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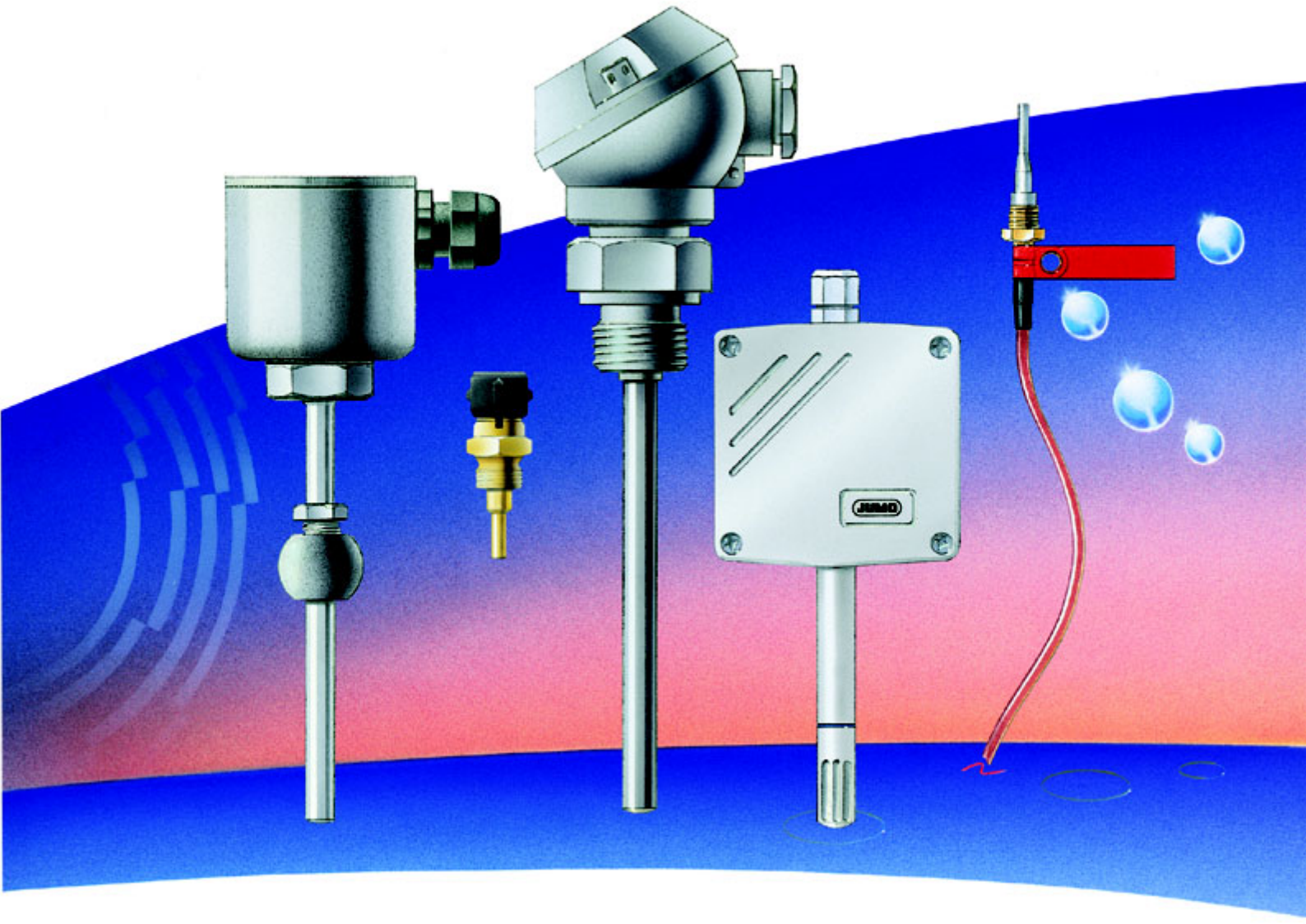

Transducers
for Temperature and Humidity

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Thermocouples

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Construction and application of thermocouples

The thermoelectric effect

The effect responsible for the action of thermocouples is the **Seebeck effect**. If a temperature difference exists along a wire, this will cause a displacement of electrical charge. The amount of the charge displacement depends on the electrical characteristics of the chosen material. If two wires of different materials are joined at one point and then subjected to a temperature, then a voltage difference will be generated between the open ends of the two wires. This voltage depends on the temperature difference along the two wires. In order to be able to measure the temperature at the junction, the temperature at the open end must be known. If the temperature of the open end is not known, then it must be extended (by a compensating cable) into the zone of known temperature (reference junction, usually referred to as the "cold junction").

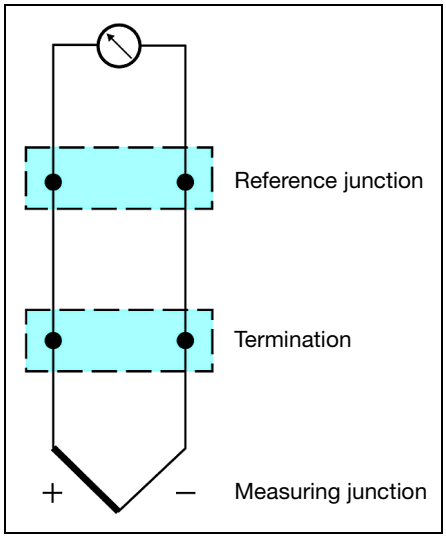

Fig. 1: Measuring circuit (schematic)

The temperature of the reference junction must be known and constant. If no constant reference junction temperature is available, the reference junction has to be arranged as a thermostat, or its temperature has to be determined by means of a second sensor.

Thermocouples to EN 60 584 and DIN 43 710

From the variety of possible metal combinations, certain ones have been selected (Tables 1 and 2) and their voltage tables and permitted tolerances incorporated in standard specifications (Fig. 2 and Tables 3 and 4).

Note that two Fe-Con thermocouples (Type J and L) and two Cu-Con thermocouples (Type T and U) have been standardized in both EN 60 584 and DIN 43 710.

The "old" thermocouples L and U are now being used less frequently than the thermocouples J and T to EN 60 584.

Thermocouple		Maximum temperature	Defined up to	Positive limb	Negative limb
Fe-Con	J	750°C	1200°C	black	white
Cu-Con	T	350°C	400°C	brown	white
NiCr-Ni	K	1200°C	1370°C	green	white
NiCr-Con	E	900°C	1000°C	violet	white
NiCrSi-NiSi	N	1200°C	1300°C	mauve	white
Pt10Rh-Pt	S	1600°C	1540°C	orange	white
Pt13Rh-Pt	R	1600°C	1760°C	orange	white
Pt30Rh-Pt6Rh	B	1700°C	1820°C	no data	white

Table 1: Thermocouples to EN 60 584

Thermocouple		Maximum temperature	Defined up to	Positive limb	Negative limb
Fe-Con	L	700°C	900°C	red	blue
Cu-Con	U	400°C	600°C	red	brown

* Continuous temperature in pure air

Table 2: Thermocouples to DIN 43 710

The individual thermocouples are not compatible, because of their differing alloy compositions. If a Fe-Con thermocouple Type L is connected to an instrument linearized for Type J, the difference in the thermal voltages leads to errors of up to several °C. The same applies to thermocouples Type U and T.

The maximum temperature represents the limit to which a tolerance is specified.

The value under "defined to" is the temperature limit to which the thermal voltage is covered by standard specifications.

In the thermocouples listed above, the first limb is always the positive one. The color codes apply both to the thermocouple itself and to the compensating cables. If the thermocouple wires are not color coded, the following differences may help to identify them.

Fe-Con: positive limb is magnetic
Cu-Con: positive limb is copper colored
NiCr-Ni: negative limb is magnetic
PtRh-Pt: negative limb is softer

These distinctions do not apply to the compensating cables.

The thermocouples are insulated inside the fittings using ceramic materials. PVC, silicone, PTFE or glass fiber are used in the cables.

Tolerances

EN 60 584 defines three tolerance classes for thermocouples. They normally apply to thermowires between 0.25 to 3mm diameter and to the condition as supplied. The standard cannot cover any possible subsequent ageing, since this largely depends on the conditions of use. The temperature limits specified for the tolerance classes are not necessarily the recommended operating temperature limits (see Tables 3 and 4). The larger value applies in each case.

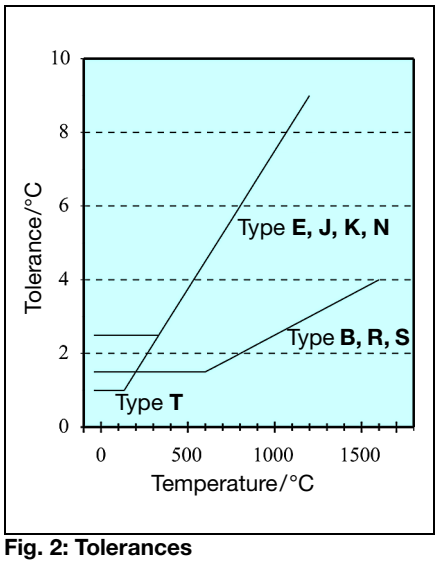

Fig. 2: Tolerances

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Linearity

The voltage produced by a thermocouple is not linear with temperature and must therefore be liniearized by the subsequent electronics. Digital instruments are programmed with linearization tables, or appropriate calibration values have to be entered by the user. Analog instruments are often provided with non-linear scales. The characteristics of thermocouples (Fig. 3) are defined by voltage tables to ensure full interchangeability.

This means, for example, that a Fe-Con thermocouple Type J can be replaced by any other thermocouple of this type irrespective of the manufacturer, without requiring any recalibration of the instrument to which it is connected.

Compensating cables to EN and DIN

Compensating cables for thermocouples have their electric and mechanical properties defined in the EN 60 584 or DIN 43 714 standards. They are made either of the same material as the thermocouple itself (thermocables, extension cables) or from special materials with the same thermoelectric properties within restricted temperature ranges (compensating cables proper). The use of compensating cables saves the extra cost in the case of certain noble metals.

Compensating cables consist of twisted cores and are identified by a color code and code letters as follows:

- Letter 1: code letter for the thermocouple
- Letter 2: X: same material as thermocouple
  C: special material
- Letter 3: several types of compensating cable can be distinguished by a third letter.

Example:

KX: compensating cable for NiCr-Ni thermocouple Type K made from thermocouple material

RCA: compensating cable for PtRh-Pt thermocouple Type R, made from special material Type A

Thermocouple		Tolerance classes			
Fe-Con	J	Class 1	- 40 to + 750°C:	±0.004 x t	or ±1.5°C
		Class 2	- 40 to + 750°C:	±0.0075 x t	or ±2.5°C
		Class 3			
Cu-Con	T	Class 1	- 40 to + 350°C:	±0.004 x t	or ±0.5°C
		Class 2	- 40 to + 350°C:	±0.0075 x t	or ±1.0°C
		Class 3	-200 to + 40°C:	±0.0015 x t	or ±1.0°C
Ni-CrNi	K	Class 1	- 40 to +1000°C:	±0.004 x t	or ±1.5°C
and		Class 2	- 40 to +1200°C:	±0.0075 x t	or ±2.5°C
NiCrSi-NiSi	N	Class 3	-200 to + 40°C:	±0.015 x t	or ±2.5°C
NiCr-Con	E	Class 1	- 40 to + 800°C:	±0.004 x t	or ±1.5°C
		Class 2	- 40 to + 900°C:	±0.0075 x t	or ±2.5°C
		Class 3	-200 to + 40°C:	±0.015 x t	or ±2.5°C
Pt10Rh-Pt	S	Class 1	0 to +1600°C:	±[1+(t-1100) x 0.003]	or ±1.0°C
and		Class 2	- 40 to +1600°C:	±0.0025 x t	or ±1.5°C
Pt13Rh-Pt	R	Class 3			
Pt30Rh-		Class 1			
Pt6Rh	B	Class 2	+600 to +1700°C:	±0.0025 x t	or ±1.5°C
		Class 3	+600 to +1700°C:	±0.005 x t	or ±4.0°C

Table 3: Tolerances to EN 60 584

Thermocouple		Tolerances		
Cu-Con	U	+100 to	+400 °C:	±3°C
		+400 to	+600 °C:	±0.0075 x t
Fe-Con	L	+100 to	+400 °C:	±3°C
		+400 to	+900 °C:	±0.0075 x t

Table 4: Tolerances to DIN 43 710 (1977)

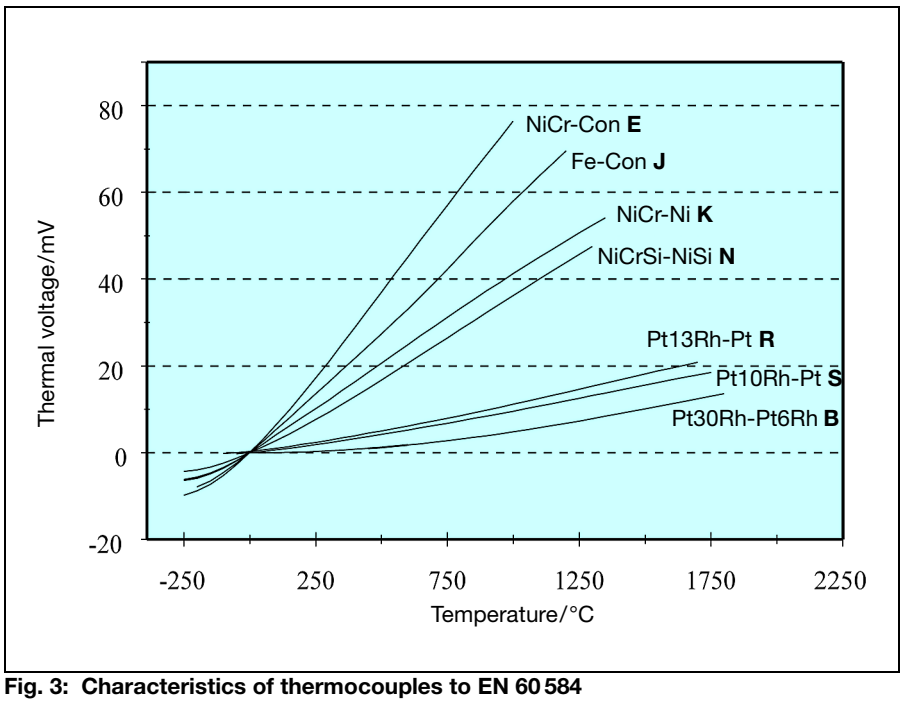

Fig. 3: Characteristics of thermocouples to EN 60 584

The tolerance classes 1 and 2 are defined for compensating cables. Class 1 has closer tolerances, which can only be met by extension cables made from the same material as the thermocouple, i.e. the X-type.

Compensating cables proper are normally supplied to Class 2. Table 5 shows the tolerances for the different compensating cable classes.

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The operating temperature range in Table 5 covers the temperature to which the entire cable may be exposed, including the thermocouple terminations, without exceeding the specified tolerances. Because of the non-linearity of the thermal voltage, the tolerances in mV or °C only apply to the measured temperatures specified in the right column.

This means, for example:

A thermocouple Type J is connected to a compensating cable Type JX, Class 2. If the measured temperature remains constant at 500°C and the temperature of the terminals and/or the compensating cable varies from -25 to +200°C, then the indicated temperature varies by not more than ±2.5°C.

Color coding of compensating cables

The color coding of compensating cables is laid down in EN 60 584 and DIN 43 713 (1990). For thermocouples to EN 60 584 (Table 6) this means:
The positive limb has the same color as the sheath, the negative limb is white. The “old” thermocouples Type L and U to DIN 43 713 (Table 7) are coded differently.

There are no details for the Pt30Rh-Pt6Rh thermocouple Type B. Ordinary copper connecting cables (plain copper) can be used as compensating cables in this case.

According to DIN 43 714, the cable cores are twisted together for electromagnetic screening. Additional screening by foil or braiding can be provided. The insulation resistance between the cores and between cores and screening must not be less than $10^7 \Omega \times m^{-1}$ at the maximum temperature; the breakdown voltage exceeds 500 VAC.

In addition to these color codes for compensating cables, there are also those according to DIN 43 714, 1979 (Table 8). They differ in certain respects from the ones mentioned above.

Where there are no color codes, it is not possible to identify cables by magnetism, color or hardness. Compensating cables Type KCA and KCB differ from the thermocable KX and the thermocouple Type K by having a magnetic positive limb.

Thermocouple and wire type	Tolerance classes 1	2	Operating temperature range [°C]	Measuring temperature [°C]
JX	± 85µV/±1.5°C	± 140µV/±2.5°C	-25 to +200	500
TX	± 30µV/±0.5°C	± 60µV/±1.0°C	-25 to +100	300
EX	± 120µV/±1.5°C	± 200µV/±2.5°C	-25 to +200	500
KX	± 60µV/±1.5°C	± 100µV/±2.5°C	-25 to +200	900
NX	± 60µV/±1.5°C	± 100µV/±2.5°C	-25 to +200	900
KCA	-	± 100µV/±2.5°C	0 to +150	900
KCB	-	± 100µV/±2.5°C	0 to +100	900
NC	-	± 100µV/±2.5°C	0 to +150	900
RCA	-	± 30µV/±2.5°C	0 to +100	1000
RCB	-	± 60µV/±5.0°C	0 to +200	1000
SCA	-	± 30µV/±2.5°C	0 to +100	1000
SCB	-	± 60µV/±5.0°C	0 to +200	1000

Table 5: Tolerances for thermocables and compensating cables

Thermocouple	Type	Sheath	Positive limb	Negative limb
Cu-Con	T	brown	brown	white
Fe-Con	J	black	black	white
NiCr-Ni	K	green	green	white
NiCrSi-NiSi	N	mauve	mauve	white
NiCr-Con	E	violet	violet	white
Pt10Rh-Pt	S	orange	orange	white
Pt13Rh-Pt	R	orange	orange	white

Table 6: Color coding for thermocouples to EN 60 584

Thermocouple	Type	Sheath	Positive limb	Negative limb
Fe-Con	L	blue	red	blue
Cu-Con	U	brown	red	brown

Table 7: Color coding for thermocouples to DIN 43 713

Thermocouple	Type	Sheath	Positive limb	Negative limb
NiCr-Ni	K	green	red	green
Pt10Rh-Pt	S	white	red	white
Pt13Rh-Pt	R	white	red	white

Table 8: Color coding for thermocouples to DIN 43 714 (1979)

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Construction of thermocouples

Apart from the virtually unlimited number of special models, there are also those whose components are completely defined by standard specifications.

Thermocouples with terminal head

These **thermocouples** are of modular construction, consisting of the thermocouple proper, insert tube, terminal plate, protection tube and the terminal head. A flange or a screw fitting can be provided for mounting in position.

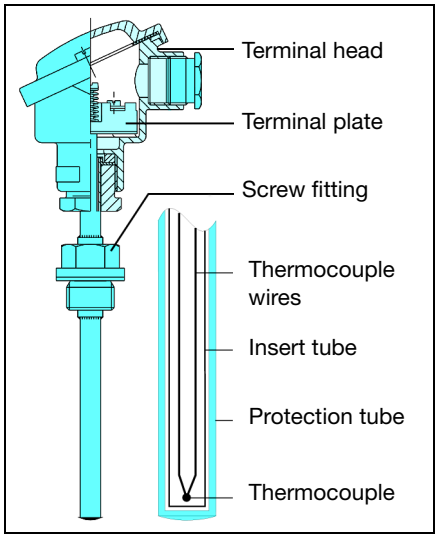

Fig. 4: Construction of a thermocouple

The **measuring insert** is a completely fabricated unit consisting of thermocouple sensor and terminal plate, with the thermocouple contained in an **insert tube** of 6 or 8 mm diameter made from bronze SnBz6 to DIN 17 681 (up to 300°C) or nickel. It is inserted into the actual protection tube, which is often made from stainless steel. The tip of the insert tube is in full contact with the inside of the protection tube end plate in order to ensure good heat transfer. The fixing screws of the insert are backed by springs, to maintain good contact even with differential expansion between insert tube and protection tube. This arrangement ensures that the insert can be readily replaced.

The thermometers are available in single and twin versions. Their dimensions are laid down in DIN 43 735. If no measuring insert is used, the thermocouple is mounted directly in the **protection tube** using ceramic insulation.

The choice of the protection tube material depends on the thermal, chemical and mechanical conditions on site.

Metal protection tubes in high-temperature steel, e.g. Material Ref. 1.4749, are used up to 1150°C. The corrosion resistance of the protection tube materials is described in DIN 43 720.

These details are provided for general information only, and the user remains responsible for fully evaluating the protection tube material for its suitability to the operating conditions on site. The indicated temperature refers to the use without mechanical loads and (unless otherwise specified) in clean air.

Ceramic protection tubes are employed where local conditions prevent the use of metal fittings, either for chemical reasons or because of high temperatures. Their main application is at temperatures between 1000 and 1650°C. They may be in direct contact with the medium, or may be used as a gas-tight inner tube to separate the thermocouple from the actual protection tube. Even hair cracks may lead to a poisoning and drifting of the thermocouple. The resistance of a ceramic to temperature shock increases with its thermal conductivity and the tensile strength, and is larger for a lower thermal expansion coefficient. The wall thickness of the material is also important; thin-walled tubes are preferable to those with larger wall thicknesses.

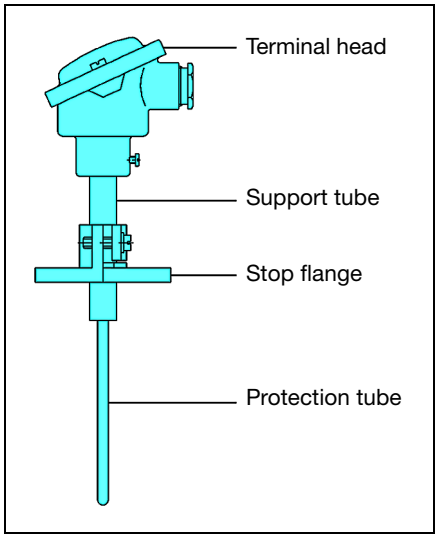

Fig. 5: Thermocouple with ceramic protection tube

In the case of noble thermocouples, the ceramic has to be of the highest purity.

Platinum thermocouples are very sensitive to poisoning by foreign chemical elements. These include especially silicon, arsenic, phosphorus, sulfur and boron. Special care must therefore be taken in high-temperature fittings to ensure that insulation and protection tube do not contain such elements, as far as this is possible. A particularly damaging material is SiO_2. Poisoning takes place much more rapidly in a neutral or reducing atmosphere and is caused by the reduction of SiO_2 to SiO, which reacts with platinum to form Pt_5Si_2. As little as 0.2% SiO_2 in the insulation of the protection tube material is sufficient in a reducing atmosphere to form such brittle silicides.

Thermocouples with protection tubes that are permeable to gas can therefore not be used in a reducing atmosphere, such as in annealing furnaces, but are permitted in an oxidizing atmosphere or under a protective gas blanket. If an inner tube of gas-tight ceramic is used, the outer protection tube can be permeable to gas.

In the high-temperature range, the insulation properties of the materials become important. Protection tubes in aluminium-oxide (KER 610) and magnesium oxide exhibit appreciable conductivity above 1000°C. This produces a shunt effect which introduces errors into the thermocouple signal. The insulation of ceramics deteriorates with increasing alkali content. Pure aluminium oxide ceramics exhibit the best characteristics. KER 710 is therefore used for 4-bore insulators and protection tubes.

Two gas-tight ceramics are described below, whose characteristics are defined in DIN 43 724:

KER 710 is a pure oxide ceramic consisting of more than 99.7% Al_2O_3, with traces of MgO, Si_2O and Na_2O, which is fire resistant up to 1900°C and has a melting point of 2050°C. It is the best ceramic material, with an insulation resistance of $10^7 \Omega$ x cm at 1000°C and good strength under alternating temperatures, thanks to its high thermal conductivity and relatively low thermal expansion. With platinum thermocouples, both the insulation rod and the protection tube must be in KER 710.

The material **KER 610** has a higher alkali content (60% Al_2O_3, 37% SiO_2, 3% alkali) and, therefore, a low insulation resistance of about $10^4 \Omega$ x cm at 1000°C. Because of the high silicon dioxide content, it cannot be used in a reducing atmosphere. Compared with KER 710, it has only one-ninth the thermal conductivity; its mechanical stability is good.
The advantage of KER 610 is its price, which is only about one-fifth that of KER 710.

For the **terminal heads**, DIN 43 729 defines the two forms A and B, which differ in size and also slightly in style.

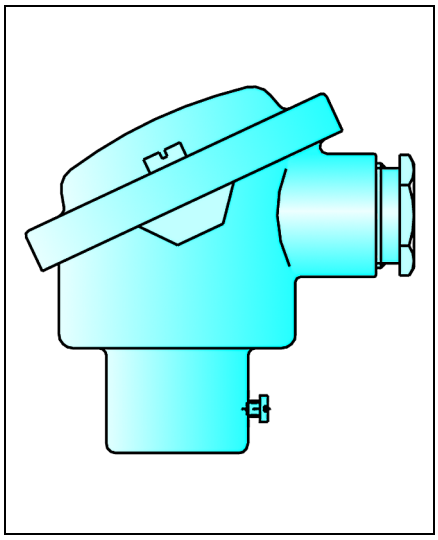

Fig. 6: Terminal head to DIN 43 729, Form B

The material used is aluminium.

Protection is not covered by a standard; it is usually splash-proof to IP54. The nominal diameter of the bore to take the protection tube is as follows:

Form A: 22, 24 or 32 mm.
Form B: 15 mm or thread M 24 x 1.5.

Thermocouples to DIN 3440
Thermocouples for use with temperature controllers or temperature limiters for indirect heating systems must meet the requirements of DIN 3440 and are subject to additional TUV approval.

The thermocouples must withstand temperatures that are 15% above the upper temperature limit for at least one hour and have to meet certain response times in relation to the medium (e.g. air $t_{0.63}$ = 120sec). The thermometers are designed to withstand mechanical loads caused by external pressure and the flow velocity of the medium at the operating temperature.
No modifications to the thermometers are permitted without obtaining a fresh TUV approval!

Thermocouples with compensating cable
Thermocouples with an attached compensating cable do not have a measuring insert or a terminal head. The thermocouple is directly connected to the thermocable or the compensating cable and enclosed in the protection tube. Strain relief is provided by crimping the protection tube at the entry of the compensating cable.
The thermocouple is normally insulated; alternatively, it can be welded to the protection tube tip for improved thermal contact. The maximum temperature is determined mainly by the thermal stability of the cable sheath and insulation. Table 9 shows as examples some insulation materials and their upper temperature limit.

Material	Max. temperature °C
PVC	80
Silicone	180
PTFE	260
Glass fiber	350

Table 9: Temperature limits of insulation materials

There are many different thermometer designs, and they are often adapted to suit particular customer requirements.
Some characteristic data are given below:

- diameter: 0.5 – 6mm
- protection tube length: 35 – 150mm
- protection tube material: stainless steel, heat-resistant steel or brass
- mounting: fixed or sliding flange, fixed thread or clamp

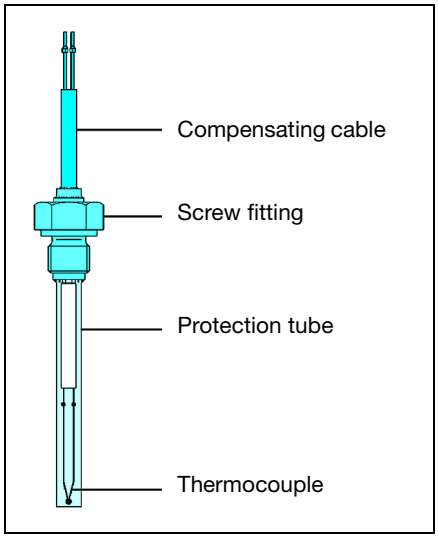

Fig. 7: Construction of a thermocouple with compensating cable

Thermocouples with bayonet fitting
Another version incorporates a bayonet fitting. The stainless steel pressure spring (Material Ref. 1.4310) also acts as a cable protector and ensures uniform pressure of the protection tube and sensing tip against the bottom of the bore.

The fitting length can be varied by rotating the bayonet lock. Bayonet fittings and sockets are available in 12, 15 and 16 mm diameters.

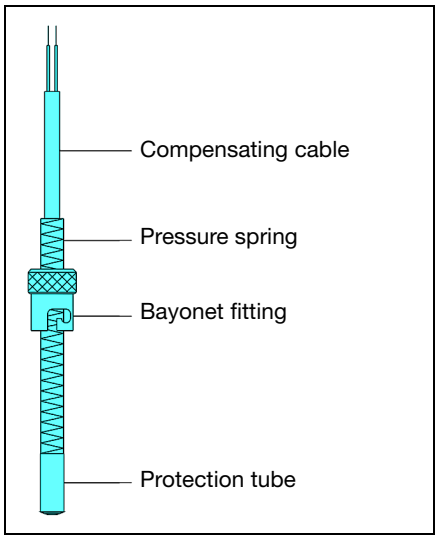

Fig. 8: Thermocouple with bayonet fitting

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Thermocouples with a bayonet fitting are largely employed for measuring temperatures in solids, on bearings and moulding tools, e.g. in the plastics industry. Because of the special shape of the sensing tip, these thermocouples are suitable for both flat-bottom and cone-shaped bores.

Mineral-insulated thermocouples
Mineral-insulated thermocouples consist of a thin-walled sheath of stainless or high-temperature steel (Inconel 600) in which thermocouple wires are embedded in compressed fire-resistant magnesium oxide.

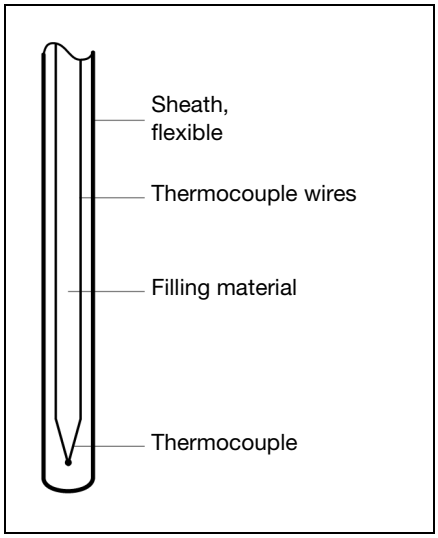

Fig. 9: Construction of a mineral-insulated thermocouple

Excellent heat transfer between sheath and thermocouple enables a fast response ($t_{0.5}$ from 0.1sec) and high accuracy.
The shock-resistant construction ensures a long life.
The flexible **sheath**, minimum bending radius 5 times the external diameter of 0.5 – 6mm, permits temperature measurement in locations where access is difficult. Thanks to their special features, mineral-insulated thermocouples are used in chemical plant, power stations, pipelines, on test beds and wherever resistance to vibration, flexibility and easy installation are required.

Connection of thermocouples

The length of the compensating cable is of minor importance in view of the low internal resistance. With long distances and a small cross-section, the resistance of the compensating cable may, however, become relatively large.
In order to avoid errors, the resistance of the input circuit of the instrument must be at least 1000 times the resistance of the thermocouple connected.

It is essential to use only compensating cables of the same material as the thermocouple, or with the same thermoelectric characteristics, otherwise an additional thermocouple is formed at the connection point. The compensating cable has to be run up to the cold junction. The correct polarity must be observed when connecting up the thermocouple.

Effect on short-circuit and break

A thermocouple produces no voltage if the measured temperature is equal to the cold junction temperature.

If a thermocouple or compensating cable is short-circuited, a new measuring point is produced at the location of the short-circuit. If it occurs in the terminal head, for example, the temperature measurement relates not to the actual measuring point, but to the terminal head. If there is a break in the measuring circuit, the instrument will show the cold junction temperature.

Measurement errors arising from the installation

A temperature probe can only indicate the temperature of its temperature-sensitive sensor. This temperature is not necessarily the same as that for the medium which is intended to be measured. The thermometer is not installed purely in the medium, but is also thermally linked to its surroundings. This results in a temperature shift (thermal conduction error). This error depends on a number of factors. These include: the temperature of the medium, ambient temperature, thermal characteristics of the medium, flow velocity and the immersion length of the thermometer. A lasting reduction of this error requires a suitable choice of installation site, whereby the immersion depth of the thermometer in the medium plays a particularly important role. As a rough guide for measurement in liquid media, the immersion depth should be at least 15 times the thermometer diameter. For critical applications, or to meet requirements for very high accuracy, the installation-induced error should be checked by a test measurement. To do this, the thermometer is pulled out of the normal installation position by about 10 mm, and the temperature indication is noted.

Fault finding

One of the most frequent faults is the omission or the incorrect choice of the compensating cable. The thermocouple can be readily checked using a simple continuity tester or ohmmeter. The operation of the thermocouple and its correct polarity can be tested with a voltmeter (millivolt range), by heating its sensing tip.

Possible connection errors and their effects:

- *Indicator shows room temperature*
  thermocouple or cable open-circuit.
- *Indication has correct value but negative sign*
  reversed polarity at the indicator.
- *Indication cleary too high or too low*
  a) incorrect linearization of the indicator.
  b) incorrect compensating cable or connections reversed.
- *Indication too high or too low by a fixed amount*
  incorrect cold junction temperature.
- *Indication correct but drifting slowly in spite of constant measured temperature*
  cold junction temperature not constant or not evaluated correctly.
- *Temperature still indicated with one limb disconnected*
  a) electromagnetic interference picked up on the input cable.
  b) parasitic voltages produced due to missing or faulty electrical isolation e.g. in furnaces.
- *High reading when both thermocouple limbs are disconnected*
  a) electromagnetic interference picked up on the input cable
  b) parasitic galvanic voltages, e.g. due to damp insulation in the compensating cable.

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Safety notes

All welded joints on thermometers and pockets are monitored through a quality assurance system to DIN 8563, Part 113. Special regulations apply to certain applications (e.g. pressure vessels) according to Section 24 of the German Trade Regulations. Where the user specifies such special requirements, the weld is monitored according to EN 287 and EN 288.

Pressure loading for temperature probes

The pressure resistance of protection fittings, such as are used for electric thermometers, depends largely on the different process parameters.
These include:

- temperature
- pressure
- flow velocity
- vibration

In addition, physical properties, such as material, fitting length, diameter and type of process connection have to be taken into account.

The following diagrams are taken from DIN 43 763 and show the load limit for the different basic types in relation to the temperature and the fitting length, as well as the flow velocity, temperature and medium

.

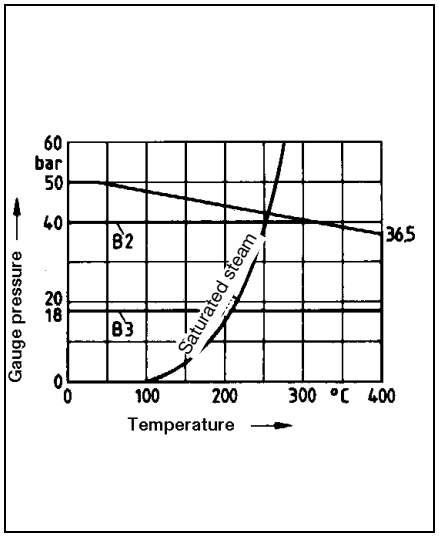

Fig. 10: Pressure loading for protection tube Form B

stainless steel 1.4571
velocity up to 25m/sec in air
velocity up to 3m/sec in water

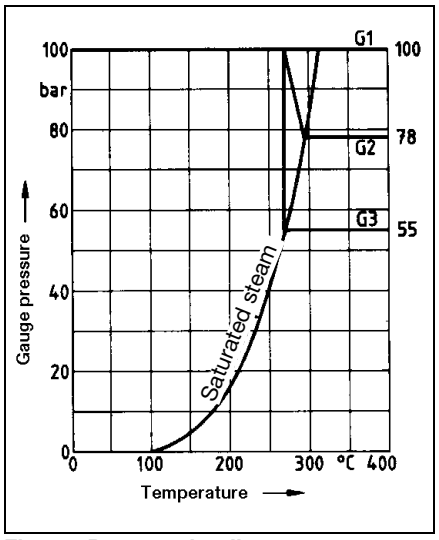

Fig. 11: Pressure loading for protection tube Form G

stainless steel 1.4571
velocity up to 40m/sec in air
velocity up to 4m/sec in water

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As explained in the standard, the values indicated are guide values, which have to be individually examined for the specific application. Slight differences in the measurement conditions may suffice to destroy the protection tube.
If, when ordering an electric thermometer, the protection fitting needs to be checked, the load type and the limit values must be specified.

Fig. 12 shows the load limits (guide values) for different tube dimensions on a variety of additional thermometer designs. The maximum pressure loading of cylindrical protection tubes is shown in relation to the wall thickness with different tube diameters.
The data refer to protection tubes in stainless steel 1.4571, 100mm fitting length, 10m/sec flow velocity in air, or 4m/sec in water, and a temperature range from -20 to +100°C. A safety factor of 1.8 has been taken into account. For higher temperatures or different materials, the maximum pressure loading has to be reduced by the percentage values given in the table.

Material	Temperature	Reduction
CrNi 1.4571	up to +200°C	-10%
CrNi 1.4571	up to +300°C	-20%
CrNi 1.4571	up to +400°C	-25%
CrNi 1.4571	up to +500°C	-30%
CuZn 2.0401	up to +100°C	-15%
CuZn 2.0401	up to +175°C	-60%

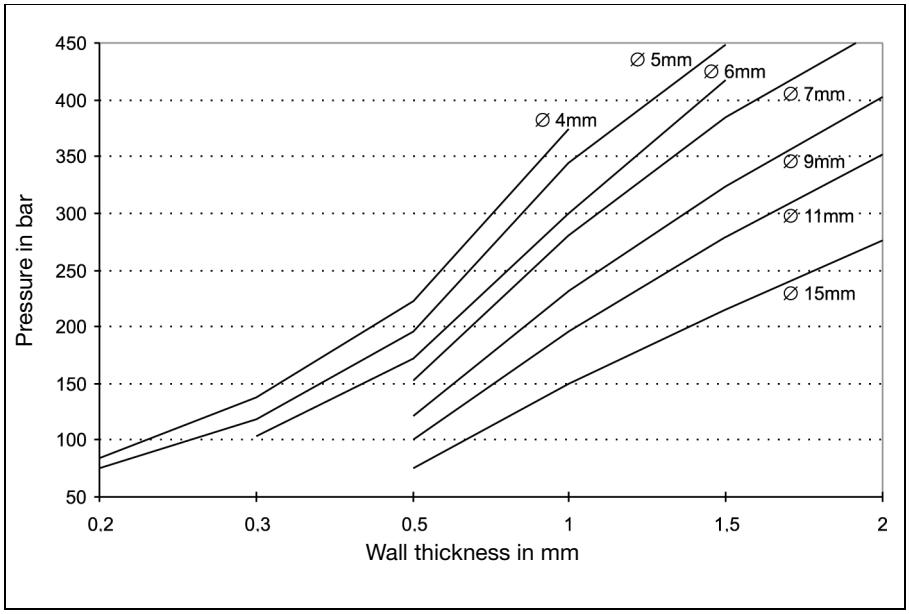

Fig. 12: Load limits on protection tubes for various tube dimensions

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Pressure test for thermometer protection fittings

The welded protection fittings of JUMO thermometers are subjected to a leakage test or a pressure test, depending on the construction of the protection fitting.

Thermometers which are manufactured to DIN or to application-specific guidelines (chemical or petrochemical plant, pressure vessel regulation, steam boilers) require different pressure tests according to the specific application.
If the thermometers are to be manufactured to such standards or guidelines, then the required tests or standards and/or guidelines have to be specified when ordering.

Scope of test
Tests can be carried out on each individual protection fitting and documented in a test report or acceptance certificate to EN 10 204 (at extra cost).

Type of test
Tests can be performed on protection fittings up to a fitting length of 1050mm with flange connection DN25 or screw connection up to 1" thread size.

The following tests can be carried out:

Test type	Test medium	Pressure range	Test duration
Leakage test	helium	vacuum	10 sec
Pressure test I	nitrogen	1 — 50 bar	10 sec
Pressure test II	water	50 — 300 bar	10 sec

Leakage test
A vacuum is produced inside the protection tube. From the outside, helium is applied to the protection fitting. If there is a leak in the protection tube, helium will penetrate and will be recognized through analysis. A leakage rate is determined by the rise in pressure (leakage rate > 1 x 10^{-6} l/bar).

Pressure test I
A positive pressure of nitrogen is applied to the protection tube from the outside. If there is a leak in the fitting, a volume flow will be produced inside the protection tube, which will be recognized.

Pressure test II
Water pressure is applied to the protection tube from the outside. The pressure must remain constant for a certain length of time. If this is not the case, the protection fitting has a leak.

Qualified welding processes for the production of protection tubes for thermometers

In addition to using perfect materials, it is the joining technique which ultimately determines the mechanical stability and quality of the protection fittings. This is why the welding techniques at JUMO comply with the European Standards EN 287 and EN 288. Manual welding is carried out by qualified welders according to EN 287. Automatic welding processes are qualified by a WPS (welding instruction) to EN 288.

The following table gives an overview of qualified welding processes:

	WIG welding	
Material	manual	automatic
W11, W11 with W01-W04 to EN 287	Tube diameter 2 — 30 mm Wall thickness 0.75 — 5.6 mm	Tube diameter 5 — 10 mm Wall thickness 0.5 — 1.0 mm

Table 10: Qualified welding processes

Based on these experiences, our welders can also join different materials and dimensions.

Laser beam welding is employed for wall thicknesses of less than 0.6mm, which is monitored by a laser beam specialist according to guideline DSV 1187.

On customer request, material test certificates can be issued at extra cost. Likewise, special tests and treatments can be carried out, which are calculated according to the extent of the work, as set out in various application guidelines. This includes X-ray examinations, crack test (dye penetration test), thermal treatment, special cleaning processes and markings.

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Voltage table for thermocouples to EN 60 584

im mV for 10°C temperature steps (0°C cold junction)

Pt13Rh-Pt R

°C	0	10	20	30	40	50	60	70	80	90
0	0	0.054	0.111	0.171	0.232	0.296	0.363	0.431	0.501	0.573
100	0.647	0.723	0.800	0.879	0.959	1.041	1.124	1.208	1.294	1.380
200	1.468	1.557	1.647	1.738	1.830	1.923	2.017	2.111	2.207	2.303
300	2.400	2.498	2.596	2.695	2.795	2.896	2.997	3.099	3.201	3.304
400	3.407	3.511	3.616	3.721	3.826	3.933	4.039	4.146	4.254	4.362
500	4.471	4.580	4.689	4.799	4.910	5.021	5.132	5.244	5.356	5.469
600	5.582	5.696	5.810	5.925	6.040	6.155	6.272	6.388	6.505	6.623
700	6.741	6.860	6.979	7.098	7.218	7.339	7.460	7.582	7.703	7.826
800	7.949	8.072	8.196	8.320	8.445	8.570	8.696	8.822	8.949	9.076
900	9.203	9.331	9.460	9.589	9.718	9.848	9.978	10.109	10.240	10.371
1000	10.503	10.636	10.768	10.902	11.035	11.170	11.304	11.439	11.574	11.710
1100	11.846	11.983	12.119	12.257	12.394	12.532	12.669	12.808	12.946	13.085
1200	13.224	13.363	13.502	13.642	13.782	13.922	14.062	14.202	14.343	14.483
1300	14.624	14.765	14.906	15.047	15.188	15.329	15.470	15.611	15.752	15.893
1400	16.035	16.176	16.317	16.458	16.599	16.741	16.882	17.022	17.163	17.304
1500	17.445	17.585	17.726	17.866	18.006	18.146	18.286	18.425	18.564	18.703
1600	18.842	18.981	19.119	19.257	19.395	19.533	19.670	19.807	19.944	20.080

Pt10Rh-Pt S

°C	0	10	20	30	40	50	60	70	80	90
0	0	0.055	0.113	0.173	1.235	0.299	0.365	0.432	0.502	0.573
100	0.645	0.719	0.795	0.872	0.950	1.029	1.109	1.190	1.273	1.356
200	1.440	1.525	1.611	1.698	1.785	1.873	1.962	2.051	2.141	2.232
300	2.323	2.414	2.506	2.599	2.692	2.786	2.880	2.974	3.069	3.164
400	3.260	3.356	3.452	3.549	3.645	3.743	3.840	3.938	4.036	4.135
500	4.234	4.333	4.432	4.532	4.632	4.732	4.832	4.933	5.034	5.136
600	5.237	5.339	5.442	5.544	5.648	5.751	5.855	5.960	6.064	6.169
700	6.274	6.380	6.486	6.592	6.699	6.805	6.913	7.020	7.128	7.236
800	7.345	7.454	7.563	7.672	7.782	7.892	8.003	8.114	8.225	8.336
900	8.448	8.560	8.673	8.786	8.899	9.012	9.126	9.240	9.355	9.470
1000	9.585	9.700	9.816	9.932	10.048	10.165	10.282	10.400	10.517	10.635
1100	10.754	10.872	10.991	11.110	11.229	11.348	11.467	11.587	11.707	11.827
1200	11.947	12.067	12.188	12.308	12.429	12.550	12.671	12.792	12.913	13.034
1300	13.155	13.276	13.397	13.519	13.640	13.761	13.883	14.004	14.125	14.247
1400	14.368	14.489	14.610	14.731	14.852	14.973	15.094	15.215	15.336	15.456
1500	15.576	15.697	15.817	15.937	16.057	16.176	16.296	16.415	16.534	16.653
1600	16.771	16.890	17.008	17.125	17.243	17.360	17.477	17.594	17.711	17.826

Pt30Rh-Pt6Rh B

°C	0	10	20	30	40	50	60	70	80	90
0	0	-0.002	-0.003	-0.002	-0	0.002	0.006	0.011	0.017	0.025
100	0.033	0.043	0.053	0.065	0.078	0.092	0.107	0.123	0.140	0.159
200	0.178	0.199	0.220	0.243	0.266	0.291	0.317	0.344	0.372	0.401
300	0.431	0.462	0.494	0.527	0.561	0.596	0.632	0.669	0.707	0.746
400	0.786	0.827	0.870	0.913	0.957	1.002	1.048	1.095	1.143	1.192
500	1.241	1.292	1.344	1.397	1.450	1.505	1.560	1.617	1.674	1.732
600	1.791	1.851	1.912	1.974	2.036	2.100	2.164	2.230	2.296	2.363
700	2.430	2.499	2.569	2.639	2.710	2.782	2.855	2.928	3.003	3.078
800	3.154	3.231	3.308	3.387	3.466	3.546	3.626	3.708	3.790	3.873
900	3.957	4.041	4.126	4.212	4.298	4.386	4.474	4.562	4.652	4.742
1000	4.833	4.924	5.016	5.109	5.202	5.297	5.391	5.487	5.583	5.680
1100	5.777	5.875	5.973	6.073	6.172	6.273	6.374	6.475	6.577	6.680
1200	6.783	6.887	6.991	7.096	7.202	7.308	7.414	7.521	7.628	7.736
1300	7.845	7.953	8.063	8.172	8.283	8.393	8.504	8.616	8.727	8.839
1400	8.952	9.065	9.178	9.291	9.405	9.519	9.634	9.748	9.863	9.979
1500	10.094	10.210	10.325	10.441	10.558	10.674	10.790	10.907	11.024	11.141
1600	11.257	11.374	11.491	11.608	11.725	11.842	11.959	12.076	12.193	12.310
1700	12.426	12.543	12.659	12.776	12.892	13.008	13.124	13.239	13.354	13.470

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Voltage table for thermocouples to EN 60 584

im mV for 10°C temperature steps (0°C cold junction)

Cu-Con T

°C	0	-10	-20	-30	-40	-50	-60	-70	-80	-90
-200	-5.603	-	-	-	-	-	-	-	-	-
-100	-3.378	-3.656	-3.923	-4.177	-4.419	-4.648	-4.865	-5.069	-5.261	-5.439
0	0	-0.383	-0.757	-1.121	-1.475	-1.819	-2.152	-2.475	-2.788	-3.089

°C	0	10	20	30	40	50	60	70	80	90
0	0	0.391	0.789	1.196	1.611	2.035	2.467	2.908	3.357	3.813
100	4.277	4.749	5.227	5.712	6.204	6.702	7.207	7.718	8.235	8.757
200	9.286	9.820	10.360	10.905	11.456	12.011	12.572	13.137	13.707	14.281
300	14.860	15.443	16.030	16.621	17.217	17.816	18.420	19.027	19.638	20.252

Fe-Con J

°C	0	-10	-20	-30	-40	-50	-60	-70	-80	-90
-200	-7.890	-	-	-	-	-	-	-	-	-
-100	-4.632	-5.036	-5.426	-5.801	-6.159	-6.499	-6.821	-7.122	-7.402	-7.659
0	0	-0.501	-0.995	-1.481	-1.960	-2.431	-2.892	-3.344	-3.785	-4.215

°C	0	10	20	30	40	50	60	70	80	90
0	0	0.507	1.019	1.536	2.058	2.585	3.115	3.649	4.186	4.725
100	5.268	5.812	6.359	6.907	7.457	8.008	8.560	9.113	9.667	10.222
200	10.777	11.332	11.887	12.442	12.998	13.553	14.108	14.663	15.217	15.771
300	16.325	16.879	17.432	17.984	18.537	19.089	19.640	20.192	20.743	21.295
400	21.846	22.397	22.949	23.501	24.054	24.607	25.161	25.716	26.272	26.829
500	27.388	27.949	28.511	29.075	29.642	30.210	30.782	31.356	31.933	32.513
600	33.096	33.683	34.273	34.867	35.464	36.066	36.671	37.280	37.893	38.510
700	39.130	39.754	40.382	41.013	41.647	42.283	42.922	43.563	44.207	44.852

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NiCr-Ni K

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-200	-5.891	-	-	-	-	-	-	-	-	-
-100	-3.554	-3.852	-4.138	-4.411	-4.669	-4.913	-5.141	-5.354	-5.550	-5.730
0	0	-0.392	-0.778	-1.156	-1.527	-1.889	-2.243	-2.587	-2.920	-3.243

°C	0	10	20	30	40	50	60	70	80	90
0	0	0.397	0.798	1.203	1.612	2.023	2.436	2.851	3.267	3.682
100	4.096	4.509	4.920	5.328	5.735	6.138	6.540	6.941	7.340	7.739
200	8.138	8.539	8.940	9.343	9.747	10.153	10.561	10.971	11.382	11.795
300	12.209	12.624	13.040	13.457	13.874	14.293	14.713	15.133	15.554	15.975
400	16.397	16.820	17.243	17.667	18.091	18.516	18.941	19.366	19.792	20.218
500	20.644	21.071	21.497	21.924	22.350	22.776	23.203	23.629	24.055	24.480
600	24.905	25.330	25.755	26.179	26.602	27.025	27.447	27.869	28.289	28.710
700	29.129	29.548	29.965	30.382	30.798	31.213	31.628	32.041	32.453	32.865
800	33.275	33.685	34.093	34.501	34.908	35.313	35.718	36.121	36.524	36.925
900	37.326	37.725	38.124	38.522	38.918	39.314	39.708	40.101	40.494	40.885
1000	41.276	41.665	42.053	42.440	42.826	43.211	43.595	43.978	44.359	44.740
1100	45.119	45.497	45.873	46.249	46.623	46.995	47.367	47.737	48.105	48.473
1200	48.838	49.202	49.565	49.926	50.286	50.644	51.000	51.355	51.708	52.060
1300	52.410	52.759	53.106	53.451	53.795	54.138	54.479	54.819	-	-

NiCr-Con E

°C	0	-10	-20	-30	-40	-50	-60	-70	-80	-90
-200	-8.824	-9.063	-9.274	-9.455	-9.604	-9.719	-9.797	-9.835		
-100	-5.237	-5.680	-6.107	-6.516	-6.907	-7.279	-7.631	-7.963	-8.273	-8.561
0	0	-0.581	-1.151	-1.709	-2.254	-2.787	-3.306	-3.811	-4.301	-4.771

°C	0	10	20	30	40	50	60	70	80	90
0	0	0.591	1.192	1.801	2.419	3.047	3.683	4.329	4.983	5.646
100	6.317	6.996	7.683	8.377	9.078	9.787	10.501	11.222	11.949	12.681
200	13.419	14.161	14.909	15.661	16.417	17.178	17.942	18.710	19.481	20.256
300	21.033	21.814	22.597	23.383	24.171	24.961	25.754	26.549	27.345	28.143
400	28.943	29.744	30.546	31.350	32.155	32.960	33.767	34.574	35.382	36.190
500	36.999	37.808	38.617	39.426	40.236	41.045	41.853	42.662	43.470	44.278
600	45.085	45.891	46.697	47.502	48.306	49.109	49.911	50.713	51.513	52.312
700	53.110	53.907	54.703	55.498	56.291	57.083	57.873	58.663	59.451	60.237
800	61.022	61.806	62.588	63.368	64.147	64.924	65.700	66.473	67.245	68.015
900	68.783	69.549	70.313	71.075	71.835	72.593	73.350	74.104	74.857	75.608

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Tolerance classes

for thermocouples (0°C cold junction) to EN 60 584

Thermocouple		**Class 1**
	Operating range	Tolerance (±)[1]
copper/constantan T	-40 to + 350°C	0.5°C or 0.004 x |t|
iron/constantan J	-40 to + 750°C	1.5°C or 0.004 x |t|
nickel-chrome/constantan E	-40 to + 800°C	0.5°C or 0.004 x |t|
nickel-chrome/nickel K	-40 to +1000°C	1.5°C or 0.004 x |t|
platinum-13% rhodium/platinum R	0 to +1600°C	1 °C or [1+(t-1100) x 0.003]°C
platinum-10% rhodium/platinum S	0 to +1600°C	1 °C or [1+(t-1100) x 0.003]°C
platinum-30% rhodium/platinum-6% rhodium B	-	-

Thermocouple		**Class 2**
	Operating range	Tolerance (±)[1]
copper/constantan T	-40 to + 350°C	1 °C or 0.0075 x |t|
iron/constantan J	-40 to + 750°C	2.5°C or 0.0075 x |t|
nickel-chrome/constantan E	-40 to + 900°C	1 °C or 0.0075 x |t|
nickel-chrome/nickel K	-40 to +1200°C	2.5°C or 0.0075 x |t|
platinum-13% rhodium/platinum R	0 to +1600°C	1.5°C or 0.0025 x t
platinum-10% rhodium/platinum S	0 to +1600°C	1.5°C or 0.0025 x t
platinum-30% rhodium/platinum-6% rhodium B	+600 to +1700°C	1.5°C or 0.0025 x t

Thermocouple		**Class 3**[2]
	Operating range	Tolerance (±)[1]
copper/constantan T	-200 to +40°C	1 °C or 0.015 x |t|
iron/constantan J	-200 to +40°C	2.5°C or 0.015 x |t|
nickel-chrome/constantan E	-200 to +40°C	1 °C or 0.015 x |t|
nickel-chrome/nickel K	-200 to +40°C	2.5°C or 0.015 x |t|
platinum-13% rhodium/platinum R	-	-
platinum-10% rhodium/platinum S	-	-
platinum-30% rhodium/platinum-6% rhodium B	+600 to +1700°C	4 °C or 0.005 x t

The standard tolerance for thermocouples corresponds to DIN 43 760 or EN 60 584, Class 2.
Restricted tolerance to Class 1 is possible on mineral-insulated thermocouples.

1. The tolerance is the specified value in °C or the percentage based on the actual temperature in °C, whichever is larger.
2. Thermocouples and thermocouple wires are usually supplied conforming to the tolerances according to the table above for the temperature range above -40°C.
   At temperatures below -40°C, the deviations for thermocouples of the same material may exceed the tolerances for Class 3.
   Where thermocouples according to tolerance classes 1, 2 and/or 3 are required, this has to be specified by the user; specially selected material is then used.

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Voltage table to DIN 43 710

im mV for 10°C temperature steps (0°C cold junction)

Cu-Con U

°C	0	-10	-20	-30	-40	-50	-60	-70	-80	-90
-200	-5.70	-	-	-	-	-	-	-	-	-
-100	-3.40	-3.68	-3.95	-4.21	-4.46	-4.69	-4.91	-5.12	-5.32	-5.51
0	0	-0.39	-0.77	-1.14	-1.50	-1.85	-2.18	-2.50	-2.81	-3.11

°C	0	10	20	30	40	50	60	70	80	90
0	0	0.40	0.80	1.21	1.63	2.05	2.48	2.91	3.35	3.80
100	4.25	4.71	5.18	5.65	6.13	6.62	7.12	7.63	8.15	8.67
200	9.20	9.74	10.29	10.85	11.41	11.98	12.55	13.13	13.71	14.30
300	14.90	15.50	16.10	16.70	17.31	17.92	18.53	19.14	19.76	20.38
400	21.00	21.62	22.25	22.88	23.51	24.15	24.79	25.44	26.09	26.75
500	27.41	28.08	28.75	29.43	30.11	30.80	31.49	32.19	32.89	33.60

Fe-Con L

°C	0	-10	-20	-30	-40	-50	-60	-70	-80	-90
-200	-8.15	-	-	-	-	-	-	-	-	-
-100	-4.75	-5.15	-5.53	-5.90	-6.26	-6.60	-6.93	-7.25	-7.56	-7.86
0	0	-0.51	-1.02	-1.53	-2.03	-2.51	-2.98	-3.44	-3.89	-4.33

°C	0	10	20	30	40	50	60	70	80	90
0	0	0.52	1.05	1.58	2.11	2.65	3.19	3.73	4.27	4.82
100	5.37	5.92	6.47	7.03	7.59	8.15	8.71	9.27	9.83	10.39
200	10.95	11.51	12.07	12.63	13.19	13.75	14.31	14.88	15.44	16.00
300	16.56	17.12	17.68	18.24	18.80	19.36	19.92	20.48	21.04	21.60
400	22.16	22.72	23.29	23.86	24.43	25.00	25.57	26.14	26.71	27.28
500	27.85	28.43	29.01	29.59	30.17	30.75	31.33	31.91	32.49	33.08
600	33.67	34.26	34.85	35.44	36.04	36.64	37.25	37.85	38.47	39.09
700	39.72	40.35	40.98	41.62	42.27	42.92	43.57	44.23	44.89	45.55
800	46.22	46.89	47.57	48.25	48.94	49.63	50.32	51.02	51.72	52. 43

Electrical Temperature Measurement

with thermocouples and resistance thermometers

Matthias Nau

Electrical temperature sensors have become indispensable in automation and domestic engineering, as well as in production technology. As a result of the rapid expansion of automation in recent years, they have become firmly established in industrial engineering.

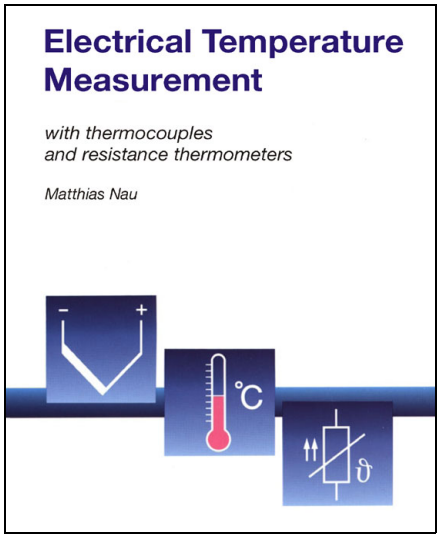

Fig. 13: Publication
Electrical temperature measurement with thermocouples and resistance thermometers

It is therefore particularly important that the user can select the product that best fits his application from the large variety of for available products for electrical temperature measuremen.

On 160 pages this publication covers the theoretical fundamentals of electrical temperature measurement, the practical construction of temperature sensors, their standardization, tolerances and styles.

In addition, it describes in detail the different fittings for electrical thermometers, their classification to DIN and the great variety of applications. The book includes an extensive section with tables for voltage and resistance series to DIN and EN, thus making it a valuable guide both for the experienced practical engineer and the newcomer to the field of electrical temperature measurement.
You can order a copy under Sales No. 90/00085081,
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Because of the high handling costs, schools, institutes and universities are asked to place a bulk order.

Error Analysis of a Temperature Measurement System

with worked examples

Gerd Scheller

This 44-page publication helps in the evaluation of measurement uncertainty, particularly through the worked examples in Chapter 3. Where problems arise, we are glad to discuss specific problems with our customers, and to provide practical advice.

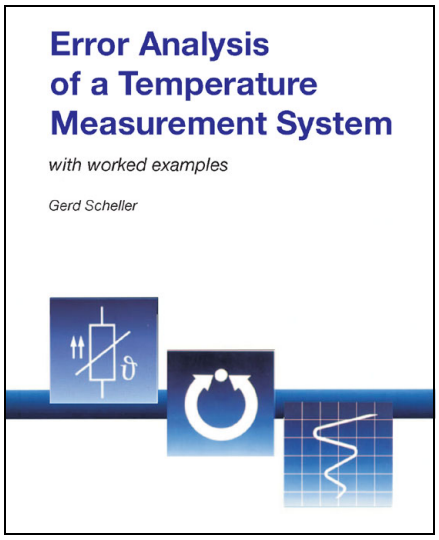

Fig. 14: Publication
Error analysis of a temperature measurement system, with worked examples

In order to be able to make comparable measurements, their quality must be established through details of the measurement uncertainty. The ISO/BIPM “Guide to the Expression of Uncertainty in Measurement”, published in 1993 and usually referred to as GUM, introduced a standardized method for the determination and definition of measurement uncertainty. This method was adopted by calibration laboratories around the world. However, the application requires a certain level of mathematical understanding.

Further chapters present the topic of measurement uncertainty in a simplified and easily understandable fashion for all users of temperature measurement systems.
Errors in the installation of the temperature sensors and the connections to the evaluation electronics lead to increased errors in measurement. To these must be added the measurement uncertainty components of the sensor and of the evaluation electronics itself. The explanation of the various components of measurement uncertainty is followed by some worked examples.
Knowledge of the various measurement uncertainty components and their magnitudes enable the user to reduce individual components through the selection of equipment or altered installation conditions. The decisive factor is always, which level of measurement uncertainty is acceptable for a specific measurement task. For instance, if a standard specifies tolerance limits for the deviation of a temperature from a nominal value, then the measurement uncertainty of the method used for temperature measurement should not be larger than 1/3 of the tolerance.

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German Calibration Service (DKD) at JUCHHEIM

Certification laboratory for temperature

Raised quality expectations, improved measurement technology and, of course, quality assurance systems, such as ISO 9000, make increasing demands on the documentation of processes and the monitoring of measuring devices.
In addition, there are increasing calls from customers for high product quality standards. Particularly stringent demands arise from ISO 9000 and EN 45 000, whereby measurements must be traceable to national or international standards. This provides the legal basis for obliging suppliers and manufacturers (of products that are subject to processes where temperature is relevant) to check all testing devices, which can affect the product quality, before use or at certain intervals. Generally, this is done by calibrating or adjusting using certified devices. Because of the high demand for calibrated instruments and the large number of instruments to be calibrated, the state laboratories have insufficient capacity. The industry has therefore established and also supports special calibration laboratories which are linked to the German Calibration Service (DKD) and are subordinate to the PTB (Physikalisch-Technische-Bundesanstalt) for all aspects of instrumentation.

The certification laboratory of the German Calibration Service at JUMO has carried out calibration certification for temperature since 1992. This service provides fast and economical certification for everyone.
DKD calibration certificates can be issued for resistance thermometers, thermocouples, measurement sets, data loggers and temperature block calibrators within the range -80 to +1100°C. The traceability of the reference standard is the central issue here. All DKD calibration certificates are recognized as documents of traceability, without any further specifications. The DKD calibration laboratory at JUMO has the identification DKD-K-09501-04 and is accredited to DIN EN ISO/IEC 17 025.

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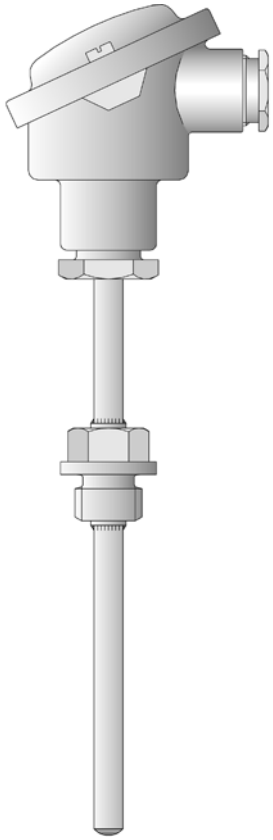
Screw-in thermocouples with terminal head Form B



- **for temperatures from -200 to +800°C**
- **available with different thermocouples**
- **as single or twin thermocouple**
- **terminal head Form B, BUZ, BUZH, BBK**
- **available with transmitter**

Screw-in thermocouples are preferred for measuring temperatures in liquids and gases. An important selection criterion is their reliable sealing against both negative and positive pressures. Applications include heating installations, ovens, furnaces and plant engineering, as well as process technology.

The terminal head is suitable for ambient temperatures up to +100°C. Terminal heads BUZ, BUZH and BBK are available in addition to the standard Form B.

Stainless steel protection tubes protect the measuring insert from chemical effects and mechanical damage.

The measuring insert is fitted with thermocouples to EN 60 584, Class 2 and DIN 43 710. Versions with two thermocouples are also available.

Technical data

Terminal head	Form B DIN 43 729, aluminium die-casting M 20x1.5; IP54, ambient temperature -40 to +100°C Form BUZ, aluminium die-casting M 20x1.5; IP65, ambient temperature -40 to +100°C Form BUZH, aluminium die-casting M 20x1.5; IP65, ambient temperature -40 to +100°C Form BBK, plastic, M 20x1.5; IP54, ambient temperature -30 to +130°C Caution: reduced ambient temperature when using transmitters, Data Sheet 70.7010 (95.6550)
Extension tube	stainless steel 1.4571, length 130mm
Process connection	thread, stainless steel 1.4571
Protection tube	stainless steel 1.4571, 9mm dia.
Measuring insert	replaceable, insulated assembly 1 x Fe-Con J, EN 60 584, Cl. 2, operating temperature -200 to +600°C 1 x Fe-Con L, DIN 43 710, Cl. 2, operating temperature -200 to +600°C 1 x NiCr-Ni K, EN 60 584, Cl. 2, operating temperature -200 to +800°C 2 x Fe-Con J, EN 60 584, Cl. 2, operating temperature -200 to +600°C 2 x Fe-Con L, DIN 43 710, Cl. 2, operating temperature -200 to +600°C 2 x NiCr-Ni K, EN 60 584, Cl. 2, operating temperature -200 to +800°C
Transmitter	programmable transmitter, output 4 - 20mA/20 - 4mA, Data Sheet 70.7010 (95.6550)
Accessories	pockets, Data Sheet 90.9721

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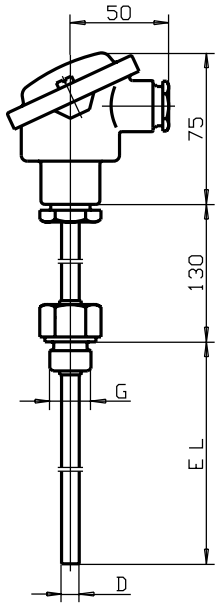
Dimensions



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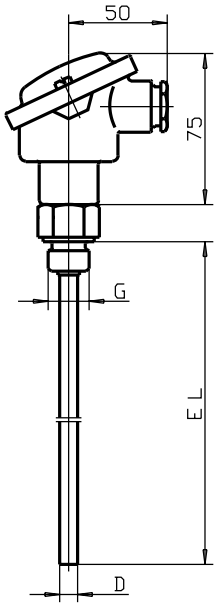

Type 901002/20

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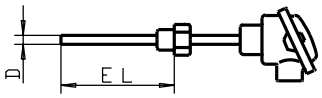
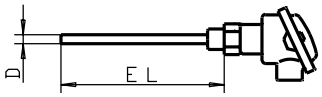
Order details: Screw-in thermocouples with terminal head Form B

(1) Basic version

901002/10 Screw-in thermocouple with extension tube and continuous protection tube



901002/20 Screw-in thermocouple without extension tube and continuous protection tube



			(2) Operating temperature in °C
x	x	150	-200 to +600°C
x	x	165	-200 to +800°C
			(3) Measuring insert
x	x	1040	1 x Fe-Con J
x	x	1042	1 x Fe-Con L
x	x	1043	1 x NiCr-Ni K
x	x	2040	2 x Fe-Con J
x	x	2042	2 x Fe-Con L
x	x	2043	2 x NiCr-Ni K
			(4) Protection tube diameter D in mm
x	x	9	9mm
			(5) Fitting length EL in mm (100≤ EL ≤1000)
x	x	160	160mm
x	x	200	200mm
x	x	250	250mm
x	x	300	300mm
x	x	400	400mm
x	x	600	600mm
x	x	...	please specify in plain text (50mm steps)
			(6) Process connection
x	x	104	thread 1/2"pipe
x	x	105	thread 3/4"pipe
x	x	106	thread 1"pipe
x	x	126	thread M 18 x 1.5
			(7) Extra codes
x	x	000	no extra code
x		306	extension tube 70mm
x	x	320	terminal head Form BUZ
x	x	321	terminal head Form BUZH
x	x	322	terminal head Form BBK
x	x	331	1 x programmable transmitter, output 4 - 20mA/20 - 4mA[3], Data Sheet 70.7010 (95.6550)
x	x	335	2 x programmable transmitter, output 4 - 20mA/20 - 4mA[3], Data Sheet 70.7010 (95.6550)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Order code	☐	- ☐	- ☐	- ☐	- ☐	- ☐	/ ☐ ,...
Order example	901002/10	- 150	- 1042	- 9	- 250	- 104	/ 000[1]

1. List extra codes in sequence, separated by commas.
3. Please specify range and output signal in plain text.

Note: Pockets, Data Sheet 90.9721

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JUMO PROCESS CONTROL INC.

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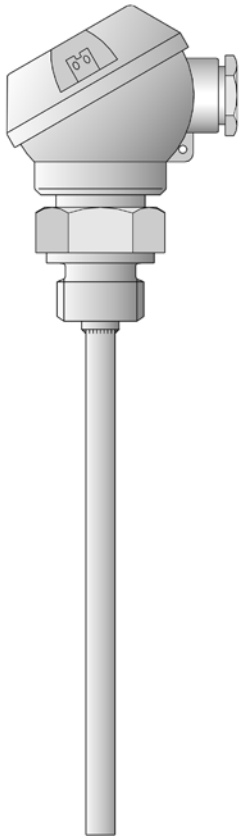
Screw-in thermocouples with terminal head Form J



- **for temperatures from -200 to +600°C**
- **as single or twin thermocouple**
- **insulated or joined to protection tube**

Screw-in thermocouples are the preferred choice for measuring temperatures in liquids and gases. An important selection criterion is their reliable sealing against both negative and positive pressures. Applications include heating installations, ovens, furnaces and plant engineering.

The measuring insert is normally fitted with thermocouples to EN 60 584 or DIN 43 710. Versions with two thermocouples are also available.

Technical data

Terminal head	Form J, aluminium die-casting, M 16x1.5; IP54, ambient temperature -40 to +100°C
Process connection	thread, stainless steel 1.4571
Protection tube	stainless steel 1.4571, 6mm and 7mm dia.
Measuring insert	insulated assembly: 1 x Fe-Con J, EN 60 584, Cl. 2, operating temperature -200 to +600°C 1 x Fe-Con L, DIN 43 710, Cl. 2, operating temperature -200 to +600°C 1 x NiCr-Ni K, EN 60 584, Cl. 2, operating temperature -200 to +800°C 2 x Fe-Con J, EN 60 584, Cl. 2, operating temperature -200 to +600°C 2 x Fe-Con L, 43 710, Cl. 2, operating temperature -200 to +600°C 2 x NiCr-Ni K, EN 60 584, Cl. 2, operating temperature -200 to +800°C
Accessories	pockets, Data Sheet 90.9721

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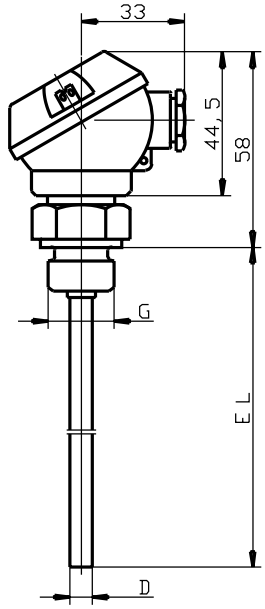
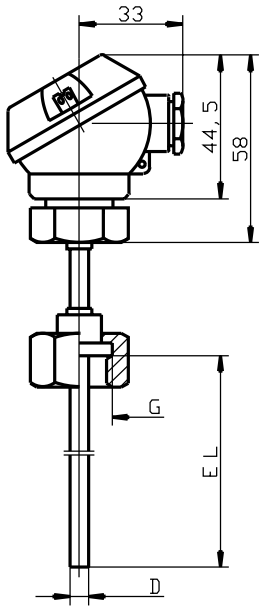
Dimensions



Type 901003/10



Type 901003/20

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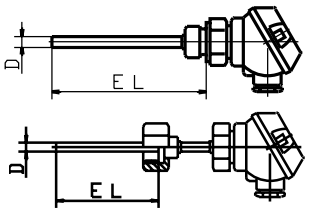
Order details: Screw-in thermocouples with terminal head Form J

(1) Basic version

		901003/10	Screw-in thermocouple with continuous protection tube
		901003/20	Screw-in thermocouple with continuous protection tube and union nut



			(2) Operating temperature in °C
x	x	130	-200 to +400°C
x	x	150	-200 to +600°C
			(3) Measuring insert
x	x	1040	1 x Fe-Con J
x	x	1042	1 x Fe-Con L
x	x	1043	1 x NiCr-Ni K
x	x	2040	2 x Fe-Con J
x	x	2042	2 x Fe-Con L
x	x	2043	2 x NiCr-Ni K
			(4) Protection tube diameter D in mm
	x	6	6mm
x		7	7mm
			(5) Fitting length EL in mm (50≤ EL ≤600, EL ≥150 for type 901003/20)
x		50	50mm
x		75	75mm
x		100	100mm
x	x	150	150mm
x	x	250	250mm
x	x	...	please specify in plain text (50mm steps)
			(6) Process connection
x		102	thread 1/4"pipe
x		103	thread 3/8"pipe
x		104	thread 1/2"pipe
	x	164	union nut 1/2"pipe
	x	165	union nut 3/4"pipe

	(1)		(2)		(3)		(4)		(5)		(6)
Order code		-		-		-		-		-	
Order example	901003/10	-	130	-	1042	-	7	-	100	-	104

Note: Pockets, Data Sheet 90.9721

Stock versions

(1)		(2)		(3)		(4)		(5)		(6)	Sales No.
901003/10	-	130	-	1042	-	7	-	50	-	104	90/00055436
901003/10	-	150	-	1042	-	7	-	100	-	104	90/00055437
901003/10	-	150	-	1042	-	7	-	150	-	104	90/00055438

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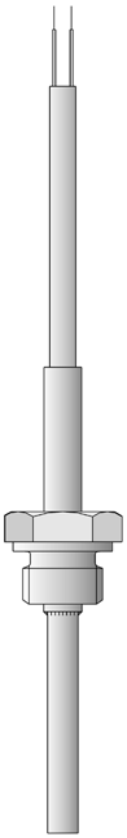
Screw-in thermocouples with compensating cable



- **for temperatures from -200 to +600°C**
- **available with different thermocouples**
- **as single or twin thermocouple**
- **compensating cable in silicone or with metal braiding**

Screw-in thermocouples are preferred for measuring temperatures in liquids and gases. An important selection criterion is their reliable sealing against both negative and positive pressures. Applications include heating installations, ovens, furnaces and plant engineering.

Depending on the version, the compensating cables are suitable for use in dry and humid areas within a temperature range from -20 to +350°C. The connection of the cable to the protection tube incorporates strain relief and can be provided with a cable protector (option).

Protection tubes in stainles steel protect the measuring insert from chemical influences and mechanical damage.

The measuring insert is fitted with thermocouples to EN 60 584 and DIN 43 710. Versions with two thermocouples are also available.

Technical data

Connection	available with cable ends as: bare wires, ferrules, with receptacles or multipole connector
Compensating cable	silicone, ambient temperature -50 to +180°C metal braiding, ambient temperature -20 to +350°C
Process connection	thread, stainless steel 1.4571
Protection tube	stainless steel 1.4571, 6mm and 8mm dia.
Measuring insert	insulated assembly: 1 x Fe-Con L, DIN 43 710, Cl. 2, operating temperature -200 to +600°C 1 x NiCr-Ni K, EN 60 584, Cl. 2, operating temperature -200 to +600°C 2 x Fe-Con L, DIN 43 710, Cl. 2, operating temperature -200 to +600°C 2 x NiCr-Ni K, EN 60 584, Cl. 2, operating temperature -200 to +600°C
Accessories	pockets, Data Sheet 90.9721

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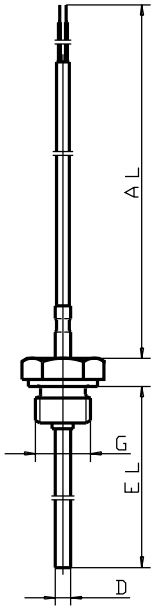
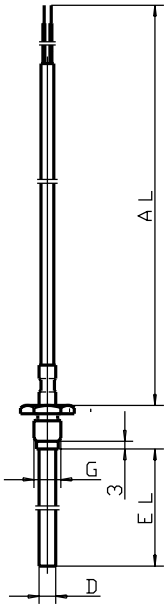
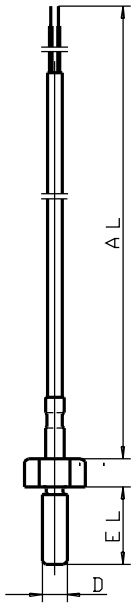
Dimensions



Type 901005/10



Type 901005/20



Type 901005/30

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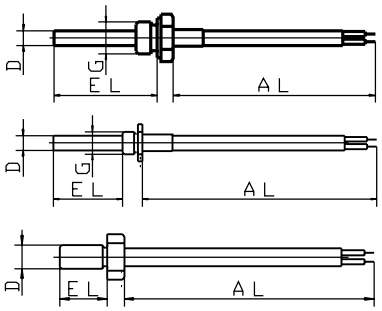
Order details: Screw-in thermocouples with compensating cable

(1) Basic version

			901005/10	Screw-in thermocouple with fixed screw fitting
			901005/20	Screw-in thermocouple with loose screw fitting
			901005/30	Screw-in thermocouple with screw-in protection tube



				(2) Operating temperature in °C / compensating cable
x	x		150	-200 to +600°C / metal braiding
x	x	x	380	-50 to +200°C / silicone
x	x	x	390	-50 to +300°C / metal braiding
x	x		402	-50 to +400°C / metal braiding
				(3) Measuring insert
x	x	x	1042	1 x Fe-Con L
x	x	x	1043	1 x NiCr-Ni K
x	x		2042	2 x Fe-Con L
x	x		2043	2 x NiCr-Ni K
				(4) Protection tube diameter D in mm
x	x		6	6mm
		x	8	8mm (M 8)
				(5) Fitting length EL in mm (50≤ EL ≤500 for Type 901005/10, 901005/20)
	x		17	17mm
		x	25	25mm
	x		37	37mm
x			100	100mm
	x		137	137mm
x	x		...	please specify in plain text (50mm steps)
				(6) Process connection
x			104	thread 1/2"pipe
x			105	thread 3/4"pipe
x			106	thread 1"pipe
		x	111	thread M 8
	x		114	thread M 10 x 1
				(7) Compensating cable end
x	x	x	03	bare cable ends
x	x	x	11	ferrules to DIN 46 228 Part 4 (standard)
x	x	x	13	receptacle 6.3 to DIN 46 247
x	x	x	80	multipole connector (please specify type in plain text)
				(8) Compensating cable length AL in mm (500≤ AL ≤500000)
x	x	x	2500	2500mm
x	x	x	...	please specify in plain text (500mm steps)
				(9) Extra codes
x	x	x	000	no extra code
x	x	x	309	uninsulated assembly (thermocouple welded to tip)
x	x	x	315	cable protector: coil
x	x	x	316	cable protector: tube

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
Order code		-		-		-		-		-		-		-		/		,...
Order example	901005/10	-	150	-	1042	-	6	-	100	-	104	-	11	-	2500	/	000[1]	

1. List extra codes in sequence, separated by commas.

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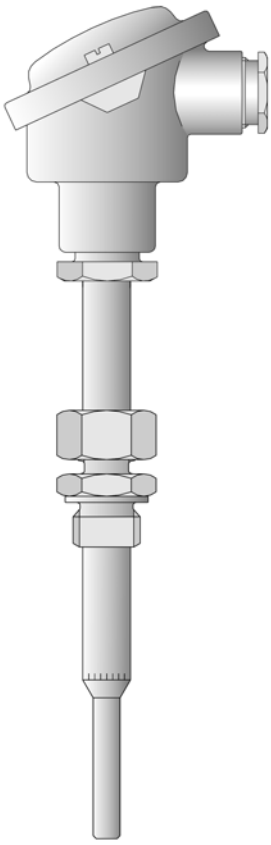
Thermocouples for equipment and systems tested to DIN 34 40



- **for indirect heating systems to DIN 47 54**
- **for temperatures up to 1500°C**
- **as single or twin thermocouple**
- **for operation in water, oil or air**
- **for tested control and limiter instruments**

The thermocouples listed in this data sheet may be used in indirect heating systems to DIN 47 54, in conjunction with temperature control and limitation equipment tested to DIN 34 40 (see table on page 4/4).

Thermocouples are preferably used for measuring temperatures in liquids and gases. Applications include heating installations, ovens, furnaces and equipment engineering.

The terminal head Form B is suitable for ambient temperatures up to 100°C.

Protection tubes in different materials protect the measuring insert from chemical influences and mechanical damage. The choice of the appropriate protection tube material depends on the conditions prevailing on site.

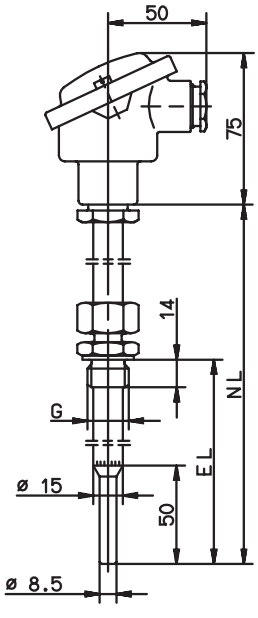
The measuring insert is fitted with thermocouples to EN 60 584, Class 2 and DIN 43 710.

Modifications to the versions described below require a fresh type approval.

Note: when ordering please specify the Sales No. as shown in Price Sheet 90.1006

Screw-in thermocouples with screwed pipe joint and terminal head to DIN 43 729, Form B M 24 x 1.5

Fitting length EL in mm	Nom. length NL in mm	Thread G in inch	Temperature in °C	Type 1 thermocpl.	Type 2 thermocouples
Protection tube stainless steel X 6 CrNiMoTi 17 12 2, Material Ref. 1.4571					
Thermocouple NiCr-Ni K					
65 – 670	710	1/2"	550	90.020-F03	-
65 – 670	710	1/2"	550	-	90.020-F02
Thermocouple Fe-Con L					
65 – 670	710	1/2"	550	90.020-F13	-
65 – 670	710	1/2"	550	-	90.020-F12



Item 1

Operating medium: water, oil
Operating pressure: 27 bar max. up to 100°C, 20 bar up to 400°C, no pressure above 400°C.

● available from stock

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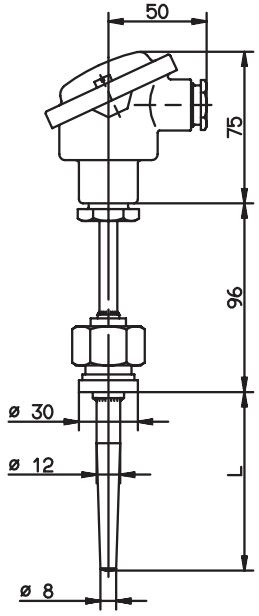
Screw-in thermocouples with weld-in pocket and terminal head to DIN 43 729, Form B M 24 x 1.5

Fitting length[1] EL in mm	Length L in mm	Temperature in °C	Type 1 thermocpl.	Type 2 thermocouples
Welding shoulder steel 15 Mo 3, Material Ref. 1.5415 Protection tube steel St 35.8, Material Ref. 1.0305				
Thermocouple Fe-Con L				
220	200	480	90.111-F01 ●	90.111-F02



Item 2

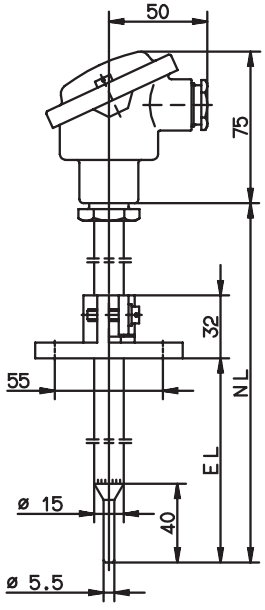
Operating medium: water, oil
Operating pressure: 103 bar max. up to 100 °C, 30 bar up to 480 °C.

● available from stock.

1. Fitting length of thermocouple

Push-in thermocouples with sliding stop flange and terminal head to DIN 43 729, Form B M 24 x 1.5

Fitting length EL in mm	Nom. length NL in mm	Temperature in °C	Type 2 thermocouples
Protection tube stainless steel X 6 CrNiMoTi 17 12 2, Material Ref. 1.4571			
Thermocouple NiCr-Ni K			
50 – 460	500	800	90.019-F01 ●
50 – 670	710	800	90.020-F01
50 – 960	1000	800	90.021-F01
Thermocouple Fe-Con L			
50 – 460	500	700	90.019-F11
50 – 670	710	700	90.020-F11
50 – 960	1000	700	90.021-F11



Item 3

Operating medium: air

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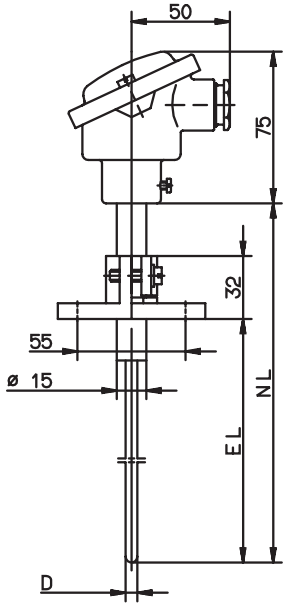
Push-in thermocouples with sliding stop flange and terminal head to DIN 43 729, Form B 15

Fitting length EL in mm	Nom. length NL in mm	Diameter D in mm	Temperature in °C	Type 2 thermocouples
Protection tube ceramic KER 710				
Thermocouple NiCr-Ni K				
420 – 475	500	6	1000	90.023-F01 ●



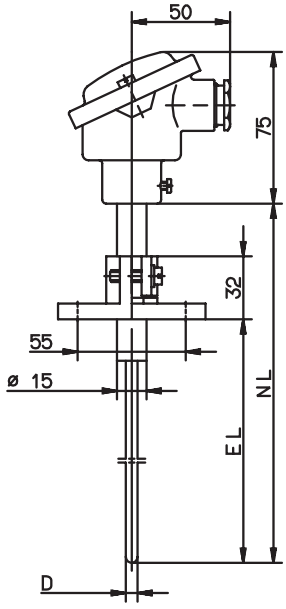
Item 4

Operating medium: air

● available from stock

Push-in thermocouples with sliding stop flange and terminal head to DIN 43 729, Form B 15

Fitting length EL in mm	Nom. length NL in mm	Diameter D in mm	Temperature in °C	Type 1 thermocpl.	Type 2 thermocouples
Protection tube ceramic KER 710					
Thermocouple Pt10Rh-Pt S					
420 – 215	250	6	1300	90.021	90 D 021
275 – 320	355	6	1300	90.022	90 D 022
420 – 465	500	6	1300	90.023	90 D 023
Thermocouple Pt30Rh-Pt6Rh B					
170 – 215	250	6	1500	90.027	90 D 027
275 – 320	355	6	1500	90.028	90 D 028
420 – 465	500	6	1500	90.029	90 D 029



Item 5

Operating medium: air

● available from stock

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e-mail: info@JumoUSA.com
Internet: www.JumoUSA.com

Universal process controller (TR), temperature limiter (TB), temperature monitor (TW), safety temperature limiter (STB) and safety temperature monitor (STW) with approved temperature probes, tested to DIN 34 40

Thermo-couple	Transducer	Max. temp. °C	Weld-in pocket	Water/ oil	Air/ gas	TB/TW/ STB/STW t70.1130[1]	TB/TW t70.1140[1]	TR t70.3570[1]	TR t70.3580[1]
90.020-F02	2x NiCr-Ni K	550	-	X	-	X	X	X	X
90.020-F03	1x NiCr-Ni K	550	-	X	-	X	X	X	X
90.020-F12	2x Fe-Con L	550	-	X	-	X	X	X	X
90.020-F13	1x Fe-Con L	550	-	X	-	X	X	X	X
90.111-F01	1x Fe-Con L	480	X	X	-	X	X	X	X
90.111-F02	2x Fe-Con L	480	X	X	-	X	X	X	X
90.019-F01	2x NiCr-Ni K	800	-	-	X	X	X	X	X
90.020-F01	2x NiCr-Ni K	800	-	-	X	X	X	X	X
90.021-F01	2x NiCr-Ni K	800	-	-	X	X	X	X	X
90.019-F11	2x Fe-Con L	700	-	-	X	X	X	X	X
90.020-F11	2x Fe-Con L	700	-	-	X	X	X	X	X
90.021-F11	2x Fe-Con L	700	-	-	X	X	X	X	X
90.023-F01	2x NiCr-Ni K	1000	-	-	X	X	X	X	X
90.021	1x Pt10Rh-Pt S	1300	-	-	X	-	X	X	X
90.022	1x Pt10Rh-Pt S	1300	-	-	X	-	X	X	X
90.023	1x Pt10Rh-Pt S	1300	-	-	X	X	X	X	X
90 D 021	2x Pt10Rh-Pt S	1300	-	-	X	-	X	X	X
90 D 022	2x Pt10Rh-Pt S	1300	-	-	X	-	X	X	X
90 D 023	2x Pt10Rh-Pt S	1300	-	-	X	X	X	X	X
90.027	1x Pt30Rh-Pt6Rh B	1500	-	-	X	-	X	X	X
90.028	1x Pt30Rh-Pt6Rh B	1500	-	-	X	-	X	X	X
90.029	1x Pt30Rh-Pt6Rh B	1500	-	-	X	X	X	X	X
90 D 027	2x Pt30Rh-Pt6Rh B	1500	-	-	X	-	X	X	X
90 D 028	2x Pt30Rh-Pt6Rh B	1500	-	-	X	-	X	X	X
90 D 029	2x Pt30Rh-Pt6Rh B	1500	-	-	X	X	X	X	X

X = approved - = not approved 1. t70. ... = data sheet 70. ... see Sectional catalog “Controllers, power units and system technology”

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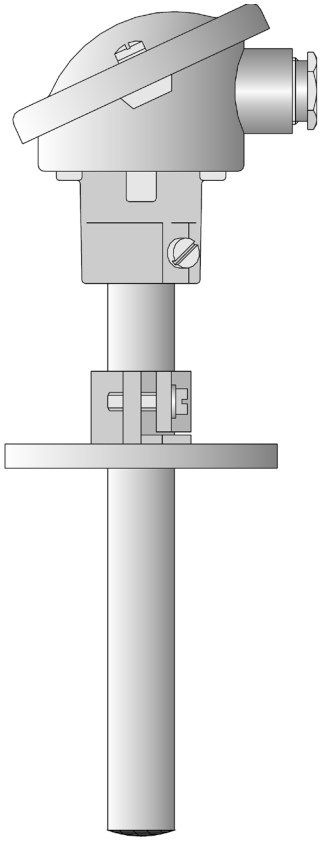
Push-in thermocouples with terminal head Form A



- **for temperatures from -200 to +1600°C**
- **with protection tubes in different materials**
- **as single or twin thermocouple**
- **available with transmitter**

Push-in thermocouples are the preferred choice for measuring temperatures in liquids and gases. Applications include heating installations, ovens, furnaces and plant engineering.

Terminal head Form A is suitable for ambient temperatures up to +100°C. The support tube is made from steel. When using a backing flange (see Data Sheet 90.9725), the mounting location can be sealed against 1bar max.

Protection tubes in different ceramic materials, and in heat-resistant steel, protect the measuring insert from chemical effects and mechanical damage. The choice of the appropriate protection tube material depends on the site conditions.

The measuring insert is fitted with thermocouples according to Class 2 of EN 60 584 and DIN 43 710 respectively. Versions with two thermocouples can also be supplied.

Technical data

Terminal head	Form A DIN 43 729, aluminium die-casting, M 20x1.5; IP54, ambient temperature -40 to +100°C Caution: reduced ambient temperature when using head-mounted transmitters, Data Sheet 70.7010
Process connection	screwed pipe joint 1" stop flange 22mm dia. to DIN 43 734 stop flange 32mm dia. to DIN 43 734
Protection tube	steel 1.4749, 22mm dia., operating temperature up to +1150°C (seamless drawn) steel 1.4841, 22mm dia., operating temperature up to +1150°C (seamless drawn) ceramic KER 610, 15mm and 24mm dia., operating temperature up to +1300°C ceramic KER 710, 15mm and 24mm dia., operating temperature up to +1600°C
Measuring insert	insulated assembly: 1 x Fe-Con J, EN 60 584, Cl. 2, operating temperature -200 to +600°C 1 x Fe-Con L, DIN 43 710, Cl. 2, operating temperature -200 to +600°C 1 x NiCr-Ni K, EN 60 584, Cl. 2, operating temperature -200 to +1200°C 1 x Pt10Rh-Pt S, EN 60 584, Cl. 2, operating temperature 0 to 1300°C 1 x Pt30Rh-Pt6Rh B, EN 60 584, Cl. 2, operating temperature 600 to 1600°C 2 x Fe-Con J, EN 60 584, Cl. 2, operating temperature -200 to +600°C 2 x Fe-Con L, DIN 43 710, Cl. 2, operating temperature -200 to +600°C 2 x NiCr-Ni K, EN 60 584, Cl. 2, operating temperature -200 to +1200°C 2 x Pt10Rh-Pt S, EN 60 584, Cl. 2, operating temperature 0 to 1300°C 2 x Pt30Rh-Pt6Rh B, EN 60 584, Cl. 2, operating temperature 600 to 1600°C
Transmitter	programmable transmitter, output 4 - 20mA/20 - 4mA, Data Sheet 70.7010

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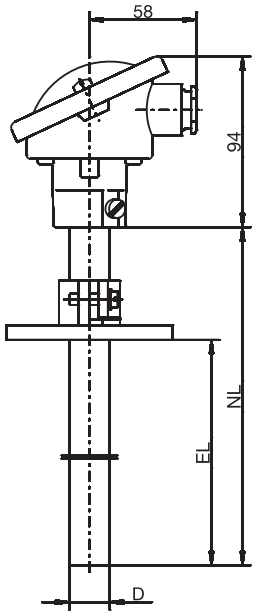
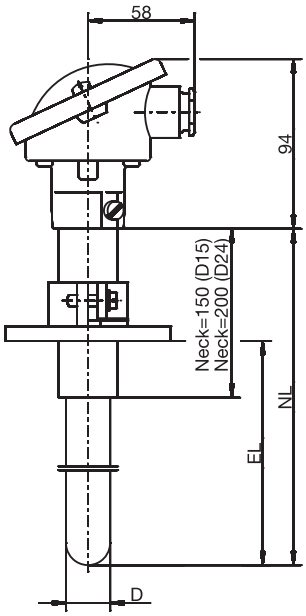
Internet: www.jumo.us

Dimensions



Type 901101/10



Type 901101/20

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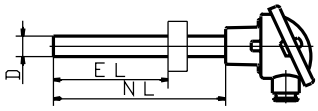
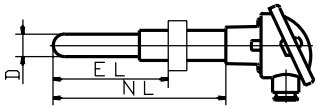
Order details: Push-in thermocouples with terminal head Form A

(1) Basic version

901101/10 Push-in thermocouple with continuous protection tube in heat-resistant steel



901101/20 Push-in thermocouple with stepped ceramic protection tube



(2) Measuring insert / operating temperature in °C

x		1040	1 x Fe-Con J, operating temperature -200 to +600°C
x		1042	1 x Fe-Con L, operating temperature -200 to +600°C
x	x	1043	1 x NiCr-Ni K, operating temperature -200 to +1200°C
	x	1044	1 x Pt 10 Rh-Pt S, operating temperature 0 to 1300°C
	x	1046	1 x Pt 30 Rh-Pt 6 Rh B, operating temperature 600 to 1600°C
x		2040	2 x Fe-Con J, operating temperature -200 to +600°C
x		2042	2 x Fe-Con L, operating temperature -200 to +600°C
x	x	2043	2 x NiCr-Ni K, operating temperature -200 to +1200°C
	x	2044	2 x Pt 10 Rh-Pt S, operating temperature 0 to 1300°C
	x	2046	2 x Pt 30 Rh-Pt 6 Rh B, operating temperature 600 to 1600°C

(3) Protection tube diameter D in mm

	x	15	15mm (support tube 22mm dia.)
x		22	22mm
	x	24	24mm (support tube 32mm dia.)

(4) Nominal length NL in mm (180 ≤NL ≤1400)

x	x	500	500mm, fitting length (EL) 100 - 460mm
x	x	710	710mm, fitting length (EL) 100 - 670mm
x	x	1000	1000mm, fitting length (EL) 100 - 960mm
x	x	1400	1400mm, fitting length (EL) 100 - 1360mm
x	x	...	please specify in plain text (100mm steps)

(5) Process connection

x	x	000	no process connection
x		256	screwed pipe joint 1" (only for 22mm dia.), steel
x	x	669	stop flange D 22mm, DIN 43 734
	x	671	stop flange D 32mm, DIN 43 734

(6) Protection tube material

x		27	steel X 18 CrN 28 Mat. Ref. 1.4749 (operating temp. up to +1150°C)
x		28	steel X 15 CrNiSi 25 20 Mat. Ref. 1.4841 (operating temp. up to +1150°C)
	x	93	ceramic KER 610 (operating temperature up to +1300°C)
	x	94	ceramic KER 710 (operating temperature up to +1600°C)

(7) Extra codes

x	x	000	no extra code
x	x	331	1 x programmable transmitter, output 4 - 20mA/20 - 4mA[1], Data Sheet 70.7010

	(1)		(2)		(3)		(4)		(5)		(6)		(7)
Order code		-		-		-		-		-		/	
Order example	901101/10	-	1042	-	22	-	710	-	669	-	27	/	000

1. Please specify range and output signal in plain text.

Stock versions

(1)		(2)		(3)		(4)		(5)		(6)		(7)	Sales No.
901101/10	-	1043	-	22	-	500	-	669	-	27	/	000	90/00054836
901101/10	-	1043	-	22	-	710	-	669	-	27	/	000	90/00054837
901101/10	-	1043	-	22	-	1000	-	669	-	27	/	000	90/00054838
901101/10	-	2043	-	22	-	710	-	669	-	27	/	000	90/00054842
901101/20	-	1043	-	15	-	500	-	669	-	93	/	000	90/00054846

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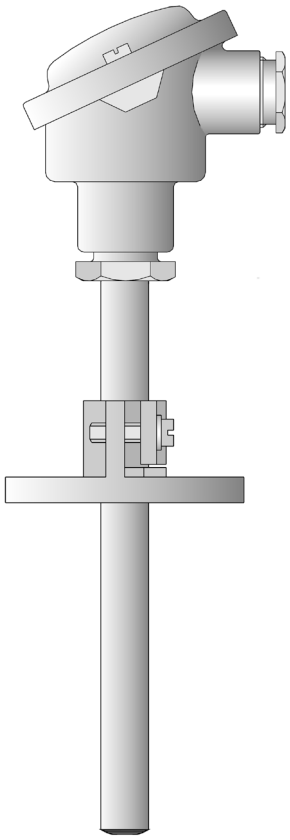
Push-in thermocouples with terminal head Form B



- **for temperatures from -200 to +1600°C**
- **with protection tubes in different materials**
- **as single or twin thermocouple**
- **terminal head Form B, BUZ, BUZH, BBK**
- **available with transmitter**

Push-in thermocouples are preferred for measuring temperatures in liquids and gases. Applications include heating installations, ovens, furnaces and plant engineering.

Terminal head Form B is suitable for ambient temperatures up to +100°C. The support tube is made from steel. When using a backing flange (see Data Sheet 90.9725), the mounting location can be sealed against 1bar max.

Protection tubes in different materials protect the measuring insert from chemical effects and mechanical damage. The choice of the appropriate protection tube material depends on the site conditions.

The measuring insert is fitted with thermocouples according to Class 2 of EN 60 584 and DIN 43 710 respectively. Versions with two thermocouples can also be supplied.

Technical data

Terminal head	Form B DIN 43 729, aluminium die-casting, M 20x1.5; IP54, ambient temp. -40 to +100°C Form BUZ, aluminium die-casting, M 20x1.5; IP65, ambient temperature -40 to +100°C Form BUZH, aluminium die-casting, M 20x1.5; IP65, ambient temperature -40 to +100°C Form BBK, plastic, M 20x1.5; IP54, ambient temperature -30 to +130°C Caution: reduced ambient temperature when using head-mounted transmitters Data Sheet 70.7010
Process connection	screwed pipe joint 1/2" stop flange 15mm dia. to DIN 43 734
Protection tube	steel 1.4749, 15mm dia., operating temperature up to +1150°C (seamless drawn) steel 1.4841, 15mm dia., operating temperature up to +1150°C (seamless drawn) ceramic KER 710, 6mm, 8mm and 10mm dia., operating temperature up to +1600°C
Measuring insert	insulated assembly: 1 x Fe-Con J, EN 60 584, Cl. 2, operating temperature -200 to +600°C 1 x Fe-Con L, DIN 43 710, Cl. 2, operating temperature -200 to +600°C 1 x NiCr-Ni K, EN 60 584, Cl. 2, operating temperature -200 to +1200°C 1 x Pt10Rh-Pt S, EN 60 584, Cl. 2, operating temperature 0 to 1300°C 1 x Pt30Rh-Pt6Rh B, EN 60 584, Cl. 2, operating temperature 600 to 1600°C 2 x Fe-Con J, EN 60 584, Cl. 2, operating temperature -200 to +600°C 2 x Fe-Con L, DIN 43 710, Cl. 2, operating temperature -200 to +600°C 2 x NiCr-Ni K, EN 60 584, Cl. 2, operating temperature -200 to +1200°C 2 x Pt10Rh-Pt S, EN 60 584, Cl. 2, operating temperature 0 to 1300°C 2 x Pt30Rh-Pt6Rh B, EN 60 584, Cl. 2, operating temperature 600 to 1600°C
Transmitter	programmable transmitter, output 4 - 20mA/20 - 4mA, Data Sheet 70.7010

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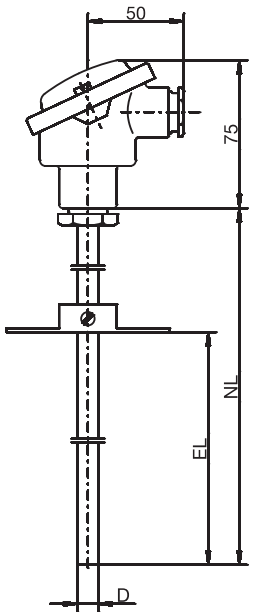
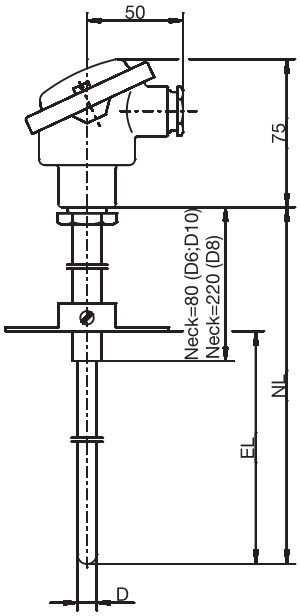
Dimensions



Type 901102/10



Type 901102/20

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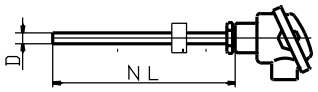
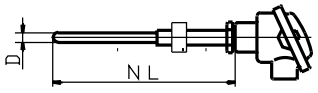
Order details: Push-in thermocouples with terminal head Form B

(1) Basic version

901102/10 Push-in thermocouple with continuous protection tube in heat-resistant steel



901102/20 Push-in thermocouple with stepped ceramic protection tube



			(2) Measuring insert / operating temperature in °C
x		1040	1 x Fe-Con J, operating temperature -200 to +600°C
x		1042	1 x Fe-Con L, operating temperature -200 to +600°C
x		1043	1 x NiCr-Ni K, operating temperature -200 to +1200°C
	x	1044	1 x Pt 10 Rh-Pt S, operating temperature 0 to 1300°C
	x	1046	1 x Pt 30 Rh-Pt 6 Rh B, operating temperature 600 to 1600°C
x		2040	2 x Fe-Con J, operating temperature -200 to +600°C
x		2042	2 x Fe-Con L, operating temperature -200 to +600°C
x		2043	2 x NiCr-Ni K, operating temperature -200 to +1200°C
	x	2044	2 x Pt 10 Rh-Pt S, operating temperature 0 to 1300°C
	x	2046	2 x Pt 30 Rh-Pt 6 Rh B, operating temperature 600 to 1600°C
			(3) Protection tube diameter D in mm
	x	6	6mm (support tube 15mm dia.)
	x	8	8mm (support tube 15mm dia.)
	x	10	10mm (support tube 15mm dia.)
x		15	15mm
			(4) Nominal length NL in mm (180≤NL ≤1200, NL ≤1000 for type 901102/20)
	x	180	180mm, fitting length (EL) 100 - 140mm
x	x	250	250mm, fitting length (EL) 100 - 210mm
	x	355	355mm, fitting length (EL) 100 - 315mm
x	x	500	500mm, fitting length (EL) 100 - 460mm
	x	710	710mm, fitting length (EL) 100 - 670mm only with D=8mm
	x	1000	1000mm, fitting length (EL) 100 - 960mm only with D=8mm
x	x	...	please specify in plain text (50mm steps)
			(5) Process connection
x	x	000	no process connection
x	x	254	screwed pipe joint 1/2"
x	x	668	stop flange 15mm dia., DIN 43 734
			(6) Protection tube material
x		27	steel X 18 CrNi 28 Mat. Ref. 1.4749 (operating temp. up to +1150°C)
x		28	steel X 15 CrNiSi 25 20 Mat. Ref. 1.4841 (operating temp. up to +1150°C)
	x	94	ceramic KER 710 (operating temperature up to +1600°C)
			(7) Extra codes
x	x	000	no extra code
x	x	320	terminal head Form BUZ
x	x	321	terminal head Form BUZH
x	x	322	terminal head Form BBK
x	x	331	1 x programmable transmitter, output 4 - 20mA/20 - 4mA[2], Data Sheet 70.7010
x	x	335	2 x programmable transmitter, output 4 - 20mA/20 - 4mA[2], Data Sheet 70.7010

	(1)		(2)		(3)		(4)		(5)		(6)		(7)
Order code		-		-		-		-		-		/	,...
Order example	901102/10	-	1042	-	15	-	250	-	668	-	27	/	000[1]

1. List extra codes in sequence, separated by commas.
2. Please specify range and output signal in plain text.

Stock versions

(1)		(2)		(3)		(4)		(5)		(6)		(7)	Sales No.
901102/10	-	1043	-	15	-	500	-	668	-	27	/	000	90/00054589
901102/10	-	2043	-	15	-	500	-	668	-	27	/	000	90/00054593

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Push-in thermocouples with compensating cable

- **for temperatures from 0 to 600°C**
- **available with different thermocouples**
- **with stainless steel protection tube**
- **silicone compensating cable or with metal braiding**
- **also with 90° cable entry**

Push-in thermocouples are preferred for measuring temperatures on solids, such as hot-plates and welding jaws. Applications include ovens, plant engineering and machinery.

Depending on the version, compensating cables are suitable for use in dry areas within the temperature range -20 to +350°C. The connection of the cable to the protection tube incorporates strain relief. A cable protector is available as an option.

Protection tubes in stainless steel protect the measuring insert from chemical influences and mechanical damage.

The measuring insert is fitted with thermocouples to EN 60 584 and DIN 43 710.

Technical data

Connection	available with cable ends as: bare wires, with ferrules, receptacle or multipole connector (e.g. connectors that are free from thermal emf)
Compensating cable	silicone, ambient temperature -50 to +180°C metal braiding, ambient temperature -20 to +350°C compensating cable available with shielding (option)
Protection tube	stainless steel 1.4571, 6mm dia.
Measuring insert	insulated assembly: 1 x Fe-Con L, DIN 43 710, Cl. 2, operating temperature -200 to +600°C 1 x NiCr-Ni K, EN 60 584, Cl. 2, operating temperature -200 to +600°C
Accessories	pockets, Data Sheet 90.9721

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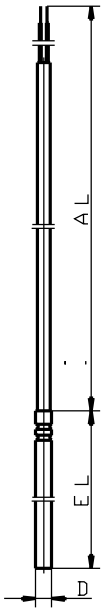
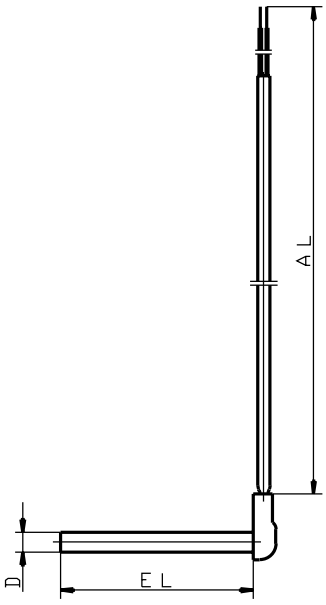
Internet: www.JumoUSA.com

Dimensions



Type 901105/10



Type 901105/20

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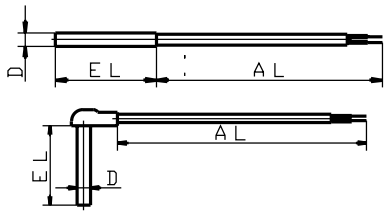
Order details: Push-in thermocouples with compensating cable

(1) Basic version

		901105/10	Push-in thermocouple with stainless steel protection tube
		901105/20	Push-in thermocouple with stainless steel protection tube angled at 90°



			(2) Operating temperature in °C / compensating cable
x	x	380	-50 to +200°C / silicone
x	x	390	-50 to +300°C / metal braiding
	x	840	0 to 300°C / metal braiding
	x	843	0 to 350°C / metal braiding
x		848	0 to 400°C / metal braiding
x		858	0 to 600°C / metal braiding
			(3) Measuring insert
x	x	1042	1 x Fe-Con L
x	x	1043	1 x NiCr-Ni K
			(4) Protection tube diameter D in mm
x	x	6	6mm
			(5) Fitting length EL in mm (40≤ EL ≤500 for Type 901105/10)
	x	12	12mm
x		50	50mm
	x	60	60mm
x		100	100mm
x		200	200mm
x		300	300mm
x		...	please specify in plain text (50mm steps)
			(6) Compensating cable end
x	x	03	bare cable ends
x	x	11	ferrules to DIN 46 228 Part 4 (standard)
x	x	13	receptacle 6.3 to DIN 46 247
x	x	80	multipole connector (please specify type in plain text)
			(7) Compensating cable length AL in mm (500≤ AL ≤500000)
x	x	2500	2500mm
x	x	...	please specify in plain text (500mm steps)
			(8) Extra codes
x	x	000	no extra code
x	x	309	uninsulated assembly (thermocouple welded to tip)
x	x	315	cable protector: coil
x		316	cable protector: tube

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
Order code		-		-		-		-		-		-		/		,...
Order example	901105/10	-	848	-	1042	-	6	-	100	-	11	-	2500	/	000[1]	

1. List extra codes in sequence, separated by commas.

Stock versions

(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	Sales No.
901105/10	-	848	-	1042	-	6	-	50	-	11	-	2500	/	315	90/00055455
901105/10	-	858	-	1042	-	6	-	100	-	11	-	2500	/	315	90/00065812
901105/20	-	840	-	1042	-	6	-	60	-	11	-	2500	/	000	90/00055448

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Push-in thermocouples with bayonet lock

- **for temperatures from 0 to 400°C**
- **as single or twin thermocouple**
- **good heat transfer through adjustable spring pressure**
- **insulated assembly, or joined to protection tube**
- **insertion and removal without tools**

Push-in thermocouples with bayonet lock are preferred for measuring temperatures in solids, bearings and molding tools, for example in the plastics industry. The special form of the measuring tips makes these temperature probes suitable for use in flat-bottom or cone-shaped bores.

The rugged pressure spring, which also functions as a cable protector, is made from rust and acid resistant stainless steel 1.4310 and ensures a steady pressure between the measuring tip and the bottom of the hole. The fitting length can be altered by rotating the bayonet lock. Bayonet locks and suitable sockets are available in the diameters 12, 14.5, 15 and 16mm.

The measuring insert is normally fitted with thermocouples to EN 60 584 or DIN 43 710. Versions with two thermocouples are also available.

Technical data

Connection	available with cable ends as: bare wires, with ferrules, receptacles or multipole connector (e.g. connectors that are free from thermal emf)
Compensating cable	silicone, ambient temperature -50 to +180°C PTFE, ambient temperature -190 to +260°C metal braiding, ambient temperature -20 to +350°C
Process connection	bayonet lock, nickel-plated brass, 12mm, 14.5mm, 15mm or 16mm dia.
Protection tube	stainless steel 1.4571, 6mm and 8mm dia.
Measuring insert	insulated assembly: 1 x Fe-Con J, EN 60 584, Cl. 2, operating temperature 0 to 400°C 1 x Fe-Con L, DIN 43 710, Cl. 2, operating temperature 0 to 400°C 1 x NiCr-Ni K, EN 60 584, Cl. 2, operating temperture 0 to 400°C 2 x Fe-Con L, DIN 43 710, Cl. 2, operating temperature 0 to 400°C 2 x NiCr-Ni K, EN 60 584, Cl. 2, operating temperature 0 to 400°C
Accessories	bayonet sockets, Data Sheet 90.9725

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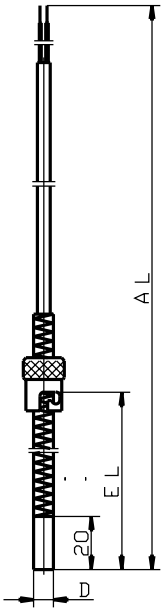
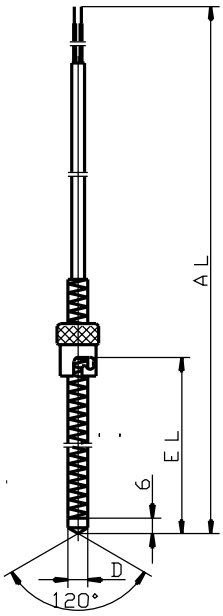
Dimensions



Type 901109/10



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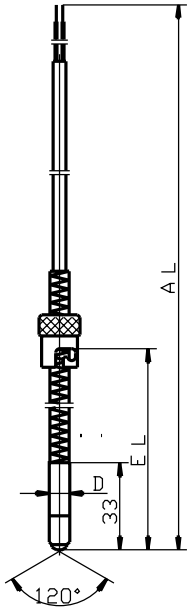
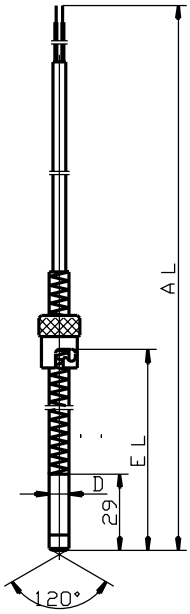


Type 901109/30



Type 901109/40

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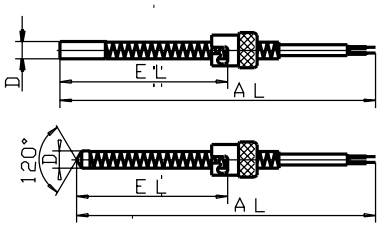
Order details: Push-in thermocouples with bayonet lock

(1) Basic version

901109/10	Push-in thermocouple, protection tube / measuring tip (flat-bottom) stainless steel, Mat. Ref. 1.4571, bayonet lock 12mm dia.
901109/20	Push-in thermocouple, protection tube / measuring tip (120°) stainless steel, Mat. Ref. 1.4571, bayonet lock 12mm dia.



			(2) Operating temperature in °C / compensating cable
x	x	832	0 to 200°C / silicone
x	x	835	0 to 260°C / metal braiding
x	x	836	0 to 260°C / PTFE
x	x	848	0 to 400°C / metal braiding
			(3) Measuring insert
x	x	1040	1 x Fe-Con J
x	x	1042	1 x Fe-Con L
x	x	1043	1 x NiCr-Ni K
x	x	2042	2 x Fe-Con L
x	x	2043	2 x NiCr-Ni K
			(4) Protection tube diameter D in mm
x		6	6mm
x	x	8	8mm
			(5) Fitting length EL in mm
x		175	20 - 175mm
	x	240	6 - 240mm
			(6) Compensating cable end
x	x	03	bare cable ends
x	x	11	ferrules to DIN 46 228 Part 4 (standard)
x	x	13	receptacle 6.3 to DIN 46 247
x	x	80	multipole connector (please specify type in plain text)
			(7) Compensating cable length AL in mm (500≤ AL ≤500000)
x	x	2500	2500mm (standard)
x	x	...	please specify in plain text (500mm steps)
			(8) Extra codes
x	x	000	no extra code
x	x	300	bayonet lock 14.5mm dia.
x	x	302	bayonet lock 15mm dia.
x	x	303	bayonet lock 16mm dia.
x	x	309	uninsulated assembly (thermocouple welded to tip)

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
Order code		-		-		-		-		-		-		/		,...
Order example	901109/10	-	848	-	1042	-	6	-	175	-	11	-	2500	/	000[1]	

1. List extra codes in sequence, separated by commas.

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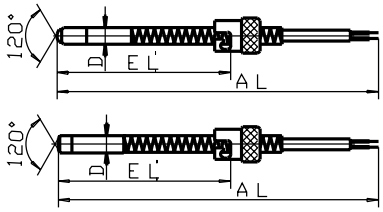
Order details: Push-in thermocouples with bayonet lock

(1) Basic version

		901109/30	Push-in thermocouple, protection tube / measuring tip (120°) stainless steel, Mat. Ref. 1.4571, bayonet lock 12mm dia.
		901109/40	Push-in thermocouple, protection tube stainless steel, Mat. Ref. 1.4571, measuring tip (120°) ceramic, KER 221, bayonet lock 12mm dia.



			(2) Operating temperature in °C / compensating cable
x	x	832	0 to 200°C / silicone
x		835	0 to 260°C / metal braiding
x		836	0 to 260°C / PTFE
	x	848	0 to 400°C / metal braiding
			(3) Measuring insert
x	x	1040	1 x Fe-Con J
x	x	1042	1 x Fe-Con L
x	x	1043	1 x NiCr-Ni K
x	x	2042	2 x Fe-Con L
x	x	2043	2 x NiCr-Ni K
			(4) Protection tube diameter D in mm
x	x	6	6mm
			(5) Fitting length EL in mm
x		175	33 - 175mm
	x	175	29 - 175mm
			(6) Compensating cable end
x	x	03	bare cable ends
x	x	11	ferrules to DIN 46 228 Part 4 (standard)
x	x	13	receptacle 6.3 to DIN 46 247
x	x	80	multipole connector (please specify type in plain text)
			(7) Compensating cable length AL in mm (500≤ AL ≤500000)
x	x	2500	2500mm (standard)
x	x	...	please specify in plain text (500mm steps)
			(8) Extra codes
x	x	000	no extra code
x	x	300	bayonet lock 14.5mm dia.
x	x	302	bayonet lock 15mm dia.
x	x	303	bayonet lock 16mm dia.
x	x	309	uninsulated assembly (thermocouple welded to tip)

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
Order code		-		-		-		-		-		-		/		,...
Order example	901109/30	-	836	-	1042	-	6	-	175	-	11	-	2500	/	000[1]	

1. List extra codes in sequence, separated by commas.

Note: Bayonet sockets, Data Sheet 90.9725

Stock versions

(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	Sales No.
901109/10		848		1040		6		175		11		2500		000	90/00352190
901109/10	-	848	-	1040	-	8	-	175	-	11	-	2500	/	000	90/00371309
901109/10	-	848	-	1042	-	6	-	175	-	11	-	2500	/	000	90/00055784
901109/10	-	848	-	1042	-	8	-	175	-	11	-	2500	/	000	90/00055785
901109/20	-	848	-	1042	-	8	-	240	-	11	-	2500	/	309	90/00055792
901109/30	-	835	-	1042	-	6	-	175	-	13	-	2500	/	309	90/00055806
901109/40	-	848	-	1042	-	6	-	175	-	13	-	2500	/	000	90/00055804

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Mineral-insulated thermocouples to DIN 43 710 and EN 60 584

- **for temperatures from -200 to +1200°C**
- **flexible sheath with shock-proof measuring insert**
- **protection tube diameter from 0.5mm**
- **fast response**
- **fitting length to suit application**

Thanks to their special properties, mineral-insulated thermocouples are used in chemical plant, power stations, pipelines, in engine construction and on test beds. The thermocouple wires are embedded in compressed fire-resistant magnesium oxide inside the flexible thin-walled sheath.

The excellent heat transfer between the sheath and the thermocouple enables short response times ($t_{0.5}$ from 0.15sec) and high measurement accuracy. The shock-proof construction ensures a long life. The minimum bending radius is 5 x the external diameter. The minimum fitting length EL is 50mm for 0.5mm to 2.0mm dia., and 100mm for 3.0 to 6.0mm dia.

The thermocouples are normally insulated from the sheath. The measuring insert is fitted with thermocouples to EN 60 584 or DIN 43 710. Versions with two thermocouples are also available.

Test pressure: 40 bar (helium) leakage test at the measurement point.

Insulation resistance: thermocouple against sheath at ambient temperature for lengths up to 1m: 200MΩ, for lengths 1m and above: 200MΩ x m.

Technical data

Connection	available with cable ends as: bare wires, with ferrules, receptacles or multipole connector (e.g. connectors that are free from thermal emf)
Compensating cable	silicone, ambient temperature -50 to +180°C PTFE, ambient temperature -190 to +260°C metal braiding, ambient temperature -20 to +350°C
Protection tube	stainless steel 1.4541, thermocouple Type L and Type J Inconel 2.4816 (Inconel 600) , thermocouple Type K
Measuring insert	insulated assembly: 1 x Fe-Con J, EN 60 584, Cl. 2, operating temperature -200 to +800°C 1 x Fe-Con L, DIN 43 710, Cl. 2, operating temperature -200 to +800°C 1 x NiCr-Ni K, EN 60 584, Cl. 2, operating temperature -200 to +1200°C 2 x Fe-Con L, DIN 43 710, Cl. 2, operating temperature -200 to +800°C 2 x NiCr-Ni K, EN 60 584, Cl. 2, operating temperature -200 to +1200°C
Response times	in water with 0.4m/sec / in air with 2m/sec 0.5mm dia: water $t_{0.5}$ = 0.15sec, $t_{0.9}$ = 0.30sec / air $t_{0.5}$ = 3.5sec, $t_{0.9}$ = 8.0sec 1.0mm dia: water $t_{0.5}$ = 0.20sec, $t_{0.9}$ = 0.60sec / air $t_{0.5}$ = 7.5sec, $t_{0.9}$ = 17.0sec 1.5mm dia: water $t_{0.5}$ = 0.40sec, $t_{0.9}$ = 0.90sec / air $t_{0.5}$ = 10.0sec, $t_{0.9}$ = 25.0sec 2.0mm dia: water $t_{0.5}$ = 0.80sec, $t_{0.9}$ = 2.60sec / air $t_{0.5}$ = 13.0sec, $t_{0.9}$ = 34.0sec 3.0mm dia: water $t_{0.5}$ = 1.00sec, $t_{0.9}$ = 2.80sec / air $t_{0.5}$ = 22.0sec, $t_{0.9}$ = 64.0sec 4.5mm dia: water $t_{0.5}$ = 2.50sec, $t_{0.9}$ = 6.50sec / air $t_{0.5}$ = 34.0sec, $t_{0.9}$ = 113.0sec 6.0mm dia: water $t_{0.5}$ = 3.00sec, $t_{0.9}$ = 9.00sec / air $t_{0.5}$ = 55.0sec, $t_{0.9}$ = 170.0sec

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Lead resistances in Ω/m at 20°C for mineral-insulated thermocouples

Diameter D in mm	1 thermocouple resistance in Ω/m	2 thermocouples resistance in Ω/m
Thermocouple Fe-Con L		
6.0	0.66	0.85
4.5	1.40	1.80
3.0	2.70	3.50
2.0	5.00	7.70
1.5	12.00	-
1.0	21.50	-
Thermocouple Fe-Con J		
6.0	0.54	-
3.0	2.10	-
2.0	8.60	-
1.5	15.00	-
1.0	34.00	-
Thermocouple NiCr-Ni K		
6.0	0.88	2.70
4.5	1.56	4.80
3.0	3.50	11.00
2.0	7.90	25.00
1.5	14.00	-
1.0	32.00	-
0.5	126.00	-

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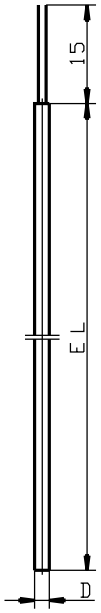
e-mail: info@JumoUSA.com
Internet: www.JumoUSA.com

Dimensions



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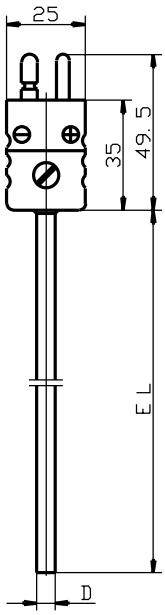

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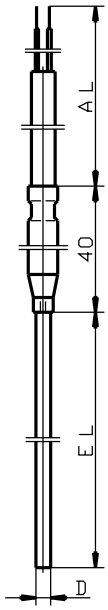

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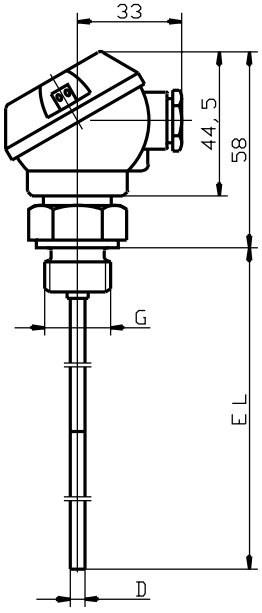

Type 901221/40

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Order details: Mineral-insulated thermocouples to DIN 43 710 and EN 60 584

(1) Basic version

		901221/10	Mineral-insulated thermocouple with bare connecting wires
		901221/20	Mineral-insulated thermocouple with standard flat emf-free connector

			(2) Measuring insert / operating temperature in °C
x	x	1040	1 x Fe-Con J, operating temperature -200 to +800°C, sheath, Mat. Ref. 1.4541
x	x	1042	1 x Fe-Con L, operating temperature -200 to +800°C, sheath, Mat. Ref. 1.4541
x	x	1043	1 x NiCr-Ni K, operating temperature -200 to +1200°C, sheath, Mat. Ref. 2.4816
x		2042	2 x Fe-Con L, operating temperature -200 to +800°C, sheath, Mat. Ref. 1.4541
x		2043	2 x NiCr-Ni K, operating temperature -200 to +1200°C, sheath, Mat. Ref. 2.4816
			(3) Protection tube diameter D in mm
	x	0.5	0.5mm, only with Type 1 x NiCr-Ni K
x	x	1	1mm
x	x	1.5	1.5mm
x	x	2	2mm
x	x	3	3mm
x	x	4.5	4.5mm
x	x	6	6mm
			(4) Fitting length EL in mm (50 ≤EL ≤50000)
x	x	100	100mm
x	x	200	200mm
x	x	300	300mm
x	x	400	400mm
x	x	500	500mm
x	x	...	please specify in plain text (50mm steps)
			(5) Extra codes
x	x	000	no extra code
x	x	309	uninsulated assembly (thermocouple welded to tip)

	(1)		(2)		(3)		(4)		(5)
Order code		-		-		-		/	
Order example	901221/10	-	1042	-	3	-	200	/	000

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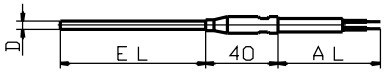
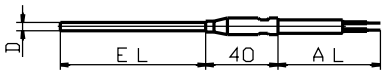
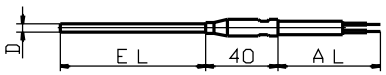
Order details: Mineral-insulated thermocouples to DIN 43 710 and EN 60 584

(1) Basic version

			901221/32	Mineral-insulated thermocouple with siliconized compensating cable
			901221/33	Mineral-insulated thermocouple with PTFE- insulated compensating cable
			901221/34	Mineral-insulated thermocouple and compensating cable with metal-braiding and glass silk insulation







				(2) Measuring insert / operating temperature in °C
x	x	x	1040	1 x Fe-Con J, operating temperature -200 to +800°C, sheath, Mat. Ref. 1.4541
x	x	x	1042	1 x Fe-Con L, operating temperature -200 to +800°C, sheath, Mat. Ref. 1.4541
x	x	x	1043	1 x NiCr-Ni K, operating temperature -200 to +1200°C, sheath, Mat. Ref. 2.4816
x		x	2042	2 x Fe-Con L, operating temperature -200 to +800°C, sheath, Mat. Ref. 1.4541
x		x	2043	2 x NiCr-Ni K, operating temperature -200 to +1200°C, sheath, Mat. Ref. 2.4816
				(3) Protection tube diameter D in mm
x	x	x	0.5	0.5mm, only with Type 1 x NiCr-Ni K
x	x	x	1	1mm
x	x	x	1.5	1.5mm
x	x	x	2	2mm
x	x	x	3	3mm
x	x	x	4.5	4.5mm
x	x	x	6	6mm
				(4) Fitting length EL in mm (50 ≤EL ≤50000)
x	x	x	100	100mm
x	x	x	200	200mm
x	x	x	300	300mm
x	x	x	400	400mm
x	x	x	500	500mm
x	x	x	...	please specify in plain text (50mm steps)
				(5) Compensating cable end
x	x	x	03	bare cable ends
x	x	x	11	ferrules to DIN 46 228 Part 4 (standard)
x	x	x	13	receptacle 6.3 to DIN 46 247
x	x	x	80	multipole connector (please specify type in plain text)
				(6) Compensating cable length AL in mm (500 ≤AL ≤500000)
x	x	x	2500	2500mm (standard)
x	x	x	...	please specify in plain text (500mm steps)
				(7) Extra codes
x	x	x	000	no extra code
x	x	x	309	uninsulated assembly (thermocouple welded to tip)
x	x	x	317	shielded compensating cable

	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
Order code		-		-		-		-		-		/		,...
Order example	901221/32	-	1042	-	3	-	200	-	11	-	2500	/	000[1]	

1. List extra codes in sequence, separated by commas.

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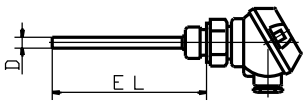
Order details: Mineral-insulated thermocouples to DIN 43 710 and EN 60 584

(1) Basic version

	901221/40	Mineral-insulated thermocouple with terminal head Form J



		(2) Measuring insert / operating temperature in °C
x	1040	1 x Fe-Con J, operating temperature -200 to +800°C, sheath, Mat. Ref. 1.4541
x	1042	1 x Fe-Con L, operating temperature -200 to +800°C, sheath, Mat. Ref. 1.4541
x	1043	1 x NiCr-Ni K, operating temperature -200 to +1200°C, sheath, Mat. Ref. 2.4816
x	2042	2 x Fe-Con L, operating temperature -200 to +800°C, sheath, Mat. Ref. 1.4541
x	2043	2 x NiCr-Ni K, operating temperature -200 to +1200°C, sheath, Mat. Ref. 2.4816
		(3) Protection tube diameter D in mm
x	3	3mm
x	4.5	4.5mm
x	6	6mm
		(4) Fitting length EL in mm (50 ≤EL ≤50000)
x	100	100mm
x	200	200mm
x	300	300mm
x	400	400mm
x	500	500mm
x	...	please specify in plain text (50mm steps)
		(5) Process connection
x	103	thread 3/8" pipe
x	104	thread 1/2" pipe
		(6) Extra codes
x	000	no extra code
x	309	uninsulated assembly (thermocouple welded to tip)

	(1)		(2)		(3)		(4)		(5)		(6)
Order code		-		-		-		-		/	
Order example	901221/40	-	1042	-	6	-	200	-	104	/	000

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Stock versions

(1)		(2)		(3)		(4)		(5)	Sales No.
901221/20	-	1043	-	3	-	100	/	000	90/00056899
901221/20	-	1043	-	3	-	250	/	000	90/00068440

Stock versions

(1)		(2)		(3)		(4)		(5)		(6)		(7)	Sales No.
901221/32	-	1042	-	6	-	100	-	11	-	2500	/	000	90/00049206
901221/32	-	1042	-	6	-	200	-	11	-	2500	/	000	90/00068450
901221/32	-	1042	-	6	-	500	-	11	-	2500	/	000	90/00068452
901221/32	-	1042	-	3	-	100	-	11	-	2500	/	000	90/00056809
901221/32	-	1042	-	3	-	200	-	11	-	2500	/	000	90/00068433
901221/32	-	1042	-	3	-	500	-	11	-	2500	/	000	90/00068435
901221/32	-	1042	-	1.5	-	100	-	11	-	2500	/	000	90/00056811
901221/32	-	1042	-	1.5	-	200	-	11	-	2500	/	000	90/00068438
901221/32	-	1042	-	1.5	-	500	-	11	-	2500	/	000	90/00068439
901221/32	-	1043	-	6	-	100	-	11	-	2500	/	000	90/00056812
901221/32	-	1043	-	6	-	200	-	11	-	2500	/	000	90/00068427
901221/32	-	1043	-	6	-	300	-	11	-	2500	/	000	90/00068428
901221/32	-	1043	-	3	-	100	-	11	-	2500	/	000	90/00056813
901221/32	-	1043	-	3	-	200	-	11	-	2500	/	000	90/00068441
901221/32	-	1043	-	3	-	300	-	11	-	2500	/	000	90/00068442
901221/32	-	1043	-	3	-	500	-	11	-	2500	/	000	90/00068443
901221/32	-	1043	-	1.5	-	100	-	11	-	2500	/	000	90/00049205
901221/32	-	1043	-	1.5	-	200	-	11	-	2500	/	000	90/00068436
901221/32	-	1043	-	1.5	-	500	-	11	-	2500	/	000	90/00068437
901221/32	-	1043	-	0.5	-	100	-	11	-	2500	/	000	90/00066345

Stock versions

(1)		(2)		(3)		(4)		(5)		(6)	Sales No.
901221/40	-	1042	-	6	-	100	-	104	/	000	90/00087482
901221/40	-	1042	-	6	-	300	-	104	/	000	90/00068454
901221/40	-	1043	-	6	-	200	-	104	/	000	90/00068430
901221/40	-	1043	-	6	-	300	-	104	/	000	90/00068431
901221/40	-	1043	-	6	-	500	-	104	/	000	90/00068432

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JUMO FOODtemp
Insertion thermocouples

- **for temperatures from -100 to +260°C**
- **steam-tight**
- **high mechanical strength**
- **for use in the food industry**
- **with several measurement points**

Thanks to their special construction, the rugged steam-tight insertion thermocouples are particularly suitable for cooking and baking processes in all areas of food processing and preservation.

The stainless steel probe tube is available with concentric point or oblique tip.

All versions are highly resistant to shock and vibration. The handles are resistant to oil and acid.

The measuring insert is fitted with thermocouples NiCr-Ni to EN 60 584, Class 1.

Technical data

Connection	cable ends available as: bare wires, with ferrules, receptacles or multipole connector
Compensating cable	PTFE, ambient temperature -100 to +260°C
Handle	PTFE handle, ambient temperature +260°C max. PEEK handle, ambient temperature +260 °C max.
Protection tube	stainless steel 1.4571, 4mm and 4.5mm dia.
Protection tube end	concentric, angled at approx. 25° oblique, angled at 45°
Measuring insert	3 x NiCr-Ni K, EN 60 584, Cl. 1, operating temperature -100 to + 260°C 4 x NiCr-Ni K, EN 60 584, Cl. 1, operating temperature -100 to + 260°C 5 x NiCr-Ni K, EN 60 584, Cl. 1, operating temperature -100 to + 260°C
Protection	IP67

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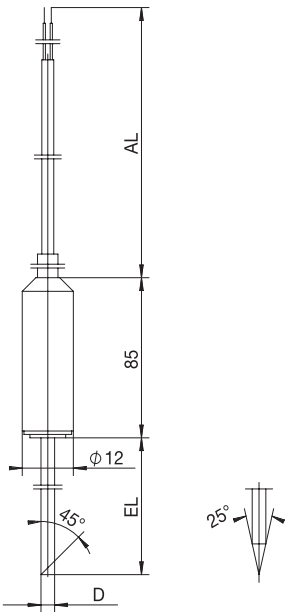
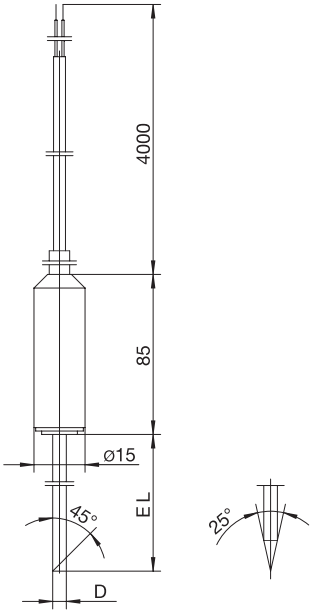
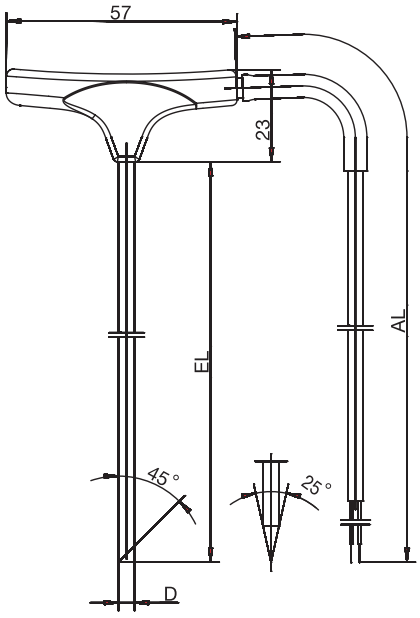
Dimensions



Type 901305/33



Type 901305/63



Type 901305/83

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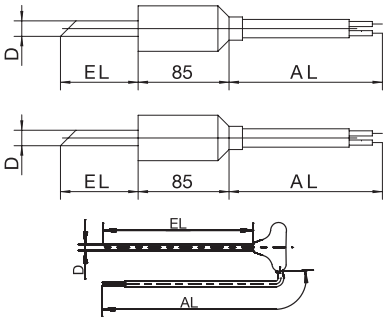
Order details: Insertion thermocouples

(1) Basic version

901305/33	Insertion thermocouple with several measurement points, PTFE handle 12mm dia. and PTFE cable
901305/63	Insertion thermocouple with several measurement points, PTFE handle 15mm dia. and PTFE cable
901305/83	Insertion thermocouple with several measurement points, PEEK handle and PTFE cable



(2) Operating temperature in °C

x	x	x	261	-100 to +260°C

(3) Measuring insert (arranged over fitting length)

x	x	x	3043	3 x NiCr-Ni K
x	x	x	4043	4 x NiCr-Ni K
x	x		5043	5 x NiCr-Ni K (only in conjunction with protection tube dia. D 4.5mm)

(4) Protection tube diameter D in mm

x	x	x	4	4mm
x	x		4.5	4.5mm

(5) Fitting length EL in mm

x	x	x	100	100mm (standard)
x	x	x	150	150mm
x	x		200	200mm

(6) Insertion tip

x	x	x	2	concentric, angled at 25° (approx.)
x	x	x	3	oblique, angled at 45° (standard)

(7) Compensating cable end

x	x	x	03	bare cable ends
x	x	x	11	ferrules to DIN 46 228 Part 4 (standard)
x	x	x	80	multipole connector (please specify type in plain text)

(8) Compensating cable length AL in mm (500 ≤ AL ≤ 500000)

x	x	x	4000	4000mm (standard)
x	x	x	...	please specify in plain text (500mm steps)

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)
Order code		-		-		-		-		-		-		-	
Order example	901305/33	-	261	-	3043	-	4	-	100	-	2	-	03	-	4000

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Contents:

Resistance thermometers

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Installation locations for temperature probes	**Data Sheet**
Various types	90.2440

Surface resistance thermometers	**Data Sheet**
Various types	90.2522

Indoor, outdoor and duct resistance thermometers	**Data Sheet**
Various types	90.2523

Test equipment for temperature and its traceability	**Data Sheet**
Various types	90.2721

Resistance thermometers for the food and pharmaceutical industries	**Data Sheet**
Various types	90.2810
JUMO Dtrans T100 - Screw-in resistance thermometers with/without transmitter	90.2815

Resistance thermometers for process technology, optional Protection EEx “d“ and EEx “i“		**Data Sheet**
Various types	**JUMO PROCESStemp**	90.2820

Push-in resistance thermometers		**Data Sheet**
Steam-tight versions	**JUMO STEAMtemp**	90.2830

Resistance thermometers with CANopen output	**Nr.**
JUMO CANtrans T - Various types	90.2910

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Construction and application of resistance thermometers

Temperature-dependent resistance

The variation of the electrical resistance of metals with temperature is very often employed for the electrical measurement of temperature. Since the electrical resistance increases with increasing temperature, we speak of a **positive temperature coefficient** or **PTC** (in platinum temperature sensors, for example).

In order to employ this effect for temperature measurement, the electrical resistance of the metal must vary in a reproducible manner depending on temperature. The characteristics of the metal must not change during operation, as this would introduce measurement errors. The temperature coefficient should be as independent as possible of temperature, pressure and chemical effects.

Standardized platinum temperature sensors

Platinum has established itself as the resistance material of choice in industrial instrumentation. Its advantages include high chemical stability, relatively easy workability (especially in wire manufacture), its availability in highly pure form, and the good reproducibility of its electrical properties. In order to ensure universal interchangeability, these properties are defined in the standard EN 60751.

This standard lays down the electrical resistance and the permitted tolerances at different temperatures.

Additional definitions cover the nominal value of the temperature sensor and the temperature range. The calculation makes a distinction between the two temperature ranges -200 to 0°C and 0 to 850°C.

The range from -200 to 0°C is covered by the third-order polynomial:

$$R(t) = R_0(1 + A \times t + B \times t^2 + C \times (t - 100^\circ C) \times t^3)$$

A second-order polynomial applies to the range 0 to 850°C …

$$R(t) = R_0(1 + A \times t + B \times t^2)$$

…with the coefficients:

$$A = 3{,}9083 \times 10^{-3} {}^\circ C^{-1}$$
$$B = -5.775 \times 10^{-7} {}^\circ C^{-2}$$
$$C = -4{,}183 \times 10^{-12} {}^\circ C^{-4}$$

The term R_0 is referred to as the **nominal value,** and represents the resistance at 0°C.

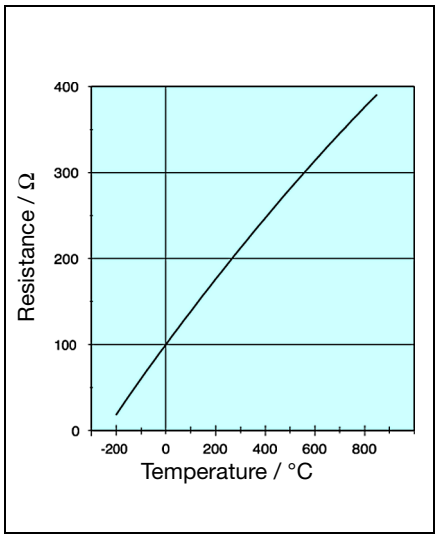

Fig. 1: Pt100 characteristic

According to EN 60751, the nominal value is 100.000 Ω at 0°C. We therefore speak of a Pt100 temperature sensor.

Temperature sensors with nominal values of 500 and 1000Ω are also available. Their advantage is a higher sensitivity, i.e. a larger variation of their resistance with temperature.

The resistance change in the temperature range up to 100°C is approximately:
0.4Ω/°C for Pt100 temperature sensors
2.0Ω/°C for Pt500 temperature sensors
4.0Ω/°C for Pt1000 temperature sensors

As an additional parameter, the standard defines a mean temperature coefficient between 0°C and 100°C. This represents the average change in resistance, referred to the nominal value at 0°C:

$$\alpha = \frac{R_{100} - R_0}{R_0 \times 100^\circ C} = 3{,}850 \times 10^{-3} {}^\circ C^{-1}$$

R_0 and R_{100} are the resistances at the temperatures 0°C and 100°C respectively.

Calculating the temperature from the resistance

In its application as a thermometer, the resistance of the temperature sensor is used to calculate the corresponding temperature. The formulae above represent the variation of electrical resistance with temperature.

For temperatures above 0°C it is possible to derive an explicit expression from the characteristic according to EN 60 751:

$$= \frac{-R_0 \times A + [(R_0 \times A)^2 - 4 \times R_0 \times B \times (R_0 - R)]^{1/}}{2 \times R_0 \times B}$$

R = measured resistance in Ω
t = calculated temperature in °C
R_0, A, B = parameter as per IEC 751

Tolerance limits

EN 60 751 distinguishes between two tolerance classes:

Class A: $\Delta t = \pm (0.15 + 0.002 \times |t|)$
Class B: $\Delta t = \pm (0.30 + 0.005 \times |t|)$

t = temperature in °C (without sign)

The formula for calculating the tolerance ΔR in Ω at a temperature of t > 0°C is:

$$\Delta R = R_0(A + 2 \times B \times t) \times \Delta t$$

For t < 0°C it is:

$$\Delta R = R_0(A + 2 \times B \times t - 300^\circ C \times C \times t^2 + 4 \times C \times t^3) \times \Delta t$$

Tolerance Class A applies for temperatures between -200 and +600°C.

Tolerance Class B covers the entire definition range of -200 to +850°C.

Extended tolerance classes

It is frequently found that the two tolerance classes specified in the standard are not adequate to meet particular requirements. On the basis of the standard tolerances, **JUMO** have defined additional classes in order to meet the different requirements of the market.

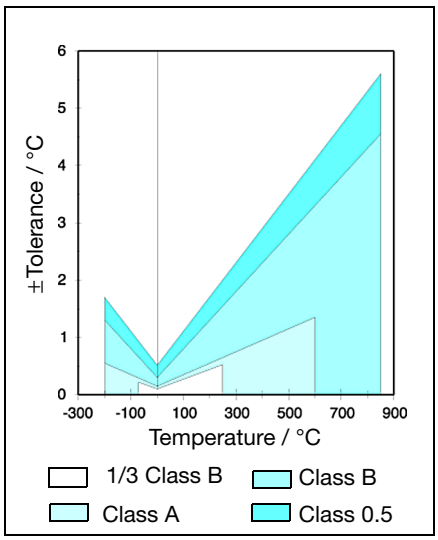

Fig. 2: Tolerance variation, depending on measurement temperature

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Tolerance class	Temperature range	Tolerance in °C	Tolerance at	
			t = 0°C	t = 100°C
1/3Class B	- 70 to +250°C	± (0.10 °C + 0.0017 x |t|)	± 0.10°C	± 0.27°C
Class A	-200 to +600°C	± (0.15 °C + 0.0020 x |t|)	± 0.15°C	± 0.35°C
Class B	-200 to +850°C	± (0.30 °C + 0.0050 x |t|)	± 0.30°C	± 0.80°C
Class 0.5	-200 to +850°C	± (0.50 °C + 0.0060 x |t|)	± 0.50°C	± 1.10°C

Table 1: Tolerance classes

\|t\| = measured temperature in °C, without sign

Construction of resistance thermometer probes

Apart from the virtually unlimited number of special models, there is also a series of probes whose components are completely defined by standard specifications.

Resistance thermometers with terminal head

These **resistance thermometers** are of modular construction, consisting of the measurement insert, protection tube, the terminal head and the terminal plate inside the head. A flange or a screw fitting can also be provided.

The **temperature sensor** is that part of the resistance thermometer which is directly affected by the measured temperature.

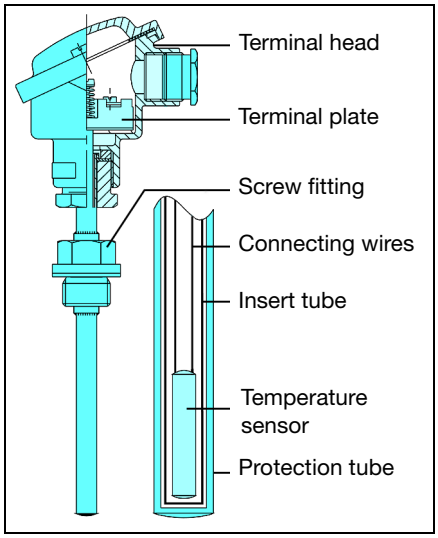

Fig. 3: Construction of an electrical thermometer

Measuring inserts are completely fabricated units, consisting of a temperature sensor and a terminal plate, with the sensor contained in an **insert tube** of 6 or 8mm diameter, made from bronze SnBz6 as per DIN 17 681 (up to 300°C) or nickel.

It is inserted into the actual **protection tube**, which is often made from stainless steel.

The tip of the insert tube is in full contact with the inside of the protection tube end plate, in order to ensure good heat transfer. The insert fixing screws are backed by springs so that bottom contact is maintained even with differential expansion between the insert tube and protection tube lengths. This arrangement makes it easy to replace the insert at a later date. The thermometers are available in single and twin versions. Their dimensions are specified in the standard DIN 43 762. Inserts with an integral 2-wire transmitter are also available.

If no insert is used, the temperature sensor is positioned directly inside the protection tube, embedded in aluminium oxide or a thermally conducting medium. After assembly, the terminal plate is mounted inside the terminal head and the connecting wires are soldered up.

In this arrangement, the sensor cannot be changed later; the complete resistance thermometer has to be replaced.

If a **pocket** is used, the thermometer can be removed without having to drain or depressurize the system.

The pocket is a type of protection tube which is mounted permanently at the measurement site, and in which the thermometer can be inserted and fixed in position. Other forms of pocket have an internal thread, so that a thermometer can be screwed in. The thermometer can then be made simply as an insert, or have its own protection tube. This, however, results in a much poorer response. The pocket itself is welded in position (which is not possible with a protection tube, because of the thin wall of the tube) or has an external thread, usually a pipe thread.

Since pockets are in direct contact with the fluid, they have to meet the same requirements for chemical resistance and mechanical robustness as protection tubes.

For the **terminal heads**, the DIN 43 729 standard defines two forms, A and B, which differ in size and also slightly in shape.

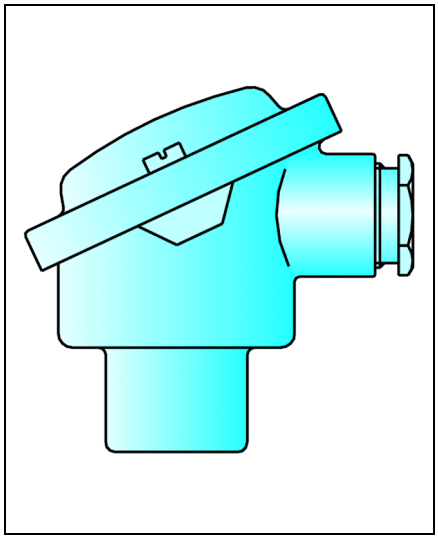

Fig. 4: Terminal head to DIN 43 729, Form B

The material used is cast iron, aluminium or plastic.

In addition, there are various other forms which are adapted to meet special requirements. The enclosure protection is not convered by the standard, it is usually a splashproof form (IP 54).

The nominal diameter of the bore in the terminal head, to take the protection tube, is:
for Form A: 22, 24 or 32mm.
for Form B: 15mm or
thread M 24 x 1.5.

The smaller terminal head (Form B) is the most widely used one, and the 2-wire transmitters are designed for this form.

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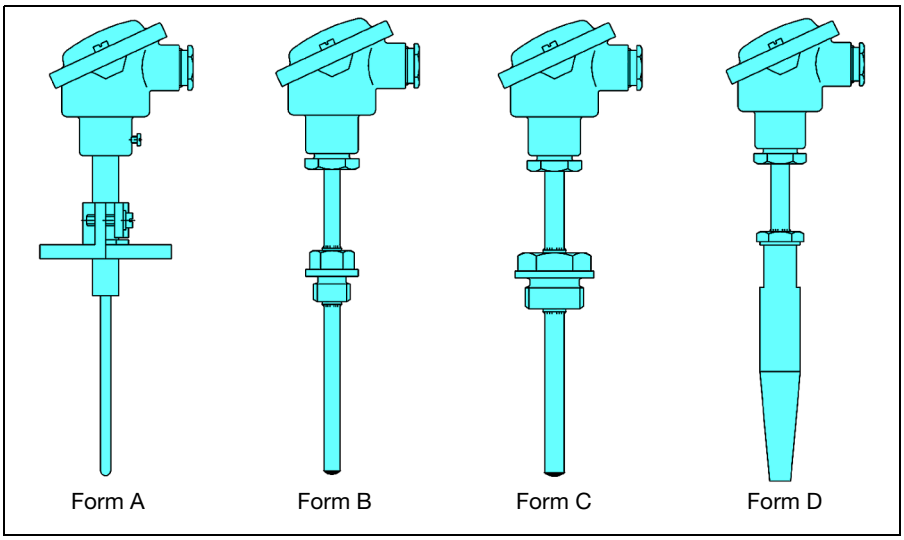

Fig. 5: Thermometers to DIN 43 770

The standards DIN 43 764 to 43 769 define various protection tube designs for different resistance thermometers **and** thermocouples in different applications. They are all fitted with an insert and a terminal head Form B. The diameters and lengths of the protection tubes are also fixed.
The design of the protection tubes of these thermometers (with flange, taper, etc.) are identified by code letters A to G, which themselves are laid down in DIN 43 763.
Form A: enamelled tube for mounting by sliding stop flange, for flue gas measurement

Form B: tube with fixed external ½" pipe thread

Form C: tube with fixed external 1" pipe thread

Form D: pressure-resistant thick-walled tube, for welding into position

Form E: tube tapering at the tip, for rapid response and mounting by sliding stop flange

Form F: tube as Code E, but with fixed flange

Form G: tube as Code E, but with fixed external 1" pipe thread

The above-mentioned standard DIN 43 763 also lays down the materials and their abbreviations in the form of special codes. For instance: the designation "Protection tube DIN 43 763-B1-H" identifies a tube to Form B, i.e. with a welded-on external ½" pipe thread, length 305mm (code number 1), in steel St 35.8 (code letter H). The standard also indicates the maximum pressure in air, water or steam as well as the maximum flow velocity. This makes it easy to select the protection tubes during the design phase of system construction.
There are also numerous special versions available, partly with standardized terminal heads and partly in highly specialized non-standard forms with plug connectors or attached cable.

Resistance thermometers to DIN 3440

Resistance thermometers for use with temperature controllers or limiters for heating systems must meet the requirements of the standard DIN 3440. These are resistance thermometers, as described in the previous section, but with an additional TUV type approval.
The resistance thermometer must withstand temperatures which are 15% above the upper temperature limit for at least one hour, and must meet specific response times, depending on the fluid
(e.g. in air: $t_{0.63}$ = 120 sec).
Furthermore, the thermometer must be designed to withstand mechanical loading caused by the external pressure and the flow rate of the medium, at the operating temperatures.
Alterations to such thermometers are not permitted without obtaining a fresh TUV approval!

Explosion-protected resistance thermometers

In all areas where flammable materials are stored, processed or manufactured, there is a possibility that, in combination with air, an explosive atmosphere may be formed which represents a hazard to the environment. The necessary conditions and requirements which electrical equipment has to meet in order that it can be used in an area exposed to an explosion hazard are summarized in the European Standards EN 50 014 … EN 50 020. Equipment that conforms to these standards can therefore be used throughout Europe.

Pressure-tight enclosure EEx "d"

Transducers in pressure-tight enclosures are designed so that all components which could ignite an explosive atmosphere are safely enclosed in the protective fitting or in the terminal head. Any explosion produced inside can therefore not be propagated to the outside. This is achieved by close tolerances, special cable glands and a particularly robust construction of the terminal head. Advantages of this version:
- an intrinsically safe power supply is not required
- connection in 2-wire, 3-wire or 4-wire circuit is possible
- also available with 2-wire transmitter

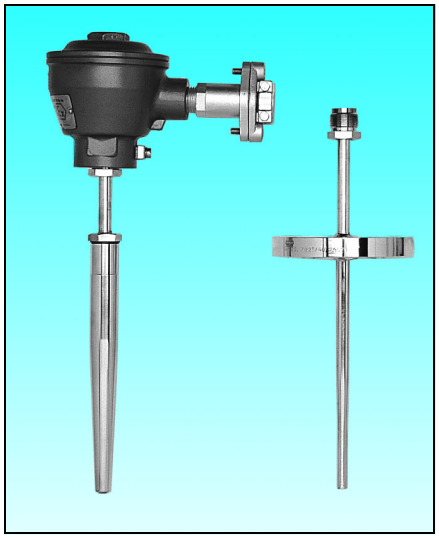

Fig. 6: Resistance thermometer in pressure-tight enclosure EEx "d"

Intrinsic safety EEx "i"

By contrast with protection "d", which refers generally to the actual device, protection "i" always considers the complete circuit.

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In this form of resistance thermometer, the intrinsically safe 2-wire transmitter with a 4 — 20 mA output signal is located directly inside the enlarged terminal head of the thermometer, and is included in an intrinsically safe circuit.
This arrangement offers decisive advantages:

- interference-free output signal, directly from the thermometer
- low installation cost
- no lead compensation required
- signal can be transmitted over long distances
- installation and repair while the system is in operation

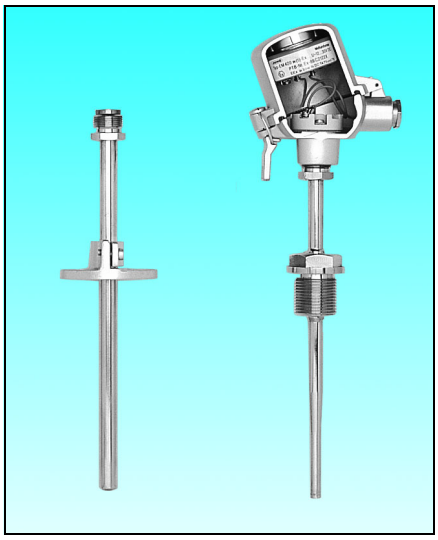

Fig. 7: Resistance thermometer with intrinsic safety EEx "i"

Resistance thermometers with 2-wire transmitters

Resistance thermometers with transmitter are used for measuring temperatures in liquids and gases when measurement signals have to be transmitted over considerable distances, free from interference. The transmitter converts the sensor signal into a standard 4 — 20mA current signal which is linear with temperature.
The supply for the transmitter is fed through the same connections, utilizing the quiescent current level of 4 mA. Because of the zero offset, this method is also referred to as "live zero". The 2-wire transmitter amplifies the signal and achieves a considerable reduction in its sensitivity to interference. In these styles, the 2-wire transmitter is encapsulated in epoxy resin and mounted directly inside the terminal head of the resistance thermometer.

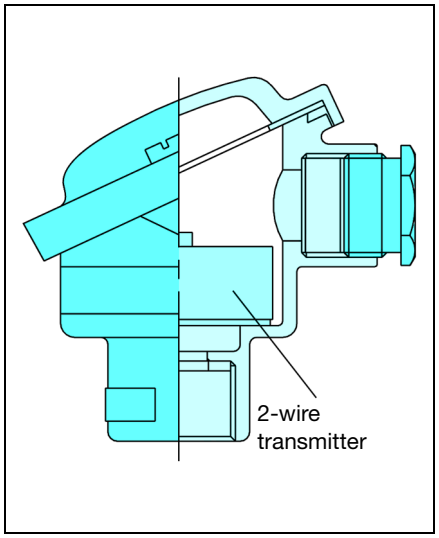

Fig. 8: Terminal head with a 2-wire transmitter

The transmitter is suitable for operating temperatures up to 90°C. Terminal heads are available in Forms BUZ, BBK and BUZH, as well as the standard Form B.

Resistance thermometers with connecting cable

On resistance thermometers with a connecting cable, the insert and terminal head are omitted. The temperature sensor is joined directly to the connecting cable, and placed in the protection tube. Strain relief is provided, for instance by grooving or compressing the end of the protection tube several times (enclosure IP65). The internal space between the protection tube and the temperature sensor is normally filled with thermally conductive material to improve the thermal contact to the fluid being measured. The maximum operating temperature is determined mainly by the temperature limit for the sheathing and insulating material of the connecting cable. The table shows some typical materials and their temperature limits.

Material	t_{max}/°C
PVC	80
PVC 105	105
Silicone	180
PTFE	260

The thermometers are available in many different styles, which are frequently designed to suit particular user requirements.

Some typical data values are:

- diameter: 2 — 8 mm
- protection tube length: 35 — 150 mm
- protection tube material: stainless steel, brass, coated steel
- circuit connection: 2, 3, or 4-wire
- mounting: flange with union connector, fixed nipple and clamping nipple

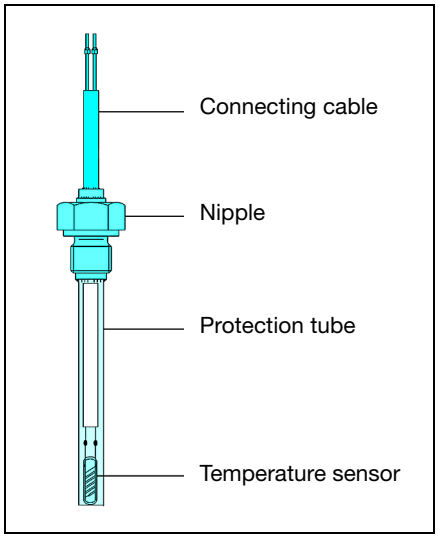

Fig. 9: Construction of a resistance thermometer with attached cable

Another type is **resistance thermometers for sterilizers.**
The temperature probes must have an especially high reliability, since these installations usually operate 24 hours a day.
The transition from the protection tube to the connecting cable is sealed steam-tight and can withstand absolute pressures of 0.1 to 4 bar at temperatures up to 150°C.
The basic versions are fitted with high-temperature PTFE connecting cables and smooth protection tubes. Up to three Pt100 temperature sensors to EN 60 751 can be fitted in these temperature probes (see Data Sheet 90.2830).

Mineral-insulated resistance thermometers

Mineral-insulated resistance thermometers are constructed using a mineral-insulated cable. The thin stainless-steel cable sheath contains the copper conductors embedded in compressed, fire-resistant magnesium oxide. The temperature sensor (in 2-, 3- or 4-wire circuit) is connected to the internal conductors and fitted into the stainless steel protection tube, which is welded to the cable sheath. Diameters as small as 1.9 mm are available.

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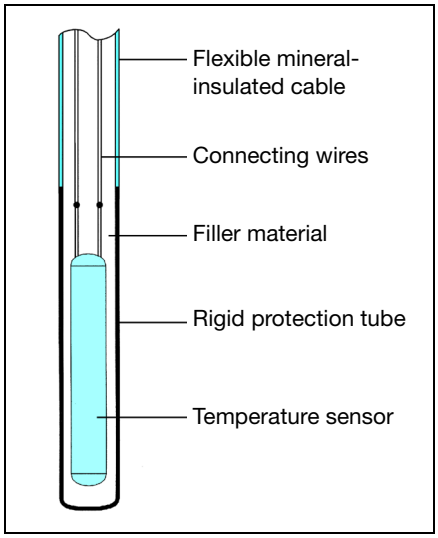

Fig. 10: Construction of a mineral-insulated resistance thermometer

The excellent heat transfer between the **protection tube** and the temperature sensor leads to a fast response ($t_{0.5}$ from 1.2 sec) and high accuracy. The shockproof construction ensures a long life. The flexible **mineral-insulated cable**, with a minimum bending radius of 5 x outside diameter (1.9/3/6mm), permits temperature measurement at relatively inaccessible locations. Because of their special properties, mineral-insulated resistance thermometers are used in chemical plant, power stations, pipelines, in engines, on test beds and in all locations where flexibility and problem-free installation are required.

Heat meter resistance thermometers

Resistance thermometers for heat meters have a federal type approval from the German Physikalisch-Technische-Bundesanstalt (PTB). The various styles meet the requirements of the Draft European Standard EN 1434 and are recommended by the German District Heating Association (AGFW = Arbeitsgemeinschaft für Fernwärme). **Thermometers with a terminal head** are available for direct temperature measurement as well as for use in suitable close-fitting pockets. The fitting length varies from 85 to 400mm. A variant is the **resistance thermometer with attached cable,** as a screw-in or push-in version. Screw-in resistance thermometers with an M 10x1 thread measure temperature directly inside the liquid, with the advantages of fast response and low heat conduction error. Using push-in thermometers in close-fitting pockets makes it unnecessary to drain the system when replacing the thermometer at the end of the certification period. The ideal locations for screw-in resistance thermometers with an attached cable are ball valves for 1/2", 3/4" and 1" pipes. The special design of the ball valves makes it unnecessary to drain the system when fitting or replacing the temperature probe. The small pipe diameters lead to a fitting length no greater than 30mm. This gives rise to a heat conduction error which affects the measurement. The optimized internal construction of **JUMO** resistance thermometers results in a negligible heat conduction error of less than 0.03°C, and is thus even lower than the PTB specification of 0.1°C.

Insertion resistance thermometers

The design is essentially a resistance thermometer with attached cable, which is fitted with a handle. Special features of this thermometer style are: it is unaffected by alternating temperatures, sealed against water (vapor), resistant to mechanical shock and vibration. The temperature sensor in 2-wire or 3-wire circuit is inserted into the protection tube which is then sealed. The stainless steel protection tube is 100 mm long and has a concentric point or angled tip. The handles in PTFE, PPS plastics or HTV silicone are resistant to a large number of aggressive media. The connecting cable has PTFE insulation for good heat resistance.

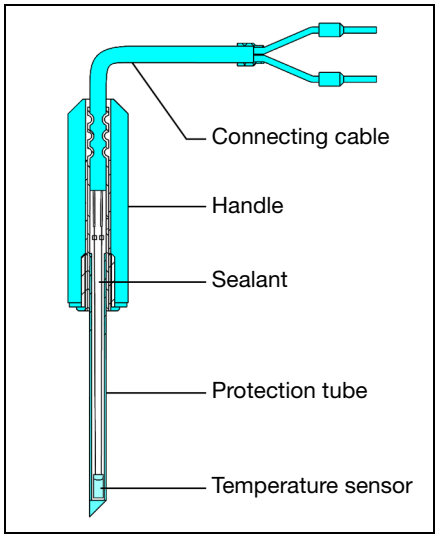

Fig. 11: Construction of an insertion resistance thermometer

A special feature of the internal construction is the sealing, which withstands high temperatures and prevents entry of water (vapor).

Surface resistance thermometers

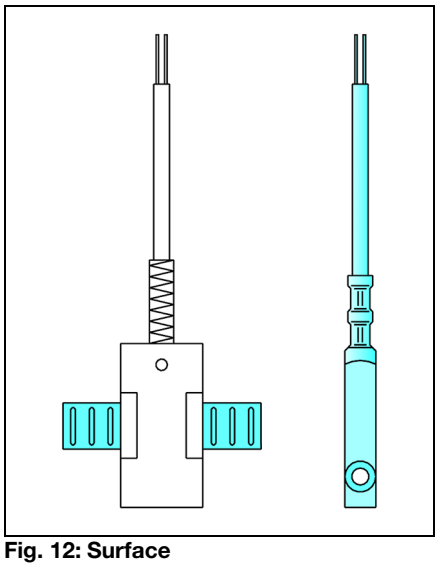

Fig. 12: Surface resistance thermometers

Surface resistance thermometers are used preferably for measuring temperatures on closed pipe systems and other round or flat surfaces. Simple installation by tension bands or hose clips avoids any mechanical preparation of the measurement location. Other versions have a mounting hole, for securing to any form of surface by a screw. Indirect temperature measurement avoids disturbing the flow of the liquid or gas. In addition, pressure and chemical effects do not influence the life of the resistance thermometer.

The object being measured is hardly affected by the small thermal mass. Heat-conductive paste can be used to improve the heat transfer. Large temperature differences between the gas/liquid and the surroundings have a direct effect on the measurement. In such cases, it is advisable to provide the thermometer with thermal insulation.

Indoor and outdoor resistance thermometers

Different versions are available for temperature measurement indoors and in the open. In the **domestic version,** the temperature sensor is enclosed in an elegant plastic housing with IP20 protection. On **outdoor thermometers for industrial use,** with IP65 protection, the temperature sensor is mounted outside the housing and enclosed by a protective cap.

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A further version is provided with a stainless steel protection tube, into which the temperature sensor is inserted.
Electrical connection is made through a Pg9 cable gland. The measuring range covers -30 to +80°C. Various versions can be fitted with a 2-wire transmitter having a 4 — 20mA output signal.

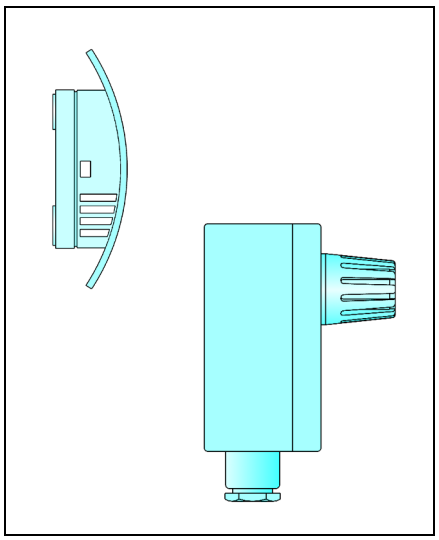

Fig. 13: Indoor and outdoor resistance thermometers

Precision resistance thermometers
For maximum stability, it is usual to arrange the resistance coil freely suspended inside the protection tube.

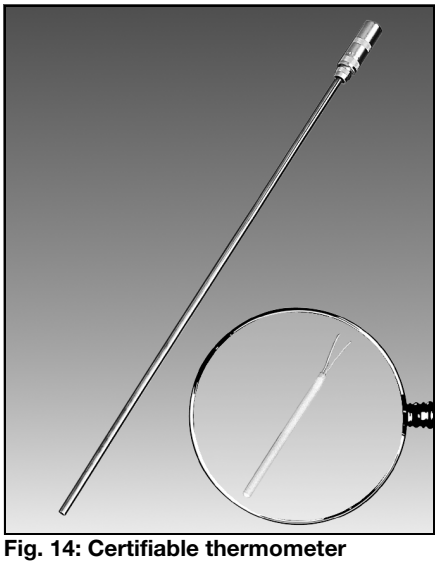

Fig. 14: Certifiable thermometer

This prevents mechanical loading under temperature, caused by differential expansion. But vibration can very easily result in a break in the coil. So, while these thermometers have excellent long-term stability, of the order of 0.001°C or less, the low mechanical strength means that they are unsuited for industrial use. For such applications **JUMO** employs a temperature sensor with a platinum coil that is secured in a ceramic sleeve. The leads to the connector are made as a 4-wire circuit. A stainless steel tube protects the sensor from mechanical influences. The temperature range covers -200 to +450°C, depending on the version. The measurement accuracy can be up to ±0.025°C.

Measurement

Connection of resistance thermometers
In a resistance thermometer, the electrical resistance varies with temperature. For evaluating the output signal, a constant current is passed through the thermometer and the voltage drop across it is measured. For this voltage drop, Ohm's Law states that:

$$V = R \times I$$

The measuring current should be as small as possible, in order to avoid heating of the sensor. It can be assumed that a measuring current of 1 mA does not introduce any appreciable errors. This current produces a voltage drop of 0.1 V in a Pt100 at 0°C. This signal voltage must now be transmitted through the connecting cables to the indicating or evaluation point, with a minimum of alteration.

Three different types of connecting circuit are used for this purpose:

2-wire circuit
The connection between the thermometer and the evaluation electronics is provided by a 2-core cable. Like any other electrical conductor, this cable has an electrical resistance which is in series with the temperature sensor. So the two resistances are added, and the result is a systematically higher temperature indication. For longer distances, the lead resistance may amount to a few ohms and produce an appreciable shift in the measured value. In order to avoid this error, the resistance is compensated electrically.
The instrument is designed to allow always for a lead resistance of, for instance, 10Ω When the resistance thermometer is connected up, a compensating resistance is connected in one of the measurement lines and the sensor is replaced initially by a 100.00Ω resistor. The compensating resistance is then altered until a reading of 0°C appears on the instrument.
Because of the relative large amount of work involved and the fact that effects of temperature on the measurement cable are not covered, the use of the 2-wire circuit is becoming increasingly rare.

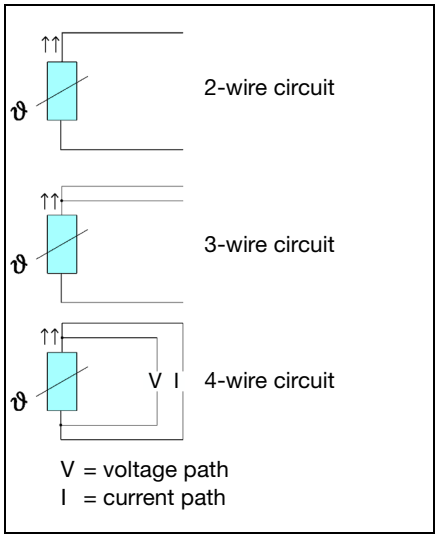

Fig. 15: Connection of resistance thermometers

3-wire circuit
The effects of the lead resistances and their fluctuation with temperature are reduced to a minimum in the 3-wire circuit. In this circuit, an additional lead is brought out to a contact on the resistance thermometer. This results in two measuring circuits, one of which is used as a reference.
The 3-wire circuit makes it possible to compensate for both the value and the temperature dependency of the lead resistance. But it is a requirement that all three cores have identical properties and are at the same temperature. In most cases, this is true to a sufficient degree of accuracy, so that the 3-wire circuit is the one most frequently used these days. No lead compensation is required.

4-wire circuit
The optimum form of connection for resistance thermometers is the 4-wire circuit. The measurement depends neither on the lead resistances nor on their variation due to temperature. No lead compensation is required. The thermometer receives the measuring current I through the supply connections. The voltage drop V across the temperature sensor is picked off by the measuring leads.

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If the input resistance of the electronics is many times greater than the lead resistance, then the latter can be neglected. The voltage drop determined in this way is independent of the properties of the connecting wires.

With both 3-wire and 4-wire circuits it must be remembered that the circuit is not always taken right up to the actual sensing element. The connection from the sensor to the terminal head of the fitting, the so-called internal connection, is frequently made in a 2-wire circuit. This results in similar problems to those discussed for the 2-wire circuit, although to a much smaller extent. The total resistance, consisting of the sum of internal connection and sensor, is defined by DIN 16160 as the **thermometer resistance**.

Insufficient insulation resistance

Because of the finite resistance between the connections and within the insulation material in which the sensor is embedded, there is a possibility of a further error due to poor insulation resistance which reduces the indicated temperature. Based on a Pt100 thermometer, an insulation resistance of 100 kΩ results in an error of 0.25°C, and 25 kΩ one of 1°C. Because of the variation of insulation resistance with temperature, it is possible for this error to vary with the measuring conditions.
For ceramic insulating materials in particular, the resistance decreases with increasing temperature.

In view of the relatively low maximum temperature of about 600°C, this effect is hardly noticeable for platinum temperature sensors. Much more important is any moisture which may penetrate the insulation, as this can cause a substantial measurement error. Sensors are therefore usually covered by a glaze or some other form of hermetic sealing. The measuring insert itself is also sealed, in order to prevent entry of moisture into the probe tube. Inserts are readily interchangeable, since they are completely enclosed units. For resistance thermometers without inserts, on the other hand, it is vital to ensure a reliable seal if they have to be repaired.

Self-heating

The output signal of a resistance thermometer can only be measured by passing a current through the sensor. This measurement current produces a power loss and therefore heats up the sensor, with the result that the temperature indication is increased. Self-heating depends on a number of factors, including the extent to which the heat generated can be removed by the fluid (or gas) being measured. Because the relationship for electrical power is $P = R \times I^2$, the effect depends also on the basic resistance of the temperature sensor. For the same measurement current, a Pt1000 temperature sensor is heated ten times as much as a Pt100. In addition, design features (thermometer size) and thermal conduction and capacity also determine the error. The thermal capacity of the fluid and its flow velocity also have a large influence on this effect.
Thermometer manufacturers often specify a self-heating coefficient, which represents a measure for the temperature increase through a defined power loss in the sensor. Such calorimetric measurements are carried out under standard conditions (in water at 0.5m/sec, or air at 2m/sec), but the information is somewhat theoretical and serves only for comparison between different designs.
In most cases, the measurement current is set at 1mA by the instrument manufacturer, since this value has been found appropriate in practice and produces no appreciable self-heating.
For example, a Pt100 temperature sensor is placed in a closed and fully insulated container with $10cm^3$ of air, and this measurement current of 1 milliampere increases the air temperature by 39°C after one hour. With flowing gases and liquids the effect is very much less pronounced, because of the much greater heat dissipation.
Because of differences in measurement conditions it is necessary to measure the actual self-heating effect on site. The current is varied and the corresponding temperature is measured. The self-heating coefficient E is derived as:

$$E = \Delta t / (R \times I^2)$$

where
Δt = (indicated temperature) – (fluid temperature),
R = thermometer resistance
I = measurement current

The self-heating coefficient can be used to determine the maximum measurement current if an error Δt is permitted.

$$I = (\Delta t / E \times R)^{1/2}$$

Parasitic thermal voltages

The effect of thermo-electric voltages can also be seen during temperature measurement with resistance thermometers, in this case as a highly undesirable side effect. Thermal voltages can be generated at the junction of two different metals.
Such metal junctions occur at the lead connections in the resistance thermometer. The connecting wires of the sensor frequently consist of silver, with extensions of copper or nickel as internal conductors, for example.

Under normal conditions, it can be assumed that both junctions are at the same temperature and that the resulting thermal voltages cancel each other. Differences in heat conduction to the outside may however lead to the establishment of different temperatures; the resulting thermal voltage is interpreted by the electronics as a voltage drop, thus producing a measurement error.
This can take the form of an increase or a decrease, depending on the polarity of the thermal voltage which is produced.

The magnitude of the resulting error depends very much on the characteristics of the electronics, in particular on how the voltage is evaluated as a temperature.

A simple method for diagnosing such errors consists of performing two measurements with the measurement current in opposite directions. The larger the difference between the two measurements, the greater is the thermal voltage generated.

Transfer function

A sensor will never respond instantaneously, but always with a certain delay, because of the ever-present thermal resistances within the probe. The resulting measurement error, caused by the measurement or output signal lagging behind a change in the substance being measured, is known as the **dynamic error**.
As a simplification, it is possible to think of the probe as consisting of a combination of resistances and energy stores. The material masses and the corresponding thermal capacities form the energy stores. The materials have different thermal conductivities which cause the resistances. The components of the thermometer often have both characteristics simultaneously.

The speed with which the thermometer responds depends in the first instance on the ratio of the thermal resistance to the thermal capacity of the probe. The larger this thermal resistance, the slower the probe heats up. So in order to achieve a fast response it is desirable to use small sensors and thin materials which conduct heat readily. A particularly unfavourable feature is the air gap between the measurement insert and its protection tube, since all gases are poor heat conductors. The remedy consists of embedding the insert in thermally conductive pastes or metal oxides. Thermocouples have essentially shorter reponse times than resistance thermometers, because of their lower thermal mass. This applies in particular to thin mineral-insulated thermocouples. However, in most cases the difference is largely outweighed by the comparatively high thermal capacity of the protective fitting. The response time generally increases with increasing protection tube diameter. It is therefore advisable to use thin-walled fittings of small diameter, as far as the mechanical circumstances allow.

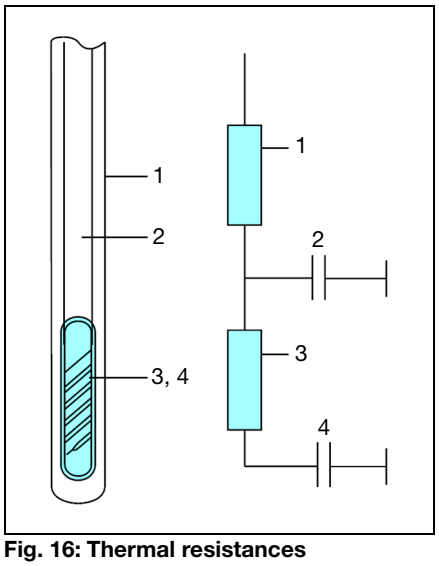

Fig. 16: Thermal resistances in a thermometer

The thermal conductivity of the protection tube material is also very important. Copper and iron are comparatively good heat conductors, but stainless steel and ceramics are not so good.

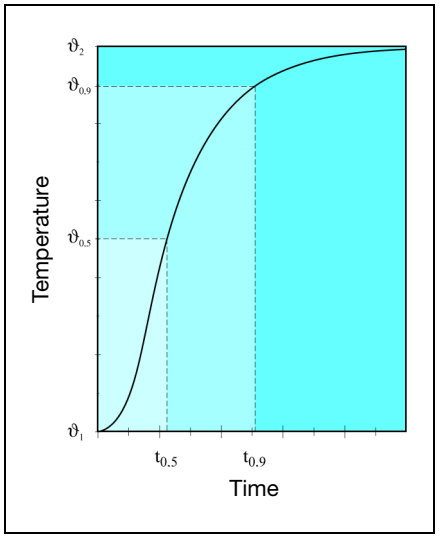

Fig. 17: The transfer function

The **transfer function**, i.e. the variation of the measured value following a sudden change in temperature, provides information on this effect. Tests to determine the transfer function of the thermometer are carried out in a flow of warm water or air, using special test set-ups, as specified for example in EN 60 751. Two times (response periods) characterize the transfer function:

- **Half-value time $t_{0.5}$**
  The half-value time indicates the period during which the measured value reaches 50% of its final value.
- **90%-time $t_{0.9}$**
  The 90%-time indicates the period during which the measured value reaches 90% of its final value.

A time τ taken to reach 63.2% of the final value is not generally specified, because of possible confusion with the time constant of an exponential function. The heat transfer function of virtually all thermometers deviates clearly from such a function.

Errors in resistance thermometers

Effect of the cable

In measurements using resistance thermometers, the results may be falsified by design features or measurement effects. The following section explains the most important effects which may cause erroneous measurements.
As described elsewhere, the lead resistance enters into the measurement as a resistor in series with the sensor.
Particularly in large installations, with the resulting longer transmission distances, the lead resistance can reach the same order of magnitude as the sensor resistance itself. Compensation of the lead resistance is therefore absolutely essential, and usually consists of shifting the zero of the instrument connected to the sensor. However, such compensation does not take account of the changes in the lead resistance with temperature. If the connecting cable is subjected to fluctuating temperatures, this will lead to varying degrees of measurement error. The effect only becomes apparent with larger lead resistances, i.e. with longer cable lengths and small conductor cross-sections.

Heat conduction error

A thermometer is rarely used in the range of ambient temperatures. If the measured temperature is above or below the ambient temperature, a temperature gradient will result at the thermometer, between the measurement point and the surroundings.
This leads to an error in the temperature indication: heat flows through the protection tube and the internal components from the hotter to the cooler location. In addition, the sensor is connected to the cable, forming a direct metallic contact between the sensor and the surroundings – a thermal bridge which also causes an error. Good electrical conductors always have a low thermal resistance, so the requirement for a lower lead resistance is counteracted by a higher heat conduction error.
Furthermore, the design of the thermometer influences the heat conduction error. The sensor must have a good thermal connection to the protection tube, but at the same time be thermally decoupled from the connecting cable. The installation length of the thermometer must not be made too short, otherwise too much heat will be dissipated. The **immersion depth** (the length of the portion of the thermometer which is exposed to the medium being measured) depends on the type of medium and the rate at which it transports heat. For example, a fast-flowing liquid will transfer more heat than still air, and will therefore provide better compensation for the heat conduction of the thermometer.
Measurements in liquids only require about half of the installation length compared with that used with gases.

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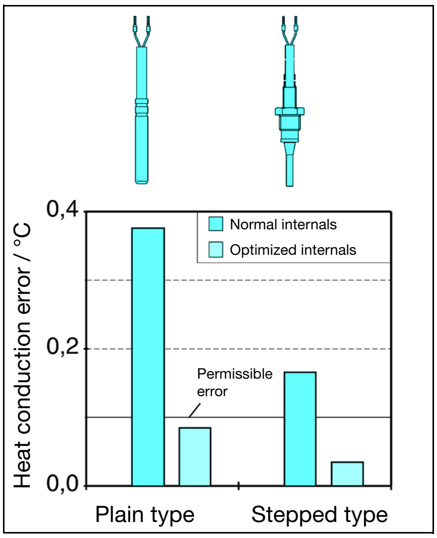


Fig. 18: Optimizing the heat conduction error, through protection tube geometry and internal layout

An example will demonstrate the effect of design on the heat conduction error. When used with heat meters, thermometers must have a heat conduction error not exceeding 0.1°C under the following conditions:

- Measured temperature: 80°C,
- Ambient temperature: 20°C,
- Measured medium: water, at a flow velocity of 0.1 to 0.2 m/sec

Particularly in short temperature probes with a fitting length less than 50mm, the achievement of the accuracy specified above raises problems which have to be solved through the design. The connecting cable is taken right up to the sensor and consists of copper. The thermal interface between sensor and protection tube is usually provided by heat conductive paste.

In the absence of any special precautions for thermal decoupling, there is a heat conduction error of about 0.3°C.

A 50% improvement is achieved by reducing the protection tube diameter in the region of the sensor. The error of 0.15°C for this probe version is still not adequate to meet the test criteria. Finally, a thermal decoupling of the connecting cable from the sensor reduces the heat conduction error to 0.03°C, which is now a factor of 10 better than the original version.

Measures for reducing the heat conduction error

It is not always possible to optimize the probe design for a particular measurement application so that the result is not affected by heat conduction errors. The publication "Electrical Temperature Measurement", described on page 15, summarizes the most important selection criteria for a probe with regard to heat conduction errors.

Calibration

During its operational life, a thermometer experiences changes in its characteristic compared with its original ex-factory condition, because of chemical and mechanical effects, as well as through ageing phenomena such as recrystallization and diffusion. In order to allow for drift and to compensate for it, it is necessary to recalibrate the thermometer at regular intervals.


DEUTSCHER KALIBRIERDIENST (DKD)
Kalibrierlaboratorium für die Meßgröße Temperatur
Calibration laboratory for the measured Temperature
AKKREDITIERT DURCH DIE PHYSIKALISCH-TECHNISCHE BUNDESANSTALT (PTB)

JUMO MESS- UND REGELTECHNIK

Kalibrierschein / Calibration Certificate — Kalibrierzeichen / Calibration mark: 0066 DKD-K 09501 94-10

Gegenstand / Object	Platinwiderstandsthermometer
Hersteller / Manufacturer	M.K. Juchheim GmbH D-36039 Fulda
Typ / Type	90.286 - F11 P2
Fabrikate/Serien-Nr. / Serial number	C 28
Auftraggeber / Customer	Fa. Mustermann D-99999 Musterstadt
Auftragsnummer / Order No.	723796
Anzahl der Seiten des Kalibrierscheines / Number of pages of the certificate	5
Datum der Kalibrierung / Date of calibration	13.10.1994

M. K. JUCHHEIM GMBH & CO · D-36035 Fulda · Postfach 12 09 · D-36039 Fulda · Moltkestraße 13 – 31
Telefon (06 61) 60 03-631 · Telefax (06 61) 60 03-601 · Teletex 6619726

Fig. 19: Calibration certificate

Recalibration consists of checking the indicated temperature values and, where appropriate, recording the amounts by which they deviate from the true temperatures. By contrast, the concept of **adjustment**, which is often used in this connection, means altering the instrument to render the deviation small, at least to within the tolerance limits.

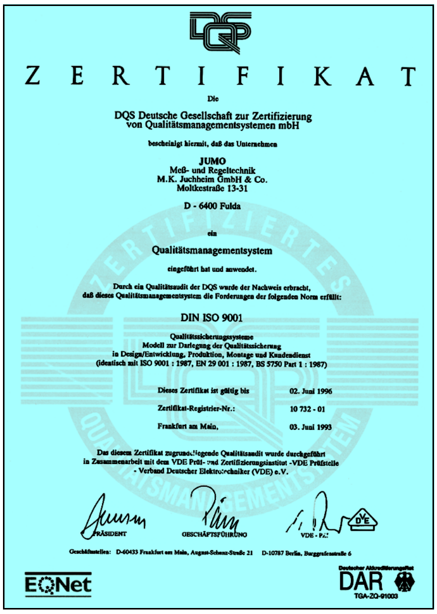
Calibration is identical with testing and measuring the accuracy for each individual thermometer. The manufacturer is, however, unable to provide any guarantee for the long-term stability of these values, since he cannot predict the future application and frequency of use, and the resulting stresses on the thermometer. It is advisable to recalibrate a thermometer initially every year and to compare the results with the previous calibration data. In the course of time, this produces a life history of the thermometer, from which its stability can be seen.

Depending on whether the reproducibility is adequate or not for the particular application, the recalibration period can then be extended or shortened.

The question concerning the actual details and the accuracy of a calibration cannot be answered in general terms. It is always subject to agreement between the user and the calibration laboratory, including temperature ranges and test points. The accuracy is determined by the type of measurement that is applied.

The German Calibration Service (Deutscher Kalibrierdienst, DKD)

The opening of the internal European trade boundaries after 1992, the new quality standards such as ISO 9001, and the more stringent product liability regulations make increasing demands on the documentation of processes and on the monitoring of measuring devices. In addition, there is an increasing demand from users for higher product quality standards. A particularly stringent requirement arises from the ISO 9001 standard, which describes the global concept of a quality assurance system.


ZERTIFIKAT

Die DQS Deutsche Gesellschaft zur Zertifizierung von Qualitätsmanagementsystemen mbH bescheinigt hiermit, daß das Unternehmen

JUMO Meß- und Regeltechnik M.K. Juchheim GmbH & Co. Moltkestraße 13-31 D - 6400 Fulda

ein Qualitätsmanagementsystem eingeführt hat und anwendet.

DIN ISO 9001

Dieses Zertifikat ist gültig bis 02. Juni 1996
Zertifikat-Registrier-Nr.: 10 732 - 01
Frankfurt am Main, 03. Juni 1993

EQNet DAR

Fig. 20: Certificate to ISO 9001

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If a manufacturer wishes to issue certificates based on this standard, it is necessary that the testing devices involved in production can be traced back to recognized national standards.

Traceability to a national standard means that in the checking of a testing device, the actual measurements are documented so that they can be traced back to legal instrument standards. In Germany, the PTB (Physikalisch-Technische-Bundesanstalt) lays down the national standards and compares them with the results from other organizations so that the representation of important parameters such as temperature can be ensured uniformly by physical means throughout the world.

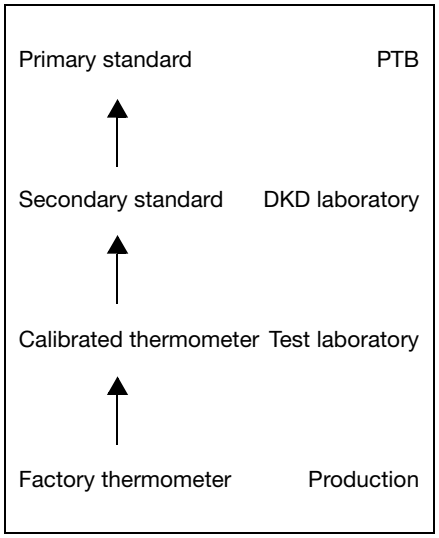

Fig. 21: Traceability

Because of the large demand for such calibrated devices, the government laboratories are found to have insufficient capacity and industry has therefore established and supports special calibration laboratories. These laboratories, including the **JUMO DKD Laboratory for Temperature 9501**, are linked to the German Calibration Service (DKD) and are subordinate to the national PTB laboratory for instrumental aspects. This ensures that the measuring devices used in a DKD laboratory can be traced back unequivocally to the national standards, and therefore also to the thermometers used there.

Safety note

All welded joints on thermometers and pockets are monitored through a fundamental quality assurance system according to DIN 8563, Part 113. Special safety regulations apply to the “Mandatory monitored area” (e.g. pressure vessels) according to Section 24 of the German Trade Regulations. In cases where the customer specifies such an application, the welding is monitored according to EN 287 and EN 288.

Pressure loading for temperature probes

The pressure resistance of protection fittings, such as are used for electric thermometers, depends largely on the different process parameters.
These include:
- temperature
- pressure
- flow velocity
- vibration

In addition, physical properties, such as material, fitting length, diameter and type of process connection have to be taken into account.

The diagrams below are taken from DIN 43 763 and show the load limit for the different basic types in relation to the temperature and the fitting length, as well as the flow velocity, temperature and medium.

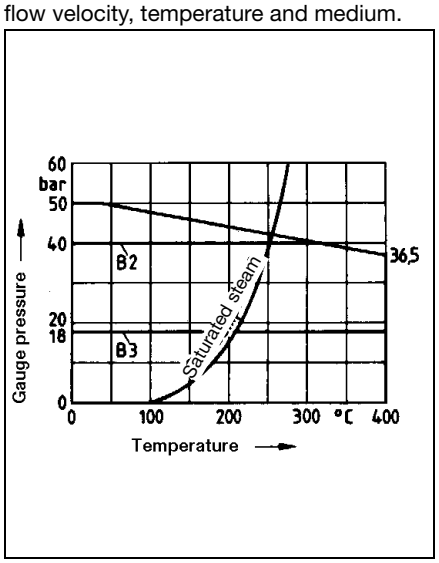

Fig. 22: Pressure loading for Form B protection tubes

stainless steel 1.4571
velocity up to 25m/sec in air
velocity up to 3m/sec in water

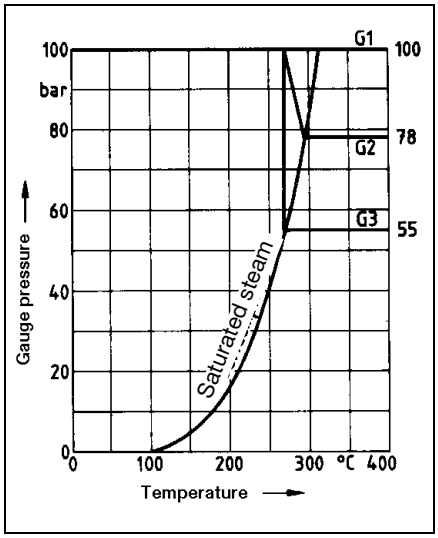

Fig. 23: Pressure loading for Form G protection tubes

stainless steel 1.4571
velocity up to 40m/sec in air
velocity up to 4m/sec in water

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As explained in the standard, the values indicated are guide values, which have to be individually examined for the specific application. Slight differences in the measurement conditions may suffice to destroy the protection tube.
If, when ordering an electric thermometer, it is required that the protection fitting be checked, the load type and the limit values have to be specified.

Fig. 24 shows the load limits (guide values) for different tube dimensions on a variety of additional thermometer designs. The maximum pressure loading of cylindrical protection tubes is shown in relation to the wall thickness with different tube diameters.
The data refer to protection tubes in stainless steel 1.4571, 100mm fitting length, 10m/sec flow velocity in air, or 4m/sec in water, and a temperature range from -20 to +100°C. A safety factor of 1.8 has been taken into account. For higher temperatures or different materials, the maximum pressure loading has to be reduced by the percentage values given in the table.

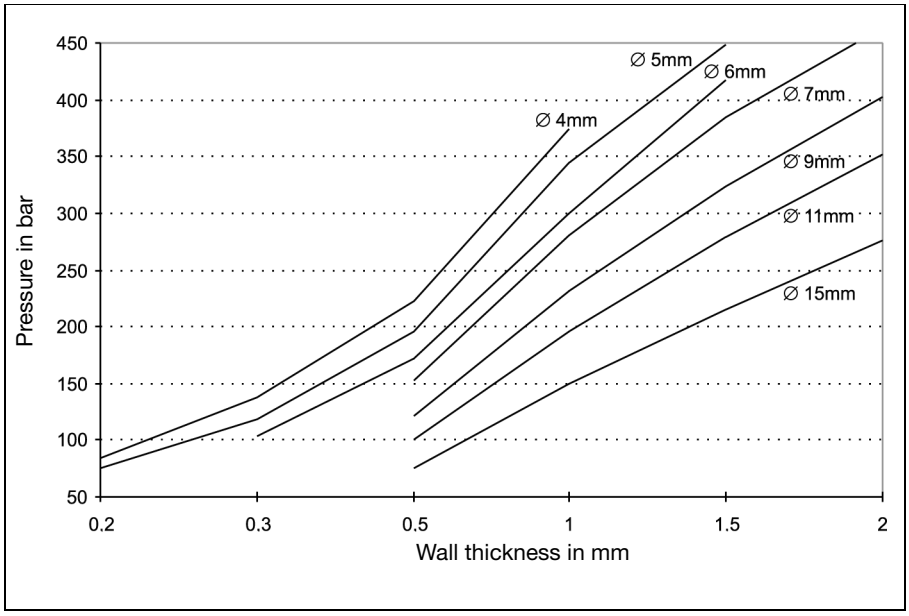

Fig. 24: Load limits on protection tubes, for various tube dimensions

Material	Temperature	Reduction
CrNi 1.4571	up to +200°C	-10%
CrNi 1.4571	up to +300°C	-20%
CrNi 1.4571	up to +400°C	-25%
CrNi 1.4571	up to +500°C	-30%
CuZn 2.0401	up to +100°C	-15%
CuZn 2.0401	up to +175°C	-60%

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Pressure test for thermometer protection fittings

The welded protection fittings of JUMO thermometers are subjected to a leakage test or a pressure test, depending on the construction of the protection fitting.

Thermometers which are manufactured to DIN or to application-specific guidelines (chemical or petrochemical plant, pressure vessel regulation, steam boilers) require different pressure tests according to the specific application.

If the thermometers are to be manufactured to such standards or guidelines, then the required tests or standards and/or guidelines have to be specified when ordering.

Scope of test
Tests can be carried out on each individual protection fitting and documented with a test report or acceptance certificate to EN 10204 (at extra cost).

Type of test
Tests can be performed on protection fittings up to a fitting length of 1050mm with flange connection DN25 or screw connection up to 1" thread size.

The following tests can be carried out:

Test type	Test medium	Pressure range	Test duration
Leakage test	helium	vacuum	10sec
Pressure test I	nitrogen	1 — 50bar	10sec
Pressure test II	water	50 — 300bar	10sec

Leakage test
A vacuum is produced inside the protection tube. From the outside, helium is applied to the protection fitting. If there is a leak in the protection tube, helium will penetrate and will be recognized through analysis. A leakage rate is determined by the rise in pressure (leakage rate > 1 x 10^{-6} l/bar).

Pressure test I
A positive pressure of nitrogen is applied to the protection tube from the outside. If there is a leak in the fitting, a volume flow will be produced inside the protection tube, which will be recognized.

Pressure test II
Water pressure is applied to the protection tube from the outside. The pressure must remain constant for a certain length of time. If this is not the case, the protection fitting has a leak.

Qualified welding processes for the production of protection tubes for thermometers

In addition to using perfect materials, it is the joining technique which, in the end, determines the mechanical stability and quality of the protection fittings. This is why the welding techniques at JUMO comply with the European Standards EN 287 and EN 288. Manual welding is carried out by qualified welders according to EN 287. Automatic welding processes are qualified by a WPS (welding instruction) to EN 288.

The following table provides an overview of the qualified welding processes:

	WIG welding	
Material	manual	automatic
W11, W11 with W01-W04 to EN 287	Tube diameter 2 — 30mm Wall thickness 0.75 — 5.6mm	Tube diameter 5 — 10mm Wall thickness 0.5 — 1.0mm

Table. 2: Qualified welding processes

Based on this experience, our welders can also join different materials and dimensions.

Laser beam welding is employed for wall thicknesses of less than 0.6mm, which is monitored by a laser beam specialist according to guideline DSV 1187.

On customers' request, material test certificates can be issued at extra cost. Likewise, special tests and treatments can be carried out, which are calculated according to the extent of the work, as set out in various application guidelines. This includes X-ray examinations, crack test (dye penetration test), thermal treatment, special cleaning processes and markings.

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Reference values according to EN 60 751 (ITS 90)

in ohms, for Pt100 temperature sensors, in 1°C steps

°C	-0	-1	-2	-3	-4	-5	-6	-7	-8	-9
-200	18.520	-	-	-	-	-	-	-	-	-
-190	22.825	22.397	21.967	21.538	21.108	20.677	20.247	19.815	19.384	18.952
-180	27.096	26.671	26.245	25.819	25.392	24.965	24.538	24.110	23.682	23.254
-170	31.335	30.913	30.490	30.067	29.643	29.220	28.796	28.371	27.947	27.552
-160	35.543	35.124	34.704	34.284	33.864	33.443	33.022	32.601	32.179	31.757
-150	39.723	39.306	38.889	38.472	38.055	37.637	37.219	36.800	36.382	35.963
-140	43.876	43.462	43.048	42.633	42.218	41.803	41.388	40.972	40.556	40.140
-130	48.005	47.593	47.181	46.769	46.356	45.944	45.531	45.117	44.704	44.290
-120	52.110	51.700	51.291	50.881	50.470	50.060	49.649	49.239	48.828	48.416
-110	56.193	55.786	55.378	54.970	54.562	54.154	53.746	53.337	52.928	52.519
-100	60.256	59.850	59.445	59.039	58.633	58.227	57.821	57.414	57.007	56.600
- 90	64.300	63.896	63.492	63.088	62.684	62.280	61.876	61.471	61.066	60.661
- 80	68.325	67.924	67.552	67.120	66.717	66.315	65.912	65.509	65.106	64.703
- 70	72.335	71.934	71.534	71.134	70.733	70.332	69.931	69.530	69.129	68.727
- 60	76.328	75.929	75.530	75.131	74.732	74.333	73.934	73.534	73.134	72.735
- 50	80.306	79.909	79.512	79.114	78.717	78.319	77.921	77.523	77.125	76.726
- 40	84.271	83.875	83.479	82.083	82.687	82.290	81.894	81.497	81.100	80.703
- 30	88.222	87.827	87.432	87.038	86.643	86.248	85.853	85.457	85.062	84.666
- 20	92.160	91.767	91.373	90.980	90.586	90.192	89.798	89.404	89.010	88.616
- 10	96.086	95.694	95.302	94.909	94.517	94.124	93.732	93.339	92.946	92.553
0	100.000	99.609	99.218	98.827	98.436	98.044	97.653	97.261	96.870	96.478

°C	0	1	2	3	4	5	6	7	8	9
0	100.000	100.391	100.781	101.172	101.562	101.953	102.343	102.733	103.123	103.513
10	103.903	104.292	104.682	105.071	105.460	105.849	106.238	106.627	107.016	107.405
20	107.794	108.182	108.570	108.959	109.347	109.735	110.123	110.510	110.898	111.286
30	111.673	112.060	112.447	112.835	113.221	113.608	113.995	114.382	114.768	115.155
40	115.541	115.927	116.313	116.699	117.085	117.470	117.856	118.241	118.627	119.012
50	119.397	119.782	120.167	120.552	120.936	121.321	121.705	122.090	122.474	122.858
60	123.242	123.626	124.009	124.393	124.777	125.160	125.543	125.926	126.309	126.692
70	127.075	127.458	127.840	128.223	128.605	128.987	129.370	129.752	130.133	130.515
80	130.897	131.278	131.660	132.041	132.422	132.803	133.184	133.565	133.946	134.326
90	134.707	135.087	135.468	135.848	136.228	136.608	136.987	137.367	137.747	138.126
100	138.506	138.885	139.264	139.643	140.022	140.400	140.779	141.158	141.536	141.914
110	142.293	142.671	143.049	143.426	143.804	144.182	144.559	144.937	145.314	145.691
120	146.068	146.445	146.822	147.198	147.575	147.951	148.328	148.704	149.080	149.456
130	149.832	150.208	150.583	150.959	151.334	151.710	152.085	152.460	152.865	153.210
140	153.584	153.959	154.333	154.708	155.082	155.456	155.830	156.204	156.578	156.952
150	157.325	157.699	158.072	158.445	158.818	159.191	159.564	159.937	160.309	160.682
160	161.054	161.427	161.799	162.171	162.543	162.915	163.286	163.658	164.030	164.401
170	164.772	165.143	165.514	165.885	166.256	166.627	166.997	167.368	167.738	168.108
180	168.478	168.848	169.218	169.588	169.958	170.327	170.696	171.066	171.435	171.804
190	172.173	172.542	172.910	173.279	173.648	174.016	174.384	174.752	175.120	175.488
200	175.856	176.224	176.591	176.959	177.326	177.693	178.060	178.427	178.794	179.161
210	179.528	179.894	180.260	180.627	180.993	181.359	181.725	182.091	182.456	182.822
220	183.188	183.553	183.918	184.283	184.648	185.013	185.378	185.743	186.107	186.472
230	186.836	187.200	187.564	187.928	188.292	188.656	189.019	189.383	189.746	190.110
240	190.473	190.836	191.199	191.562	191.924	192.287	192.649	193.012	193.374	193.736
250	194.098	194.460	194.822	195.183	195.545	195.906	196.268	196.629	196.990	197.351
260	197.712	198.073	198.433	198.794	199.154	199.514	199.875	200.235	200.595	200.954
270	201.314	201.674	202.033	202.393	202.752	203.111	203.470	203.829	204.188	204.546
280	204.905	205.263	205.622	205.980	206.338	206.696	207.054	207.411	207.769	208.127
290	208.484	208.841	209.198	209.555	209.912	210.269	210.626	210.982	211.339	211.695
300	212.052	212.408	212.764	213.120	213.475	213.831	214.187	214.542	214.897	215.252

The reference values have been calculated according to the International Temperature Scale ITS 90.
(The reference values must be multiplied by the factor 5 or 10 for Pt500 or Pt1000 temperature sensors).

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Reference values according to EN 60 751 (ITS 90)

in ohms, for Pt100 temperature sensors, in 1°C steps

°C	0	1	2	3	4	5	6	7	8	9
310	215.608	215.962	216.317	216.672	217.027	217.381	217.736	218.090	218.444	218.798
320	219.152	219.506	219.860	220.213	220.567	220.920	221.273	221.626	221.979	222.332
330	222.685	223.038	223.390	223.743	224.095	224.447	224.799	225.151	225.503	225.855
340	226.206	226.558	226.909	227.260	227.612	227.963	228.314	228.664	229.015	229.366
350	229.716	230.066	230.417	230.767	231.117	231.467	231.816	232.166	232.516	232.865
360	233.214	233.564	233.913	234.262	234.610	234.959	235.308	235.656	236.005	236.353
370	236.701	237.049	237.397	237.745	238.093	238.440	238.788	239.135	239.482	239.829
380	240.176	240.523	240.870	241.217	241.563	241.910	242.256	242.602	242.948	243.294
390	243.640	243.986	244.331	244.677	245.022	245.367	245.713	246.058	246.403	246.747
400	247.092	247.437	247.781	248.125	248.470	248.814	249.158	249.502	249.845	250.189
410	250.533	250.876	251.219	251.562	251.906	252.248	252.591	252.934	253.277	253.619
420	253.962	254.304	254.646	254.988	255.330	255.672	256.013	256.355	256.696	257.038
430	257.379	257.720	258.061	258.402	258.743	259.083	259.424	259.764	260.105	260.445
440	260.785	261.125	261.465	261.804	262.144	262.483	262.823	263.162	263.501	263.840
450	264.179	264.518	264.857	265.195	265.534	265.872	266.210	266.548	266.886	267.224
460	267.562	267.900	268.237	268.574	268.912	269.249	269.586	269.923	270.260	270.597
470	270.933	271.270	271.606	271.942	272.278	272.614	272.950	273.286	273.622	273.957
480	274.293	274.628	274.963	275.298	275.633	275.968	276.303	276.638	276.972	277.307
490	277.641	277.975	278.309	278.643	278.977	279.311	279.644	279.978	280.311	280.644
500	280.978	281.311	281.643	281.976	282.309	282.641	282.974	283.306	283.638	283.971
510	284.303	284.634	284.966	285.298	285.629	285.961	286.292	286.623	286.954	287.285
520	287.616	287.947	288.277	288.608	288.938	289.268	289.599	289.929	290.258	290.588
530	290.918	291.247	291.577	291.906	292.235	292.565	292.894	293.222	293.551	293.880
540	294.208	294.537	294.865	295.193	295.521	295.849	296.177	296.505	296.832	297.160
550	297.487	297.814	298.142	298.469	298.795	299.122	299.449	299.775	300.102	300.428
560	300.754	301.080	301.406	301.732	302.058	302.384	302.709	303.035	303.360	303.685
570	304.010	304.335	304.660	304.985	305.309	305.634	305.958	306.282	306.606	306.930
580	307.254	307.578	307.902	308.225	308.549	308.872	309.195	309.518	309.841	310.164
590	310.487	310.810	311.132	311.454	311.777	312.099	312.421	312.743	313.065	313.386
600	313.708	314.029	314.351	314.672	314.993	315.314	315.635	315.956	316.277	316.597
610	316.918	317.238	317.558	317.878	318.198	318.518	318.838	319.157	319.477	319.796
620	320.116	320.435	320.754	321.073	321.391	321.710	322.029	322.347	322.666	322.984
630	323.302	323.620	323.938	324.256	324.573	324.891	325.208	325.526	325.843	326.160
640	326.477	326.794	327.110	327.427	327.744	328.060	328.376	328.692	329.008	329.324
650	329.640	329.956	330.271	330.587	330.902	331.217	331.533	331.848	332.162	332.477
660	332.792	333.106	333.421	333.735	334.049	334.363	334.677	334.991	335.305	335.619
670	335.932	336.246	336.559	336.872	337.185	337.498	337.811	338.123	338.436	338.748
680	339.061	339.373	339.685	339.997	340.309	340.621	340.932	341.244	341.555	341.867
690	342.178	342.489	342.800	343.111	343.422	343.732	344.043	344.353	344.663	344.973
700	345.284	345.593	345.903	346.213	346.522	346.832	347.141	347.451	347.760	348.069
710	348.378	348.686	348.995	349.303	349.612	349.920	350.228	350.536	350.844	351.152
720	351.460	351.768	352.075	352.382	352.690	352.997	353.304	353.611	353.918	354.224
730	354.531	354.837	355.144	355.450	355.756	256.062	356.368	356.674	356.979	357.285
740	357.590	357.896	358.201	358.506	358.811	359.116	359.420	359.725	360.029	360.334
750	360.638	360.942	361.246	361.550	361.854	362.158	362.461	362.765	363.068	363.371
760	363.674	363.977	364.280	364.583	364.886	365.188	365.491	365.793	366.095	366.397
770	366.699	367.001	367.303	367.604	367.906	368.207	368.508	368.810	369.111	369.412
780	369.712	370.013	370.314	370.614	370.914	371.215	371.515	371.815	372.115	372.414
790	372.714	373.013	373.313	373.612	373.911	374.210	374.509	374.808	375.107	375.406
800	375.704	376.002	376.301	376.599	376.897	377.195	377.493	377.790	378.088	378.385
810	378.683	378.980	379.277	379.574	379.871	380.167	380.464	380.761	381.057	381.353
820	381.650	381.946	382.242	382.537	382.833	383.129	383.424	383.720	384.015	384.310
830	384.605	384.900	385.195	385.489	385.784	386.078	386.373	386.667	386.961	387.255
840	387.549	387.843	388.136	388.430	388.723	389.016	389.310	389.603	389.896	390.188
850	390.481	-	-	-	-	-	-	-	-	-

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Electrical Temperature Measurement

with thermocouples and resistance thermometers

Matthias Nau

Electrical temperature sensors have become indispensable components in modern automation, consumer goods and production technology. As a result of the rapid expansion of automation during recent years, they have become firmly established in industrial engineering.

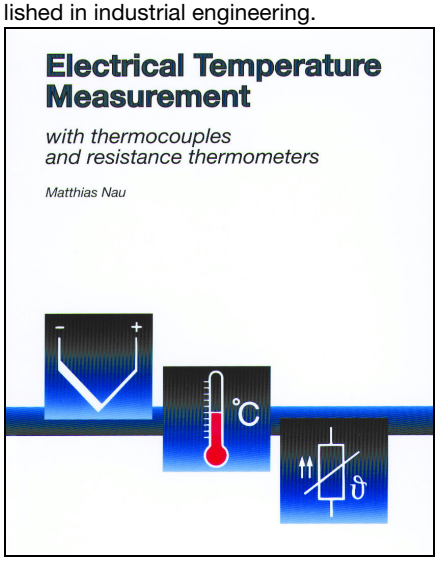

Fig. 25: Publication Electrical Temperature Measurement with thermocouples and resistance thermometers

In view of this large spectrum of available products for temperature measurement it is becoming ever more important for the user to select the one suitable for his application.

On 160 pages this publication deals with the theoretical fundamentals of electrical temperature measurement, the practical implementation of temperature sensors, their standardization, electrical connection, tolerances and types of construction.

In addition, it describes in detail the different fittings for electrical thermometers, their classification according to DIN standards, and the great variety of applications. An extensive section with tables for voltage and resistance series according to DIN and EN makes the book a valuable guide, both for the experienced practical engineer and the novice in the field of electrical temperature measurement.

You can order a copy by quoting Sales No. 90/00085081 or download from www.jumo.net.

Because of the high handling costs, schools, institutes and universities are asked to place a bulk order.

Error Analysis of a Temperature Measurement System

with worked examples

Gerd Scheller

This 44-page publication helps in the evaluation of measurement uncertainty, particularly through the worked examples in Chapter 3. Where problems arise, we are glad to discuss specific problems with our customers, and to give practical advice.

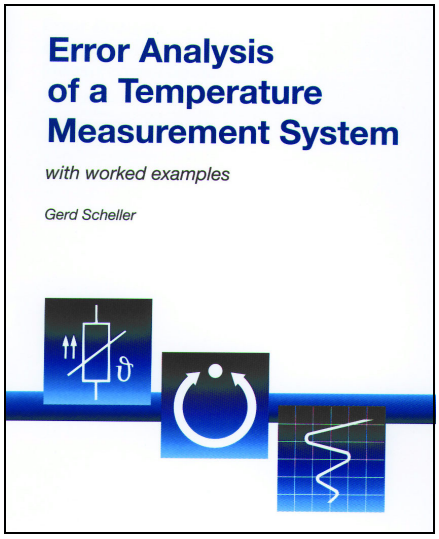

Fig. 26: Publication Error Analysis of a Temperature Measurement System, with worked examples

In order to be able to make comparable measurements, their quality must be expressed through specifying the measurement uncertainty. The ISO/BIPM “Guide to the Expression of Uncertainty in Measurement”, published in 1993 and usually referred to as GUM, introduced a standardized method for the determination and definition of measurement uncertainty. This method was adopted by calibration laboratories around the world. However, the application requires a certain level of mathematical understanding. Further chapters present the topic of measurement uncertainty in a simplified and easily understandable fashion to all users of temperature measurement systems.
Errors in the installation of the temperature sensors and the connections to the evaluation electronics lead to increased errors in measurement. To these must be added the measurement uncertainty components of the sensor and the evaluation electronics. The explanation of the various components of measurement uncertainty is followed by some worked examples.
Knowledge of the measurement uncertainty components and their magnitudes enable the user to reduce individual components through the choice of equipment or altered installation conditions. The decisive factor is always, which level of measurement uncertainty is acceptable for a specific application. For instance, if a standard specifies tolerance limits for the deviation of a temperature from a nominal value, the measurement uncertainty of the method used for temperature measurement should not be larger than 1/3 of the tolerance.

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German Calibration Service (DKD) at JUMO

Certification laboratory for temperature

Raised quality expectations, improved measurement technology and, of course, quality assurance systems, such as ISO 9000, make increasing demands on the documentation of processes and the monitoring of measuring devices.
In addition, there are increasing calls from customers for high product quality standards. Particularly stringent demands arise from ISO 9000 and EN 45 000, whereby measurements must be traceable to national or international standards. This provides the legal basis for obliging suppliers and manufacturers (of products that are subject to processes where temperature is relevant) to check all testing devices which can affect the product quality, before use or at specified intervals. Generally, this is done by calibrating or adjusting with certified devices. Because of the high demand for calibrated instruments and the large number of instruments to be calibrated, the state laboratories have insufficient capacity. The industry has therefore established and supports special calibration laboratories which are linked to the German Calibration Service (DKD) and subordinate to the PTB (Physikalisch-Technische-Bundesanstalt) for all aspects of instrumentation.

The certification laboratory of the German Calibration Service at JUMO has carried out calibration certification for temperature since 1992. This service provides fast and economical certification for everyone.
DKD calibration certificates can be issued for resistance thermometers, thermocouples, direct-reading measuring systems, data loggers and temperature block calibrators as well as temperature probes with built-in transmitter, within the measuring range -80 to +1100°C.
The traceability of the reference standard is the central issue here. All DKD calibration certificates are recognized as documents of traceability, without any further specifications. The DKD certification laboratory at JUMO has the identification DKD-K-09501-04 and is accredited to EN ISO/IEC 17 025.

You can order a brochure free of charge, either by ordering Publication PR 90029 or download from www.jumo.net

A practical aid for everyday use

"Standard values for resistance thermometers and thermocouples"

This practical aid for use in laboratories, production, customer service and education contains the standard voltage values for thermocouple types J, K, T, N, S, R and B according to EN 60 584, and resistance values for Pt100 resistance thermometers according to EN 60 751.

With this tool you can quickly find the thermal voltage or resistance value for any temperature – or the other way around.

The pocket slide-rule type calculator, the replaceable data tables, color-coded according the type of element, and the corresponding operating instructions, are all made in wipeable plastic. The complete set is kept in a clear plastic pocket to keep it clean.

The WINDOWS calculation program, provided on a diskette, generates the standard values for freely selectable temperature limits and increment sizes. These tables can also be exported for further processing in other applications.

In addition, resistance values, thermal voltages and tolerance classes defined in the standards can be determined for any temperature. Conversely, you can calculate the temperature that corresponds to a given signal from the sensor.

Furthermore, the individual characteristic parameters for resistance thermometers can be programmed and saved, whereby all the calculation options are available and can be used.

Pocket slide-rule calculator
Can be ordered by quoting
Sales No. 90/00341111.

3 1/2" diskette version
Can be ordered by quoting
Sales No. 90/00341183 or
download from www.jumo.net

Because of the high handling costs, schools, institutes and universities are asked to place a bulk order.

Fig. 27: Pocket slide-rule calculator and WINDOWS program "Standard values for resistance thermometers and thermocouples" – a practical aid for everyday use

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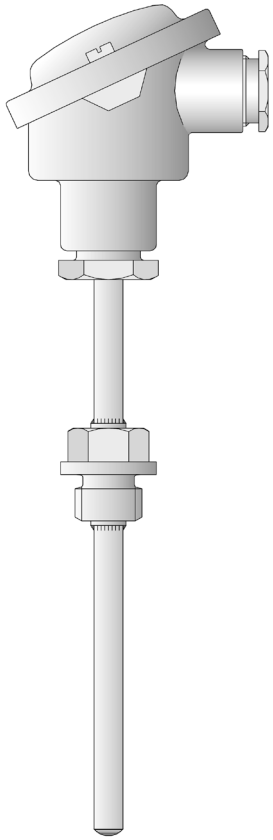
Screw-in resistance thermometers with terminal head Form B



- **for temperatures from -50 to +600°C**
- **with replaceable measuring insert**
- **as single or twin resistance thermometer**
- **terminal head Form B, BUZ, BUZH, BBK**
- **with transmitter option**

Screw-in resistance thermometers are preferred for measuring temperatures in liquids and gases. An important selection criterion is their reliable sealing against both negative and positive pressures. Applications include HVAC and refrigeration, as well as heating installations, ovens, furnaces and plant engineering.

The terminal head is suitable for temperatures up to +100°C. Terminal heads Form BUZ, BUZH and BBK are available in addition to the standard Form B.

The measuring insert is normally fitted with a Pt100 temperature sensor to EN 60 751, Class B in 2-wire circuit. Versions with Pt500 or Pt1000 are also available. 3-wire or 4-wire circuit connections can be provided. Optionally, it is possible to integrate a transmitter into the terminal head.

Technical data

Terminal head	Form B DIN 43 729, aluminium die-casting, M 20x1.5; IP54, ambient temperature -40 to +100°C Form BUZ, aluminium die-casting, M 20x1.5; IP65, ambient temperature -40 to +100°C Form BUZH, aluminium die-casting, M 20x1.5; IP65, ambient temperature -40 to +100°C Form BBK, plastic, M 20x1.5; IP54, ambient temperature -30 to +130°C Caution: reduced ambient temperature when using transmitters, Data Sheets 70.7030 (95.6530) and 70.7010 (95.6550)
Extension tube	stainless steel 1.4571, length 130mm (150mm for Type 902002/50.../51...)
Process connection	thread, stainless steel 1.4571 pocket, stainless steel 1.4571 or steel 1.7335
Protection tube	stainless steel 1.4571, 9mm, 11mm and 12mm dia.
Measuring insert	replaceable, Pt100 temperature sensor EN 60 751, Cl. B, 2-wire circuit (not replaceable on Type 902002/25)
Response times	$t_{0.9}$ approx. 50sec, in water 0.2 m/sec, 9mm dia.
Transmitter	analog transmitter, output 4 - 20mA, Data Sheet 70.7030 (95.6530) analog transmitter, output 0 - 10V, Data Sheet 70.7030 (95.6530) programmable transmitter, output 4 - 20mA/20 - 4mA, Data Sheet 70.7010 (95.6550)
Accessories	pocket, Data Sheet 90.9721

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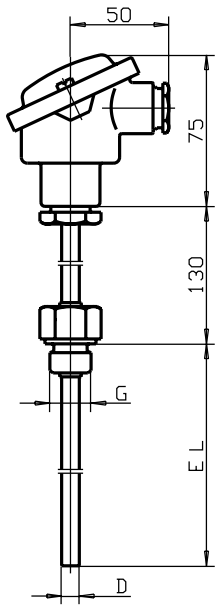
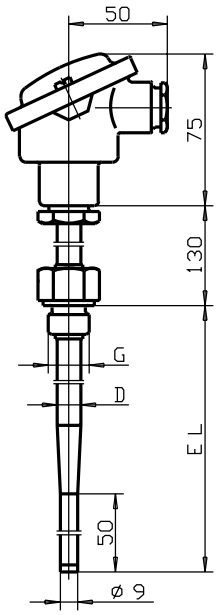
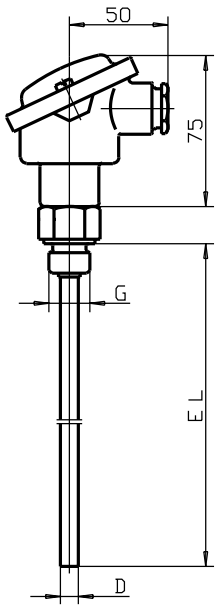
Dimensions



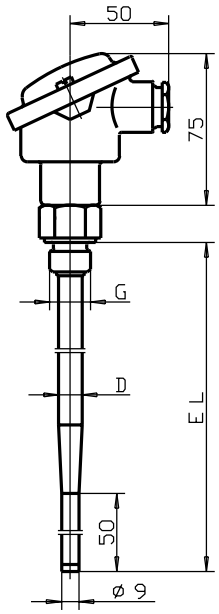
Type 902002/10



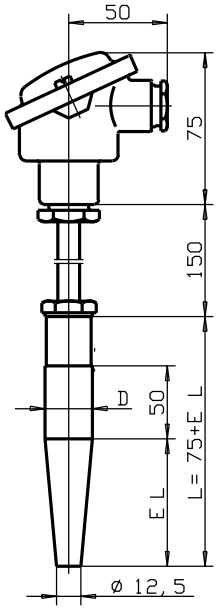
Type 902002/11



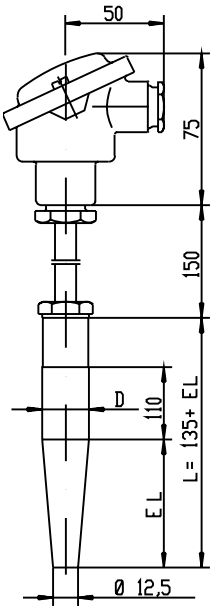
Type 902002/20
Type 902002/25



Type 902002/21



Type 902002/50



Type 902002/51

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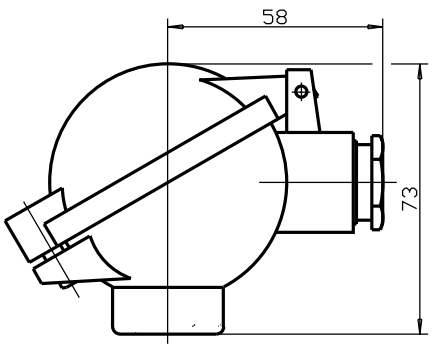
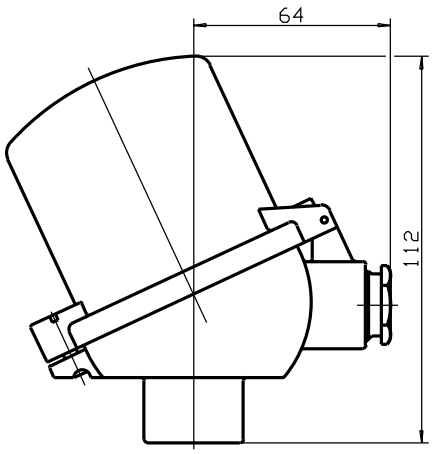
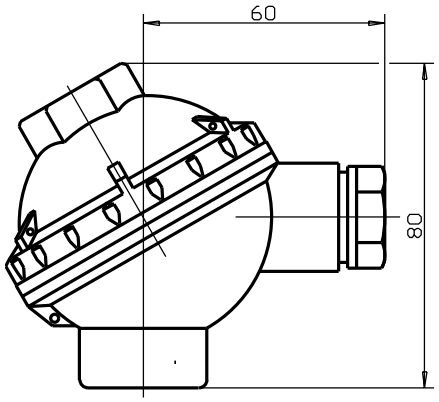
Dimensions



Terminal head Form BUZ
extra code 320



Terminal head Form BUZH
extra code 321



Terminal head Form BBK
extra code 322

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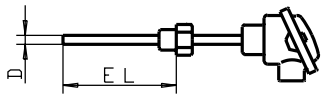
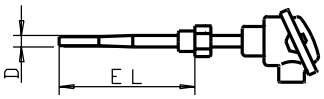
Order details: Screw-in resistance thermometers with terminal head Form B

(1) Basic version

902002/10 Screw-in resistance thermometer with extension tube, continuous protection tube



902002/11 Screw-in resistance thermometer with stepped protection tube



			(2) Operating temperature in °C
x	x	402	-50 to +400°C (standard)
x	x	415	-50 to +600°C
			(3) Measuring insert
x	x	1001	1 x Pt100 in 3-wire circuit
x	x	1003	1 x Pt100 in 2-wire circuit
x	x	1011	1 x Pt100 in 4-wire circuit
x	x	2001	2 x Pt100 in 3-wire circuit
x	x	2003	2 x Pt100 in 2-wire circuit
			(4) Tolerance class to EN 60 751
x	x	1	Class B (standard)
x	x	2	Class A
			(5) Protection tube diameter D in mm
x		9	9mm
x		11	11mm
	x	12	12mm stepped down to 9mm
			(6) Fitting length EL in mm (100 ≤EL ≤1000, EL ≤700 for Type 902002/11)
x	x	160	160mm
	x	220	220mm
x	x	250	250mm
	x	280	280mm
x	x	400	400mm
x	x	...	please specify in plain text (50mm steps)
			(7) Process connection
x	x	104	thread 1/2"pipe
x	x	105	thread 3/4"pipe
x	x	106	thread 1"pipe
x	x	126	thread M 18 x 1.5
			(8) Extra codes
x	x	000	no extra code
x	x	306	extension tube 70mm
x	x	320	terminal head Form BUZ
x	x	321	terminal head Form BUZH
x	x	322	terminal head Form BBK
x	x	330	1 x analog transmitter, output 4 - 20mA[2], Data Sheet 70.7030 (95.6530)
x	x	331	1 x programmable transmitter, output 4 - 20mA/20 - 4mA[3], Data Sheet 70.7010 (95.6550)
x	x	333	1 x analog transmitter, output 0 - 10V[2], Data Sheet 70.7030 (95.6530)
x	x	334	2 x analog transmitter, output 4 - 20mA[2], Data Sheet 70.7030 (95.6530)
x	x	335	2 x programmable transmitter, output 4 - 20mA/20 - 4mA[3], Data Sheet 70.7010 (95.6550)
x	x	337	2 x analog transmitter, output 0 - 10V[2], Data Sheet 70.7030 (95.6530)

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
Order code		-		-		-		-		-		-		/		,...
Order example	902002/10	-	402	-	1001	-	1	-	11	-	250	-	106	/	000[1]	

1. List extra codes in sequence, separated by commas.
2. Please specify range in plain text.
3. Please specify range and output signal in plain text.

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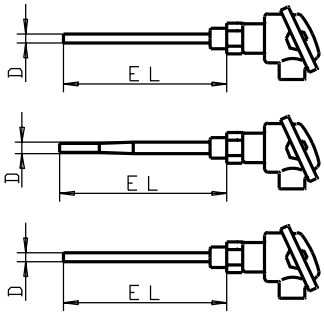
Order details: Screw-in resistance thermometers with terminal head Form B

(1) Basic version

			902002/20	Screw-in resistance thermometer without extension tube, continuous protection tube
			902002/21	Screw-in resistance thermometer without extension tube, stepped protection tube
			902002/25	Screw-in resistance thermometer without extension tube, continuous protection tube, without replaceable measuring insert



				(2) Operating temperature in °C
x	x	x	402	-50 to +400°C (standard)
x	x	x	415	-50 to +600°C
				(3) Measuring insert
x	x	x	1001	1 x Pt100 in 3-wire circuit
x	x	x	1003	1 x Pt100 in 2-wire circuit
x	x	x	1011	1 x Pt100 in 4-wire circuit
x	x		2001	2 x Pt100 in 3-wire circuit
x	x	x	2003	2 x Pt100 in 2-wire circuit
				(4) Tolerance class to EN 60 751
x	x	x	1	Class B (standard)
x	x	x	2	Class A
				(5) Protection tube diameter D in mm
		x	7	7mm
x			9	9mm
x			11	11mm
	x		12	12mm stepped down to 9mm
				(6) Fitting length EL in mm (100 ≤EL ≤1000, EL ≤700 for Type 902002/21)
x	x	x	100	100mm
x	x	x	160	160mm
x	x	x	250	250mm
x	x	x	400	400mm
x	x	x	...	please specify in plain text (50mm steps)
				(7) Process connection
x	x	x	104	thread 1/2"pipe
x	x	x	105	thread 3/4"pipe
x	x	x	106	thread 1"pipe
x	x	x	126	thread M 18 x 1.5
				(8) Extra codes
x	x	x	000	no extra code
x	x	x	320	terminal head Form BUZ
x	x	x	321	terminal head Form BUZH
x	x	x	322	terminal head Form BBK
x	x	x	330	1 x analog transmitter, output 4 - 20mA[2], Data Sheet 70.7030 (95.6530)
x	x	x	331	1 x programmable transmitter, output 4 - 20mA/20 - 4mA[3], Data Sheet 70.7010 (95.6550)
x	x	x	333	1 x analog transmitter, output 0 - 10V[2], Data Sheet 70.7030 (95.6530)
x	x	x	334	2 x analog transmitter, output 4 - 20mA[2], Data Sheet 70.7030 (95.6530)
x	x	x	335	2 x programmable transmitter, output 4 - 20mA/20 - 4mA[3], Data Sheet 70.7010 (95.6550)
x	x	x	337	2 x analog transmitter, output 0 - 10V[2], Data Sheet 70.7030 (95.6530)

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
Order code		-		-		-		-		-		-		/		,...
Order example	902002/20	-	402	-	1001	-	1	-	9	-	160	-	104	/	000[1]	

1. List extra codes in sequence, separated by commas.
2. Please specify range in plain text.
3. Please specify range and output signal in plain text.

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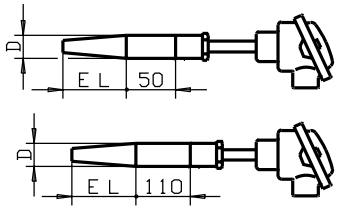
Order details: Screw-in resistance thermometers with terminal head Form B

(1) Basic version

		902002/50	Screw-in resistance thermometer with pocket DIN 43 767 Form D1/D2
		902002/51	Screw-in resistance thermometer with pocket DIN 43 767 Form D4/D5



			(2) Operating temperature in °C (for restrictions see DIN 43 763)
x	x	402	-50 to +400°C (standard)
x	x	415	-50 to +600°C
			(3) Measuring insert
x	x	1001	1 x Pt100 in 3-wire circuit
x	x	1003	1 x Pt100 in 2-wire circuit
x	x	1011	1 x Pt100 in 4-wire circuit
x	x	2001	2 x Pt100 in 3-wire circuit
x	x	2003	2 x Pt100 in 2-wire circuit
			(4) Tolerance class to EN 60 751
x	x	1	Class B (standard)
x	x	2	Class A
			(5) Pocket diameter D in mm
x	x	24	24 mm dia. stepped down to 12.5mm
			(6) Fitting length EL in mm
x	x	65	65mm with Form D 1 / D 4
x	x	125	125mm with Form D2 / D5
			(7) Pocket material
x	x	26	stainless steel X 6 CrNiMoTi 17 12 2, 1.4571 (operating temperature +600°C)
x	x	36	steel 13 CrMo 44, 1.7335 (operating temperature +540°C)
			(8) Extra codes
x	x	000	no extra code
x	x	306	extension tube 70mm
x	x	320	terminal head Form BUZ
x	x	321	terminal head Form BUZH
x	x	322	terminal head Form BBK
x	x	330	1 x analog transmitter, output 4 - 20mA[2], Data Sheet 70.7030 (95.6530)
x	x	331	1 x programmable transmitter, output 4 - 20mA/20 - 4mA[3], Data Sheet 70.7010 (95.6550)
x	x	333	1 x analog transmitter, output 0 - 10V[2], Data Sheet 70.7030 (95.6530)
x	x	334	2 x analog transmitter, output 4 - 20mA[2], Data Sheet 70.7030 (95.6530)
x	x	335	2 x programmable transmitter, output 4 - 20mA/20 - 4mA[3], Data Sheet 70.7010 (95.6550)
x	x	337	2 x analog transmitter, output 0 - 10V[2], Data Sheet 70.7030 (95.6530)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Order code	[ ]	- [ ]	- [ ]	- [ ]	- [ ]	- [ ]	- [ ]	/ [ ] ,...
Order example	902002/50	- 402	- 1001	- 1	- 24	- 65	- 26	/ 000[1]

1. List extra codes in sequence, separated by commas.
2. Please specify range in plain text.
3. Please specify range and output signal in plain text.

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Stock versions

(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	Sales No.
902002/10	-	402	-	1003	-	1	-	9	-	160	-	104	/	000	90/00055562
902002/10	-	402	-	1003	-	1	-	9	-	250	-	104	/	000	90/00055563
902002/10	-	402	-	1003	-	1	-	9	-	400	-	104	/	000	90/00055564
902002/10	-	402	-	2003	-	1	-	9	-	160	-	104	/	000	90/00055565
902002/10	-	402	-	2003	-	1	-	9	-	250	-	104	/	000	90/00055566
902002/10	-	402	-	2003	-	1	-	9	-	400	-	104	/	000	90/00055567
902002/10	-	402	-	1001	-	1	-	9	-	160	-	104	/	330 (0 to 100°C)	90/00054616
902002/10	-	402	-	1001	-	1	-	9	-	160	-	104	/	330 (0 to 200°C)	90/00087522
902002/10	-	402	-	1001	-	1	-	9	-	250	-	104	/	330 (0 to 100°C)	90/00054617
902002/10	-	402	-	1001	-	1	-	9	-	250	-	104	/	330 (0 to 200°C)	90/00087527
902002/10	-	402	-	1001	-	1	-	9	-	400	-	104	/	331 (0 to 100°C)	90/00335111
902002/25	-	402	-	1003	-	1	-	7	-	100	-	104	/	330 (0 to 100°C)	90/00081832
902002/25	-	402	-	1003	-	1	-	7	-	100	-	104	/	331 (0 to 100°C)	90/00342414

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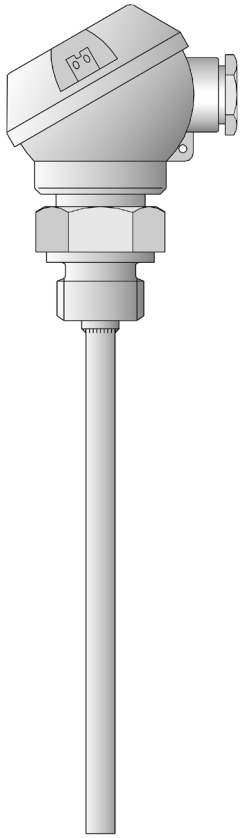
Screw-in resistance thermometers with terminal head Form J



- **for temperatures from -50 to +400°C**
- **as single or twin resistance thermometer**
- **available with transmitter**

Screw-in resistance thermometers are preferred for measuring temperatures in liquids and gases. An important selection criterion is their reliable sealing against both positive and negative pressures. Applications include HVAC and refrigeration, as well as heating installations, ovens, furnaces and plant engineering.

The measuring insert is normally fitted with a Pt100 temperature sensor to EN 60 751, Class B in 2-wire circuit. Versions with Pt500 or Pt1000 are also available. There is a choice of 3-wire and 4-wire circuit connections. A transmitter can optionally be integrated into the terminal head.

Technical data

Terminal head	Form J, aluminium die-casting, M 16x1.5; IP54, ambient temperature -40 to +100°C Caution: reduced ambient temperature when using transmitters, Data Sheet 70.7030
Process connection	thread, stainless steel 1.4571
Protection tube	stainless steel 1.4571, 6mm, 7mm and 8mm dia.
Measuring insert	Pt100 temperature sensor, EN 60 751, Cl. B, 2-wire circuit
Response times	$t_{0.9}$ = 14sec, in water 0.2m/sec, 7mm dia.
Transmitter	analog transmitter, output 4 - 20mA, Data Sheet 70.7030
Accessories	pocket, see Data Sheet 90.9721

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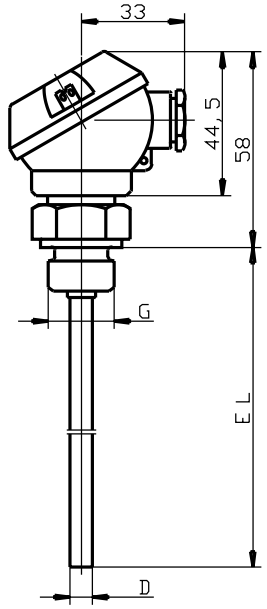
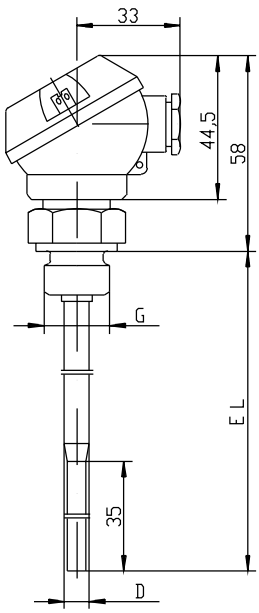
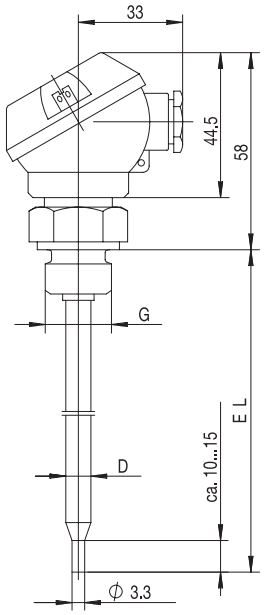
Dimensions



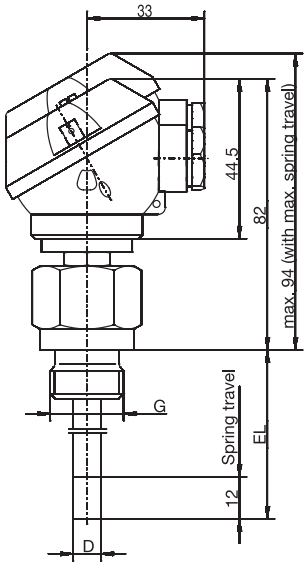
Type 902003/10



Type 902003/11



Type 902003/31



Type 902003/80

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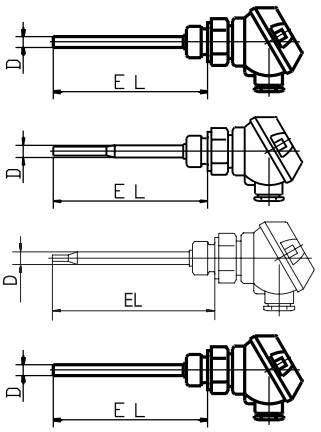
Order details: Screw-in resistance thermometers with terminal head Form J

(1) Basic version

902003/10	Screw-in resistance thermometer with continuous protection tube
902003/11	Screw-in resistance thermometer with stepped protection tube
902003/31	Screw-in resistance thermometer with stepped protection tube for measurement in air
902003/80	Screw-in resistance thermometer with spring-loaded screw fitting, 12mm spring travel, terminal head can be rotated through 360°



					(2) Operating temperature in °C
			x	378	-50 to +180°C
		x		380	-50 to +200°C
x	x			402	-50 to +400°C
					(3) Measuring insert
x	x	x	x	1001	1 x Pt100 in 3-wire circuit
x	x	x	x	1003	1 x Pt100 in 2-wire circuit
x	x	x	x	1011	1 x Pt100 in 4-wire circuit
x	x	x	x	2003	2 x Pt100 in 2-wire circuit
					(4) Tolerance class to EN 60 751
x	x	x	x	1	Class B (standard)
x	x	x	x	2	Class A
					(5) Protection tube diameter D in mm
		x		6	6mm
x				7	7mm
	x		x	8	8mm stepped down to 6mm (basic version 902003/80 not stepped down)
					(6) Fitting length EL in mm (100≤ EL ≤1000, EL ≥50 for type 902003/10)
x			x	50	50mm
x	x	x	x	100	100mm
x	x	x	x	150	150mm
x	x	x	x	250	250mm
x	x	x	x	...	please specify in plain text (50mm steps)
					(7) Process connection
x	x	x		103	thread 3/8" pipe
x	x	x	x	104	thread 1/2" pipe
					(8) Extra codes
x	x	x	x	000	no extra code
x	x	x	x	330	1 x analog transmitter, output 4 - 20mA[2], Data Sheet 70.7030

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)
Order code		-		-		-		-		-		-		/	
Order example	902003/10	-	402	-	1001	-	1	-	7	-	100	-	104	/	000

2. please specify range in plain text

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Stock versions

(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	Sales No.
902003/10	-	402	-	1003	-	1	-	7	-	50	-	104	/	000	90/00055689
902003/10	-	402	-	1003	-	1	-	7	-	100	-	104	/	000	90/00055690
902003/10	-	402	-	1003	-	1	-	7	-	150	-	104	/	000	90/00055691
902003/10	-	402	-	1003	-	1	-	7	-	250	-	104	/	000	90/00064839
902003/10	-	402	-	2003	-	1	-	7	-	50	-	104	/	000	90/00064777
902003/10	-	402	-	2003	-	1	-	7	-	100	-	104	/	000	90/00055695
902003/10	-	402	-	2003	-	1	-	7	-	150	-	104	/	000	90/00064778
902003/10	-	402	-	1003	-	1	-	7	-	50	-	103	/	000	90/00055700
902003/10	-	402	-	1003	-	1	-	7	-	100	-	103	/	000	90/00055701
902003/10	-	402	-	1003	-	1	-	7	-	100	-	104	/	330 (-40 to +60°C)	90/00089239
902003/10	-	402	-	1003	-	1	-	7	-	100	-	104	/	330 (0 to 100°C)	90/00088375
902003/10	-	402	-	1003	-	1	-	7	-	150	-	104	/	330 (0 to 100°C)	90/00088279
902003/31	-	380	-	1003	-	1	-	6	-	75	-	104	/	000	90/00438406
902003/31	-	380	-	1003	-	1	-	6	-	100	-	104	/	000	90/00438408
902003/31	-	380	-	1003	-	1	-	6	-	150	-	104	/	000	90/00438409

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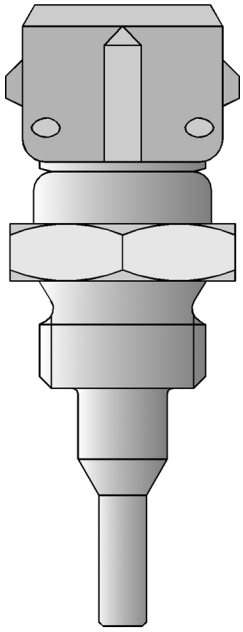
JUMO VIBROtemp
Screw-in resistance thermometers with plug connector



- **for temperatures from -50 to +300°C**
- **highly resistant to shock and vibration**
- **connector locked in for reliable contact, IP65 or IP69K protection**
- **available with transmitter**
- **GL approval for Type 902004/20 ...**

Shockproof screw-in resistance thermometers enable temperature measurement under pressure in motors, compressors, plant engineering and in ship building.
The connection between the protection fitting and the connecting cable incorporates a locking system and has IP65 or IP69K protection rating when assembled.

The measuring insert is normally fitted with a Pt100 temperature sensor to EN 60 751, Class B in 2-wire circuit. Versions with Pt500 or Pt1000 as well as semiconductor or NTC temperature sensors (only on Types 902004/10 and .../15) can also be supplied. With Types 902004/20 and .../21, there is a choice between 2-wire and 4-wire circuit connections. Types 902004/25 to .../29 are available with transmitter (output 4 – 20 mA).

Technical data

Connection	Type 902004/10 plug connector with gold-plated contacts, IP65 when assembled Type 902004/15 connector DIN 72 585, IP69K when assembled Types 902004/20, ... /25 and .../28, connector EN 175301-803, Pg9 Types 902004/21, ... /26 and .../29, connector EN 175301-803, Pg11 max. conductor cross-section 1.5 mm^2, IP65, ambient temperature -40 to +125°C, version with transmitter: ambient temperature -40 to +85°C	
Process connection	thread, stainless steel 1.4301 / 1.4571	
Protection tube	stainless steel 1.4301, 6 mm and 7.5 mm dia. stepped down to 4 mm brass 2.0401, 7.5 mm dia. stepped down to 4 mm stainless steel 1.4571, 8 mm and 6 mm dia. stepped down to 3.3 mm, pressure loading 50 bar max. at 200°C (Types 902004/20 and .../21)	
Measuring insert	Pt100 temperature sensor, EN 60 751, Class B in 2-wire circuit (replaceable on Types 902004/20 and .../21)[1]	
Protection	IP65, IP69K when assembled (Type 902004/15)	
Response times	Type 902004/10:	$t_{0.5}$ = 1.2 sec, $t_{0.9}$ = 6 sec, in water with 0.2 m/sec, 4 mm dia.
	Type 902004/15:	$t_{0.5}$ = 1.2 sec, $t_{0.9}$ = 6 sec, in water with 0.2 m/sec, 4 mm dia.
	Types 902004/20 and .../21:	$t_{0.5}$ = 15 sec, $t_{0.9}$ = 45 sec, in water with 0.2 m/sec, 8 mm dia.
		$t_{0.5}$ = 23 sec, $t_{0.9}$ = 59 sec, in oil with 0.2 m/sec, 8 mm dia.
	Types 902004/25 to .../29:	$t_{0.5}$ = <2 sec, $t_{0.9}$ = <4 sec, in water with 0.2 m/sec, 6 mm dia. stepped down to 3.3 mm
Vibration strength	Germanischer Lloyd Application Category D Characteristic 2	
Approvals	Types 902004/20 and .../21 GL Germanischer Lloyd	
Accessories	pockets, Data Sheet 90.9721 mating plug for Type 902004/10 with or without siliconized connecting cable, 2.5 m long, Data Sheet 90.9726, mating plug for Type 902004/15 on request mating plug for extra code 424 (machinery plug M 12x1) with PVC connecting cable, 2 m long	

[1] On Types 902004/20 and ... /21, short fitting lengths in conjunction with unfavorable installation conditions (heat conduction error) may result in the tolerance class being exceeded.

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Technical data

Transmitter	**Input**	
	Measurement input	Pt100 (EN 60 751)
	Measurement range limits	-50 to +260°C
	Measurement span	25 to 310°C (also see “zero point shift”)
	Zero point shift see Data Sheet 95.6530, page 7/10	on spans < 75°C fixed zero point setting: -40°C, -20°C, 0°C, 20°C, 40°C on spans ≥ 75°C: ±50°C
	Sensor current	≤ 0.5mA
	Sampling rate	continuous measurement because of analog signal path
	Measurement circuit monitoring	
	Underrange	falling to ≤ 3.6mA
	Overrange	rising to ≥ 22mA to < 28mA (24mA typical)
	Probe short circuit	≤ 3.6mA
	Probe and lead break	positive: ≥ 22mA to < 28mA (24mA typical)
	Output	
	Output signal	proportional DC current 4 – 20mA
	Transfer characteristic	linear with temperature
	Transfer accuracy	≤ ±0.1%
	Damping of ripple on 24V supply, amplitude 10V/50Hz, burden 470Ω/load 10MΩ	40dB
	Burden (Rb)	Rb = (Ub - 7.5V) / 22mA
	Burden error	≤ ±0.02% / 100Ω[1]
	Settling time on temperature change	≤10msec
	Calibration conditions	24V DC / approx. 22°C
	Calibration accuracy	≤ ±0.2%[1,2] or ≤ ±0.2°C
	Overall accuracy: sensor/calibration	±0.4°C (typical) at 20°C / 24V DC supply voltage
	Supply	
	Supply voltage (Ub)	7.5 – 30V DC
	Reverse polarity protection	yes
	Supply voltage error	≤ ±0.01% per V deviation from 24V[1]
	Ambient conditions	
	Operating temperature range	-40 to +85°C
	Storage temperature range	-40 to +100°C
	Temperature error	≤ ±0.01% per °C deviation from 22°C[1]
	Climatic conditions similar to EN 60 654 Class D1	relative humidity ≤ 95% annual mean, no condensation
	EMC interference emission/immunity	EN 61 326 Class B / to industrial requirements

[1] All data refer to the range-end-value 20 mA.

[2] The larger value applies.

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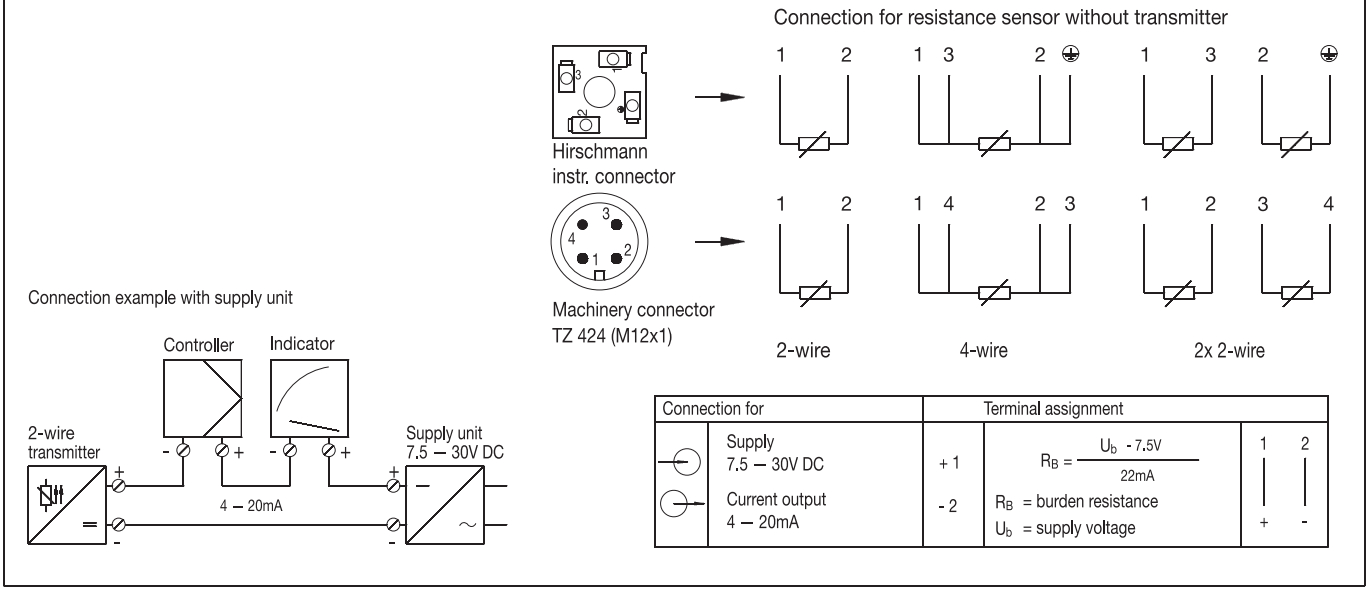
Connection diagram



Connection for	Terminal assignment		
Supply 7.5 — 30V DC	+ 1	$R_B = \frac{U_b - 7.5V}{22mA}$	1 2
Current output 4 — 20mA	- 2	R_B = burden resistance U_b = supply voltage	+ -

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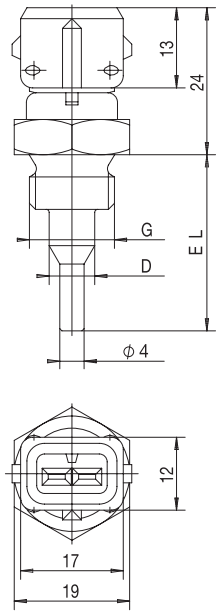
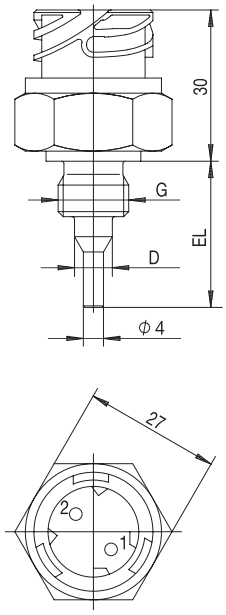
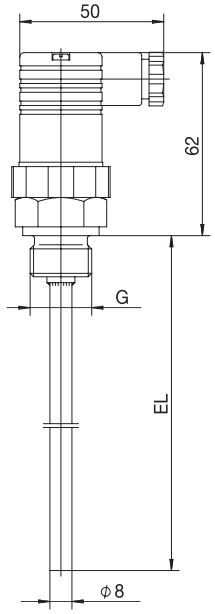
Dimensions



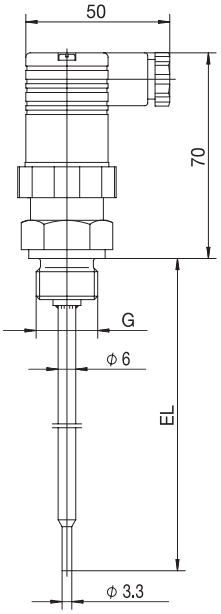
Type 902004/10



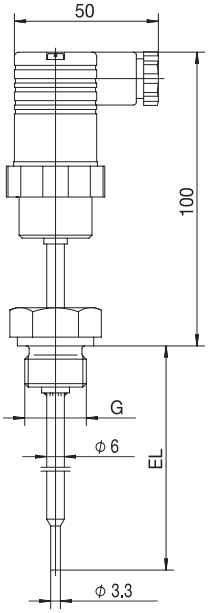
Type 902004/15



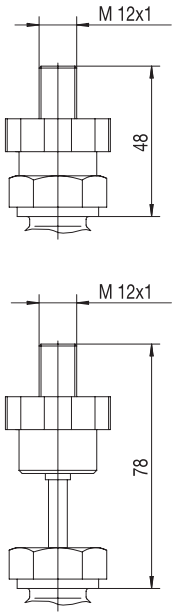
Type 902004/20
Type 902004/21



Type 902004/25
Type 902004/26



Type 902004/28
Type 902004/29



with extra code 424

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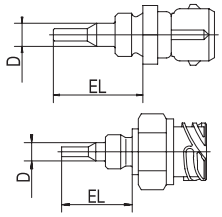
Order details: Screw-in resistance thermometers with plug connector

			(1)	**Basic version**
		902004/10		Screw-in resistance thermometer with plug connector
		902004/15		Screw-in resistance thermometer with connector DIN 72 585
			(2)	**Operating temperature in °C**
	x	384		-50 to +240°C
x		390		-50 to +300°C
			(3)	**Measuring insert**
x	x	1003		1 x Pt100 in 2-wire circuit
x	x	1004		1 x Pt500 in 2-wire circuit
x	x	1005		1 x Pt1000 in 2-wire circuit
x	x	1601		1 x KTY 11-6 in 2-wire circuit
			(4)	**Tolerance class to EN 60 751**
x	x	0		KTY temperature sensor
x	x	1		Class B (standard)
x	x	2		Class A
			(5)	**Protection tube diameter D in mm**
x	x	6		6mm with EL = 60mm
x	x	7.5		7.5mm stepped down to 4mm with EL = 29mm
			(6)	**Fitting length EL in mm**
x	x	29		29mm
x	x	60		60mm
			(7)	**Process connection**
x	x	103		G 3/8 thread
x	x	121		M 14x1.5 thread
x	x	141		1/8-27NPT thread
x	x	542		R 3/8 DIN 2999 thread
x	x	543		R 1/2 DIN 2999 thread, only with EL = 60mm
			(8)	**Protection tube material**
x	x	21		stainless steel 1.4301
x	x	50		brass 2.0401



	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)
Order code		-		-		-		-		-		-		-	
Order example	902004/10	-	390	-	1003	-	1	-	6	-	29	-	103	-	21

[1] List extra codes in sequence, separated by commas.

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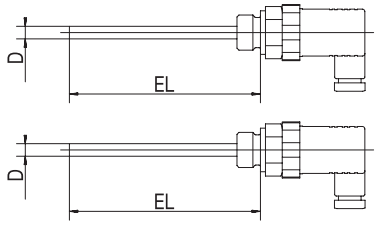
Order details: Screw-in resistance thermometers with plug connector

(1) Basic version

902004/20 Screw-in resistance thermometer with terminal box, Pg9, to EN 175301-803 (DIN 43 650)

902004/21 Screw-in resistance thermometer with terminal box, Pg11, to EN 175301-803 (DIN 43 650)



			(2) Operating temperature in °C
x	x	380	-50 to +200°C
			(3) Measuring insert
x	x	1003	1 x Pt100 in 2-wire circuit
x	x	1011	1 x Pt100 in 4-wire circuit
x	x	2003	2 x Pt100 in 2-wire circuit
			(4) Tolerance class to EN 60 751
x	x	1	Class B (standard)
x	x	2	Class A
			(5) Protection tube diameter D in mm
x	x	8	8mm
			(6) Fitting length EL in mm (50 ≤ EL ≤ 250)
x	x	50	50mm
x	x	100	100mm
x	x	150	150mm
x	x	200	200mm
x	x	250	250mm (without GL approval)
x	x	...	please specify in plain text (in 50mm steps)
			(7) Process connection
x	x	102	G 1/4 thread
x	x	103	G 3/8 thread
x	x	104	G 1/2 thread
x	x	126	M 18x1.5 thread
x	x	128	M 20x1.5 thread
x	x	144	1/2-14NPT thread
			(8) Protection tube material
x	x	26	stainless steel 1.4571
			(9) Extra code
x	x	000	no extra code
x	x	062	GL approval (max. fitting length EL = 200mm)
x		424	machinery plug M 12x1

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
Order code		-		-		-		-		-		-		-		/		,...
Order example	902004/20	-	380	-	1003	-	1	-	8	-	50	-	102	-	26	/	000[1]	

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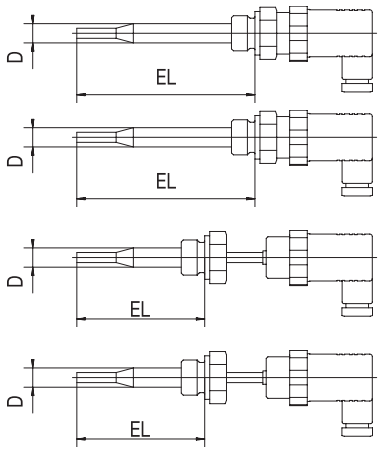
Order details: Screw-in resistance thermometers with plug connector

					(1) Basic version
				902004/25	Screw-in resistance thermometer with analog transmitter and terminal box Pg9 to EN 175301-803 (DIN 43 650) (please specifiy range in plain text)
				902004/26	Screw-in resistance thermometer with analog transmitter and terminal box Pg11 to EN 175301-803 (DIN 43 650) (please specifiy range in plain text)
				902004/28	Screw-in resistance thermometer with analog transmitter and terminal box Pg9 to EN 175301-803 (DIN 43 650), version with extension for elevated temperatures (please specifiy range in plain text)
				902004/29	Screw-in resistance thermometer with analog transmitter and terminal box Pg11 to EN 175301-803 (DIN 43 650), version with extension for elevated temperatures (please specifiy range in plain text)
					(2) Operating temperature in °C
x	x			370	-50 to +150°C
		x	x	386	-50 to +260°C
					(3) Measuring insert
x	x	x	x	1003	1 x Pt100 in 2-wire circuit
					(4) Tolerance class to EN 60 751
x	x	x	x	1	Class B (standard)
x	x	x	x	2	Class A
					(5) Protection tube diameter D in mm
x	x	x	x	6	6mm stepped down to 3.3mm
					(6) Fitting length EL in mm (50 ≤ EL ≤ 250)
x	x	x	x	50	50mm
x	x	x	x	100	100mm
x	x	x	x	150	150mm
x	x	x	x	200	200mm
x	x	x	x	250	250mm
x	x	x	x	...	please specify in plain text (in 50mm steps)
					(7) Process connection
x	x	x	x	102	G 1/4 thread
x	x	x	x	103	G 3/8 thread
x	x	x	x	104	G 1/2 thread
x	x	x	x	126	M 18x1.5 thread
x	x	x	x	128	M 20x1.5 thread
x	x	x	x	144	1/2-14NPT thread
					(8) Protection tube material
x	x	x	x	26	stainless steel 1.4571
					(9) Extra code
x	x	x	x	000	no extra code
x		x		424	machinery plug M 12x1



	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
Order code		-		-		-		-		-		-		-		/		,...
Order example	902004/25	-	370	-	1003	-	1	-	6	-	50	-	102	-	26	/	000	

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Stock versions

(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	Sales No.
902004/10	-	390	-	1003	-	1	-	7.5	-	29	-	121	-	21	90/00446901
902004/10	-	390	-	1003	-	1	-	7.5	-	29	-	121	-	50	90/00447301

Stock versions

(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	Sales No.
902004/20	-	380	-	1003	-	1	-	8	-	50	-	104	-	26	/	000	90/00365259
902004/20	-	380	-	1003	-	1	-	8	-	100	-	104	-	26	/	000	90/00368414
902004/20	-	380	-	1003	-	1	-	8	-	150	-	104	-	26	/	000	90/00368416

Accessories

	Sales No.
Mating plug for Type 902004/10 with siliconized connecting cable, 2.5m long	90/00308880
Mating plug for Type 902004/15	90/00439715
Mating plug for extra code 424 (machinery plug M 12x1) with PVC connecting cable, 2m long	90/00404585

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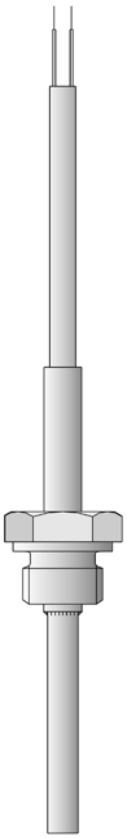
Screw-in resistance thermometers with connecting cable



- **for temperatures from -50 to +400°C**
- **as single or twin resistance thermometer**
- **in 2-wire, 3-wire or 4-wire circuit**
- **connecting cable in PVC, silicone, Teflon or with metal braiding**

Screw-in resistance thermometers are mainly used for measuring temperatures in liquids and gases. An important selection criterion is their reliable sealing against both negative and positive pressures. Applications include HVAC, refrigeration, heating installations, ovens, furnaces and plant engineering.

Depending on the version, the connecting cables are suitable for use in dry and humid areas within the temperature range -50 to +350°C. The junction between cable and protection tube incorporates strain relief. A cable protector can be supplied as an option.

The measuring insert is normally fitted with a Pt100 temperature sensor to EN 60 751, Class B in 2-wire circuit. Versions with Pt500 or Pt1000 are also available. In addition, there is a choice of 3-wire or 4-wire circuit connections.

Technical data

Connection	available with cable ends as: bare wires, with ferrules, receptacles or multipole connector
Connecting cable	PVC, ambient temperature -5 to +80°C (+105°C) silicone, ambient temperature -50 to +180°C Teflon, ambient temperature -190 to +260°C metal braiding, ambient temperature -50 to +350°C connecting cable can optionally be supplied with shielding
Process connection	thread, stainless steel 1.4571
Protection tube	stainless steel 1.4571 (Type 902005/30 Inconel 2.4816), 5mm, 5.4mm, 6mm and 8mm dia.
Measuring insert	Pt100 temperature sensor, EN 60 751, Cl. B, 2-wire circuit
Response times	$t_{0.5}$ approx. 2sec, $t_{0.9}$ approx. 6sec, in water 0.2m/sec, 6mm dia.
Accessories	pocket, see Data Sheet 90.9721and 90.2440

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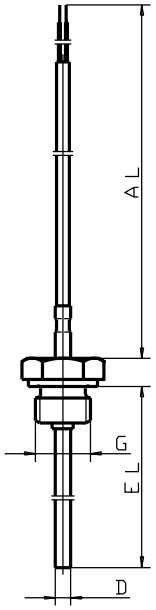
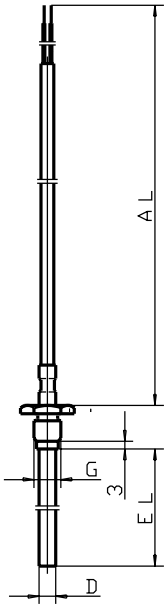
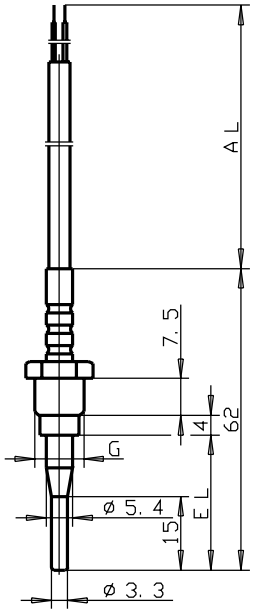
Dimensions



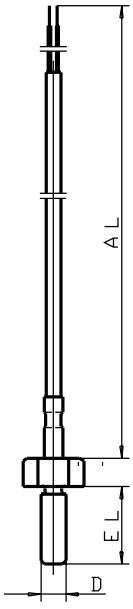
Type 902005/10



Type 902005/20



Type 902005/30



Type 902005/40

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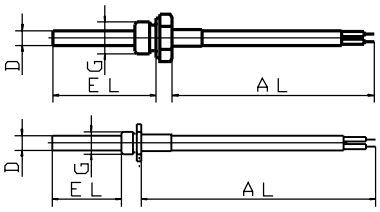
Order details: Screw-in resistance thermometers with connecting cable

(1) Basic version

		902005/10	Screw-in resistance thermometer with fixed screw fitting
		902005/20	Screw-in resistance thermometer with loose screw fitting



			(2) Operating temperature in °C / connecting cable
x	x	130	-200 to +400°C / metal braiding
x	x	380	-50 to +200°C / silicone
x	x	386	-50 to +260°C / Teflon
x	x	402	-50 to +400°C / metal braiding
x	x	724	-5 to +80°C / PVC
x	x	912	5 to 105°C / PVC (only with 1 x 2-wire or 3-wire circuit)
			(3) Measuring insert
x	x	1001	1 x Pt100 in 3-wire circuit
x	x	1003	1 x Pt100 in 2-wire circuit
x	x	1011	1 x Pt100 in 4-wire circuit
x	x	2001	2 x Pt100 in 3-wire circuit
x	x	2003	2 x Pt100 in 2-wire circuit
			(4) Tolerance class to EN 60 751
x	x	1	Class B (standard)
x	x	2	Class A
			(5) Protection tube diameter D in mm
x	x	5	5mm
x	x	6	6mm
			(6) Fitting length EL in mm (50≤ EL ≤500)
	x	17	17mm
	x	37	37mm
x	x	50	50mm
x	x	100	100mm
	x	137	137mm
x	x	200	200mm
x		250	250mm
x	x	...	please specify in plain text (50mm steps)
			(7) Process connection
x		102	thread 1/4"pipe
x		104	thread 1/2"pipe
	x	114	thread M 10 x 1
			(8) Connecting cable end
x	x	03	bare cable ends
x	x	11	ferrules to DIN 46 228 Part 4 (standard)
x	x	13	receptacle 6.3 to DIN 46 247
x	x	80	multipole connector (please specify type in plain text)
x	x	99	to customer specification
			(9) Connecting cable length AL in mm (500≤ AL ≤500000)
x	x	2500	2500mm
x	x	...	please specify in plain text (500mm steps)
			(10) Extra codes
x	x	000	no extra code
x	x	310	stepped protection tube
x	x	315	cable protector: coil
x	x	316	cable protector: tube
x	x	317	shielded connecting cable

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)	
Order code		-		-		-		-		-		-		-		-		/		,...
Order example	902005/10	-	380	-	1001	-	1	-	6	-	100	-	104	-	11	-	2500	/	000[1]	

1.List extra codes in sequence, separated by commas.

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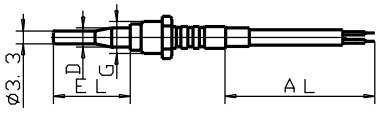
Order details: Screw-in resistance thermometers with connecting cable

(1) Basic version

902005/30 Screw-in resistance thermometer with loose screw fitting and stepped protection tube



		(2) Operating temperature in °C / connecting cable
x	380	-50 to +200°C / silicone
		(3) Measuring insert
x	1001	1 x Pt100 in 3-wire circuit
x	1003	1 x Pt100 in 2-wire circuit
		(4) Tolerance class to EN 60 751
x	1	Class B (standard)
x	2	Class A
		(5) Protection tube diameter D in mm
x	5.4	5.4mm dia. stepped down to 3.3mm
		(6) Fitting length EL in mm
x	27.5	27.5mm
		(7) Process connection
x	114	thread M 10 x 1
		(8) Connecting cable end
x	03	bare cable ends
x	11	ferrules to DIN 46 228 Part 4 (standard)
x	13	receptacle 6.3 to DIN 46 247
x	80	multipole connector (please specify type in plain text)
x	99	to customer specification
		(9) Connecting cable length AL in mm (500≤ AL ≤500000)
x	2500	2500mm
x	...	please specify in plain text (500mm steps)
		(10) Extra codes
x	000	no extra code
x	315	cable protector: coil
x	316	cable protector: tube
x	317	shielded connecting cable

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)	
Order code		-		-		-		-		-		-		-		-		/		,...
Order example	902005/30	-	380	-	1003	-	1	-	5.4	-	27.5	-	114	-	11	-	2500	/	000[1]	

1.List extra codes in sequence, separated by commas.

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Order details: Screw-in resistance thermometers with connecting cable

(1) Basic version

902005/40 Screw-in resistance thermometer, screw-in protection tube

		(2) Operating temperature in °C / connecting cable
x	380	-50 to +200°C / silicone
x	390	-50 to +300°C / metal braiding
x	724	-5 to +80°C / PVC
x	912	5 to 105°C / PVC (only with 1 x 2-wire or 3-wire circuit)
		(3) Measuring insert
x	1001	1 x Pt100 in 3-wire circuit
x	1003	1 x Pt100 in 2-wire circuit
		(4) Tolerance class to EN 60 751
x	1	Class B (standard)
x	2	Class A
		(5) Protection tube diameter D in mm
x	8	M 8
		(6) Fitting length EL in mm
x	25	25mm
		(7) Process connection
x	111	thread M 8
		(8) Connecting cable end
x	03	bare cable ends
x	11	ferrules to DIN 46 228 Part 4 (standard)
x	13	receptacle 6.3 to DIN 46 247
x	80	multipole connector (please specify type in plain text)
x	99	to customer specification
		(9) Connecting cable length AL in mm (500≤ AL ≤500000)
x	2500	2500mm
x	...	please specify in plain text (500mm steps)
		(10) Extra codes
x	000	no extra code
x	315	cable protector: coil
x	316	cable protector: tube
x	317	shielded connecting cable

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)	
Order code		-		-		-		-		-		-		-		-		/		,...
Order example	902005/40	-	390	-	1003	-	1	-	8	-	25	-	111	-	11	-	2500	/	000[1]	

1.List extra codes in sequence, separated by commas.

Stock versions:

(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)	Sales No.
902005/10	-	380	-	1003	-	1	-	6	-	100	-	104	-	11	-	2500	/	316	90/00065230
902005/10	-	380	-	1001	-	1	-	6	-	100	-	104	-	11	-	2500	/	316	90/00065232
902005/10	-	380	-	1001	-	1	-	6	-	250	-	104	-	11	-	2500	/	316	90/00065235
902005/20	-	130	-	1003	-	1	-	6	-	37	-	114	-	11	-	2500	/	315,317	90/00055644
902005/20	-	130	-	1001	-	1	-	6	-	37	-	114	-	11	-	2500	/	315,317	90/00055646
902005/30	-	380	-	1001	-	1	-	5.4	-	27.5	-	114	-	11	-	2500	/	316	90/00089972
902005/40	-	390	-	1003	-	1	-	8	-	25	-	111	-	11	-	2500	/	315,317	90/00055722
902005/40	-	390	-	1001	-	1	-	8	-	25	-	111	-	11	-	2500	/	315,317	90/00055732

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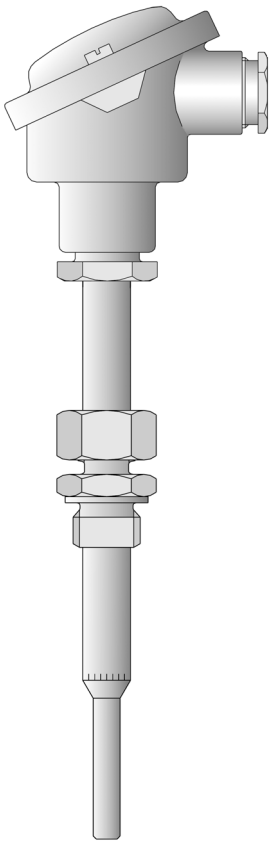
Resistance thermometers for plant and equipment approved to DIN 34 40



- **for indirect heating installations to DIN 47 54**
- **for temperatures up to 700 °C**
- **as single, twin or triple resistance thermometer**
- **for operation in water, oil or air**
- **for approved control and limiter instruments**

The resistance themometers cited in this Data Sheet may be used in conjunction with temperature control and limitation equipment approved to DIN 34 40 in indirect heating installations to DIN 47 54 (see table on page 5/5).

Resistance thermometers are preferably used for measuring temperatures in liquids and gases. Applications include HVAC and refrigeration, as well as heating installations, ovens furnaces and plant engineering.

The terminal head Form B is suitable for ambient temperatures up to 100 °C.

Protection tubes in different materials protect the measuring insert from chemical influences and mechanical damage. The choice of the appropriate protection tube material depends on the conditions prevailing on site.

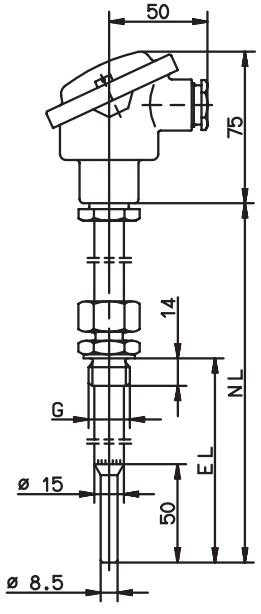
The measuring insert is normally fitted with a Pt100 temperature sensor to EN 60 751, Class B in 2-wire circuit.

Modifications to the versions described below require a fresh type approval.

Note: Please state sales no. as per price sheet 90.2006 when ordering!

Screw-in resistance thermometers with screwed pipe joint and terminal head to DIN 43 729, Form B M 24 x 1.5

Fitting length EL in mm	Nom. length NL in mm	Thread G in inch	Temperature range in °C	Type 1x Pt100	Type 2x Pt100
Protection tube stainless steel X 6 CrNiMoTi 17 12 2, Material Ref. 1.4571					
65 – 670	710	1/2"	-170 to +550	90.272-F03	-
65 – 670	710	1/2"	-170 to +550	-	90.272-F02



Item 1

Note: Please note the internal conductor resistance due to the operating temperature; for resistance values see page 5/5.

Operating medium: water, oil
Operating pressure: 27 bar max. up to 100 °C, 20 bar up to 400 °C, no pressure above 400 °C.

● available from stock

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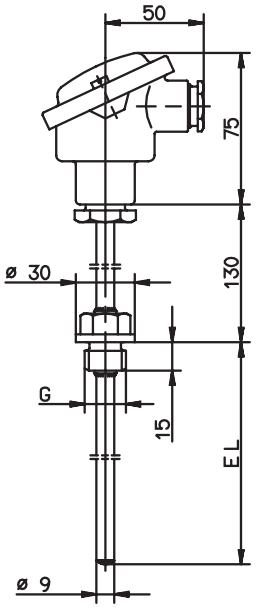
Screw-in resistance thermometers to DIN 43 765, Form B and terminal head to DIN 43 729, Form B M 24 x 1.5

Fitting length EL in mm	Thread G in inch	Temperature range in °C	Type 1x Pt100	Type 2x Pt100
Protection tube steel St 35.8, Material Ref. 1.0305				
250	1/2"	-170 to +480	90.239 ●	90 D 239
Protection tube stainless steel X 6 CrNiMoTi 17 12 2, Material Ref. 1.4571				
100	1/2"	-40 to +400	902006/10-402-1003	-
100	1/2"	-40 to +400	-	902006/10-402-2003

Operating medium: water, oil
Operating pressure: 35 bar max. up to 100 °C, 20 bar up to 400 °C, no pressure above 400 °C.

● available from stock

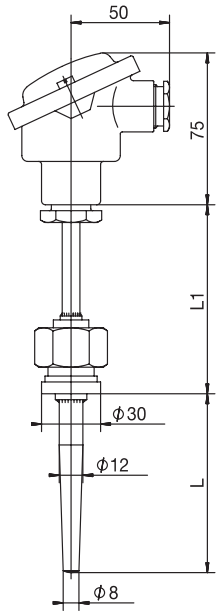


Item 2

Screw-in resistance thermometers with weld-in pocket and terminal head to DIN 43 729, Form B M 24 x 1.5

Fitting length [1] EL in mm	Length L in mm	Length L1 in mm	Temperature range in °C	Type 1x Pt100	Type 2x Pt100	Type 3x Pt100
Welding shoulder steel 15 Mo 3, Material Ref. 1.5415 Protection tube steel St 35.8, Material Ref. 1.0305						
100	80	96	-40 to +480	90.239-F01	-	-
160	140	96	-40 to +480	90.239-F11	-	-
190	170	146	-40 to +400	90.239-F03	-	-
220	200	96	-40 to +480	90.239-F21 ●	-	-
100	80	96	-40 to +480	-	90.239-F02 ●	-
160	140	96	-40 to +480	-	90.239-F12	-
190	170	146	-40 to +400	-	90 D 239-F03 ●	-
220	200	96	-40 to +480	-	902006/ 53-507-2003 ●	-
100	80	96	-40 to +400	-	-	90.239-F07
160	140	96	-40 to +400	-	-	90.239-F17
220	200	96	-40 to +400	-	-	90.239-F27

Operating medium: water, oil
Operating pressure: 103 bar max. up to 100 °C, 30 bar up to 480 °C.



Item 3

● available from stock.

1. Fitting length of resistance thermometer

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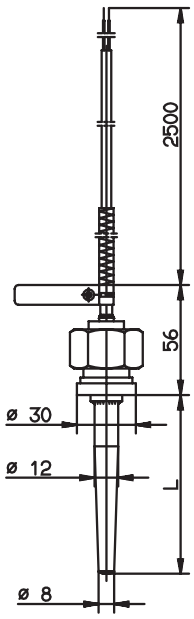
Screw-in resistance thermometers with weld-in pocket and 0.35 mm² connecting cable with stainless steel braiding and cable protector

Fitting length[1] EL in mm	Length L in mm	Temperature range in °C	Type 1x Pt100
Welding shoulder steel 15 Mo 3, Material Ref. 1.5415 Protection tube steel St 35.8, Material Ref. 1.0305			
100	80	-170 to +480	90.280-F32
220	200	-170 to +480	90.280-F30



Item 4

Operating medium: water, oil
Operating pressure: 103 bar max. up to 100 °C, 30 bar up up to 480 °C.

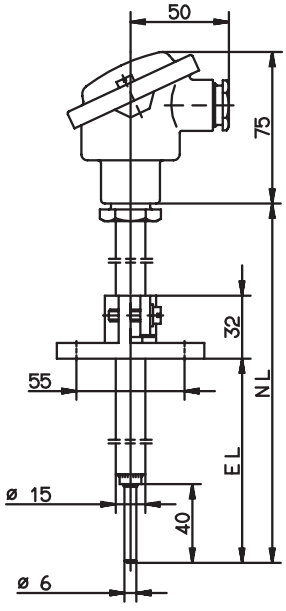
● available from stock

1. Fitting length of resistance thermometer

Push-in resistance thermometers with sliding stop flange and terminal head to DIN 43 729, Form B M 24x1.5

Fitting length EL in mm	Nominal length NL in mm	Temperature range in °C	Type 2x Pt100
Protection tube stainless steel X 6 CrNiMoTi 17 12 2, Material Ref. 1.4571			
50 – 460	500	-170 to +700	90.271-F01
50 – 670	710	-170 to +700	90.272-F01
50 – 960	1000	-170 to +700	90.273-F01

Note: Please note the internal conductor resistance due to the operating temperature; for resistance values see page 5/5.



Item 5

Operating medium: air

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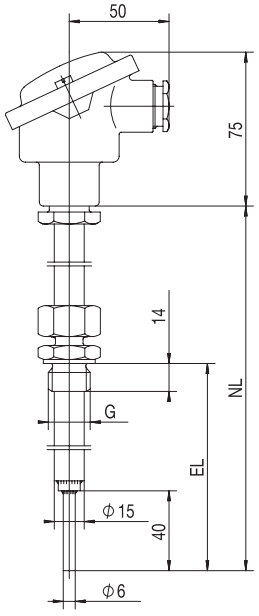
Screw-in resistance thermometer with screwed pipe joint and terminal head to DIN 43 729, Form B M 24x1.5

Fitting length EL in mm	Thread G in inch	Nom. length NL in mm	Temperature range in °C	Type 2x Pt100
Protection tube stainless steel X 6 CrNiMoTi 17 12 2, Material Ref. 1.4571				
50 — 460	1/2"	500	-170 to +700	902006/55-228-2003-15-500-254
50 — 670	1/2"	710	-170 to +700	902006/55-228-2003-15-710-254
50 — 960	1/2"	1000	-170 to +700	902006/55-228-2003-15-1000-254

Note: Please note the internal conductor resistance due to the operating temperature; for resistance values see page 5/5.

Operating medium: air



Item 6

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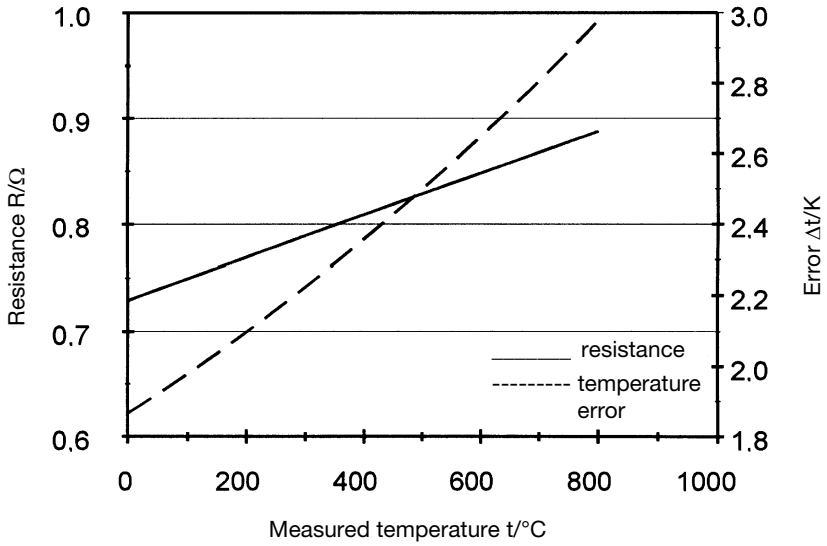
Universal process controllers (DICON 500), temperature limiters (TB), temperature monitors (TW), safety temperature limiters (STB) and safety temperature monitors (STW) together with the approved temperature probes to DIN 34 40

Resistance thermometer	Transducer	Max. temp. in °C	Weld-in pocket	Water/ oil	Air/ gas	DICON 500 T 70.3570[1]	TB/TW T 70.1130[1]	STB/STW T 70.1130[1]	TB/TW T 70.1140[1]
90.272-F03	1x Pt100	550	-	X	-	X	X	X	X
90.272-F02	2x Pt100	550	-	X	-	X	X	X	X
90.239	1x Pt100	480	-	X	-	X	X	X	X
90 D 239	2x Pt100	480	-	X	-	X	X	X	X
902006/10-402-1003	1x Pt100	400	-	X	-	X	X	X	X
902006/10-402-2003	2x Pt100	400	-	X	-	X	X	X	X
90.239-F01	1x Pt100	480	X	X	-	X	X	X	X
90.239-F11	1x Pt100	480	X	X	-	X	X	X	X
90.239-F03	1x Pt100	400	X	X	-	X	X	X	X
90.239-F21	1x Pt100	480	X	X	-	X	X	X	X
90.239-F02	2x Pt100	480	X	X	-	X	X	X	X
90.239-F12	2x Pt100	480	X	X	-	X	X	X	X
90 D 239-F03	2x Pt100	400	X	X	-	X	X	X	X
902006/53-507-2003	2x Pt100	480	X	X	-	X	X	X	X
90.239-F07	3x Pt100	400	X	X	-	X	X	X	X
90.239-F17	3x Pt100	400	X	X	-	X	X	X	X
90.239-F27	3x Pt100	400	X	X	-	X	X	X	X
90.280-F32	1x Pt100	480	X	X	-	X	X	X	X
90.280-F31	1x Pt100	480	X	X	-	X	X	X	X
90.280-F30	1x Pt100	480	X	X	-	X	X	X	X
90.271-F01	2x Pt100	700	-	-	X	X	X	X	X
90.272-F01	2x Pt100	700	-	-	X	X	X	X	X
90.273-F01	2x Pt100	700	-	-	X	X	X	X	X
902006/55-228-2003	2x Pt100	700	-	-	X	X	-	-	X

X = approved - = not approved 1. T 70. ... = Data Sheet 70. ... see Section Catalog “Controllers, power units and system technology”

Temperature error



The versions 90.272-F03, 90.272-F02, 90.271-F01, 90.272-F01, 90.273-F01 and 902006/55 are subject to a systematic error due to the internal conductor. This depends both on the nominal length NL and on the measured temperature. The table shows the error **per 100 mm fitting length EL** for different measured temperatures.

t/°C	R/Ω	Δt/K
0	0.73	1.87
100	0.75	1.98
200	0.77	2.09
300	0.79	2.22
400	0.81	2.35
500	0.83	2.49
600	0.85	2.64
700	0.87	2.80
800	0.89	2.98

Resistance of a 0.5 mm NiCr wire **per 100 mm fitting length EL** (2 lengths of wire).
The details are provided as a rough guide only.

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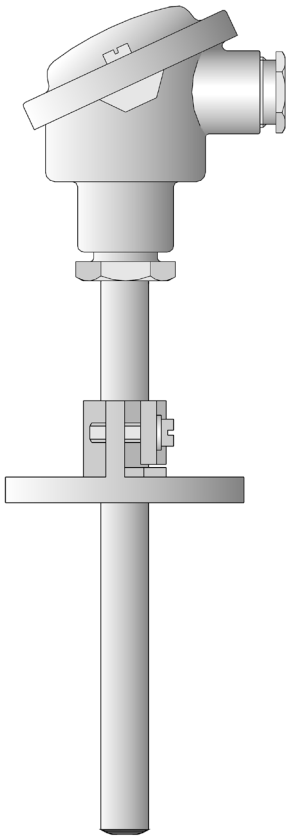
Push-in resistance thermometers with terminal head Form B



- **for temperatures from -50 to +600°C**
- **with replaceable measuring insert**
- **as single or twin resistance thermometer**
- **terminal head Form B, BUZ, BUZH, BBK**
- **available with transmitter**

Push-in resistance thermometers are preferred for measuring temperatures in liquids and gases. Applications include HVAC and refrigeration, heating installations, ovens, furnaces and plant engineering, as well as process technology.

The terminal head is suitable for ambient temperatures up to +100°C. Terminal heads Form BUZ, BUZH and BBK are available in addition to the standard Form B.

The measuring insert is normally fitted with a Pt100 temperature sensor to EN 60 751, Class B in 2-wire circuit. Versions with Pt500 or Pt1000 are also available. There is a choice of 3-wire and 4-wire circuit connections. A transmitter can optionally be integrated into the terminal head.

Technical data

Terminal head	Form B DIN 43 729, aluminium die-casting M 20x1.5; IP54, ambient temperature -40 to +100°C Form BUZ, aluminium die-casting M 20x1.5; IP65, ambient temperature -40 to +100°C Form BUZH, aluminium die-casting M 20x1.5; IP65, ambient temperature -40 to +100°C Form BBK, plastic, M 20x1.5; IP54, ambient temperature -30 to +130°C Caution: reduced ambient temperature when using transmitters, Data Sheets 70.7030 (95.6530) and 70.7010 (95.6550)
Process connection	plate flange 9mm and 11mm dia., galvanized steel stop flange 15mm dia., DIN 43 734, cast iron screwed pipe joint 12mm dia., 15mm dia., stainless steel
Protection tube	stainless steel, 1.4571, 9mm, 11mm and 15mm dia.
Measuring insert	replaceable, Pt100 temperature sensor EN 60 751, Cl. B, 2-wire circuit
Transmitter	analog transmitter, output 4 - 20mA, Data Sheet 70.7030 (95.6530) analog transmitter, output 0 - 10V, Data Sheet 70.7030 (95.6530) programmable transmitter, output 4- 20mA/20 - 4mA, Data Sheet 70.7010 (95.6550)

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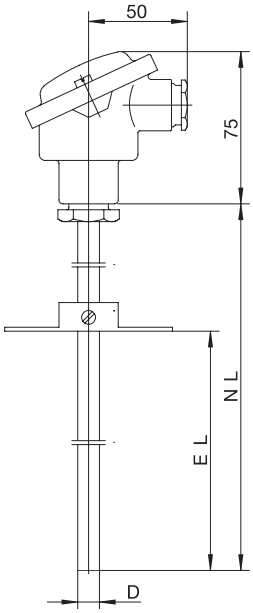
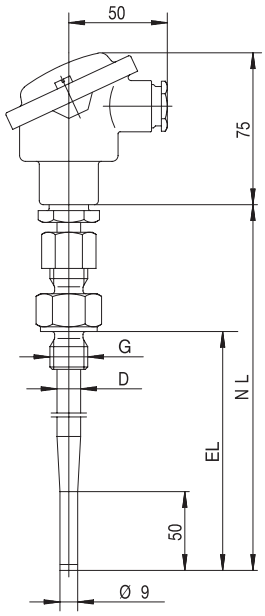
Dimensions



Type 902102/10



Type 902102/11

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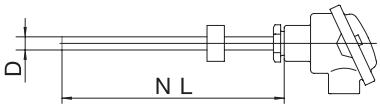
Order details: Push-in resistance thermometers with terminal head Form B

(1) Basic version

	902102/10	Push-in resistance thermometer with continuous protection tube



		(2) Operating temperature in °C
x	150	-200 to +600°C
x	402	-50 to +400°C (standard)
x	415	-50 to +600°C
		(3) Measuring insert
x	1001	1 x Pt100 in 3-wire circuit
x	1003	1 x Pt100 in 2-wire circuit
x	1011	1 x Pt100 in 4-wire circuit
x	2001	2 x Pt100 in 3-wire circuit
x	2003	2 x Pt100 in 2-wire circuit
		(4) Tolerance class to EN 60 751
x	1	Class B (standard)
x	2	Class A
		(5) Protection tube diameter D in mm
x	9	9mm
x	11	11mm
x	15	15mm
		(6) Nominal length NL in mm (100 ≤NL ≤1000)
x	180	180mm, fitting length (EL) 100 - 140mm
x	270	270mm, fitting length (EL) 100 - 230mm
x	290	290mm, fitting length (EL) 100 - 250mm
x	350	350mm, fitting length (EL) 100 - 310mm
x	410	410mm, fitting length (EL) 100 - 370mm
x	420	420mm, fitting length (EL) 100 - 400mm
x	500	500mm, fitting length (EL) 100 - 460mm
x	710	710mm, fitting length (EL) 100 - 670mm
x	1000	1000mm, fitting length (EL) 100 - 960mm
x	...	please specify in plain text (50mm steps)
		(7) Process connection
x	000	no process connection
x	254	screwed pipe joint 1/2" (only for 15mm dia.)
x	663	plate flange for 9mm dia.
x	665	plate flange for 11mm dia.
x	668	stop flange 15mm dia., DIN 43 734
		(8) Extra codes
x	000	no extra code
x	320	terminal head Form BUZ
x	321	terminal head Form BUZH
x	322	terminal head Form BBK
x	330	1 x analog transmitter, output 4 - 20mA[2], Data Sheet 70.7030 (95.6530)
x	331	1 x programmable transmitter, output 4 - 20mA/20 - 4mA[3], Data Sheet 70.7010 (95.6550)
x	333	1 x analog transmitter, output 0 - 10V[2], Data Sheet 70.7030 (95.6530)
x	334	2 x analog transmitter, output 4 - 20mA[2], Data Sheet 70.7030 (95.6530)
x	335	2 x programmable transmitter, output 4 - 20mA/20 - 4mA[3], Data Sheet 70.7010 (95.6550)
x	337	2 x analog transmitter, output 0 - 10V[2], Data Sheet 70.7030 (95.6530)

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
Order code		-		-		-		-		-		-		/		,...
Order example	902102/10	-	402	-	1001	-	1	-	9	-	410	-	663	/	000[1]	

1. List extra codes in sequence, separated by commas.
2. Specify range in plain text.
3. Specify range and output signal in plain text.

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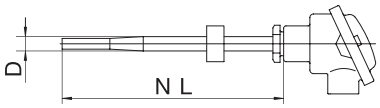
Order details: Push-in resistance thermometers with terminal head Form B

		(1)	**Basic version**
	902102/11		Push-in resistance thermometer with stepped protection tube
		(2)	**Operating temperature in °C**
x	150		-200 to +600°C
x	402		-50 to +400°C (standard)
x	415		-50 to +600°C
		(3)	**Measuring insert**
x	1001		1 x Pt100 in 3-wire circuit
x	1003		1 x Pt100 in 2-wire circuit
x	1011		1 x Pt100 in 4-wire circuit
x	2001		2 x Pt100 in 3-wire circuit
x	2003		2 x Pt100 in 2-wire circuit
		(4)	**Tolerance class to EN 60 751**
x	1		Class B (standard)
x	2		Class A
		(5)	**Protection tube diameter D in mm**
x	12		12mm stepped down to 9mm
		(6)	**Nominal length NL in mm (100 ≤NL ≤700)**
x	180		180mm, fitting length (EL) 100 - 140mm
x	270		270mm, fitting length (EL) 100 - 230mm
x	290		290mm, fitting length (EL) 100 - 250mm
x	350		350mm, fitting length (EL) 100 - 310mm
x	410		410mm, fitting length (EL) 100 - 370mm
x	500		500mm, fitting length (EL) 100 - 460mm
x	...		please specify in plain text (50mm steps)
		(7)	**Process connection**
x	000		no process connection
x	254		screwed pipe joint 1/2"
		(8)	**Extra codes**
x	000		no extra code
x	320		terminal head Form BUZ
x	321		terminal head Form BUZH
x	322		terminal head Form BBK
x	330		1 x analog transmitter, output 4 - 20mA[2], Data Sheet 70.7030 (95.6530)
x	331		1 x programmable transmitter, output 4 - 20mA/20 - 4mA[3], Data Sheet 70.7010 (95.6550)
x	333		1 x analog transmitter, output 0 - 10V[2], Data Sheet 70.7030 (95.6530)
x	334		2 x analog transmitter, output 4 - 20mA[2], Data Sheet 70.7030 (95.6530)
x	335		2 x programmable transmitter, output 4 - 20mA/20 - 4mA[3], Data Sheet 70.7010 (95.6550)
x	337		2 x analog transmitter, output 0 - 10V[2], Data Sheet 70.7030 (95.6530)



	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
Order code		-		-		-		-		-		-		/		,...
Order example	902102/11	-	402	-	1001	-	1	-	12	-	410	-	000	/	000[1]	

1. List extra codes in sequence, separated by commas.
2. Specify range in plain text.
3. Specify range and output signal in plain text.

Stock versions

(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	Sales No.
902102/10	-	415	-	1003	-	1	-	15	-	500	-	668	/	000	90/00055514
902102/10	-	402	-	1003	-	1	-	11	-	180	-	665	/	000	90/00055681

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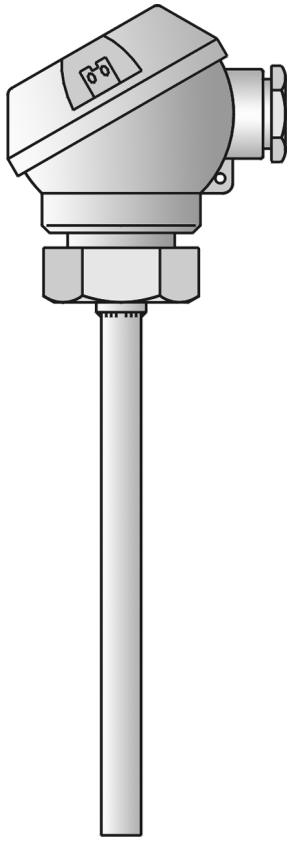
Push-in resistance thermometers with terminal head Form J



- **for temperatures from -50 to +400°C**
- **as single or twin resistance thermometer**
- **available with transmitter**

Push-in resistance thermometers are preferably used for measuring temperatures in liquids and gases. An important selection criterion is their reliable sealing against both positive and negative pressures. Applications include HVAC and refrigeration, as well as heating installations, ovens, furnaces and plant engineering.

The measuring insert is normally fitted with a Pt100 temperature sensor to EN 60 751, Class B in 2-wire circuit. Versions with Pt500 or Pt1000 are also available. There is a choice of 3-wire and 4-wire circuit connections. A transmitter can optionally be integrated into the terminal head.

Technical data

Terminal head	Form J, aluminium die-casting, M 16x1.5; IP54, ambient temperature -40 to +100°C Caution: reduced ambient temperature when using transmitters, Data Sheet 70.7030
Process connection	plate flange 6mm, 8mm dia., galvanized steel screwed pipe joint 6mm, 8mm dia., stainless steel screwed pipe joint, spring-loaded, 8mm dia., spring travel 12mm, stainless steel
Protection tube	stainless steel 1.4571, 6mm, 7mm and 8mm dia.
Measuring insert	Pt100 temperature sensor, EN 60 751, Cl. B, 2-wire circuit
Transmitter	analog transmitter, output 4 - 20mA, Data Sheet 70.7030
Accessories	pocket, see Data Sheet 90.2440 and 90.9721

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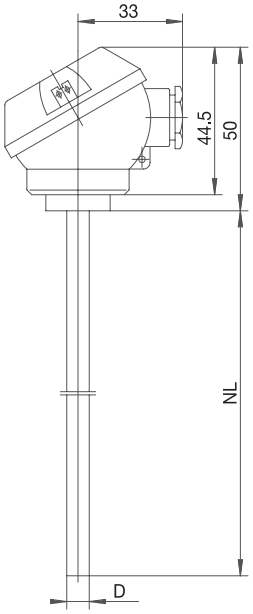
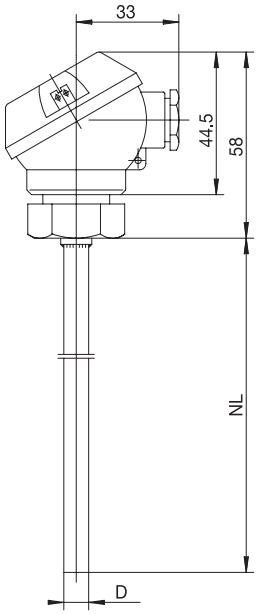
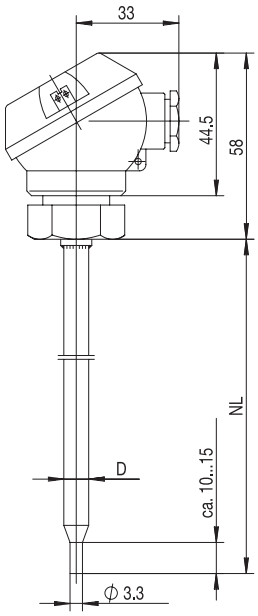
Dimensions



Type 902103/10



Type 902103/20



Type 902103/31

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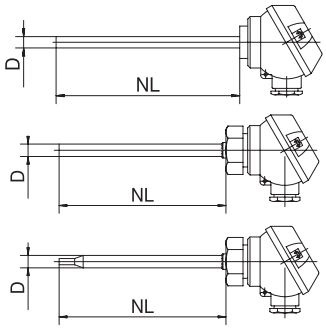
Order details: Push-in resistance thermometers with terminal head Form J

(1) Basic version

902103/10 — Push-in resistance thermometer with continuous protection tube, ≤ 7mm dia.

902103/20 — Push-in resistance thermometer with continuous protection tube, > 7mm dia.

902103/31 — Push-in resistance thermometer with stepped protection tube for measurement in air



				(2) Operating temperature in °C
	x		378	-50 to +180°C
		x	380	-50 to +200°C
x	x		402	-50 to +400°C
				(3) Measuring insert
x	x		1001	1 x Pt100 in 3-wire circuit
x	x	x	1003	1 x Pt100 in 2-wire circuit
x	x		1011	1 x Pt100 in 4-wire circuit
x	x	x	2003	2 x Pt100 in 2-wire circuit
				(4) Tolerance class to EN 60 751
x	x	x	1	Class B (standard)
x	x	x	2	Class A
				(5) Protection tube diameter D in mm
x		x	6	6mm
x			7	7mm
	x		8	8mm
				(6) Nominal length NL in mm (50≤ NL ≤1000)
x	x	x	50	50mm
x	x	x	100	100mm
x	x	x	150	150mm
x	x	x	250	250mm
		x	290	290mm
x	x	x	...	please specify in plain text (50mm steps)
				(7) Process connection
x	x	x	000	no process connection
	x		245	screwed pipe joint 1/2“, spring-loaded, spring travel 12mm (for 8mm dia. only, Tmax. 180°C)
x		x	252	screwed pipe joint 1/4" (only for 6mm dia.)
x	x	x	254	screwed pipe joint 1/2" (only for 6mm or 8mm dia.)
x		x	662	plate flange 6mm dia.
	x		667	plate flange 8mm dia.
				(8) Extra codes
x	x	x	000	no extra code
x	x	x	330	1 x analog transmitter, output 4 - 20mA[2], Data Sheet 70.7030

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)
Order code		-		-		-		-		-		-		/	
Order example	902103/10	-	402	-	1001	-	1	-	6	-	100	-	000	/	000

2. please specify range in plain text

Stock versions

(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	Sales No.
902103/10	-	402	-	1003	-	1	-	6	-	150	-	000	/	000	90/00063620
902103/10	-	402	-	1003	-	1	-	6	-	250	-	000	/	000	90/00063622
902103/31	-	380	-	1003	-	1	-	6	-	290	-	000	/	000	90/00438399

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Push-in resistance thermometers with connecting cable

- **for temperatures from -50 to +400°C**
- **as single or twin resistance thermometer**
- **in 2-wire, 3-wire or 4-wire circuit**
- **connecting cable in PVC, silicone, PTFE, or with metal braiding**

Push-in resistance thermometers are preferred for measuring temperatures in liquids and gases. Applications include HVAC and refrigeration, heating installations, ovens, plant engineering, and laboratories.

Depending on the version, the connecting cables are suitable for dry or humid areas within the range -50 to +350°C. The connection of the cable to the protection tube incorporates strain relief. A cable protector can be supplied as an option.

The measuring insert is normally fitted with a Pt100 temperature sensor to EN 60 751, Class B in 2-wire circuit. Versions with Pt500 or Pt1000 are also available. Furthermore, there is a choice of 3-wire and 4-wire circuit connections.

Technical data

Connection	cable ends available as: bare wires, with ferrules, receptacles or multipole connectors
Connecting cable	PVC, ambient temperature -5 to +80°C (+100/+105°C) silicone, ambient temperature -50 to +180°C PTFE, ambient temperature -190 to +260°C metal braiding, ambient temperature -50 to +350°C a shielded connecting cable can be supplied as an option
Protection tube	stainless steel 1.4571, 5mm, 5.2mm, 6mm and 8mm dia.
Measuring insert	Pt100 temperature sensor, EN 60 751, Cl. B, 2-wire circuit
Response times	$t_{0.9}$ approx. 10sec, in water 0.2 m/sec, 6mm dia.
Accessories	pocket, see Data Sheet 90.9721 and 90.2440

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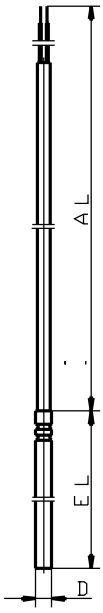
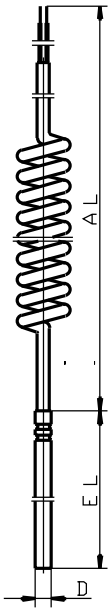
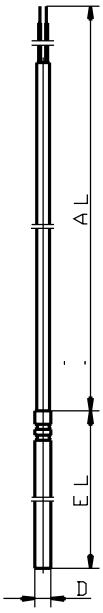
Dimensions



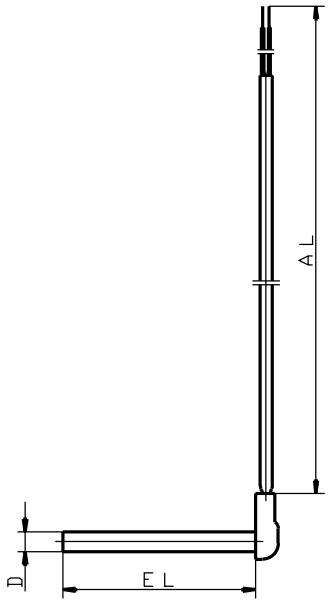
Type 902105/10



Type 902105/20



Type 902105/30



Type 902105/40

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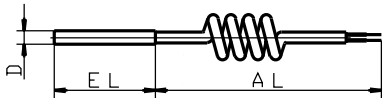
Order details: Push-in resistance thermometers with connecting cable

(1) Basic version

902105/10 — Push-in resistance thermometer with connecting cable, one-piece protection tube in stainless steel

902105/20 — Push-in resistance thermometer with coiled connecting cable, one-piece protection tube in stainless steel



			(2) Operating temperature in °C / connecting cable
x		378	-50 to +180°C / silicone
x		386	-50 to +260°C / PTFE
x		388	-50 to +260°C / metal braiding
x		724	-5 to +80°C / PVC
	x	730	-5 to +105°C / PUR
x		912	-5 to +105°C / PUR (for 1 x 2-wire circuit only)
			(3) Measuring insert
x		1001	1 x Pt100 in 3-wire circuit
x	x	1003	1 x Pt100 in 2-wire circuit
x		1011	1 x Pt100 in 4-wire circuit
x		2001	2 x Pt100 in 3-wire circuit
x		2003	2 x Pt100 in 2-wire circuit
			(4) Tolerance class to EN 60 751
x	x	1	Class B (standard)
x	x	2	Class A
			(5) Protection tube diameter D in mm
x		5	5mm
x		5.2	5.2mm
x	x	6	6mm
			(6) Fitting length EL in mm
x		45	45mm (standard with D 5mm and D 5.2mm)
x	x	50	50mm (with D 6mm only)
x		60	60mm (with D 6mm only)
			(7) Connecting cable end
x	x	03	bare cable ends
x	x	11	ferrules to DIN 46 228 Part 4 (standard)
x	x	13	receptacle 6.3 to DIN 46 247
x	x	80	multipole connector (please specify type in plain text)
			(8) Connecting cable length AL in mm (500≤ AL ≤500000 for type 902105/10)
	x	1100	1100mm (stretched)
x		2500	2500mm
x		...	please specify in plain text (500mm steps)
			(9) Extra codes
x	x	000	no extra code
x		315	cable protector: coil
x		316	cable protector: tube
x	x	317	shielded connecting cable

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
Order code		-		-		-		-		-		-		-		/		,...
Order example	902105/10	-	378	-	1001	-	1	-	6	-	50	-	11	-	2500	/	000[1]	

1. List extra codes in sequence, separated by commas.

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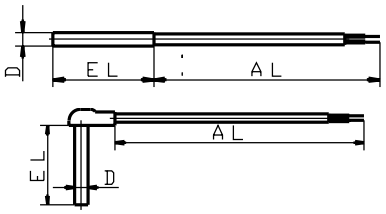
Order details: Push-in resistance thermometers with connecting cable

(1) Basic version

		902105/30	Push-in resistance thermometer with connecting cable, multi-piece protection tube (welded) in stainless steel
		902105/40	Push-in resistance thermometer with connecting cable, protection tube angled 90° (welded) in stainless steel



			(2) Operating temperature in °C / connecting cable
x		378	-50 to +180°C / silicone
x		386	-50 to +260°C / PTFE
x		388	-50 to +260°C / metal braiding
	x	397	-50 to +350°C / metal braiding
x		402	-50 to +400°C / metal braiding
x		724	-5 to +80°C / PVC
x		912	5 to 105°C / PUR (for 1 x 2-wire circuit only)
			(3) Measuring insert
x		1001	1 x Pt100 in 3-wire circuit
x	x	1003	1 x Pt100 in 2-wire circuit
x		1011	1 x Pt100 in 4-wire circuit
x		2001	2 x Pt100 in 3-wire circuit
x	x	2003	2 x Pt100 in 2-wire circuit
			(4) Tolerance class to EN 60 751
x	x	1	Class B (standard)
x	x	2	Class A
			(5) Protection tube diameter D in mm
x	x	6	6mm
x		8	8mm
			(6) Fitting length EL in mm (50≤ EL ≤500)
x		50	50mm
x	x	60	60mm
x	x	100	100mm
x	x	150	150mm
x	x	200	200mm
x	x	...	please specify in plain text (50mm steps)
			(7) Connecting cable end
x	x	03	bare cable ends
x	x	11	ferrules to DIN 46 228 Part 4 (standard)
x	x	13	receptacle 6.3 to DIN 46 247
x	x	80	multipole connector (please specify type in plain text)
			(8) Connecting cable length AL in mm (500≤ AL ≤500000)
x	x	2500	2500mm
x	x	...	please specify in plain text (500mm steps)
			(9) Extra codes
x		000	no extra code
x		310	stepped protection tube
x		315	cable protector: coil
x		316	cable protector: tube
x	x	317	shielded connecting cable

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
Order code		-		-		-		-		-		-		-		/		,...
Order example	902105/30	-	378	-	1001	-	1	-	6	-	50	-	11	-	2500	/	000[1]	

1. List extra codes in sequence, separated by commas.

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Stock versions

(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	Sales No.
902105/10	-	378	-	1003	-	1	-	5.2	-	45	-	11	-	2500	/	000	90/00326037
902105/10	-	378	-	1003	-	1	-	6	-	50	-	11	-	2500	/	000	90/00389771
902105/10	-	378	-	1001	-	1	-	6	-	50	-	11	-	2500	/	000	90/00392513
902105/10	-	724	-	1003	-	1	-	6	-	50	-	11	-	2500	/	000	90/00059085
902105/20	-	730	-	1003	-	1	-	6	-	50	-	11	-	1100	/	000	90/00065495
902105/30	-	388	-	1003	-	1	-	6	-	50	-	11	-	2500	/	315,317	90/00055718
902105/30	-	388	-	1003	-	1	-	6	-	100	-	11	-	2500	/	315,317	90/00055719
902105/30	-	388	-	1001	-	1	-	6	-	50	-	11	-	2500	/	315,317	90/00065451
902105/30	-	388	-	1001	-	1	-	6	-	100	-	11	-	2500	/	315,317	90/00065453
902105/40	-	397	-	1003	-	1	-	6	-	60	-	11	-	2500	/	317	90/00055715

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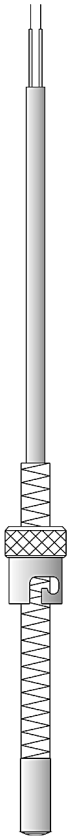
Push-in resistance thermometers with bayonet lock



- **for temperatures from -50 to +350°C**
- **with protection tubes in different materials**
- **as single or twin resistance thermometer**
- **good heat transfer through adjustable spring pressure**
- **insertion and removal without tools**

Push-in resistance thermometers with bayonet lock are preferred for measuring temperatures in solids, on bearings and moulding tools, for example in the plastics industry. Thanks to the special shape of the measuring tip, these temperature probes are suitable for use in flat-bottom and cone-shaped bores.

The rugged pressure spring is made from rust and acid resistant stainless steel, Mat. Ref. 1.4310, which also acts as a cable protector and ensures a uniform pressure between the measuring tip and the bottom of the hole. The fitting length can be altered by rotating the bayonet lock. Bayonet locks are available in the diameters 12, 15 and 16mm.

The sensor is normally a Pt100 temperature sensor to EN 60 751, Class B in 2-wire circuit, but versions with Pt500 or Pt1000 are also available. 3-wire and 4-wire connections can be provided.

Technical data

Connection	cable ends available as: bare wires, with ferrules, receptacle or multipole connector
Connecting cable	silicone, ambient temperature -50 to +180°C PTFE, ambient temperature -190 to +260°C metal braiding, ambient temperature -50 to +350°C connecting cable available with shielding (option)
Process connection	bayonet lock, nickel-plated brass, 12mm, 15mm or 16mm dia.
Protection tube	stainless steel 1.4571, 6mm and 8mm dia.
Measuring insert	Pt100 temperature sensor, EN 60 751, Cl. B, 2-wire circuit
Accessories	bayonet sockets, Data Sheet 90.9725

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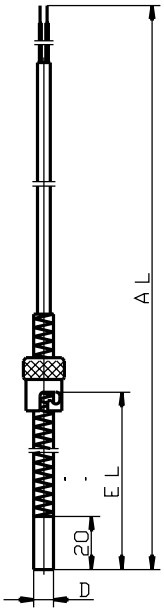
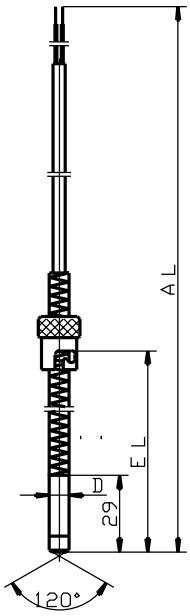
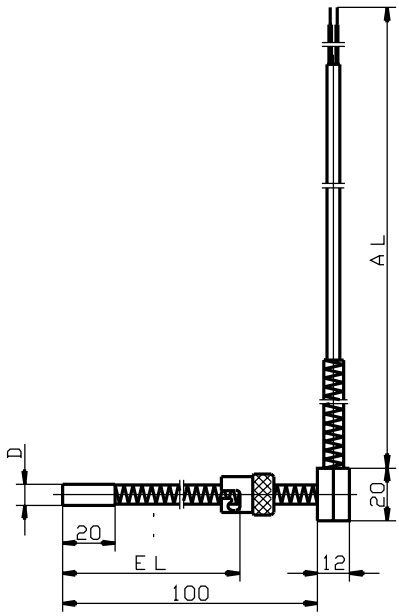
Dimensions



Type 902109/10



Type 902109/20



Type 902109/30

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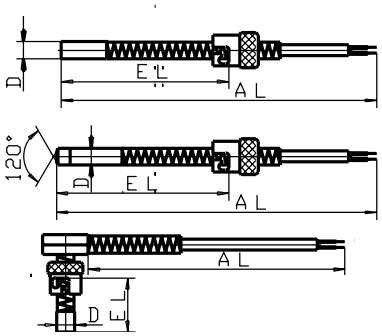
Order details: Push-in resistance thermometers with bayonet lock

				(1) Basic version
			902109/10	Push-in resistance thermometer, protection tube / measuring tip (flat-bottom) in stainless steel, Mat. Ref. 1.4571; bayonet lock: 12mm dia.
			902109/20	Push-in resistance thermometer, protection tube in stainless steel, Mat. Ref. 1.4571, measuring tip (120°) ceramic, KER 221; bayonet lock: 12mm dia.
			902109/30	Push-in resistance thermometer, protection tube / measuring tip (flat-bottom) in stainless steel, Mat. Ref. 1.4571; bayonet lock: 12mm dia.
				(2) Operating temperature in °C / connecting cable
x	x	x	380	-50 to +200°C / silicone
x	x	x	386	-50 to +260°C / PTFE
x	x	x	388	-50 to +260°C / metal braiding
x	x	x	397	-50 to +350°C / metal braiding
				(3) Measuring insert
x	x	x	1001	1 x Pt100 in 3-wire circuit
x	x	x	1003	1 x Pt100 in 2-wire circuit
x	x	x	2003	2 x Pt100 in 2-wire circuit
				(4) Tolerance class to EN 60 751
x	x	x	1	Class B (standard)
x	x	x	2	Class A
				(5) Protection tube diameter D in mm
x	x		6	6mm
x		x	8	8mm
				(6) Fitting length EL in mm
		x	85	20 - 85mm
x			175	20 - 175mm
	x		185	29 - 185mm
				(7) Connecting cable end
x	x	x	03	bare cable ends
x	x	x	11	ferrules to DIN 46 228 Part 4 (standard)
x	x	x	13	receptacle 6.3 to DIN 46 247
x	x	x	80	multipole connector (please specify type in plain text)
				(8) Connecting cable length AL in mm (500≤AL ≤500000)
x	x	x	2500	2500mm
x	x	x	...	please specify in plain text (500mm steps)
				(9) Extra codes
x	x	x	000	no extra code
x	x	x	302	bayonet lock 15mm dia.
x	x	x	303	bayonet lock 16mm dia.
x	x	x	317	shielded connecting cable



	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
Order code		-		-		-		-		-		-		-		/		,...
Order example	902109/10	-	397	-	1003	-	1	-	8	-	175	-	11	-	2500	/	000[1]	

1.List extra codes in sequence, separated by commas.

Note: Bayonet sockets, Data Sheet 90.9725

Stock versions

(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	Sales No.
902109/10	-	397	-	1003	-	1	-	8	-	175	-	11	-	2500	/	317	90/00055797
902109/10	-	388	-	1003	-	1	-	6	-	175	-	11	-	2500	/	317	90/00055798
902109/20	-	388	-	1003	-	1	-	6	-	185	-	13	-	2500	/	317	90/00055808

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Mineral-insulated resistance thermometers to EN 60 751

- **for temperatures from -50 (-200) to +600°C**
- **flexible sheath with shock-protected sensor**
- **as single or twin resistance thermometer in 2-wire, 3-wire or 4-wire circuit**
- **fast response time**
- **application-specific fitting length**

Thanks to their special properties, mineral-insulated resistance thermometers are used in chemical plants, power stations, pipelines, in engine construction, on test beds and in all applications where flexibility and problem-free replacement are required. The low-resistance internal copper conductors are embedded in compressed heat-resistant magnesium oxide inside a flexible thin-walled sheath in stainless steel.

The temperature sensor in 2-wire, 3-wire or 4-wire circuit is connected to the internal wires and fitted in the stainless steel protection tube. Protection tube and sheath are welded together. Diameters as small as 1.9mm are available.

The excellent heat transfer between the protection tube and the temperature sensor enables short response times ($t_{0.5}$ from 0.7sec) and high accuracy. The shock-proof construction ensures a long life. The flexible probe tube permits temperature measurement at points that are difficult to reach. The smallest bending radius is 5 times the external diameter.

The measuring insert is normally fitted with a Pt100 temperature sensor to EN 60 751, Class B in 2-wire circuit. Versions with Pt500 or Pt1000 are also available. 3-wire or 4-wire circuit connections can be provided.

Technical data

Terminal head	Form J, aluminium die-casting, M 16x1.5; IP54, ambient temperature -40 to +100°C Caution: reduced ambient temperature when using transmitters, Data Sheet 70.7030 (95.6530)
Connection	cable ends available as: bare wires, with ferrules, receptacles or multipole connector
Connecting cable	silicone, ambient temperature -50 to +180°C PTFE, ambient temperature -190 to +260°C metal braiding, ambient temperature -50 to +350°C
Process connection	thread, stainless steel 1.4571
Protection tube	stainless steel 1.4541, 1.9mm, 3mm and 6mm dia.
Measuring insert	Pt100 temperature sensor, EN 60 751, Cl. B, 2-wire circuit
Response times	in water with 0.4m/sec / in air with 3m/sec 1.9mm dia.: water $t_{0.5}$ = 0.7sec, $t_{0.9}$ = 2.1sec / air $t_{0.5}$ = 7.2sec, $t_{0.9}$ = 20.5sec 3.0mm dia.: water $t_{0.5}$ = 1.3sec, $t_{0.9}$ = 4.0sec / air $t_{0.5}$ = 13.5sec, $t_{0.9}$ = 41.0sec 6.0mm dia.: water $t_{0.5}$ = 5.0sec, $t_{0.9}$ =11.5sec / air $t_{0.5}$ = 37.5sec, $t_{0.9}$ = 117.5sec
Transmitter	analog transmitter, output 4 - 20mA, Data Sheet 70.7030 (95.6530)

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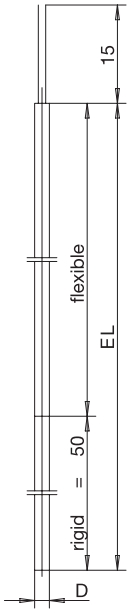
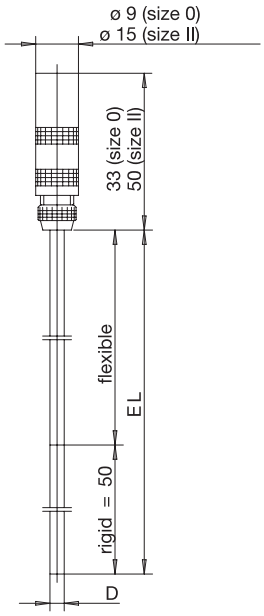
Dimensions



Type 902221/10



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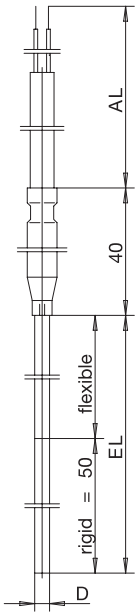

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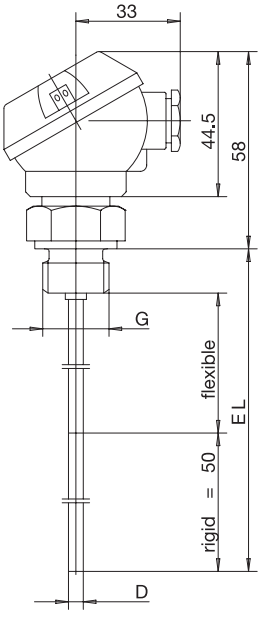

Type 902221/40

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Order details: Mineral-insulated resistance thermometers to EN 60 751

(1) Basic version

902221/10 — Mineral-insulated resistance thermometer with bare connecting wires

902221/20 — Mineral-insulated resistance thermometer with Lemosa connector

			(2) Operating temperature in °C
x	x	150	-200 to +600°C
x	x	415	-50 to +600°C (standard)
			(3) Measuring insert
x	x	1001	1 x Pt100 in 3-wire circuit
x	x	1003	1 x Pt100 in 2-wire circuit
x	x	1005	1 x Pt1000 in 2-wire circuit (only for -50 to +600°C)
x	x	1006	1 x Pt1000 in 3-wire circuit (only for -50 to +600°C)
x	x	1011	1 x Pt100 in 4-wire circuit
x		2001	2 x Pt100 in 3-wire circuit (only in conjunction with D 6mm)
x	x	2003	2 x Pt100 in 2-wire circuit
			(4) Tolerance class to EN 60 751
x	x	1	Class B (standard)
x	x	2	Class A
x	x	3	Class 1/3 DIN
			(5) Protection tube diameter D in mm
x	x	1.9	1.9mm, with Type 902221/20 incl. Lemosa connector Size 0
x	x	3	3.0mm, with Type 902221/20 incl. Lemosa connector Size 0
x	x	6	6.0mm, with Type 902221/20 incl. Lemosa connector Size 2
			(6) Fitting length EL in mm (70≤EL ≤1000)
x	x	100	100mm
x	x	200	200mm
x	x	300	300mm
x	x	...	please specify in plain text (50mm steps)

	(1)		(2)		(3)		(4)		(5)		(6)
Order code		-		-		-		-		-	
Order example	902221/20	-	415	-	1001	-	1	-	6	-	200

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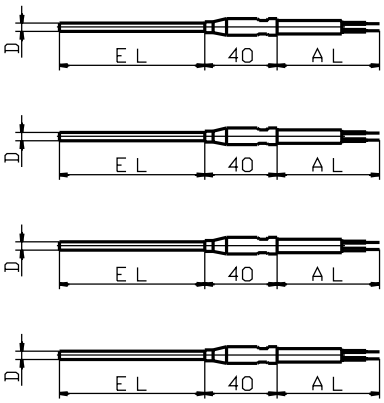
Order details: Mineral-insulated resistance thermometers to EN 60 751

(1) Basic version

902221/30	Mineral-insulated resistance thermometer with PVC cable (cable temperature range -5 to +80 (+105°C)
902221/32	Mineral-insulated resistance thermometer with silicone cable (cable temperature range -50 to +180°C)
902221/33	Mineral-insulated resistance thermometer with PTFE cable (cable temperature range -190 to +260°C)
902221/34	Mineral-insulated resistance thermometer with metal-braided cable (cable temperature range -50 to +350°C)



					(2) Operating temperature in °C
x	x	x	x	150	-200 to +600°C
x	x	x	x	415	-50 to +600°C (standard)
					(3) Measuring insert
x	x	x	x	1001	1 x Pt100 in 3-wire circuit
x	x	x	x	1003	1 x Pt100 in 2-wire circuit
x	x	x	x	1005	1 x Pt1000 in 2-wire circuit (only for -50 to +600°C)
x	x	x	x	1006	1 x Pt1000 in 3-wire circuit (only for -50 to +600°C)
x	x	x	x	1011	1 x Pt100 in 4-wire circuit
	x	x	x	2001	2 x Pt100 in 3-wire circuit (only in conjunction with D 6mm)
x	x	x	x	2003	2 x Pt100 in 2-wire circuit
					(4) Tolerance class to EN 60 751
x	x	x	x	1	Class B (standard)
x	x	x	x	2	Class A
x	x	x	x	3	Class 1/3 DIN
					(5) Protection tube diameter D in mm
x	x	x	x	1.9	1.9mm
x	x	x	x	3	3mm
x	x	x	x	6	6mm
					(6) Fitting length EL in mm (70≤EL ≤1000)
x	x	x	x	100	100mm
x	x	x	x	200	200mm
x	x	x	x	300	300mm
x	x	x	x	...	please specify in plain text (50mm steps)
					(7) Connecting cable end
x	x	x	x	03	bare cable ends
x	x	x	x	11	ferrules to DIN 46 228 Part 4 (standard)
x	x	x	x	13	receptacle 6.3 to DIN 46 247
x	x	x	x	80	multipole connector (please specify type in plain text)
					(8) Connecting cable length AL in mm (500≤AL ≤500000)
x	x	x	x	2500	2500mm
x	x	x	x	...	please specify in plain text (500mm steps)
					(9) Extra codes
x	x	x	x	000	no extra code
x	x	x	x	317	shielded connecting cable

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)
Order code		-		-		-		-		-		-		-		/	
Order example	902221/32	-	415	-	1001	-	1	-	3	-	200	-	11	-	2500	/	000

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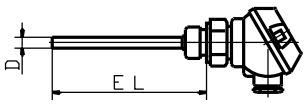
Order details: Mineral-insulated resistance thermometers to EN 60 751

		(1) Basic version
	902221/40	Mineral-insulated resistance thermometer with terminal head Form J



		(2) Operating temperature in °C
x	150	-200 to +600°C
x	415	-50 to +600°C (standard)
		(3) Measuring insert
x	1001	1 x Pt100 in 3-wire circuit
x	1003	1 x Pt100 in 2-wire circuit
x	1005	1 x Pt1000 in 2-wire circuit (only for -50 to +600°C)
x	1006	1 x Pt1000 in 3-wire circuit (only for -50 to +600°C)
x	1011	1 x Pt100 in 4-wire circuit
x	2003	2 x Pt100 in 2-wire circuit
		(4) Tolerance class to EN 60 751
x	1	Class B (standard)
x	2	Class A
x	3	Class 1/3 DIN
		(5) Protection tube diameter D in mm
x	3	3mm
x	6	6mm
		(6) Fitting length EL in mm (100≤EL ≤10000)
x	100	100mm
x	200	200mm
x	300	300mm
x	...	please specify in plain text (50mm steps)
		(7) Process connection
x	104	thread 1/2"pipe
x	105	thread 3/4"pipe
		(8) Extra codes
x	000	no extra code
x	330	1 x analog transmitter, output 4 - 20mA[2], Data Sheet 70.7030 (95.6530)

	(1)		**(2)**		**(3)**		**(4)**		**(5)**		**(6)**		**(7)**		**(8)**
Order code		-		-		-		-		-		-		/	
Order example	902221/40	-	415	-	1001	-	1	-	6	-	100	-	104	/	000

2. Please specify range in plain text.

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Internet: www.JumoUSA.com

Stock versions

(1)		(2)		(3)		(4)		(5)		(6)	Sales No.
902221/20	-	150	-	1003	-	1	-	1.9	-	300	90/00066527
902221/20	-	415	-	1011	-	1	-	3	-	300	90/00055770
902221/20	-	415	-	1011	-	1	-	6	-	300	90/00055773

Stock versions

(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	Sales No.
902221/32	-	150	-	1011	-	1	-	1.9	-	300	-	11	-	2500	/	000	90/00066531
902221/32	-	415	-	1003	-	1	-	3	-	100	-	11	-	2500	/	000	90/00068243
902221/32	-	415	-	1003	-	1	-	3	-	200	-	11	-	2500	/	000	90/00068244
902221/32	-	415	-	1003	-	1	-	3	-	300	-	11	-	2500	/	000	90/00055763
902221/32	-	415	-	1001	-	1	-	3	-	100	-	11	-	2500	/	000	90/00068247
902221/32	-	415	-	1001	-	1	-	3	-	300	-	11	-	2500	/	000	90/00055764
902221/32	-	415	-	1001	-	1	-	3	-	500	-	11	-	2500	/	000	90/00068248
902221/32	-	415	-	2003	-	1	-	3	-	300	-	11	-	2500	/	000	90/00055765
902221/32	-	415	-	1001	-	1	-	6	-	300	-	11	-	2500	/	000	90/00055767
902221/32	-	415	-	1001	-	1	-	6	-	500	-	11	-	2500	/	000	90/00068250

Stock versions

(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	Sales No.
902221/40	-	415	-	1003	-	1	-	3	-	100	-	104	/	000	90/00066731
902221/40	-	415	-	1003	-	1	-	3	-	200	-	104	/	000	90/00066732
902221/40	-	415	-	1003	-	1	-	3	-	300	-	104	/	000	90/00057512
902221/40	-	415	-	1003	-	1	-	6	-	200	-	104	/	000	90/00068252
902221/40	-	415	-	1003	-	1	-	6	-	300	-	104	/	000	90/00055775
902221/40	-	415	-	2003	-	1	-	6	-	300	-	104	/	000	90/00055777

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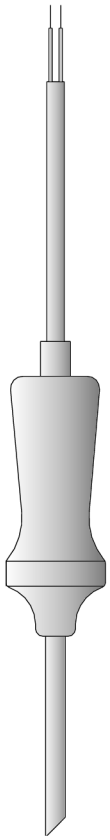
JUMO FOODtemp
Insertion resistance thermometers



- **for temperatures from -50 to +260°C**
- **steam-tight and pressure-proof**
- **high mechanical strength**
- **for use in the food industry**
- **with several measurement points**

Thanks to their special construction, the rugged steam-tight insertion resistance thermometers are particularly suitable for cooking and baking processes in all areas of food processing and preservation. Other applications are autoclaves and sterilizers.

The stainless steel probe tube is available with concentric point or oblique tip (approx. 25° or 45°).

All versions are highly resistant to shock and vibration. The handles are resistant to oil and acid.

The measuring insert is normally fitted with a Pt100 temperature sensor to EN 60 751, Class B in 2-wire or 3-wire circuit.

Technical data

Connection	cable ends available as: bare wires, with ferrules, receptacles or multipole connector
Connecting cable	silicone, ambient temperature -50 to +180°C PTFE, ambient temperature -50 to +260°C connecting cable available with shielding (option)
Handle	PPS plastic handle, ambient temperature +200°C max. silicone handle, ambient temperature +200°C max. PTFE handle, ambient temperature +260°C max. FPM handle, ambient temperature +200°C max. PEEK handle, ambient temperature +260°C max.
Protection tube	stainless steel 1.4571, 3.2mm, 4mm and 4.5mm dia.
Protection tube end	concentric, angled at approx. 25° oblique, angled at 45°
Measuring insert	Pt100 temperature sensor, EN 60 751, Cl. B, 2-wire circuit
Protection	IP67

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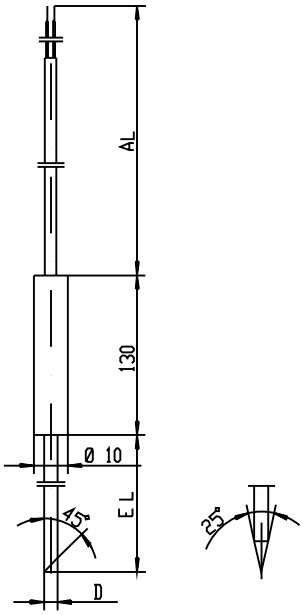
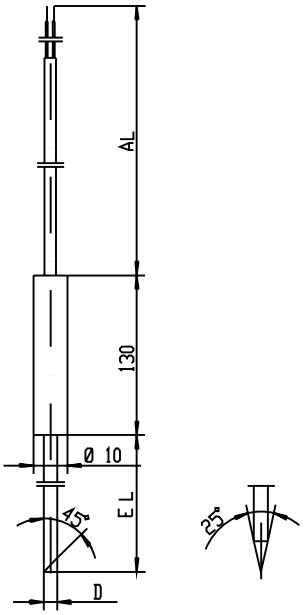
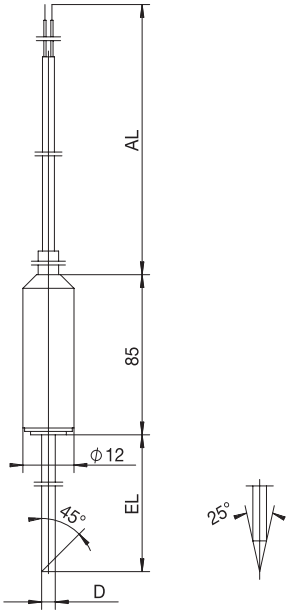
Dimensions



Type 902305/22



Type 902305/23



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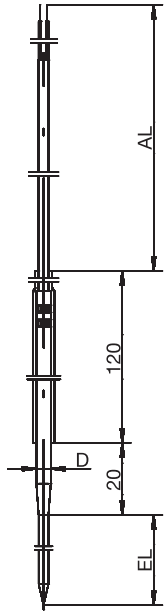
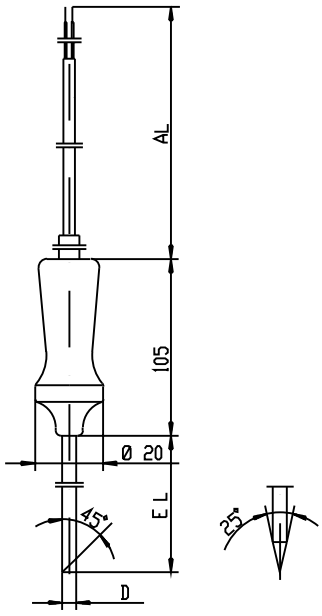


Type 902305/37
Type 902305/38



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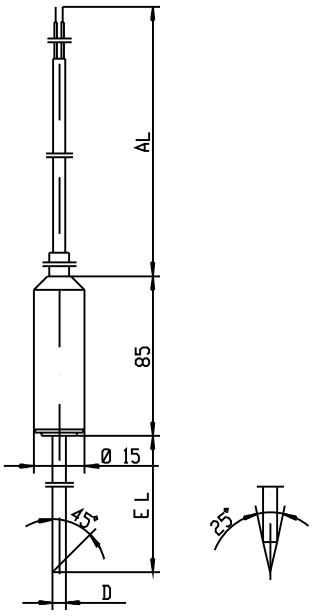

Type 902305/52

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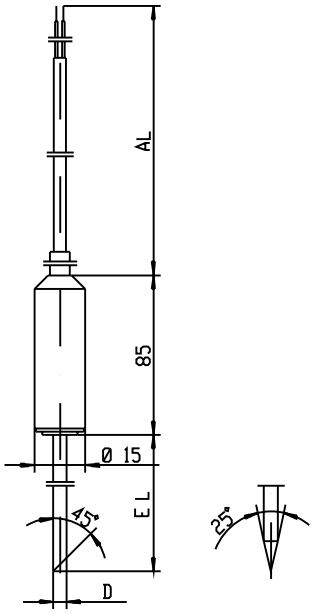
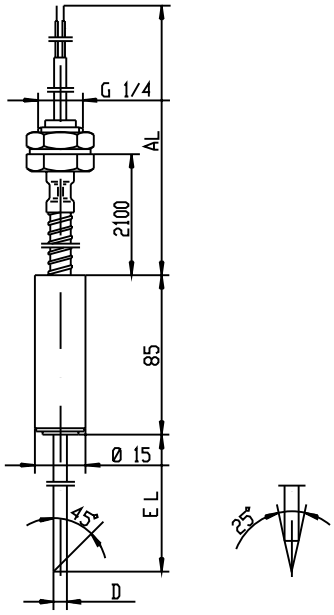


Type 902305/63



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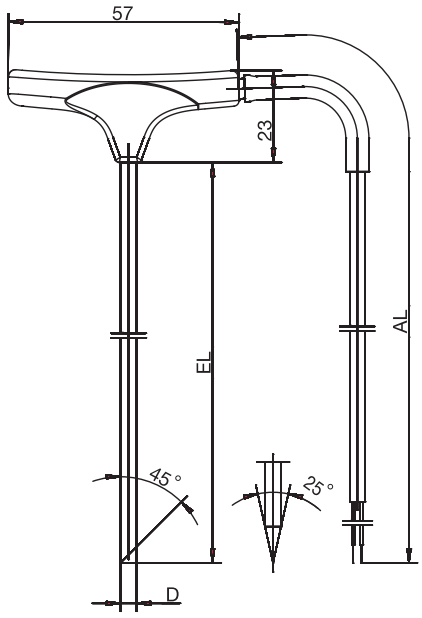

Type 902305/82
Type 902305/83

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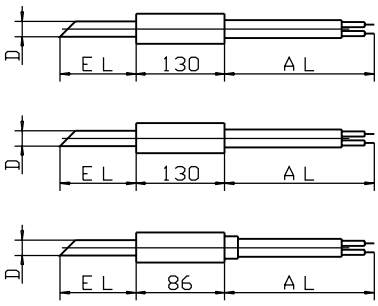
Order details: Insertion resistance thermometers

(1) Basic version

			902305/22	Insertion resistance thermometer with silicone handle 10 mm dia. and silicone cable
			902305/23	Insertion resistance thermometer with silicone handle 10 mm dia. and PTFE cable
			902305/33	Insertion resistance thermometer with PTFE handle 12 mm dia. and PTFE cable



				(2) Operating temperature in °C
x	x	x	380	-50 to +200°C
		x	386	-50 to +260°C
				(3) Measuring insert
x	x	x	1001	1 x Pt100 in 3-wire circuit
x	x	x	1003	1 x Pt100 in 2-wire circuit
x	x	x	1011	1 x Pt100 in 4-wire circuit
x	x	x	2001	2 x Pt100 in 3-wire circuit
x	x	x	2003	2 x Pt100 in 2-wire circuit
				(4) Tolerance class to EN 60 751
x	x	x	1	Class B (standard)
x	x	x	2	Class A
				(5) Protection tube diameter D in mm
x	x	x	4	4mm
x	x	x	4.5	4.5mm (only with 2 x Pt100 in 3-wire circuit)
				(6) Fitting length EL in mm
x	x	x	100	100mm
x	x	x	150	150mm
x	x	x	200	200mm
				(7) Insertion tip
x	x	x	2	concentric, angled at 25°
x	x	x	3	oblique, angled at 45°
				(8) Connecting cable end
x	x	x	03	bare cable ends
x	x	x	11	ferrules to DIN 46 228 Part 4 (standard)
x	x	x	13	receptacle 6.3 to DIN 46 247
x	x	x	80	multipole connector (please specify type in plain text)
				(9) Connecting cable length AL in mm (500 ≤ AL ≤ 500000)
x	x	x	4000	4000mm (standard)
x	x	x	...	please specify in plain text (500mm steps)
				(10) Extra codes
x	x	x	000	no extra code
x	x	x	317	shielded connecting cable

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)
Order code		-		-		-		-		-		-		-		-		/	
Order example	902305/22	-	380	-	1003	-	1	-	4	-	100	-	3	-	11	-	4000	/	000

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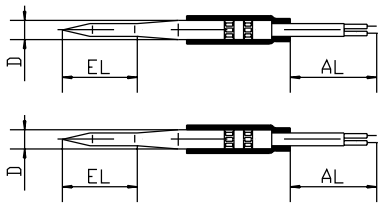
Order details: Insertion resistance thermometers

(1) Basic version

		902305/37	Miniature insertion resistance thermometer with FPM handle 6.5mm dia. and silicone cable
		902305/38	Miniature insertion resistance thermometer with FPM handle 6.5mm dia. and shielded PTFE cable



			(2) Operating temperature in °C
x	x	380	-50 to +200°C
			(3) Measuring insert
	x	1001	1 x Pt100 in 3-wire circuit
x	x	1003	1 x Pt100 in 2-wire circuit
	x	1011	1 x Pt100 in 4-wire circuit
			(4) Tolerance class to EN 60 751
x	x	1	Class B (standard)
x	x	2	Class A
			(5) Protection tube diameter D in mm
x	x	4	4mm stepped down to 2.5mm
			(6) Fitting length EL in mm
x	x	30	30mm
x	x	50	50mm
x	x	80	80mm
x	x	100	100mm
			(7) Connecting cable end
x	x	03	bare cable ends
x	x	11	ferrules to DIN 46 228 Part 4 (standard)
x	x	13	fast-on connector 6.3 to DIN 46 249
x	x	80	multipole connector (please specify type in plain text)
			(8) Connecting cable length AL in mm (500 ≤ AL ≤ 500000)
x	x	4000	4000mm (standard)
x	x	...	please specify in plain text (500mm steps)

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)
Order code		-		-		-		-		-		-		-	
Order example	902305/37	-	380	-	1003	-	1	-	4	-	80	-	11	-	4000

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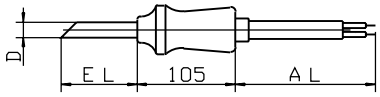
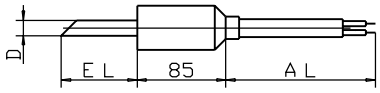
Order details: Insertion resistance thermometers

(1) Basic version

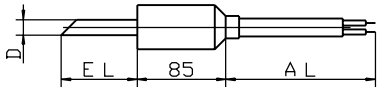
902305/43 Insertion resistance thermometer with PPS plastic handle 20mm dia. and PTFE cable



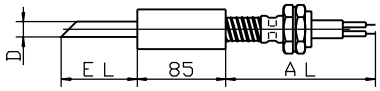
902305/52 Insertion resistance thermometer with PTFE handle 15mm dia. and silicone cable



902305/63 Insertion resistance thermometer with PTFE handle 15mm dia. and PTFE cable



902305/74 Insertion resistance thermometer with PTFE handle 15mm dia. and stainless steel corrugated tube



					(2) Operating temperature in °C
x	x	x	x	380	-50 to +200°C
		x	x	386	-50 to +260°C
					(3) Measuring insert
x	x	x	x	1001	1 x Pt100 in 3-wire circuit
x	x	x	x	1003	1 x Pt100 in 2-wire circuit
x	x	x	x	1011	1 x Pt100 in 4-wire circuit
x	x	x	x	2001	2 x Pt100 in 3-wire circuit
	x	x	x	2003	2 x Pt100 in 2-wire circuit
					(4) Tolerance class to EN 60 751
x	x	x	x	1	Class B (standard)
x	x	x	x	2	Class A
					(5) Protection tube diameter D in mm
	x	x	x	3.2	3.2mm dia. (only with 1 x Pt100 in 2-wire circuit)
x	x	x	x	4	4mm
	x	x	x	4.5	4.5mm (only with 2 x Pt100 in 3-wire circuit)
					(6) Fitting length EL in mm
x	x	x	x	100	100mm
x	x	x	x	150	150mm
	x	x	x	200	200mm
					(7) Insertion tip
x	x	x	x	2	concentric, angled at 25°
x	x	x	x	3	oblique, angled at 45°
					(8) Connecting cable end
x	x	x	x	03	bare cable ends
x	x	x	x	11	ferrules to DIN 46 228 Part 4 (standard)
x	x	x	x	13	receptacle 6.3 to DIN 46 247
x	x	x	x	80	multipole connector (please specify type in plain text)
					(9) Connecting cable length AL in mm (500 ≤ AL ≤ 500000)
x	x	x	x	4000	4000mm (standard)
x	x	x	x	...	please specify in plain text (500mm steps)
					(10) Extra codes
x	x	x	x	000	no extra code
x	x	x	x	317	shielded connecting cable

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)
Order code		-		-		-		-		-		-		-		-		/	
Order example	902305/43	-	380	-	1003	-	1	-	4	-	100	-	3	-	11	-	4000	/	000

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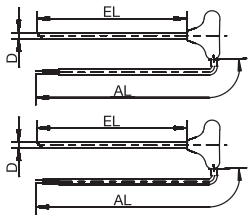
Order details: Insertion resistance thermometers

(1) Basic version

		902305/82	Insertion resistance thermometer with PEEK handle and silicone cable
		902305/83	Insertion resistance thermometer with PEEK handle and PTFE cable



			(2) Operating temperature in °C
x		380	-50 to +200°C
	x	386	-50 to +260°C
			(3) Measuring insert
x	x	1001	1 x Pt100 in 3-wire circuit
x	x	1003	1 x Pt100 in 2-wire circuit
	x	1011	1 x Pt100 in 4-wire circuit
	x	2001	2 x Pt100 in 3-wire circuit (only PTFE cable with diameter D = 4.5mm)
	x	2003	2 x Pt100 in 2-wire circuit
			(4) Tolerance class to EN 60 751
x	x	1	Class B (standard)
x	x	2	Class A
			(5) Protection tube diameter D in mm
	x	4	4mm dia.
x		4.5	4.5mm
			(6) Fitting length EL in mm
x	x	100	100mm (standard)
x	x	150	150mm
			(7) Insertion tip
x	x	2	concentric, angled at 25° (approx.)
x	x	3	oblique, angled at 45° (standard)
			(8) Connecting cable end
x	x	03	bare cable ends
x	x	11	ferrules to DIN 46 228 Part 4 (standard)
x	x	13	receptacle 6.3 to DIN 46 247
x	x	80	multipole connector (please specify type in plain text)
			(9) Connecting cable length AL in mm (500 ≤ AL ≤ 500000)
x	x	4000	4000mm (standard)
x	x	...	please specify in plain text (500mm steps)
			(10) Extra codes
x	x	000	no extra code
	x	317	shielded connecting cable

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)
Order code		-		-		-		-		-		-		-		-		/	
Order example	902305/83	-	386	-	1001	-	1	-	4,5	-	100	-	2	-	03	-	4000	/	000

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Stock versions

(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)	Sales No.
902305/22	-	380	-	1003	-	1	-	4	-	100	-	3	-	11	-	4000	/	000	90/00338150
902305/22	-	380	-	1001	-	1	-	4	-	100	-	2	-	11	-	4000	/	317	90/00338153
902305/23	-	380	-	1003	-	1	-	4	-	100	-	3	-	11	-	4000	/	000	90/00085418
902305/23	-	380	-	1003	-	1	-	4	-	100	-	2	-	11	-	4000	/	000	90/00085420
902305/43	-	380	-	1003	-	1	-	4	-	100	-	3	-	11	-	4000	/	000	90/00083365
902305/43	-	380	-	1001	-	1	-	4	-	100	-	3	-	11	-	4000	/	000	90/00083366
902305/43	-	380	-	1003	-	1	-	4	-	100	-	2	-	11	-	4000	/	000	90/00083791
902305/43	-	380	-	2001	-	1	-	4	-	100	-	2	-	11	-	4000	/	000	90/00089569
902305/43	-	380	-	1001	-	1	-	4	-	100	-	2	-	11	-	4000	/	000	90/00083792
902305/63	-	386	-	1001	-	1	-	4	-	100	-	3	-	11	-	4000	/	000	90/00325270
902305/63	-	386	-	1001	-	1	-	4	-	100	-	2	-	11	-	4000	/	000	90/00333089

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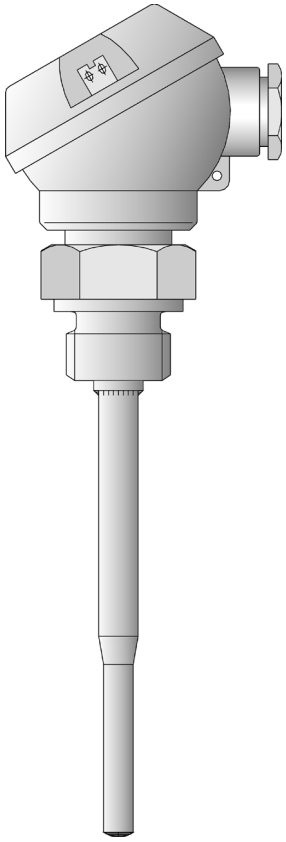
JUMO HEATtemp

Heat meter resistance thermometers with terminal head, PTB approved



- **for temperatures from 0 to 200°C, Type Direct Long (DL) and Pocket Long (PL)**
- **approved to calibration regulations EO 22 and EN 14 34 as interchangeable temperature probes according to AGFW regulation FW 202**
- **paired and certified in-house**
- **measurement directly in medium or in additional pocket**

Heat meter resistance thermometers are used for temperature measurement in closed pipe systems. Mounting in pockets with close tolerances avoids drainage of the system in the event of replacement after the end of the certification period. Screw-in or push-in versions with terminal head Form J are available.

The measuring insert is normally fitted with a Pt100 temperature sensor to EN 60 751, Class B in 2-wire circuit. Versions with Pt500 or Pt1000 are also approved. 3-wire and 4-wire circuit connections can be provided.

The resistance thermometers can be tested, paired and certified at temperatures between 20 and 150°C in the in-house Heat Test Laboratory **KF2**, which has state approval, or in the accredited test laboratory.

Measurement and certification charge for resistance thermometers to Federal Legal Document No. 28 of 1st August 2001.

Technical data

Terminal head	Form J, aluminium die-casting, Pg9, IP54, ambient temperature -20 to +100°C
Process connection	thread, stainless steel 1.4571
Protection tube	stainless steel 1.4571, 6mm and 8mm dia. stepped down to 6mm dia.
Measuring insert	Pt100 temperature sensors, EN 60 751, Cl. B, 2-wire circuit
Accessories	pocket, see Data Sheet 90.2440

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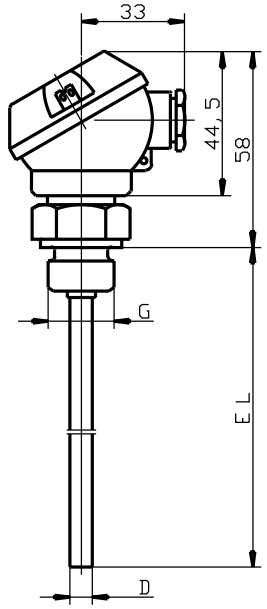
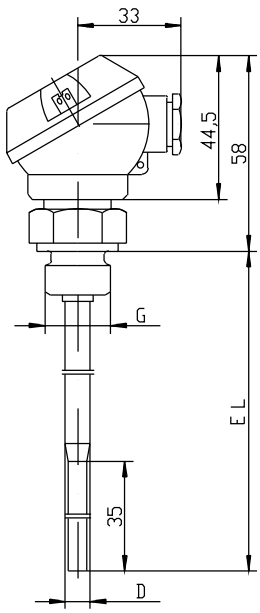
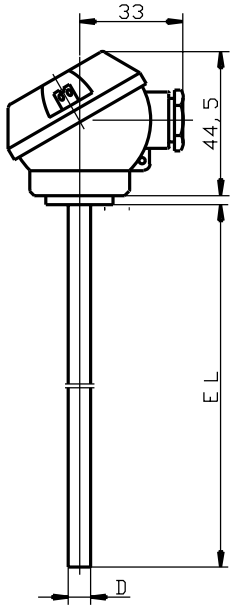
Dimensions



Type 902424/10 (DL)



Type 902424/11 (DL)



Type 902434/10 (PL)

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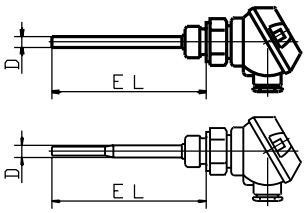
Order details: Heat meter resistance thermometers with terminal head, PTB approved

(1) Basic version

902424/10 Screw-in resistance thermometer with continuous protection tube, Form DL to EN 14 34

902424/11 Screw-in resistance thermometer with stepped protection tube, Form DL to EN 14 34



			(2) Operating temperature in °C
x	x	832	0 to 200°C
			(3) Measuring insert
x	x	1003	1 x Pt100 in 2-wire circuit
x	x	1004	1 x Pt500 in 2-wire circuit
x	x	1005	1 x Pt1000 in 2-wire circuit
x	x	1011	1 x Pt100 in 4-wire circuit
x	x	1012	1 x Pt500 in 4-wire circuit
x	x	1013	1 x Pt1000 in 4-wire circuit
			(4) Tolerance class to EN 60 751
x	x	1	Class B (standard)
x	x	2	Class A
x	x	3	Class 1/3 DIN
			(5) Protection tube diameter D in mm
x		6	6mm
	x	8	8mm stepped down to 6mm
			(6) Fitting length EL in mm
x	x	85	85mm
x	x	100	100mm
x	x	120	120mm
x	x	210	210mm
			(7) Process connection
x	x	104	thread 1/2"pipe
			(8) Extra codes
x	x	000	no extra code
x	x	319	terminal head Form B
x	x	320	terminal head Form BUZ
x	x	323	terminal head Form JK
x	x	340	version paired to EN 14 34 up to 150°C
x	x	341	version paired to EN 14 34 and certified up to 150°C
x	x	347	wire-wound temperature sensor

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
Order code		-		-		-		-		-		-		/		,...
Order example	902424/10	-	832	-	1003	-	1	-	6	-	120	-	104	/	000[1]	

1.List extra codes in sequence, separated by commas.

According to EN 14 34, the maximum operating temperature is 30°C above the highest measurement temperature during pairing (standard: 120°C).

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Order details: Heat meter resistance thermometers with terminal head, PTB approved

		(1) Basic version
	902434/10	Push-in resistance thermometer with continuous protection tube, Form PL to EN 14 34
		(2) Operating temperature in °C
x	832	0 to 200°C
		(3) Measuring insert
x	1003	1 x Pt100 in 2-wire circuit
x	1004	1 x Pt500 in 2-wire circuit
x	1005	1 x Pt1000 in 2-wire circuit
x	1011	1 x Pt100 in 4-wire circuit
x	1012	1 x Pt500 in 4-wire circuit
x	1013	1 x Pt1000 in 4-wire circuit
		(4) Tolerance class to EN 60 751
x	1	Class B (standard)
x	2	Class A
x	3	Class 1/3 DIN
		(5) Protection tube diameter D in mm
x	6	6mm, tolerance d10 (to EN 14 34)
		(6) Fitting length EL in mm
x	105	105mm
x	140	140mm
x	230	230mm
		(7) Extra codes
x	000	no extra code
x	319	terminal head Form B
x	320	terminal head Form BUZ
x	323	terminal head Form JK
x	340	version paired to EN 14 34 up to 150°C
x	341	version paired to EN 14 34 and certified up to 150°C
x	347	wire-wound temperature sensor

	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
Order code		-		-		-		-		-		/		,...
Order example	902434/10	-	832	-	1003	-	1	-	6	-	140	/	000[1]	

1.List extra codes in sequence, separated by commas.

According to EN 14 34, the maximum operating temperature is 30°C above the highest measurement temperature during pairing (standard: 120°C).

Note: Pockets, see Data Sheet 90.2440
Measurement and certification costs for resistance thermometers to Federal Legal Document No. 28 of 1st August 2001.
Other approved styles on request!

Stock versions:

(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	Sales No.
902424/11	-	832	-	1003	-	1	-	8	-	100	-	104	/	347	90/00084541

Stock versions:

(1)		(2)		(3)		(4)		(5)		(6)		(7)	Sales No.
902434/10	-	832	-	1003	-	1	-	6	-	140	/	000	90/00081727

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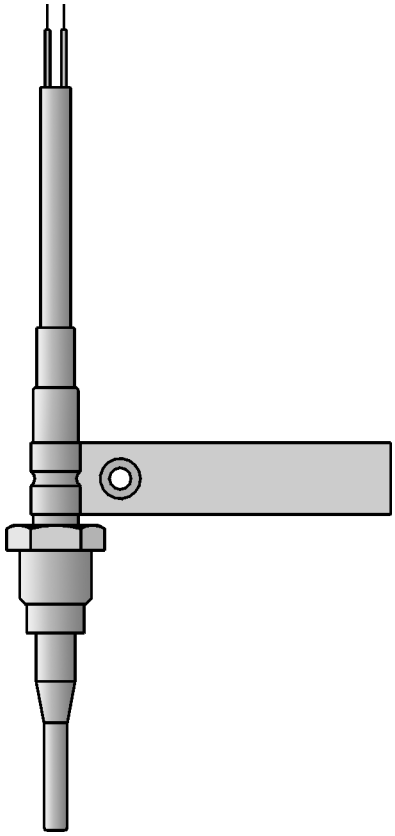
JUMO HEATtemp

Heat meter resistance thermometers with connecting cable, PTB approved



- **for temperatures from 0 to 180°C, Type Direct Short (DS), Direct Long (DL), Pocket Long (PL) and Pocket Short (PS)**
- **approved to calibration regulations EO 22 and EN 14 34 as interchangeable temperature probes according to AGFW regulation FW 202**
- **paired and certified in-house**

Heat meter resistance thermometers Type PS are preferably used for temperature measurement in closed pipe systems. Mounting in ball valves avoids drainage of the system for installation purposes and replacement after the end of the certification period.

The versions Type PL and PS are preferably fitted in pockets with close tolerances, which have the relevant approval. For correct temperature acquisition, it has to be ensured that the external diameter of the temperature probe matches the appropriate and approved internal diameter of the pocket.

The measuring insert is normally fitted with a Pt100 temperature sensor to EN 60 751, Class B in 2-wire circuit. Versions with Pt500 or Pt1000 are also approved. 4-wire connections can be provided.

The resistance thermometers can be measured, paired and certified at temperatures between 20 and 200°C in the in-house Heat Test Laboratory **KF2**, which has state approval, or in the accredited test laboratory.

Certification charge to Federal Legal Document No. 28 of 1st August 1996.

Technical data

Connection	cable ends available tinned or with ferrules
Connecting cable	PVC, ambient temperature -5 to +80°C PUR, ambient temperature +5 to +105°C silicone, ambient temperature -50 to +180°C maximum cable length, see table
Process connection	thread, brass and stainless steel
Protection tube	stainless steel 1.4571, 5mm, 5.2mm and 5.4mm dia. stepped down to 3.3mm dia. and 6mm dia.
Measuring insert	Pt100 temperature sensor, EN 60 751, Cl. B, 2-wire circuit
Accessories	pocket, see Data Sheet 90.2440

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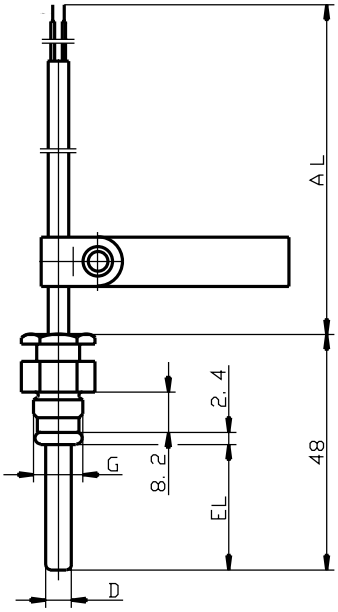
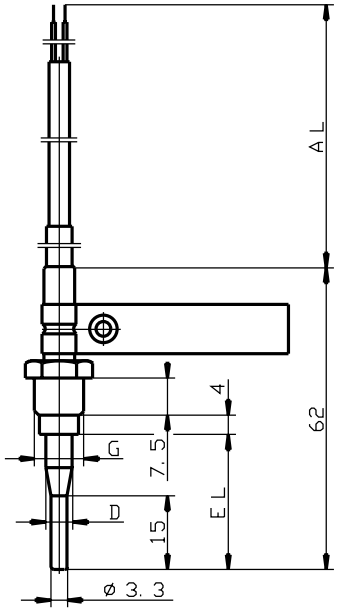
Cable cross-section	Maximum length for Pt100	Maximum length for Pt500	Maximum length for Pt1000
0.22mm^2	2500mm	12500mm	25000mm
0.34mm^2	3500mm	17500mm	35000mm
0.50mm^2	5000mm	25000mm	50000mm

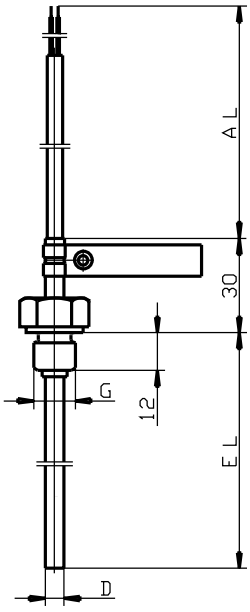
Dimensions



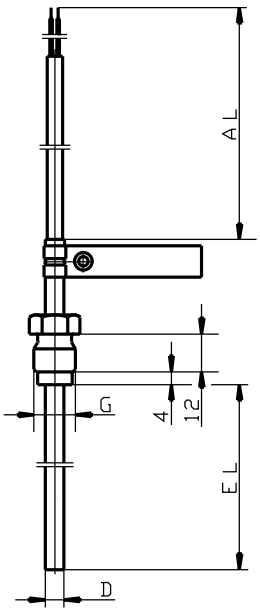
Type 902425/10 (DS)



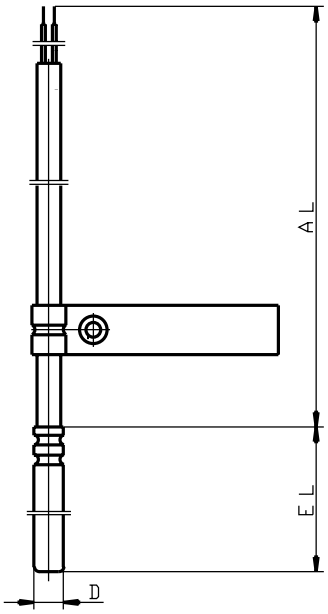
Type 902425/20 (DS)



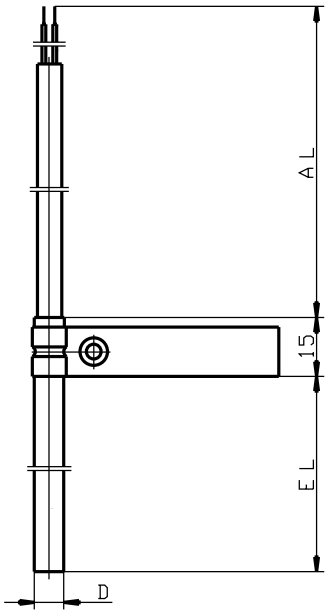
Type 902425/30 (DL)



Type 902425/40 (DL)



Type 902435/10.../20 (PS)



Type 902435/30 (PL)

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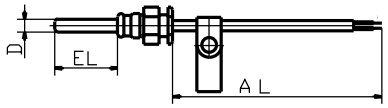
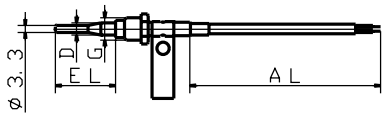
Order details: Heat meter resistance thermometers with connecting cable, PTB approved

(1) Basic version

902425/10 — Screw-in resistance thermometer for direct installation (DS) with loose screw fitting and plain protection tube



902425/20 — Screw-in resistance thermometer for direct installation (DS) with loose screw fitting and stepped protection tube



			(2) Operating temperature in °C / connecting cable
x	x	815	0 to 105°C / PUR (2-wire circuit only)
x		824	0 to 150°C / silicone
	x	830	0 to 180°C / silicone
			(3) Measuring insert
x	x	1003	1 x Pt100 in 2-wire circuit
x	x	1004	1 x Pt500 in 2-wire circuit
x	x	1005	1 x Pt1000 in 2-wire circuit
			(4) Tolerance class to EN 60 751
x	x	1	Class B (standard)
x	x	2	Class A
x	x	3	Class 1/3 DIN
			(5) Protection tube diameter D in mm
x		5	5mm
x		5.2	5.2mm
	x	5.4	5.4mm dia. stepped down to 3.3mm
			(6) Fitting length EL in mm (26≤ EL ≤60 for Type 902425/10)
x		26	26mm
	x	27.5	27.5mm
	x	38	38mm
x		...	please specify in plain text (10mm steps)
			(7) Process connection
x	x	114	thread M 10 x 1
			(8) Connecting cable end
x	x	04	tinned wires
x	x	11	ferrules to DIN 46 228 Part 4 (standard)
			(9) Connecting cable length AL in mm (500≤AL ≤30000)
x	x	2500	2500mm (standard)
x	x	...	please specify in plain text (500 mm steps)
			(10) Extra codes
x	x	000	no extra code
x	x	317	shielded connecting cable
x		318	coiled cable (PUR only)
x	x	340	version paired to EN 14 34
x	x	341	version paired to EN 14 34, certified

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)	
Order code		-		-		-		-		-		-		-		-		/		,...
Order example	902425/10	-	824	-	1003	-	1	-	5,2	-	26	-	114	-	11	-	2500	/	000[1]	

1. List extra codes in sequence, separated by commas.

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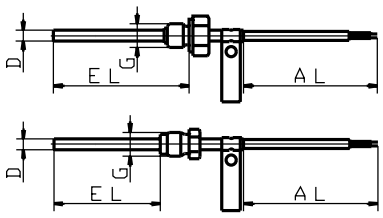
Order details: Heat meter resistance thermometers with connecting cable, PTB approved

(1) Basic version

902425/30 — Screw-in resistance thermometer for direct installation (DL) with fixed screw fitting and plain protection tube

902425/40 — Screw-in resistance thermometer for direct installation (DL) with loose screw fitting and plain protection tube



			(2) Operating temperature in °C / connecting cable
x	x	830	0 to 180°C / silicone
			(3) Measuring insert
x	x	1003	1 x Pt100 in 2-wire circuit
x	x	1004	1 x Pt500 in 2-wire circuit
x	x	1005	1 x Pt1000 in 2-wire circuit
x	x	1011	1 x Pt100 in 4-wire circuit
x	x	1012	1 x Pt500 in 4-wire circuit
x	x	1013	1 x Pt1000 in 4-wire circuit
			(4) Tolerance class to EN 60 751
x	x	1	Class B (standard)
x	x	2	Class A
x	x	3	Class 1/3 DIN
			(5) Protection tube diameter D in mm
x	x	6	6mm
x		8	8mm stepped down to 6mm
			(6) Fitting length EL in mm (85≤ EL ≤400)
x	x	85	85mm
x	x	120	120mm
x	x	210	210mm
x	x	...	please specify in plain text (50mm steps)
			(7) Process connection
x	x	102	thread 1/4" pipe
x		104	thread 1/2" pipe
			(8) Connecting cable end
x	x	04	tinned wires
x	x	11	ferrules to DIN 46 228 Part 4 (standard)
			(9) Connecting cable length AL in mm (500≤ AL ≤30000)
x	x	2500	2500mm (standard)
x	x	...	please specify in plain text (500mm steps)
			(10) Extra codes
x	x	000	no extra code
x	x	317	shielded connecting cable
x	x	340	version paired to EN 14 34
x	x	341	version paired to EN 14 34, certified

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)	
Order code		-		-		-		-		-		-		-		-		/		,...
Order example	902425/30	-	830	-	1003	-	1	-	6	-	120	-	104	-	11	-	2500	/	000[1]	

1. List extra codes in sequence, separated by commas.

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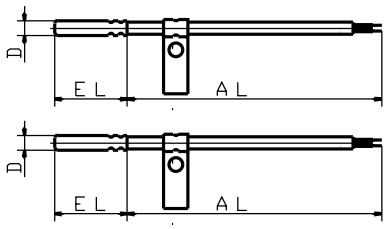
Order details: Heat meter resistance thermometers with connecting cable, PTB approved

(1) Basic version

		902435/10	Push-in resistance thermometer (PS), stainless steel protection tube, for fitting in pocket
		902435/20	Push-in resistance thermometer (PS), brass protection tube, for fitting in pocket



			(2) Operating temperature in °C / connecting cable
x	x	810	0 to 80°C / PVC (2-wire circuit only)
x	x	815	0 to 105°C / PUR (2-wire circuit only)
x	x	824	0 to 150°C / silicone
			(3) Measuring insert
x	x	1003	1 x Pt100 in 2-wire circuit
x	x	1004	1 x Pt500 in 2-wire circuit
x	x	1005	1 x Pt1000 in 2-wire circuit
			(4) Tolerance class to EN 60 751
x	x	1	Class B (standard)
x	x	2	Class A
x	x	3	Class 1/3 DIN
			(5) Protection tube diameter D in mm
x		5	5mm
x		5.2	5.2mm
x	x	6	6mm
			(6) Fitting length EL in mm (45≤ EL ≤85 for Type 902435/10)
x		45	45mm
x	x	50	50mm
x		60	60mm
x		...	please specify in plain text (5mm steps)
			(7) Connecting cable end
x	x	04	tinned wires
x	x	11	ferrules to DIN 46 228 Part 4 (standard)
			(8) Connecting cable length AL in mm (500≤ AL ≤30000)
x	x	2500	2500mm (standard)
x	x	...	please specify in plain text (500mm steps)
			(9) Extra codes
x	x	000	no extra code
x	x	317	shielded connecting cable
x	x	318	coiled cable (PUR only)
x	x	340	version paired to EN 14 34
x	x	341	version paired to EN 14 34, certified

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
Order code		-		-		-		-		-		-		-		/		,...
Order example	902435/10	-	824	-	1003	-	1	-	5	-	45	-	11	-	2500	/	000[1]	

1. List extra codes in sequence, separated by commas.

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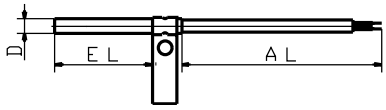
Order details: Heat meter resistance thermometers with connecting cable, PTB approved

		(1) Basic version
	902435/30	Push-in resistance thermometer for fitting in pocket (PL), stainless steel protection tube
		(2) Operating temperature in °C / connecting cable
x	810	0 to 80°C / PVC (2-wire circuit only)
x	815	0 to 105°C / PUR (2-wire circuit only)
x	830	0 to 180°C / silicone
		(3) Measuring insert
x	1003	1 x Pt100 in 2-wire circuit
x	1004	1 x Pt500 in 2-wire circuit
x	1005	1 x Pt1000 in 2-wire circuit
x	1011	1 x Pt100 in 4-wire circuit
x	1012	1 x Pt500 in 4-wire circuit
x	1013	1 x Pt1000 in 4-wire circuit
		(4) Tolerance class to EN 60 751
x	1	Class B (standard)
x	2	Class A
x	3	Class 1/3 DIN
		(5) Protection tube diameter D in mm
x	6	6mm
		(6) Fitting length EL in mm (85≤ EL ≤400)
x	85	85mm
x	105	105mm
x	140	140mm
x	230	230mm
x	...	please specify in plain text (50mm steps)
		(7) Connecting cable end
x	04	tinned wires
x	11	ferrules to DIN 46 228 Part 4 (standard)
		(8) Connecting cable length AL in mm (500≤ EL ≤30000)
x	2500	2500mm (standard)
x	...	please specify in plain text (500mm steps)
		(9) Extra codes
x	000	no extra code
x	317	shielded connecting cable
x	340	version paired to EN 14 34
x	341	version paired to EN 14 34, certified



	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
Order code		-		-		-		-		-		-		-		/		,...
Order example	902435/30	-	830	-	1003	-	1	-	6	-	140	-	11	-	2500	/	000[1]	

1. List extra codes in sequence, separated by commas .

Note: Installation locations and pockets, see Data Sheet 90.2440
Measurement and certification charge for resistance thermometers to Federal Legal Document No. 28 of 1st August 1996.

Stock versions:

(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	Sales No.
902435/30	-	830	-	1003	-	1	-	6	-	140	-	11	-	2500	/	000	90/00306816

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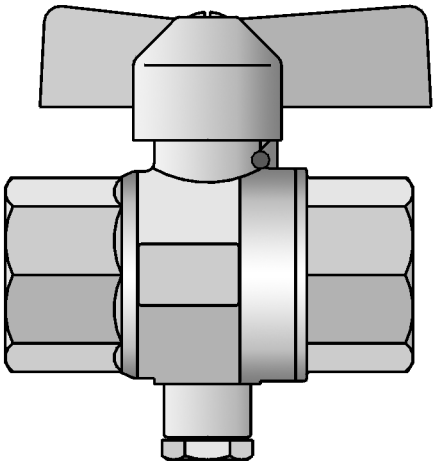
Installation locations for temperature probes

- **ball valves**
- **tees**
- **pockets**
- **adapter screw fittings**
- **mounting accessories**



When measuring temperatures in pipelines, it is absolutely essential to choose the correct installation location, to enable acquisition of the temperature prevailing on site.
Wrong installation often means losing the high accuracy of the temperature probe, which is then interpreted as poor probe quality. The correct installation location is, therefore, the first step towards a correct temperature measurement.

Technical data

Pocket

Pockets are employed when direct mounting of the temperature probe is not intended, or technically impermissible or impossible. Short pockets are screwed into tees, longer forms into special welding nipples, or welded directly to the pipe wall. With nominal values up to DN 50, the protection tube should be immersed into the pipe cross-section by more than half, with larger diameters sufficiently deep (at least 50mm), to eliminate heat transfer errors.

Ball valve

Ball valves are a combination of a shut-off device with an integral location for a direct-measuring temperature probe. They meet the requirements of integrated environmental protection for avoiding or reducing damage at the point of origin. The pipe systems need not be drained when the temperature probe has to be fitted or replaced. The location for the type 902425/2x temperature probe in the ball valve provides the best temperature measurement available today in pipelines with small nominal sizes.

Tee

Tees are ideally suited as mounting locations for pockets, especially when the optimum immersion depth has been ensured by design. When using the intended temperature probe, a location with the maximum immersion depth is available for the corresponding pipe cross-section. A minimum heat conduction error can only be achieved in this way.

Adapter screw fitting

Adapter screw fittings are used to adapt process connection threads to the threads of the pockets or temperature probes. The correct choice eliminates stacking, which has the effect of moving the measurement-active part of the temperature probe away from the center of the pipe.

Mounting accessories

Mounting accessories, such as welding nipples, round off the range available for adapting the installation location to the temperature probe or the pocket.

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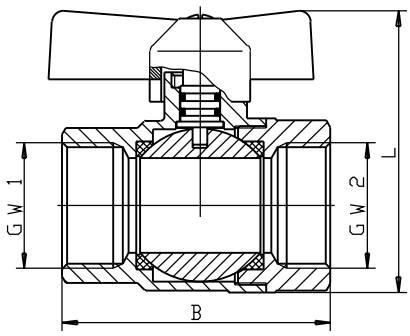
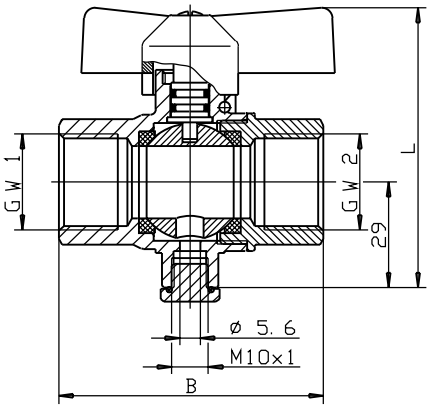
Dimensions



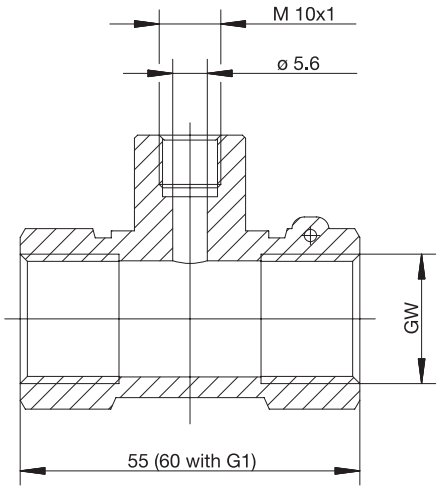
	G1/2	G3/4	G1
L	67	67	74
B	64	64	71

Type 902440/10

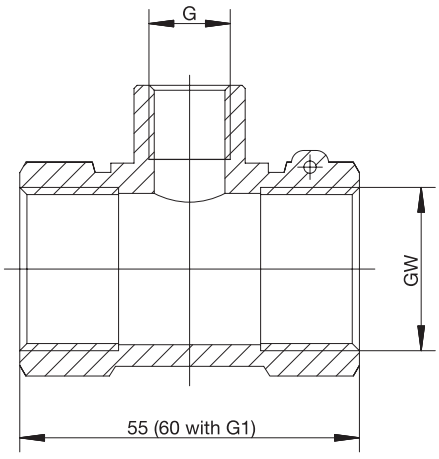


	G1/2	G3/4	G1
L	77	77	84
B	64	73	85, 5

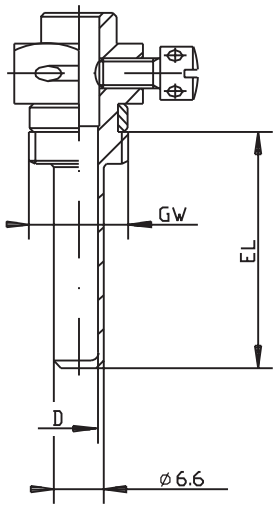
Type 902440/11



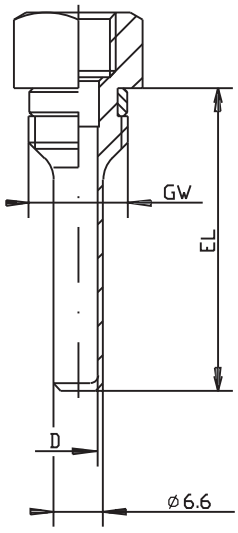
Type 902440/30



Type 902440/31



Type 902440/40



Type 902440/41

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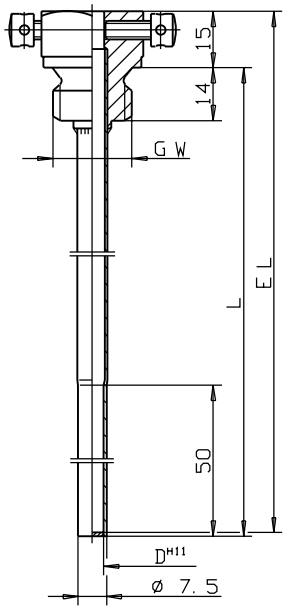
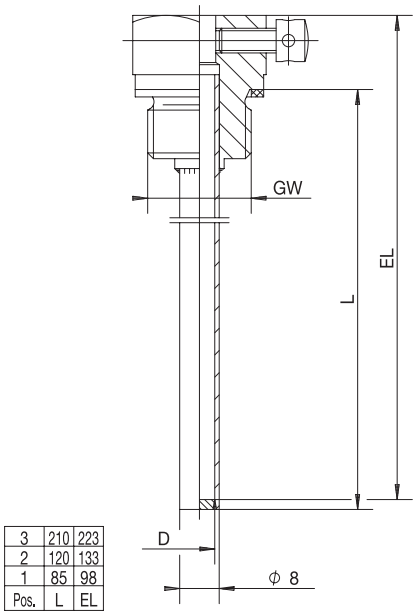
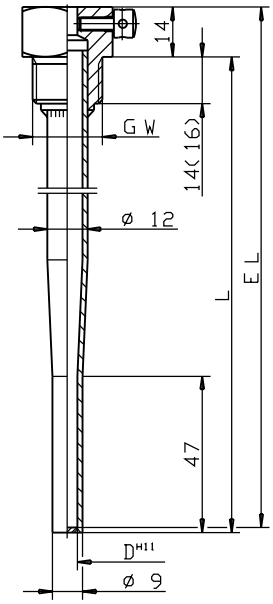


Type 902440/42

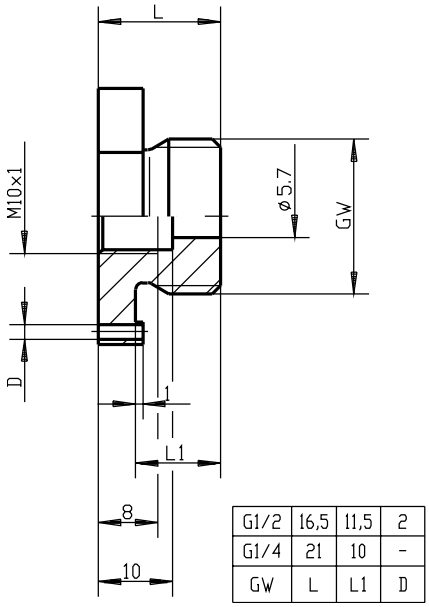


Pos.	L	EL
3	210	223
2	120	133
1	85	98

Type 902440/43

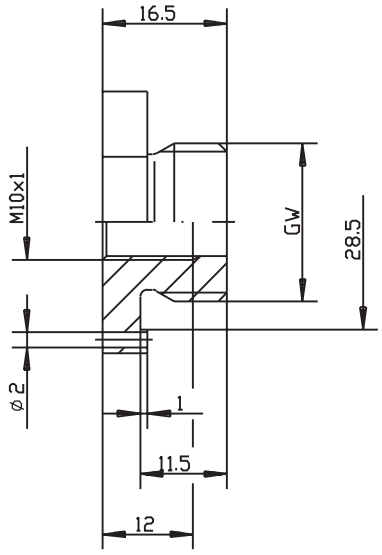


Type 902440/44

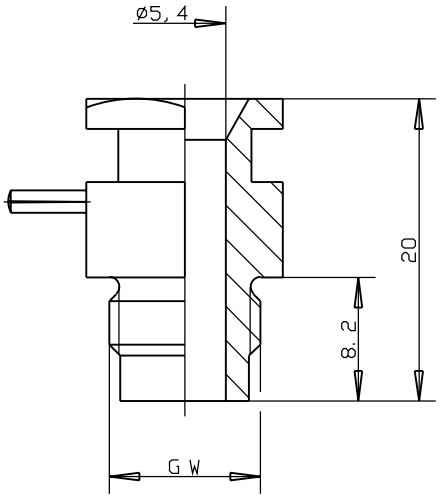


GW	L	L1	D
G1/2	16,5	11,5	2
G1/4	21	10	-

Type 902440/50



Type 902440/51



Type 902440/60

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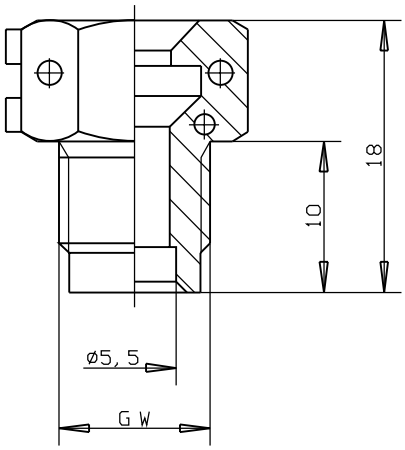
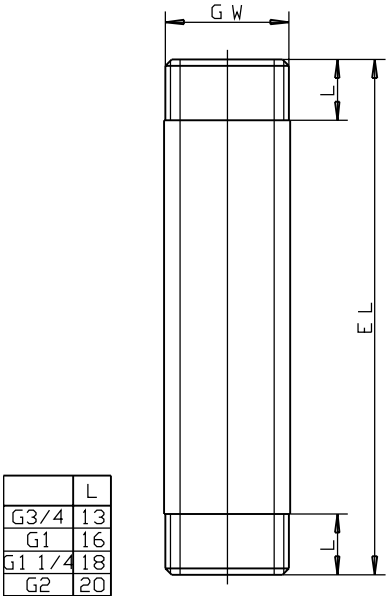
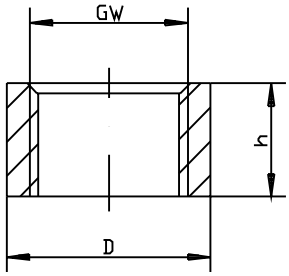


Type 902440/61



	L
G3/4	13
G1	16
G1 1/4	18
G2	20

Type 902440/65



G1/4	18.5	25
G1/2	27	15
GW	D	h

Type 902440/67

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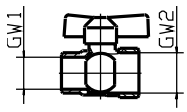
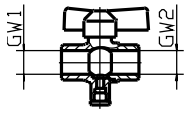
Order details: Installation locations for temperature probes

(1) Basic version

902440/10 Ball valve with 2 process connections, no measurement nipple, nickel-plated brass, $T_{max.}$ = 150°C, PN = 16bar



902440/11 Ball valve with 2 process connections, measurement nipple M10 x 1 to EN 14 34, for fitting type DS temperature probes, nickel-plated brass, $T_{max.}$ = 150°C, PN = 16bar



(2) Process connection GW 1

x	x	104	female thread G 1/2 (1/2" pipe)
x	x	105	female thread G 3/4 (3/4" pipe)
x	x	106	female thread G 1 (1" pipe)

(3) Process connection GW 2

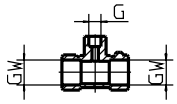
	x	104	female thread G 1/2 (1/2" pipe)
	x	105	female thread G 3/4 (3/4" pipe)
x	x	106	female thread G 1 (1" pipe)
	x	165	union nut 3/4" pipe
	x	166	union nut G 1 (1" pipe) (cannot be combined with G 1/2)
	x	167	union nut G 1 1/4 (1 1/4" pipe) (cannot be combined with G 1/2 and G 3/4)

	(1)		(2)		(3)
Order code		-		-	
Order example	902440/11	-	105	-	105

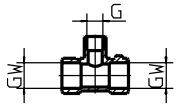
Order details: Installation locations for temperature probes

(1) Basic version

902440/30 Tee with identical female thread at both ends, measurement nipple M10 x 1 to EN 14 34, for fitting type DS temperature probes, brass



902440/31 Tee with identical female thread at both ends, measurement nipple with thread throughout, brass



(2) Process connection GW

x	x	104	female thread G 1/2 (1/2" pipe)
x	x	105	female thread G 3/4 (3/4" pipe)
x	x	106	female thread G 1 (1" pipe)

(3) Measurement nipple G

	x	102	G 1/4 (1/4" pipe)
	x	104	G 1/2 (1/2" pipe)
x	x	114	M 10 x 1

	(1)		(2)		(3)
Order code		-		-	
Order example	902440/30	-	105	-	114

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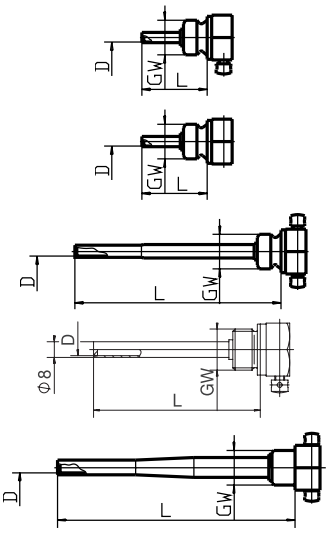
Order details: Installation locations for temperature probes

(1) Basic version

902440/40	Screw-in pocket with screw for lead sealing, straight protection tube, approved up to 90°C, PN = 16bar
902440/41	Screw-in pocket with M 10 x 1 thread, straight protection tube, approved up to 130°C, PN = 16bar
902440/42	Screw-in pocket to EN 14 34 with screw for lead sealing, external dia. 8mm stepped down to 7.5mm, internal dia. 6mm, fitting tolerance H10, approved up to 200°C, PN = 16bar
902440/43	Screw-in pocket with screw for lead sealing, external dia. 8mm, internal dia. 6.2mm max., approved up to 200°C, PN = 16bar
902440/44	Screw-in pocket with screw for lead sealing, external dia. 12mm stepped down to 9mm, internal dia. 6mm, fitting tolerance H12, PN = 25bar



(2) Internal diameter of protection tube in mm

x	x				5	5mm
x	x				5.2	5.2mm
x	x	x	x	x	6	6mm

(3) Fitting length EL in mm (85≤ EL ≤400 for Types 902440/42, 902440/43)

x					35	35mm
x	x				40	40mm
x					50	50mm
		x	x		85	85mm
		x	x	x	120	120mm
			x		155	155mm
		x	x	x	210	210mm

(4) Process connection GW

x	x				102	male thread G 1/4 (1/4" pipe)
x					103	male thread G 3/8 (3/8" pipe)
x		x	x	x	104	male thread G 1/2 (1/2" pipe)
				x	105	male thread G 3/4 (3/4" pipe)

(5) Material

		x	x	x	20	stainless steel
x	x				46	brass

	(1)		(2)		(3)		(4)		(5)
Order code		-		-		-		-	
Order example	902440/40	-	5	-	40	-	102	-	46

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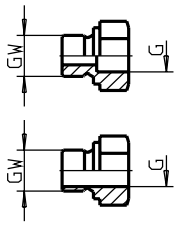
Order details: Installation locations for temperature probes

(1) Basic version

		902440/50	Adapter screw fitting, measurement nipple M10 x 1 to EN 14 34, for fitting type DS temperature probes
		902440/51	Adapter screw fitting, measurement nipple thread throughout



		(2) Process connection GW	
x		102	male thread G 1/4 (1/4" pipe)
x	x	104	male thread G 1/2 (1/2" pipe)
		(3) Measurement nipple G	
x	x	114	M 10 x 1
		(4) Material	
x		20	stainless steel
x	x	46	brass

	(1)		(2)		(3)		(4)
Order code		-		-		-	
Order example	902440/50	-	102	-	114	-	46

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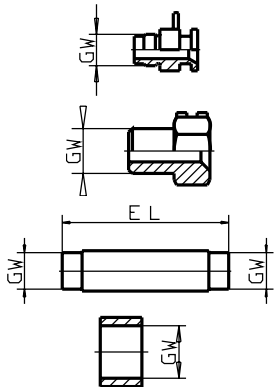
Order details: Installation locations for temperature probes

(1) Basic version

				902440/60	Adapter screw fitting set, for temperature probe conversion to direct installation in EN 14 34 location
				902440/61	Screw-fitting, folding, for fitting the temperature probe in type 902440/41 pocket
				902440/65	Twin nipple (meter substitution unit)
				902440/67	Welding nipple
					(2) Fitting length EL in mm
x	x		x	000	no fitting length
		x		105	105mm (with 1" pipe)
		x		110	110mm (with 3/4" pipe)
		x		130	130mm (with 1" pipe)
		x		135	135mm (with 1 1/4" pipe)
		x		150	150mm (with 2" pipe)
		x		190	190mm (with 1" pipe)
		x		260	260mm (with 1 1/4" pipe)
		x		300	300mm (with 2" pipe)
					(3) Process connection GW
			x	102	G 1/4 (1/4" pipe)
			x	104	G 1/2 (1/2" pipe)
		x		105	G 3/4 (3/4" pipe)
		x		106	G 1 (1" pipe)
		x		107	G 1 1/4 (1 1/4" pipe)
		x		110	G 2 (2" pipe)
x	x			114	M 10 x 1
					(4) Material
		x	x	01	steel
x				46	brass
	x			85	plastic



	(1)		(2)		(3)
Order code		-		-	
Order example	902440/60	-	000	-	114 - 46

Stock versions:

(1)		(2)		(3)	Sales No.
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902440/10	-	105	-	106	90/00364323
902440/10	-	106	-	106	90/00364331
902440/11	-	104	-	104	90/00349813
902440/11	-	105	-	105	90/00349814
902440/11	-	106	-	106	90/00349816
902440/31	-	104	-	102	90/00329064
902440/31	-	105	-	102	90/00329067
902440/31	-	106	-	102	90/00329068

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Stock versions:

(1)		(2)		(3)		(4)		(5)	Sales No.
902440/40	-	5	-	35	-	102	-	46	90/00340460
902440/40	-	5.2	-	35	-	102	-	46	90/00330518
902440/40	-	5.2	-	50	-	103	-	46	90/00330497
902440/40	-	5.2	-	50	-	104	-	46	90/00326403
902440/41	-	5.2	-	40	-	102	-	46	90/00362827
902440/42	-	6	-	85	-	104	-	20	90/00081683
902440/42	-	6	-	120	-	104	-	20	90/00081684
902440/43	-	6	-	85	-	104	-	20	90/00349100
902440/43	-	6	-	120	-	104	-	20	90/00352465

Stock versions:

(1)		(2)		(3)		(4)	Sales No.
902440/50	-	104	-	114	-	46	90/00062424

Stock versions:

(1)		(2)		(3)		(4)	Sales No.
902440/60	-	000	-	114	-	46	90/00355259
902440/61	-	000	-	114	-	85	90/00362826

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Surface resistance thermometers

- **for temperatures from -50 to +260°C**
- **with protection fittings in different materials**
- **for round and flat surfaces**
- **quick and easy installation**
- **low thermal mass**

Surface resistance thermometers are preferably used for temperature measurement on closed pipe systems or other round or flat surfaces. Simple installation by tension bands or hose clips avoids any mechanical preparation of the measurement site. An exception are basic versions 902522/10 and 902522/11, which have a mounting hole for screwing on to any surface, e.g. heating plates.

Indirect temperature measurement avoids disturbing the flow of the medium. On the other hand, pressure and chemical effects have no influence on the life of the resistance thermometer.

The measurement object is hardly affected by the low thermal mass. A heat conduction paste can be supplied to improve the heat transfer. Large temperature differences between the measurement medium and the surroundings directly affect the measurement. In such cases, additional insulation is advisable.

The measuring insert is normally fitted with a Pt100 temperature sensor to EN 60 751, Class B in 2-wire circuit. Versions with Pt500 or Pt1000 can also be provided.

Technical data

Connection	cable ends are available tinned, with ferrules, receptacles or multipole connector
Connecting cable	silicone, ambient temperature -50 to +180°C PTFE, ambient temperature -190 to +260°C Kapton, ambient temperature -50 to +260°C
Protection tube	stainless steel 1.4571, aluminium, plastic
Measuring insert	Pt100 temperature sensor, EN 60 751, Cl. B, 2-wire circuit

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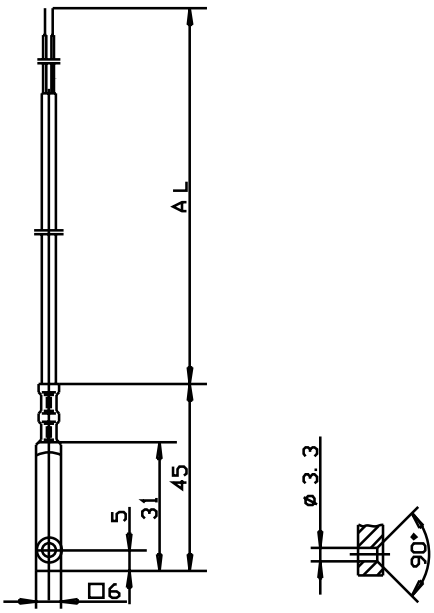
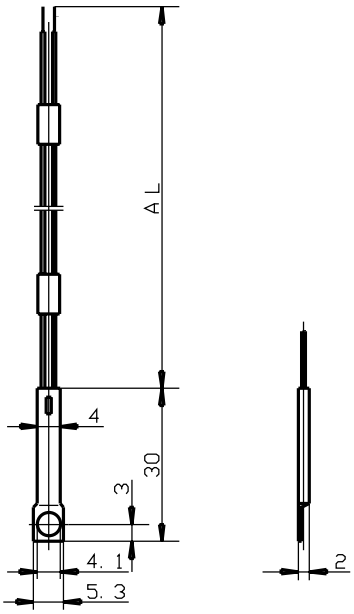
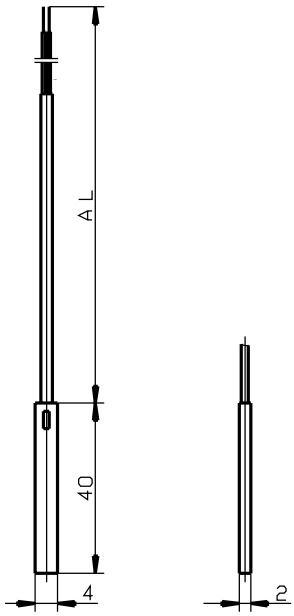
Dimensions



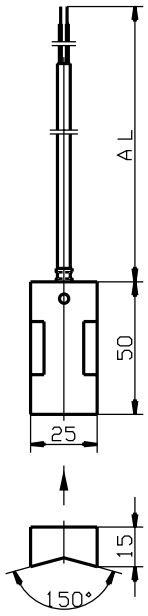
Type 902522/10



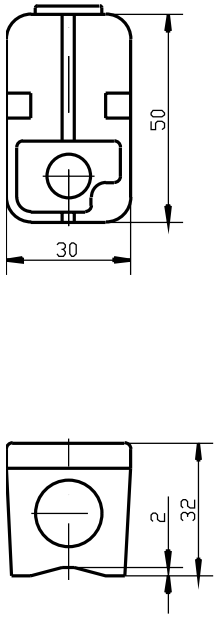
Type 902522/11



Type 902522/20



Type 902522/30



Type 902522/41
Type 902522/42

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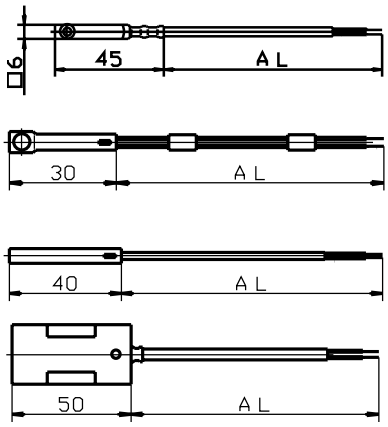
Order details: Surface resistance thermometers

(1) Basic version

				902522/10	Surface resistance thermometer with fixing hole, aluminium protection fitting
				902522/11	Surface resistance thermometer with fixing hole, stainless steel protection fitting
				902522/20	Surface resistance thermometer, stainless steel protection fitting
				902522/30	Surface resistance thermometer, aluminium protection fitting



					(2) Operating temperature in °C / connecting cable
			x	378	-50 to +180°C / silicone
x	x			386	-50 to +260°C / PTFE
		x		391	-50 to +260°C / Kapton
					(3) Measuring insert
x	x	x	x	1003	1 x Pt100 in 2-wire circuit
					(4) Tolerance class to EN 60 751
x	x	x	x	1	Class B (standard)
x	x	x	x	2	Class A
					(5) Connecting cable end
x	x	x	x	04	tinned wires
x	x	x	x	11	ferrules to DIN 46 228 Part 4 (standard)
x	x	x	x	13	receptacle 6.3 to DIN 46 247
					(6) Connecting cable length AL in mm (500≤ AL ≤500000)
x	x	x	x	2500	2500mm
x	x	x	x	...	please specify in plain text (500mm steps)
					(7) Extra codes
x	x	x	x	000	no extra code
x			x	315	cable protector: coil
x			x	316	cable protector: tube

	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
Order code		-		-		-		-		-		/		,...
Order example	902522/10	-	386	-	1003	-	1	-	11	-	2500	/	000[1]	

1.List extra codes in sequence, separated by commas.

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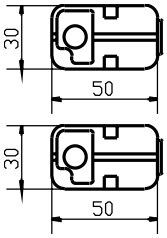
Order details: Surface resistance thermometers

(1) Basic version

		902522/41	Surface resistance thermometer, pipe-surface probe
		902522/42	Surface resistance thermometer, flat-surface probe



			(2) Operating temperature in °C
x	x	365	-50 to +120°C
			(3) Measuring insert
x	x	1003	1 x Pt100 in 2-wire circuit
x	x	1004	1 x Pt500 in 2-wire circuit
x	x	1005	1 x Pt1000 in 2-wire circuit
x	x	1009	1 x Ni 1000 in 2-wire circuit
x	x	1621	1 x KTY81-122 in 2-wire circuit
			(4) Tolerance class to EN 60 751
x	x	0	tolerance with KTY sensor
x		1	Class B (standard)
x		2	Class A
			(5) Extra codes
x	x	000	no extra code
x	x	404	Protection IP65 (M 16x1.5 cable gland)

	(1)		(2)		(3)		(4)		(5)
Order code		-		-		-		/	
Order example	902522/41	-	365	-	1003	-	1	/	000

Stock versions

(1)		(2)		(3)		(4)		(5)		(6)		(7)	Sales No.
902522/10	-	386	-	1003	-	1	-	11	-	2500	/	000	90/00306774
902522/11	-	386	-	1003	-	1	-	11	-	2500	/	000	90/00065548
902522/20	-	391	-	1003	-	1	-	11	-	2500	/	000	90/00065547
902522/30	-	378	-	1003	-	1	-	11	-	2500	/	315	90/00065531

Stock versions

(1)		(2)		(3)		(4)		(5)	Sales No.
902522/41	-	365	-	1003	-	1	/	000	90/00378669
902522/41	-	365	-	1003	-	1	/	404	90/00376703

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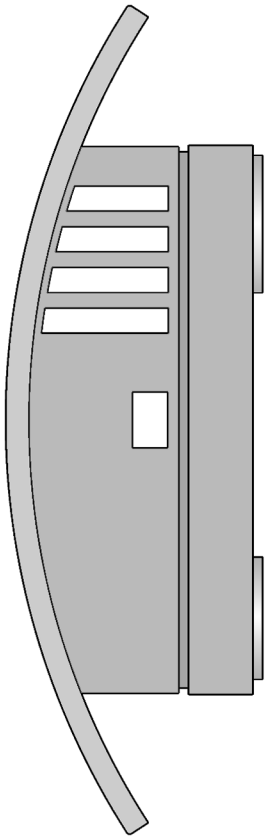
Indoor, outdoor and duct resistance thermometers



- **for temperatures from -30 to +80°C (200°C)**
- **for use in HVAC**
- **IP20 to IP65 protection**
- **for 2-wire, 3-wire or 4-wire connections**
- **fitted transmitter option 4 – 20mA or 0 – 10V**

Indoor, outdoor and duct resistance thermometers for HVAC applications are mainly used for temperature measurement in rooms, air ducts and outdoors.

Different instrument versions with plastic housings for different protection ratings are available to suit the particular measurement task.

The measuring insert is normally fitted with a Pt100 temperature sensor to EN 60 751, Class B, in 2-wire circuit. Versions with Pt500, Pt1000 or Ni 1000 can also be supplied. An extension in 3- or 4-wire circuit, starting from the terminals, is possible.
A transmitter can optionally be integrated.

Technical data

Terminal box	plastic PC housing (material PP on Type 902523/11), IP20 to IP65, Type 902523/25: IP54 and IP65 protection
Protection tube	stainless steel 1.4571; 5.4mm and 6mm dia.
Measuring insert	Pt100 temperature sensor, EN 60 751, Class B, 2-wire circuit
Transmitter	analog transmitter, output signal 4 – 20mA or 0 – 10V

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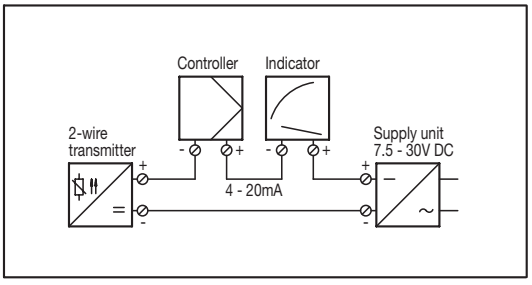
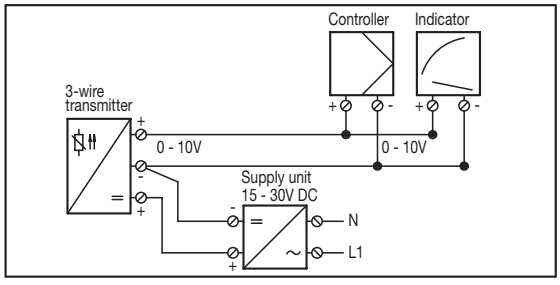
Transmitter		**Output 4 – 20mA**	**Output 0 – 10V**
	Input		
	Measurement input	Pt100 (EN 60 751)	
	Sensor current	≤0.5mA	
	Sampling rate	continuous measurement because of analog signal path	
	Measurement circuit monitoring		
	Underrange	falling to ≤3.6mA	0V
	Overrange	rising to ≥ 22mA to < 28mA (24mA typical)	rising to ≥ 11V to < 14V (12V typical)
	Probe short circuit	≤3.6mA	0V
	Probe and lead break	≥ 22mA to < 28mA (24mA typical)	≥ 11V to < 14V (12V typical)
	Output		
	Output signal	proportional DC current 4 – 20mA	DC voltage 0 – 10V
	Transfer characteristic	linear with temperature	
	Transfer accuracy	≤±0.1%	≤±0.2%
	Damping of ripple on 24V supply voltage, amplitude 10V/50Hz, burden 470Ω/load 10MΩ	37dB	40dB
	Burden (Rb)	Rb = (Ub - 7.5V) / 22mA	-
	Burden error	≤ ±0.02% / 100Ω[1]	-
	Load/load error	-	≥ 10kΩ / ≤±0.1%
	Settling time on temperature change	≤10msec	
	Calibration conditions	24V DC / approx. 22°C	
	Calibration accuracy	≤±0.2%[1,2] or ≤±0.2°C	
	Overall accuracy: sensor/calibration	±0.4°C (typical) at 20°C / 24V supply voltage	
	Supply		
	Supply voltage (Ub)	7.5 – 30V DC	15 – 30V DC
	Reverse polarity protection	yes	
	Supply voltage error	≤±0.01% per V deviation from 24V[1]	
	Ambient conditions		
	Operating temperature range	-40 to +85°C	
	Storage temperature range	-40 to +100°C	
	Temperature error	≤ ±0.01% per °C deviation from 22°C[1]	
	Climatic conditions similar to EN 60 654, Class C1	relative humidity ≤95% annual mean, no condensation	
	EMC interference emission/immunity	EN 61 326, Class B / to industrial requirements	

1. All data refer to the end-of-range value 20mA. 2. The larger value applies.

Connection example with supply unit, 4 – 20mA output

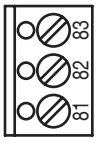


Connection example with supply unit, 0 – 10V output



Connection diagram

Output 4 - 20mA



Connection for		Terminal		
Supply voltage 7.5 - 30V DC	+ 81	$R_B = \frac{U_b - 7.5V}{22mA}$	81	82
Current output 4 - 20mA	- 82	R_B = burden resistance U_b = supply voltage	+	-

Output 0 - 10V

Connection for	Terminal			
Supply voltage 15 - 30V DC	+ 81 - 82	Load ≥ 10kΩ	81	82 83
Voltage output 0 - 10V	- 82 + 83		+	- +

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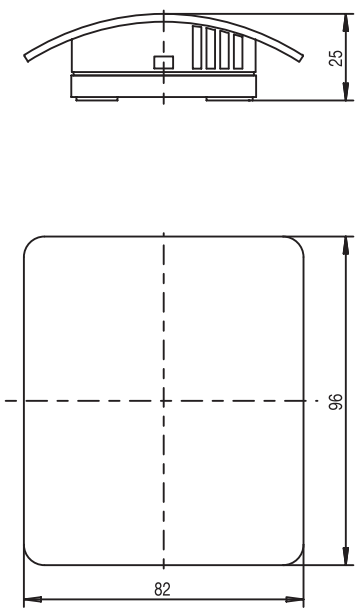
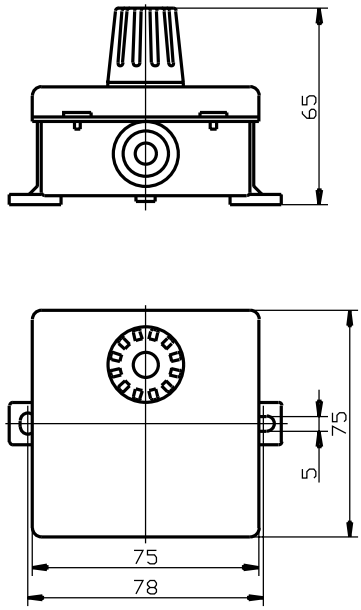
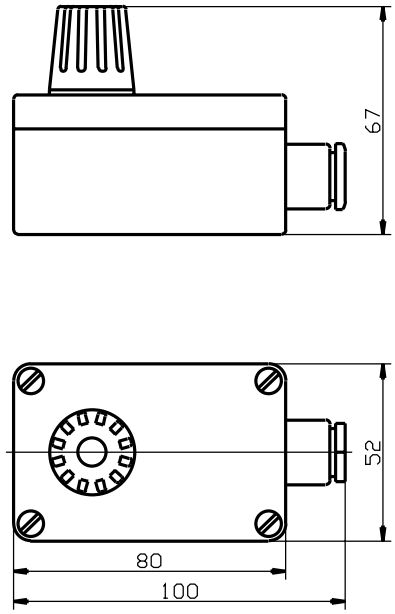
Dimensions



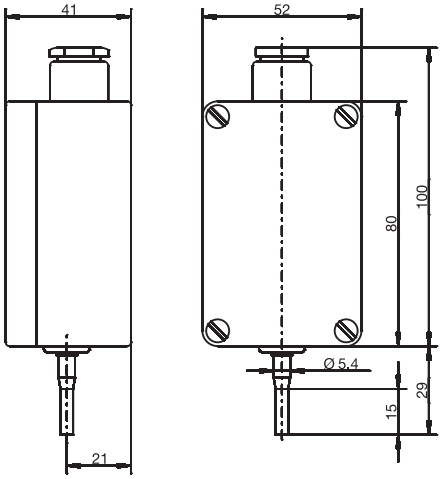
Type 902523/10



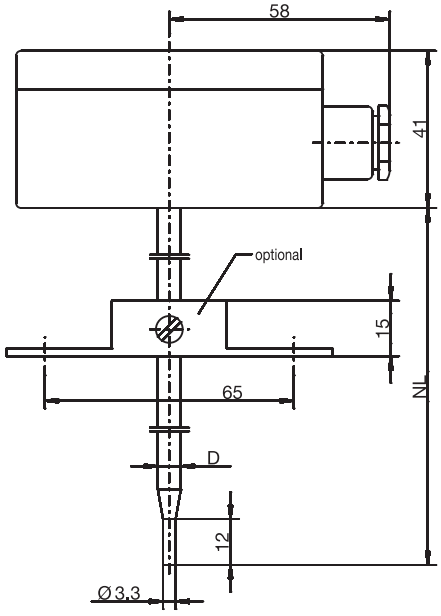
Type 902523/11



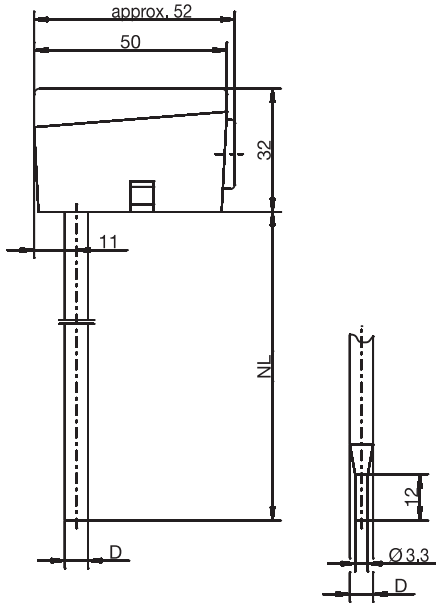
Type 902523/12



Type 902523/13



Type 902523/20



Type 902523/25

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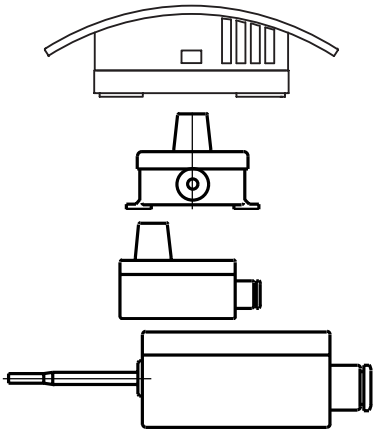
Order details: Indoor, outdoor and duct resistance thermometers



					(1) Basic version
				902523/10	Indoor resistance thermometer, Protection IP20
				902523/11	Indoor and outdoor resistance thermometer, Protection IP54
				902523/12	Indoor and outdoor resistance thermometer, Protection IP65
				902523/13	Indoor and outdoor resistance thermometer with stepped protection tube, Protection IP65
					(2) Operating temperature in °C
		x	x	568	-30 to +60°C (range only in conjunction with extra code 330 or 333)
x		x	x	572	-30 to +80°C (standard)
	x			635	-20 to +80°C (standard)
x		x	x	803	0 to 40°C (range only in conjunction with extra code 330 or 333)
x		x	x	807	0 to 60°C (range only in conjunction with extra code 330 or 333)
					(3) Measuring insert
x			x	1001	1 x Pt100 in 3-wire circuit
x	x	x	x	1003	1 x Pt100 in 2-wire circuit
x	x	x	x	1005	1 x Pt1000 in 2-wire circuit
x	x	x	x	1009	1 x Ni 1000 in 2-wire circuit
x				2001	2 x Pt100 in 3-wire circuit
	x	x	x	2003	2 x Pt100 in 2-wire circuit
					(4) Tolerance class to EN 60 751
x	x	x	x	1	Class B (standard)
x			x	2	Class A (not for Type 902523/10 in conjuction with transmitter)
x			x	3	Class 1/3 DIN (not for Type 902523/10 in conjunction with transmitter)
					(5) Extra codes
x	x	x	x	000	no extra code
x		x	x	330	analog transmitter, 4 – 20mA[2] output (in conjunction with 1 x Pt100)
x		x	x	333	analog transmitter, 0 – 10V[2] output (in conjunction with 1 x Pt100)

	(1)		(2)		(3)		(4)		(5)	
Order code		-		-		-		/		,...
Order example	902523/10	-	572	-	1001	-	1	/	000[1]	

1. List extra codes in sequence, separated by commas.
2. Please specify range in plain text.

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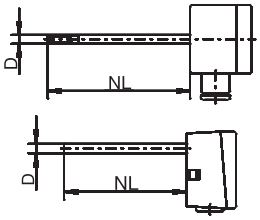
Order details: Indoor, outdoor and duct resistance thermometers

(1) Basic version

		902523/20	Duct resistance thermometer with stepped protection tube, Protection IP65
		902523/25	Duct resistance thermometer with plain protection tube, Protection IP54



			(2) Operating temperature in °C
	x	380	-50 to +200°C (standard)
x		568	-30 to +60°C (range only in conjunction with extra code 330 or 333)
x		572	-30 to +80°C (standard)
x		807	0 to 60°C (range only in conjunction with extra code 330 or 333)
			(3) Measuring insert
x	x	1003	1 x Pt100 in 2-wire circuit
x	x	1005	1 x Pt1000 in 2-wire circuit
x	x	1009	1 x Ni 1000 in 2-wire circuit
x		2003	2 x Pt100 in 2-wire circuit
			(4) Tolerance class to EN 60 751
x	x	1	Class B (standard)
x	x	2	Class A
x		3	Class 1/3 DIN
			(5) Protection tube diameter D in mm
x	x	6	6mm (Type 902523/20: stepped down from 6mm dia. to 3.3mm dia.)
			(6) Nominal length NL in mm (50≤NL ≤500)
x	x	100	100mm
	x	150	150mm
	x	200	200mm
	x	...	please specify in plain text (in 50mm steps)
			(7) Process connection
x	x	000	no process connection
x	x	252	screwed pipe joint G 1/4 (1/4" pipe)
x	x	254	screwed pipe joint G 1/2 (1/2" pipe)
x	x	662	stop flange 6mm dia.
			(8) Extra codes
x	x	000	no extra code
	x	310	protection tube stepped down from 6mm dia. to 3.3mm dia.
x		330	analog transmitter, 4 – 20 mA[2] output (in conjunction with 1 x Pt100)*
x		333	analog transmitter, 0 – 10 V[2] output (in conjunction with 1 x Pt100)*
	x	404	Protection IP65

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
Order code		-		-		-		-		-		-		/		,...
Order example	902523/20	-	572	-	1003	-	1	-	6	-	100	-	252	/	000[1]	

1. List extra codes in sequence, separated by commas.
2. Please specify range in plain text

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Stock versions

(1)		(2)		(3)		(4)		(5)	Sales No.
902523/10	-	572	-	1001	-	1	/	000	90/00065671
902523/10	-	803	-	1003	-	1	/	330 (0 to 40°C)	90/00064003
902523/10	-	807	-	1003	-	1	/	330 (0 to 60°C)	90/00065717
902523/11	-	635	-	1003	-	1	/	000	90/00055723
902523/12	-	572	-	1003	-	1	/	000	90/00064881
902523/12	-	807	-	1003	-	1	/	330 (0 to 60°C)	90/00064883
902523/13	-	572	-	1003	-	1	/	000	90/00419733
902523/13	-	572	-	2003	-	1	/	000	90/00419734
902523/13	-	568	-	1003	-	1	/	330 (-30 to +60°C)	90/00419736

(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	Sales No.
902523/20	-	572	-	1003	-	1	-	6	-	100	-	662	/	000	90/00064894
902523/20	-	568	-	1003	-	1	-	6	-	100	-	662	/	330 (-30 to +60°C)	90/00065087

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Test equipment for temperature and its traceability

- **Pt100 precision resistance thermometer**
- **calibrated temperature measuring system with precision indicator**
- **DKD calibration provided as a service**
- **calibration range -80 to +1100°C**

Raised quality expectations, improved measurement techniques, as well as quality assurance systems, such as ISO 9000, have all led to increased demands on the documentation of processes and the monitoring of measuring equipment.

Precision platinum resistance thermometers are the preferred choice for use as factory standards. They are employed for monitoring all temperature probes used in industry, building technology and quality assurance.

In conjunction with the precision indicator (temperature measuring system), the temperatures measured can be read off directly and transmitted online via the RS232 interface. The optional SmartGraph software enables the creation of tables and graphs, and the processing of the data in other Windows applications for documentation purposes.

The central issue for all instruments is the traceability of the measurement results to national standards. DKD-certified test equipment is recognized, without any further specification, as an instrument of traceability within Europe and in many non-European countries. As a service, calibration of existing test equipment can be provided at any time.

Technical data

Precision resistance thermometer

Measuring insert
Pt100 ceramic temperature sensor to EN 60 751, Class A

Temperatures
-50 to +250°C, -200 to +450°C

Protection tube
stainless steel 1.4541, 3mm and 4.5mm dia.

Protection
IP65

Connection
4-pole Lemosa coupling, size 1, 4-wire circuit, 1.5m silicone-insulated connecting cable with mating plug is included in delivery, ambient temperature -30 to +150°C

Response times: (in water with 0.4 m/sec and air with 3 m/sec)

3 mm dia.:	water	$t_{0.5}$ = 1.3 sec,	$t_{0.9}$ = 4.0 sec
	air	$t_{0.5}$ = 14 sec,	$t_{0.9}$ = 41 sec
4.5 mm dia.:	water	$t_{0.5}$ = 3.5 sec,	$t_{0.9}$ = 9.0 sec
	air	$t_{0.5}$ = 31.5 sec,	$t_{0.9}$ = 89.0 sec

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Precision indicator

Description

These universal process-led indicators are distinguished by their supreme accuracy, and are therefore ideally suited for measurement tasks where the highest level of accuracy is required. Applications are frequently found in the areas of quality assurance, production, maintenance and servicing, as well as in HVAC and environmental engineering. As a standard feature, all instrument versions have an electrically isolated RS232 PC interface, which enables the online documentation of the measured values. The measurement data can be processed by using the optional SmartGraph Windows software.

Product features

- integrated calibration function for easy compensation of probe tolerances
- 1-point, 2-point or 3-point calibration selectable
- electrically isolated RS232 interface
- Windows evaluation software available as an option (see SmartGraph accessory pack)
- large LC display with bargraph trend display
- storage of MAX, MIN, HOLD and average values
- differential temperature display on 2-channel instruments, both values can be displayed simultaneously
- operation off mains supply possible
- Pt100 input in 4-wire circuit, thermocouple inputs to EN 60 584
- measurement channels can be freely assigned

Versions:

902721/20	Pt100, thermocouple type J, K, L, N, R, S, T 1-channel; resolution 0.1°C
902721/25	Pt100, thermocouple type J, K, L, N, R, S, T 2-channel; resolution 0.1°C
902721/30	Pt100, thermocouple type J, K, L, N, R, S, T, 1-channel; resolution 0.01°C from -200 to +200°C, otherwise 0.1°C
902721/35	Pt100, thermocouple type J, K, L, N, R, S, T 2-channel; resolution 0.01°C from -200 to +200°C, otherwise 0.1°C

Note

The precision indicators (Pt100 only) are also optionally available in Ex design (see extra code).

Ranges

-200 to +850°C (Pt100), thermocouples to EN 60 584

Accuracy

Version 90.2721/20...25:

with Pt100	±0.1°C from -100 to +200°C, remaining range: 0.1% of measured value
with thermocouple type R, S	±0.1°C + 0.1% of measured value
with thermocouple type K, J, L, N, T	±0.3°C from 0 to 200°C, ±1.0°C up to 1000°C, remaining range: ±1.5°C of measured value

Version 902721/30...35:

with Pt100	±0.03°C from -100 to +150°C, ±0.05°C from -200 to +200°C, remaining range: 0.1% of measured value
with thermocouple type R, S	±0.1°C + 0.1% of measured value
with thermocouple type K, J, L, N, T	±0.3°C from 0 to 200°C, ±1.0°C up to 1000°C, remaining range: ±1.5°C of measured value

Display

2-line LC display with bargraph trend display

Housing

ABS plastic, dimensions 200mm x 85mm x 40mm (L x W x H)

Weight

approx. 300g

Permissible operating temperature

0 to 40°C

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SmartGraph

Documentation and evaluation software with mains supply adapter for stationary operation

This accessory pack offers a wide range of facilities for online documentation and processing of the measured values under Windows (95/98/2000/XP/NT). It can be usefully applied wherever measurement data have to be frequently documented and compared. In addition, it permits efficient management of the precision resistance thermometers and their calibration numbers.

A special interface adapter cable provides the physical connection between the indicator and the PC. The measurement data can be conveniently shown as graphs or tables and analyzed. The number of measurement channels and graphics windows can be freely selected. Data can be printed out on any installed Windows printer.

The delivery package also contains a mains supply adapter, to enable continuous operation without the inconvenience of having to change batteries.

Calibration services

The **Calibration Laboratory for Temperature (DKD-K 09501) at JUMO** has been accredited by the Physikalisch-Technische Bundesanstalt (PTB) since 1992. The latest accreditation entitles the calibration laboratory to issue calibration certificates for the calibration objects and measurement ranges that are listed below.

When considering the smallest measurement uncertainty, it must be taken into account that the given tolerance values relate to the measurement setup. Details in the calibration certificate may therefore show larger measurement uncertainties. The values are the result of stability tests performed on the calibration objects concerned.

Object for calibration	Measurement range	Measurement uncertainty
- resistance thermometers, - direct-reading electronic thermometers (temperature measuring system), - data loggers	0.01°C -80 to 0°C >0 to 90°C >90 to 300°C	0.005°C 0.015°C 0.010°C 0.015°C
- thermocouples	-80 to +200°C >200 to 300°C	0.2°C 0.3°C
- noble metal thermocouples	>300 to 1100°C	1.0°C
- base metal thermocouples, - direct-reading electronic thermometers	>300 to 1100°C	1.5°C
- resistance thermometers with transmitter, - direct-reading electronic thermometers, with transmitter	-80 to 0°C >0 to 90°C >90 to 300°C	0.045°C 0.040°C 0.045°C
- temperature block calibrators	30 to 133°C >133 to 660°C >660 to 1100°C	0.2°C 0.0015°C x (t) 2.5°C

Extended possibilities through factory calibration are available on request!

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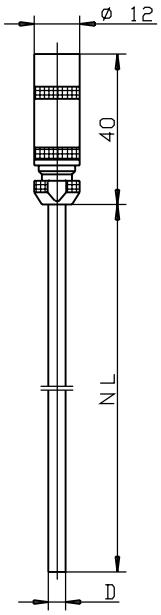
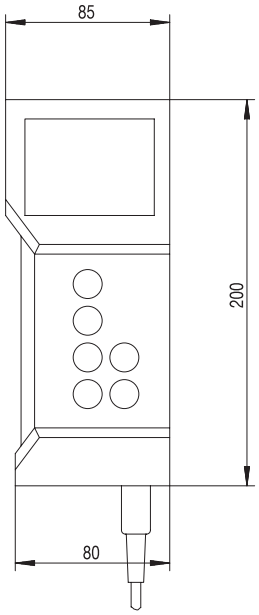
Internet: www.JumoUSA.com

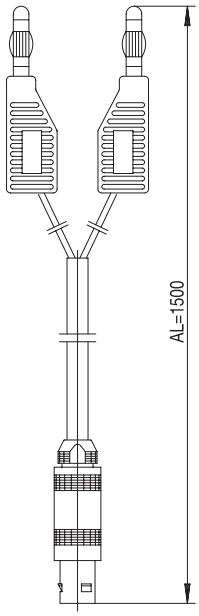
Dimensions



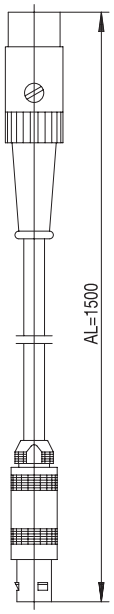
Precision resistance thermometer
Type 902721/10
Type 902721/15



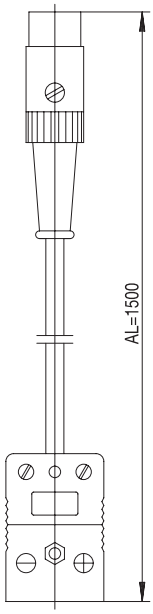
Precision indicator
Type 902721/20
Type 902721/25
Type 902721/30
Type 902721/35



Connecting cable for precision resistance thermometer



Connecting cable for temperature measuring system for Pt100



Connecting cable for temperature measuring system for thermocouples (NiCr-Ni)

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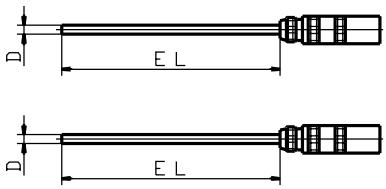
Order details: Precision resistance thermometer

(1) Basic version

		902721/10	Precision resistance thermometer to EN 60 751 Pt100 4-wire / Lemosa connector / connecting cable / -50 to +250°C
		902721/15	Precision resistance thermometer to EN 60 751 Pt100 4-wire / Lemosa connector / connecting cable / -200 to +450°C



			(2) Protection tube diameter D in mm
x	x	3	3mm
x	x	4.5	4.5mm
			(3) Fitting length EL in mm
x		200	200mm
x	x	300	300mm
	x	400	400mm
			(4) Packaging
x	x	10	in twist-pack
x	x	11	in wooden case (EL ≤ 300mm only)
			(5) Extra codes
x	x	000	no extra code
x	x	774	DKD calibration (standard, with table of resistance values)**
x	x	775	DKD calibration (as service, specify calibration points in plain text)

	(1)		(2)		(3)		(4)		(5)	
Order code		-		-		-		/		,...
Order example	902721/10	-	3	-	200	-	10	/	775, -10, 0, +25°C[1]	

1. List extra codes in sequence, separated by commas.

Note

** With extra code “standard calibration”, the temperatures 0, 100 and 200°C are used as calibration points. Other or additional calibration points can optionally be selected under extra code 775.

Temperature probe connection

A silicone-insulated connecting cable, 1.5m long, is included in the delivery.

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Order details: Temperature measuring system

					(1) Basic version, indicator
				902721/20	Precision indicator P600 1-channel / resolution 0.1°C / -200 to +850°C Pt100, thermocouples: type K, J, L, N, R, S, T
				902721/25	Precision indicator P605 2-channel / resolution 0.1°C / -200 to +850°C Pt100, thermocouples: type K, J, L, N, R, S, T
				902721/30	Precision indicator P650 1-channel / resolution 0.01°C / 0.1°C / -200 to +850°C Pt100, thermocouples: type K, J, L, N, R, S, T
				902721/35	Precision indicator P655 2-channel / resolution 0.01°C / 0.1°C / -200 to +850°C Pt100, thermocouples: type K, J, L, N, R, S, T
					(2) Operating temperature in °C, temperature probe
x	x	x	x	135	-200 to +450°C (precision resistance thermometer)
x	x	x	x	150	-200 to +600°C (resistance thermometer), version 902221/20 ...
x	x	x	x	185	-200 to +1200°C (thermocouples), version 901221/20-1043 ...
x	x	x	x	385	-50 to +250°C (precision resistance thermometer)
x	x	x	x	415	-50 to +600°C (resistance thermometer), version 902221/20 ...
					(3) Protection tube diameter D in mm, temperature probe
x	x	x	x	3	3mm
x	x	x	x	4.5	4.5mm
x	x	x	x	...	please specify in plain text (only with (2) selection 150, 180 and 415)*
					(4) Fitting length EL in mm, temperature probe
x	x	x	x	200	200mm (only with (2) selection 385)
x	x	x	x	300	300mm
x	x	x	x	400	400mm (only with (2) selection 135)
x	x	x	x	...	please specify in plain text (in 50mm steps, only with (2) selection 150, 180 and 415)*
					(5) Number of temperature probes
x	x	x	x	...	please specify in plain text
					(6) Extra codes
x	x	x	x	000	no extra code
x	x	x	x	346	SmartGraph accessory pack
x	x	x	x	362	indicator Pt100, Ex version (II 2 G EEx ib II B T4)
x	x	x	x	773	DKD calibration (standard, display values only)**
x	x	x	x	774	DKD calibration (standard, with table of resistance values)**
x	x	x	x	775	DKD calibration (as service, specify calibration points in plain text)
x	x	x	x	779	9V mains supply adapter
x	x	x	x	782	service case (plastic) with foam rubber padding

	(1)		(2)		(3)		(4)		(5)		(6)	
Order code		-		-		-		-		/		, ...
Order example	902721/35	-	135	-	3	-	200	-	2	/	775, -40, 0, 100°C[1]	

1. List extra codes in sequence, separated by commas.

Note

* Please choose the version that fits your requirements from the corresponding data sheets 90.1221 and 90.2221, and enter fitting length and protection tube diameter in your order details.

** With extra code “standard calibration”, the temperatures 0, 100 and 200°C are used as calibration points. Other or additional calibration points can optionally be selected under extra code 775.

Temperature probe connection

Depending on the number of temperature probes (5), a silicone-insulated connecting cable, 1.5m long, is included in the delivery.

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Order details: Calibration as a service

			(1) Type of calibration	
		902721/50	DKD calibration	
		902721/55	factory calibration	
			(2) Calibration object	
x	x	1	resistance thermometer/thermocouple/temperature measuring system	
x	x	2	data logger/temperature measuring system (display values only)	
x		3	temperature block calibrator	
			(3) Calibration points/temperatures	
x	x	...	please specify in plain text	

	(1)		(2)		(3)
Order code		-		-	
Order example	902721/50	-	1	-	+25, +50, +100 °C[1]

Note
The prices listed in the Price Sheet for calibration objects are prices for individual items. An increased number of test specimens or calibration points will reduce the costs considerably. Additional special conditions apply to recalibrations. Price details on request!

1. List extra codes “Calibration points/temperatures” in sequence, separated by commas.

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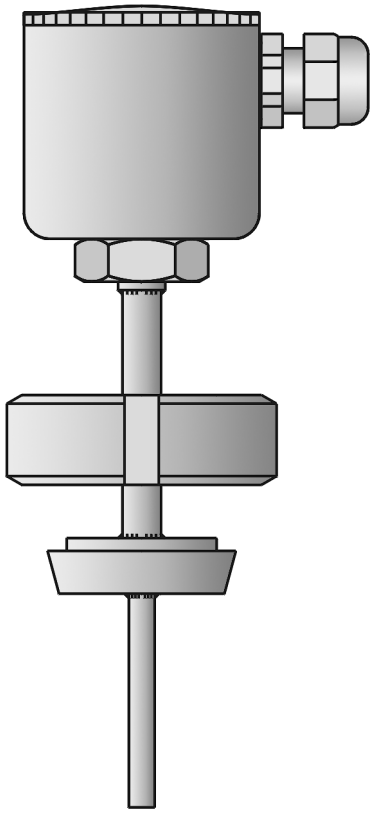
Resistance thermometers for the food and pharmaceutical industries



- **for temperatures from -50 to +250°C**
- **EHEDG certification**
- **stainless steel protection tubes**
- **with optional 2-wire transmitter**
- **CIP-compliant installation**

The resistance thermometers can optionally be provided with terminal heads in stainless steel, aluminium die-casting, or plastic.

To suit the specific needs of the different sectors of the food and pharmaceutical industries, a wide variety of process connections can be supplied: from G 1/2 (1/2" pipe) screw fittings with CIP-compliant sealing cone, through taper nipples with ring nut (milke pipe fitting), and clamping nipples, to sliding ball weld-in sockets, weld-in sockets, Varivent connections, and ball weld-in pockets. The protection tubes are made from stainless steel.

The resistance thermometers for the food and pharmaceuticual industries are suitable for the temperature range from -50 to +250°C.

Pt100 single and twin temperature sensors to EN 60 751, Class A, in 3-wire circuit ensure the highest degree of accuracy.
For longer transmission distances, analog or programmable 2-wire transmitters are optionally available.

Technical data

Terminal head	stainless steel 1.4571, M 16x1.5; IP67, ambient temperature -20 to +100°C Form B DIN 43 729, aluminium die-casting, M 20x1.5; IP54, ambient temperature -40 to +100°C Form BUZ, aluminium die-casting, M 20x1.5; IP65, ambient temperature -40 to +100°C Form BUZH, aluminium die-casting, M 20x1.5; IP65, ambient temperature -40 to +100°C Form BBKS, plastic (PA 6), M 20x1.5; IP54, ambient temperature -30 to +130°C Caution: reduced ambient temperature when using transmitters; data sheet 70.7010/70.7030
Extension tube	stainless steel, approx. 70mm long, 9mm dia.
Process connection	screw fitting with CIP-compliant sealing cone, stainless steel 316 L, with EHEDG certification clamping nipple to DIN 32 676, stainless steel 316 L clamping nipple with ring nut (milk pipe fitting) to DIN 11 851, stainless steel 316 L ball weld-in socket, stainless steel 316 L, clamping ring in PTFE CIP-compliant weld-in socket, stainless steel 316 L, seal in PTFE Varivent connection, stainless steel 316 L ball weld-in pocket, stainless steel 316 Ti JUMO PEKA process connection adapter, stainless steel 316 L, with EHEDG certification
Protection tube	stainless steel 316 L, 6mm dia. stainless steel 316 Ti, on request
Measuring insert	Pt100 temperature sensor to EN 60 751, Class A, 3-wire circuit
Response times	$t_{0.9}$ = 10sec, in water 0.4m/sec, 6mm dia.
Transmitter	analog transmitter, output 4 – 20mA, data sheet 70.7030 analog transmitter, output 0 – 10V, data sheet 70.7030 programmable transmitter, output 4 – 20mA/20 – 4mA, data sheet 70.7010

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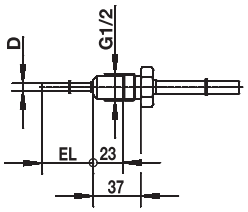
Dimensions

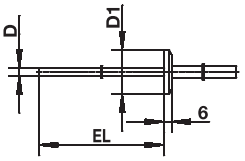
Possible variants

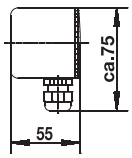
Screw fitting with
CIP-compliant conical seal



Clamping nipple to DIN 32676

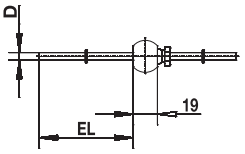
DN	D1	DN	D1
-	Ø25	40/1,5"	Ø50.5
10/20	Ø34	50/2"	Ø64
25/1"	Ø50.5	2.5"	Ø77.5

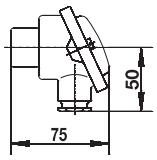




Stainless steel
terminal head KGI-1

Ball weld-in socket
with clamping thread

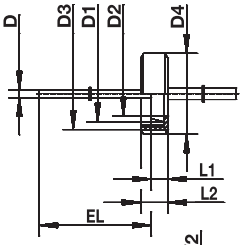


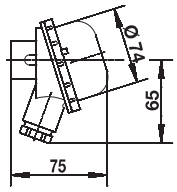


Aluminium die-casting
terminal head Form B

Taper nipple with ring nut
to DIN 11851
(milk pipe fitting)

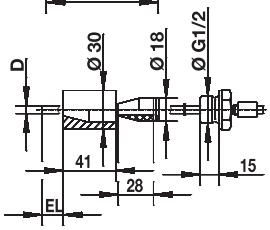
DN	D1	D2	D3	D4	L1	L2
10	Ø22	Ø18	RD 28x1/8	Ø38	9	18
25	Ø44	Ø35	RD 52x1/6	Ø63	13	21
32	Ø50	Ø41	RD 58x1/6	Ø70		





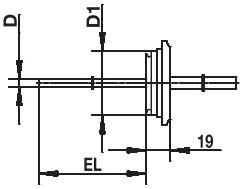
Plastic
terminal head Form BBKS

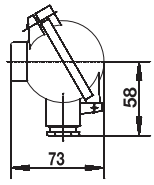
Weld-in socket
with CIP-compliant sealing system



Varivent connection

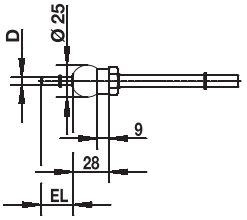
DN	D1
15/10	Ø31
32/25	Ø50
50/40	Ø68

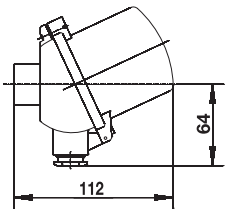




Aluminium die-casting
terminal head Form BUZ

Ball weld-in pocket

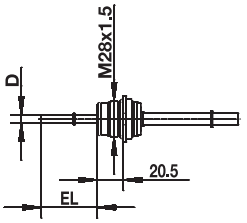




Aluminium die-casting
terminal head Form BUZH

JUMO PEKA
Process connection adapter
as per data sheet 40.9711

Varivent	Clamp	Aseptic	Weld-in socket
DN 25/32	DN 25/32/40	DN 40	Ø 55 mm
DN 40-125	DN 50	DN 50	
		NKS DN 40	



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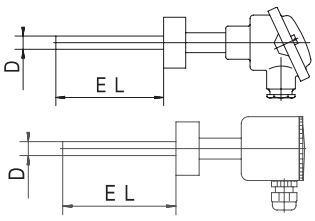
Order details: Resistance thermometers for the food and pharmaceutical industries

(1) Basic type

902810/13 — Resistance thermometer with terminal head Form B

902810/20 — Resistance thermometer with terminal head in stainless steel



		(2)	**Measuring insert**
x	x	1001	1 x Pt100 in 3-wire circuit
x	x	2001	2 x Pt100 in 3-wire circuit
		(3)	**Tolerance class to EN 60 751**
x	x	2	Class A (standard)
x	x	3	Class 1/3 DIN
		(4)	**Protection tube diameter D in mm**
x	x	6	6mm
		(5)	**Fitting length EL in mm (25 ≤ EL ≤ 400)**
x	x	25	25mm
x	x	50	50mm
x	x	100	100mm
x	x	150	150mm
x	x	...	please specify in plain text (50mm steps)
		(6)	**Process connection**
x	x	104	G 1/2 (1/2" pipe) thread
x	x	380	G 1/2 (1/2" pipe) thread with CIP-compliant conical seal, with EHEDG certification
x	x	601	taper nipple with ring nut DN10 to DIN 11 851 (milk pipe fitting)
x	x	604	taper nipple with ring nut DN25 to DIN 11 851 (milk pipe fitting)
x	x	605	taper nipple with ring nut DN32 to DIN 11 851 (milk pipe fitting)
x	x	611	clamping nipple DN 10/20 to DIN 32 676
x	x	613	clamping nipple DN 25/40 (1"/1.5") to DIN 32 676
x	x	616	clamping nipple DN 50 (2") to DIN 32 676
x	x	617	clamping nipple 2.5" similar to DIN 32 676
x	x	681	ball weld-in socket with clamping thread
x	x	682	weld-in socket with CIP-compliant sealing system
x	x	684	Varivent connection DN 15/10
x	x	685	Varivent connection DN 32/25
x	x	686	Varivent connection DN 50/40
x	x	840	ball weld-in pocket (material 316 Ti)
x	x	997	JUMO PEKA with EHEDG certification[4]
		(7)	**Protection tube material**
x	x	24	stainless steel 316 L (Mat. Ref. 1.4404 / 1.4435)
x	x	26	stainless steel 316 Ti (Mat. Ref. 1.4571) (on request)
		(8)	**Extra codes**
x	x	000	no extra code
x	x	305	without extension (only for process connection 104 and 380)
x		320	terminal head Form BUZ
x		321	terminal head Form BUZH
x		324	terminal head Form BBKS
x	x	330	1 x analog transmitter, output 4 – 20mA[2], data sheet 70.7030
x	x	331	1 x programmable transmitter, output 4 – 20mA/20 – 4mA[3], data sheet 70.7010
x	x	333	1 x analog transmitter, output 0 – 10V[2], data sheet 70.7030
x	x	365	acceptance test certificate 3.1B EN 10 204: insulation resistance
x	x	367	acceptance test certificate 3.1B EN 10 204: pressure test
x	x	368	acceptance test certificate 3.1B EN 10 204: leakage test
x	x	374	acceptance test certificate 3.1B EN 10 204: material
x	x	452	parts in contact with the medium electrolytically polished, surface roughness Ra ≤ 0.8µm (not for process connection 104, 681, 682 and 840)
x	x	810	weld-in socket (only for process connection 380)

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
Order code		-		-		-		-		-		-		/		,...
Order example	902810/13	-	1001	-	2	-	6	-	100	-	380	-	24	/	000[1]	

1. List extra codes in sequence, separated by commas.
2. Specify range in plain text.
3. Specify range and output signal in plain text.
4. For matching process connection adapters, see data sheet 40.9711

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Internet: www.jumo.us

Stock versions

(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	Sales No.
902810/20	-	1001	-	2	-	6	-	100	-	681	-	24	/	000	90/00379859

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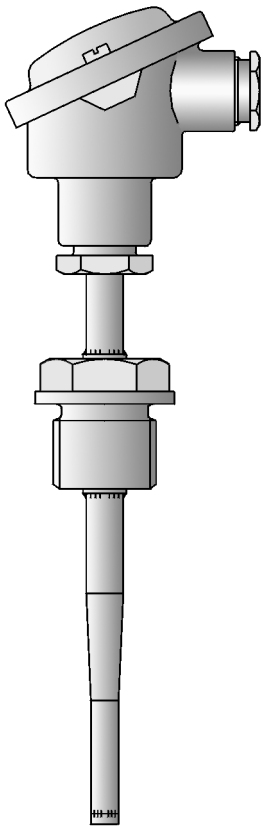
JUMO PROCESStemp
Resistance thermometers for process technology with ATEX approval



- **for temperatures from -200 to +600°C**
- **with protection tubes in stainless steel, titanium, tantalum, Inconel and Hastelloy**
- **available with 2-wire transmitter (4 — 20mA / HART®) in Ex version**
- **Ex II 1/2 GD EEx ia II C T1 - T6 IP 6x T80 - T400°C[1]**
  Ex II 1/2 GD EEx d II C T1 - T6 IP 6x T80 - T400°C[1]
- **with replaceable measuring insert**

Resistance thermometers for process technology (chemical and petrochemical plant, pressure vessels, etc.) are preferentially used for measuring temperatures in liquids and gases. The thermometers consist of a protection fitting to DIN 43 763 with various process connection options, a terminal head and a replaceable measuring insert. The protection fitting is normally made from material 1.4571. Other materials are available for special applications. All fittings are manufactured in accordance with the pressure vessel regulations and are subjected to a pressure and leakage test. The measuring insert is normally fitted with a Pt100 temperature sensor to EN 60 751, Class B in 2-wire circuit; versions with two Pt100 measuring circuits can also be supplied, as well as 3- and 4-wire circuits. An analog or programmable transmitter can be integrated for measurement transmission with a 4 — 20mA standard signal or via the HART® interface. Versions with flameproof enclosure or intrinsic safety are available for temperature measurement in areas with an explosion hazard. For documentation purposes, the instrument parameters (measurement tolerance, material, etc.) can be certified with a works test certificate.

Push-in and screw-in resistance thermometers with connecting cable and ATEX approval can be provided on request.

Technical data

Terminal head	Form B DIN 43 729, die-cast aluminium, M 20x1.5; IP54, ambient temperature -40 to +100°C Form BUZ, die-cast aluminium, M 20x1.5; IP65, ambient temperature -40 to +100°C Form BUZH, die-cast aluminium, M 20x1.5; IP65, ambient temperature -40 to +100°C Form BBKS, plastic (PA 6), M 20x1.5; IP54, ambient temperature -30 to +130°C Form BEGF, stainless steel 1.4541, M 20x1.5, IP65, ambient temperature -40 to +100°C Form XD-AD (EEx d ATEX), die-cast aluminium, M 20x1.5; IP66, ambient temperature -40 to +100°C Caution: reduced ambient temperature range when using transmitters, Data Sheets 70.7010 and 70.7030
Extension tube	stainless steel 1.4571, length 130mm (150mm on Type 902820/50.../51...)
Process connection	thread, stainless steel 1.4571 flange, stainless steel 1.4571 pocket, stainless steel 1.4571 or steel 1.7335 highly corrosion-resistant materials/coatings are optionally available
Protection tube	stainless steel 1.4571, 9mm, 11mm, 12mm dia. highly corrosion-resistant materials/coatings are optionally available
Measuring insert	interchangeable, Pt100 temperature sensor to EN 60 751, Class B, 2-wire circuit
Response times	$t_{0.9}$ approx. 50sec, in water 0.4m/sec, 9mm dia.
Transmitter	analog transmitter, 4 – 20mA output, Data Sheet 70.7030 analog transmitter, 0 – 10V output, Data Sheet 70.7030 programmable transmitter, 4 – 20mA/20 – 4mA output, Data Sheet 70.7010 programmable transmitter, 4 – 20mA output and HART® interface, Data Sheet 70.7010
Accessories	pocket, Data Sheet 90.9721
DIN versions	DIN 43 765 Form B1, B2, B3, load capacity, see diagram 1 DIN 43 766 Form C1, C2, load capacity, see diagram 2 DIN 43 767 Form D1, D2, D4, D5, load capacity, see diagram 3 DIN 43 771 Form G1, G2, G3, load capacity, see diagram 4

[1] Explosion protection: The maximum product-specific explosion protection Ex II 1/2 GD EEx d ia II C T1 to T6 IP6x T80 to T400°C depends on the constructional type of the resistance thermometer. For an exact classification of the resistance thermometer, please see the Operating Instructions B 90.2820.

03.07/00386333

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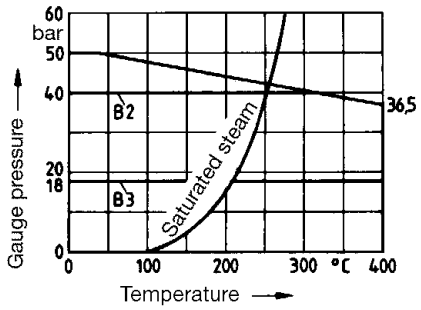

Diagram 1:
Permissible flow velocity
for air, superheated steam: up to 25m/sec
for water: up to 3m/sec
Permissible tightening torque: 50Nm

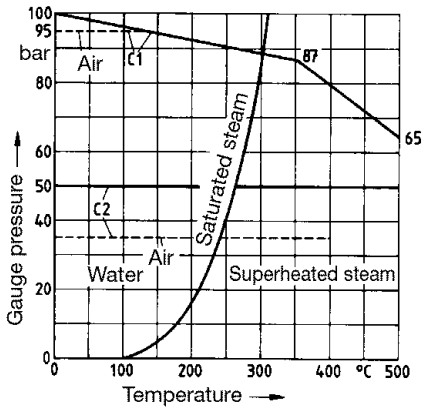

Diagram 2:
Permissible flow velocity
for air, superheated steam: up to 40m/sec
for water: up to 5m/sec
Permissible tightening torque: 100Nm

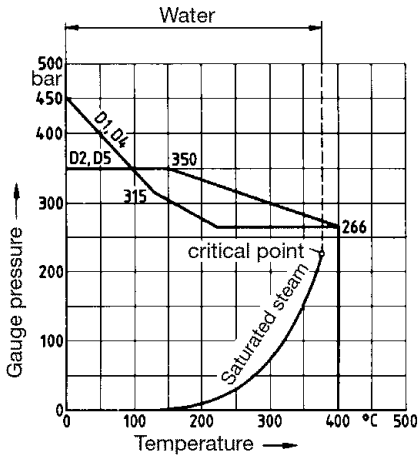

Diagram 3:
Form D1; D4: permissible flow velocity for air, water, superheated steam: up to 60m/sec
Form D2; D5: permissible flow velocity
for air: up to 60m/sec
for water, superheated steam: up to 30m/sec

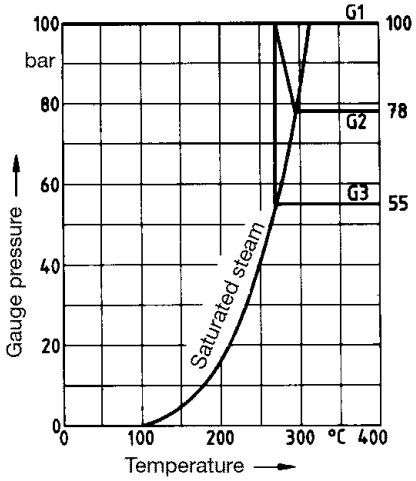

Diagram 4:
Permissible flow velocity
for superheated steam: up to 40m/sec
for water: up to 5m/sec
for air: up to 400°C

Type	DIN Form	D	L2	EL	Thread
902820/10	B1	9	-	160	G 1/2
902820/10	B2	9	-	250	G 1/2
902820/10	B3	9	-	400	G 1/2
902820/10	C1	11	-	160	G 1
902820/10	C2	11	-	250	G 1
902820/11	G1	9	-	160	G 1

Type	DIN Form	D	L2	EL	Thread
902820/11	G2	9	-	220	G 1
902820/11	G3	9	-	280	G 1
902820/50	D1	12.5	140	65	-
902820/50	D2	12.5	200	125	-
902820/51	D4	12.5	200	65	-
902820/51	D5	12.5	260	125	-

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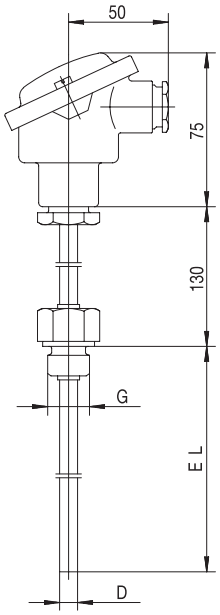
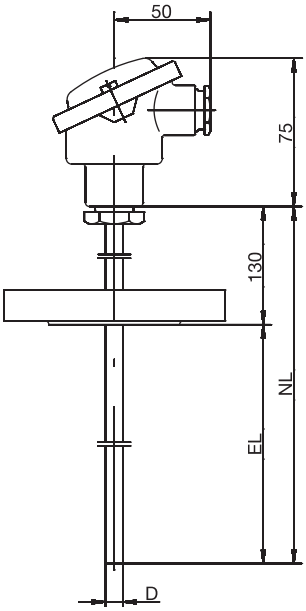
Dimensions



Type 902820/10



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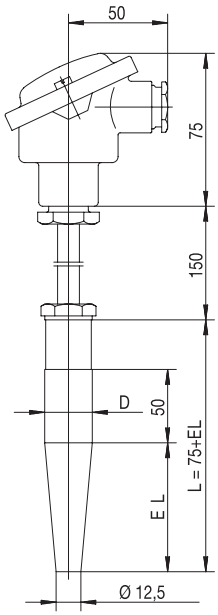
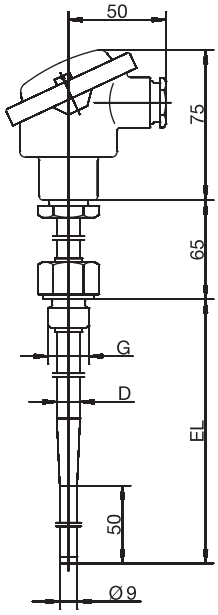
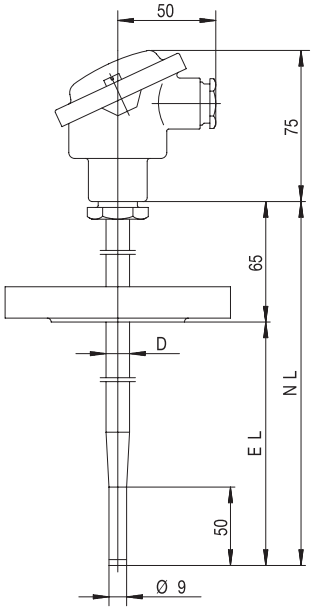


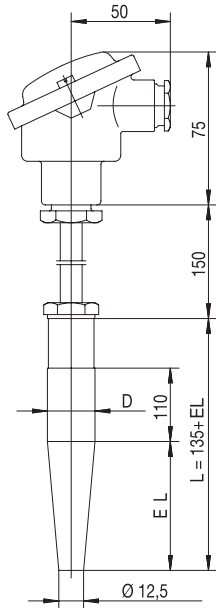
Type 902820/50



Type 902820/11



Type 902820/21



Type 902820/51

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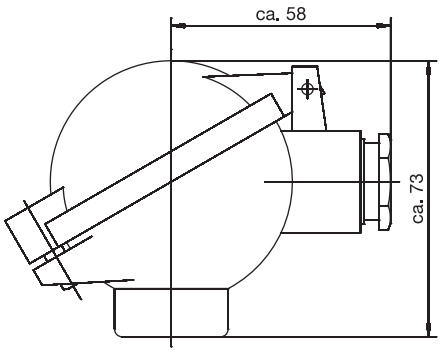
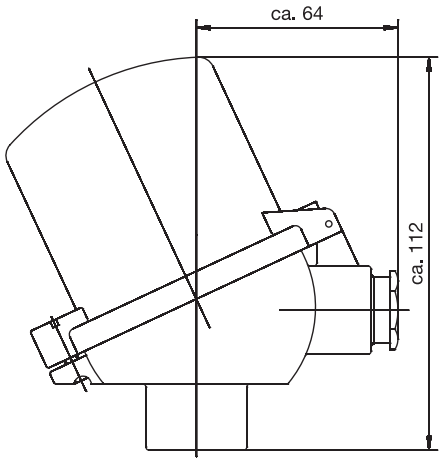
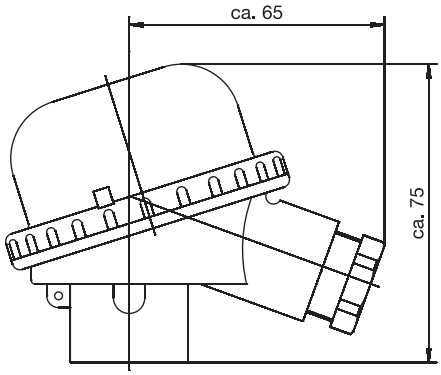
Dimensions



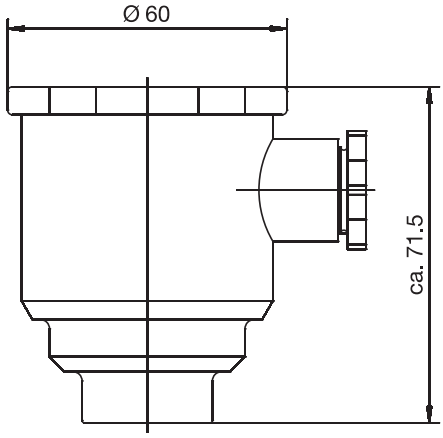
Terminal head Form BUZ
extra code 320



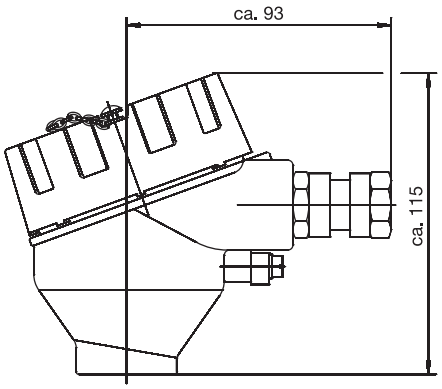
Terminal head Form BUZH
extra code 321



Terminal head Form BBKS
extra code 324



Terminal head Form BEGF
extra code 397



Terminal head Form XD-AD
extra code 399

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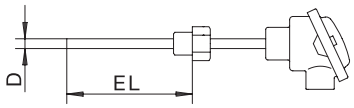
Order details: Resistance thermometers for process technology

(1) Basic versions

902820/10 Screw-in resistance thermometers with continuous protection tube



(2) Operating temperature in °C

x	150	-200 to +600°C (wire-wound temperature sensor)
x	402	-50 to +400°C (thin-film temperature sensor)
x	415	-50 to +600°C (thin-film temperature sensor)

(3) Measuring insert

x	1001	1 x Pt100 in 3-wire circuit
x	1003	1 x Pt100 in 2-wire circuit
x	1011	1 x Pt100 in 4-wire circuit
x	2001	2 x Pt100 in 3-wire circuit
x	2003	2 x Pt100 in 2-wire circuit
x	2011	2 x Pt100 in 4-wire circuit (only with terminal head Form BUZH)

(4) Tolerance class to EN 60 751

x	1	Class B (standard)
x	2	Class A
x	3	Class 1/3 DIN

(5) Protection tube diameter D in mm

x	9	9 x 1mm
x	11	11 x 2mm

(6) Fitting length EL in mm (100 ≤ EL ≤ 1000)

x	160	160mm
x	250	250mm
x	400	400mm
x	...	please specify in plain text (50mm steps)

(7) Process connection

x	104	thread G 1/2 (1/2" pipe)
x	106	thread G 1 (1" pipe)
x	144	thread 1/2-14NPT
x	146	thread 1-11.5NPT

(8) Protection tube material

x	26	stainless steel 1.4571
x	60	titanium, on request
x	81	Inconel, on request
x	82	Hastelloy, on request

(9) Extra codes

x	000	no extra code
x	320	terminal head Form BUZ
x	321	terminal head Form BUZH
x	324	terminal head Form BBKS
x	330	1 x analog transmitter, 4 – 20mA output[2], Data Sheet 70.7030 (not with extra code 362)
x	331	1 x programmable transmitter, 4 – 20mA / 20 – 4mA output[3], Data Sheet 70.7010
x	333	1 x analog transmitter, 0 – 10V output[2], Data Sheet 70.7030 (not with extra code 362)
x	336	1 x programmable transmitter, 4 – 20mA output[3] and HART® interface, Data Sheet 70.7010
x	365	acceptance test certificate 3.1 EN 10 204: insulation resistance
x	367	acceptance test certificate 3.1 EN 10 204: pressure test
x	368	acceptance test certificate 3.1 EN 10 204: leakage test
x	374	acceptance test certificate 3.1 EN 10 204: material
x	562	parts in contact with medium with PTFE covering, on request
x	563	parts in contact with medium with HALAR coating, on request

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
Order code		-		-		-		-		-		-		-		/		,...
Order example	902820/10	-	402	-	1001	-	1	-	9	-	250	-	104	-	26	/	000[1]	

1. List extra codes in sequence, separated by commas.
2. Specify range in plain text.
3. Specify range and output signal in plain text.

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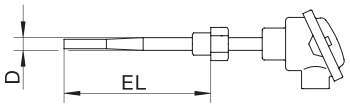
Order details: Resistance thermometers for process technology

			(1) Basic versions
	902820/11		Screw-in resistance thermometers with stepped protection tube
			(2) Operating temperature in °C
x	150		-200 to +600°C (wire-wound temperature sensor)
x	402		-50 to +400°C (thin-film temperature sensor)
x	415		-50 to +600°C (thin-film temperature sensor)
			(3) Measuring insert
x	1001		1 x Pt100 in 3-wire circuit
x	1003		1 x Pt100 in 2-wire circuit
x	1011		1 x Pt100 in 4-wire circuit
x	2001		2 x Pt100 in 3-wire circuit
x	2003		2 x Pt100 in 2-wire circuit
x	2011		2 x Pt100 in 4-wire circuit (only with terminal head Form BUZH)
			(4) Tolerance class to EN 60 751
x	1		Class B (standard)
x	2		Class A
x	3		Class 1/3 DIN
			(5) Protection tube diameter D in mm
x	12		12 x 2.5mm, stepped down to 9mm
			(6) Fitting length EL in mm (100 ≤ EL ≤ 700)
x	160		160mm
x	220		220mm
x	250		250mm
x	280		280mm
x	400		400mm
			(7) Process connection
x	104		thread G 1/2 (1/2" pipe)
x	106		thread G 1 (1" pipe)
x	144		thread 1/2-14NPT
x	146		thread 1-11.5NPT
			(8) Protection tube material
x	26		stainless steel 1.4571
			(9) Extra codes
x	000		no extra code
x	320		terminal head Form BUZ
x	321		terminal head Form BUZH
x	324		terminal head Form BBKS
x	330		1 x analog transmitter, 4 – 20mA output[2], Data Sheet 70.7030 (not with extra code 362)
x	331		1 x programmable transmitter, 4 – 20mA / 20 – 4mA output[3], Data Sheet 70.7010
x	333		1 x analog transmitter, 0 – 10V output[2], Data Sheet 70.7030 (not with extra code 362)
x	336		1 x programmable transmitter, 4 – 20mA output[3] and HART® interface, Data Sheet 70.7010
x	365		acceptance test certificate 3.1 EN 10 204: insulation resistance
x	367		acceptance test certificate 3.1 EN 10 204: pressure test
x	368		acceptance test certificate 3.1 EN 10 204: leakage test
x	374		acceptance test certificate 3.1 EN 10 204: material
x	562		parts in contact with medium with PTFE covering, on request
x	563		parts in contact with medium with HALAR coating, on request



	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
Order code		-		-		-		-		-		-		-		/		,...
Order example	902820/11	-	402	-	1001	-	1	-	12	-	250	-	104	-	26	/	000[1]	

1. List extra codes in sequence, separated by commas.
2. Specify range in plain text.
3. Specify range and output signal in plain text.

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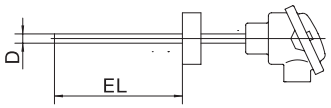
Order details: Resistance thermometers for process technology

		(1)	**Basic versions**
	902820/20		Push-in resistance thermometers with continuous protection tube
		(2)	**Operating temperature in °C**
x	150		-200 to +600°C (wire-wound temperature sensor)
x	402		-50 to +400°C (thin-film temperature sensor)
x	415		-50 to +600°C (thin-film temperature sensor)
		(3)	**Measuring insert**
x	1001		1 x Pt100 in 3-wire circuit
x	1003		1 x Pt100 in 2-wire circuit
x	1011		1 x Pt100 in 4-wire circuit
x	2001		2 x Pt100 in 3-wire circuit
x	2003		2 x Pt100 in 2-wire circuit
x	2011		2 x Pt100 in 4-wire circuit (only with terminal head Form BUZH)
		(4)	**Tolerance class to EN 60 751**
x	1		Class B (standard)
x	2		Class A
x	3		Class 1/3 DIN
		(5)	**Protection tube diameter D in mm**
x	9		9 x 1mm
x	11		11 x 2mm
		(6)	**Fitting length EL in mm (100 ≤ EL ≤ 1000)**
x	160		160mm
x	250		250mm
x	400		400mm
x	...		please specify in plain text (50mm steps)
		(7)	**Process connection**
x	000		no process connection
x	642		flange C DN 25 PN 40, DIN 25 01
x	644		flange C DN 40 PN 40, DIN 25 01
		(8)	**Protection tube material**
x	26		stainless steel 1.4571
x	60		titanium, on request
x	80		tantalum, on request
x	81		Inconel, on request
x	82		Hastelloy, on request
		(9)	**Extra codes**
x	000		no extra code
x	320		terminal head Form BUZ
x	321		terminal head Form BUZH
x	324		terminal head Form BBKS
x	330		1 x analog transmitter, 4 – 20mA output[2], Data Sheet 70.7030 (not with extra code 362)
x	331		1 x programmable transmitter, 4 – 20mA / 20 – 4mA output[3], Data Sheet 70.7010
x	333		1 x analog transmitter, 0 – 10V output[2], Data Sheet 70.7030 (not with extra code 362)
x	336		1 x programmable transmitter, 4 – 20mA output[3] and HART® interface, Data Sheet 70.7010
x	365		acceptance test certificate 3.1 EN 10 204: insulation resistance
x	367		acceptance test certificate 3.1 EN 10 204: pressure test
x	368		acceptance test certificate 3.1 EN 10 204: leakage test
x	374		acceptance test certificate 3.1 EN 10 204: material
x	562		parts in contact with medium with PTFE covering, on request
x	563		parts in contact with medium with HALAR coating, on request



	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
Order code		-		-		-		-		-		-		-		/		,...
Order example	902820/20	-	402	-	1001	-	1	-	9	-	250	-	642	-	26	/	000[1]	

1. List extra codes in sequence, separated by commas.
2. Specify range in plain text.
3. Specify range and output signal in plain text.

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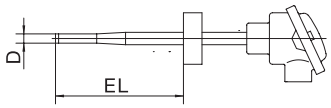
Order details: Resistance thermometers for process technology

(1) Basic versions

902820/21 Push-in resistance thermometers with stepped protection tube



		(2) Operating temperature in °C
x	150	-200 to +600°C (wire-wound temperature sensor)
x	402	-50 to +400°C (thin-film temperature sensor)
x	415	-50 to +600°C (thin-film temperature sensor)
		(3) Measuring insert
x	1001	1 x Pt100 in 3-wire circuit
x	1003	1 x Pt100 in 2-wire circuit
x	1011	1 x Pt100 in 4-wire circuit
x	2001	2 x Pt100 in 3-wire circuit
x	2003	2 x Pt100 in 2-wire circuit
x	2011	2 x Pt100 in 4-wire circuit (only with terminal head Form BUZH)
		(4) Tolerance class to EN 60 751
x	1	Class B (standard)
x	2	Class A
x	3	Class 1/3 DIN
		(5) Protection tube diameter D in mm
x	12	12 x 2.5mm, stepped down to 9mm
		(6) Fitting length EL in mm (100 ≤ EL ≤ 700)
x	160	160mm
x	225	225mm
x	250	250mm
x	285	285mm
x	345	345mm
x	400	400mm
		(7) Process connection
x	000	no process connection
x	642	flange C DN 25 PN 40, DIN 25 01
x	644	flange C DN 40 PN 40, DIN 25 01
		(8) Protection tube material
x	26	stainless steel 1.4571
		(9) Extra codes
x	000	no extra code
x	320	terminal head Form BUZ
x	321	terminal head Form BUZH
x	324	terminal head Form BBKS
x	330	1 x analog transmitter, 4 – 20mA output[2], Data Sheet 70.7030 (not with extra code 362)
x	331	1 x programmable transmitter, 4 – 20mA / 20 – 4mA output[3], Data Sheet 70.7010
x	333	1 x analog transmitter, 0 – 10V output[2], Data Sheet 70.7030 (not with extra code 362)
x	336	1 x programmable transmitter, 4 – 20mA output[3] and HART® interface, Data Sheet 70.7010
x	365	acceptance test certificate 3.1B EN 10 204: insulation resistance
x	367	acceptance test certificate 3.1B EN 10 204: pressure test
x	368	acceptance test certificate 3.1B EN 10 204: leakage test
x	374	acceptance test certificate 3.1B EN 10 204: material
x	562	parts in contact with medium with PTFE covering, on request
x	563	parts in contact with medium with HALAR coating, on request

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
Order code		-		-		-		-		-		-		-		/		,...
Order example	902820/21	-	402	-	1001	-	1	-	12	-	250	-	642	-	26	/	000[1]	

1. List extra codes in sequence, separated by commas.
2. Specify range in plain text.
3. Specify range and output signal in plain text.

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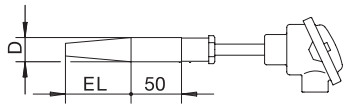
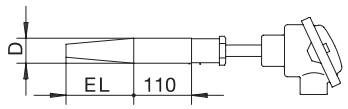
Order details: Resistance thermometers for process technology

(1) Basic versions

902820/50 Screw-in resistance thermometers with pocket DIN 43 767 Form D1/D2



902820/51 Screw-in resistance thermometers with pocket DIN 43 767 Form D4/D5



			(2) Operating temperature in °C (for restrictions, see DIN 43 763)
x	x	150	-200 to +600°C (wire-wound temperature sensor)
x	x	402	-50 to +400°C (thin-film temperature sensor)
x	x	415	-50 to +600°C (thin-film temperature sensor)
			(3) Measuring insert
x	x	1001	1 x Pt100 in 3-wire circuit
x	x	1003	1 x Pt100 in 2-wire circuit
x	x	1011	1 x Pt100 in 4-wire circuit
x	x	2001	2 x Pt100 in 3-wire circuit
x	x	2003	2 x Pt100 in 2-wire circuit
x	x	2011	2 x Pt100 in 4-wire circuit (only with terminal head Form BUZH)
			(4) Tolerance class to EN 60 751
x	x	1	Class B (standard)
x	x	2	Class A
x	x	3	Class 1/3 DIN
			(5) Pocket diameter D in mm
x	x	24	24mm, stepped down to 12.5mm
			(6) Fitting length EL in mm
x	x	65	65mm for Form D1/D4
x	x	125	125mm for Form D2/D5
			(7) Pocket material
x	x	26	stainless steel 1.4571 (operating temperature +600°C)
x	x	36	steel 1.7335 (operating temperature +540°C)
x	x	60	titanium, on request
x	x	80	tantalum, on request
x	x	81	Inconel, on request
x	x	82	Hastelloy, on request
			(8) Extra codes
x	x	000	no extra code
x	x	320	terminal head Form BUZ
x	x	321	terminal head Form BUZH
x	x	324	terminal head Form BBKS
x	x	330	1 x analog transmitter, 4 – 20mA output[2], Data Sheet 70.7030 (not with extra code 362)
x	x	331	1 x programmable transmitter, 4 – 20mA / 20 – 4mA output[3], Data Sheet 70.7010
x	x	333	1 x analog transmitter, 0 – 10V output[2], Data Sheet 70.7030 (not with extra code 362)
x	x	336	1 x programmable transmitter, 4 – 20mA output[3] and HART® interface, Data Sheet 70.7010
x	x	365	acceptance test certificate 3.1 EN 10 204: insulation resistance
x	x	367	acceptance test certificate 3.1 EN 10 204: pressure test
x	x	368	acceptance test certificate 3.1 EN 10 204: leakage test
x	x	374	acceptance test certificate 3.1 EN 10 204: material
x	x	562	parts in contact with medium with PTFE covering, on request
x	x	563	parts in contact with medium with HALAR coating, on request

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
Order code		-		-		-		-		-		-		/		,...
Order example	902820/50	-	402	-	1001	-	1	-	24	-	125	-	26	/	000[1]	

1. List extra codes in sequence, separated by commas.
2. Specify range in plain text.
3. Specify range and output signal in plain text.

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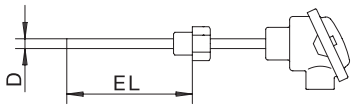
Order details: Resistance thermometers for process technology with Ex (ATEX) approval

		(1) Basic versions
	902820/10	Screw-in resistance thermometers with continuous protection tube



		(2) Operating temperature in °C
x	150	-200 to +600°C (wire-wound temperature sensor)
x	415	-50 to +600°C (thin-film temperature sensor)
		(3) Measuring insert
x	1001	1 x Pt100 in 3-wire circuit (not in conjunction with transmitter 331, 336)
x	1003	1 x Pt100 in 2-wire circuit (not in conjunction with transmitter 331, 336)
x	1011	1 x Pt100 in 4-wire circuit
x	2001	2 x Pt100 in 3-wire circuit
x	2003	2 x Pt100 in 2-wire circuit (not in conjunction with transmitter 331, 336)
		(4) Tolerance class to EN 60 751
x	1	Class B (standard)
x	2	Class A
x	3	Class 1/3 DIN
		(5) Protection tube diameter D in mm
x	9	9 x 1mm (for use in Zone 0 or 20 on request)
x	11	11 x 2mm
		(6) Fitting length EL in mm (100 ≤ EL ≤ 1000)
x	160	160mm
x	250	250mm
x	400	400mm
x	...	please specify in plain text (50mm steps)
		(7) Process connection
x	104	thread G 1/2 (1/2" pipe)
x	106	thread G 1 (1" pipe)
x	144	thread 1/2-14NPT
x	146	thread 1-11.5NPT
		(8) Protection tube material
x	26	stainless steel 1.4571
x	60	titanium, on request
x	81	Inconel, on request
x	82	Hastelloy, on request
		(9) Extra codes
		Caution: for application in Zone 20, 21 and 22, only a terminal head with at least IP65 protection can be used.
x	320	terminal head Form BUZ
x	321	terminal head Form BUZH
x	397	terminal head Form BEGF
x	331	1 x programmable transmitter, 4 – 20mA / 20 – 4mA output[3], Data Sheet 70.7010
x	336	1 x programmable transmitter, 4 – 20mA output[3] and HART® interface, Data Sheet 70.7010
x	**362**	**Ex protection Ex i as per EU Directive 94/9/EC (ATEX)**
x	399	Ex protection **Ex d** flameproof enclosure, terminal head Form XD-AD (ATEX) cable gland for cable dia. D 3.0 – 8.0mm (for cable dia. D 7.5 – 11.9mm, on request), only in conjunction with 362.
x	365	acceptance test certificate 3.1 EN 10 204: insulation resistance
x	367	acceptance test certificate 3.1 EN 10 204: pressure test
x	368	acceptance test certificate 3.1 EN 10 204: leakage test
x	374	acceptance test certificate 3.1 EN 10 204: material
x	562	parts in contact with medium with PTFE covering, on request
x	563	parts in contact with medium with HALAR coating, on request

Additional details: In which zone will the resistance thermometer be used?

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
Order code		-		-		-		-		-		-		-		/	**362**	,...
Order example	902820/10	-	415	-	1001	-	1	-	9	-	250	-	104	-	26	/	362[1]	

1. List extra codes in sequence, separated by commas.
3. Specify range and output signal in plain text.

Note:
It is not possible to illustrate all variations, because of the wide variety of combinations that can be implemented.
We must draw your attention to the fact that not all combinations can be supplied for all ATEX categories.

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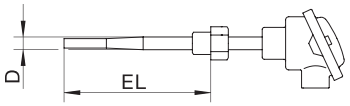
Order details: Resistance thermometers for process technology with Ex (ATEX) approval

		(1) Basic versions	
	902820/11	Screw-in resistance thermometers with stepped protection tube	
		(2) Operating temperature in °C	
x	150	-200 to +600°C (wire-wound temperature sensor)	
x	415	-50 to +600°C (thin-film temperature sensor)	
		(3) Measuring insert	
x	1001	1 x Pt100 in 3-wire circuit (not in conjunction with transmitter 331, 336)	
x	1003	1 x Pt100 in 2-wire circuit (not in conjunction with transmitter 331, 336)	
x	1011	1 x Pt100 in 4-wire circuit	
x	2001	2 x Pt100 in 3-wire circuit	
x	2003	2 x Pt100 in 2-wire circuit (not in conjunction with transmitter 331, 336)	
		(4) Tolerance class to EN 60 751	
x	1	Class B (standard)	
x	2	Class A	
x	3	Class 1/3 DIN	
		(5) Protection tube diameter D in mm	
x	12	12 x 2.5mm, stepped down to 9mm (for use in Zone 0 or 20, on request)	
		(6) Fitting length EL in mm (100 ≤ EL ≤ 700)	
x	160	160mm	
x	220	220mm	
x	250	250mm	
x	280	280mm	
x	400	400mm	
		(7) Process connection	
x	104	thread G 1/2 (1/2" pipe)	
x	106	thread G 1 (1" pipe)	
x	144	thread 1/2-14NPT	
x	146	thread 1-11.5NPT	
		(8) Protection tube material	
x	26	stainless steel 1.4571	
		(9) Extra codes	
		Caution: for application in Zone 20, 21 and 22, only a terminal head with at least IP65 protection can be used.	
x	320	terminal head Form BUZ	
x	321	terminal head Form BUZH	
x	397	terminal head Form BEGF	
x	331	1 x programmable transmitter, 4 – 20mA / 20 – 4mA output[3], Data Sheet 70.7010	
x	336	1 x programmable transmitter, 4 – 20mA output[3] and HART® interface, Data Sheet 70.7010	
x	**362**	**Ex protection Ex i as per EU Directive 94/9/EC (ATEX)**	
x	399	Ex protection **Ex d** flameproof enclosure, terminal head Form XD-AD (ATEX) cable gland for cable dia. D 3.0 – 8.0mm (for cable dia. D 7.5 – 11.9mm, on request), only in conjunction with 362.	
x	365	acceptance test certificate 3.1 EN 10 204: insulation resistance	
x	367	acceptance test certificate 3.1 EN 10 204: pressure test	
x	368	acceptance test certificate 3.1 EN 10 204: leakage test	
x	374	acceptance test certificate 3.1 EN 10 204: material	
x	562	parts in contact with medium with PTFE covering, on request	
x	563	parts in contact with medium with HALAR coating, on request	



Additional details: In which zone will the resistance thermometer be used?

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Order code									**362** ,...
Order example	902820/11	415	1001	1	12	250	104	26	362[1]

1. List extra codes in sequence, separated by commas.
3. Specify range and output signal in plain text.

Note:
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We must draw your attention to the fact that not all combinations can be supplied for all ATEX categories.

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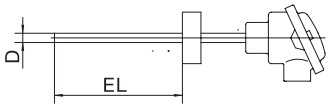
Order details: Resistance thermometers for process technology with Ex (ATEX) approval

(1) Basic versions

902820/20 Push-in resistance thermometers with continuous protection tube



(2) Operating temperature in °C

x	150	-200 to +600°C (wire-wound temperature sensor)
x	415	-50 to +600°C (thin-film temperature sensor)

(3) Measuring insert

x	1001	1 x Pt100 in 3-wire circuit (not in conjunction with transmitter 331, 336)
x	1003	1 x Pt100 in 2-wire circuit (not in conjunction with transmitter 331, 336)
x	1011	1 x Pt100 in 4-wire circuit
x	2001	2 x Pt100 in 3-wire circuit
x	2003	2 x Pt100 in 2-wire circuit (not in conjunction with transmitter 331, 336)

(4) Tolerance class to EN 60 751

x	1	Class B (standard)
x	2	Class A
x	3	Class 1/3 DIN

(5) Protection tube diameter D in mm

x	9	9 x 1mm (for use in Zone 0 or 20, on request)
x	11	11 x 2mm

(6) Fitting length EL in mm (100 ≤ EL ≤ 1000)

x	160	160mm
x	250	250mm
x	400	400mm
x	...	please specify in plain text (50mm steps)

(7) Process connection

x	000	no process connection
x	642	flange C DN 25 PN 40, DIN 25 01
x	644	flange C DN 40 PN 40, DIN 25 01

(8) Protection tube material

x	26	stainless steel 1.4571
x	60	titanium, on request
x	80	tantalum, on request
x	81	Inconel, on request
x	82	Hastelloy, on request

(9) Extra codes

Caution: for application in Zone 20, 21 and 22, only a terminal head with at least IP65 protection can be used.

x	320	terminal head Form BUZ
x	321	terminal head Form BUZH
x	397	terminal head Form BEGF
x	331	1 x programmable transmitter, 4 – 20mA / 20 – 4mA output[3], Data Sheet 70.7010
x	336	1 x programmable transmitter, 4 – 20mA output[3] and HART® interface, Data Sheet 70.7010
x	**362**	**Ex protection Ex i as per EU Directive 94/9/EC (ATEX)**
x	399	Ex protection **Ex d** flameproof enclosure, terminal head Form XD-AD (ATEX) cable gland for cable dia. D 3.0 – 8.0mm (for cable dia. D 7.5 – 11.9mm, on request), only in conjunction with 362.
x	365	acceptance test certificate 3.1 EN 10 204: insulation resistance
x	367	acceptance test certificate 3.1 EN 10 204: pressure test
x	368	acceptance test certificate 3.1 EN 10 204: leakage test
x	374	acceptance test certificate 3.1 EN 10 204: material
x	562	parts in contact with medium with PTFE covering, on request
x	563	parts in contact with medium with HALAR coating, on request

Additional details: In which zone will the resistance thermometer be used?

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
Order code		-		-		-		-		-		-		-		/	**362**	,...
Order example	902820/20	-	415	-	1001	-	1	-	9	-	250	-	642	-	26	/	362[1]	

1. List extra codes in sequence, separated by commas.
3. Specify range and output signal in plain text.

Note:
It is not possible to illustrate all variations, because of the wide variety of combinations that can be implemented.
We must draw your attention to the fact that not all combinations can be supplied for all ATEX categories.

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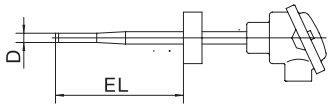
Internet: www.jumo.us

Order details: Resistance thermometers for process technology with Ex (ATEX) approval

		(1) Basic versions
	902820/21	Push-in resistance thermometers with stepped protection tube



		(2) Operating temperature in °C
x	150	-200 to +600°C (wire-wound temperature sensor)
x	415	-50 to +600°C (thin-film temperature sensor)
		(3) Measuring insert
x	1001	1 x Pt100 in 3-wire circuit (not in conjunction with transmitter 331, 336)
x	1003	1 x Pt100 in 2-wire circuit (not in conjunction with transmitter 331, 336)
x	1011	1 x Pt100 in 4-wire circuit
x	2001	2 x Pt100 in 3-wire circuit
x	2003	2 x Pt100 in 2-wire circuit (not in conjunction with transmitter 331, 336)
		(4) Tolerance class to EN 60 751
x	1	Class B (standard)
x	2	Class A
x	3	Class 1/3 DIN
		(5) Protection tube diameter D in mm
x	12	12 x 2.5mm, stepped down to 9mm (for use in Zone 0 or 20, on request)
		(6) Fitting length EL in mm (100 ≤ EL ≤ 700)
x	160	160mm
x	225	225mm
x	250	250mm
x	285	285mm
x	345	345mm
x	400	400mm
		(7) Process connection
x	000	no process connection
x	642	flange C DN 25 PN 40, DIN 25 01
x	644	flange C DN 40 PN 40, DIN 25 01
		(8) Protection tube material
x	26	stainless steel 1.4571
		(9) Extra codes
		Caution: for application in Zone 20, 21 and 22, only a terminal head with at least IP65 protection can be used.
x	320	terminal head Form BUZ
x	321	terminal head Form BUZH
x	397	terminal head Form BEGF
x	331	1 x programmable transmitter, 4 – 20mA / 20 – 4mA output[3], Data Sheet 70.7010
x	336	1 x programmable transmitter, 4 – 20mA output[3] and HART® interface, Data Sheet 70.7010
x	**362**	**Ex protection Ex i as per EU Directive 94/9/EC (ATEX)**
x	399	Ex protection **Ex d** flameproof enclosure, terminal head Form XD-AD (ATEX) cable gland for cable dia. D 3.0 – 8.0mm (for cable dia. D 7.5 – 11.9mm, on request) Only in conjunction with 362.
x	365	acceptance test certificate 3.1 EN 10 204: insulation resistance
x	367	acceptance test certificate 3.1 EN 10 204: pressure test
x	368	acceptance test certificate 3.1 EN 10 204: leakage test
x	374	acceptance test certificate 3.1 EN 10 204: material
x	562	parts in contact with medium with PTFE covering, on request
x	563	parts in contact with medium with HALAR coating, on request

Additional details: In which zone will the resistance thermometer be used?

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
Order code		-		-		-		-		-		-		-		/	**362**	,...
Order example	902820/21	-	415	-	1001	-	1	-	12	-	250	-	642	-	26	/	362[1]	

1. List extra codes in sequence, separated by commas.
3. Specify range and output signal in plain text.

Note:
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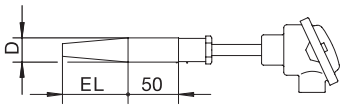
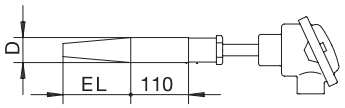
Order details: Resistance thermometers for process technology with Ex (ATEX) approval

(1) Basic versions

902820/50 — Screw-in resistance thermometers with pocket DIN 43 767 Form D1/D2



902820/51 — Screw-in resistance thermometers with pocket DIN 43 767 Form D4/D5



			(2) Operating temperature in °C (for restrictions, see DIN 43 763)
x	x	150	-200 to +600°C (wire-wound temperature sensor)
x	x	415	-50 to +600°C (thin-film temperature sensor)
			(3) Measuring insert
x	x	1001	1 x Pt100 in 3-wire circuit (not in conjunction with transmitter 331, 336)
x	x	1003	1 x Pt100 in 2-wire circuit (not in conjunction with transmitter 331, 336)
x	x	1011	1 x Pt100 in 4-wire circuit
x	x	2001	2 x Pt100 in 3-wire circuit
x	x	2003	2 x Pt100 in 2-wire circuit (not in conjunction with transmitter 331, 336)
			(4) Tolerance class to EN 60 751
x	x	1	Class B (standard)
x	x	2	Class A
x	x	3	Class 1/3 DIN
			(5) Pocket diameter D in mm
x	x	24	24mm, stepped down to 12.5mm
			(6) Fitting length EL in mm
x	x	65	65mm for Form D1/D4
x	x	125	125mm for Form D2/D5
			(7) Pocket material
x	x	26	stainless steel 1.4571 (operating temperature +600°C)
x	x	36	steel 1.7335 (operating temperature +540°C)
x	x	60	titanium, on request
x	x	80	tantalum, on request
x	x	81	Inconel, on request
x	x	82	Hastelloy, on request
			(8) Extra codes
			Caution: for application in Zone 20, 21 and 22, only a terminal head with at least IP65 protection can be used.
x	x	320	terminal head Form BUZ
x	x	321	terminal head Form BUZH
x	x	397	terminal head Form BEGF
x	x	331	1 x programmable transmitter, 4 – 20mA / 20 – 4mA output[3], Data Sheet 70.7010
x	x	336	1 x programmable transmitter, 4 – 20mA output[3] and HART® interface, Data Sheet 70.7010
x	**x**	**362**	**Ex protection Ex i as per EU Directive 94/9/EC (ATEX)**
x	x	399	Ex protection **Ex d** flameproof enclosure, terminal head Form XD-AD (ATEX) cable gland for cable dia. D 3.0 – 8.0mm (for cable dia. D 7.5 – 11.9mm, on request), only in conjunction with 362.
x	x	365	acceptance test certificate 3.1 EN 10 204: insulation resistance
x	x	367	acceptance test certificate 3.1 EN 10 204: pressure test
x	x	368	acceptance test certificate 3.1 EN 10 204: leakage test
x	x	374	acceptance test certificate 3.1 EN 10 204: material
x	x	562	parts in contact with medium with PTFE covering, on request
x	x	563	parts in contact with medium with HALAR coating, on request

Additional details: In which zone will the resistance thermometer be used?

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Order code								/ **362** ,...
Order example	902820/50	415	1001	1	24	125	26	/ 362[1]

1. List extra codes in sequence, separated by commas.
3. Specify range and output signal in plain text.

Note:
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JUMO STEAMtemp

Push-in resistance thermometers in steam-tight version

- **for temperatures from -70 to +200°C**
- **as single, twin or triple resistance thermometer**
- **in 2-wire, 3-wire or 4-wire circuit**
- **connecting cable in PTFE, FEP and silicone**

Push-in resistance thermometers are preferably used for temperature measurement in sterilizers. Thanks to their special construction, they are highly suitable for application in pressurized atmospheres containing steam. Other applications include plant engineering and laboratories.

The PTFE connecting cable is suitable for use in humid areas within the temperature range -190 to +260°C, the FEP cable from -70 to +200°C. The cable connection incorporates strain relief.

The measuring insert is normally fitted with a Pt100 temperature sensor to EN 60 751, Class A in 2-wire circuit. Versions with 2 or 3 measuring circuits are also available. 3-and 4-wire circuit connections can be provided.

Technical data

Connection	cable ends available as: bare wires, with ferrules, receptacles or multipole connector.
Connecting cable	PTFE, ambient temperature -190 to +260°C FEP, ambient temperature -70 to +200°C silicone, ambient temperature -50 to +150°C connecting cable available with shielding (option)
Protection tube	stainless steel 1.4571, 4mm, 4.5mm, 6mm dia.
Measuring insert	Pt100 temperature sensor, EN 60 751, Cl. A, 2-/3-/4-wire circuit
Protection	IP69

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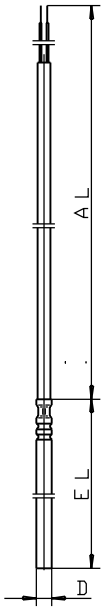
Dimensions



Type 902830/10
Type 902830/30

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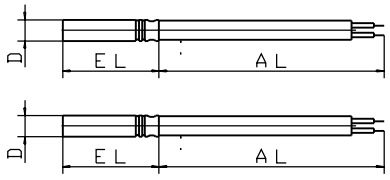
Order details: Push-in resistance thermometers in steam-tight version

(1) Basic version

		902830/10	Push-in resistance thermometer, steam-tight
		902830/30	Push-in resistance thermometer, steam-tight, pressure-tight up to 5.0bar



			(2) Operating temperature in °C
	x	302	-70 to +200°C / FEP connecting cable
x		370	-50 to +150°C / PTFE connecting cable
x		371	-50 to +150°C / silicone connecting cable
			(3) Measuring insert
x		1001	1 x Pt100 in 3-wire circuit
x		1003	1 x Pt100 in 2-wire circuit
x	x	1011	1 x Pt100 in 4-wire circuit
x		2001	2 x Pt100 in 3-wire circuit
x	x	2003	2 x Pt100 in 2-wire circuit
x	x	2011	2 x Pt100 in 4-wire circuit (not in conjunction with 371)
x		3028	3 x Pt100 1 x 2-wire circuit, 2 x 3-wire circuit (not in conjunction with 371)
			(4) Tolerance class to EN 60 751
x	x	2	Class A
			(5) Protection tube diameter D in mm
	x	4	4mm
	x	4.5	4.5mm with 2 measuring circuits in 4-wire circuit
x		6	6mm
			(6) Fitting length EL in mm (50 ≤ EL ≤ 500)
	x	50	50mm
x	x	100	100mm
x	x	150	150mm
x	x	200	200mm
x	x	...	please specify in plain text (in 50mm steps)
			(7) Connecting cable end
x	x	03	bare cable ends
x	x	11	ferrules to DIN 46 228 Part 4 (standard)
x		13	receptacle 6.3 to DIN 46 247
x	x	80	multipole connector (specify type in plain text)
			(8) Connecting cable length AL in mm (500 ≤ AL ≤ 500000)
x	x	2500	2500mm (standard)
x	x	...	please specify in plain text (in 500mm steps)
			(9) Extra codes
x	x	000	no extra code
	x	304	without protection tube (sensor enclosed in PTFE sleeve)
x	x	312	curved protection tube R 13mm (only 4.5mm dia. on Type 902830/30) (please specify dimensions in plain text)
x		317	shielded connecting cable

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
Order code		-		-		-		-		-		-		-		/		,...
Order example	902830/10	-	370	-	1011	-	2	-	6	-	100	-	11	-	2500	/	000[1]	

1. List extra codes in sequence, separated by commas.

Stock versions

(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	Sales No.
902830/10	-	370	-	1011	-	2	-	6	-	100	-	11	-	2500	/	317	90/00306448
902830/10	-	370	-	2001	-	2	-	6	-	100	-	11	-	2500	/	000	90/00306449
902830/30	-	302	-	1011	-	2	-	4	-	50	-	11	-	2500	/	000	90/00445084
902830/30	-	302	-	2011	-	2	-	4.5	-	50	-	11	-	2500	/	000	90/00445085

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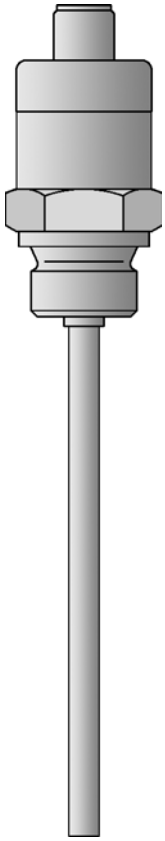
JUMO CANtrans T resistance thermometers with CANopen output



- **for temperatures from -50 to +450°C**
- **as single or twin resistance thermometer**
- **vibration-proof construction**
- **limit monitoring**
- **settable through standard CANopen software tools**

Resistance thermometers are predominantly used for measuring temperatures in liquids and gases. An important selection criterion is their reliable sealing against both positive and negative pressures. Applications can be found in medical technology, mechanical engineering, drive technology, commercial vehicles, and railways.
The measuring insert is normally fitted with a Pt1000 temperature sensor to EN 60 751, Class B. The temperature measurement is digitized, linearized and made available for further processing via the serial CANopen bus protocol (CAN slave). A large variety of useful extra functions can be implemented through the DS 404 device profile. All settings can be made using standard CANopen software tools.

For pressure transmitters with CANopen output, Data Sheet 40.2055

Technical data

Connection	circular connector M 12x1, 5-pole to IEC 60 947-5-2
Process connection	thread, stainless steel 1.4571
Protection tube	stainless steel 1.4571
Measuring insert	Pt1000 temperature sensor, EN 60 751, Class B, 2-wire circuit
Protection	IP67, to EN 60 529, with screwed-on connector
Response time	$t_{0.9}$ = 12 sec, in water 0.2 m/sec

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CAN transmitter

Protocol	CiA DS 301, V4.02, CANopen slave	
Profile	CiA DS 404, V1.2 Measuring devices and closed-loop controllers	
Baud rate	20kbaud to 1Mbaud, setting via LSS or SDO	
Module ID	1 — 127, setting via LSS or SDO	
PDO	0 Rx, 1 Tx	
SDO	1 Rx, 1 Tx	
Emergency	yes	
Heartbeat	yes	
LSS	yes	
SYNC	yes	
Operation, project design	All parameters are accessible via the CANopen object directory (EDS) and can be set using standard CANopen software tools.	
Input		
Measurement input	Pt1000 to EN 60 751, Class B	
Range limits	-50 to +150°C, -50 to +450°C	
Sampling rate	250msec	
Output		
Output signal	CANopen as per CiA DS 404 V1.2, in °C, can be switched over to °F, K selectable decimal place 0, 1, 2	
Transfer characteristic	linear with temperature	
Electrical connection	circular connector M 12x1, 5-pole to IEC 60 947-5-2	
Supply		
Supply voltage	10 — 30V DC	
Current drawn	approx. 45mA max.	
Monitoring		
	measurement circuit - underrange (low limit is freely selectable) - overrange (high limit is freely selectable) probe short-circuit probe break	
Extra functions		
	min./max. measurement storage	
	fine calibration	
	changeover °C, °F, K	
	selectable decimal place 0, 1, 2	
Ambient conditions		
Operating temperature range	-20 to +85°C	
Storage temperature range	-40 to +85°C	
Temperature effect	≤ ± 0.0025% / °C deviation from 22°C of range span	
Accuracy	Class B to EN 60 751, ± 0.2% max. of range span	
EMC	EN 61 326 interference emission, Class B immunity to interference, industrial requirements	
Mechanical shock	to IEC 68-2-27 (for Type 902910/10)	EL 50mm: 50g / 3msec; EL 100mm: 30g / 3msec EL 200mm: 15g / 3msec
Mechanical vibration	to IEC 68-2-6 (for Type 902910/10)	EL 50mm: 10g max. at 10 — 2000Hz EL 100mm: 5g max. at 10 — 300Hz EL 200mm: 2g max. at 10 — 100Hz
Protection	IP67, to EN 60 529, with screwed-on connector	

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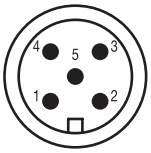
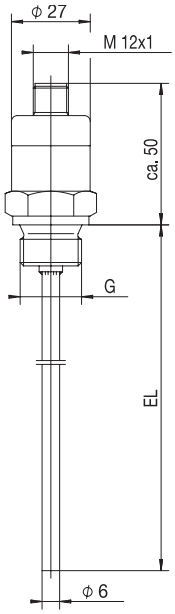
Connection diagram



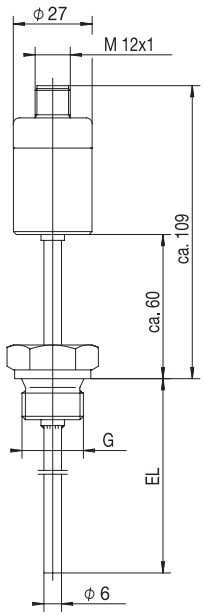
Circular connector M 12x1
5-pole to
IEC 60 947-5-2

Connection		Terminal assignment
Supply 10—30 V DC	V+	2
	V-	3
Output CANopen	screen	1
	CAN_H	4
	CAN_L	5

Dimensions

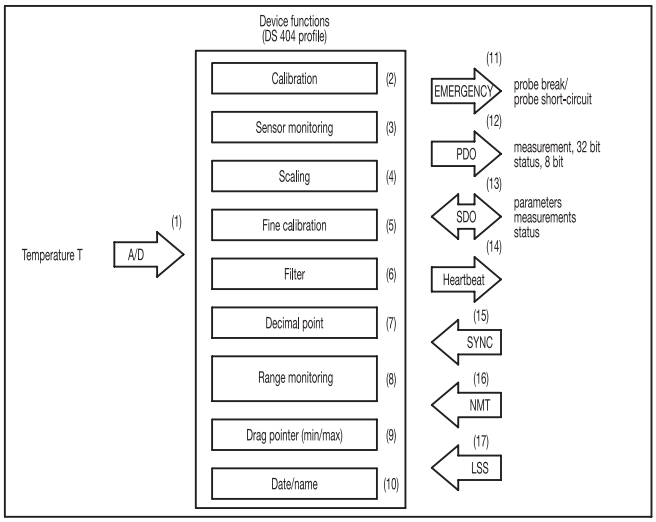


Type 902910/10



Type 902910/12

Block diagram



Operation

(1) The temperature measurement is digitized.
(2) The temperature signal is digitally calibrated ex-factory.
(3) The sensor monitoring facility continuously checks the correct performance of the sensor signal and triggers high-priority emergency telegrams in the event of an error.
(4) The temperature measurement can be scaled to any dimensional unit (or in % of measurement range).
(5) Fine calibration features a freely adjustable shift of the characteristic.
(6) Undesirable signal fluctuations can be suppressed by means of the (adjustable) filter constant.
(7) The measurement is output with a freely selectable decimal place.
(8) Range monitoring features freely selectable upper and lower limits. The result is output as a status byte with the measurement in the PDO telegram.
(9) The drag pointer function serves to store the minimum and maximum temperature values.
(10) Date and name of the last servicing action can be stored.
(11) An emergency telegram is triggered in the event of a sensor fault.
(12) The PDO telegram contains the 32-bit measurement and the 8-bit status. The measurement that is output can be controlled by means of different trigger conditions.
(13) SDO telegrams can be used for setting parameters, as well as for requesting measurements and status.
(14) The heartbeat signal serves to additionally monitor the transmitter function.
(15) The measurements can additionally be controlled by using the Sync command.
(16) NMT telegrams serve to control the operational state of the transmitter.
(17) The CAN module ID and CAN baud rate are set through LSS or SDO, according to choice.

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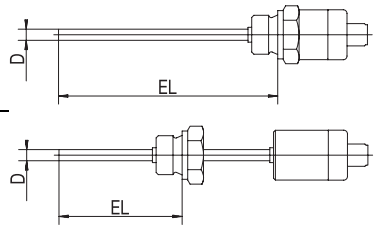
Order details: Resistance thermometers with CANopen output

(1) Basic version

		902910/10	Resistance thermometer with CANopen output
		902910/12	Resistance thermometer with CANopen output, extension tube for elevated temperatures



			(2) Operating temperature in °C
x		370	-50 to +150°C
	x	404	-50 to +450°C
			(3) Measuring insert
x	x	1005	1 x Pt1000
x	x	2005	2 x Pt1000
			(4) Tolerance class to EN 60 751
x	x	1	Class B (standard)
x	x	2	Class A
			(5) Protection tube diameter D in mm
x	x	6	6mm
			(6) Fitting length EL in mm (50 ≤ EL ≤ 500)
x	x	50	50mm
x	x	100	100mm
x	x	150	150mm
x	x	200	200mm
x	x	250	250mm
x	x	...	details in plain text (50mm steps)
			(7) Process connection
x	x	102	thread G 1/4 (1/4" pipe)
x	x	103	thread G 3/8 (3/8" pipe)
x	x	104	thread G 1/2 (1/2" pipe)
x	x	121	thread M 14x1.5
x	x	126	thread M 18x1.5
x	x	128	thread M 20x1.5
x	x	144	thread 1/2-14NPT
			(8) Extra codes
x	x	000	no extra code
x	x	100	customer-specific factory setting
x	x	310	stepped protection tube

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
Order code		-		-		-		-		-		-		/		, ...
Order example	902910/10	-	370	-	1005	-	1	-	6	-	50	-	102	/	000	

1. List extra codes in sequence, separated by commas.

Accessories for resistance thermometers with CANopen output

	Sales No.
5-pole terminal box M 12x1, straight, with 5m long moulded connecting cable	90/00337625
5-pole terminal box M 12x1, angled, with 2m long moulded connecting cable	90/00375164
5-pole terminal box M 12x1, straight, no cable, assembly by customer	90/00419130
5-pole terminal box M 12x1, angled, no cable, assembly by customer	90/00419133
Tee	90/00419129
PC CAN interface for USB interface	40/00449941
PC configuration software for CANopen	40/00449942
EDS files on diskette	90/00434520
EDS files, for download (www.jumo.net, see Product Information)	-
Operating Instructions, for download (www.jumo.net, see Product Information)	40/00421871

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Contents:

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The measurement of humidity in air

Introduction

Besides temperature, humidity is a very important process parameter. The relative humidity of the surrounding atmosphere, for example, has a far-reaching influence on our well-being and our health.

In industrial processes the correct adjustment of humidity is often decisive for the competitiveness and quality of the product. Correct adjustment of humidity level can also contribute to appreciable savings in energy consumption.

The list of applications in which the measurement of humidity is considered important can be extended indefinitely. Wherever the water vapour content of the air can produce or influence chemical, physical or biological processes it is very important to ensure that humidity is monitored continuously.

Concepts and physical laws

The composition of air

Clean and dry air contains the following constituents (in vol %):

78.10 % nitrogen
20.93 % oxygen
0.93 % argon
0.03 % carbon dioxide
0.01 % hydrogen

together with smaller amounts of neon, helium, krypton and xenon.

In addition to these constituents, indoor and outdoor air contains a number of gases and solids as well as a certain quantity of moisture in the form of water vapour. Air is therefore a homogeneous mixture of different gases and can be considered as an "ideal gas". Solar radiation and wind ensure uniform mixing of the gases involved so that there is no stratification despite the differences in specific gravity.

Dalton's Law P = P1 + P2 + ...

The total pressure of a gas mixture consists of the sum of the partial pressures of its constituents. Expressed in simple terms, air thus consists of dry air and water vapour.

$$P = P_W + P_{dry}$$

where P_w represents the partial pressure produced by water vapour and P_{dry} the sum of the partial pressures of all other gases.

Saturation water vapour pressure

Air is capable of absorbing and storing a certain quantity of water vapour depending on its temperature. This quantity increases with increasing temperature.

At any particular temperature the resulting water vapour pressure can only rise up to the saturation limit which is designated as the saturation water vapour pressure P_S.

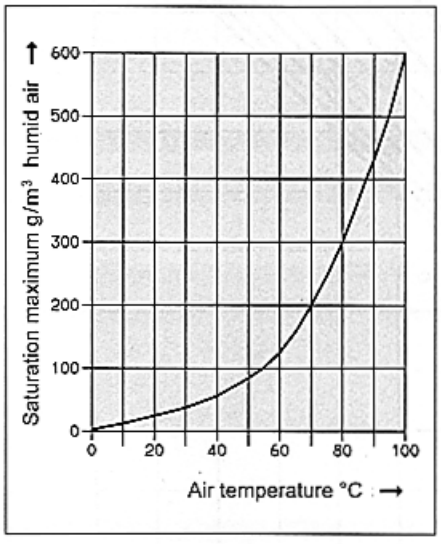

Fig. 1: The water vapour pressure curve indicates the saturation maximum of water vapour content in air at different temperatures

The atmospheric pressure and the presence of other gases or contaminants have no influence on the behaviour described above.

Dew point

The dew point temperature T_d is the temperature at which air is saturated with water vapour; further addition of water vapour or cooling of the air results in condensation. The excess water vapour condenses as rain, mist or condensate. The saturated state is maintained. The dew point temperature is equal to the water vapour saturation temperature and can be a maximum of 100 °C at normal pressure.

Measured parameters

The humidity content of air can be characterised by two parameters. We distinguish between relative humidity and absolute humidity.

Relative humidity

Relative humidity is defined as the ratio between the actual partial vapour pressure P_W in a gas and the maximum possible vapour pressure, i.e. the saturation vapour pressure P_S, at the particular temperature.

$$rH = \frac{P_W}{P_S\,(t)} \cdot 100 \quad [\%]$$

Relative humidity is a non-dimensional value. It represents a ratio and is specified in percent.

Since the saturation pressure depends only on the temperature of the air, it follows that relative humidity is also dependent on temperature. Relative humidity decreases with increasing temperature, and vice versa.

The influence of temperature variations on relative humidity can be very appreciable.

	10 °C	20 °C	30 °C	50 °C	70 °C
10 %rH	±0.7 %	±0.6 %	±0.6 %	±0.5 %	±0.5 %
50 %rH	±3.5 %	±3.2 %	±3.0 %	±2.6 %	±2.3 %
90 %rH	±6.3 %	±5.7 %	±5.4 %	±4.6 %	±4.1 %

Table 1: Influence of a temperature variation of ±1 °C at different temperatures and humidities

Absolute humidity

Absolute humidity a is the quantity of water vapour contained in a certain volume of air.

$$a = \frac{\text{mass of water vapour}}{\text{volume of air}}$$

The unit for absolute humidity is g/m³. Measurement of absolute humidity has the great advantage that it represents the quantity of water actually present in a gas, for example, independent of temperature.

Mixing ratio or water content (x)

This parameter indicates the ratio of the mass of water vapour to the mass of the dry gas. Commonly used units are g/kg dry air and %.

It specifies how many grammes of water vapour are contained in a kg of dry air. The determination of water content plays an important role in processing technology, since such data provide more valuable information than relative humidity.

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There is a fixed relationship between the values of absolute and relative humidity, see Fig. 2.

The unit of absolute humidity can be selected to suit individual requirements.

The most common units are:
- dew point temperature °C
- mixture ratio $g/kg_{dry\ air}$
- absolute humidity g/m^3

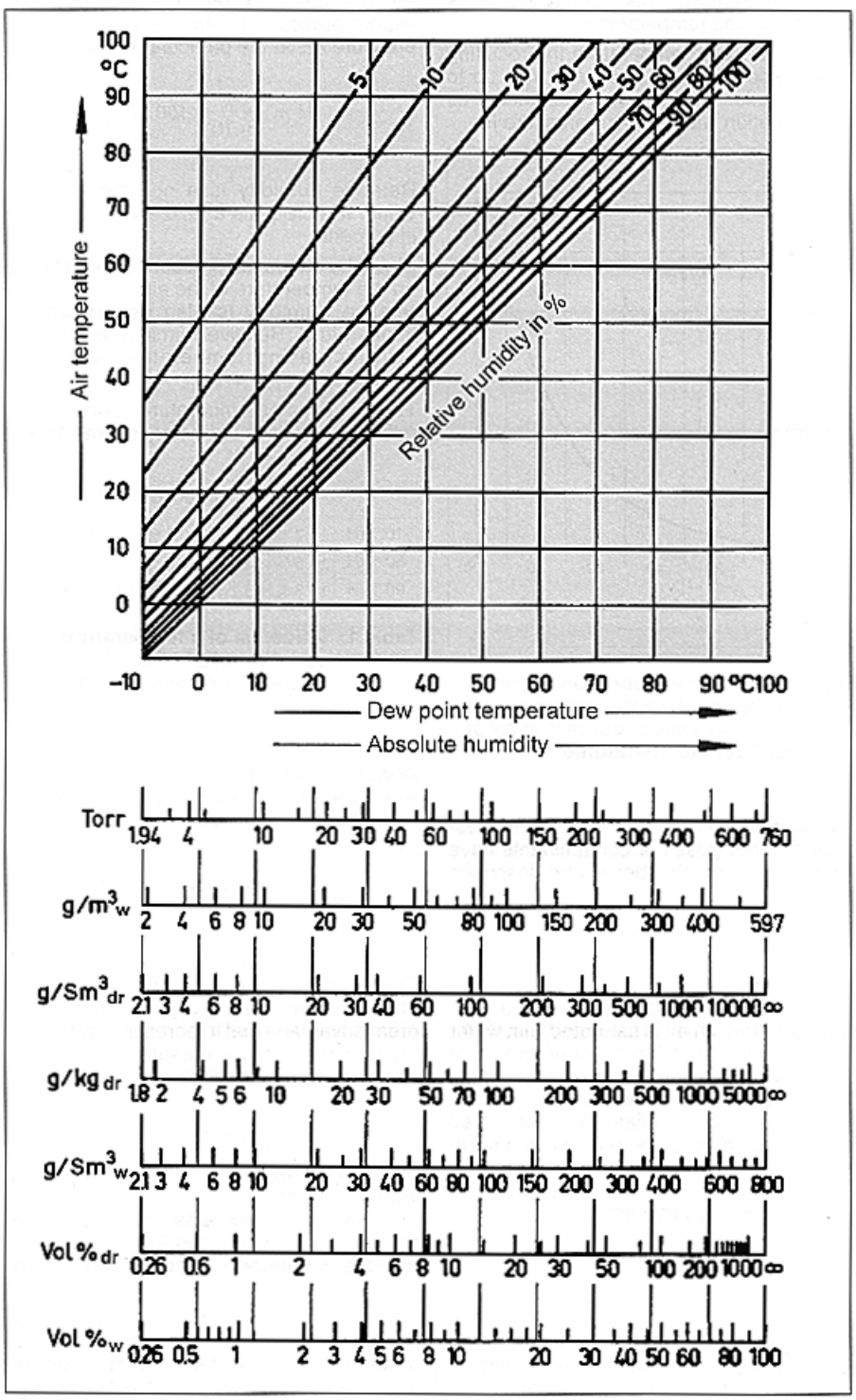

Fig. 2: Units of absolute humidity and their relation to relative humidity

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Relationship between temperature, moisture content and relative humidity
These relationships are shown in the i-x diagram (Mollier diagram, see Fig. 3).

Example for the use of the diagram:
a) Determining the water content x and the water vapour pressure e
Measured values: air temperature 28 °C
air humidity 60 % rH

Look up the measured values in the diagram and determine the point of intersection A. From this intersection draw a vertical line and extend it to the top and bottom edges of the diagram. The intersection with the top scale gives the water vapour pressure e = 17 mm Hg, at the bottom scale the water content x = 14 g/kg.

b) Evaluating the dew point temperature
Measured values: air temperature 28 °C
air humidity 60 % rH

Find the point of intersection A as under a). From the intersection A go down vertically to the maximum humidity line 100 % and from that point draw a horizontal line to the left-hand scale with the temperature graduation. The new intersection gives the required dew point temperature of 19.4 °C.

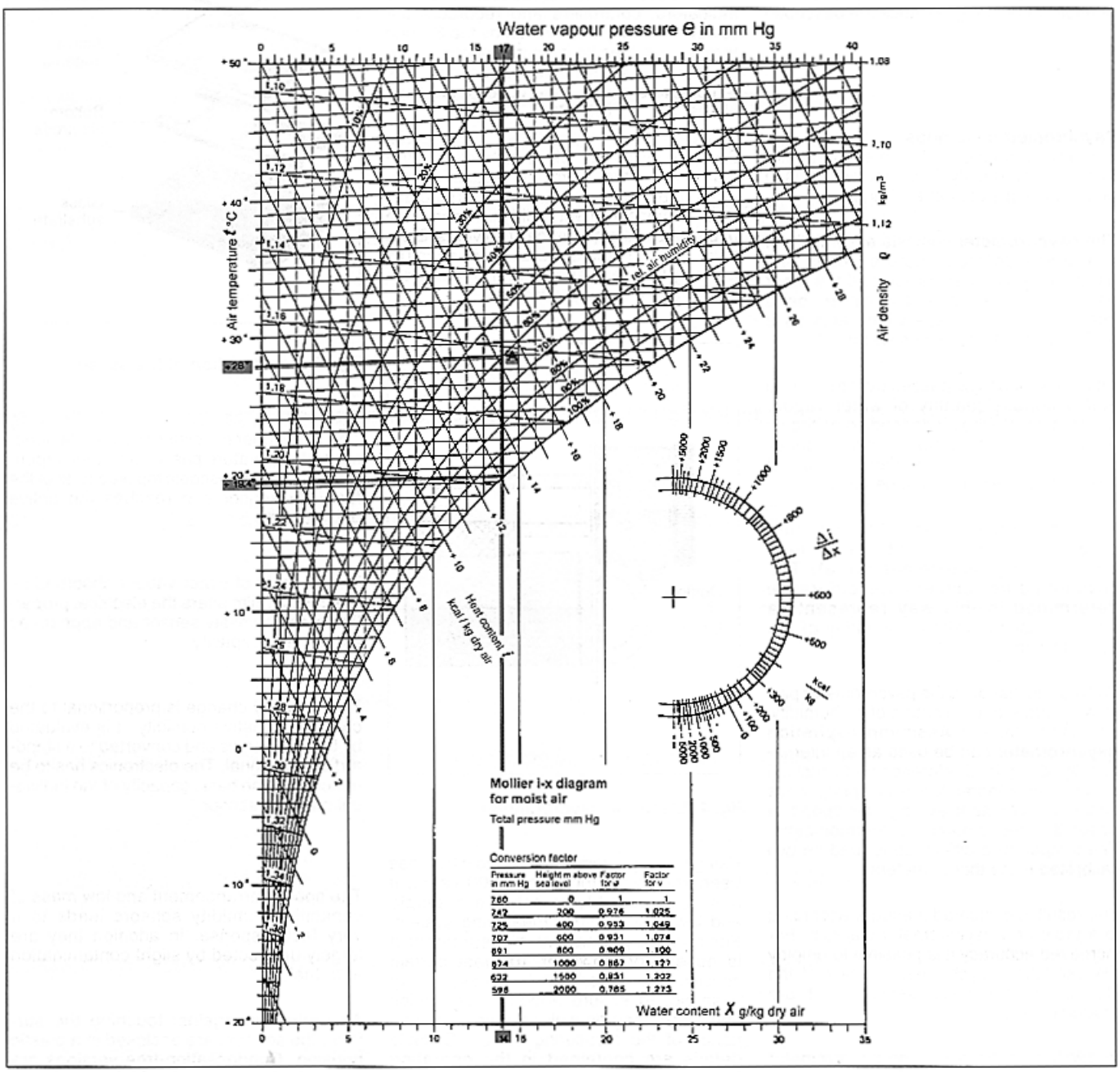

Fig. 3: Relationship between temperature, moisture content and relative humidity

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Humidity measurement methods and their application

A number of different methods are used for measuring humidity in air. The choice of the most suitable method is usually made by the user based on the local situation. The use of a simple but correctly applied humidity measuring device often permits achieving a better accuracy or meeting the particular requirements.

In order to provide general assistance, some of the best known and widely used humidity measuring methods are described below.

Psychrometric methods

The psychrometric method measures relative humidity directly. This method is based on the principle of heat exchange.

The **psychrometer** consists essentially of two independent temperature probes, one used as the wet bulb probe and the other as the dry bulb probe. The wet probe is surrounded by a tissue which acts as a wick and is saturated with water.

An air flow has to be passed over this probe and a certain quantity of water vapour evaporates into the air depending on the air temperature and humidity. This produces a cooling effect at the surface of the wet thermometer (wet bulb temperature).

At the same time a second temperature probe measures the ambient air temperature (dry bulb temperature). The psychrometric temperature difference determined in this way represents a measure for the relative humidity of the surrounding air.

With careful handling the psychrometer permits accurate determination of air humidity. For example, the **Assmann aspiration psychrometer** can be used as an internationally recognised reference and checking device. An integral fan with spring drive ensures a constant average air speed of about 3 m/sec around the thermometers. The temperature difference is read on two calibrated glass thermometers.

The result is evaluated manually according to a table or a psychrometer diagram. For increased accuracy it is possible to employ the aspiration psychrometer tables of the German meteorological service which are graduated in 0.1 °C.

In addition to the aspiration psychrometer there are numerous different arrangements.

The field of application of most mechanical psychrometers with glass thermometers is restricted to the climatic range for temperatures up to 60 °C. The advantage of this type of instrument is that no electrical supply is required.

Electrical psychrometers have more extensive applications. Here the wet bulb and dry bulb temperatures are measured using Pt 100 resistance thermometers.

In the case of microprocessor-controlled indicators, controllers and recorders the relative humidity determined by the Sprung formula can then be indicated or processed directly, using a suitable input circuit. The temperature range covered extends from almost 0 °C to 100 °C.

Because of its reliable construction compared with other humidity measuring devices, the psychrometric method generally permits measurement in dirty and corrosive gases and in the presence of solvents. Electrical psychrometers are used for example for long-term measurement in meat processing and cheese production.

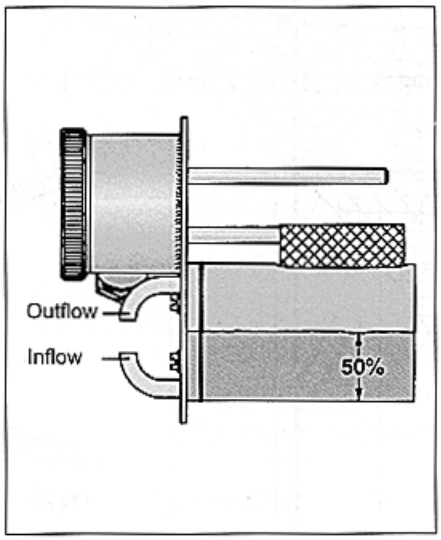

Fig. 4: Electrical psychrometer

Using the psychrometric method which has been known for more than 100 years, it has been possible to achieve a simple and low-cost humidity measuring system. For reliable permanent measurement it is necessary, however, to meet certain specific user criteria. It is necessary, for example, to ensure adequate ventilation and moistening as well as proper maintenance of the measuring device. Suitable details are contained in the operating instructions and method descriptions of the individual instruments.

Capacitive method

The capacitive method is based generally on the condenser principle. The function of the humidity sensor depends on the change of capacity of a thin polymer film through the absorption or removal of water molecules.

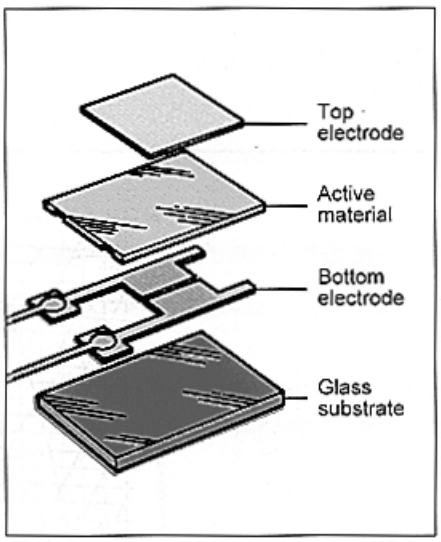

Fig. 5: Construction of the sensor

The atmospheric moisture content depending on temperature passes as water vapour through the hygroscopic top electrode of the humidity sensor and reaches the active polymer film.

The quantity of water vapour absorbed by the polymer film alters the electrical properties of the humidity sensor and appears as a change in capacity.

This capacity change is proportional to the change in relative humidity; it is evaluated by the electronics and converted to a standard output signal. The electronics has to be matched to the basic capacity of the individual humidity sensor.

The special arrangement and low mass of capacitive humidity sensors leads to a very fast response. In addition they are largely unaffected by slight contamination and dust.

As protection against touching the surface, the sensors are enclosed in a plastic housing. Condensation-free versions are available for use in the higher moisture range.

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Capacitive measurement methods are used e.g in climatic engineering and in industrial processes where there are no high concentrations of corrosive gases or solvents.

The standard measuring range of capacitive humidity sensors is generally from 10 — 90 % rH. High-grade versions permit use in the full range between 0 and 100 % rH.

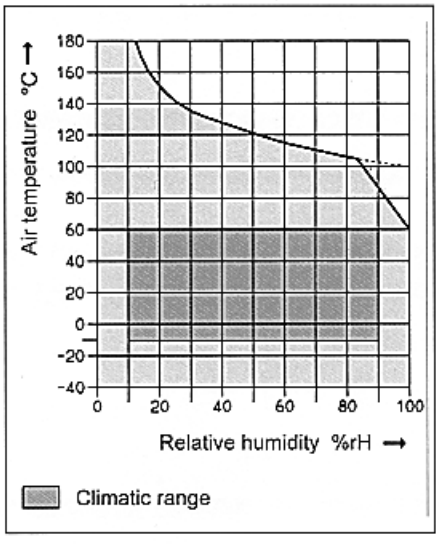

Fig. 6: Working range of a capacitive humidity sensor for industrial applications

One of the main advantages of the capacitive method is the temperature range over which humidity can be measured.

For example, modern industrial humidity transducers permit measurements between –40 and +180 °C, with the temperature being measured simultaneously and provided as a standardised output signal.

Variations of the working range shown are possible depending on the instrument version.

Because of its purely electrical measurement the capacitive method offers a further advantage. High-performance humidity transducers incorporating modern microprocessor technology can be provided with a large number of possible options and functions.

Variations in gas pressure and air flow rates have hardly any influence on the capacitive humidity sensor so that instrument versions are available for measurement under pressures between 0 and 100 bar.

Accuracy is between ±2 and ±5 % rH depending on the instrument version. Under certain conditions it is even possible to achieve accuracies of ±1 % rH.

Hygrometric methods
The hygrometric procedure employs the special characteristics of hygroscopic fibrous materials for determining humidity. If these fibres are exposed to ambient air, there is (after an equilibration period) a measurable change in length depending on the moisture content of the air.

From the condition of the fibres it is possible to deduce the amount of humidity present.

Hygrometric measuring elements employ mainly specially prepared plastic threads and human hair.

Hair measuring element
The action of the measuring element is based on the fact that the hair used is capable of absorbing moisture. This moisture take-up causes the hair to swell which shows itself mainly in a change in length.

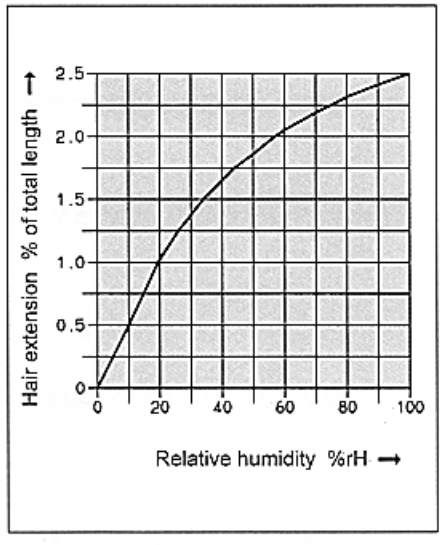

Fig. 7: Change of hair length depending on relative humidity

Increasing humidity in the air causes an increase in the hair length. The length change amounts to approx. 2.5 % of the total hair length for a humidity change from 0 to 100 %. At high humidities the hair exhibits only a relatively small increase in length (see Fig. 7).

Hair measuring elements are used mainly in dial instruments in the climatic field. A special precision mechanism converts the length change of the hair into a pointer or pen movement. For increased mechanical strength it is usual to combine several hairs into a hair bundle or hair grid.

The method offers an accuracy of ±3 % within the range 0 — 90 (100) % rH. Ambient temperatures between –35 and +50 °C can be covered.

When used for longer periods in the low humidity range below 40 % rH the hair element has to be regenerated. This operation consists of exposing the hair hygrometer for approx. 60 minutes to virtually saturated air (about 94 — 98 %). Any correction of the pointer position which may prove necessary can then be carried out using an adjusting screw.

Hair hygrometers are sensitive to hygroscopic dust and have to be suitably protected and/or cleaned at appropriate intervals.

Plastic measuring element
Plastic elements employ plastic threads in place of human hair. A special process is used to give these fibres certain hygroscopic properties. Changes in relative humidity produce a proportional length change of the measuring element. The change in length is again transmitted by a precision mechanism.

Plastic elements offer the advantage that they can be used at higher temperatures (up to 110 °C) and also for longer periods at low relative humidities. No regeneration as in the case of hair element is required here.

The plastic measuring element is resistant to water and unaffected by dry dirt, dust, loose fibres and similar contamination. The measurement/working range covers (0) 30 — 100 % rH, but depends on ambient temperature (see Fig. 8).

Accuracy is ±2 — 3 %.

Hygrometric instruments with a plastic element are employed for long-term humidity measurement in industrial processes and in climatic engineering because of their extensive stability and compatibility with higher temperatures.

Various instrument versions are available to suit particular applications.

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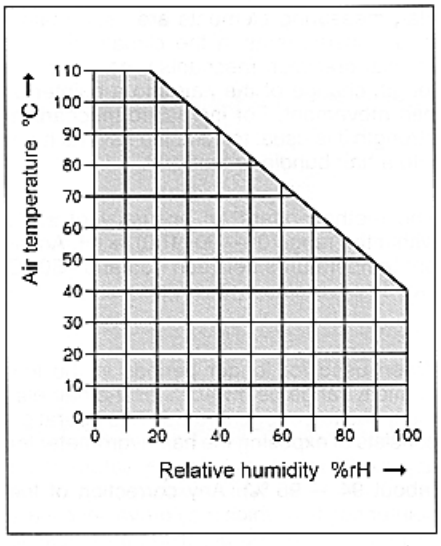

Fig. 8: Maximum temperature and humidity of a plastic measuring element

They include, among others:

Hygro transducers
In these devices the length change of the plastic element is sensed through a suitable system and usually converted into a linear resistance signal. Versions are also available with built-in 2-wire transmitter so that standardised current and voltage signals are provided at the output. Units with an additional temperature measuring range are referred to as hygro-thermo transducers.

Hygrostats
In this variant the length change of the measuring element is used to operate a switching contact. Hygrostats are used to control humidifiers and de-humidifiers.

Hygrograph
A hygrograph is a humidity recorder with a hygrometric hair or plastic sensing element. Additional temperature recording is also possible (hygro-thermograph). Applications include meteorological stations.

Hygrometric methods can be used generally for humidity measurement at atmospheric pressure and in a non-aggressive atmosphere.

Use in corrosive atmospheres or those containing solvents should be avoided as these result in incorrect readings depending on type and concentration, and can even destroy the measuring element.

Conclusions

The section on humidity measurement methods and their applications covers basic principles. Actual instrument descriptions and technical data may therefore vary for different manufacturers. Full information can be obtained from operating instructions or data sheets for the individual instruments.

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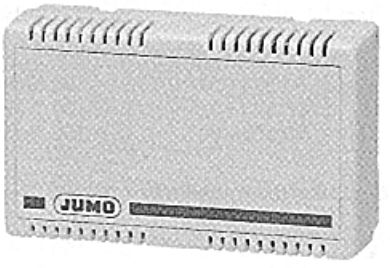
Hygro and hygrothermo transducers (capacitive) for climatic applications

- **to measure relative humidity and temperature**
- **for indoor and air duct mounting**
- **special rod model for laboratory or variable application**
- **with current or voltage outputs**
- **with fast-response capacitive humidity sensor**



Indoor version

Correct measurement of air humidity in climatic applications is very important, as is that of other variables, e.g. temperature. Optimum adjustment of humidity in climatic installations, for example, can contribute to significant savings in energy consumption and to improvement in personal comfort.

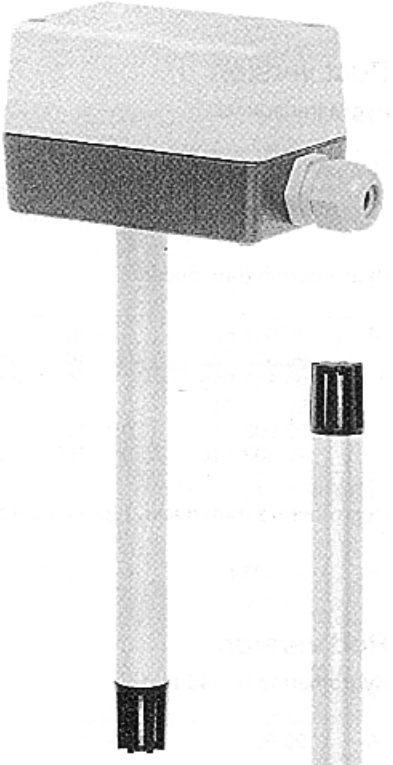
Hygro and hygrothermo transducers with capacitive humidity sensor are specially designed for such applications, e.g. in ventilating and air conditioning systems as well as for climatic monitoring indoors.

The method is based on the capacity change of a capacitor with changes in the dielectric. The humidity sensor consists of a support plate carrying the electrodes and covered by a hygroscopic polymer layer. This polymer layer absorbs water molecules from the medium being measured (air) or gives them off, and as a result changes the capacity of the capacitor. An electronic circuit converts the capacity corresponding to humidity and produces a standard current or voltage output signal. Due to the small intrinsic mass of the sensor and its special construction it is possible to achieve very fast response.

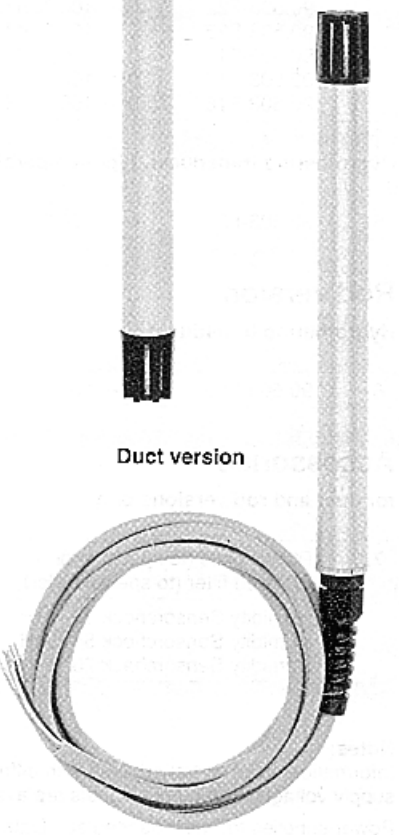
The transducer ensures reliable humidity measurement in the working range of 10 — 95 % rH. Versions with an additional temperature measuring range are available for wider applications. Temperature is measured with a fast-response thin-film Pt 100 temperature sensor to EN 60 751.

Instrument versions are available with output signals of 4 — 20 mA, 0 — 20 mA or 0 — 10 V corresponding to the humidity range 0 — 100 % rH and the different temperature ranges (see page 2 / 5).

Different constructional styles ensure simple and reliable installation to suit application and location.



Duct version



Rod version

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Indoor version

Hygro transducer

Item	Type	Humidity		Temperature		Supply	Sales No.
		range*	output 1	range**	output 2		
1	90.503-F01	0 — 100 % rH	4 — 20 mA	–	–	15 — 24 V DC	90 / 00315097 ●
	90.503-F02	0 — 100 % rH	0 — 10 V	–	–	15 — 24 V DC	90 / 00315098
	90.503-F03	0 — 100 % rH	0 — 20 mA	–	–	15 — 24 V DC	90 / 00315099

Hygrothermo transducer

2	90.503-F05	0 — 100 % rH	4 — 20 mA	– 30 to +60 °C	4 — 20 mA	15 — 24 V DC	90 / 00332708 ●
	90.503-F06	0 — 100 % rH	4 — 20 mA	0 — 50 °C	4 — 20 mA	15 — 24 V DC	90 / 00315100
	90.503-F07	0 — 100 % rH	0 — 10 V	0 — 50 °C	0 — 10 V	15 — 24 V DC	90 / 00315101
	90.503-F08	0 — 100 % rH	0 — 20 mA	0 — 50 °C	0 — 20 mA	15 — 24 V DC	90 / 00315102

Duct version

Hygro transducer

3	90.503-F11	0 — 100 % rH	4 — 20 mA	–	–	15 — 30 V DC	90 / 00315103 ●
	90.503-F12	0 — 100 % rH	0 — 10 V	–	–	15 — 30 V DC	90 / 00315104
	90.503-F13	0 — 100 % rH	0 — 20 mA	–	–	15 — 30 V DC	90 / 00315105

Hygrothermo transducer

4	90.503-F21	0 — 100 % rH	4 — 20 mA	– 30 to +60 °C	4 — 20 mA	15 — 30 V DC	90 / 00332698 ●
	90.503-F22	0 — 100 % rH	4 — 20 mA	– 10 to +90 °C	4 — 20 mA	15 — 30 V DC	90 / 00332699
	90.503-F23	0 — 100 % rH	4 — 20 mA	0 — 100 °C	4 — 20 mA	15 — 30 V DC	90 / 00332700
	90.503-F16	0 — 100 % rH	4 — 20 mA	0 — 50 °C	4 — 20 mA	15 — 30 V DC	90 / 00315106 ●
	90.503-F17	0 — 100 % rH	0 — 10 V	0 — 50 °C	0 — 10 V	15 — 30 V DC	90 / 00315107
	90.503-F18	0 — 100 % rH	0 — 20 mA	0 — 50 °C	0 — 20 mA	15 — 30 V DC	90 / 00315108

Hygrothermo transducer, high-temperature version for air temperatures up to 120 °C

5	90.503-F24	0 — 100 % rH	4 — 20 mA	0 — 120 °C	4 — 20 mA	15 — 30 V DC	90 / 00332709 ●

Rod version

Hygrothermo transducer

6	90.503-F30	0 — 100 % rH	4 — 20 mA	– 20 to +80 °C	4 — 20 mA	15 — 30 V DC	90 / 00315109 ●

Accessories

for duct and rod versions only

7	Plastic grille (to special order)	–
	Sintered filter (to special order)	–
	Humidity Sensorcheck 33 % rH	90 / 00332758
	Humidity Sensorcheck 55 % rH	90 / 00332759
	Humidity Sensorcheck 76 % rH	90 / 00332760

Notes:
Information on other transducers with different temperature ranges, supply voltages and output signals are available on request.

Power supplies for rail mounting see Data Sheet 95.6010.
Recommended supply units: Type TN-22 / 02,055 (1 channel) and TN-67 / 02,055 (4 channels).

* Note working range
** Note permitted ambient temperature

● Available from stock

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Technical data

Humidity

Sensing element
capacitive

Measuring / working range
0 / 10 — 100 / 95 % rH
(see diagram page 4 / 5)

Accuracy
± 3.5 % rH
(between 0 — 60 °C)

Medium
air, atmospheric pressure, not corrosive, not condensing

Response times
50 % time
at v = 2 m / sec: 10 sec approx.
with sintered filter
at v = 2 m / sec: 1.2 min approx.

Temperature coefficient
at 20 °C and 50 % rH
0.05 % rH / °C

Humidity output
current / voltage signal
0 — 20 mA or 0 — 10 V
in 4-wire circuit
and
4 — 20 mA
in 2-wire circuit

Temperature

Sensing element
Pt 100 temperature sensor
to EN 60 751 Class B

Measuring ranges
indoor version:
– 30 to +60 °C or 0 — 50 °C

Duct version:
– 30 to +60 °C, – 10 to +90 °C,
0 — 50 °C, 0 — 100 °C
or
0 — 120 °C
on high-temperature version

Rod version:
– 20 to +80 °C

Accuracy
indoor version:
± 0.8 °C

duct version:
± 0.8 °C
or
± 0.5 °C
on high-temperature version

rod version:
± 0.5 °C

Temperature output
current / voltage signal
0 — 20 mA or 0 — 10 V
in 4-wire circuit
and
4 — 20 mA
in 2-wire circuit

Electrical data

Supply
15 — 24 V DC / 15 — 30 V DC
(see table page 2 / 5)
(24 V AC to special order)

Max. burden resistance for current output
500 Ω

Min. burden resistance for voltage output
10 k Ω

Maximum current uptake
25 mA approx. per channel

Linearity
better than 0.5 %

Output signals
(0) 4 — 20 mA / 0 — 10 V

Electromagnetic compatibility

interference immunity	EN 50 082-2
interference emission	EN 50 081-2

Construction

Case

indoor version:
high impact strength plastic, light grey

duct version:
ABS plastic
with fitted aluminium shaft

rod version
aluminium shaft with 2 m connecting cable

Permitted ambient temperature
indoor version:
– 10 to +60 °C

duct version:
– 30 to +80 °C on shaft
– 10 to +60 °C on case
or
– 20 to +120 °C on shaft
– 10 to + 60 °C on case
on high-temperature version

rod version:
– 20 to +80 °C

Permitted air velocity
15 m / sec max.

Protection
indoor version:
IP20

duct version:
IP64

rod version:
IP 20

Operating position:
unrestricted, preferable probe vertical downwards. On indoor version the ventilation slots at right angles to the air flow.

Weight
200 — 300 g depending on version

Dimensions
indoor version:
115 mm x 70 mm x 43 mm

duct version:
272 mm x 120 mm x 80 mm
or
300 mm x 120 mm x 80 mm
for high-temperature version

rod version:
20 mm dia., 220 mm long

Maintenance notes

Humidity sensing element

The capacitive humidity sensing element requires no maintenance in normal clean ambient air. Corrosive media or those containing solvents may cause faulty readings or complete failure. Deposits forming a water-repellent film on the sensor are liable to result in faulty operation. Dirty protective filters have to be replaced. The surface of the humidity sensor must not be touched. The sensor can only be cleaned by rinsing with distilled water. Correct measurement is restored again after complete drying. On the indoor and rod versions a soft brush may be used for cleaning.

Installation notes for Indoor version

The indoor sensor should be mounted on a vertical wall approx. 1.5 m above floor level. Installation above heating radiators, close to windows or doors, on surfaces subject to strong shock or vibration, on surfaces exposed to direct sunlight, on external walls and on chimneys should be avoided.
The sensors have to be protected against dripping and splashing water. It is important that no air can pass into the interior of the case through cable entries underneath the plaster. Silicone sealants must not be used for sealing the cable entry.
The sensor should be mounted so that room air can pass freely from the bottom upwards through the air slits in the case cover.

WARNING:

Contact with internal parts invalidates any warranty claim.

Checking and calibration

Humidity Sensorchecks can be used to test the transducer (at least once a year) for accuracy of the humidity measurement. The procedure is described in DIN 50 008, IEC Publication 260, ISO/R 483-1966. The basic principle consists of an appropriate climate being produced above an aqueous saturated salt solution. Sensorchecks with values of 33 % rH, 55 % rH and 76 % rH are available as accessories.

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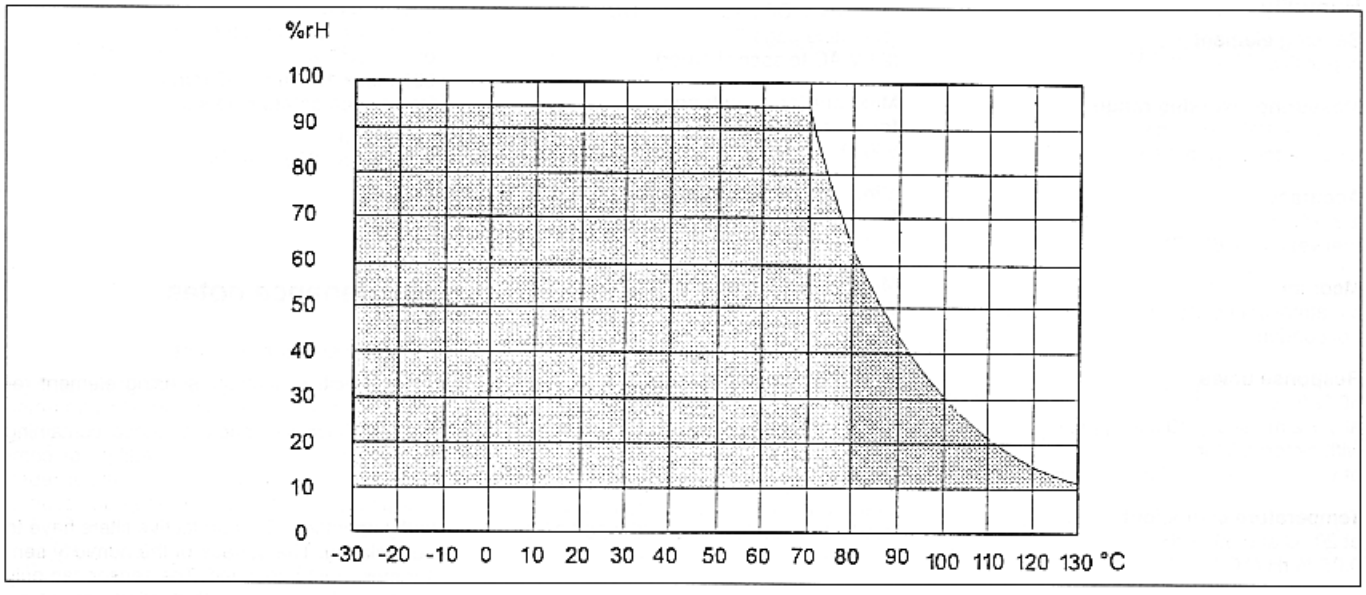
Permitted working range

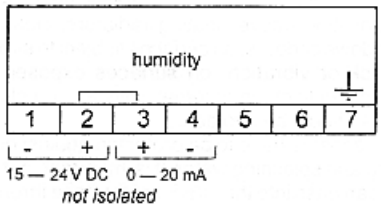


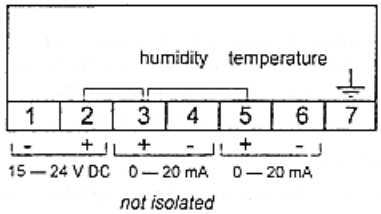
Connection diagram

Connection diagrams for indoor, duct and high-temperature versions

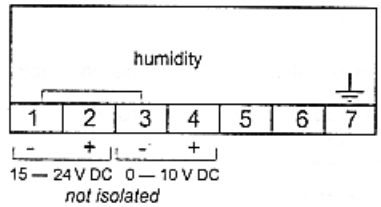
EMC Note: use screened signal cable and earth the screen!

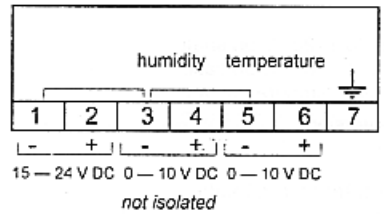
4-wire system 0 — 20 mA***



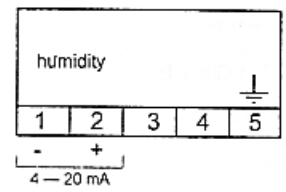


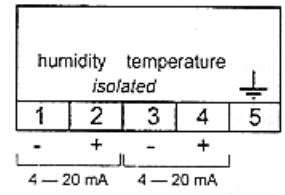
3/4-wire system 0 — 10 V DC**





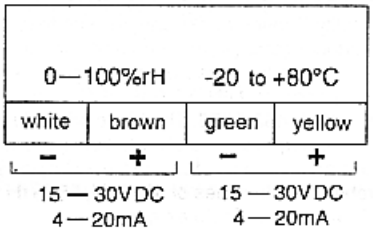
2-wire system 4 — 20 mA*





Connection diagram for rod version

2-wire system 4 — 20 mA*



* isolated
** not isolated, negative is linked
*** not isolated, positive is linked

mm	inch	mm	inch
4.5	0.18	80	3.15
5	0.20	98	3.86
20	0.79	107	4.21
22	0.87	115	4.53
35	1.38	120	4.72
35.3	1.39	200	7.87
43	1.69	272	10.71
54	2.13	300	11.8
68	2.68	2000	78.7
70	2.76		

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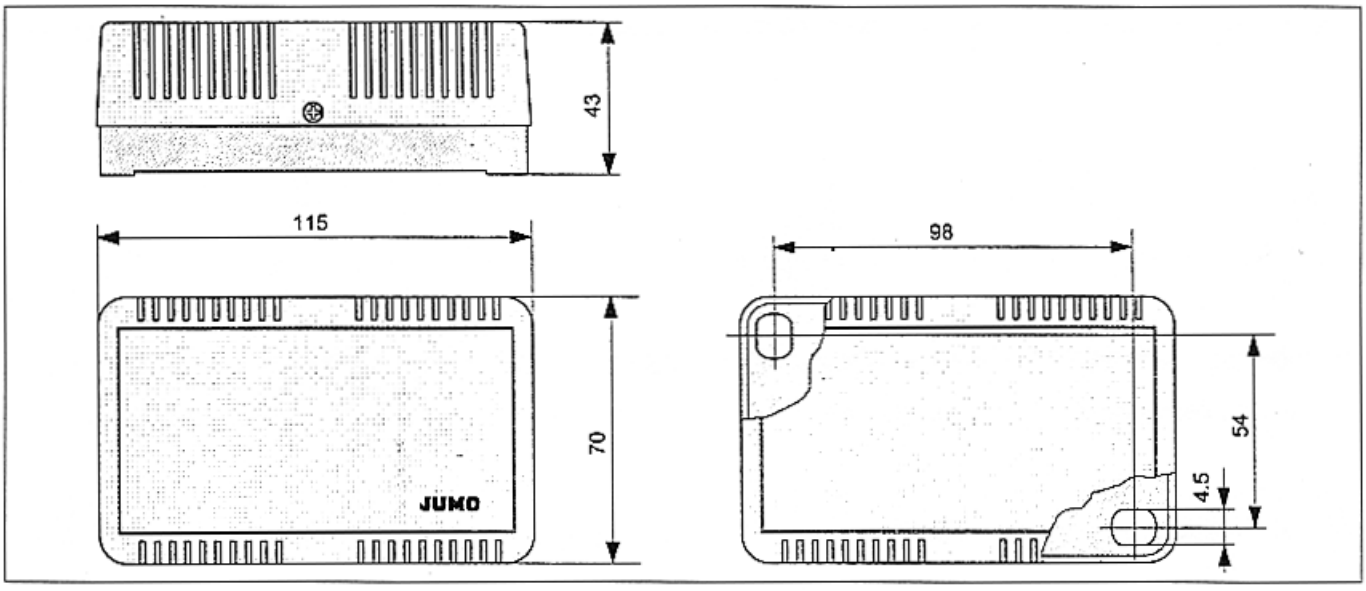
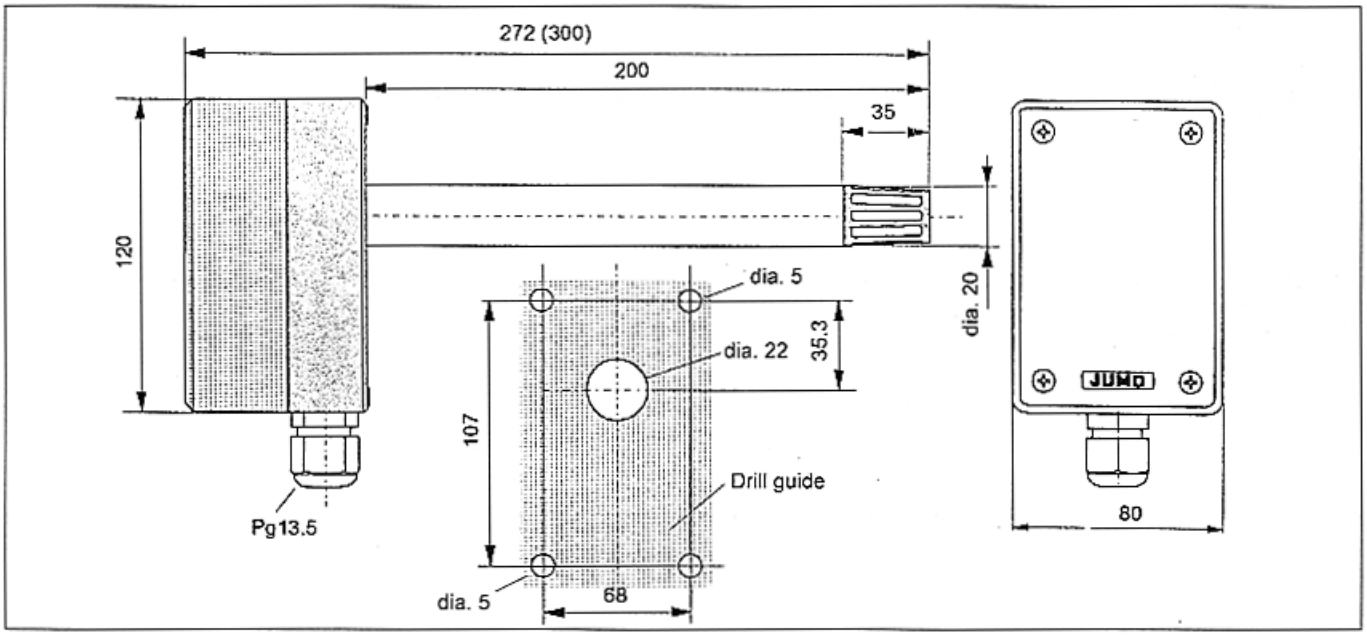
Dimensions

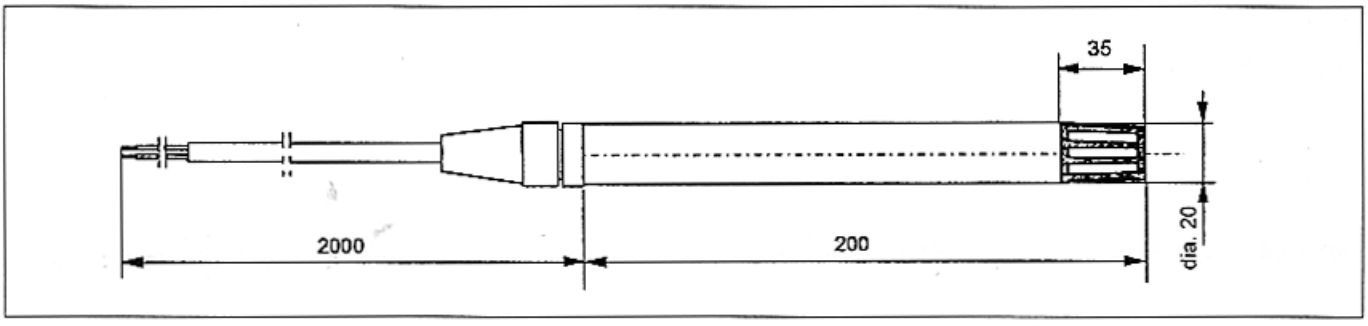
Indoor version



Duct version or high-temperature version



Rod version



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Hygro/hygrothermal transducers (capacitive) for climate monitoring

- **for measuring relative humidity in air and temperature**
- **for building automation, storage rooms, climate and ventilation control**
- **as indoor, wall and duct versions**
- **special miniature rod version for OEM applications**
- **with current or voltage outputs as well as passive temperature output**
- **hygrothermometers as table-top or wall-mounting units**

These humidity transducers have been developed especially for HVAC applications. Their special features are outstanding long-term stability, high measuring accuracy, excellent high-humidity response and good chemical resistance.
Indoor, wall and duct models as well as a miniature rod model – all in attractively designed housings – are ideally suited to take care of almost any air-conditioning task.
In addition to humidity transducers, combined units for humidity and temperature with current or voltage outputs and passive temperature outputs can also be supplied.
Applications are found throughout the entire air-conditioning and ventilation system – in domestic and office buildings, storage areas, and greenhouses. Version A transducers, which also achieve excellent measurement results in meteorology, have proved particularly successful in meeting the exacting requirements of indoor swimming pools and stables. And, in conjunction with the connector provided for version A and the mounting plate, the new optional snap-in mounting flange ensures that the transducer can be changed quickly and easily, for routine maintenance, for example.

Furthermore, the special rod model can be used for integrating humidity measurement into existing systems where space is tight, thus making it particularly suitable for OEM applications.

The indoor variant, complete with mounting bracket and battery, serves as a table-top or wall-mounting indicator.

Technical data

Humidity sensor	capacitive, condensation permitted
Humidity range	0 to 100 % RH
Humidity working ranges	10 to 95 % RH: table-top or wall-mounting indicator 0 to 95 % RH: indoor version 10 to 95 % RH: wall or duct version (version B) 0 to 100 % RH: wall or duct version (version A); rod version
Humidity accuracy at 20 °C	± 2 % RH: indoor version and indicator in the humidity range from 40 to 60 % RH ± 3 % RH: wall or duct version (version B), indoor version in the remaining humidity range ± 3 % RH: rod version in the humidity range from 0 to 95 % RH ± 2 % RH: wall or duct version (version A) in the humidity range from 0 to 90 % RH ± 3 % RH: wall or duct version (version A) in the remaining humidity range
Temperature error at 45 % RH	typically -0.05 % RH per °C
Temperature sensor	Pt1000 platinum-chip temperature sensor (passively also Pt100) to EN 60 751, tolerance class A
Temperature ranges	-5 to +55 °C: table-top or wall-mounting indicator 0 to 50 °C: indoor version; wall or duct version (version B) -20 to +80 °C: wall or duct version (version A) -40 to +60 °C: rod version

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Temperature accuracy at 20 °C	± 0.25 °C: indoor version: voltage output ± 0.4 °C: indoor version: current output ± 0.3 °C: wall or duct version (version A); table-top or wall-mounting indicator ± 0.5 °C: wall or duct version (version B); rod version
Output signals	4 — 20 mA, 0 — 1 V, 0 — 5 V, 0 — 10 V (instrument version according to order details)
Supply	2 x 1.5 V DC alkaline batteries: table-top or wall-mounting indicator 15 — 35 V DC; 24 V AC ± 20 %: instruments with voltage output 20 — 28 V DC: instruments with current output 4.5 — 30 V DC with rod version only
Electromagnetic compatibility	to EN 61 000-6-1 and EN 61 000-6-3
Housing	PC plastic
Connection	screw terminals up to 1.5 mm^2
Cable gland	M 16x1.5 (optionally plug connector) wall/duct version
Protection	IP20: indoor version, table-top/wall-mounting indicator IP65: wall/duct/rod version
Load resistance	R_L 500 ohm max. with current output
Internal power supply	20 mA max., 5 mA with rod version
Ambient temperature	-5 to +50 °C: indoor/wall/duct version (version B) and table-top/wall-mounting indicator -40 to +60 °C (sensor head +80 °C): wall/duct version (version A) -40 to +60 °C: rod version
Storage temperature	-25 to +60 °C
Weight	approx. 100 g for indoor version and table-top/wall-mounting indicator approx. 150 g for wall version approx. 250 g for duct version approx. 50 g for rod version

Accessories

Dust filter	**Membrane filter:** (standard) for low-level pollution in HVAC (indoor application) **Sintered bronze filter:** with mechanical stress and very dusty atmospheres **Sintered stainless steel filter:** extremely effective with mechanical and thermal stress, as well as corrosive media **Metal mesh filter:** for high humidity, risk of condensation or rapidly changing humidity cycles
Humidity sensors	Type: HC 101 for rod version nominal capacity 200 ± 20 pF Type: HC 200 for wall/duct version (version B) nominal capacity 200 ± 20 pF Type: HC 1000 for indoor/wall/duct version (version A) nominal capacity 500 ± 50 pF
Temperature sensor	platinum-chip temperature sensor produced in thin-film technique to EN 60 751, tolerance class A nominal value 1000 ohm at 0 °C (with passive output also 100 ohm) dimensions in mm (W x L x H) 2.0 x 5.0 x 1.3
Humidity sensor checks	Humidity sensor checks can be carried out to check the accuracy of humidity transducers. The checking procedure is described in detail in DIN 50 008, IEC publication 260, ISO/R 483-1966. The underlying principle hereby is that a certain climate forms in the air above an aqueous, saturated salt solution. Sensor check sets with the values 33 %, 53 % and 76 % RH are available from stock.

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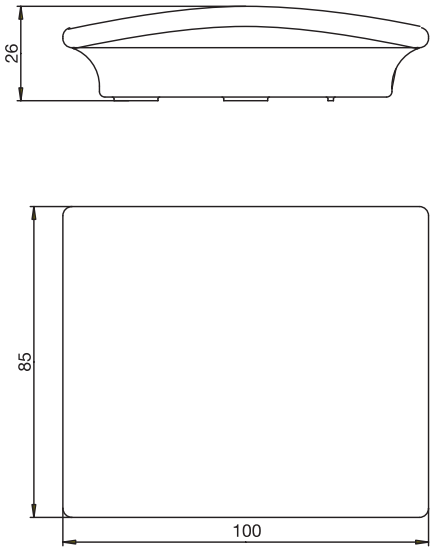
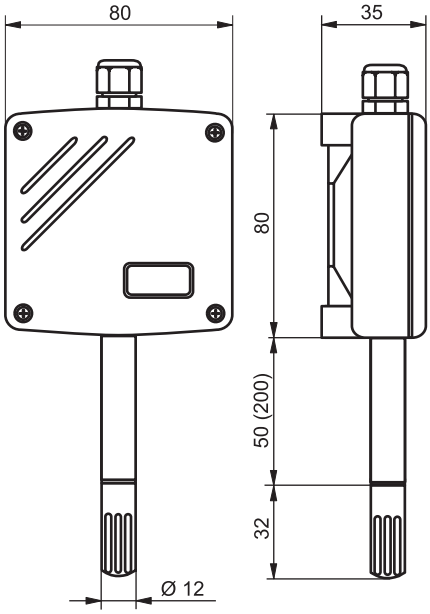
Internet: www.jumo.us

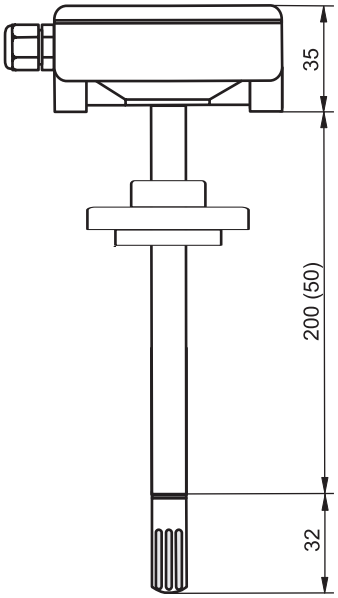
Dimensions



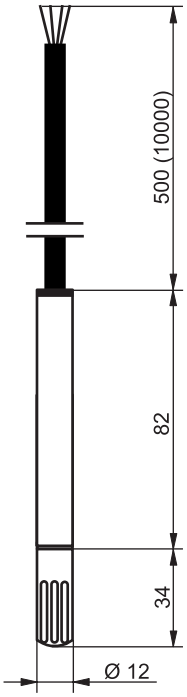
Indoor version
Type 907021/11
and table-top/wall-mounting indicator
Type 907021/12



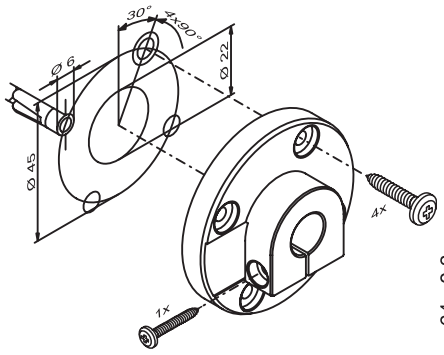
Wall versions
Type 907021/20
Type 907021/21



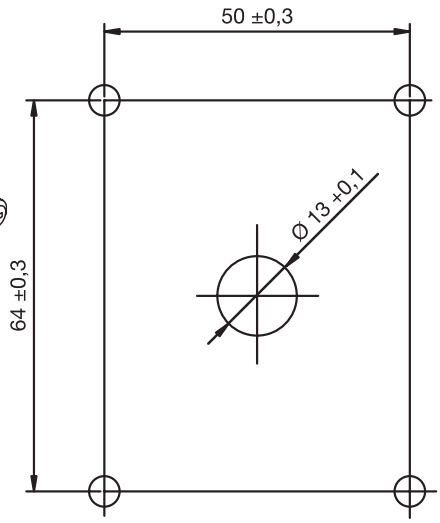
Duct versions
Type 907021/30
Type 907021/31



Rod version
Type 907021/40



Mounting flange
for duct versions



Drilling template
for wall/duct versions

Dimensions in mm.

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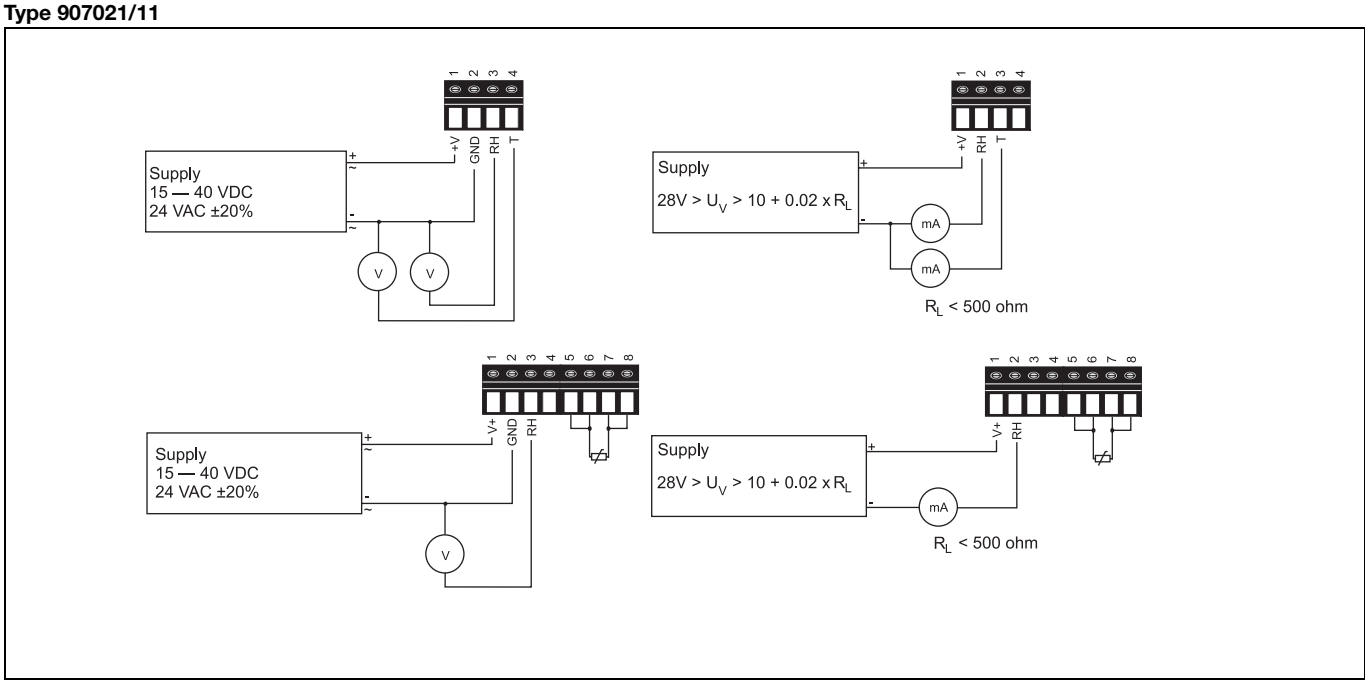
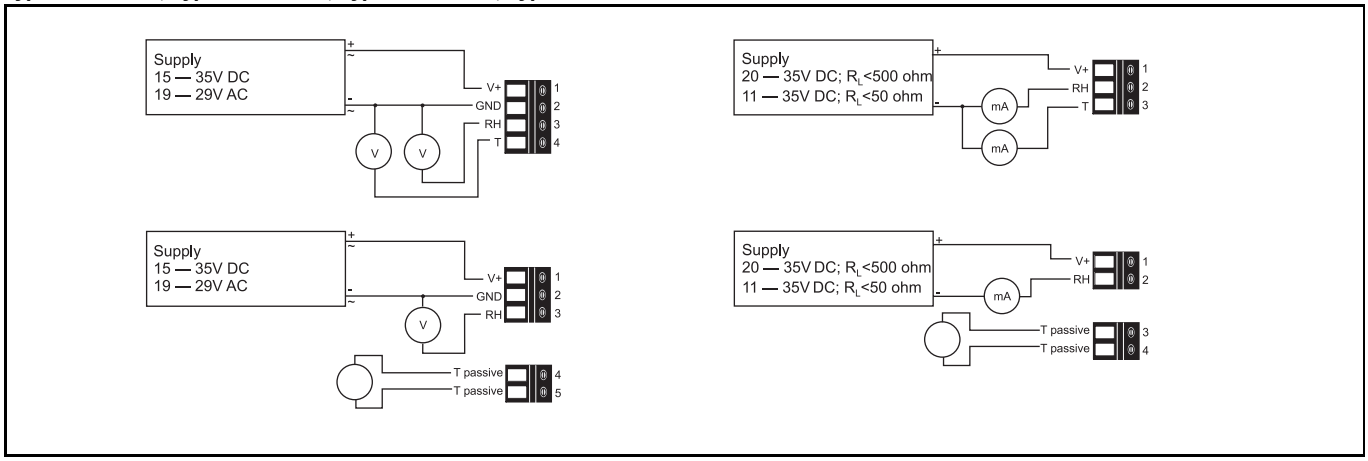
Connection diagram

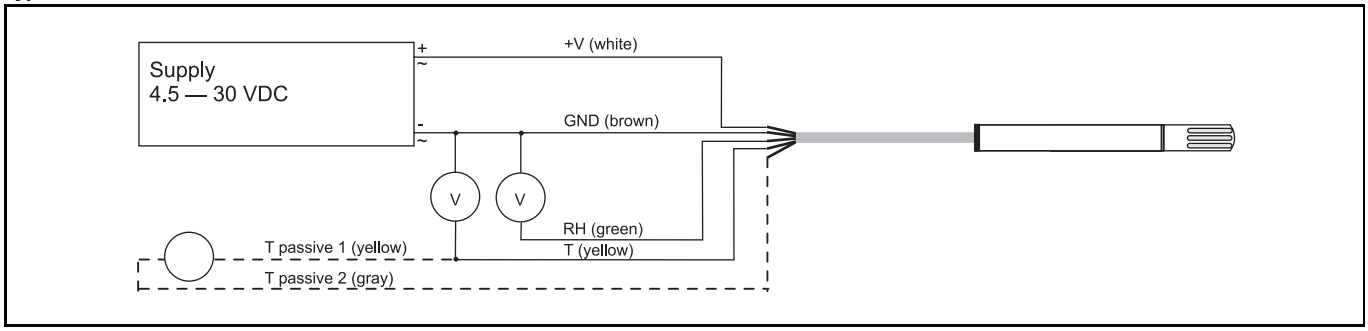
Indoor version
Type 907021/11



Wall/duct version
Type 907021/20, Type 907021/21, Type 907021/30, Type 907021/31



Rod version
Type 907021/40



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Order details: Hygro/hygrothermal transducers (capacitive) for climate monitoring

(1) Basic version

907021/11	Hygro/hygrothermal transducer, indoor version
907021/12	Hygrothermometer, table-top/wall-mounting indicator
907021/20	Hygro/hygrothermal transducer, wall version (version A)
907021/21	Hygro/hygrothermal transducer, wall version (version B)
907021/30	Hygro/hygrothermal transducer, duct version (version A)
907021/31	Hygro/hygrothermal transducer, duct version (version B)
907021/40	Hygro/hygrothermal transducer, rod version

(2) Hygrotransducer / Hygrothermal transducer / Hygrothermometer

1	humidity
2	humidity and temperature
3	humidity and temperature, passive

(3) Measuring ranges[1]

33	10 to 95% RH; -5 to +55°C
34	0 to 100% RH; 0 to 50°C
10	0 to 100% RH; -20 to +80°C
14	0 to 100% RH; -40 to +60°C
22	0 to 100% RH; -30 to +70°C

(4) Output signals

005	4 — 20mA
006	4 — 20mA / temperature, passive, Pt100 Class A
007	4 — 20mA / temperature, passive, Pt1000 Class A
051	0 — 1V
052	0 — 1V / temperature, passive, Pt100 Class A
053	0 — 1V / temperature, passive, Pt1000 Class A
057	0 — 5V
065	0 — 10V
066	0 — 10V / temperature, passive, Pt100 Class A
067	0 — 10V / temperature, passive, Pt1000 Class A
000	no output, indication only

(5) Extra codes

000	no extra code
793	integrated LC display (for humidity and temperature, alternating indication)
794	integrated LC display (as above, but temperature in °F)
764	snap-in mounting flange (mounting plate and plug connector)
796	measurement probe - short version for duct model (50mm)
845	longer connecting cable, length 1.5m
846	longer connecting cable, length 2m
847	longer connecting cable, length 3m
848	longer connecting cable, length 5m
849	longer connecting cable, length 10m

	(1)		(2)		(3)		(4)		(5)	
Order code		-		-		-		/		, ...
Order example	907021/11	-	2	-	34	-	065	/	000[2]	

1. Please take note of the humidity working ranges under Technical data!
2. List extra codes in sequence, separated by commas.

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Stock versions

(1)		(2)		(3)		(4)	Sales No.
907021/11	-	1	-	34	-	005	90/00436297
907021/11	-	2	-	34	-	005	90/00436298
907021/20	-	1	-	10	-	005	90/00388170
907021/20	-	2	-	10	-	005	90/00388171
907021/21	-	1	-	34	-	005	90/00388172
907021/21	-	2	-	34	-	005	90/00388173
907021/30	-	1	-	10	-	005	90/00388174
907021/30	-	2	-	10	-	005	90/00388175
907021/31	-	1	-	34	-	005	90/00388176
907021/31	-	2	-	34	-	005	90/00388177
907021/40	-	1	-	14	-	051	90/00388179
907021/40	-	2	-	14	-	051	90/00388180

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Order details: Accessories

			(1) Basic version
	907021/90		Filter
	907021/91		Humidity sensor, capacitive
	907021/92		Temperature sensor
	907021/93		Humidity sensor check set
			(2) Filter
X		801	Membrane filter (standard)
X		802	Sintered bronze filter
X		803	Sintered stainless steel filter
X		804	Metal mesh filter
			(2) Humidity sensor
	X	806	HC 1000
	X	807	HC 200
	X	808	HC 101
			(2) Temperature sensor
	X	004	Pt100
	X	005	Pt1000
			(2) Humidity sensor check set
	X	820	33 % RH magnesium chloride
	X	821	53 % RH magnesium nitrate
	X	822	76 % RH sodium chloride

	(1)		(2)
Order code		-	
Order example	907021/90	-	801

Stock versions

(1)		(2)	Sales No.
907021/90	-	801	90/00388181
907021/90	-	802	90/00388182
907021/90	-	803	90/00388183
907021/90	-	804	90/00389114
907021/91	-	806	90/00388184
907021/91	-	807	90/00388185
907021/91	-	808	90/00388193
907021/92	-	004	90/00387455
907021/92	-	005	90/00358359
907021/93	-	820	90/00332758
907021/93	-	821	90/00332759
907021/93	-	822	90/00332760

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Hygrostats (capacitive) for HVAC applications

- **for on-off control of relative humidity**
- **for domestic and office buildings**
- **for the control of ventilating systems**
- **in wall and duct versions**
- **output relay with changeover contact**

Hygrostats are mainly used for simple control tasks in HVAC applications. An integral output relay with changeover contact removes the need for connecting cost-intensive electronics.

Based on high-quality capacitive humidity sensors, the principal features of these hygrostats are their excellent long-term stability, minimum hysteresis and high chemical resistance. In addition, they meet the ever increasing requirements concerning functionality, freedom from maintenance and reproducibility of the switching values.

The large setting range from 10 to 95 % rH is particularly advantageous. The switching differential can be set between 3 % and 15 % rH, via a second potentiometer. An externally accessible pushbutton is available as an option, and can be used to interrupt the humidity control for 24 hours under certain operating conditions. This operating state is displayed on an LED. After this time, the hygrostat will be in operation again.

The instruments, which are housed in attractive cases, are available from stock both as duct and as wall-mounting version.

Technical data

Humidity sensor	capacitive, with condensation
Measuring range for humidity	10 — 95 % rH
Setting range, switching point	10 — 95 % rH
Setting accuracy, switching point	± 5 % rH
Setting range, hysteresis	3 — 15 % rH
Setting accuracy, hysteresis	± 2 % rH
Output	relay with changeover contact
Switch rating	5A 30V DC or 5A 48V AC
Supply	24V DC/AC ± 15 %
Electromagnetic compatibility	to EN 50 081-1/EN 50 081-2 and EN 50 082-1/EN 50 082-2
Case	PC plastic
Protection	IP65, IP40 with 24-hour switch-off option
Ambient temperature	- 5 to +50 °C
Storage temperature	-30 to +60 °C
Weight	approx. 150g for wall version approx. 250g for duct verion

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Accessories

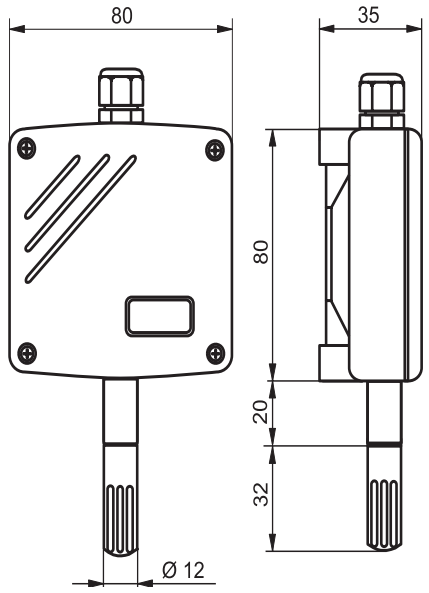
Dust filter

Membrane filter
(standard) for low-level contamination in the HVAC area
(indoor application)
Sintered bronze filter
for mechanical loads and very dusty atmospheres
Sintered stainless steel filter
extremely effective with mechanical and thermal loads, as well as with corrosive media
Mesh filter
for high humidity, risk of condensation or rapidly changing humidity cycles

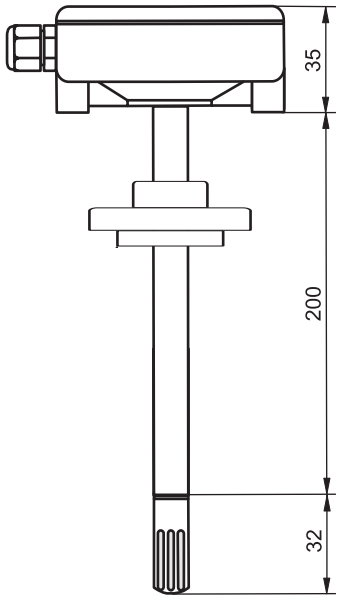
Checks for humidity sensors

Humidity sensor checks can be carried out, to check the accuracy of humidity transducers. The checking procedure is described in detail in DIN 50 008, IEC Publication 260, ISO/R 483-1966.
The underlying principle is that a certain climate forms in the air above an aqueous, saturated salt solution. Sensor check sets with values of 33 %, 53 % and 76 % rH are available from stock.

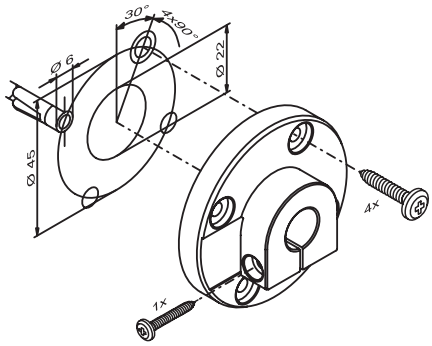
Dimensions



Wall-mounting version
Type 907022/20



Duct version
Type 907022/30



Mounting flange
for duct version

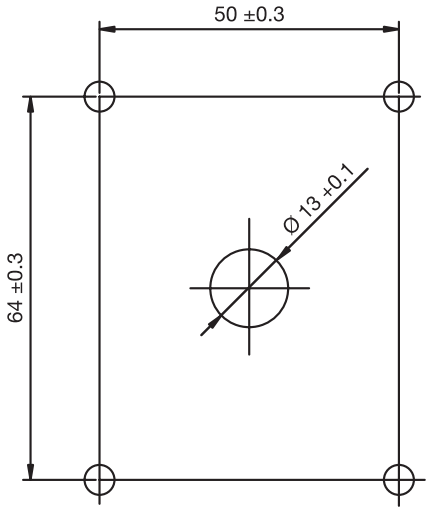
Connection diagram

Changeover contact

Relay output
5 A 48 VAC or
5 A 30 VDC

Supply
24 VDC/AC ±15 %

Wall/duct version
Type 907022/20, Type 907022/30



Drilling template
Wall/duct version

Dimensions in mm.

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Order details: Hygrostats (capacitive) for HVAC applications

			(1) Basic version
		907022/20	Hygrostat, wall-mounting version
		907022/30	Hygrostat, duct version
			(2) Probe length
X		20	20 mm
	X	200	200 mm
			(3) Extra codes
X	X	000	no extra code (standard)
X	X	825	switch-off with LED display

	(1)		(2)		(3)
Order code		-		-	
Order example	907022/20	-	20	-	000

Stock versions

(1)		(2)		(3)	Sales No.
	-		-		
907022/20	-	20	-	000	90/00389124
907022/30	-	200	-	000	90/00389125

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Order details: Accessories

			(1) Basic version
		907022/90	Filter
		907022/93	Check sets for humidity sensors
			(2) Filter
X		801	Membrane filter (standard)
X		802	Sintered bronze filter
X		803	Sintered stainless steel filter
X		804	Metal mesh filter
			(2) Humidity sensor checks
	X	820	33 % rH magnesium chloride
	X	821	53 % rH magnesium nitrate
	X	822	76 % rH sodium chloride

	(1)		(2)
Order code		-	
Order example	907022/90	-	801

Stock versions

(1)		(2)	Sales No.
907022/90	-	801	90/00388181
907022/90	-	802	90/00388182
907022/90	-	803	90/00388183
907022/90	-	804	90/00389114
907022/93	-	820	90/00332758
907022/93	-	821	90/00332759
907022/93	-	822	90/00332760

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Humidity and temperature transducers for industrial applications

- **measurement within the entire range from 0 to 100 % RH**
- **temperature-resistant up to 180 °C (depending on probe type)**
- **withstands pressures up to 100 bar (depending on probe type)**
- **rugged metal housing, IP65 protection**
- **outstanding accuracy and stability**
- **graphical trend display and measurement history of the past year**
- **retraceability to NIST**
- **options: calculation and output of dew point, absolute humidity, mixing ratio, wet bulb temperature, enthalpy and water vapor pressure**

These transducers are the first choice for demanding industrial humidity measurements

These humidity and temperature transducers are designed to meet demanding industrial applications, where stable measurements and a large variety of adaptation options are essential.

Humidity sensor
The instrument series is based on 30 years of experience in industrial humidity measurement. The sensor measures accurately and reliably, as well as being resistant to contaminants and many chemicals.

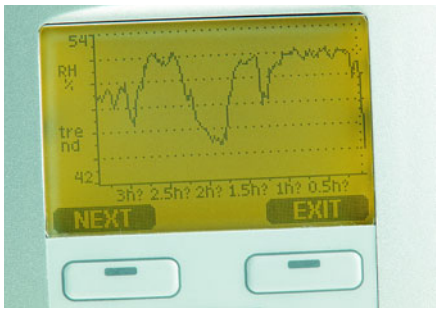
Cleaning the sensor helps with impurities
In environments with a high concentration of chemicals and cleaning agents, sensor cleaning helps achieve lasting accuracy between calibrations. During the cleaning procedure, the sensor is briefly heated up to such an extent as to cause the foreign molecules deposited on it to vaporize. If measurements seem to drift, sensor cleaning can be called up manually at any time or activated automatically at freely programmable time intervals.

Graphical trend and development display
The transducers can optionally be supplied with a large numerical/graphical display on which the process development can be monitored easily and traced back for up to a year.

Data acquisition and transmission to a PC
The recorded measurement data can be visualized on the display or transferred to a PC using a Windows® program.

Easy integration
Extensive mounting accessories as well as the most diverse connection options to d.c. or a.c. voltage sources ensure that the transducers can be integrated without any problems.

Various outputs
The instrument series comes with up to three analog outputs. An electrical isolation between supply voltage and analog outputs can also be implemented. RS232/RS485 interfaces and relay outputs are available for digital communication.



The display can be used to trace measurement trends back for up to a year.

Flexible calibration
The instruments are factory-calibrated at six humidity points. If required, fast 1-point calibration can easily be carried out on site using an optional measuring device (available on request). In addition, JUMO sensor checks are provided for a more accurate 2-point calibration. Alternatively, our customer service is at your disposal for multi-point calibration and adjustment. We recommend that this should be carried out at least once a year.

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Technical data

Measured variables

Relative humidity

Measuring range: 0 – 100 % RH

Accuracy with regard to works standards, including non-linearity, hysteresis and repeatability

at 20 °C: ±1 % RH (0 – 90 % RH);
±1.7 % RH (90 – 100% RH)

at -20 to +40 °C: ±(1.0 + 0.8 % of measurement) % RH[1]

at -40 to -20 °C, 40 to 180 °C: ±(1.5 + 1.5 % of measurement) % RH[1]

Uncertainty of factory calibration[2] (20 °C)

for 0 – 40 % RH: ±0.6 % RH

for 40 – 97 % RH: ±1.0 % RH

Sensors

- for general applications: HUMICAP® 180
- with heated probe: HUMICAP® 180C
- for high chemical concentrations: HUMICAP® 180L2[1]

Response time ($t_{0.9}$) at 20 °C in stationary air:

- with grid filter: 8 sec
- with st. steel mesh filter: 20 sec
- with sintered filter: 40 sec

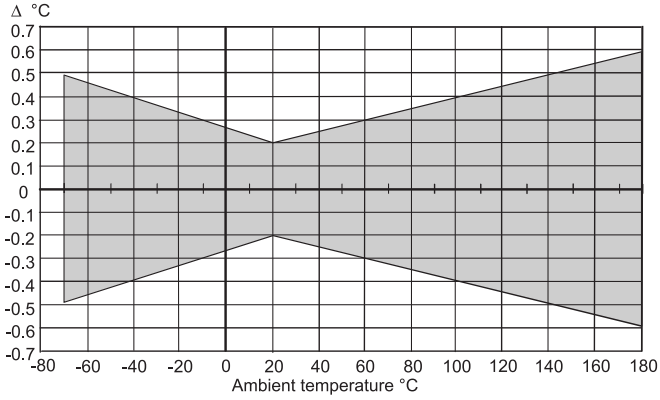
Temperature

Measuring range for type:

- 907023/331: -40 to +60 °C
- 907023/333: -40 to +80 °C
- 907023/334, 907023/335, 907023/337, 907023/338: -70 to +180 °C

Temperature sensor: Pt100 to EN 60 751

Accuracy at 20 °C: ±0.2 °C



Accuracy over the entire range

Derived variables (option)

dew point temperature, mixing ratio, absolute humidity, wet bulb temperature, enthalpy, water vapor pressure

Operating conditions

Operating temperature range at

- probes: as measuring ranges
- electronics: -40 to +60 °C
- with LC display: 0 to 60 °C

Operating pressure range for

- 907023/334: 0 – 10 MPa (0 – 100 bar)
- 907023/338: 0 – 4 MPa (0 – 40 bar)
- 907023/333, 907023/335, 907023/337: vapor-tight

EMC: as per EN 61 326-1:1997 + Annex 1:1998 + Annex 2:2001

Inputs/outputs

Operating voltage range: 10 – 25 V DC, 24 V AC

- with optional supply module: 100 – 240 V AC 50/60 Hz

Current drawn (20 °C, U_b = 24 V DC)

- when used with RS232C: ≤25 mA
- output 2x 0 – 1 V / 0 – 5 V / 0 – 10 V: ≤25 mA
- output 2x 0 – 20 mA: ≤60 mA
- with display and background lighting: 20 mA
- during sensor cleaning: 110 mA max.
- with probe heating (907023/337): 120 mA

Analog outputs (2 are standard, 3rd is optional)

- current output: 0 – 20 mA, 4 – 20 mA
- voltage output: 0 – 1 V, 0 – 5 V, 0 – 10 V

Accuracy of the analog outputs at 20 °C: ±0.05 % of full scale

Temperature drift of the analog outputs: ±0.005 % of full scale

External loads

- burden for current outputs: <500 Ω
- voltage output 0 – 1 V: >2 kΩ
- voltage output 0 – 5 V / 0 – 10 V: >10 kΩ

Maximum core cross-section: 0.5 mm²

Serial interface: RS232C, RS485 (option)

Relay outputs (option): 0.5 A, 250 V AC

Digital display: LCD with background lighting, graphical trend display of all variables

Menu languages: English, German, French, Spanish, Japanese, Swedish, Finnish

General data

Connection options

- cable gland: M 20x1.5 for 8 –11 mm dia. cable
- conduit fitting (option): M 20x1.5 / NPT 1/2"
- connector: M 12, 8-pole, type RKC8/9.M12
- 5 m connecting cable: M 12, 8-pole, type RKT8-282/5M

Probe cable diameter

- 907023/333: 6.0 mm
- all other probes: 5.5 mm

Housing material: G-AlSi 10 Mg (DIN 1725)

Enclosure protection: IP65

Alteration of individual specifications is possible.

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[1] For HUMICAP® 180L2 sensor at -10 to +40 °C: ±(1.0 + 1 % of measured value) % RH;
at -40 to -10 °C, 40 to 180 °C: ±(1.5 + 2 % of measured value) % RH.

[2] Defined as ±2 standard deviation limits.

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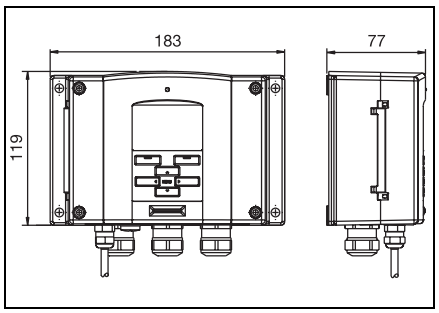
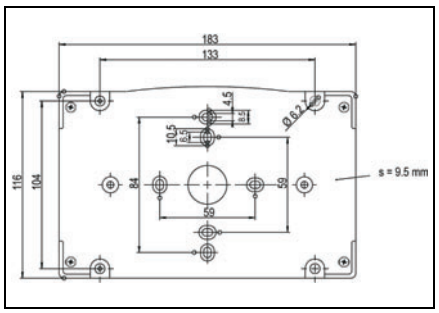
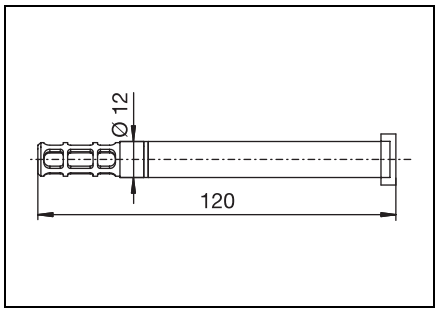
Dimensions



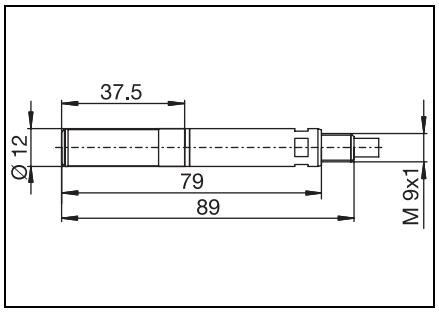
Housing, type 907023/330



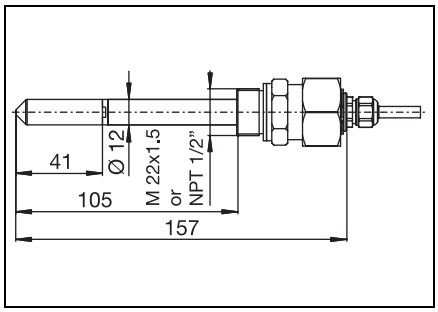
Plastic mounting plate or drilling template



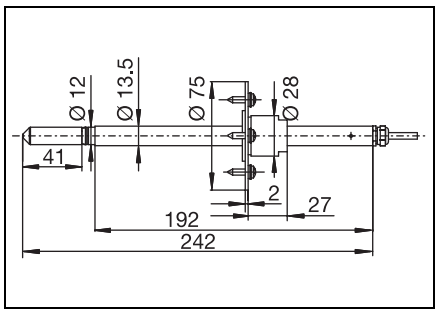
Probe, type 907023/331



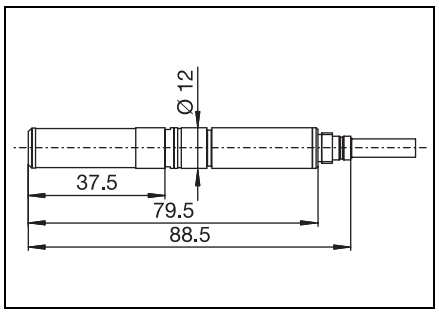
Probe, type 907023/333



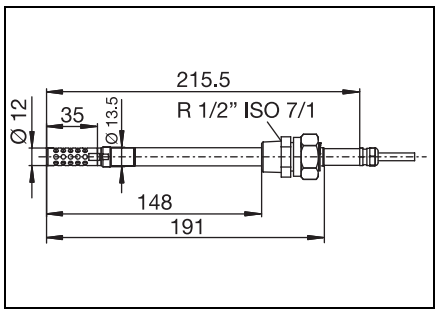
Probe, type 907023/334



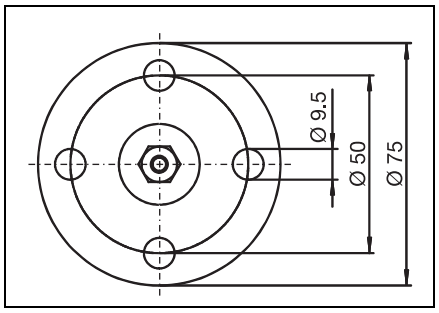
Probe, type 907023/335 (mounting flange is optional)



Probe, type 907023/337



Probe, type 907023/338



Mounting flange (for probe types 907023/333, 907023/337, 907023/335 and additional T probe)

All dimensions in mm.

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Humidity and temperature transducers for wall mounting Type 907023/331

- **for temperatures ranging from -40 to +60°C**
- **outstanding accuracy and stability**
- **graphical trend display and measurement history of the past year**
- **corrosion-resistant housing, IP65 rating**
- **retraceability to NIST**
- **applications include: clean rooms, pharmaceutical processes, greenhouses, swimming baths, museums and archives**

This transducer for wall mounting is highly suitable for monitoring humidity in rooms

This humidity and temperature transducer for wall mounting is especially suitable for the monitoring and control of HVAC installations. Compared with conventional wall-mounted probes for air-conditioning, this transducers offers

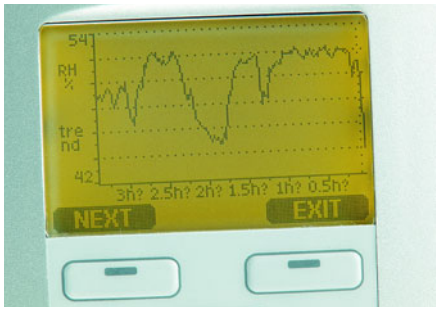
- better performance data,
- higher resistance to chemicals,
- state-of-the-art digital display functions,
- extensive range of supply options,
- more signal outputs,
- more humidity measurement variables,

Graphical trend and development display

The transducers can optionally be supplied with a large numerical/graphical display on which the process development can be monitored easily and traced back for up to a year.

The measurement history is particularly important for rooms that require stable climatic conditions, such as archives.

Maximum and minimum values of the past year can be graphically displayed in a simple manner.



The display can be used to trace measurement trends back for up to a year.

Outputs and supply options for all needs

The output options include up to three analog outputs, RS232 and RS485 interfaces as well as alarm relays.

The possible supply voltage ranges from 10 to 35V DC. A wide-range power supply module ensures that the transducers can be connected to all supply voltages used around the globe.

The supply/signal cable can be passed through an opening in the housing base, which enables practical mounting, particularly in clean rooms.

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Order details: Humidity and temperature transducers for wall mounting, type 907023/331

	Ch1	Ch2	Code	No.	Description		
				(1)	**Basic version**		
			907023/331		Humidity and temperature transducer for wall mounting		
				(2)	**Version for wall mounting**		
x			A		probe placed directly on housing		
				(3)	**Additional temperature probe**		
x			0		not for type 907023/331		
				(4)	**Parameters**		
x			A		RH + T		
x			B		RH+T+Td+Tdf+a+x+Tw+ppm+pw+pws+h+dT		
				(5)	**Display**		
x			0		no display		
x			1		graphics LCD with background lighting		
				(6)	**Supply**		
x			0		10 – 35V DC, 24V AC		
x			1		electrical isolation for outputs 10 – 35V DC, 24V AC		
x			2		universal AC supply (100 – 240V AC)		
x			3		universal AC supply (100 – 240V AC) and US connecting cable		
x			4		universal AC supply (100 – 240V AC) and EUR connecting cable		
x			5		universal AC supply (100 – 240V AC) and UK connecting cable		
x			6		universal AC supply (100 – 240V AC) and AUS connecting cable		
				(7)	**Signal output (and serial RS232 interface or (optionally) communication module)**		
x			1		analog output channel (Ch1+Ch2+Ch3) 4 – 20mA		
x			2		analog output channel (Ch1+Ch2+Ch3) 0 – 20mA		
x			3		analog output channel (Ch1+Ch2+Ch3) 0 – 1V		
x			4		analog output channel (Ch1+Ch2+Ch3) 0 – 5V		
x			5		analog output channel (Ch1+Ch2+Ch3) 0 – 10V		
	Ch1	Ch2	Ch3	**(8)**	**Analog output signals for Ch1, Ch2 and Ch3**		
x			A		no third analog output (choose A if not required)		
x	B	B	B		RH	(0 – 100% RH)	
x	C	C	C		T	(see (9) output range temp.)	
x	D	D	D		Td (-20 to +100°C)	(-4 to +212°F)	
x	E	E	E		Tdf (-20 to +100°C)	(-4 to +212°F)	
x	F	F	F		a (0 – 600g/m³)	(0 – 262gr/ft3)	
x	G	G	G		Tw (0 to 100°C)	(+32 to +212°F)	
x	H	H	H		x (0 – 500g/kg d.a.)	(0 – 3500gr/lb)	
x	J	J	J		h (-40 to +1500kJ/kg)	(-9.5 to +652.6Btu/lb)	
x	K	K	K		ppm (0 – 5000)	(0 – 5000)	
x	L	L	L		pw (0 – 1000hPa)	(0 – 14.5psi)	
x	M	M	M		pws (0 – 1000hPa)	(0 – 14.5psi)	
x	N	N	N		dT (-10 to +50°C)	(14 to +122°F)	
x	X	X	X		Define special scaling	Ch1: ___________	Ch2: ___________ Option Ch3: ___________
				(9)	**Analog output range for temperature**		
x			A		no temperature output (choose A if not required)		
x			B		-40 to +60°C	(-40 to +140°F)	
x			F		-20 to +60°C	(-4 to +140°F)	
x			K		0 to 60°C	(32 to 140°F)	
x			X		Specifics: ______________		
				(10)	**Output unit**		
x			1		metric		
x			2		non-metric		
				(11)	**Option for module slot 1**		**Option for module slot 2**
x		0	0		no module		no module
x		1	1		relay output		relay output
x		2	3		RS485 serial interface (electrically isolated)		third analog output (required if Ch3 (8) is selected)
				(12)	**Cable bushings**		
x			A		cable gland M 20x1.5		
x			B		conduit fitting NPT 1/2"		
x			C		8-pole connector with 5m cable		
x			D		8-pole mating connector equipped with screw terminals		
				(13)	**Transducer mounting**		
x			0		standard mounting		
x			1		wall-mounting plate		
x			2		pole installation kit		
x			3		pole installation kit with rain shield		
x			4		DIN rail kit		
				(14)	**Humidity sensor type**		
x			1		general application (standard)		HUMICAP® 180
x			4		sensor with cleaning function		HUMICAP® 180C
				(15)	**Sensor protection / filter**		
x			A		PPS plastic grid with stainless steel mesh		
x			B		PPS plastic grid		
x			C		sintered stainless steel filter		
				(16)	**Probe installation kit**		
x			A		no installation kit		
				(17)	**Operating instructions: language**		
x			1		English		
x			2		German		
x			3		French		
				(18)	**Calibration**		
x			3A1		calibration to ISO 9001 standard (calibration report is available on request)		

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Order code																		
Order example	907023/331	A	0	A	1	0	1	BCA	B	1	00	A	0	1	A	A	2	3A1

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Humidity and temperature transducers for ducts and locations where space is tight, Type 907023/333

- **for temperatures ranging from -40 to +80 °C**
- **cable probe for remote measurement, for demanding HVAC applications**
- **outstanding accuracy and stability**
- **short response times thanks to low thermal mass**
- **graphical trend display and measurement history of the past year**
- **corrosion-resistant housing, IP65 rating**
- **retraceable to NIST**
- **applications include: clean rooms, pharmaceutical processes, greenhouses and climatic chambers**

Transducer with a small cable probe for ducts and locations where space is tight

This humidity and temperature transducer is a universal measuring device for applications that require a small, thin cable probe.

Flexible installation
A duct installation kit (consisting of aluminium flange, screw fitting and support rod) is available for installing the probe in tubes, ducts or through walls.
The probe cable is flexible and comes in lengths of 2 m, 5 m and 10 m.
The user can choose between two range options, for ambient temperatures up to 80 °C or up to 120 °C.

Duct installation kit

For outside installations, the optional radiation shield protects the probe from sun and rain. It can be mounted on a pole, a beam, or directly on a wall.

For moderate humidity and temperature
The transducers are mainly used for the control and monitoring of HVAC systems, for example in clean rooms, pharmaceutical process and greenhouses.

However, in environments with a predominantly high humidity, we recommend type 907023/337 with a heated, vapor-tight stainless steel probe.

Graphical trend and development display
The transducers can optionally be supplied with a large numerical/graphical display on which the process development can be monitored easily and traced back for up to a year.
The measurement history is particularly important for rooms that require stable climatic conditions, such as clean rooms. Maximum and minimum values of the past year can be graphically displayed in a simple manner.

The display can be used to trace measurement trends back for up to a year.

Outputs and supply options for all needs
The output options include up to three analog outputs, RS232 and RS485 interfaces as well as alarm relays.

The possible supply voltage ranges from 10 to 35 V DC. A wide-range power supply module ensures that the transducers can be connected to all supply voltages used around the globe.

The supply/signal cable can be passed through an opening in the housing base, which enables practical mounting, particularly in clean rooms.

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Order details: Humidity and temperature transducers for ducts and locations where space is tight, type 907023/333

				(1)	**Basic version**	
			907023/333		Humidity and temperature transducer for ducts and locations where space is tight	
				(2)	**Sensor cable / cable length**	
x			E		2m cable, 80°C	
x			F		5m cable, 80°C	
x			G		10m cable, 80°C	
x			4		2m cable, 120°C	
x			5		5m cable, 120°C	
x			6		10m cable, 120°C	
				(3)	**Additional temperature probe**	
x			0		not for type 907023/333	
				(4)	**Parameters**	
x			A		RH + T	
x			B		RH+T+Td+Tdf+a+x+Tw+ppm+pw+pws+h+dT	
				(5)	**Display**	
x			0		no display	
x			1		graphics LCD with background lighting	
				(6)	**Supply**	
x			0		10 – 35V DC, 24V AC	
x			1		electrical isolation for outputs 10 – 35V DC, 24V AC	
x			2		universal AC supply (100 – 240V AC)	
x			3		universal AC supply (100 – 240V AC) and US connecting cable	
x			4		universal AC supply (100 – 240V AC) and EUR connecting cable	
x			5		universal AC supply (100 – 240V AC) and UK connecting cable	
x			6		universal AC supply (100 – 240V AC) and AUS connecting cable	
				(7)	**Signal output (and serial RS232 interface or (optionally) communication module)**	
x			1		analog output channel (Ch1+Ch2+Ch3) 4 – 20mA	
x			2		analog output channel (Ch1+Ch2+Ch3) 0 – 20mA	
x			3		analog output channel (Ch1+Ch2+Ch3) 0 – 1V	
x			4		analog output channel (Ch1+Ch2+Ch3) 0 – 5V	
x			5		analog output channel (Ch1+Ch2+Ch3) 0 – 10V	
	Ch1	Ch2	Ch3	**(8)**	**Analog output signals for Ch1, Ch2 and Ch3**	
x			A		no third analog output (choose A if not required)	
x	B	B	B		RH	(0 — 100% RH)
x	C	C	C		T	(see (9) output range temp.)
x	D	D	D		Td (-20 to +100°C)	(-4 to +212°F)
x	E	E	E		Tdf (-20 to +100°C)	(-4 to +212°F)
x	F	F	F		a (0 – 600g/m³)	(0 – 262gr/ft3)
x	G	G	G		Tw (0 to 100°C)	(+32 to +212°F)
x	H	H	H		x (0 – 500g/kg d.a.)	(0 – 3500gr/lb)
x	J	J	J		h (-40 to +1500kJ/kg)	(-9.5 to +652.6Btu/lb)
x	K	K	K		ppm (0 – 5000)	(0 – 5000)
x	L	L	L		pw (0 – 1000hPa)	(0 – 14.5psi)
x	M	M	M		pws (0 – 1000hPa)	(0 – 14.5psi)
x	N	N	N		dT (-10 to +50°C)	(14 to +122°F)
x	X	X	X		Define special scaling	Ch1: _____ Ch2: _____ Option Ch3: _____
				(9)	**Analog output range for temperature**	
x			A		no temperature output (choose A if not required)	
x			B		-40 to +60°C	(-40 to +140°F)
x			C		-40 to +80°C	(-40 to +176°F)
x			D		-40 to +120°C	(-40 to +248°F)
x			F		-20 to +60°C	(-4 to +140°F)
x			G		-20 to +80°C	(-4 to +176°F)
x			H		-20 to +120°C	(-4 to +248°F)
x			K		0 to 60°C	(32 to 140°F)
x			M		0 to 120°C	(32 to 248°F)
x			X		Specifics: _____	
				(10)	**Output unit**	
x			1		metric	
x			2		non-metric	
				(11)	**Option for module slot 1**	**Option for module slot 2**
x			0	0	no module	no module
x			1	1	relay output	relay output
x			2	3	RS485 serial interface (electrically isolated)	third analog output (required if Ch3 (8) is selected)
				(12)	**Cable bushings**	
x			A		cable gland M 20x1.5	
x			B		conduit fitting NPT 1/2"	
x			C		8-pole connector with 5m cable	
x			D		8-pole mating connector equipped with screw terminals	
				(13)	**Transducer mounting**	
x			0		standard mounting	
x			1		wall-mounting plate	
x			2		pole installation kit	
x			3		pole installation kit with rain shield	
x			4		DIN rail kit	
				(14)	**Humidity sensor type**	
x			1		general application (standard)	HUMICAP® 180
x			4		sensor with cleaning function	HUMICAP® 180C
				(15)	**Sensor protection / filter**	
x			A		PPS plastic grid with stainless steel mesh	
x			B		PPS plastic grid	
x			C		sintered stainless steel filter	
				(16)	**Probe installation kit**	
x			A		no installation kit	
x			C		duct installation kit	
x			D		cable gland AGRO	
				(17)	**Operating instructions: language**	
x			1		English	
x			2		German	
x			3		French	
				(18)	**Calibration**	
x			3A1		calibration to ISO 9001 standard (calibration report is available on request)	

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)		(11)		(12)		(13)		(14)		(15)		(16)		(17)		(18)
Order code		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-	
Order example	907023/333	-	E	-	0	-	A	-	1	-	0	-	1	-	B C A	-	G	-	1	-	0 0	-	A	-	0	-	1	-	A	-	A	-	2	-	3 A 1

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Humidity and temperature transducers for high-pressure and vacuum applications, Type 907023/334

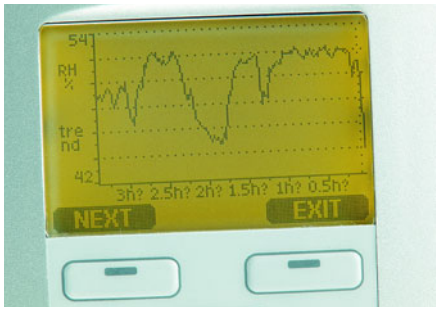
- **for temperatures ranging from -70 to +180°C**
- **for measurements within the pressure range from 0 – 100bar**
- **with a fitting element in ISO or NPT version**
- **outstanding accuracy and stability**
- **graphical trend display and measurement history of the past year**
- **corrosion-resistant housing, IP65 rating**
- **retraceable to NIST**
- **applications include: high-pressure lines or vacuum chambers**

Transducer for high-pressure lines or vacuum chambers

This humidity and temperature transducer is designed for humidity measurements in high-pressure lines or vacuum chambers. The measurement probe is constructed in such a way as to ensure gas-tight mounting.
For correct measurement results, process pressures that deviate from the normal ambient air pressure can be entered in the transducer memory via a serial interface or the operator panel.

Humidity sensor
The instrument series is based on 30 years of experience in industrial humidity measurement.
The humidity sensor enables precise and reliable measurements and is resistant to contamination and a large number of chemicals.

Graphical trend and development display
The instrument series can optionally be supplied with a large numerical/graphical display on which the process development can easily be monitored and traced back for up to a year.
The measurement data can be transferred to a PC for further processing, and for copying to other programs.



With the help of the display, the user is able to trace measurement trends back for up to a year.

Outputs and supply options for all needs
The output options include up to three analog outputs, RS232 and RS485 interfaces as well as alarm relays.

The possible supply voltage ranges from 10 to 35V DC. A wide-range power supply module ensures that the transducers can be connected to all supply voltages used around the globe.

The supply/signal cable can also be passed through an opening in the housing base.

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Order details: Humidity and temperature transducers for high-pressure and vacuum applications, type 907023/334

					(1)	**Basic version**	
				907023/334		Humidity and temperature transducer for high-pressure and vacuum applications	
					(2)	**Sensor cable / cable length**	
x				H		2m cable	
x				J		5m cable	
x				K		10m cable	
					(3)	**Additional temperature probe**	
x				0		not for type 907023/334	
					(4)	**Parameters**	
x				A		RH + T	
x				B		RH+T+Td+Tdf+a+x+Tw+ppm+pw+pws+h+dT	
					(5)	**Display**	
x				0		no display	
x				1		graphics LCD with background lighting	
					(6)	**Supply**	
x				0		10 – 35V DC, 24V AC	
x				1		electrical isolation for outputs 10 – 35V DC, 24V AC	
x				2		universal AC supply (100 – 240V AC)	
x				3		universal AC supply (100 – 240V AC) and US connecting cable	
x				4		universal AC supply (100 – 240V AC) and EUR connecting cable	
x				5		universal AC supply (100 – 240V AC) and UK connecting cable	
x				6		universal AC supply (100 – 240V AC) and AUS connecting cable	
					(7)	**Signal output (and serial RS232 interface or (optionally) communication module)**	
x				1		analog output channel (Ch1+Ch2+Ch3) 4 – 20mA	
x				2		analog output channel (Ch1+Ch2+Ch3) 0 – 20mA	
x				3		analog output channel (Ch1+Ch2+Ch3) 0 – 1V	
x				4		analog output channel (Ch1+Ch2+Ch3) 0 – 5V	
x				5		analog output channel (Ch1+Ch2+Ch3) 0 – 10V	
	Ch1	Ch2	Ch3		(8)	**Analog output signals for Ch1, Ch2 and Ch3**	
x			A			no third analog output (choose A if not required)	
x	B	B	B			RH (0 – 100% RH)	
x	C	C	C			T (see (9) output range temp.)	
x	D	D	D			Td (-20 to +100°C) (-4 to +212°F)	
x	E	E	E			Tdf (-20 to +100°C) (-4 to +212°F)	
x	F	F	F			a (0 – 600g/m³) (0 – 262gr/ft3)	
x	G	G	G			Tw (0 to 100°C) (+32 to +212°F)	
x	H	H	H			x (0 – 500g/kg d.a.) (0 – 3500gr/lb)	
x	J	J	J			h (-40 to +1500kJ/kg) (-9.5 to +652.6Btu/lb)	
x	K	K	K			ppm (0 – 5000) (0 – 5000)	
x	L	L	L			pw (0 – 1000hPa) (0 – 14.5psi)	
x	M	M	M			pws (0 – 1000hPa) (0 – 14.5psi)	
x	N	N	N			dT (-10 to +50°C) (14 to +122°F)	
x	X	X	X			Define special scaling Ch1: _____ Ch2: _____ Option Ch3: _____	
					(9)	**Analog output range for temperature**	
x				A		no temperature output (choose A if not required)	
x				B		-40 to +60°C (-40 to +140°F)	
x				C		-40 to +80°C (-40 to +176°F)	
x				D		-40 to +120°C (-40 to +248°F)	
x				E		-40 to +180°C (-40 to +356°F)	
x				F		-20 to +60°C (-4 to +140°F)	
x				G		-20 to +80°C (-4 to +176°F)	
x				H		-20 to +120°C (-4 to +248°F)	
x				J		-20 to +180°C (-4 to +356°F)	
x				K		0 to 60°C (32 to 140°F)	
x				L		0 to 100°C (32 to 212°F)	
x				M		0 to 120°C (32 to 248°F)	
x				N		0 to 180°C (32 to 356°F)	
x				P		-60 to +60°C (-76 to +140°F)	
x				X		Specifics: _____	
					(10)	**Output unit**	
x				1		metric	
x				2		non-metric	
					(11)	**Option for module slot 1**	**Option for module slot 2**
x			0	0		no module	no module
x			1	1		relay output	relay output
x			2	3		RS485 serial interface (electrically isolated)	third analog output (required if Ch3 (8) is selected)
					(12)	**Cable bushings**	
x				A		cable gland M 20x1.5	
x				B		conduit fitting NPT 1/2"	
x				C		8-pole connector with 5m cable	
x				D		8-pole mating connector equipped with screw terminals	
					(13)	**Transducer mounting**	
x				0		standard mounting	
x				1		wall-mounting plate	
x				2		pole installation kit	
x				3		pole installation kit with rain shield	
x				4		DIN rail kit	
					(14)	**Humidity sensor type**	
x				1		general application (standard)	HUMICAP® 180
x				4		sensor with cleaning function	HUMICAP® 180C
					(15)	**Sensor protection / filter**	
x				A		PPS plastic grid with stainless steel mesh	
x				B		PPS plastic grid	
x				C		sintered stainless steel filter	
x				D		stainless steel grid	
					(16)	**Probe installation kit**	
x				E		fitting element M 22x1.5	
x				F		fitting element NPT 1/2"	
					(17)	**Operating instructions: language**	
x				1		English	
x				2		German	
x				3		French	
					(18)	**Calibration**	
x				3A1		calibration to ISO 9001 standard (calibration report is available on request)	

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Order code		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Order example	907023/334	- H	- 0	- A	- 1	- 0	- 1	- BCA	- B	- 1	- 00	- A	- 0	- 1	- A	- E	- 2	- 3A1

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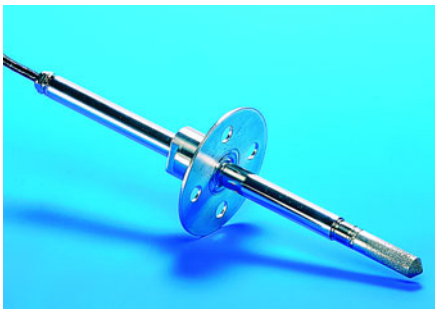
Humidity and temperature transducers for high temperatures, Type 907023/335

- **for temperatures ranging from -70 to +180°C**
- **long stainless steel probe**
- **mounting flange in stainless steel (option)**
- **variable mounting depth**
- **outstanding accuracy and stability**
- **graphical trend display and measurement history of the past year**
- **corrosion-resistant housing, IP65 rating**
- **retraceable to NIST**
- **applications include: hot-air drying processes**

Transducer with a rugged stainless steel probe – ideal for high flow velocities in drying processes

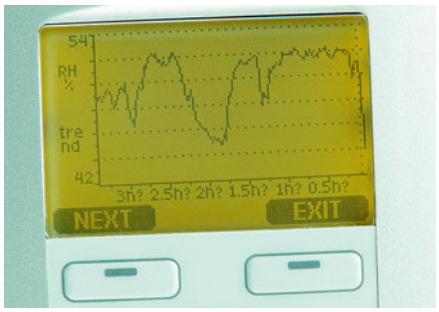
This humidity and temperature transducer is equipped with a long stainless steel probe that is especially designed for high-temperature applications.

Probe design for high flow velocity
The probe is designed to withstand high mechanical stress and high flow velocity.
This transducer is therefore highly suitable for measurements in pipes, for which smaller probes are not rugged enough.
Application example: hot-air drying processes.



Thanks to the mounting flange in stainless steel, probes can be mounted at various depths.

Graphical trend and development display
The instrument series can optionally be supplied with a large numerical/graphical display on which the process development can easily be monitored and traced back for up to a year.
The measurement data can be transferred to a PC for further processing, and for copying to other programs.



With the help of the display, the user is able to trace measurement trends back for up to a year.

Outputs and supply options for all needs
The output options include up to three analog outputs, RS232 and RS485 interfaces as well as alarm relays.

The possible supply voltage ranges from 10 to 35V DC. A wide-range power supply module ensures that the transducers can be connected to all supply voltages used around the globe.

Humidity sensor
The humidity sensor enables precise and reliable measurements as well as being resistant to contaminants and many chemicals.

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Order details: Humidity and temperature transducers for high temperatures, type 907023/335

				(1)	**Basic version**	
			907023/335		Humidity and temperature transducer for high temperatures	
				(2)	**Sensor cable / cable length**	
x			L		2m cable	
x			M		5m cable	
x			N		10m cable	
				(3)	**Additional temperature probe**	
x			0		not for type 907023/335	
				(4)	**Parameters**	
x			A		RH + T	
x			B		RH+T+Td+Tdf+a+x+Tw+ppm+pw+pws+h+dT	
				(5)	**Display**	
x			0		no display	
x			1		graphics LCD with background lighting	
				(6)	**Supply**	
x			0		10 — 35V DC, 24V AC	
x			1		electrical isolation for outputs 10 – 35V DC, 24V AC	
x			2		universal AC supply (100 – 240V AC)	
x			3		universal AC supply (100 – 240V AC) and US connecting cable	
x			4		universal AC supply (100 – 240V AC) and EUR connecting cable	
x			5		universal AC supply (100 – 240V AC) and UK connecting cable	
x			6		universal AC supply (100 – 240V AC) and AUS connecting cable	
				(7)	**Signal output (and serial RS232 interface or (optionally) communication module)**	
x			1		analog output channel (Ch1+Ch2+Ch3) 4 – 20mA	
x			2		analog output channel (Ch1+Ch2+Ch3) 0 – 20mA	
x			3		analog output channel (Ch1+Ch2+Ch3) 0 – 1V	
x			4		analog output channel (Ch1+Ch2+Ch3) 0 – 5V	
x			5		analog output channel (Ch1+Ch2+Ch3) 0 – 10V	
	Ch1	Ch2	Ch3	**(8)**	**Analog output signals for Ch1, Ch2 and Ch3**	
x			A		no third analog output (choose A if not required)	
x	B	B	B		RH	(0 – 100% RH)
x	C	C	C		T	(see (9) output range temp.)
x	D	D	D		Td (-20 to +100°C)	(-4 to +212°F)
x	E	E	E		Tdf (-20 to +100°C)	(-4 to +212°F)
x	F	F	F		a (0 – 600g/m³)	(0 – 262gr/ft3)
x	G	G	G		Tw (0 to 100°C)	(+32 to +212°F)
x	H	H	H		x (0 – 500g/kg d.a.)	(0 – 3500gr/lb)
x	J	J	J		h (-40 to +1500kJ/kg)	(-9.5 to +652.6Btu/lb)
x	K	K	K		ppm (0 – 5000)	(0 – 5000)
x	L	L	L		pw (0 – 1000hPa)	(0 – 14.5psi)
x	M	M	M		pws (0 – 1000hPa)	(0 – 14.5psi)
x	N	N	N		dT (-10 to +50°C)	(14 to +122°F)
x	X	X	X		Define special scaling	Ch1: _____ Ch2: _____ Option Ch3: _____
				(9)	**Analog output range for temperature**	
x			A		no temperature output (choose A if not required)	
x			B		-40 to +60°C	(-40 to +140°F)
x			C		-40 to +80°C	(-40 to +176°F)
x			D		-40 to +120°C	(-40 to +248°F)
x			E		-40 to +180°C	(-40 to +356°F)
x			F		-20 to +60°C	(-4 to +140°F)
x			G		-20 to +80°C	(-4 to +176°F)
x			H		-20 to +120°C	(-4 to +248°F)
x			J		-20 to +180°C	(-4 to +356°F)
x			K		0 to 60°C	(32 to 140°F)
x			L		0 to 100°C	(32 to 212°F)
x			M		0 to 120°C	(32 to 248°F)
x			N		0 to 180°C	(32 to 356°F)
x			P		-60 to +60°C	(-76 to +140°F)
x			X		Specifics: _____	
				(10)	**Output unit**	
x			1		metric	
x			2		non-metric	
				(11)	**Option for module slot 1**	**Option for module slot 2**
x		0	0		no module	no module
x		1	1		relay output	relay output
x		2	3		RS485 serial interface (electrically isolated)	third analog output (required if Ch3 (8) is selected)
				(12)	**Cable bushings**	
x			A		cable gland M 20x1.5	
x			B		conduit fitting NPT 1/2"	
x			C		8-pole connector with 5m cable	
x			D		8-pole mating connector equipped with screw terminals	
				(13)	**Transducer mounting**	
x			0		standard mounting	
x			1		wall-mounting plate	
x			2		pole installation kit	
x			3		pole installation kit with rain shield	
x			4		DIN rail kit	
				(14)	**Humidity sensor type**	
x			1		general application (standard)	HUMICAP® 180
x			4		sensor with cleaning function	HUMICAP® 180C
				(15)	**Sensor protection / filter**	
x			A		PPS plastic grid with stainless steel mesh	
x			B		PPS plastic grid	
x			C		sintered stainless steel filter	
x			D		stainless steel grid	
				(16)	**Probe installation kit**	
x			A		no installation kit	
x			G		mounting flange	
				(17)	**Operating instructions: language**	
x			1		English	
x			2		German	
x			3		French	
				(18)	**Calibration**	
x			3A1		calibration to ISO 9001 standard (calibration report is available on request)	

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Order code																		
Order example	907023/335	L	0	A	1	0	1	BCA	J	1	00	A	0	1	A	G	2	3A1

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Humidity and temperature transducers with a vapor-tight probe, Type 907023/337A

- **for temperatures ranging from -70 to +180°C**
- **for industrial and meteorological applications with moderate humidity**
- **small, vapor-tight stainless steel probe for remote measurement**
- **outstanding accuracy and stability**
- **graphical trend display and measurement history of the past year**
- **corrosion-resistant housing, IP65 rating**
- **retraceable to NIST**

Transducer for the most demanding process conditions, and for meteorological applications

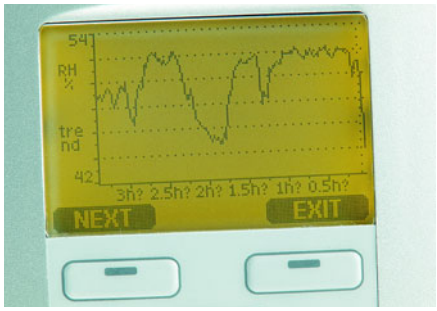
This humidity and temperature transducer is designed for the most demanding applications.
The stainless steel probe is small and slim, which means that it can be easily installed in locations where space is tight.
Compared with type 907023/333, the probe for this transducer is vapor-tight and covers a much wider temperature range.

For moderate humidities
The transducer has been conceived for demanding measurement tasks, but with the atmospheric humidity still within the moderate range.
For high-humidity applications, however, we recommend type 907023/337B with a heated probe.

Numerous mounting options
Vapor-tight mounting in a duct or pipe can be implemented using Swagelok screw fittings. A duct installation kit and, in addition, a mounting kit for meteorological outdoor measurements are available as an option.

Duct installation kit

Graphical trend and development display
The instrument series can optionally be supplied with a large numerical/graphical display on which the process development can easily be monitored and traced back for up to a year.
The measurement data can be transferred to a PC for further processing, and for copying to other programs.



With the help of the display, the user is able to trace measurement trends back for up to a year.

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Order details: Humidity and temperature transducers with a vapor-tight probe, type 907023/337A

	Code	No.	Description	
		(1)	**Basic version**	
	907023/337A		Humidity and temperature transducer with a vapor-tight probe	
		(2)	**Sensor cable / cable length**	
x	S		2m cable	
x	T		5m cable	
x	U		10m cable	
		(3)	**Additional temperature probe**	
x	0		not for type 907023/337A	
		(4)	**Parameters**	
x	A		RH + T	
x	B		RH+T+Td+Tdf+a+x+Tw+ppm+pw+pws+h+dT	
		(5)	**Display**	
x	0		no display	
x	1		graphics LCD with background lighting	
		(6)	**Supply**	
x	0		10 – 35V DC, 24V AC	
x	1		electrical isolation for outputs 10 – 35V DC, 24V AC	
x	2		universal AC supply (100 – 240V AC)	
x	3		universal AC supply (100 – 240V AC) and US connecting cable	
x	4		universal AC supply (100 – 240V AC) and EUR connecting cable	
x	5		universal AC supply (100 – 240V AC) and UK connecting cable	
x	6		universal AC supply (100 – 240V AC) and AUS connecting cable	
		(7)	**Signal output (and serial RS232 interface or (optionally) communication module)**	
x	1		analog output channel (Ch1+Ch2+Ch3) 4 – 20mA	
x	2		analog output channel (Ch1+Ch2+Ch3) 0 – 20mA	
x	3		analog output channel (Ch1+Ch2+Ch3) 0 – 1V	
x	4		analog output channel (Ch1+Ch2+Ch3) 0 – 5V	
x	5		analog output channel (Ch1+Ch2+Ch3) 0 – 10V	
	Ch1 | Ch2 | Ch3	(8)	**Analog output signals for Ch1, Ch2 and Ch3**	
x	A (Ch3)		no third analog output (choose A if not required)	
x	B B B		RH	(0 – 100% RH)
x	C C C		T	(see (9) output range temp.)
x	D D D		Td (-20 to +100°C)	(-4 to +212°F)
x	E E E		Tdf (-20 to +100°C)	(-4 to +212°F)
x	F F F		a (0 – 600g/m³)	(0 – 262gr/ft3)
x	G G G		Tw (0 to 100°C)	(+32 to +212°F)
x	H H H		x (0 – 500g/kg d.a.)	(0 – 3500gr/lb)
x	J J J		h (-40 to +1500kJ/kg)	(-9.5 to +652.6Btu/lb)
x	K K K		ppm (0 – 5000)	(0 – 5000)
x	L L L		pw (0 – 1000hPa)	(0 – 14.5psi)
x	M M M		pws (0 – 1000hPa)	(0 – 14.5psi)
x	N N N		dT (-10 to +50°C)	(14 to +122°F)
x	X X X		Define special scaling	Ch1: ___________ Ch2: ___________ Option Ch3: ___________
		(9)	**Analog output range for temperature**	
x	A		no temperature output (choose A if not required)	
x	B		-40 to +60°C	(-40 to +140°F)
x	C		-40 to +80°C	(-40 to +176°F)
x	D		-40 to +120°C	(-40 to +248°F)
x	E		-40 to +180°C	(-40 to +356°F)
x	F		-20 to +60°C	(-4 to +140°F)
x	G		-20 to +80°C	(-4 to +176°F)
x	H		-20 to +120°C	(-4 to +248°F)
x	J		-20 to +180°C	(-4 to +356°F)
x	K		0 to 60°C	(32 to 140°F)
x	L		0 to 100°C	(32 to 212°F)
x	M		0 to 120°C	(32 to 248°F)
x	N		0 to 180°C	(32 to 356°F)
x	P		-60 to +60°C	(-76 to +140°F)
x	X		Specifics: ______________	
		(10)	**Output unit**	
x	1		metric	
x	2		non-metric	
		(11)	**Option for module slot 1**	**Option for module slot 2**
x	0 | 0		no module	no module
x	1 | 1		relay output	relay output
x	2 | 3		RS485 serial interface (electrically isolated)	third analog output (required if Ch3 (8) is selected)
		(12)	**Cable bushings**	
x	A		cable gland M 20x1.5	
x	B		conduit fitting NPT 1/2"	
x	C		8-pole connector with 5m cable	
x	D		8-pole mating connector equipped with screw terminals	
		(13)	**Transducer mounting**	
x	0		standard mounting	
x	1		wall-mounting plate	
x	2		pole installation kit	
x	3		pole installation kit with rain shield	
x	4		DIN rail kit	
		(14)	**Humidity sensor type**	
x	1		general application (standard)	HUMICAP® 180
x	4		sensor with cleaning function	HUMICAP® 180C
		(15)	**Sensor protection / filter**	
x	A		PPS plastic grid with stainless steel mesh	
x	B		PPS plastic grid	
x	C		sintered stainless steel filter	
x	D		stainless steel grid	
		(16)	**Probe installation kit**	
x	A		no installation kit	
x	C		duct installation kit	
x	D		cable gland AGRO	
x	K		Swagelok NPT 1/2"	
x	L		Swagelok ISO 3/8"	
		(17)	**Operating instructions: language**	
x	1		English	
x	2		German	
x	3		French	
		(18)	**Calibration**	
x	3A1		calibration to ISO 9001 standard (calibration report is available on request)	

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Order code																		
Order example	907023/337A	S	0	A	1	0	1	BCA	B	1	00	A	0	1	A	A	2	3A1

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Humidity and temperature transducers with a heated probe for high-humidity applications, Type 907023/337B

- **for temperatures ranging from -70 to +180°C**
- **for industrial and meteorological applications with a high level of humidity**
- **excellent performance data in condensing atmospheres, thanks to the heated probe**
- **small, vapor-tight stainless steel probe for remote measurement**
- **outstanding accuracy and stability**
- **graphical trend display and measurement history of the past year**
- **corrosion-resistant housing, IP65 rating**
- **retraceable to NIST**

Transducer for the most demanding process conditions, and for meteorological applications (Picture: optionally with an additional temperature sensor)

This humidity and temperature transducer is available in two versions:
- with a heated probe:
  for dew point measurements in almost condensing atmospheres
- with a heated probe and an additional temperature sensor:
  for measuring relative humidity in almost condensing atmospheres

Correct humidity measurements with condensation
This unique, heated probe enables fast and reliable dew point measurements in environments in which humidity is near the saturation point. The heated sensor quickly returns to producing correct measurements, even with short-term condensation.

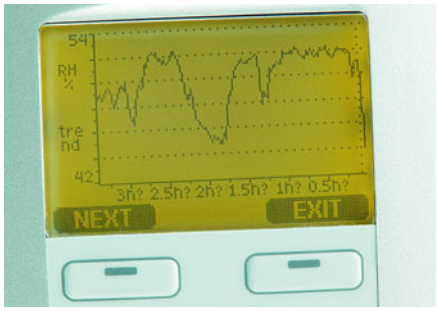
Since the probe temperature lies above the ambient temperature, the humidity level stays within the ambient humidity.
With accurate temperature measurement, the dew point of the environment can, however, be precisely calculated.

An additional temperature sensor is necessary for determining relative humidity. The ambient temperature measured in this way serves to calculate relative humidity and derived humidity variables.

Numerous mounting options
Vapor-tight mounting in a duct or pipe can be implemented using Swagelok screw fittings. A duct installation kit and, in addition, a mounting kit for meteorological outdoor measurements are available as an option.

Duct installation kit

Graphical trend and development display
The instrument series can optionally be supplied with a large numerical/graphical display on which the process development can easily be monitored and traced back for up to a year.
The measurement data can be transferred to a PC for further processing, and for copying to other programs.



With the help of the display, the user is able to trace measurement trends back for up to a year.

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Order details: Humidity and temperature transducers with a heated probe for high-humidity applications, type 907023/337B

(1) Basic version

	Code	Description
	907023/337B	Humidity and temperature transducer with a heated probe for high-humidity applications

(2) Dew point probe / cable length

	Code	Description
x	S	2m cable
x	T	5m cable
x	U	10m cable

(3) Additional temperature probe

	Code	Description
x	0	no additional temperature probe
x	1	2m cable
x	2	5m cable
x	3	10m cable

(4) Parameters

	Code	Description	
x	C	Td+Tdf+x+pw	(dew point probe only)
x	D	RH+T+Td+Tdf+a+x+Tw+ppm+pw+pws+h+dT	(with additional T probe)

(5) Display

	Code	Description
x	0	no display
x	1	graphics LCD with background lighting

(6) Supply

	Code	Description
x	0	10 – 35V DC, 24V AC
x	1	electrical isolation for outputs 10 – 35V DC, 24V AC
x	2	universal AC supply (100 – 240V AC)
x	3	universal AC supply (100 – 240V AC) and US connecting cable
x	4	universal AC supply (100 – 240V AC) and EUR connecting cable
x	5	universal AC supply (100 – 240V AC) and UK connecting cable
x	6	universal AC supply (100 – 240V AC) and AUS connecting cable

(7) Signal output (and serial RS232 interface or (optionally) communication module)

	Code	Description
	1	analog output channel (Ch1+Ch2+Ch3) 4 – 20mA
x	2	analog output channel (Ch1+Ch2+Ch3) 0 – 20mA
x	3	analog output channel (Ch1+Ch2+Ch3) 0 – 1V
x	4	analog output channel (Ch1+Ch2+Ch3) 0 – 5V
x	5	analog output channel (Ch1+Ch2+Ch3) 0 – 10V

(8) Analog output signals for Ch1, Ch2 and Ch3

	Ch1	Ch2	Ch3	Description			
x			A	no third analog output (choose A if not required)			
x	B	B	B	RH	(0 – 100% RH)		
x	C	C	C	T	(see (9) output range temp.)		
x	D	D	D	Td (-20 to +100°C)	(-4 to +212°F)		
x	E	E	E	Tdf (-20 to +100°C)	(-4 to +212°F)		
x	F	F	F	a (0 – 600g/m³)	(0 – 262gr/ft3)		
x	G	G	G	Tw (0 to 100°C)	(+32 to +212°F)		
x	H	H	H	x (0 – 500g/kg d.a.)	(0 – 3500gr/lb)		
x	J	J	J	h (-40 to +1500kJ/kg)	(-9.5 to +652.6Btu/lb)		
x	K	K	K	ppm (0 – 5000)	(0 – 5000)		
x	L	L	L	pw (0 – 1000hPa)	(0 – 14.5psi)		
x	M	M	M	pws (0 – 1000hPa)	(0 – 14.5psi)		
x	N	N	N	dT (-10 to +50°C)	(14 to +122°F)		
x	X	X	X	Define special scaling	Ch1: ___________	Ch2: ___________	Option Ch3: ___________

(9) Analog output range for temperature

	Code	Description	
x	A	no temperature output (choose A if not required)	
x	B	-40 to +60°C	(-40 to +140°F)
x	C	-40 to +80°C	(-40 to +176°F)
x	D	-40 to +120°C	(-40 to +248°F)
x	E	-40 to +180°C	(-40 to +356°F)
x	F	-20 to +60°C	(-4 to +140°F)
x	G	-20 to +80°C	(-4 to +176°F)
x	H	-20 to +120°C	(-4 to +248°F)
x	J	-20 to +180°C	(-4 to +356°F)
x	K	0 to 60°C	(32 to 140°F)
x	L	0 to 100°C	(32 to 212°F)
x	M	0 to 120°C	(32 to 248°F)
x	N	0 to 180°C	(32 to 356°F)
x	P	-60 to +60°C	(-76 to +140°F)
x	X	Specifics: ______________	

(10) Output unit

	Code	Description
x	1	metric
x	2	non-metric

(11) Option for module slot 1 / Option for module slot 2

	Slot 1	Slot 2	Option for module slot 1	Option for module slot 2
x	0	0	no module	no module
x	1	1	relay output	relay output
x	2	3	RS485 serial interface (electrically isolated)	third analog output (required if Ch3 (8) is selected)

(12) Cable bushings

	Code	Description
x	A	cable gland M 20x1.5
x	B	conduit fitting NPT 1/2"
x	C	8-pole connector with 5m cable
x	D	8-pole mating connector equipped with screw terminals

(13) Transducer mounting

	Code	Description
x	0	standard mounting
x	1	wall-mounting plate
x	2	pole installation kit
x	3	pole installation kit with rain shield
x	4	DIN rail kit

(14) Humidity sensor type

	Code	Description	
x	5	combined sensor	HUMICAP® 180C
x	6	combined sensor with cleaning function	HUMICAP® 180C

(15) Sensor protection / filter

	Code	Description
x	A	PPS plastic grid with stainless steel mesh
x	C	sintered stainless steel filter
x	D	stainless steel grid

(16) Probe installation kit

	Code	Description
x	A	no installation kit
x	C	duct installation kit
x	K	Swagelok NPT 1/2"
x	L	Swagelok ISO 3/8"
x	P	duct installation kit (RH +T probes)
x	Q	Swagelok NPT 1/2" and Swagelok NPT 1/8" (RH +T)
x	R	Swagelok ISO 3/8" and Swagelok ISO 1/8" (RH+T)

(17) Operating instructions: language

	Code	Description
x	1	English
x	2	German
x	3	French

(18) Calibration

	Code	Description
x	3A1	calibration to ISO 9001 standard (calibration report is available on request)

Order example, see page 13/32

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Humidity and temperature transducers for pressure lines and chambers, Type 907023/338

- **for temperatures ranging from -70 to +180°C**
- **installation using a ball valve, for installation and removal under pressure**
- **variable probe installation depth through a sliding gland**
- **for measurements in the pressure range from 0 – 40bar**
- **outstanding accuracy and stability**
- **graphical trend display and measurement history of the past year**
- **corrosion-resistant housing, IP65 rating**
- **two probe shaft lengths are available**
- **retraceable to NIST**

Transducer for mounting in pressure lines and chambers, from which the probe can be removed without interrupting the operation

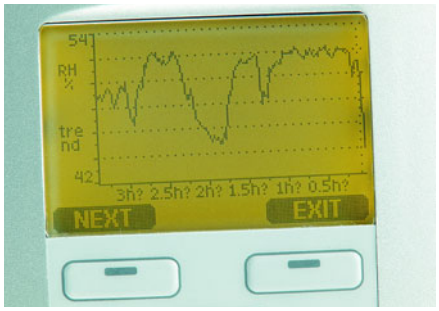
This humidity and temperature transducer is designed for processes subjected to pressures.

Installation and removal under pressure
The probe can be directly inserted into the process without interrupting the operation, and without having to vent or reduce the process pressure beforehand.

The probe head is inserted by means of a ball valve which is mounted in the pressure line or on the chamber wall.
The sliding cap nut is tightened by hand, so that the probe is initially in the minimum installation position. The ball valve is subsequently opened, which exposes the probe to the process pressure. Using a press tool, the probe is then pressed to the required installation depth and fixed with the cap nut.
The probe can be installed during operation under process pressures up to 10bar.

For correct measurement results, the prevailing process pressures can be entered in the transducer memory via a serial interface or the operator panel.

Graphical trend and development display
The transducers can optionally be supplied with a large numerical/graphical display on which the process development can be monitored easily and traced back for up to a year.
Maximum and minimum values of the past year can be graphically displayed in a simple manner.



The display can be used to trace measurement trends back for up to a year.

Outputs and supply options for all needs
The output options include up to three analog outputs, RS232 and RS485 interfaces as well as alarm relays.

The possible supply voltage ranges from 10 to 35V DC. A wide-range power supply module ensures that the transducers can be connected to all supply voltages used around the globe.

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Order details: Humidity and temperature transducers for pressure lines and chambers, type 907023/338

	Ch1	Ch2	Code	No.	Description			
				(1)	**Basic version**			
			907023/338		Humidity and temperature transducer for pressure lines and chambers			
				(2)	**Sensor cable / cable length**			
x			V		2m cable for 232mm probe			
x			W		5m cable for 232mm probe			
x			X		10m cable for 232mm probe			
x			1		2m cable for 454mm probe			
x			2		5m cable for 454mm probe			
x			3		10m cable for 454mm probe			
				(3)	**Additional temperature probe**			
x			0		not for type 907023/338			
				(4)	**Parameters**			
x			A		RH + T			
x			B		RH+T+Td+Tdf+a+x+Tw+ppm+pw+pws+h+dT			
				(5)	**Display**			
x			0		no display			
x			1		graphics LCD with background lighting			
				(6)	**Supply**			
x			0		10 – 35V DC, 24V AC			
x			1		electrical isolation for outputs 10 – 35V DC, 24V AC			
x			2		universal AC supply (100 – 240V AC)			
x			3		universal AC supply (100 – 240V AC) and US connecting cable			
x			4		universal AC supply (100 – 240V AC) and EUR connecting cable			
x			5		universal AC supply (100 – 240V AC) and UK connecting cable			
x			6		universal AC supply (100 – 240V AC) and AUS connecting cable			
				(7)	**Signal output (and serial RS232 interface or (optionally) communication module)**			
x			1		analog output channel (Ch1+Ch2+Ch3) 4 – 20mA			
x			2		analog output channel (Ch1+Ch2+Ch3) 0 – 20mA			
x			3		analog output channel (Ch1+Ch2+Ch3) 0 – 1V			
x			4		analog output channel (Ch1+Ch2+Ch3) 0 – 5V			
x			5		analog output channel (Ch1+Ch2+Ch3) 0 – 10V			
	Ch1	Ch2	Ch3	(8)	**Analog output signals for Ch1, Ch2 and Ch3**			
x			A		no third analog output (choose A if not required)			
x	B	B	B		RH	(0 — 100% RH)		
x	C	C	C		T	(see (9) output range temp.)		
x	D	D	D		Td (-20 to +100°C)	(-4 to +212°F)		
x	E	E	E		Tdf (-20 to +100°C)	(-4 to +212°F)		
x	F	F	F		a (0 – 600g/m³)	(0 – 262gr/ft3)		
x	G	G	G		Tw (0 to 100°C)	(+32 to +212°F)		
x	H	H	H		x (0 – 500g/kg d.a.)	(0 – 3500gr/lb)		
x	J	J	J		h (-40 to +1500kJ/kg)	(-9.5 to +652.6Btu/lb)		
x	K	K	K		ppm (0 – 5000)	(0 – 5000)		
x	L	L	L		pw (0 – 1000hPa)	(0 – 14.5psi)		
x	M	M	M		pws (0 – 1000hPa)	(0 – 14.5psi)		
x	N	N	N		dT (-10 to +50°C)	(14 to +122°F)		
x	X	X	X		Define special scaling	Ch1: ___________	Ch2: ___________	Option Ch3: ___________
				(9)	**Analog output range for temperature**			
x			A		no temperature output (choose A if not required)			
x			B		-40 to +60°C	(-40 to +140°F)		
x			C		-40 to +80°C	(-40 to +176°F)		
x			D		-40 to +120°C	(-40 to +248°F)		
x			E		-40 to +180°C	(-40 to +356°F)		
x			F		-20 to +60°C	(-4 to +140°F)		
x			G		-20 to +80°C	(-4 to +176°F)		
x			H		-20 to +120°C	(-4 to +248°F)		
x			J		-20 to +180°C	(-4 to +356°F)		
x			K		0 to 60°C	(32 to 140°F)		
x			L		0 to 100°C	(32 to 212°F)		
x			M		0 to 120°C	(32 to 248°F)		
x			N		0 to 180°C	(32 to 356°F)		
x			P		-60 to +60°C	(-76 to +140°F)		
x			X		Specifics: ______________			
				(10)	**Output unit**			
x			1		metric			
x			2		non-metric			
				(11)	**Option for module slot 1**		**Option for module slot 2**	
x		0	0		no module		no module	
x		1	1		relay output		relay output	
x		2	3		RS485 serial interface (electrically isolated)		third analog output (required if Ch3 (8) is selected)	
				(12)	**Cable bushings**			
x			A		cable gland M 20x1.5			
x			B		conduit fitting NPT 1/2"			
x			C		8-pole connector with 5m cable			
x			D		8-pole mating connector equipped with screw terminals			
				(13)	**Transducer mounting**			
x			0		standard mounting			
x			1		wall-mounting plate			
x			2		pole installation kit			
x			3		pole installation kit with rain shield			
x			4		DIN rail kit			
				(14)	**Humidity sensor type**			
x			1		general application (standard)		HUMICAP® 180	
x			4		combined sensor with cleaning function		HUMICAP® 180C	
				(15)	**Sensor protection / filter**			
x			A		PPS plastic grid with stainless steel mesh			
x			B		PPS plastic grid			
x			C		sintered stainless steel filter			
x			D		stainless steel grid			
				(16)	**Probe installation kit**			
x			M		ball valve installation kit (ISO 1/2")			
x			N		pressure connection NPT 1/2"			
x			V		pressure connection ISO 1/2"			
				(17)	**Operating instructions: language**			
x			1		English			
x			2		German			
x			3		French			
				(18)	**Calibration**			
x			3A1		calibration to ISO 9001 standard (calibration report is available on request)			

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)		(11)		(12)		(13)		(14)		(15)		(16)		(17)		(18)
Order code	☐	-	☐	-	☐	-	☐	-	☐	-	☐	-	☐	-	☐☐☐	-	☐	-	☐	-	☐☐	-	☐	-	☐	-	☐	-	☐	-	☐	-	☐	-	☐☐☐
Order example	907023/338	-	V	-	0	-	A	-	1	-	0	-	1	-	BCA	-	B	-	1	-	00	-	A	-	0	-	1	-	A	-	V	-	2	-	3A1

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Order details: Accessories for humidity and temperature transducers for industrial applications

(1)	Basic version
907023/80	Software package
907023/81	Installation kits
907023/82	Screw fittings
907023/90	Filter/sensor protection (12mm dia.)
907023/91	Replacement humidity sensor
907023/92	Replacement temperature sensor
907023/93	Humidity sensor checks

/80	/81	/82	/90	/91	/92	/93	(2)	
								Software package
x							893	PC software and cable
								Installation kits
	x						247	wall mounting kit (plastic mounting plate)
	x						894	DIN rail mounting kit (including plastic mounting plate)
	x						895	pole installation kit (for pipes from 30 to 100mm)
	x						896	rain protection installation kit
	x						897	duct installation kit for type 907023/333
	x						898	duct installation kit (RH probe) for type 907023/337
	x						899	duct installation kit (T probe) for type 907023/337
	x						900	mounting flange for type 907023/335
	x						901	meteorological installation kit for type 907023/337
	x						902	ball valve installation kit for type 907023/338 (0 — 40bar)
								Screw fittings
		x					903	cable glands for types 907023/333 and 907023/337
		x					904	pressure-tight Swagelok screw fitting (RH probe) ISO 3/8" for type 907023/337
		x					905	pressure-tight Swagelok screw fitting (T probe) ISO 1/8" for type 907023/337
		x					906	pressure-tight Swagelok screw fitting (RH probe) NPT 1/2" for type 907023/337
		x					907	pressure-tight Swagelok screw fitting (T probe) NPT 1/8" for type 907023/337
								Filter/sensor protection (12mm dia.)
			x				890	sintered stainless steel filter
			x				891	PPS plastic grid filter with stainless steel mesh
			x				892	PPS plastic grid filter
								Replacement humidity sensor
				x			814	HUMICAP® 180
								Replacement temperature sensor
					x		005	Pt 100 1/3 DIN Class B to DIN EN 60 751
								Humidity sensor checks
						x	820	33% RH magnesium chloride
						x	821	55% RH magnesium nitrate
						x	822	76% RH sodium chloride

	(1)		(2)
Order code		-	
Order example	907023/80	-	893

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Stock versions:

Accessories for humidity and temperature transducers for industrial applications

(1)		(2)	Sales No.
	-		
907023/90	-	890	90/00465143
907023/90	-	891	90/00465144
907023/90	-	892	90/00465145
907023/92	-	005	90/00389454
907023/93	-	820	90/00332758
907023/93	-	821	90/00332759
907023/93	-	822	90/00332760

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Intrinsically safe industrial transducers for humidity, temperature and derived variables

- **hygrothermal transducers measure relative humidity in air, and temperature**
- **option: calculation of dew point, absolute humidity, mixing ratio and wet bulb temperature**
- **new user-friendly, modular transducer concept**
- **intelligent interchangeable probes with storage of all calibration coefficients**
- **safe operation of the instrument as a whole in Category 1G / Zone 0 and 1D / Zone 20 areas, with protective cover**
- **retraceable to NIST (including certificate)**

These intrinsically safe industrial transducers are the first choice for measuring humidity, temperature and derived variables

These new, intrinsically-safe industrial transducers have been developed in response to the need of accurately monitoring humidity in hazardous areas, and without risk. The series sets entirely new standards with regard to ease of installation and user friendliness.

The modular design consists of four parts (wall bracket, housing base, electronics unit and probe) that can be detached from each other, a feature which makes installation, operation and maintenance considerably easier.
In combination with five interchangeable probes, the transducers lend themselves to the most diverse applications for almost any measurement task.

They no longer need to be recalibrated when the probes are swapped, because all the calibration coefficients are already stored within the probe itself and transferred to the central unit after connection.
Apart from this, the probe design does not differ from that of the field-proven industrial series models which are available with 2m, 5m or 10m long sensor cables. The special sensor heads are available in various styles, which permit application in vacuum or the 0 — 100bar overpressure range, and with high process temperatures up to 180°C.

The transducers are extremely rugged and incorporate the very latest sensor technology.
They can be operated safely and reliably inside areas where a Category 1 (Zone 0) explosion hazard is permanently present.

The transducers are extremely versatile, thanks to the microprocessor-based electronics and the large variety of options.
The user is able to specify the transducer configuration directly when ordering. It can also be subsequently altered on site.

Using the optional software expansion, the integral microprocessor calculates humidity variables such as dew point Td (°C), absolute humidity a (g / m³), mixing ratio x (g / kg) and wet bulb temperature Tw (°C).

The intrinsically safe transducers are equipped with an analog output (4 — 20mA) as standard. They can optionally be upgraded with a second analog output and an integrated LC display /operator panel.

When connecting up the supply voltage (12 — 28V DC) the use of safety barriers or intrinsically safe power supply units (available from outside suppliers) is mandatory for operation in locations with an explosion hazard (see Technical data).

All transducers are equipped with sensors that feature state-of-the-art thin-film technology. More than 20 years of experience have gone into their development and continuous improvement.
The sensors are distinguished by their supreme accuracy, reliability and stability.

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Technical data

Styles

Type 907023/61
Intrinsically safe humidity and temperature transducer for wall mounting, operating temperature -40 to +60 °C

Type 907023/63
Intrinsically safe humidity and temperature transducer with a small sensor head on a 2m sensor cable, operating temperature -40 to +120 °C

Type 907023/64
Intrinsically safe humidity and temperature transducer with a pressure-proof stainless steel sensor head on a 2m sensor cable for process pressures from 0 – 10 MPa (0 – 100 bar), operating temperature -40 to +180 °C

Type 907023/65
Intrinsically safe humidity and temperature transducer with a stainless steel sensor head on a 2m sensor cable, operating temperature -40 to +180 °C

Type 907023/68 and 907023/68L (long version, shaft length 400mm)
Intrinsically safe humidity and temperature transducer with a pressure-proof stainless steel sensor head on a 2m sensor cable for process pressures from 0 – 4 MPa (0 – 40 bar), sensor head with sliding clamping thread; operating temperature -40 to +180 °C

Note:
For operation in potentially hazardous surroundings, it is mandatory to connect up the supply voltage (12 – 28 V DC) via safety barriers (available from outside suppliers) or intrinsically safe power supply units. For the operation in Category 1 (Zone 0), an intrinsically safe power supply unit (e. g. type STAHL 9160/13-11-11) must be used for each channel. When operating in Categories 2 + 3 (Zone 1 + 2), it is sufficient to use safety barriers (e. g. STAHL 9001/51-280-091-141).
These devices are not supplied by JUMO!
For more details, see the operating instructions or visit http://www.stahl.de/de/ex/sicherheitsbarrieren.htm

Measured variables

Relative humidity

Range 0 – 100 % RH
Accuracy (taking into account non-linearity and reproducibility) after calibration against highly accurate,

certified humidity standards	±1 % RH (0 – 90 % RH)
	±2 % RH (90 – 100 % RH)
Salt solutions (ASTM E104-85)	±2 % RH (0 – 90 % RH)
	±3 % RH (90 – 100 % RH)

Response time $t_{0.9}$ at 20 °C in stationary air (with sintered filter) 15 sec
Humidity sensors:
HUMICAP®180 for standard applications
HUMICAP®180L2 with substantial chemical contamination

Temperature ranges

-40 to +180 °C (depending on the probe selected)

Accuracy of the electronics at 20 °C, typically	±0.1 °C
Temperature drift of electronics	0.005 °C/°C
Temperature sensor	Pt1000 1/3 DIN Class B to EN 60 751

Derived variables (option)

	with probe	with probes	
Typical ranges	907023/S61	907023/S63, .../S64, .../S65, .../S68	
Dew point T_d	-40 to +60	-40 to +100	[°C]
Mixing ratio x	0 to 160	0 to 500	[g/kg dry air]
Absolute humidity a	0 to 160	0 to 600	[g/m^3]
Wet bulb temperature T_w	0 to 60	0 to 100	[°C]

(The accuracy of the derived variable depends on the accuracy of the humidity/temperature measurement and the corresponding working point.)

Ex classifications as per CENELEC (PTB) (analog outputs)

(94/9/EC, ATEX100a)	II 1 G EEx ia IIC T4
	PTB 00 ATEX 2112 X
Limit values	Ui = 28 V, Ii = 100 mA, Pi = 700 mW, Ci = 1 nF, Li = 0 H
Ambient conditions	T_{amb} = -20 to +60 °C
	P_{amb} = 800 to 1100 hPa
Dust protection	II 1D (IP 65 T = 70 °C)
(with protective cover)	VTT04 ATEX 023X

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Outputs	2 analog outputs (one comes as standard, one is optional)	4 – 20mA (2-wire technique)
	Accuracy of the analog outputs at 20°C	0.05% of full scale
	Temperature drift	0.005% / °C of full scale
General data	Supply voltage	12 – 28V DC
	when using the service interface	15 – 28V DC
	Operating temperature range	
	Electronics with LC display	-20 to +60°C
	Storage temperature range	-40 to +70°C
	Connections	screw terminals 0.33 – 2.0mm^2
	Cable gland	Pg 11 for sensor cable with 5 – 12mm dia.
	Conduit fitting	Pg 11/NPT 1/2"-14
	Housing material	G-AlSi10 Mg (DIN 1725)
	Housing dimensions	L 164mm x W 115mm x H 62mm
	Housing weight	950g
	EMC	as per EN 61 326-1: 1997 + Annex 1: 1998 (EN 61 000-4-5 only when using external surge voltage protectors)
Probes	907023/S61	probe for wall mounting for the temperature range -40 to +60°C
	907023/S63	probe, small style for the temperature range -40 to +120°C
	907023/S64	probe for high pressures for the temperature range -40 to +180°C for the pressure range 0 – 10MPa (0 – 100bar)
	907023/S65	probe for high temperatures for the temperature range -40 to +180°C
	907023/S68 und 907023/S68L	probe for pressure lines for the temperature range -40 to +180°C for the pressure range 0 – 4MPa (0 – 4bar)
	Probe cable diameter (all types)	5.5mm
	Probe cable length	2m (standard) 5m or 10m (option)
Options	Second analog output	4 – 20mA (2-wire technique)
	Housing with display/operator panel	2-line LC display
	Character size (1st line/2nd line)	12mm/10mm
	Extension for derived variables	dew point temperature T_d, mixing ratio x, absolute humidity a, wet bulb temperature T_w
	Sensor protection	sintered filter 38µm from acid-resistant, non-rusting stainless steel AISi 316L (Mat. Ref. 1.4404), stainless steel grid AISi 316L (Mat. Ref. 1.4404), PPS grid with non-rusting stainless steel mesh AISi 316 (Mat. Ref. 1.4436), PPS grid

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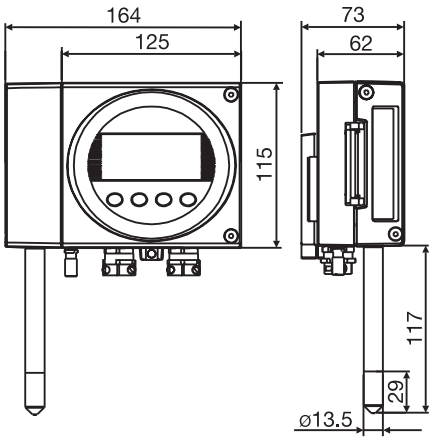
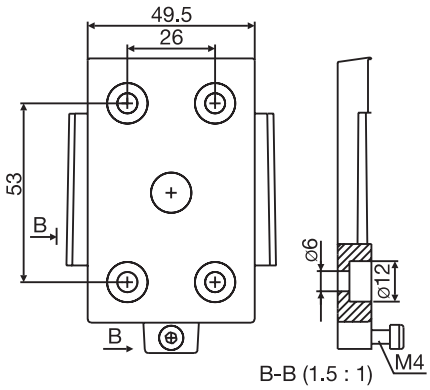
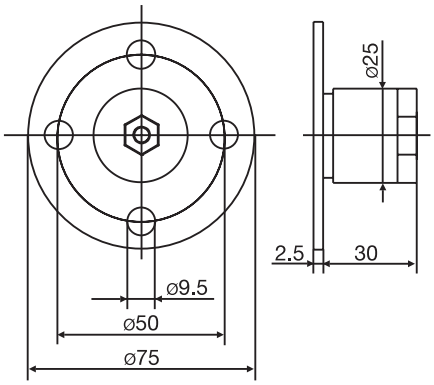
Dimensions



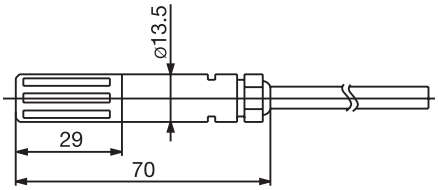
Central unit with probe 907023/S61
Type 907023/61



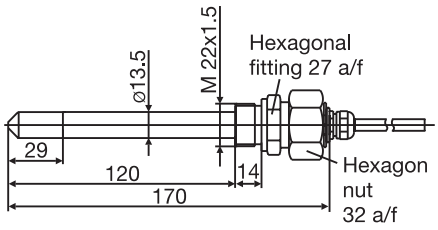
Mounting bracket



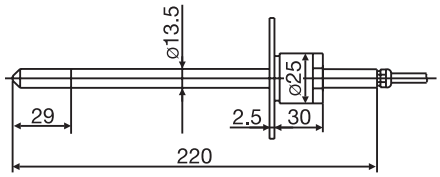
Installation kit
and mounting flange



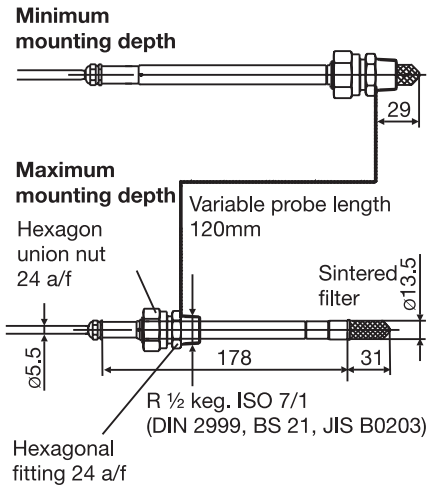
Probe
907023/S63



Probe
907023/S64



Probe
907023/S65
including mounting flange (option)



Probe
907023/S68 and .../S68L

All dimensions in mm.

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Order details:

Intrinsically safe industrial transducers for humidity, temperature and derived variables with Ex approval as per ATEX 100a 94/9/EC (PTB)

			(1)	**Basic version**
	907023/61			Intrinsically safe humidity and temperature transducer for wall mounting, operating temperature -40 to +60 °C
			(2)	**Output variables**
x	11			RH + T
x	15			RH + T + Td + a + Tw + x
			(3)	**Analog output variables, channel 1 (and channel 2, optional)**
x		.	0	If normally only one channel is used, then choose 0 for channel 2!
x		1	1	RH 0 – 100 % RH
x		2	2	T (see Temperature ranges)
x		3	3	Td[2] -40 to +60 °C
x		4	4	a[2] 0 – 160 g/m³
x		5	5	Tw[2] 0 to 60 °C
x		6	6	x[2] 0 – 160 g/kg dry air
x		9	9	special scaling (details in plain text)
			(4)	**Temperature ranges**
x	472			-40 to +60 °C
x	632			-20 to +60 °C
x	807			0 to 60 °C
x	999			special range (details in plain text)
			(5)	**Probe shaft/filter**
x	2			120 mm probe shaft length (60 °C), PPS plastic grid filter with stainless steel mesh
			(6)	**Extra codes**
x	000			no extra code
x	427			conduit fitting NPT 1/2" (for installation tube)
x	777			non-metric unit (°F)
x	789			integrated LC display/operator panel
x	801			PPS plastic grid filter with PTFE membrane
x	803			sintered stainless steel filter
x	805			PPS plastic grid filter without stainless steel mesh
x	823			special sensor for high chemical concentrations
x	826			2 analog output channels (channel 1 and channel 2), 4 — 20 mA
x	828			operating instructions in English

	(1)		**(2)**		**(3)**		**(4)**		**(5)**		**(6)**	
Order code		-		-		-		-		/		, ...[1]
Order example	907023/61	-	11	-	12	-	472	-	2	/	000	

[1] List extra codes in sequence, separated by commas.
[2] The operands Td, a, Tw and x are only available if Option 15 has been selected under Output variables.

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Order details:

Intrinsically safe industrial transducers for humidity, temperature and derived variables with Ex approval as per ATEX 100a 94/9/EC (PTB)

		(1)	**Basic version**
	907023/63		Intrinsically safe humidity and temperature transducer with a small sensor head on a 2m sensor cable, operating temperature -40 to +120°C
		(2)	**Output variables**
x	11		RH + T
x	15		RH + T + Td + a + Tw + x
		(3)	**Analog output variables, channel 1 (and channel 2, optional)**
x	.0		If normally only one channel is used, then choose 0 for channel 2!
x	1 1		RH 0 – 100% RH
x	2 2		T (see Temperature ranges)
x	3 3		Td[2] -40 to +100°C
x	4 4		a[2] 0 – 500g/m³
x	5 5		Tw[2] 0 to 100°C
x	6 6		x[2] 0 – 500g/kg dry air
x	9 9		special scaling (details in plain text)
		(4)	**Temperature ranges**
x	474		-40 to +80°C
x	478		-40 to +120°C
x	635		-20 to +80°C
x	643		-20 to +120°C
x	814		0 to 100°C
x	999		special range (details in plain text)
		(5)	**Sensor cable lengths (probe shaft/filter)**
x	2		2m shaft length 60mm (120°C), PPS plastic grid filter with stainles steel mesh
x	5		5m shaft length 60mm (120°C), PPS plastic grid filter with stainles steel mesh
x	10		10m shaft length 60mm (120°C), PPS plastic grid filter with stainles steel mesh
		(6)	**Extra codes**
x	000		no extra code
x	427		conduit fitting NPT 1/2" (for installation tube)
x	777		non-metric unit (°F)
x	783		duct installation kit
x	789		integrated LC display/operator panel
x	823		special sensor for high chemical concentrations
x	826		2 analog output channels (channel 1 and channel 2), 4 – 20mA
x	828		operating instructions in English

	(1)		(2)		(3)		(4)		(5)		(6)	
Order code		-		-		-		-		/		, ...
Order example	907023/63	-	11	-	12	-	474	-	2	/	000	[1]

[1] List extra codes in sequence, separated by commas.
[2] The operands Td, a, Tw and x are only available if Option 15 has been selected under Output variables.

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Order details:

Intrinsically safe industrial transducers for humidity, temperature and derived variables with Ex approval as per ATEX 100a 94/9/EC (PTB)

		(1)	**Basic version**
	907023/64		Intrinsically safe humidity and temperature transducer with pressure-proof stainless steel sensor head on a 2m sensor cable, for process pressures from 0 – 10MPa (0 – 100bar) operating temperature -40 to +180°C
		(2)	**Output variables**
x	11		RH + T
x	15		RH + T + Td + a + Tw + x
		(3)	**Analog output variables, channel 1 (and channel 2, optional)**
x	. | 0		If normally only one channel is used, then choose 0 for channel 2!
x	1 | 1		RH 0 – 100% RH
x	2 | 2		T (see Temperature ranges)
x	3 | 3		Td[2] -40 to +100°C
x	4 | 4		a[2] 0 – 500g/m³
x	5 | 5		Tw[2] 0 to 100°C
x	6 | 6		x[2] 0 – 500g/kg dry air
x	9 | 9		special scaling (details in plain text)
		(4)	**Temperature ranges**
x	474		-40 to +80°C
x	478		-40 to +120°C
x	485		-40 to +180°C
x	635		-20 to +80°C
x	643		-20 to +120°C
x	648		-20 to +180°C
x	814		0 to 100°C
x	830		0 to 180°C
x	999		special range (details in plain text)
		(5)	**Sensor cable lengths (probe shaft/filter)**
x	2		2m shaft length 150mm (180°C), sintered stainless steel filter
x	5		5m shaft length 150mm (180°C), sintered stainless steel filter
x	10		10m shaft length 150mm (180°C), sintered stainless steel filter
		(6)	**Extra codes**
x	000		no extra code
x	427		conduit fitting NPT 1/2" (for installation tube)
x	777		non-metric unit (°F)
x	789		integrated LC display/operator panel
x	804		PPS plastic grid filter with stainless steel mesh
x	823		special sensor for high chemical concentrations
x	826		2 analog output channels (channel 1 and channel 2), 4 – 20mA
x	828		operating instructions in English

	(1)		(2)		(3)		(4)		(5)		(6)	
Order code		-		-		-		-		/		, ...[1]
Order example	907023/64	-	11	-	12	-	474	-	2	/	000	

[1] List extra codes in sequence, separated by commas.
[2] The operands Td, a, Tw and x are only available if Option 15 has been selected under Output variables.

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Order details:

Intrinsically safe industrial transducers for humidity, temperature and derived variables with Ex approval as per ATEX 100a 94/9/EC (PTB)

			(1)	**Basic version**
	907023/65			Intrinsically safe humidity and temperature transducer with stainless steel sensor head on a 2m sensor cable, operating temperature -40 to +180°C
			(2)	**Output variables**
x	11			RH + T
x	15			RH + T + Td + a + Tw + x
			(3)	**Analog output variables, channel 1 (and channel 2, optional)**
x		.	0	If normally only one channel is used, then choose 0 for channel 2!
x		1	1	RH 0 – 100% RH
x		2	2	T (see Temperature ranges)
x		3	3	Td[2] -40 to +100°C
x		4	4	a[2] 0 – 500g/m³
x		5	5	Tw[2] 0 to 100°C
x		6	6	x[2] 0 – 500g/kg dry air
x		9	9	special scaling (details in plain text)
			(4)	**Temperature ranges**
x	474			-40 to +80°C
x	478			-40 to +120°C
x	485			-40 to +180°C
x	635			-20 to +80°C
x	643			-20 to +120°C
x	648			-20 to +180°C
x	814			0 to 100°C
x	830			0 to 180°C
x	999			special range (details in plain text)
			(5)	**Sensor cable lengths (probe shaft/filter)**
x	2			2m shaft length 150mm (180°C), sintered stainless steel filter
x	5			5m shaft length 150mm (180°C), sintered stainless steel filter
x	10			10m shaft length 150mm (180°C), sintered stainless steel filter
			(6)	**Extra codes**
x	000			no extra code
x	427			conduit fitting NPT 1/2" (for installation tube)
x	777			non-metric unit (°F)
x	785			mounting flange, aluminium
x	786			mounting flange, stainless steel
x	789			integrated LC display/operator panel
x	804			PPS plastic grid filter with stainless steel mesh
x	823			special sensor for high chemical concentrations
x	826			2 analog output channels (channel 1 and channel 2), 4 – 20mA
x	828			operating instructions in English

	(1)		**(2)**		**(3)**		**(4)**		**(5)**		**(6)**
Order code		-		-		-		-		/	, ...[1]
Order example	907023/65	-	11	-	12	-	474	-	2	/	000

[1] List extra codes in sequence, separated by commas.
[2] The operands Td, a, Tw and x are only available if Option 15 has been selected under Output variables.

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Order details:

Intrinsically safe industrial transducers for humidity, temperature and derived variables with Ex approval as per ATEX 100a 94/9/EC (PTB)

(1) Basic version

907023/68		Intrinsically safe humidity and temperature transducer with pressure-proof stainless steel sensor head on a 2m sensor cable, for process pressures from 0 – 4MPa (0 – 40bar), sensor head with sliding clamping thread; operating temperature -40 to +180°C

(2) Output variables

x	11	RH + T
x	15	RH + T + Td + a + Tw + x

(3) Analog output variables, channel 1 (and channel 2, optional)

x	.	0	If normally only one channel is used, then choose 0 for channel 2!
x	1	1	RH 0 – 100% RH
x	2	2	T (see Temperature ranges)
x	3	3	Td[2] -40 to +100°C
x	4	4	a[2] 0 – 500g/m³
x	5	5	Tw[2] 0 to 100°C
x	6	6	x[2] 0 – 500g/kg dry air
x	9	9	special scaling (details in plain text)

(4) Temperature ranges

x	474	-40 to +80°C
x	478	-40 to +120°C
x	485	-40 to +180°C
x	635	-20 to +80°C
x	643	-20 to +120°C
x	648	-20 to +180°C
x	814	0 to 100°C
x	830	0 to 180°C
x	999	special range (details in plain text)

(5) Sensor cable lengths (probe shaft/filter)

x	2	2m shaft length 178mm (180°C), sintered stainless steel filter
x	5	5m shaft length 178mm (180°C), sintered stainless steel filter
x	10	10m shaft length 178mm (180°C), sintered stainless steel filter

(6) Extra codes

x	000	no extra code
x	427	conduit fitting NPT 1/2" (for installation tube)
x	777	non-metric unit (°F)
x	787	ball valve installation kit
x	789	integrated LC display/operator panel
x	823	special sensor for high chemical concentrations
x	826	2 analog output channels (channel 1 and channel 2), 4 – 20mA
x	828	operating instructions in English

	(1)		(2)		(3)		(4)		(5)		(6)	
Order code		-		-		-		-		/		, ...[1]
Order example	907023/68	-	11	-	12	-	474	-	2	/	000	

[1] List extra codes in sequence, separated by commas.
[2] The operands Td, a, Tw and x are only available if Option 15 has been selected under Output variables.

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Order details:

Intrinsically safe industrial transducers for humidity, temperature and derived variables with Ex approval as per ATEX 100a 94/9/EC (PTB)

		(1)	**Basic version**
	907023/68L		Intrinsically safe humidity and temperature transducer with pressure-proof stainless steel sensor head (long version) on a 2m sensor cable for process pressures from 0 – 4MPa (0 – 40bar), sensor head with sliding clamping thread; operating temperature -40 to +180°C
		(2)	**Output variables**
x	11		RH + T
x	15		RH + T + Td + a + Tw + x
		(3)	**Analog output variables, channel 1 (and channel 2, optional)**
x	. 0		If normally only one channel is used, then choose 0 for channel 2!
x	1 1		RH 0 – 100% RH
x	2 2		T (see Temperature ranges)
x	3 3		Td[2] -40 to +100°C
x	4 4		a[2] 0 – 500g/m³
x	5 5		Tw[2] 0 – 100°C
x	6 6		x[2] 0 – 500g/kg dry air
x	9 9		special range (details in plain text)
		(4)	**Temperature ranges**
x	474		-40 to +80°C
x	478		-40 to +120°C
x	485		-40 to +180°C
x	635		-20 to +80°C
x	643		-20 to +120°C
x	648		-20 to +180°C
x	814		0 to 100°C
x	830		0 to 180°C
x	999		special range (details in plain text)
		(5)	**Sensor cable lengths (probe shaft/filter)**
x	2		2m shaft length 400mm (180°C), sintered stainless steel filter
x	5		5m shaft length 400mm (180°C), sintered stainless steel filter
x	10		10m shaft length 400mm (180°C), sintered stainless steel filter
		(6)	**Extra codes**
x	000		no extra code
x	427		conduit fitting NPT 1/2" (for installation tube)
x	777		non-metric unit (°F)
x	787		ball valve installation kit
x	789		integrated LC display/operator panel
x	823		special sensor for high chemical concentrations
x	826		2 analog output channels (channel 1 and channel 2), 4 – 20mA
x	828		operating instructions in English

	(1)		(2)		(3)		(4)		(5)		(6)	
Order code		-		-		-		-		/		, ...[1]
Order example	907023/68L	-	11	-	12	-	474	-	2	/	000	

[1] List extra codes in sequence, separated by commas.
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Order details:

Replacement probes for intrinsically safe industrial transducers for humidity, temperature and derived variables with Ex approval as per ATEX 100a 94/9/EC (PTB)

	(1) Basic versions
907023/S61	Probe for intrinsically safe central unit for wall mounting, operating temperature -40 to +60°C
907023/S63	Probe with a flexible sensor cable and small sensor head, operating temperature -40 to +120°C
907023/S64	Probe for process pressures from 0 – 10MPa (0 – 100bar), operating temperature -40 to +180°C
907023/S65	Probe for high process temperatures, operating temperature -40 to +180°C
907023/S68	Probe for the variable installation in pressure lines from 0 – 4MPa (0 – 40bar), operating temperature -40 to +180°C
907023/S68L	Probe for the variable installation in pressure lines from 0 – 4MPa (0 – 40bar), long version with 400mm shaft length, operating temperature -40 to +180°C

S61	S63	S64	S65	S68	S68L			
						(2)	**Sensor cable length (probe shaft)**	
x						2	120mm	probe shaft
	x					2	2m	shaft length 60mm (120°C)
	x					5	5m	shaft length 60mm (120°C)
	x					10	10m	shaft length 60mm (120°C)
		x				2	2m	shaft length 150mm (180°C)
		x				5	5m	shaft length 150mm (180°C)
		x				10	10m	shaft length 150mm (180°C)
			x			2	2m	shaft length 150mm (180°C)
			x			5	5m	shaft length 150mm (180°C)
			x			10	10m	shaft length 150mm (180°C)
				x		2	2m	shaft length 178mm (180°C)
				x		5	5m	shaft length 178mm (180°C)
				x		10	10m	shaft length 178mm (180°C)
					x	2	2m	shaft length 400mm (180°C)
					x	5	5m	shaft length 400mm (180°C)
					x	10	10m	shaft length 400mm (180°C)
						(3)	**Humidity sensor**	
x	x	x	x	x	x	000	humidity sensor (standard)	
x	x	x	x	x	x	823	special sensor for high chemical concentrations	
						(4)	**Sensor protection / filter**	
x						801	PPS plastic grid filter with PTFE membrane	
x		x	x	x	x	803	sintered stainless steel filter	
x	x	x	x			804	PPS plastic grid filter with stainless steel mesh	
x						805	PPS plastic grid filter without stainless steel mesh	
						(5)	**Installation kits**	
x	x	x	x	x	x	000	no installation kit	
	x					783	duct installation kit	
			x			785	mounting flange, aluminium	
			x			786	mounting flange, stainless steel	
				x	x	787	ball valve installation kit	

	(1)		(2)		(3)		(4)		(5)
Order code		-		-		-		-	
Order example	907023/S61	-	2	-	000	-	805	-	000

Note:
The replacement probes can be universally combined with the central unit of the intrinsically safe industrial transducers!

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Order details:

Accessories for intrinsically safe industrial transducers for humidity, temperature and derived variables with Ex approval as per ATEX 100a 94/9/EC (PTB)

			(1)	**Basic versions**
			907023/90	Filter (13.5mm dia.)
			907023/91	Replacement humidity sensor
			907023/92	Replacement temperature sensor
			907023/93	Humidity sensor checks
			907023/94	Duct installation kit
			907023/95	Mounting flange
			907023/96	Ball valve installation kit
			907023/88	Interface cable (service interface)[1]
			(2)	**Filter (13.5mm dia.)**
x			801	PPS plastic grid filter with PTFE membrane
x			803	sintered stainless steel filter
x			804	PPS plastic grid filter with stainless steel mesh
x			805	PPS plastic grid filter without stainless steel mesh
			(2)	**Replacement humidity sensor**
	x		814	HUMICAP® 180
			(2)	**Replacement temperature sensor**
		x	816	Pt 1000 1/3 DIN Class B to EN 60 751
			(2)	**Humidity sensor checks**
		x	820	33% RH magnesium chloride
		x	821	53% RH magnesium nitrate
		x	822	76% RH sodium chloride
			(2)	**Duct installation kit**
		x	783	duct installation kit (for type 907023/63)
			(2)	**Mounting flange**
	x		785	aluminium (for type 907023/65)
	x		786	stainless steel (for type 907023/65)
			(2)	**Ball valve installation kit**
		x	787	ball valve installation kit (for type 907023/68 and .../68L)
			(2)	**Interface cable**
		x	817	interface cable for service interface

	(1)		**(2)**
Order code		-	
Order example	907023/90	-	804

[1] Generally, the interface cable may only be used outside the hazardous area, and only temporarily for instrument operation! Its use for data transmission from a hazardous location is not permissible, because of the increased safety requirements of EN 50 284 for Category 1 devices!

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Stock versions:

Accessories for intrinsically safe industrial transducers for humidity, temperature and derived variables with Ex approval as per ATEX 100a 94/9/EC (PTB)

(1)		(2)	Sales No.
	-		
907023/90	-	801	90/00378136
907023/90	-	803	90/00342673
907023/90	-	804	90/00343462
907023/90	-	805	90/00342672
907023/92	-	816	90/00387458
907023/93	-	820	90/00332758
907023/93	-	821	90/00332759
907023/93	-	822	90/00332760
907023/94	-	783	90/90590560
907023/95	-	785	90/90590561
907023/95	-	786	90/90590562

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Hygro/hygrothermal transducers (hygrometric)

Duct version

Indoor version

- **for measuring relative humidity and temperature**
- **for mounting indoors, outdoors, and in air ducts**
- **with resistance, current or voltage outputs**
- **for permanent use in the high-humidity range up to 100% RH (duct version)**
- **no power supply necessary for passive instruments**
- **sensing element does not need any maintenance in clean air (no regeneration necessary)**

Humidity transducers in the 907031 series make use of the hygroscopic property of specially prepared plastic fibers to determine relative humidity in air. After this preparation, the integrated humidity sensing element is capable of absorbing moisture. The effect that can be measured externally is a change in length. A precision mechanism senses the humidity-dependent change in length, transmits this movement to the slider of a resistive track and produces it as a linearized resistance output at the terminals.

The standard output is 100 — 138.5Ω, thus corresponding to a Pt100 signal. This enables the direct connection to standard measurement, control and recording instruments, for processing the measurement signal.

Other instrument versions with different resistance outputs, with normalized current or voltage output signals as well as humidity transducers with additional temperature acquisition complete the product spectrum.

The humidity transducers are suitable for both climatic applications and industrial humidity measurement. Of particular advantage is the fact that the sensing element is highly resistant to water, which permits continuous use in the high-humidity range, up to saturation level. Under normal atmospheric conditions, the sensing element requires practically no maintenance. Any dirt deposits resulting from dust-laden air can be washed off. The working range of the sensing element covers 30 to 100% RH at permissible ambient temperatures from -40 to +80°C. Instrument versions with a passive output offer the additional advantage of not needing a power supply of their own for operation.

General applications include climate monitoring, ventilation, humidifying and de-humidifying installations, storage of fruit and vegetables as well as ripening areas for food.

Technical data

Humidity

Sensing element:	plastic, hygrometric sensing element is water-resistant and largely maintenance-free
Measuring/working range:	0/30 — 100% RH
Measuring accuracy:	±2.5% RH above 40% RH to tolerance characteristic below 40% RH TK = 0.1% RH/°C (referred to 20°C and 50% RH)
Medium:	air, unpressurized, not corrosive
Permissible air velocity:	duct version: 8m/sec max. (15m/sec with wind shield) indoor version: 15m/sec max.
Response times:	50% time: 1.5min at v = 2m/sec stabilization time: 30 to 40min at v = 2m/sec
Humidity output (passive):	0 — 100Ω linear, 2-wire circuit 0 — 200Ω linear, 2-wire circuit 0 — 1000Ω linear, 2-wire circuit 100 — 138.5Ω linear, 2-wire circuit (Pt100 standard values, see Data Sheet 90.6000)
Permissible loading:	1.0W
Electric strength:	42V
Insulation resistance:	10MΩ
Humidity output (active):	0 — 20mA, 4-wire circuit 4 — 20mA, 2-wire circuit 0 — 10V, 3-/4-wire circuit

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e-mail: info@JumoUSA.com
Internet: www.JumoUSA.com

Technical data

Temperature

Sensing element:	Pt100 temperature sensor to EN 60 751
Measuring range:	duct version, passive: -40 to +80 °C (take note of permissible ambient temperature) duct version, active: -30 to +100 °C (take note of permissible ambient temperature) indoor version, passive: 0 to 60 °C
Measuring accuracy:	±0.5 °C
Temperature output (passive):	Pt100
Measuring current:	1 mA (recommended)
or current/voltage signal:	0 — 20 mA, 4-wire circuit 4 — 20 mA, 2-wire circuit 0 — 10 V, 3-/4-wire circuit

Electrical data for active versions with transmitter

Supply voltage:	15 — 30 V DC also 24 V AC ±10 % (for 0 — 10 V output)
Burden:	500 Ω max. for current output
Load resistance:	10 kΩ min. for voltage output
Power consumption:	5 mA per measuring range, 10 mA with AC version
Linearity error:	<0.5 % for temperature output
Output signals:	0 — 20 mA; 4 — 20 mA; 0 — 10 V
Electromagnetic compatibility:	immunity to interference EN 50 082-2 interference emission EN 50 081-2

Construction

Housing:	duct version: ABS plastic fitted with stainless steel probe indoor version: ABS plastic
Cable entry:	duct version: via M 20x1.5 gland indoor version: via flush-type box
Terminals:	for conductor cross-sections up to 0.5 mm²
Protection:	duct version: IP64 indoor version: IP20
Ambient temperature:	duct version: -20 to +60 °C on housing, -40 to +80 °C on probe indoor version: 0 to 60 °C
Operating position:	probe tube vertically downwards or horizontal, mounted directly through openings in housing or, optionally, by mounting flange. On indoor version unrestricted, the ventilation slots preferably at right angles to the air flow.
Weight:	duct version: approx. 400 g indoor version: approx. 200 g

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Maintenance notes

Humidity sensor

The hygrometric sensor requires no maintenance in normally clean air. Corrosive media or those containing solvents may cause faulty readings or failure depending on the type and concentration. As is the case with nearly all humidity sensors, any deposits that may form a water-repellent film on the sensor are liable to cause damage, for instance, resin aerosols, paint aerosols or fumigating substances.

Avoid direct sunlight.

Indoor version

Cleaning and adjustment of the sensor can only be carried out in the factory.

Duct version

The special sensing element is water-resistant and can be cleaned in water. Do not use strong solvents. When using gentle detergents, rinse the sensing element thoroughly afterwards. Only rinse the plastic sensing element and the stainless steel protection tube in water, not the housing head.

Calibration

A special ageing process ensures long-term stability of the humidity sensing element. The regeneration known from hair sensor elements is not required.

The transducers are factory-calibrated at 23 °C room temperature and 50 % RH. The calibration can be checked (on the duct version only) using the sensor checks that are available as accessories. In addition, the sensor will indicate 100 % RH when the sensing element is wetted with water. Should recalibration become necessary, this can be done by carefully adjusting the setting screw at the tip of the protection tube. Please note that a very slight movement of the adjusting screw when the sensing element is wet will produce a fairly large change in the calibration in the dry range.

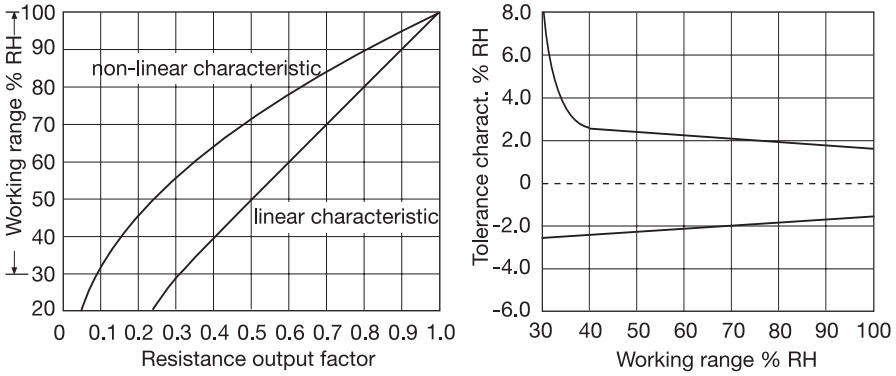
Drying

After cleaning, the humidity sensor must not be dried with warm or hot air, by using a hair drier, for example.

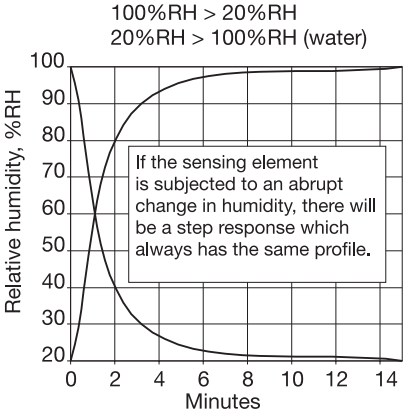
Caution

Interference with internal parts will invalidate any warranty claim.

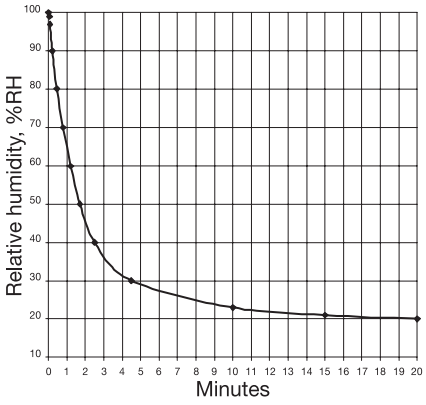
Humidity tolerance characteristic



Step response for Polyga



Reaction of the Polyga sensing element



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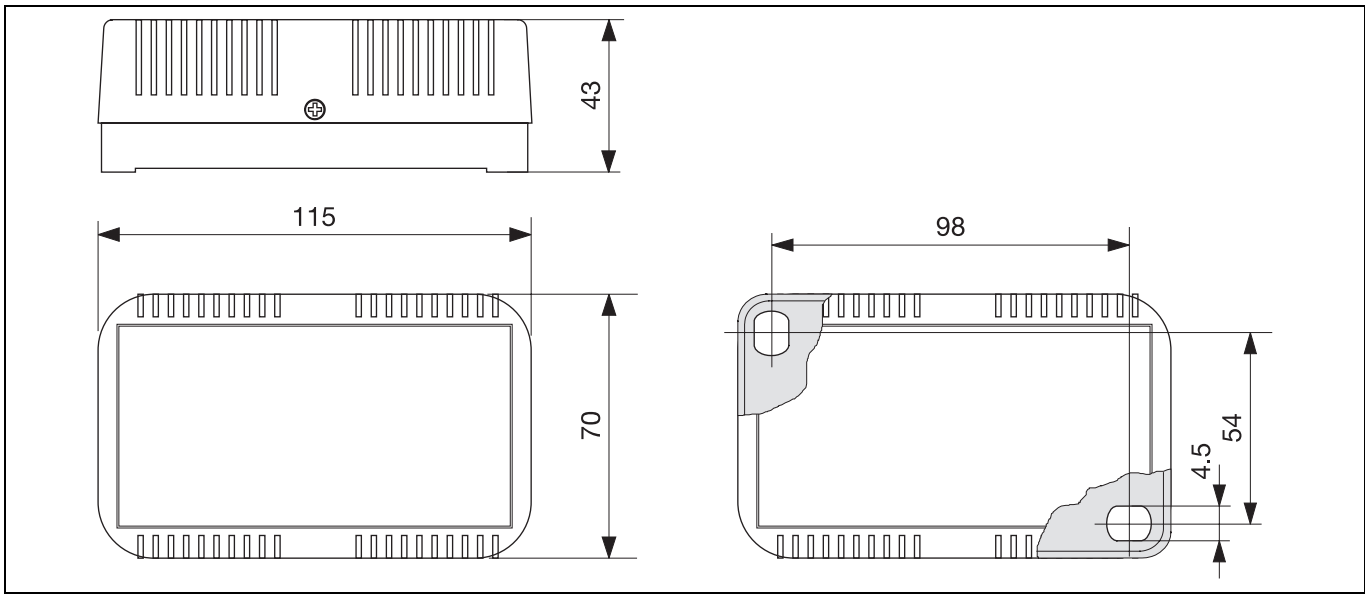
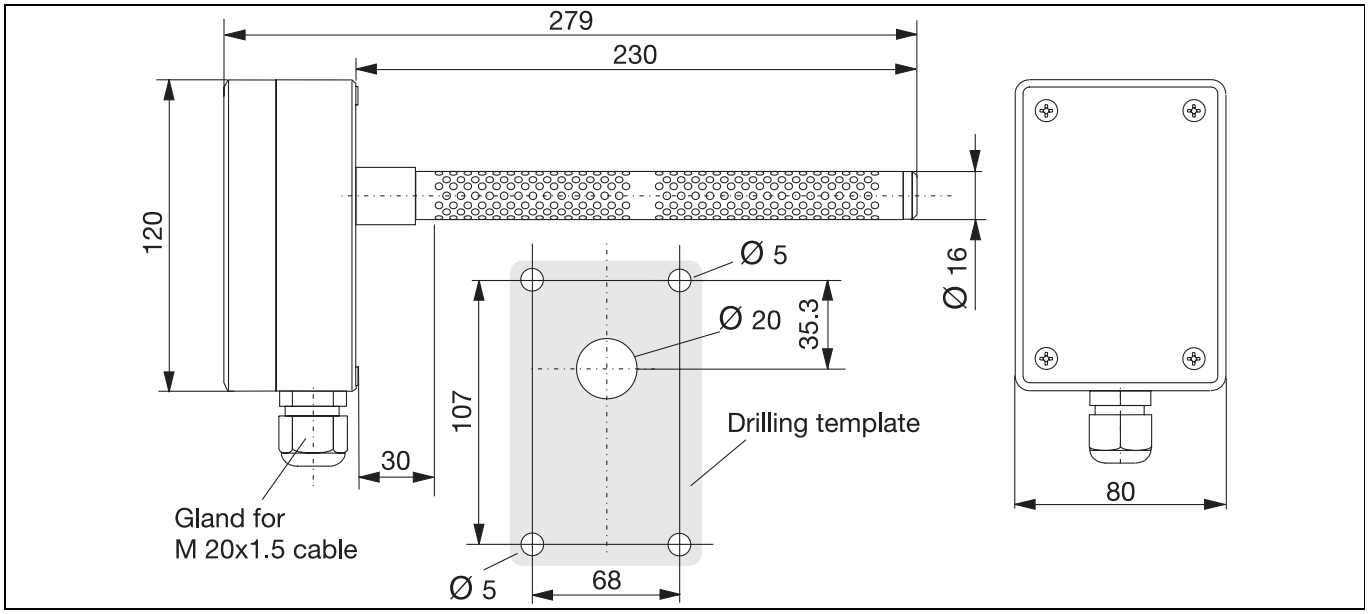
Dimensions

Indoor version

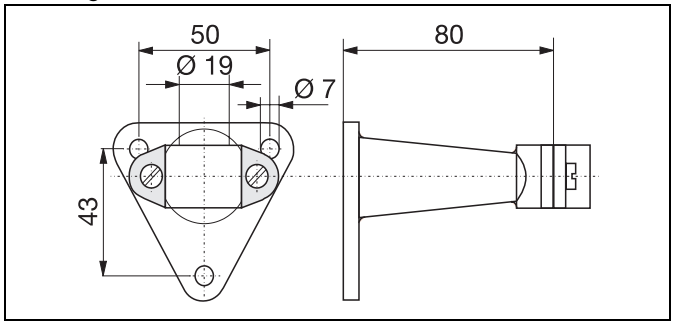


Duct version

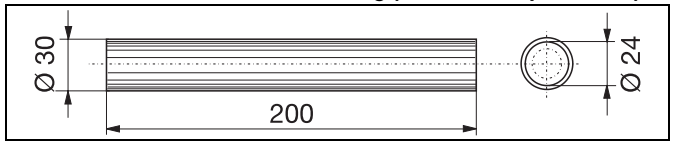


Accessories

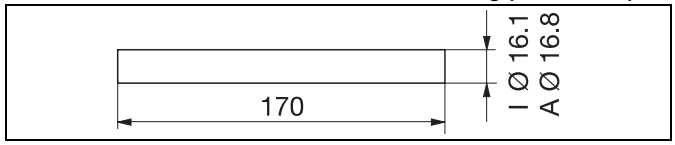
Mounting bracket



Protection tube for outdoor mounting (sun and rain protection)



Protection tube for indoor and outdoor mounting (wind shield)



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Connection diagrams

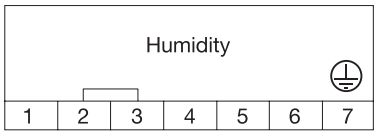
Connection diagram for passive transducers with resistance output

Connection diagram for active transducers, supply voltage 15 — 30V DC (24V AC only with 0 — 10V DC output)

EMC note: use screened signal cables and ground the screen!

4-wire circuit

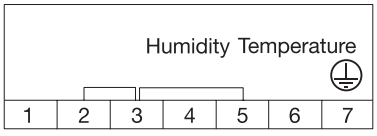
Hygro transducer with transmitter



15...30VDC 0...20mA

not electrically isolated

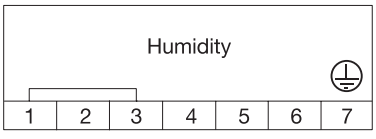
Hygrothermal transducer with transmitter



15...30VDC 0...20mA 0...20mA

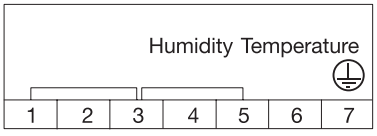
not electrically isolated

3- or 4-wire circuit



15...30VDC 0...10VDC
or
24VAC

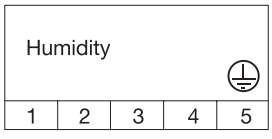
not electrically isolated



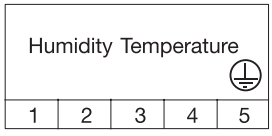
15...30VDC 0...10VDC 0...10VDC
or
24VAC

not electrically isolated

2-wire circuit



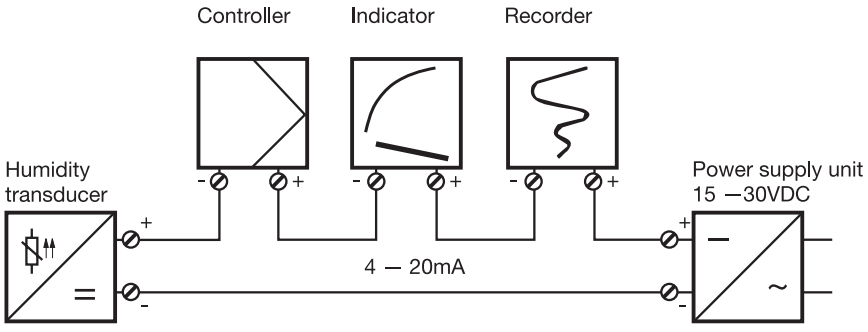
15...30VDC
4...20mA



15...30VDC 15...30VDC
4...20mA 4...20mA

electrically isolated

Block diagram for 2-wire circuit 4 — 20mA



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Order details: Hygro/hygrothermal transducers (hygrometric)

					(1)	**Basic version**
				907031/10		Hygro/hygrothermal transducer, indoor version (passive)
				907031/20		Hygro/hygrothermal transducer, duct version (passive)
				907031/30		Hygro/hygrothermal transducer, duct version (active)
				907031/50		Hygro/hygrothermal transducer, duct version (Ex i)***
					(2)	**Hygro/hygrothermal transducers**
x	x	x	x	1		humidity
		x		2		humidity and temperature
x	x		x	3		humidity and temperature (passive)
					(3)	**Ranges***
			x	09		0 to 100 % RH / -20 to +40 °C
		x		21		0 to 100 % RH / -30 to +60 °C
	x			15		0 to 100 % RH / -40 to +80 °C
x				34		0 to 100 % RH / 0 to 60 °C
		x		36		0 to 100 % RH / 0 to 100 °C
x	x	x		99		special range (on request)
					(4)	**Output signals (humidity / temperature)****
x	x			016		0 — 100 Ω (2-pole output, linear) / Pt100 (passive)
x	x			017		0 — 200 Ω (2-pole output, linear) / Pt100 (passive)
x	x		x	019		0 — 1000 Ω (2-pole output, linear) / Pt100 (passive)
x	x		x	021		100 — 138.5 Ω (2-pole output, linear) / Pt100 (passive)
		x		005		4 — 20 mA / 4 — 20 mA
		x		011		0 — 20 mA / 0 — 20 mA
		x		065		0 — 10 V DC / 0 — 10 V DC
x	x	x		999		special output (on request)
					(5)	**Extra codes**
x	x	x	x	000		no extra code
	x	x	x	764		mounting bracket (for wall fixing)
	x	x	x	797		wind shield (indoor and outdoor mounting)
	x	x	x	798		sun and rain protection (outdoor mounting)
	x	x	x	799		mounting flange (not absolutely necessary)

	(1)		(2)		(3)		(4)		(5)	
Order code		-		-		-		/		, ...
Order example	907031/10	-	1	-	15	-	016	/	000[1]	

1. List extra codes in sequence, separated by commas.
* Please note humidity working range and max. permissible ambient temperature (see Technical data).
** With selection (2) type code 1 "humidity", the second output signal is not applicable with selection (4).
*** The transducer may only be operated in an intrinsically safe circuit.
Please make sure you only use approved safety barriers, transmitters and devices suitable for the Ex area when operating in the hazardous area!

Note
Suitable power supply units for transmitters (not for Type 907031/50) can be found in Data Sheet 70.7500 (95.6024).
Recommended power supply units: Type TN-22/02, 055 (1-channel) and TN-67/02, 055 (4-channel)

Stock versions

(1)		(2)		(3)		(4)		(5)	Sales No.
	-		-		-		/		
907031/10	-	1	-	34	-	021	/	000	90/90590502
907031/10	-	3	-	34	-	021	/	000	90/90590507
907031/20	-	1	-	15	-	021	/	000	90/90590512
907031/20	-	1	-	15	-	019	/	000	90/00403758
907031/20	-	3	-	15	-	021	/	000	90/90590517
907031/30	-	1	-	21	-	005	/	000	90/90590541
907031/30	-	1	-	21	-	065	/	000	90/00332704
907031/30	-	2	-	21	-	065	/	000	90/00332705
907031/30	-	2	-	21	-	005	/	000	90/90590544
907031/30	-	2	-	36	-	005	/	000	90/90590543

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Order details: Accessories

		(1)	**Basic version**
	907031/90		Mounting bracket for duct version
	907031/91		Protection tube for duct version
	907031/92		Mounting flange for duct version
	907031/93		Humidity sensor checks
		(2)	**Mounting bracket for duct version**
x	764		Wall bracket (black plastic)
		(2)	**Protection tube for duct version**
x	797		wind shield (indoor and outdoor mounting)
x	798		sun and rain protection (outdoor mounting)
		(2)	**Mounting flange for duct version**
x	799		oval mounting flange (galvanized steel)
		(2)	**Extra codes**
x	820		33 % RH magnesium chloride
x	821		53 % RH magnesium nitride
x	822		76 % RH sodium chloride

	(1)		**(2)**
Order code		-	
Order example	907031/90	-	764

Stock versions

(1)		**(2)**	**Sales No.**
	-		
907031/90	-	764	90/60171300
907031/91	-	797	90/00323439
907031/91	-	798	90/00321186
907031/92	-	799	90/60677200
907031/93	-	820	90/00332758
907031/93	-	821	90/00332759
907031/93	-	822	90/00332760

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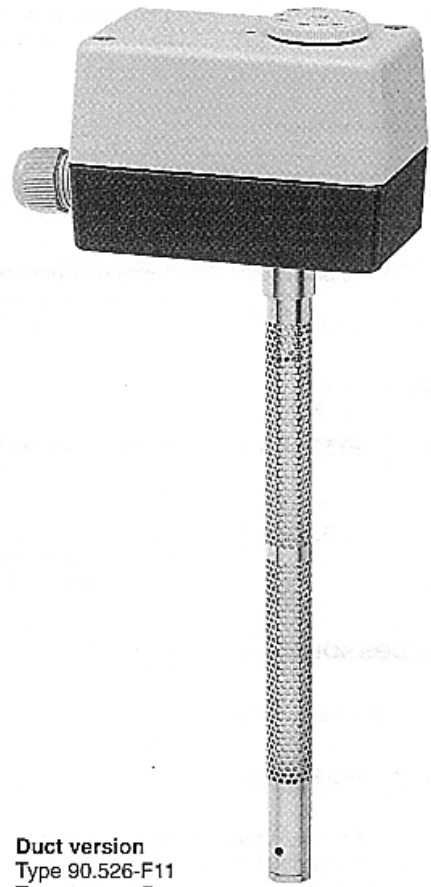
JUMO
MEASUREMENT AND CONTROL

Hygrostats (hygrometric)

- **for on-off control of relative humidity**
- **in air ducts, climatic cabinets, storage and cold rooms**
- **for controlling humidifying and de-humidifying plant**
- **for duct, wall and C-rail mounting**



Duct version
Type 90.526-F11
Type 90.526-F12

Specially prepared plastic fibres are used as the sensing element in hygrostats. The hygroscopic properties of the fibres produce a proportional change in the length of the sensing element with changes in relative humidity.

The length change is transmitted through a precision mechanism to a microswitch with an extremely small switching displacement. Movement of the setting knob shifts the mechanism so that the microswitch is operated when the relative humidity setting is reached.

The duct version is also available with two changeover contacts.
The contact spacing is adjustable within the range 3 — 18 % rH.

Compact version
Type 90.526-F06
Type 90.526-F07

Indoor version
Type 90.526-F01

Technical data

Sensing element
plastic, hygrometric

Range (scale)
30 — 100 relative humidity (% rH)

Working range (adjustment range)
35 — 100 % rH

Accuracy
± 3.5 % above 50 % rH at 23 °C
± 4.0 % below 50 % rH at 23 °C

Medium
air, atmospheric pressure, not corrosive

50 % response time
90 sec approx. at v = 2 m / sec

Switching differential
(microswitch) 3 — 6 % rH approx.
contact spacing with two switches
3 — 18 % rH

Switch rating
duct version:
resistive load 15 A at 230 V AC
inductive load 2 A at 230 V AC
(p.f. = 0.7)
DC circuit 250 mA at 230 V DC
low-voltage circuit 100 mA at 24 V AC

indoor and compact version:
resistive load 5 A at 230 V AC
inductive load 0.2 A at 230 V AC
(p.f. = 0.8 min.)

Switching voltage
up to 80 % rH 250 V AC max.
up to 100 % rH 24 V DC max.

WARNING:
250 V only if it can be ensured that there is no condensation inside the hygrostat head, otherwise flash-over must be expected.

Electromagnetic compatibility
interference immunity EN 50 082-2
interference emission EN 50 081-2

Construction

Case
duct version:
ABS plastic
with stainless steel shaft

indoor / compact version:
high impact strength plastic, light grey

Permitted ambient temperature
duct version:
– 40 to +80 °C on shaft
– 20 to +60 °C on case

indoor / compact version:
– 20 to +60 °C

Permitted air velocity
duct version:
8 m / sec max.
(with gauze protection: 15 m / sec max.)

indoor / compact version:
15 m / sec max.

Protection
duct version:
IP54

indoor/compact version:
IP20

Operating position:
unrestricted, preferably probe vertically downwards. On indoor / compact version the ventilation slots preferably at right angles to the air flow.

Installation
direct case mounting, or bracket for duct version, also C rail mounting (Type 90.526-F07)

Weight
duct version:
700 g approx.

indoor / compact version:
300 g approx.

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JUMO
MEASUREMENT AND CONTROL

Models

Indoor version

Item	Type	Output	Switch rating	Mounting	Sales No.
1	90.526-F01	1 changeover contact for humidifying and de-humidifying	5 A 230 V AC	wall mounting	90 / 90590520 ●

Compact version

2	90.526-F06	1 changeover contact for humidifying and de-humidifying	5 A 230 V AC	wall mounting	90 / 90590509 ●
	90.526-F07	1 changeover contact for humidifying and de-humidifying	5 A 230 V AC	C rail mounting	90 / 90590510 ●

Duct version

3	90.526-F11	1 changeover contact for humidifying and de-humidifying	15 A 230 V AC	duct or bracket mounting	90 / 90590523 ●
	90.526-F12 *	2 changeover contacts for humidifying and de-humidifying contact spacing 3 — 18% rH	15 A 230 V AC	duct or bracket mounting	90 / 90590546 ●

Accessories

for duct version only

4	Bracket	90 / 60171300 ●
	Protection tube for outdoor installation (sunlight and rain protection) Protection tube for indoor and outdoor installation (wind shield)	90 / 00321186 90 / 00323439
	Humidity Sensorcheck 33 % rH Humidity Sensorcheck 55 % rH Humidity Sensorcheck 76 % rH	90 / 00332758 90 / 00332759 90 / 00332760

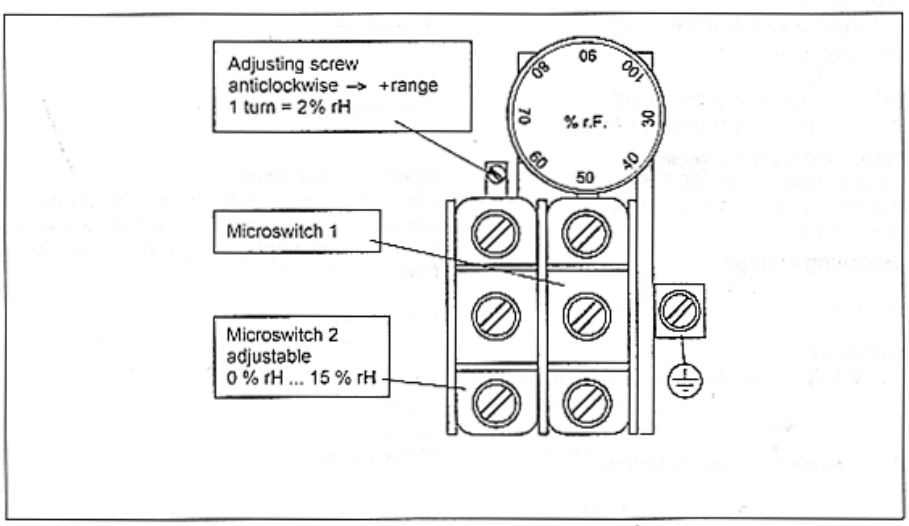
*** Adjustment of second setpoint**

The hygrostat Type 90.526-F12 is set at the factory so that setpoint 2 is 6 % rH higher than setpoint 1.

The neutral dead zone (spacing between setpoints 1 and 2) can be adjusted with a screwdriver after removing the housing cover.

Anticlockwise rotation shifts setpoint 2 upwards from 3 — 18 % rH (referred to setpoint 1).

The neutral zone can be determined by rotating the setting knob.



● Available from stock

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JUMO
MEASUREMENT AND CONTROL

Maintenance notes

Humidity sensor

The hygrometric sensor requires no maintenance in normally clean air. Corrosive media or those containing solvents may cause faulty readings or complete failure depending on type and concentration. As with nearly all humidity sensors, any deposits forming a water-repellent film on the sensor are liable to result in faulty operation; these include resin aerosols, paint aerosols, smoking substances etc.

Direct sunlight should be avoided.

Indoor/compact version

Cleaning and adjustment of the sensor can only be carried out at the factory.

Duct version

The special sensor is water-resistant and can be cleaned with water. Strong solvents must not be used. When using a gentle domestic detergent the sensor must then be rinsed thoroughly. Only the plastic sensor and the stainless steel protection tube may be rinsed with water, not however the case head.

Calibration

The humidity sensing elements have a good long-term stability through the use of a special ageing procedure. The regeneration known from hair sensors is therefore not required in this case.

Hygrostats are factory-calibrated at 23 °C ambient temperature and 50 % rH. Checking (duct version only) is possible using the Sensorchecks available as accessories.

In addition, the hygrostat indicates 100 % rH when the sensor is wetted with water. If any readjustment should become necessary this can be done by very gently turning the adjusting screw at the tip of the protection tube. Note that slight movement of the adjusting screw when the sensor is wet produces a very appreciable change of the measurement in the dry range.

Drying

After cleaning the humidity sensor must not be dried with warm or hot air, for example by using a hair drier.

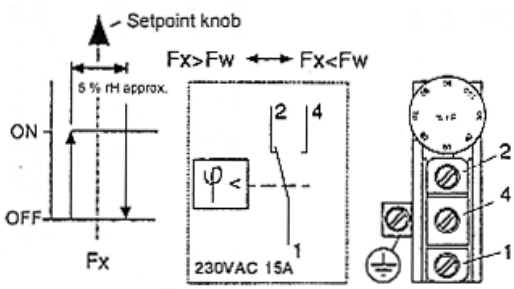
WARNING:

Contact with internal parts invalidates any warranty claim.

Connection diagrams

Duct version

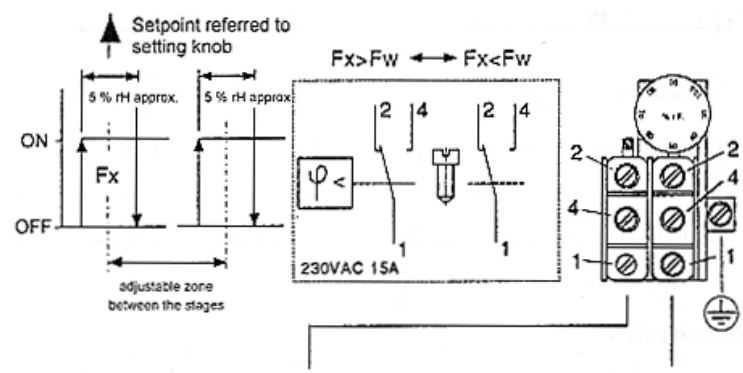
... with **one** changeover contact



F_x rel. humidity of air (actual value)
F_w humidity set on the knob (setpoint)

If the rel. humidity F_x drops below the setpoint F_w, contact 1 - 2 opens and contact 1 - 4 closes.

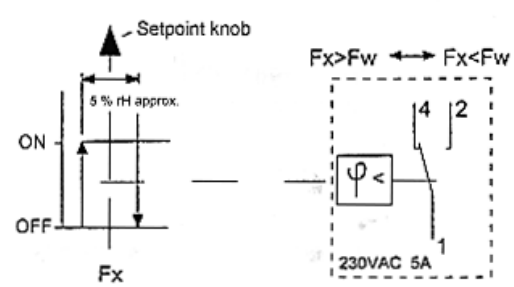
... with **two** changeover contact



Changeover contact 2 referred to adjusting screw

Changeover contact 1 referred to setpoint knob

Indoor / compact version



F_x rel. humidity of air (actual value)
F_w humidity set on the knob (setpoint)

If the rel. humidity F_x drops below the setpoint F_w, contact 1 - 4 [7 - 5] opens and contact 1 - 2 [7 - 6] closes.

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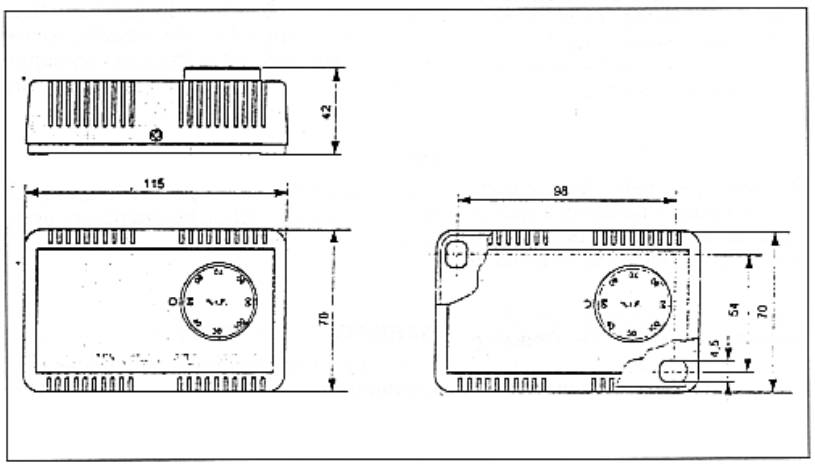
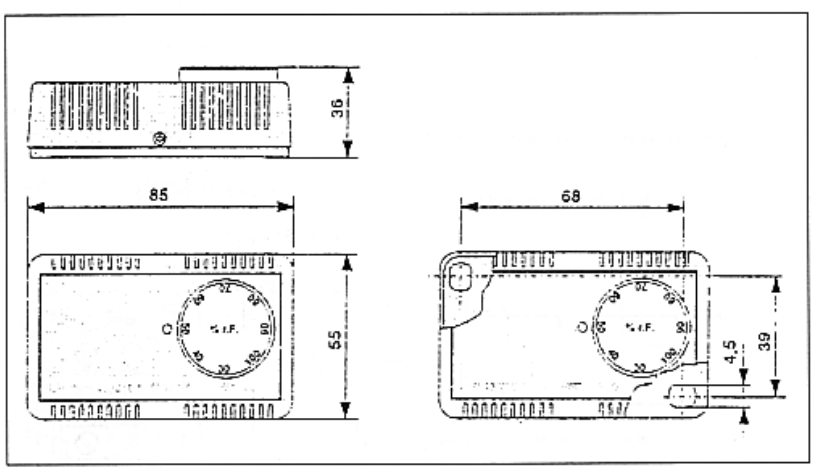
Dimensions

indoor version

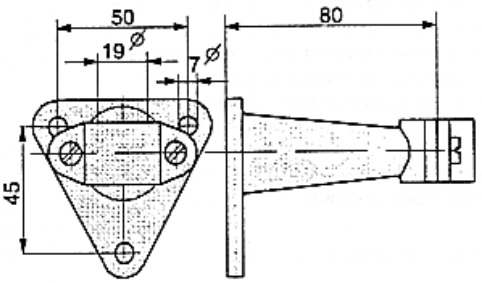


Compact version



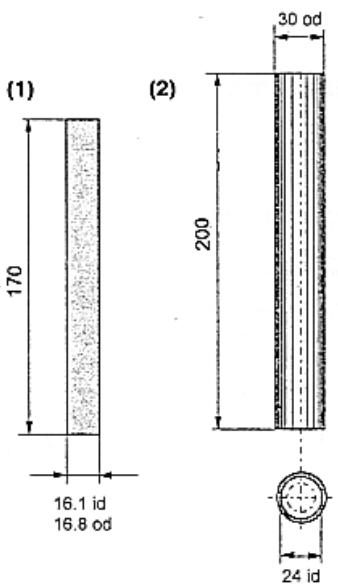
Accessories

Bracket



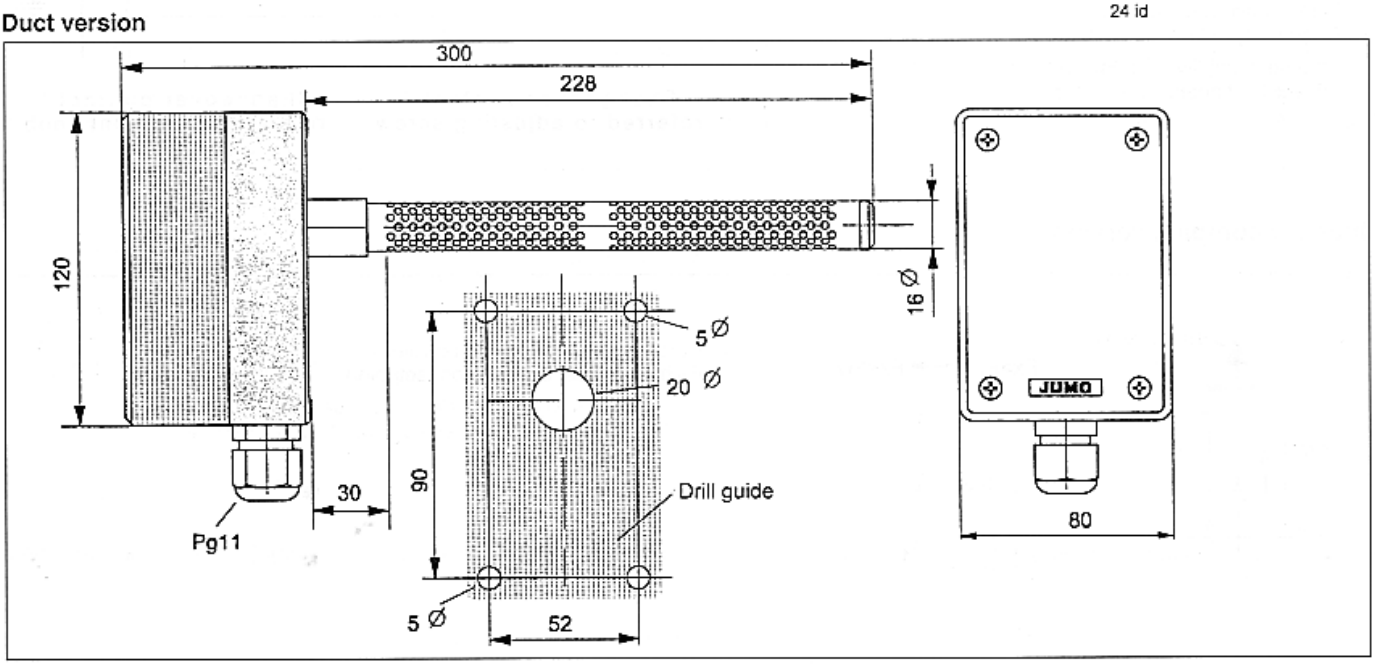
Protection tube (1)
for outdoor installation
(sunlight and rain protection)

Protection tube (2)
for indoor and outdoor
installation (wind protection)



mm	inch
4.5	0.18
5	0.20
7	0.28
16	0.63
16.1	0.634
16.8	0.661
19	0.75
20	0.79
24	0.94
30	1.18
35.3	1.39
36	1.42
39	1.54
42	1.65
45	1.77
50	1.97
54	2.13
55	2.17
68	2.68
70	2.76
80	3.15
85	3.35
98	3.86
115	4.53
120	4.72
170	6.7
228	9.0
300	11.8

Duct version



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Contents:

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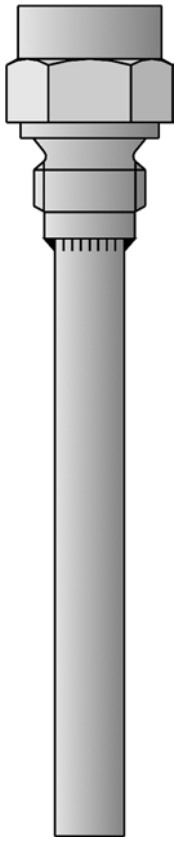
Screw-in and weld-in pockets



- **for thermocouples and resistance thermometers**
- **thermometers can be replaced without draining the system**
- **pockets in different materials**
- **operating pressure up to 450bar**
- **available with acceptance certificate 3.1B (machined from solid)**

Screw-in and weld-in pockets are used for installing thermocouples and resistance thermometers whenever replacement without draining the system and/or pressure resistance are required.

The dimensions specified for **EL** refer to the fitting lengths of the thermometers; the dimension **L** indicates the fitting length of the pocket.

The pressure resistance is dependent on the temperature and is specified for each item. The maximum pressure that can be sealed on the thread depends on the installation conditions and may be lower. The pressure specifications contain no safety margin for additional loading through flow velocity.
Calculations of the permitted pressure under given conditions of flow, temperature and medium can be provided as a service to the user.

Acceptance test certificate:
3.1B, can be requested when ordering

Technical data

Process connection	for welding in: dia. 24H7, dia. 30H11 for screwing in: G 1/2 (1/2" pipe), G 3/4 (3/4" pipe)
Protection tube	Material: steel 1.0305 stainless steel 1.4571 steel 1.7335 others on request
Operating temperature range	up to 450°C, take note of loading diagrams!

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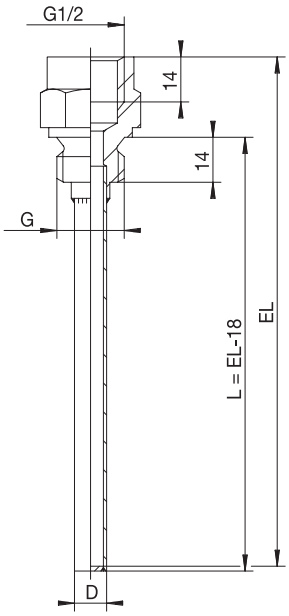
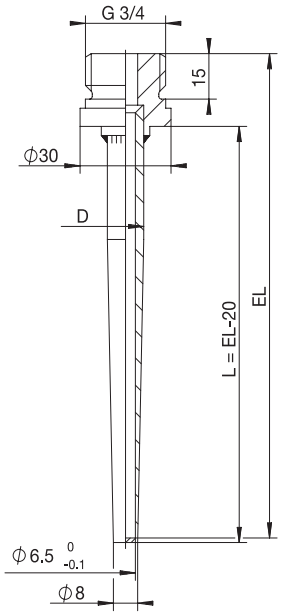
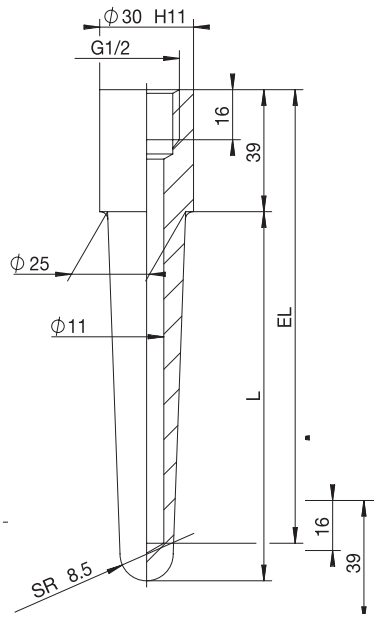
Dimensions



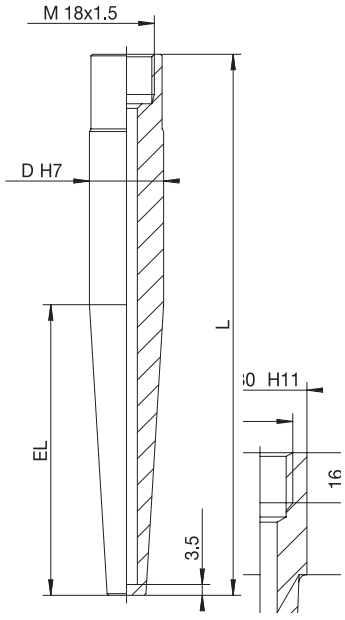
Type 909721/10
Type 909721/11



Type 909721/15



Type 909721/20



Type 909721/25

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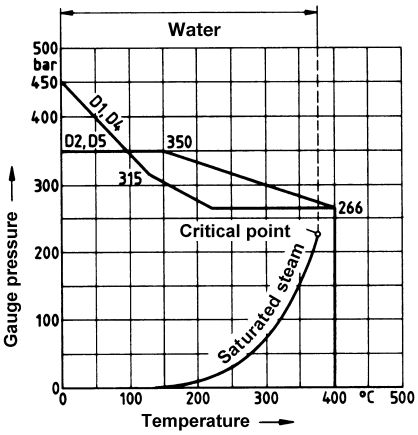
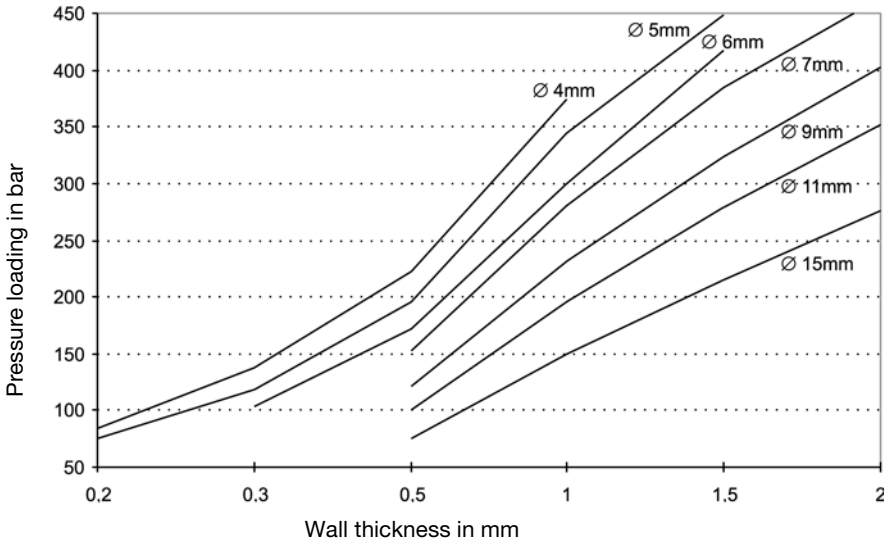
Loading diagrams



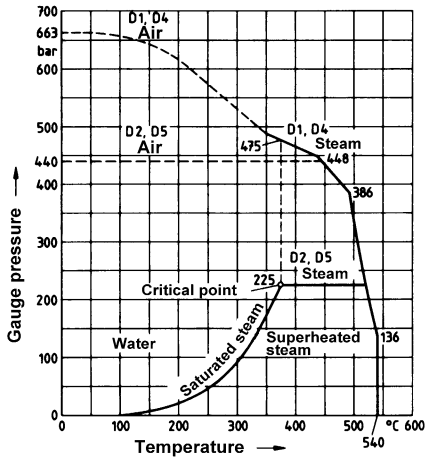


Loading of protection tubes Form D to DIN 43 763 Type 909721/25

Tube: st. steel X6 CrNiMoTi 17 12 2, Material Ref. 1.4571

Protection tubes D1 and D4:
Permissible flow velocity for
air, water, superhtd. steam: up to 60m/sec

Protection tubes D2 and D5:
Permissible flow velocity
for air: up to 60m/sec
for water, superheated steam: up to 30m/sec



Loading on protection tubes Form D to DIN 43 763 Type 909721/25

Tube: steel 13 CrMo 44, Material Ref. 1.7335

Permissible flow velocity for
air and superheated steam: up to 60m/sec

Loading in water: up to 450 bar and up to 5m/sec

Load limits on protection tubes, for various tube dimensions

The diagram shows the load limits (guide values) for different tube dimensions. The maximum pressure loading of cylindrical protection tubes is shown in relation to the wall thickness with different tube diameters. The data refer to protection tubes in stainless steel 1.4571, fitting length 100mm, flow velocity 10m/sec in air or 4m/sec in water and a temperature range from -20 to +100°C. A safety factor of 1.8 has been taken into account. For higher temperatures, or different materials, the maximum pressure loading has to be reduced by the percentage values given in the table.

Material	Temperature	Reduction
CrNi 1.4571	up to +200°C	-10%
CrNi 1.4571	up to +300°C	-20%
CrNi 1.4571	up to +400°C	-25%
CrNi 1.4571	up to +500°C	-30%
CuZn 2.0401	up to +100°C	-15%
CuZn 2.0401	up to +175°C	-60%

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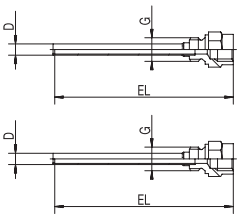
Order details: Screw-in pockets

(1) Pocket type

		909721/10	Screw-in pocket, cylindrical, with female thread G 1/2 (1/2" pipe) (similar to DIN 16 179 Form D)
		909721/11	Screw-in pocket, cylindrical, with female thread G 1/2 (1/2" pipe) (DIN 16 179 Form D)



			(2) Operating temperature in °C (also see loading diagram)
x	x	848	0 to 400°C
			(3) Protection tube diameter D in mm
x		10	outside diameter 10mm / inside diameter 8mm
	x	13	outside diameter 13mm / inside diameter 11mm
			(4) Fitting length EL of thermometer in mm
x	x	100	100mm
x		150	150mm
	x	160	160mm
	x	250	250mm
			(5) Process connection
x	x	104	screw fitting G 1/2 (1/2" pipe thread)
			(6) Protection tube material
x	x	26	stainless steel 1.4571 (max. 400°C)
			(7) Extra codes
x	x	000	no extra code

	(1)		(2)		(3)		(4)		(5)		(6)		(7)
Order code		-		-		-		-		-		/	
Order example	909721/10	-	848	-	10	-	100	-	104	-	26	/	000

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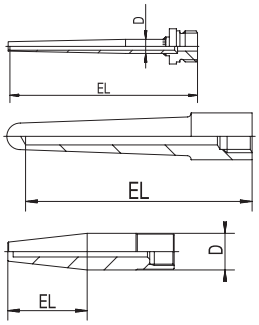
Order details: Weld-in pockets

(1) Pocket type

			909721/15	Weld-in pocket, tapered, with male thread G 3/4 (3/4" pipe)
			909721/20	Weld-in pocket, tapered, with female thread G 1/2 (1/2" pipe) (DIN 16 179 Form S)
			909721/25	Weld-in pocket, with female thread M 18x1.5 (DIN 43 763 Form D)



				(2) Operating temperature in °C (also see loading diagram)
x	x	x	848	0 to 400°C
	x	x	854	0 to 500°C
				(3) Protection tube diameter D in mm
x			12	outside diameter 12mm stepped down to 8mm / inside diameter 6.5mm
		x	24	outside diameter 24mm stepped down to 12.5mm / inside diameter 7mm
	x		25	outside diameter 25mm stepped down to 17mm / inside diameter 11mm
				(4) Fitting length EL of thermometer in mm
		x	65 (140)	65mm (L = 140mm)[1] (Form D1)
		x	65 (200)	65mm (L = 200mm) (Form D4)
x			100	100mm
		x	125 (200)	125mm (L = 200mm) (Form D2)
		x	125 (260)	125mm (L = 260mm) (Form D5)
x	x		160	160mm
x			190	190mm
x			220	220mm
	x		250	250mm
				(5) Process connection
x	x	x	000	weld-in pocket
				(6) Protection tube material
x			03	steel 1.0305
	x	x	26	stainless steel 1.4571 (max. 400°C)
	x	x	36	steel 1.7335 (max. 500°C)
				(7) Extra codes
	x	x	000	no extra code
x	x	x	374	acceptance test certificate APZ 3.1 B material

	(1)		(2)		(3)		(4)		(5)		(6)		(7)
Order code		-		-		-		-		-		/	
Order example	909721/15	-	848	-	12	-	100	-	000	-	03	/	374

1. Example: 65mm (L = 140mm). 65mm = EL taper, 140mm = L pocket

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Stock versions

(1)		(2)		(3)		(4)		(5)		(6)		(7)	Sales No.
909721/10	-	848	-	10	-	100	-	104	-	26	/	000	90/00057352
909721/10	-	848	-	10	-	150	-	104	-	26	/	000	90/00057353
909721/11	-	848	-	13	-	100	-	104	-	26	/	000	90/00044862
909721/11	-	848	-	13	-	160	-	104	-	26	/	000	90/00044863
909721/11	-	848	-	13	-	250	-	104	-	26	/	000	90/00044864
909721/15	-	848	-	12	-	100	-	000	-	03	/	374	90/00039349
909721/15	-	848	-	12	-	160	-	000	-	03	/	374	90/00032010
909721/15	-	848	-	12	-	190	-	000	-	03	/	374	90/00038739
909721/15	-	848	-	12	-	220	-	000	-	03	/	374	90/00035520
909721/20	-	848	-	25	-	160	-	000	-	26	/	000	90/00045048
909721/20	-	848	-	25	-	250	-	000	-	26	/	000	90/00045049
909721/20	-	854	-	25	-	160	-	000	-	36	/	000	90/00045411
909721/20	-	854	-	25	-	250	-	000	-	36	/	000	90/00045412
909721/25	-	848	-	24	-	65 (140)	-	000	-	26	/	000	90/00348538
909721/25	-	848	-	24	-	125 (200)	-	000	-	26	/	000	90/00340509
909721/25	-	848	-	24	-	65 (200)	-	000	-	26	/	000	90/00340384
909721/25	-	848	-	24	-	125 (260)	-	000	-	26	/	000	90/00348540
909721/25	-	854	-	24	-	65 (140)	-	000	-	36	/	000	90/00348539
909721/25	-	854	-	24	-	125 (200)	-	000	-	36	/	000	90/00317838
909721/25	-	854	-	24	-	65 (200)	-	000	-	36	/	000	90/00102673
909721/25	-	854	-	24	-	125 (260)	-	000	-	36	/	000	90/00340381

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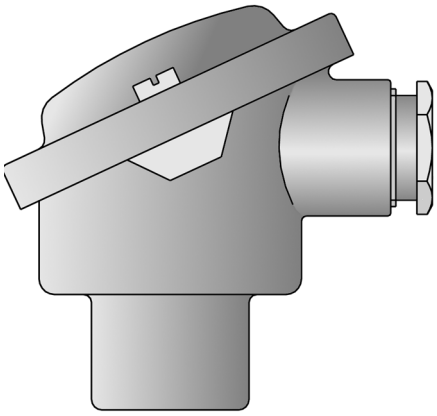
Terminal heads and blocks

- **for thermocouples and resistance thermometers**
- **terminal heads in different materials**
- **Protection IP65 max.**
- **versions for lead sealing**



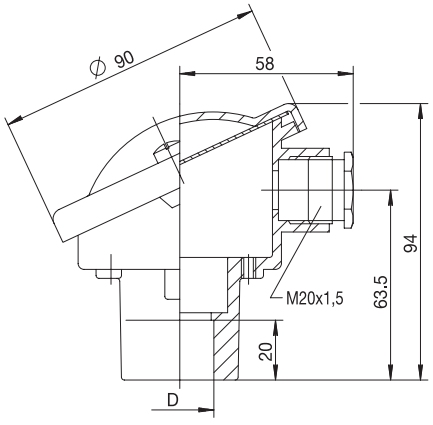
Terminal heads (pages 1 to 4)
DIN 43 729 specifies the terminal head forms A and B, which differ in size and also slightly in shape. The nominal diameter of the bore to take the protection tube is 22mm or 32mm for Form A, and 15mm or thread M 24x1.5 for Form B.
Either aluminium or plastic is used according to the application. Terminal head form B as per DIN is more widely used. The additional forms J, JK, BBK and BUZ are derived from the DIN form to meet particular requirements. These forms (except JK) are suitable for installing a 2-wire transmitter. Form JK already incorporates terminals.

Terminal blocks (pages 5 and 6)
Suitable terminal blocks with two, four or six connections are available for the different terminal heads.

Note: please state sales no. as per price sheet 90.9722 when ordering!

Terminal heads to DIN 43 729, Form A IP54 protection

Diameter D in mm	Temperature in °C	Part no.
Terminal head Form A 22 aluminium die-casting		
22.8	-40 to +100	00387685 ●
Terminal head Form A 32		
32.5	-40 to +100	00387688 ●



Note: versions up to 200°C on request

● available from stock

03.05/00073422

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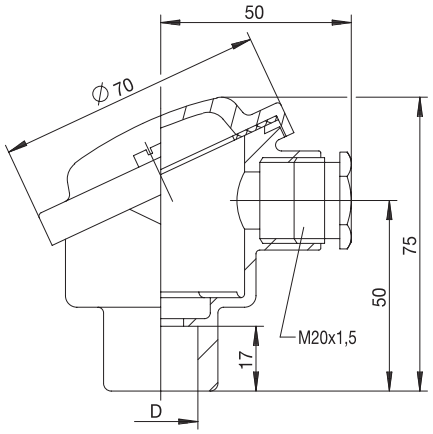
Terminal heads to DIN 43 729, Form B IP54 protection

Diameter D	Temperature in °C	Part no.
Terminal head Form B 15 aluminium die-casting		
15.8	-40 to +100	00387712 ●
Terminal head Form B M 24x1.5		
M 24x1.5	-40 to +100	00387711 ●

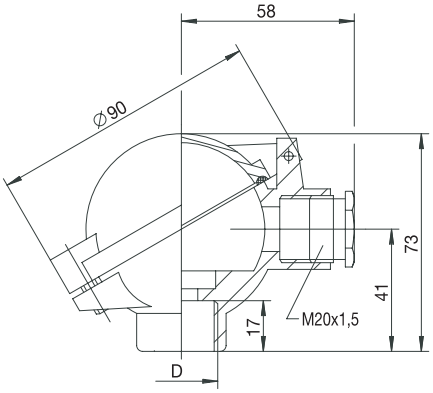


Note: versions up to 200°C on request.

● available from stock 909722 Item 2

Terminal head similar to DIN 43 729, Form B IP65 protection

Diameter D	Temperature in °C	Part no.
Terminal head Form BUZ M 24x1.5 aluminium die-casting		
M 24x1.5	-40 to +100	00387706 ●



● available from stock 909722 Item 3

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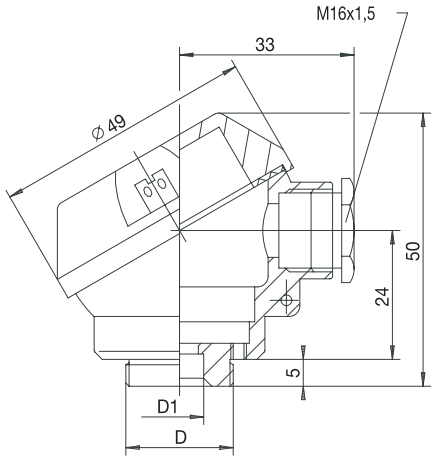
Terminal heads suitable for lead sealing, JUMO version, Form J IP54 protection

Diameter D	D1	Temperature in °C	Part no.
Terminal head Form J aluminium die-casting			
M 20x0.75	9	-40 to +100	00387708 ●
20	M 10x1	-40 to +100	00387710 ●

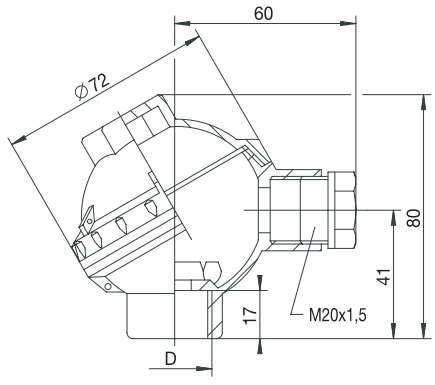


Note: versions up to 200°C on request

● available from stock 909722 Item 4

Terminal head similar to DIN 43 729, Form B IP54 protection

Diameter D	Temperature in °C	Part no.
Terminal head Form BBK M 24x1.5 PPO plastic		
M 24x1.5	-30 to +130	00387689 ●



● available from stock 909722 Item 5

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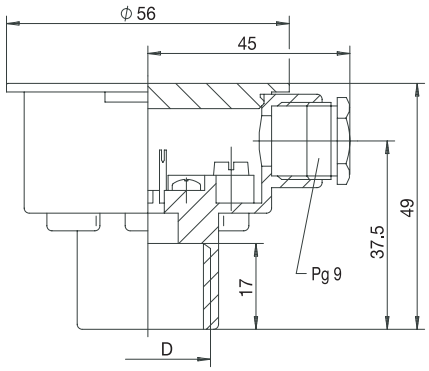
Terminal heads suitable for lead sealing, JUMO version, Form JK IP53 protection

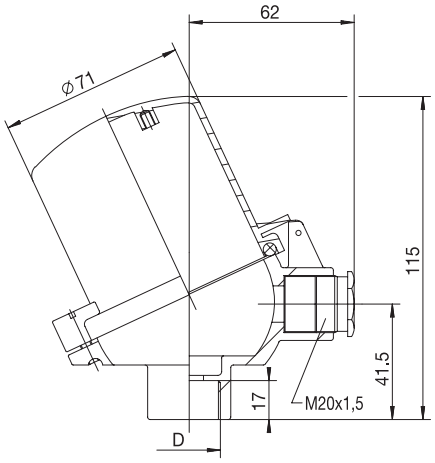
Diameter D	Number of connections	Temperature in °C	Part no.
Terminal head Form JK M 24x1.5 PTMT plastic for thermocouples with screw terminals			
M 24x1.5	2	-50 to +160	00048294 ●
M 24x1.5	4	-50 to +160	00048295 ●
M 24x1.5	6	-50 to +160	00048296 ●
Terminal head Form JK M 24x1.5 PTMT plastic for resistance thermometere with solder terminals			
M 24x1.5	2	-50 to +160	00048287 ●
M 24x1.5	4	-50 to +160	00048286 ●
M 24x1.5	6	-50 to +160	00048288 ●



● available from stock 909722 Item 6

Terminal head, Form BUZH IP65 protection

Diameter D	Temperature in °C	Part no.
Terminal head Form BUZH aluminium die-casting with screw cover		
M 24x1.5	-40 to +100	00387717 ●



● available from stock 909722 Item 7

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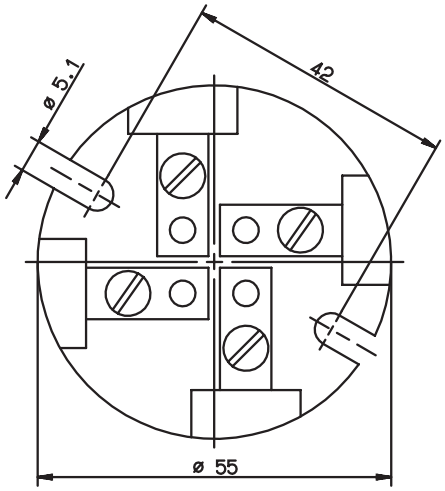
Terminal blocks with screws and seal for terminal heads Form A

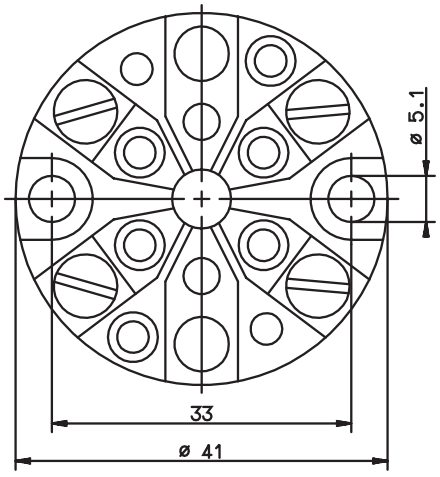
	Number of terminals	Thermocouple	Part no.
Terminal blocks for thermocouples			
	2	base metal	00014391 ●
	4	base metal	00017043 ●
	4	noble metal	00020749 ●



● available from stock 909722 Item 8

Terminal blocks for terminal heads Form B, BBK, BUZ and BUZH

	Number of terminals	Part no.
Terminal block for thermocouples		
	2	00015899 ●
	4	00021673 ●
	6	00015901 ●
Terminal block for resistance thermometers		
	2	00015888 ●
	4	00015900 ●
	6	00047370 ●



Note: screws and seals on request

● available from stock 909722 Item 9

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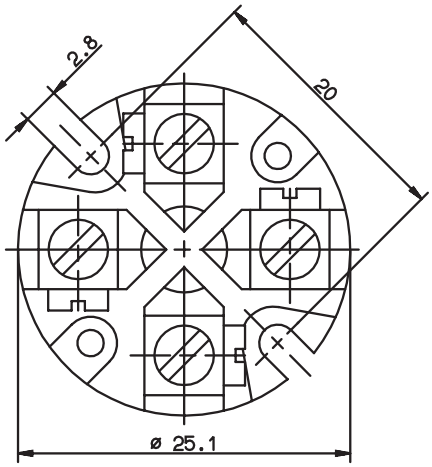
Terminal blocks for terminal heads Form J

Number of terminals	Part no.
Terminal blocks for thermocouples and resistance thermometers	
2	00030677 ●
4	00031838 ●



Note: screws amd seals on request

● available from stock 909722 Item 10

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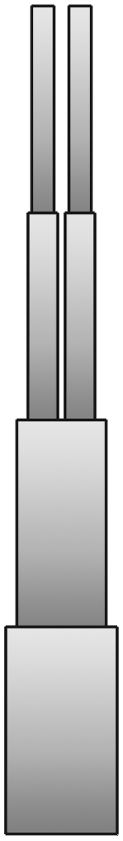
Compensating and connecting cables



- **compensating cables to IEC 584 and DIN 43 714**
- **versions from -190 to +400 °C**
- **sheath in Teflon, silicone, PVC or fiberglass**
- **for single and twin thermocouples**

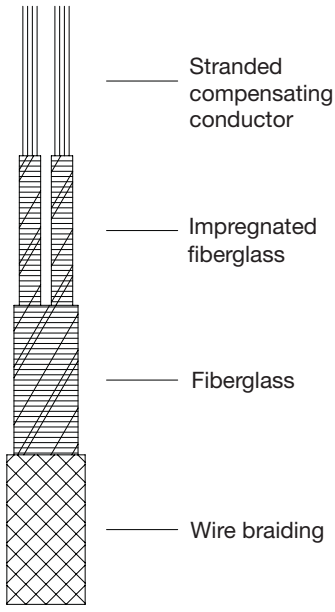
Compensating cables (pages 1 to 3)
When measuring temperature with thermocouples, the cold junction temperature has to be measured in addition to the thermal voltage. The cold junction temperature is acquired to the terminals of the evaluation electronics. Since this may not necessarily be identical with the temperature inside the terminal head, the thermocouple has to be extended by means of a compensating cable (no compensating cable is necessary for thermocouples type B).
Up to 200 °C, compensating cables have the same thermoelectric properties as the thermocouples themselves.

Connecting cables (pages 4 to 8)
Connecting cables with stranded copper conductors transmit the signals from resistance thermometers or transmitters, humidity sensors, and from transducers with a standard signal, to measurement, control and recording devices.
Their construction depends on the local conditions (temperature, humidity and mechanical stress).

Note: Please state sales no. as per price sheet 90.9723 when ordering!

Compensating cables for dry areas temperature range: -20 to +350 °C

Cross-section in mm²	Diameter in mm	Color coding/ Class	Ω/m per thermocouple	Part no.	
Thermocouple Fe-Con L					
2x 0.22	3.5	DIN 43 714	2.50	00006479	●[2]
2x 0.50	4.7	DIN 43 714	1.25	00017856	●[1]
4x 0.22	3.7	DIN 43 714	2.50	00017857	●[2]
Thermocouple Fe-Con J					
2x 0.22	3.5	IEC 584/Cl. 1	2.50	00341902	●[1]
2x 0.50	4.7	IEC 584/Cl. 1	1.25	00341903	●[1]
Thermocouple NiCr-Ni K					
2x 0.50	4.7	IEC 584/Cl. 2	2.00	00017858	●[1]
4x 0.50	3.7	IEC 584/Cl. 2	2.00	00017860	●[2]
Thermocouple Pt10Rh-Pt S					
2x 0.50	4.7	IEC 584/Cl. 2	0.20	00017859	●[1]
4x 0.50	3.7	IEC 584/Cl. 2	0.20	00017861	●[2]



● available from stock

1. with galvanized steel braiding
2. with stainless steel braiding

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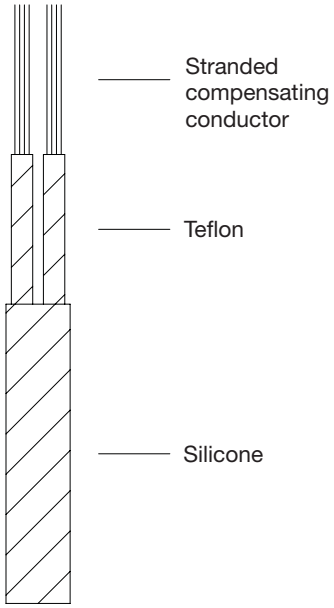
Compensating cables for dry and damp areas temperature range: -50 to +180 °C

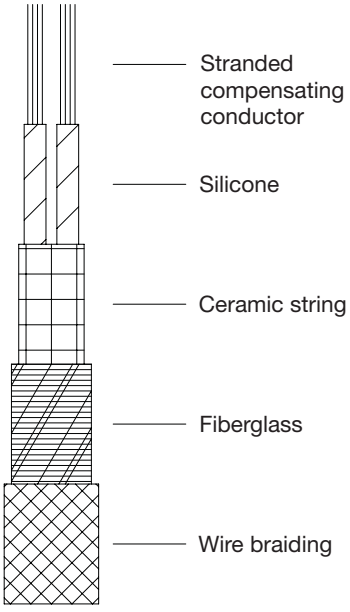
Cross-section in mm²	Diameter in mm	Color coding/ Class	Ω/m per thermocouple	Part no.
Thermocouple Fe-Con L				
2x 0.50	4.7	DIN 43 714	1.25	00017846 ●
4x 0.22	4.7	DIN 43 714	2.50	00017848 ●
Thermocouple NiCr-Ni K				
2x 0.22	3.2	IEC 584/Cl. 2	4.50	00052898 ●
2x 0.50	4.7	IEC 584/Cl. 2	2.00	00017847 ●
4x 0.22	4.7	IEC 584/Cl. 2	4.00	00017849 ●



● available from stock 909723 Item 2

Compensating cables for dry and damp areas temperature range: -50 to +180 °C

Cross-section in mm²	Diameter in mm	Color coding/ Class	Ω/m per thermocouple	Part no.
Thermocouple Fe-Con L				
2x 1.50	6.7	DIN 43 714	0.42	00017853 ●[1]
Thermocouple NiCr-Ni K				
2x 1.50	6.7	IEC 584/Cl. 2	0.70	00017854 ●[1]
Thermocouple Pt10Rh-Pt S				
2x 1.50	6.7	IEC 584/Cl. 2	0.07	00017855 ●[1]



● available from stock 1. with galvanized steel braiding 909723 Item 3

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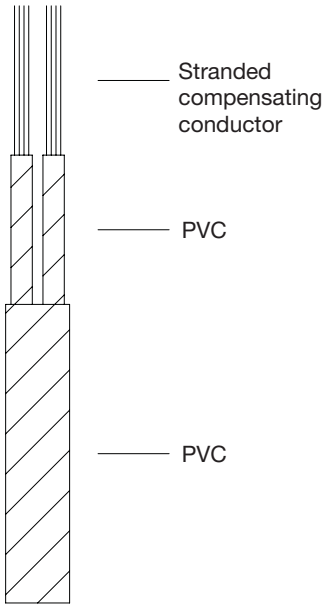
Compensating cables for dry and damp areas temperature range: +5 to +105°C

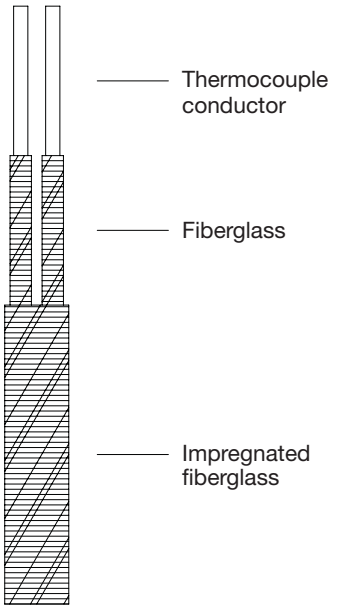
Cross-section in mm²	Diameter in mm	Color coding	Ω/m per thermocouple	Part no.
Thermocouple Fe-Con L				
2x 0.22	3.7	DIN 43 714	2.50	00038959 ●



● available from stock 909723 Item 4

Compensating cables for dry areas temperature range: -20 to +350°C

Cross-section in mm²	Ext. dimension in mm	Color coding/ Class	Ω/m per thermocouple	Part no.
Thermocouple Fe-Con L				
2x 0.19	1.20 x 1.85	DIN 43 714	3.20	00010497 ●
Thermocouple NiCr-Ni K				
2x 0.19	1.20 x 2.00	IEC 584/Cl. 2	5.20	00060294 ●



● available from stock 909726 Item 5

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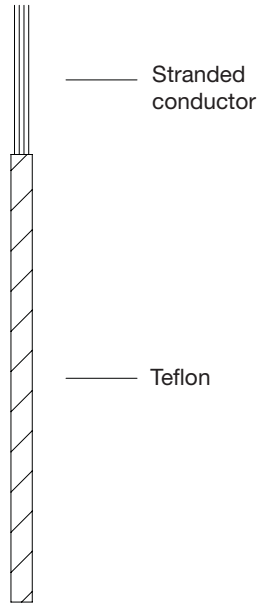
Connecting cables (single conductor) for dry and damp areas temperature range: -190 to +260°C

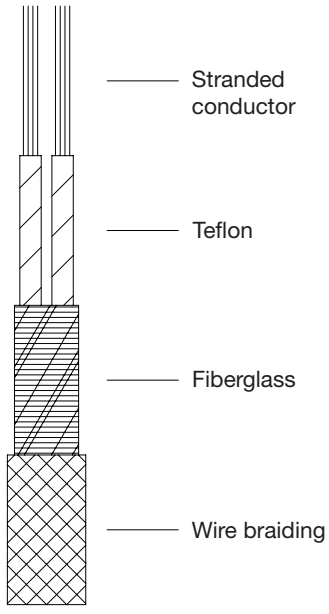
Cross-section in mm²	Diameter in mm	Ω/m per conductor	Part no.
1x 0.22	1.2	0.0869	00020778 ●



● available from stock 909723 Item 6

Connecting cables for dry and damp areas temperature range: -50 to +260°C

Cross-section in mm²	Diameter in mm	Ω/m per conductor	Part no.
2x 0.35	3.7	0.055	00011944 ●[2]
3x 0.35	3.8	0.055	00048074 ●[2]
4x 0.35	3.8	0.055	00006235 ●[2]
6x 0.22	4.7	0.080	00084534 ●[2]



● available from stock 2. with stainless steel braiding 909723 Item 7

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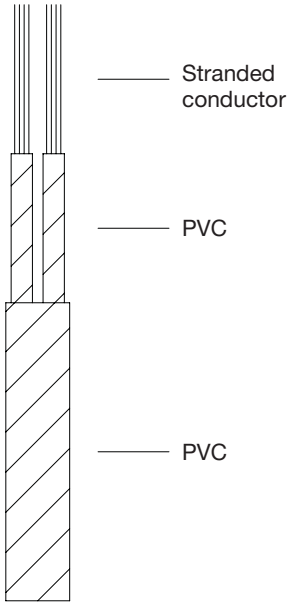
Connecting cables for dry and damp areas temperature range: -5 to +80°C

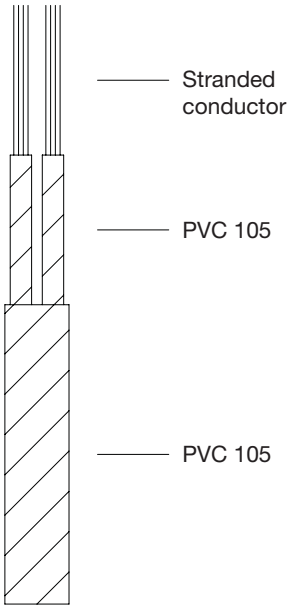
Cross-section in mm²	Diameter in mm	Ω/m per conductor	Part no.	
2x 0.14	3.2	0.130	00052058	●
2x 0.34	4.7	0.060	00037564	●
2x 0.75	5.7	0.025	00001478	●
3x 0.34	4.7	0.060	00040122	●
3x 0.75	6.3	0.025	00001480	●
4x 0.14	3.7	0.130	00038186	●
4x 0.34	4.9	0.060	00047904	●



● available from stock 909723 Item 8

Connecting cables for dry and damp areas temperature range: +5 to +105°C

Cross-section in mm²	Diameter in mm	Ω/m per conductor	Part no.	
2x 0.25	4.3	0.070	00048228	●
2x 0.34	5.3	0.060	00052804	●
2x 0.75	6.4	0.025	00045951	●



● available from stock 909723 Item 9

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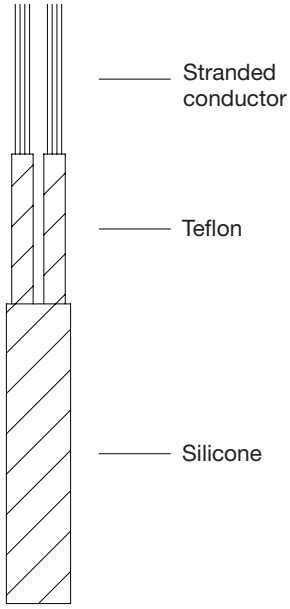
Connecting cables for dry and damp areas temperature range: -50 to +180°C

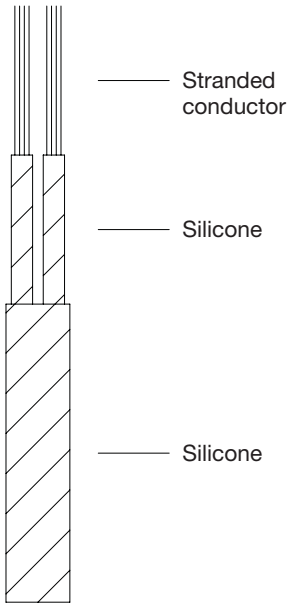
Cross-section in mm²	Diameter in mm	Ω/m per conductor	Part no.	
2x 0.22	4.2	0.081	00047713	●
2x 0.34	4.6	0.060	00037101	●
3x 0.35	4.6	0.055	00039901	●
4x 0.14	3.8	0.130	00037843	●
4x 0.35	4.8	0.055	00064944	●
6x 0.14	4.7	0.130	00062432	●
6x 0.22	6.3	0.085	00043990	●



● available from stock 909723 Item 10

Connecting cables for dry and damp areas temperature range: -50 to +180°C

Cross-section in mm²	Diameter in mm	Ω/m per conductor	Part no.	
2x 0.75	6.2	0.025	00001487	●
4x 0.75	7.8	0.025	00001492	●



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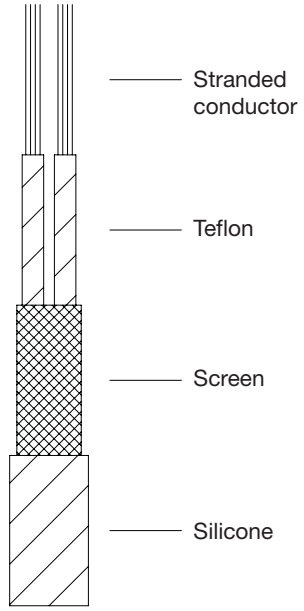
Connecting cables for dry and damp areas temperature range: -50 to +180 °C

Cross-section in mm²	Diameter in mm	Ω/m per conductor	Part no.
2x 0.22	4.5	0.085	00044774 ●[5]
4x 0.14	4.6	0.130	00062502 ●[4]
4x 0.35	6.2	0.055	00039902 ●[3]



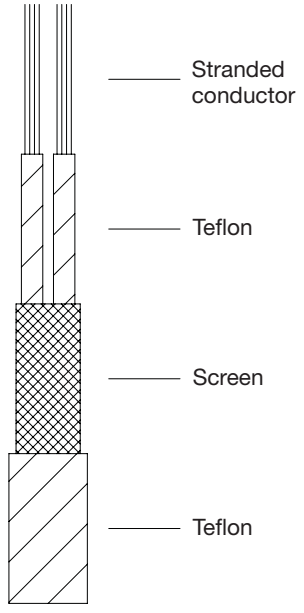
3. screen: nickel-plated copper
4. screen: silver-plated copper
5. screen: plain copper

● available from stock

909723 Item 12

Connecting cables for dry and damp areas temperature range: -190 to +260 °C

Cross-section in mm²	Diameter in mm	Ω/m per conductor	Part no.
2x 0.61	4.9	0.030	00043637 ●[3]
4x 0.14	3.5	0.130	00062849 ●[4]
4x 0.50	4.8	0.040	00045655 ●[3]
8x 0.14	4.8	0.130	00345480 ●[3]



3. screen: nickel-plated copper
4. screen: silver-plated copper

● available from stock

909723 Item 13

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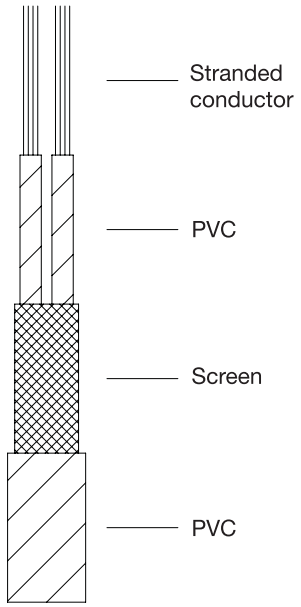
Connecting cables for dry and damp areas temperature range: -5 to +80°C

Cross-section in mm²	Diameter in mm	Ω/m per conductor	Part no.
2x 0.14	3.7	0.130	00039272 ●[6]
2x 0.25	4.7	0.070	00048185 ●[6]
6x 0.14	4.7	0.130	00044132 ●[6]



● available from stock 6. screen: tinned copper 909723 Item 14

Color coding for compensating cables and thermocables

New color coding to IEC 584					Old color coding to DIN 43 714 as of June 1979		
Thermocouple	**Type**	**Conductor color Positive limb**	**Conductor color Negative limb**	**Sheath color**	**Conductor color Positive limb**	**Conductor color Negative limb**	**Sheath color**
Cu-Con	U[1]	red	brown	brown	red	brown	brown
Cu-Con	T	brown	white	brown	-	-	-
Fe-Con	L[1]	red	blue	blue	red	blue	blue
Fe-Con	J	black	white	black	-	-	-
NiCr-Ni	K	green	white	green	red	green	green
NiCr-Con	E	violet	white	violet	-	-	-
NiCrSi-NiSi	N	mauve	white	mauve	no details		
Pt10Rh-Pt	S	orange	white	orange	red	white	white
Pt13Rh-Pt	R	orange	white	orange	red	white	white
Pt30Rh-Pt6Rh	B	gray	white	gray	no details		

Note: sheath color can also be a colored thread.

1. for thermocouples to DIN 43 710.

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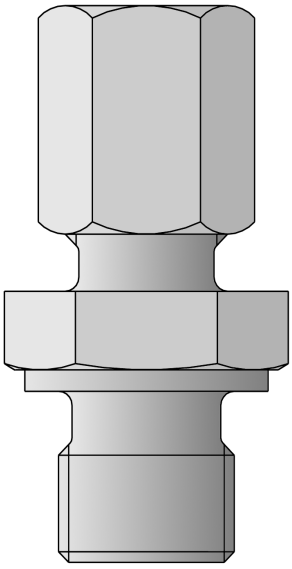
Pipe fittings and flanges, sockets for bayonet locks



- **for temperatures up to 600 °C**
- **for different fitting lengths**
- **simple installation and replacement**
- **pressure-tight sealing**

Pipe fittings
The essential advantage of pipe fittings is the variable fitting length and the simple dismantling of the temperature probe. Versions in different materials are available, with threads that can be combined with a variety of protection tube diameters. They are used for protection tubes to DIN 43 763 (pipe fittings with stuffing gland) in oven construction, as well as for installing mineral-insulated resistance thermometers and thermocouples.

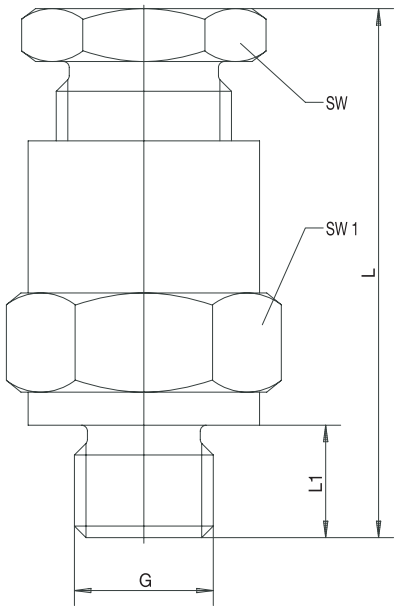
Sockets for bayonet locks
The sockets are used for installing push-in resistance thermometers / thermocouples. They are available in the diameters 12.2, 14.5, 15.2 and 16.2 mm.

Flanges
Stop flanges can be supplied in different materials. By using a backing flange, the measurement location can be sealed up to 1 bar. They are suitable as an alternative to pipe fittings for the same applications.

Note: please state sales no. as per price sheet 90.9725 when ordering!

Pipe fittings for protection tubes to DIN 43 763

For protection tube dia. in mm	Thread G	Wrench size SW	SW1 in mm	Length L	L1 in mm	Part no.	
Pipe fittings in steel with asbestos-free stuffing gland							
15	1/2"	32	36	80	17	00018468	●
15	3/4"	36	41	90	19	00018467	●
22	1"	41	46	95	20	00018469	●



● available from stock

03.07/00314553

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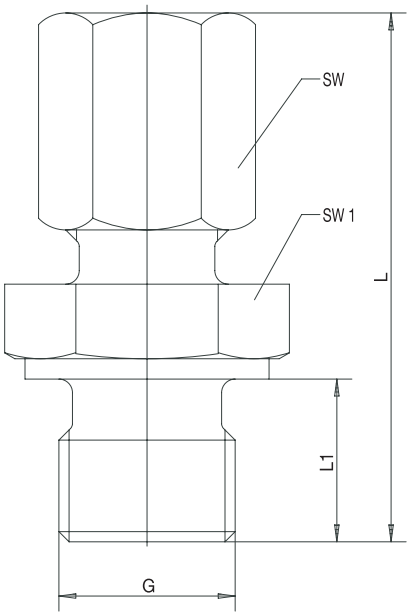
Pipe fittings



For protection tube dia. in mm	Thread G	Wrench size SW	SW1 in mm	Length L	L1 in mm	Part no.	
Pipe fittings in steel with PTFE clamping ring for temperatures up to 260°C							
1.0	M 8 x 1	10	12	29	8	00049700	●
1.5	M 8 x 1	10	12	29	8	00049701	●
2.0	M 8 x 1	12	12	25	8	00049702	●
3.0	M 8 x 1	12	12	25	8	00049703	●
4.5	M 8 x 1	10	12	29	8	00049704	●
6.0	1/4"	14	19	39	12	00049705	●
Pipe fittings in stainless steel X 6 CrNiMoTi 17 12 2, Material Ref. 1.4571 with PTFE clamping ring for temperatures up to 260°C							
1.0	M 8 x 1	8	12	24	8	00049706	●
1.5	M 8 x 1	10	12	29	8	00049707	●
2.0	M 8 x 1	8	12	25	8	00049708	●
3.0	M 8 x 1	10	14	28	8	00049709	●
4.5	M 8 x 1	10	12	29	8	00049710	●
6.0	1/4"	19	14	41	12	00049711	●
Pipe fittings in stainless steel X 6 CrNiMoTi 17 12 2, Material Ref. 1.4571 with st. steel clamping ring for temperatures up to 600°C							
1.5	M 8 x 1	8	12	23.5	8	00080809	●
3.0	M 8 x 1	10	14	27	8	00080810	●
6.0	1/4"	14	19	40	12	00080811	●
6.0	1/2"	14	27	44	14	00305445	●
12.0	1/2"	22	27	46	14	00312448	●
15.0	1/2"	27	27	42	14	00048311	●
Pipe fittings in steel with steel clamping ring for temperatures up to 500°C							
6.0	3/8"	14	22	40	10	00057945	●
6.0	1/2"	12	27	40	12	00340227	●

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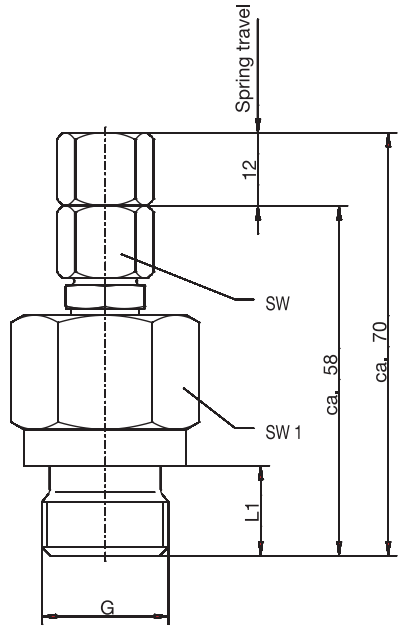
Pipe fittings, spring-loaded

For protection tube dia. in mm	Thread G inch	Wrench size SW	SW1 mm	Length L	L1 in mm	Part no.
Pipe fittings in stainless steel X8CrNiS18-9, Mat. Ref. 1.4305 with stainless steel clamping ring for temperatures up to 180 °C						
8.0	1/2"	14	27	58	14	00462809 ●



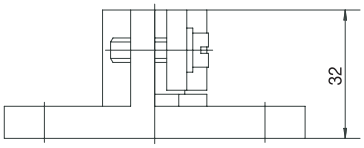
● available from stock

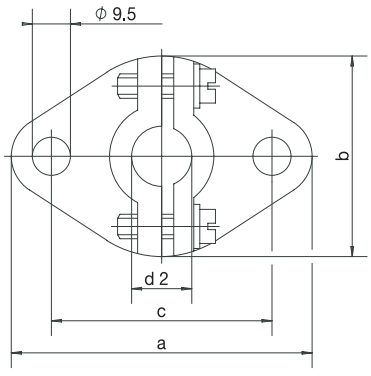
909725

Item 3

Stop flanges to DIN 43 734

For protection tube dia. in mm	Dimensions in mm a	b	c	d2	Part no.
Stop flanges in cast iron					
15	75	50	55	16	00005784 ●
22	90	65	70	23	00005785 ●
32	90	65	70	33	00014955 ●





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Item 4

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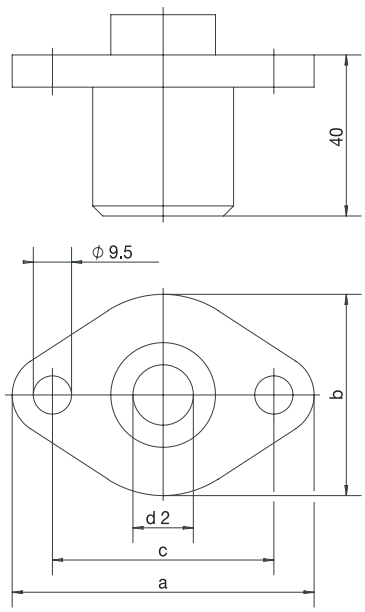
Backing flanges for stop flanges to DIN 43 734

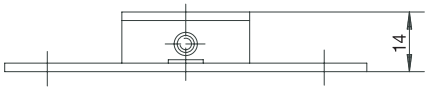
For protection tube dia. in mm	Dimensions in mm a	b	c	d2	Part no.
Backing flanges in cast iron					
15	75	50	55	15	00058371 ●
22	90	65	70	22	00058372 ●
32	90	65	70	32	00058373 ●

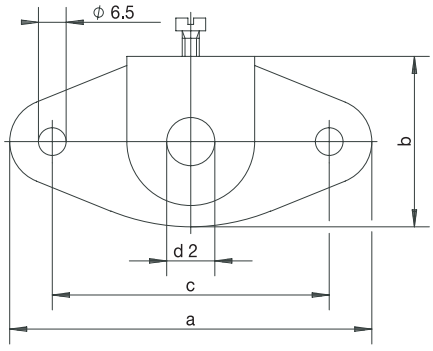


● available from stock 909725 Item 5

Plate flanges

For protection tube dia. in mm	Dimensions in mm a	b	c	d2	Part no.
Plate flanges in galvanized steel					
6	85	40	65	6.3	00065062 ●
8	85	40	65	8.3	00068165 ●
10	85	40	65	10.3	00084190 ●
11	85	40	65	11.3	00038513 ●





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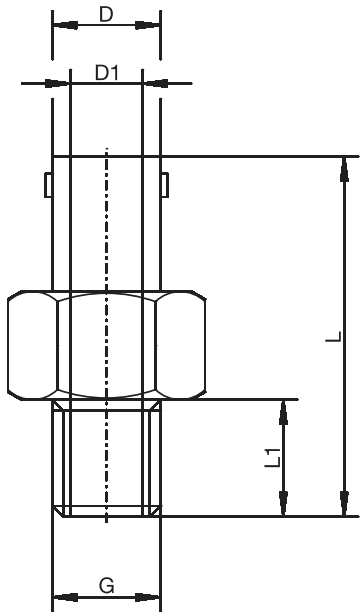
Bayonet sockets SW for push-in resistance thermometers

Thread G	Diameter D in mm	Diameter D1 in mm	Length L in mm	Length L1 in mm	Part no.	
Bayonet sockets SW in brass, Mat. Ref. 2.0401.20, nickel-plated						
M 12	12	8.5	30	10	00463477	
M 12 x 1	12	8.5	30	10	00449206	●
M 12 x 1	12	8.5	40	10	00452747	●
M 14 x 1.5	12	8.5	30	10	00463478	
1/4"	12	8.5	30	10	00463480	
3/8"	12	8.5	30	10	00441893	●
M 10 x 1	12	6.5	30	10	00459226	●
M 12	12	6.5	30	10	00463484	
M 12 x 1	12	6.5	30	10	00463486	
M 14 x 1.5	12	6.5	30	10	00463488	●
1/4"	12	6.5	30	10	00463490	
3/8"	12	6.5	30	10	00463491	
M 12	14	8.5	30	10	00463492	
M 12 x 1	14	8.5	30	10	00463493	
M 14 x 1.5	14	8.5	30	10	00454811	●
1/4"	14	8.5	30	10	00463494	●
3/8"	14	8.5	30	10	00463497	



Minimum ordering quantity for non-stock parts: 10 items

● available from stock

909725

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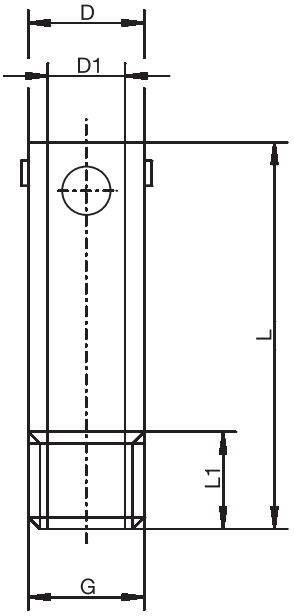
Bayonet sockets RD for push-in resistance thermometers

Thread G in mm	Diameter D in mm	Diameter D1 in mm	Length L in mm	Length L1 in mm	Part no.	
Bayonet sockets RD in brass, Mat. Ref. 2.0401.20, nickel-plated						
M 12	12	8.5	20	10	00463422	●
M 12	12	8.5	30	10	00463423	●
M 12	12	8.5	40	10	00463445	
M 12	12	8.5	50	10	00463446	
M 12 x 1	12	8.5	20	10	00451967	●
M 12 x 1	12	8.5	30	10	00463447	
M 12 x 1	12	8.5	40	10	00458580	●
M 12 x 1	12	8.5	50	10	00450720	●
M 12 x 1	12	8.5	60	10	00447366	●
1/4"	12	8.5	30	10	00463449	
M 10 x 1	12	6.5	50	10	00463450	
M 12 x 1	12	6.5	30	10	00463451	
M 12 x 1	12	6.5	40	10	00458576	●
M 12 x 1	12	6.5	50	10	00463453	●
M 12	14	8.5	30	10	00463454	
M 12	14	8.5	40	10	00463455	
M 12	14	8.5	50	10	00463457	
M 12 x 1	14	8.5	30	10	00463460	
M 12 x 1	14	8.5	40	10	00463464	
M 12 x 1	14	8.5	50	10	00451641	●
M 14 x 1.5	14	8.5	30	10	00463465	
M 14 x 1.5	14	8.5	40	10	00463466	
M 14 x 1.5	14	8.5	50	10	00463467	●
1/4"	14	8.5	30	10	00463469	
1/4"	14	8.5	40	10	00463470	
1/4"	14	8.5	50	10	00463471	
M 12 x 1	14	6.5	30	10	00463474	
M 12 x 1	14	6.5	40	10	00463475	
M 12 x 1	14	6.5	50	10	00463476	
Bayonet sockets RD in stainless steel V4A, Mat. Ref. 1.4305						
M 12 x 1	12	8.5	50	10	00450338	●
M 12 x 1	12	8.5	60	10	00439597	●
M 12 x 1	12	8.5	100	10	00439640	●
M 10 x 1	12	6.5	60	10	00459471	●



Minimum ordering quantity for non-stock parts: 10 items

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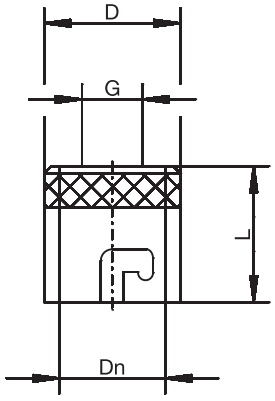
Bayonet locks for push-in resistance thermometers

Thread G in mm	Diameter D in mm	Length L in mm	Bayonet Dn in mm	Part no.	
Bayonet locks in brass, Mat. Ref. 2.0401.20, nickel-plated					
5.4	15	18	12.2	00441183	●
5.4	18	18	14.5	00441186	●
5.4	18	18	15.2	00443446	●
7.0	15	18	12.2	00441188	●
7.0	15	18	14.5	00441198	●
7.0	15	18	15.2	00443448	●



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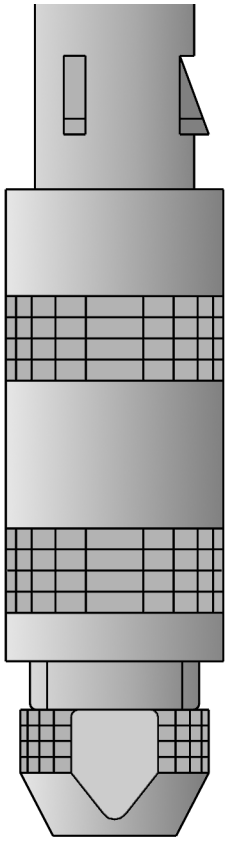
Connectors



- **for temperatures from -60 to +260°C**
- **problem-free replacement with fixed cables**
- **quick connection of test instruments**

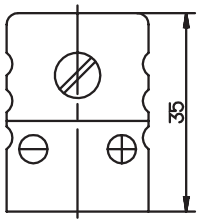
Connectors for thermocouples (pages 1 to 3)
The connection between thermocouple and compensating cable is free from thermal emf if the contacts are made from the same material as the thermocouple.

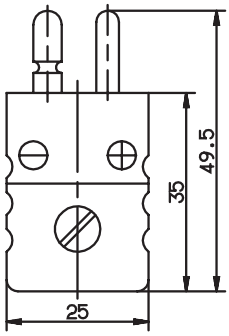
Connectors for resistance thermometers (pages 4 to 6)
The connection between resistance thermometer and connecting cable must have a low contact resistance to avoid introducing errors into the measurement. This is ensured by gold-plated contacts. The connector incorporates a locking device and is thus protected against shock and vibration.

Note: please state sales no. as per price sheet 90.9726 when ordering!

Standard connectors (free from thermal emf) for temperatures from -60 to +200 °C

Thermocouple	Color to ANSI	Part no.
Standard coupling, plastic		
Fe-Con J	black	00049880 ●
NiCr-Ni K	yellow	00049881 ●
Pt10Rh-Pt S	green	00057278 ●
Standard connector, plastic		
Fe-Con J	black	00044255 ●
NiCr-Ni K	yellow	00044256 ●
Pt10Rh-Pt S	green	00057277 ●





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05.06/00314554

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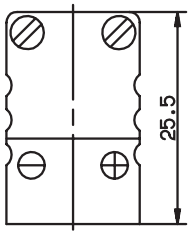
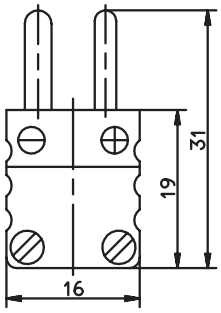
Miniature connectors (free from thermal emf) for temperatures from -60 to +200°C

Thermocouple	Color to ANSI	Part no.
Miniature coupling, plastic		
Fe-Con J	black	00057286 ●
NiCr-Ni K	yellow	00057287 ●
Pt10Rh-Pt S	green	00057288 ●
Miniature plug, plastic		
Fe-Con J	black	00057283 ●
NiCr-Ni K	yellow	00057284 ●
Pt10Rh-Pt S	green	00057285 ●

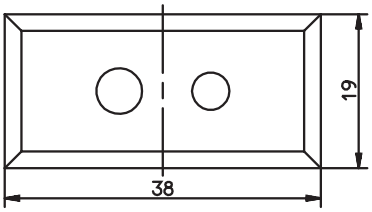


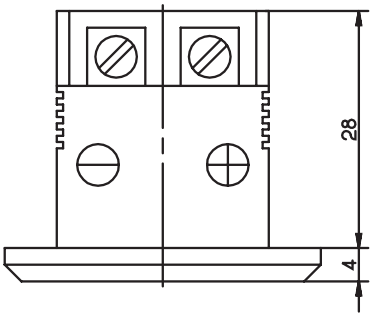


● available from stock 909726 Item 2

Standard sockets for front panel with mounting plate for temperatures from -60 to +200°C

Thermocouple	Color to ANSI	Part no.
Standard socket, plastic		
Fe-Con J	black	00057279 ●
NiCr-Ni K	yellow	00057280 ●
Pt10Rh-Pt S	green	00057281 ●





Note: panel cut-out 13mm x 27mm
panel thickness up to 5.0 mm.

● available from stock 909726 Item 3

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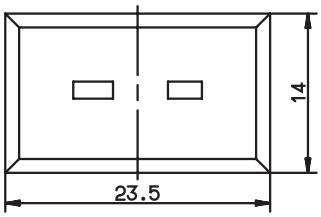
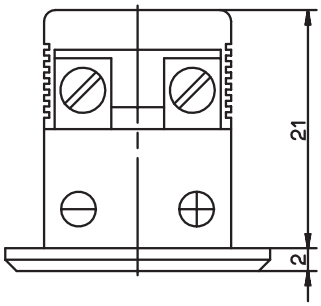
Miniature socket for front panel with mounting plate for temperatures from -60 to +200 °C

Thermocouple	Color to ANSI	Part no.
Miniature socket, plastic		
Fe-Con J	black	00057289 ●
NiCr-Ni K	yellow	00057290 ●
Pt10Rh-Pt S	green	00057291 ●





Note: panel cut-out 8.5 mm x 17 mm
panel thickness up to 5.5 mm

● available from stock 909726 Item 4

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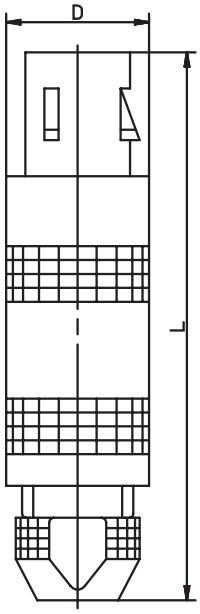
LEMOSA connectors for temperatures from -60 to +260 °C

Diameter D in mm	Length L in mm	Part no.
LEMOSA plug 2-pin, size 0 for cable diameters up to 4.2 mm		
9	34.5	00049838 ●
LEMOSA plug 4-pin, size 0 for cable diameters up to 4.2 mm		
9	34.5	00049879 ●
LEMOSA plug 2-pin, size II for cable diameters up to 5.2 mm		
15	50.0	00049836 ●
LEMOSA plug 4-pin, size II for cable diameters up to 5.2 mm		
15	50.0	00049837 ●

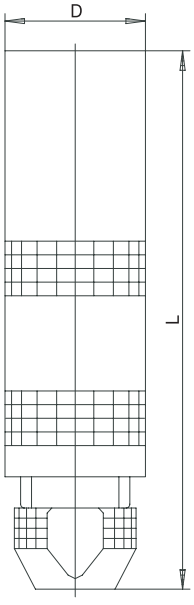
Note: mineral-insulated resistance thermometers, see Data Sheet 90.2221



● available from stock 909726 Item 5

LEMOSA coupling for temperatures from -60 to +260 °C

Diameter D in mm	Length L in mm	Part no.
LEMOSA coupling 2-pin, size 0 for cable diameters up to 4.2 mm		
9	35.0	00044806 ●
LEMOSA coupling 4-pin, size 0 for cable diameters up to 4.8 mm		
9	35.0	00326987 ●
LEMOSA coupling 4-pin, size II for cable diameters up to 6.7 mm		
15	52.5	00058087 ●



● available from stock 909726 Item 6

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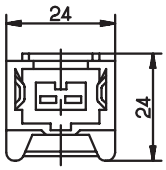
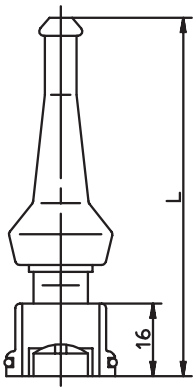
Coupling for screw-in resistance thermometers JUMO VIBROtemp Type 902004/10

Length L in mm	Temperature in °C	Part no.
Coupling, 4-part		
53	-20 to +80	00201426 ●
Coupling, 6-part, sealed to IP65		
80	-50 to +140	00089930 ●



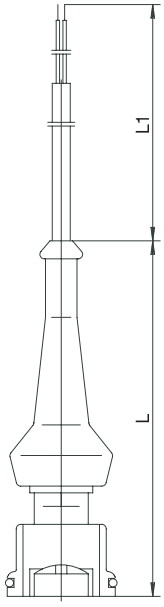


Note: screw-in resistance thermometers, see Data Sheet 90.2004.

● available from stock 909726 Item 7

Coupling with silicone-insulated connecting cable for screw-in resistance thermometers JUMO VIBROtemp Type 902004/10, IP65

Length L in mm	L1 in mm	Temperature in °C	Part no.
80	2500	-50 to + 140	00308880 ●



Note: screw-in resistance thermometers, see Data Sheet 90.2004

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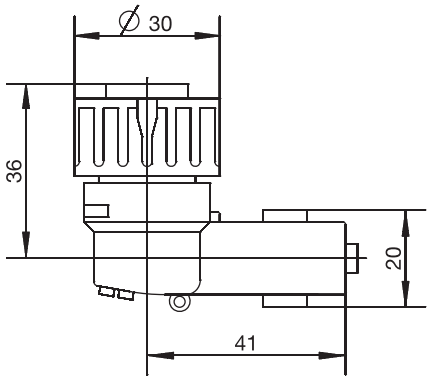
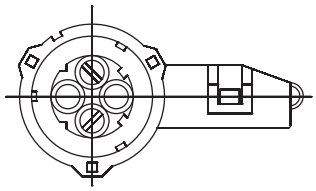
Coupling for screw-in resistance thermometers
JUMO VIBROtemp Type 902004/15, IP67 / IP69K

	Temperature in °C	Part No.
Coupling, 6-part, sealed, IP67 / IP69K	-40 to +130	00439715 ●





Note: screw-in resistance thermometers, see Data Sheet 90.2004.

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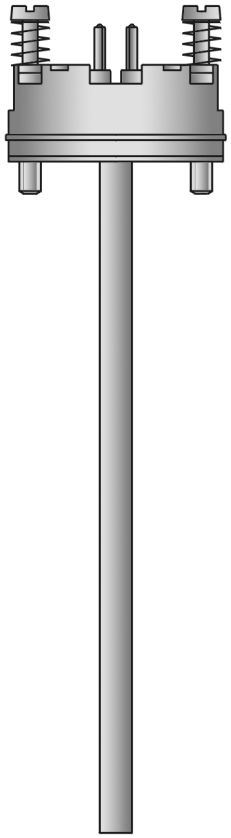
Measuring inserts for screw-in thermocouples and resistance thermometers with terminal head Form B



- **for temperatures from -200 to +1150 °C**
- **as single or twin insert**
- **available with transmitter**

The inserts are suitable for screw-in thermocouples according to Data Sheet 90.1002, as well as for screw-in resistance thermometers to Data Sheets 90.2002 and 90.2820. A mineral-insulated insert has to be used for insert lengths from 800 mm.
For the versions according to Data Sheets 90.1002 and 90.2002, the insert lengths are calculated as follows:

- Push-in resistance thermometer with extension tube:
  NL + 25 mm or EL + extension tube length + 25 mm
- Push-in resistance thermometer without extension tube:
  NL + 25 mm or EL + 25 mm
- Screw-in resistance thermometer with extension tube:
  NL + 25 mm or EL + extension tube length + 25 mm
- Screw-in resistance thermometer without extension tube:
  NL + 25 mm or EL + 25 mm

The measuring inserts for screw-in resistance thermometers are normally fitted with a Pt100 temperature sensor to EN 60 751, Class B in 2-wire circuit. Versions with Pt500 or Pt1000 can also be supplied. There is a choice of 3-or 4-wire circuit connections.

A transmitter can optionally be used instead of the terminal block.

Technical data

Terminal block	suitable for terminal heads Form B, BBK and BUZ. Caution: reduced ambient temperatures when using a transmitter instead of the terminal block, Data Sheets 70.7030 (95.6530) and 70.7010 (95.6550)
Protection tube	- stainless steel 1.4571 (for 909727/10... and 909727/30...) - stainless steel 1.4571 (rigid part) sheath st. steel 1.4541 (flexible part) (for 909727/20...) - sheath Inox 1.4541 (for 909727/40-...-.042...) - sheath Inconel 2.4816 (for 909727/40-...-.043...)
Transmitter	analog transmitter, output 4 — 20mA, for resistance thermometers, Data Sheet 70.7030 (95.6530) analog transmitter, output 0 — 10V, for resistance thermometers, Data Sheet 70.7030 (95.6530) programmable transmitter, output 4 — 20mA/20 — 4mA, for thermocouples or resistance thermometers, Data Sheet 70.7010 (95.6550)
Application	insert for screw-in thermocouples / resistance thermometers according to Data Sheets 90.1002, 90.2002 and 90.2820

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JUMO PROCESS CONTROL INC.

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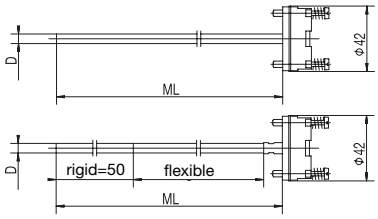
Order details: Measuring inserts for screw-in resistance thermometers with terminal head Form B

(1) Basic version

		909727/10	Inserts to DIN 43 762 for screw-in resistance thermometers to DIN 43 765/66, Form B und C
		909727/20	Insert similar to DIN 43 762 as mineral-insulated resistance thermometer



			(2) Operating temperature in °C
x	x	150	-200 to +600°C
x		402	- 50 to +400°C (standard with 909727/10)
x	x	415	- 50 to +600°C (standard with 909727/20)
			(3) Measuring insert
x	x	1001	1 x Pt100 in 3-wire circuit
x	x	1003	1 x Pt100 in 2-wire circuit
x	x	1011	1 x Pt100 in 4-wire circuit
x	x	2001	2 x Pt100 in 3-wire circuit (only in conjunction with D 6mm)
x	x	2003	2 x Pt100 in 2-wire circuit
			(4) Tolerance class to EN 60 751
x	x	1	Class B (standard)
x	x	2	Class A
x	x	3	Class 1/3 DIN
			(5) Measuring insert diameter D in mm
	x	3	3mm
x	x	6	6mm
			(6) Measuring insert length ML in mm (with 909727/10 ML max. = 800mm)
x	x	315	315mm (for resistance thermometer 902002/10-...-....-.-.-160-.../...)
x	x	405	405mm (for resistance thermometer 902002/10-...-....-.-.-250-.../...)
x	x	555	555mm (for resistance thermometer 902002/10-...-....-.-.-400-.../...)
x	x	...	please specify in plain text
			(7) Extra codes
x	x	000	no extra code
x	x	330	1 x analog transmitter, output 4 — 20mA[2], Data Sheet 70.7030 (95.6530)
x	x	331	1 x programmable transmitter, output 4 — 20mA/20 — 4mA[3], Data Sheet 70.7010 (95.6550)
x	x	333	1 x analog transmitter, output 0 — 10V[2], Data Sheet 70.7030 (95.6530)
x	x	337	2 x analog transmitter, output 0 —10V[2], Data Sheet 70.7030 (95.6530)

	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
Order code		-		-		-		-		-		/		,...
Order example	909727/10	-	402	-	1003	-	1	-	6	-	315	/	000[1]	

1. List extra codes in sequence, separated by commas.
2. Please specify range in plain text.
3. Please specify range and output signal in plain text.

Stock versions

(1)		(2)		(3)		(4)		(5)		(6)		(7)	Sales No.
909727/10	-	402	-	1003	-	1	-	6	-	315	/	000	90/00039286
909727/10	-	402	-	1003	-	1	-	6	-	405	/	000	90/00039287
909727/10	-	402	-	1003	-	1	-	6	-	555	/	000	90/00039288

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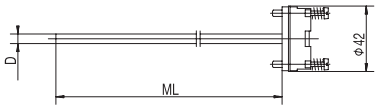
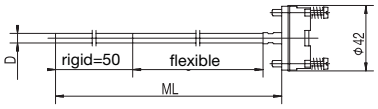
Order details: Measuring inserts for screw-in thermocouples with terminal head Form B

(1) Basic version

909727/30 Inserts for screw-in thermocouples



909727/40 Mineral-insulated inserts for screw-in thermocouples



			(2) Operating temperature in °C
x		150	-200 to + 600°C
x		165	-200 to + 800°C
	x	182	-200 to +1150°C (only in conjunction with NiCr-Ni K)
			(3) Measuring insert
x	x	1042	1 x Fe-Con L
x	x	1043	1 x NiCr-Ni K
x	x	2042	2 x Fe-Con L
x	x	2043	2 x NiCr-Ni K
			(4) Measuring insert diameter D in mm
	x	3	3mm
x	x	6	6mm
			(5) Measuring insert length ML in mm (with 909727/30 ML max. = 800mm)
x	x	315	315mm (for thermocouple 901002/10-...-....-.-.-160-.../...)
x	x	405	405mm (for thermocouple 901002/10-...-....-.-.-250-.../...)
x	x	555	555mm (for thermocouple 901002/10-...-....-.-.-400-.../...)
x	x	...	please specify in plain text
			(6) Extra codes
x	x	000	no extra code
x	x	331	1 x programmable transmitter, output 4 — 20mA/20 — 4mA[3], Data Sheet 70.7010 (95.6550)

	(1)		(2)		(3)		(4)		(5)		(6)
Order code		-		-		-		-		/	
Order example	909727/30	-	150	-	1042	-	6	-	405	/	331

3. Please specify range and output signal in plain text.

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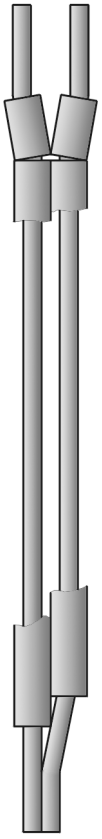
Thermocouples to DIN 43 732



- **for temperatures up to +1600°C**
- **standardized voltage tables for thermocouples to EN 60 584, Part 1 and DIN 43 710**
- **for push-in thermocouples to DIN 43 733**

These thermocouples are intended as replacement elements for thermocouples to DIN 43 733. The thermocouples can also be used for direct temperature measurement in special applications. The maximum temperatures specified can only be taken as guide values for the limit with continuous use in air that does not contain harmful gases. The thermocouple must not be mechanically stressed during operation.

Technical data

Thermocouples	**Color coding**	
	+ (positive limb)	**- (negative limb)**
Fe-Con L	red	blue
NiCr-Ni K	green	white
Pt10Rh-Pt S	orange	white
Pt30Rh-Pt6Rh B	gray	white

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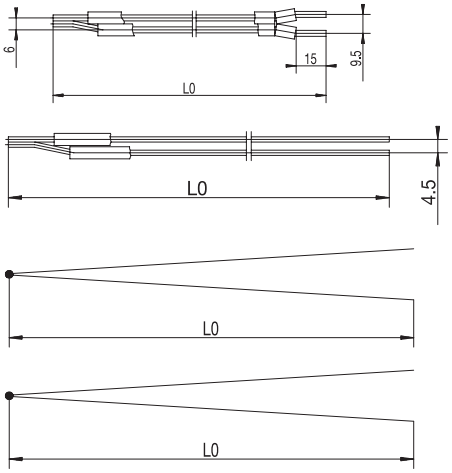
Order details: Thermocouples to DIN 43 732

(1) Basic version

				909728/10	Thermocouple to DIN 43 732, Form A
				909728/20	Thermocouple to DIN 43 732, Form B
				909728/30	Thermocouple to DIN 43 732, Form C
				909728/40	Thermocouple to DIN 43 732, Form D



(2) Measuring insert/operating temperature in °C[2]

x	x			1042	1 x Fe-Con L, -200 to +600°C (Form B); -200 to +700°C (Form A)
x	x			1043	1 x NiCr-Ni K, -200 to +900°C (Form B); -200 to +1000°C (Form A)
		x	x	1044	1 x Pt10Rh-Pt S, -50 to +1300°C
		x		1046	1 x Pt30Rh-Pt6Rh B, -50 to +1600°C

(3) Limb diameter D in mm

			x	0.35	0.35mm
		x	x	0.5	0.5 mm
	x			1	1mm (only in conjunction with insert 1 x Fe-Con L)
	x			1.38	1.38 mm (only in conjunction with insert 1 x NiCr-Ni K)
x				3	3mm

(4) Overall length L0 in mm/NL[1]

							Weight in g Type S ø 0.35	Type S ø 0.5	Type B ø 0.5
	x			220	220mm	/ 180mm			
		x		240	240mm	/ 180mm	1.00g	-	-
		x		260	260mm	/ 180mm	-	2.20g	2.11g
	x			290	290mm	/ 250mm			
			x	310	310mm	/ 250mm	1.28g	-	-
		x		330	330mm	/ 250mm	-	2.78g	2.66g
	x			395	395mm	/ 355mm			
			x	415	415mm	/ 355mm	1.71g	-	-
		x		435	435mm	/ 355mm	-	3.64g	3.49g
x	x			540	540mm	/ 500mm			
			x	560	560mm	/ 500mm	2.29g	-	-
		x		580	580mm	/ 500mm	-	4.84g	4.63g
x	x			750	750mm	/ 710mm			
		x	x	790	790mm	/ 710mm	3.22g	6.57g	6.28g
x	x			1040	1040mm	/ 1000mm			
		x	x	1080	1080mm	/ 1000mm	4.39g	8.95g	8.57g
x	x			1440	1440mm	/ 1400mm			
		x	x	1480	1480mm	/ 1400mm	6.00g	12.24g	11.72g
x	x			2040	2040mm	/ 2000mm			
x	x	x	x	...	other lengths on request				

	(1)		(2)		(3)		(4)
Order code		-		-		-	
Order example	909728/10	-	1042	-	3	-	540

1. for thermocouples to DIN 43 733 with nominal length NL in mm
2. The operating temperature refers to “open” thermocouples as per data sheet.
   Higher temperatures can be achieved when they are used inside a protection tube, Data Sheets 90.1... ff.