case stainless steel |
| Nominal size | 100, 160 mm |
| Additional electrical accessory type | M, I, E |
| Data sheet | 8221.90 |



| TFQS | |
|---|---|
| Case/ring | square case narrow front ring black clamp for switch panel mounting |
| Nominal size | 96x96, 144x144 mm |
| Additional electrical accessory type | S/M, I, E, P |
| Data sheet | 8225.90 |

| TRCh | |
|---|---|
| Case/ring | bayonet ring case stainless steel |
| Nominal size | 100, 160 mm |
| Additional electrical accessory type | S/M, I, E |
| Data sheet | 8293.90 |

[1)] Please regard the information on the specific version in the respective data sheets.

# Accessories

## According to DIN 43 772

| |  | | | | |
|---|---|---|---|---|---|
| **Type** | **HR** | **S2** | **AV1** | **AV2** | **S1** |
| | neck tube | welding piece | connection screw fitting | connection screw fitting | welding piece |
| Application | e.g. for bridging insulating material | process connection for weld-in thermowells | stem A3/B3 | stem A4/B4<br>A4.1/B4.1 | stem A4/B4<br>A4.1/B4.1<br>threaded thermowells |
| Material | stainless steel 316Ti (1.4571) | | | | |
| Data sheet | 8.8301 | 8.8301 | 8.8201 | 8.8201 | 8.8201 |

## Limit Switch Contact Assemblies

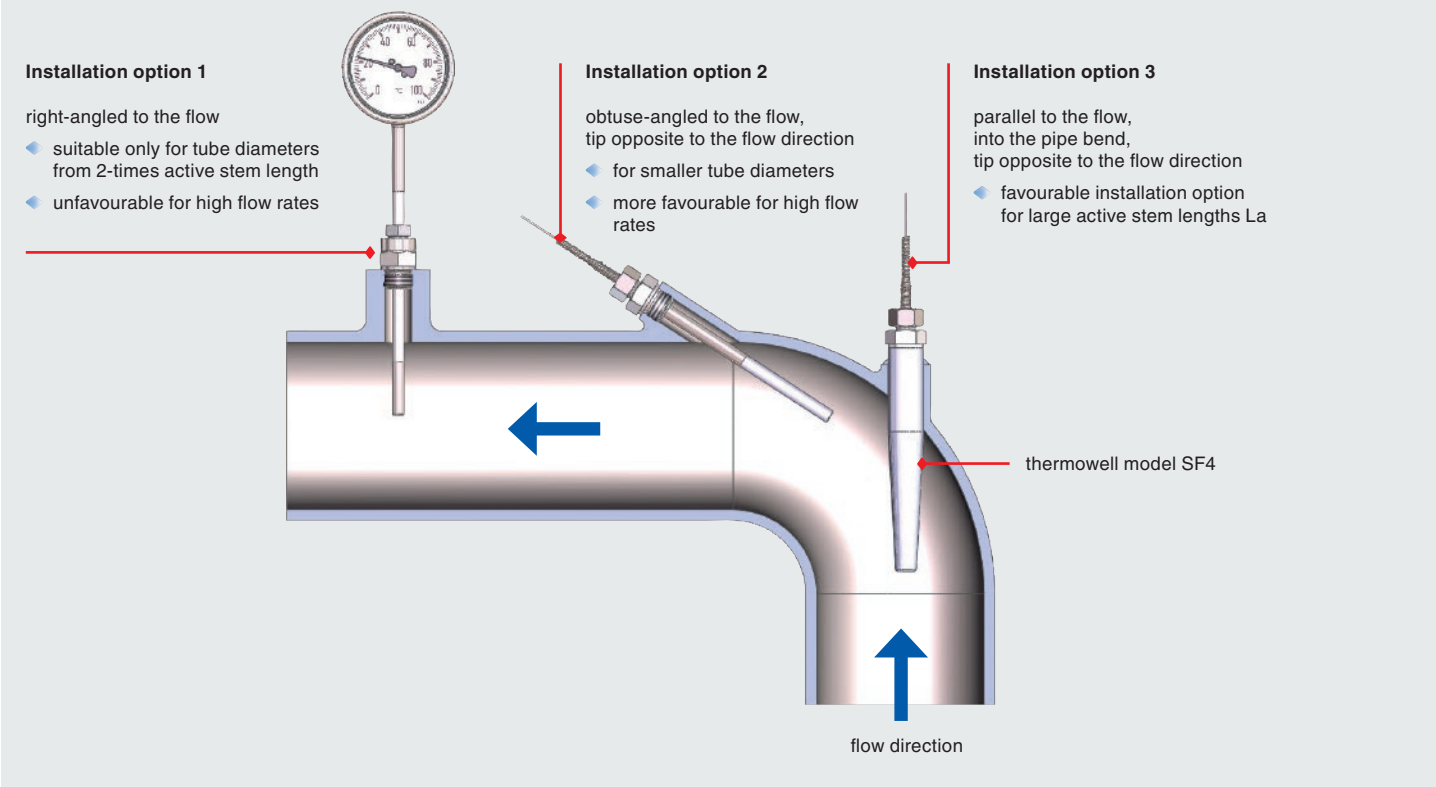
| |  | | | |
|---|---|---|---|---|
| **Type** | **S or M** | **I** | **E** | **P** |
| | direct<br>(electromechanical) | indirect<br>(contact-free) | indirect<br>(contact-free) | indirect<br>(contact-free) |
| | low-action or magnetic contact | inductive limit switch contact assembly | electronic limit switch contact assembly | pneumatic limit switch contact assembly |
| Data sheet | 9.1000 | 9.1000 | 9.1000 | 9.1000 |

## Accessories for Limit Switch Contact Assemblies

| |  | | | | |
|---|---|---|---|---|---|
| **Type** | **MSR** | **MSR-I** | **KF.. -SR2..** | **KHA6-SH-Ex1** | **MSR 000** |
| | impulse-controlled multifunctional relay | impulse-controlled multifunctional relay | switch amplifier<br>- intrinsically safe - | switch amplifier<br>- intrinsically safe - | power supply unit<br>- not intrinsically safe - |
| | for limit switch contact assemblies S and M | for inductive limit switch contact assemblies | for inductive limit switch contact assemblies | for inductive limit switch contact assemblies<br>safety switching | |
| Data sheet/T-sheet | 9521 | 9531 | 9532 | T09-000-041 | 9981 |

# General Installation Information

## Installation Examples for Thermometer Stems




## Important for the Design

- Active stem length La (see data sheets)
- Maximum values for the process pressure and process temperature
- Type of medium
- Flow rate and density of the medium
- Metrological aspects (see T08-000-031)