

Overview



The following temperature transmitters are available for installation in the connection head:

SITRANS TH320

Programmable 2-wire temperature transmitter as a 4 to 20 mA version or with HART communication (4 to 20 mA), galvanic isolation. 1 sensor input for resistance thermometer and thermocouples.

SITRANS TH420

Programmable 2-wire temperature transmitter with HART communication (4 to 20 mA), galvanic isolation. 2 sensor inputs for resistance thermometers and thermocouples; therefore expanded functions such as hot backup (redundancy) and drift detection are possible.

SITRANS TH400

Temperature transmitter with PROFIBUS PA or FOUNDATION Fieldbus connection, electrical isolation for resistance thermometers and thermocouple elements.

Note:

- SITRANS TH320/TH420/TH400 can be fitted in the high hinged cover or instead of the terminal base. Retrofitting possible only in the high hinged cover.
- If using intrinsically-safe temperature sensors any installed temperature transmitters must also be intrinsically-safe.

Selection and Ordering data

Detailed information on the transmitters can be found at the respective products under "Compact and head transmitters".

| Transmitter to be fitted | Order code |
|--|------------|
| To order the sensor with a built-in temperature transmitter, add "-Z" to the article number of the sensor, and supplement with the following order code: | |
| SITRANS TH320, input 1 x universal, 4 ... 20 mA | T24 |
| SITRANS TH320, input 1 x universal, HART | T34 |
| SITRANS TH420, input 2 x universal, HART | T35 |
| SITRANS TH400, input 1 x universal, PA | T40 |
| SITRANS TH400, input 1 x universal, PA, Ex | T41 |
| SITRANS TH400, input 1 x universal, FF | T45 |
| SITRANS TH400, input 1 x universal, FF, Ex | T46 |
| Customer-specific setting of the built-in transmitter (specify settings in plain text) | Y11 |

Temperature Measurement

Temperature sensors

Thermocouples

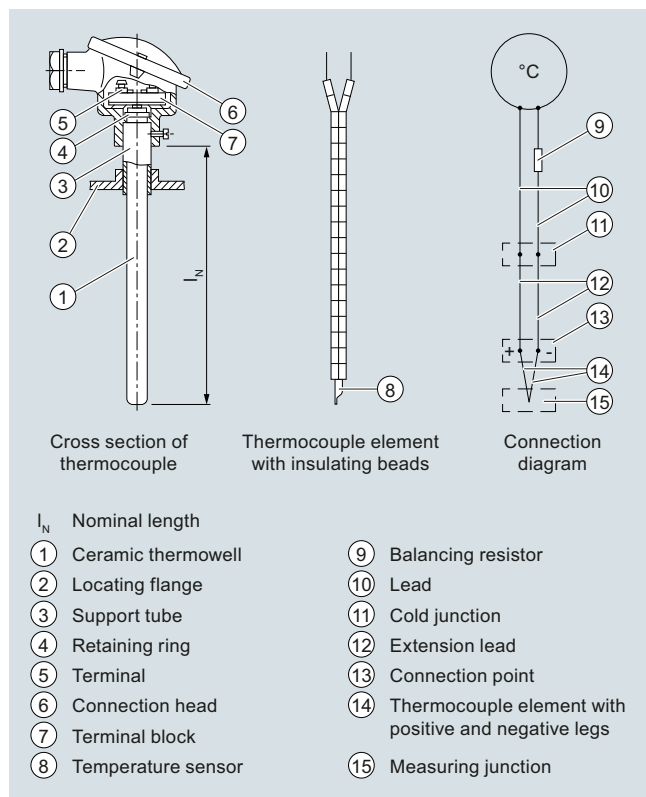
Technical description

Design

A thermocouple comprises

- The thermocouple element (sensor) and
- The mounting and connection parts required in each case.

The thermocouple element is formed by two conductors of dissimilar metals or metal alloys which are soldered or welded together at one end, the measuring junction:



Thermocouple element

Function

Measuring principle of the thermocouple element

If the measuring junction is exposed to a temperature different from that at the free ends of the thermocouple, a voltage (the thermoelectric voltage, Seebeck effect) is produced at these free ends. The magnitude of the thermoelectric voltage depends on the difference in temperature between the measuring junction and the free ends, and on the combination of materials in the thermocouple. Since a thermocouple always measures a temperature difference, the free ends of the thermocouple must be connected to a reference junction (cold junction) and held constant at a known temperature.

Calibration data for thermoelectric voltages and permissible deviations

The calibration data and the permissible deviations for commonly used thermocouples are defined (see Technical Data, Table "Calibration data for thermoelectric voltages and error limits").

The thermocouples Cu-CuNi and Fe-CuNi to DIN 43710 are used for replacement purposes. Thermocouples of class 2 are supplied as standard. For more accurate measurements, thermocouples are available with half the DIN tolerance or with a test certificate. The tolerances only apply to the condition upon delivery.

During operation at high temperatures, the tolerances of the thermocouples may change due to absorption of foreign matter, oxidation or evaporation of alloy components.

Mode of operation

The thermocouples are extended from the connection point to a point whose temperature is as constant as possible (the cold junction) by means of extension leads.

The extension leads have the same color code as the associated thermocouple elements; the positive pole is marked in red. Correct polarity must be ensured since otherwise large errors will occur. Up to 200 °C, the same calibration data and tolerances apply to the extension leads as to the corresponding thermocouples.

The influence of temperature changes at the cold junction can be balanced by means of a compensating circuit, e.g. a compensating box. The reference temperature is 0 (32 °F) or 20 °C (68 °F).

It is also possible to keep the cold junctions at a constant temperature of 50, 60 or 70 °C (122, 140 or 158 °F) using a thermostat (for several measuring junctions).

The connections from the cold junction to the measuring or process instrument are made using copper leads. With energy-consuming instruments such as indicators or multipoint recorders, the complete measuring circuit (thermocouple, extension lead and copper lead) must be balanced in the operating condition using a resistor. SITRANS T transmitters and process recorders for connection to thermocouple elements have a built-in compensating circuit for balancing the effect of the ambient temperature on the cold junction. Lead balancing is not necessary in this case because of the high input impedance.

Protection fitting/Thermowells

The thermocouple can be protected against mechanical stress and chemical attack by a ceramic or metal thermowell, which may be mounted using flanges, screwed glands or by welding into the pipe or vessel. The thermocouple element terminates in the connection head.

Installation examples with specification of the recommended thermocouples and thermowell materials can be found under "Integration" in the "Installation examples" table.

Owing to the different operating conditions, no guarantee can be given for protective fittings. The manufacturer is responsible for damages and measuring errors caused by wrong installation in compliance with the General Terms of Delivery if the instruments have been installed by the manufacturer and if the specifications for the operating conditions furnished by the customer were correct and sufficiently detailed.

Thermocouple elements are very compatible since it is almost always possible to adapt them in shape and size to the particular problem. The temperature-responsive part is almost point-shaped. Thermocouple elements are therefore particularly suitable for measuring rapidly changing temperatures.

Straight thermocouples according to EN 50446, with connection head

Overview

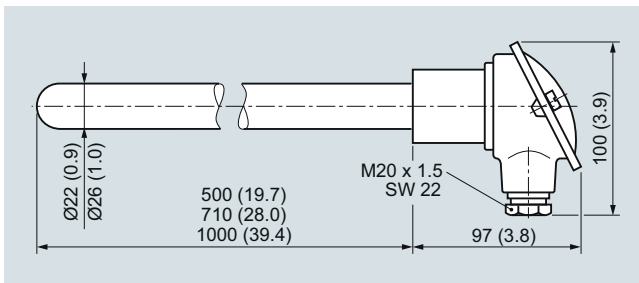


The straight thermocouple together with a metal thermowell is suitable for temperatures from 0 to 1250 °C (32 to 2282 °F) and can be supplied with a built-in temperature transmitter.

Technical specifications

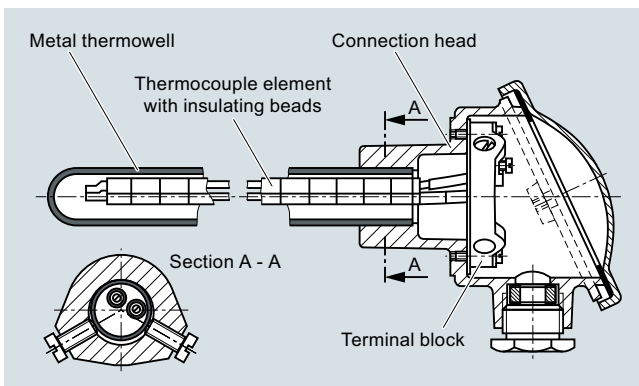
| | |
|----------------------|--|
| Thermocouples | Ni Cr/Ni type K |
| • Number | 1 or 2 |
| • Leg diameter | 2 ... 3 mm (0.08 ... 0.12 inch) |
| • Insulation of legs | Insulating beads |
| Thermowell | Metal |
| Connection head | Form A; made of cast light alloy, with one cable bushing |

Dimensional drawings



Straight thermocouple, dimensions in mm (inches)

Design



Straight thermocouple with base-metal element Ni Cr/Ni with metal thermowell

Selection and Ordering data

Article No.

Straight thermocouple with Ni Cr/Ni thermocouple (type K)

7MC2000 - 0 0

with metallic thermowell

Click on the Article No. for the online configuration in the PIA Life Cycle Portal.

Nominal length

Enter customer specific length with Y44, see Order codes below

300 ... 500 mm (11.81 ... 19.68 inch)
Initial: 500 mm (19.68 inch)

501 ... 710 mm (19.72 ... 27.95 inch)
Initial: 710 mm (27.95 inch)

711 ... 1 000 mm (27.11 ... 39.37 inch)
Initial: 1 000 mm (39.37 inch)

Thermowell

to 1 000 °C (1 832 °F)
X 10 CrAl 24, material No. 1.4762
Ø 22 mm x 2 mm (0.87 inch x 0.079 inch)
Leg diameter 2 mm (0.08 inch)

to 1 100 °C (2 012 °F)
X 18 CrNi 28, material No. 1.4749
Ø 26 mm x 4 mm (1.02 inch x 0.16 inch)
Leg diameter 3 mm (0.12 inch)

to 1 200 °C (2 192 °F)
X 15 CrNi Si 24 19, material No. 1.4841
Ø 22 mm x 2 mm (0.87 inch x 0.079 inch)
Leg diameter 2 mm (0.08 inch)

to 1 250 °C (2 282 °F)
CrAl 205 (Kantal AF), material No. 1.4767
Ø 22 mm x 2 mm (0.87 inch x 0.079 inch)
Leg diameter 3 mm (0.12 inch)

Number of thermocouples

1 thermocouple
2 thermocouples

Connection head, form A,

made of cast light alloy, with 1 cable inlet and
- screw cover
- high hinged cover

Selection and Ordering data

Order code

Straight thermocouple with Ni Cr/Ni thermocouple (type K)

for temperatures to 1250 °C (2282 °F);
with metallic thermowell

Further designs

Please add "-Z" to Article No. and specify
Order code(s) and plain text.

Special version, specify in plain text

Y98

Process number for special version

Y99

TAG plate made of stainless steel
specify TAG No. in plain text

Y15

Calibration carried out at one point, specify
desired temperature in plain text (order
equivalent number of times for several cali-
bration points).

Y33

Insertion length customer-specific

Select range,
enter desired length in plain text
(No entry = standard length)

Y44

To order a temperature transmitter installed in the connection head, see "Temperature transmitters for installation in the connection head" (page 2/113).

Installation of a transmitter is only possible here in the versions with a high hinged cover (7MC2000-...6).

Temperature Measurement

Temperature sensors

Thermocouples

Straight thermocouples, individual parts and accessories

Selection and Ordering data

Metal thermowells for straight thermocouples according to EN 50446

| | Article No. |
|---|--|
| X 10 CrAl 24, material no. 1.4762 Ø 22 x 2 mm (Ø 0.87 x 0.08 inch), 0.55 ... 1.10 kg (1.21 ... 2.42 lb), dished Nominal length/thermowell length in mm (inch): • 500 (19.7)/520 (20.5) • 710 (28.0)/730 (28.7) • 1 000 (39.4)/1 020 (40.2) | 7MC2900-1DA 7MC2900-2DA 7MC2900-3DA |
| X 18 CrN28, material no. 1.4749 Ø 26 x 4 mm (Ø 1.02 x 0.16 inch), 1.25 ... 2.20 kg (2.76 ... 4.85 lb), dished Nominal length/thermowell length in mm (inch): • 500 (19.7)/520 (20.5) • 710 (28.0)/730 (28.7) • 1 000 (39.4)/1 020 (40.2) | 7MC2900-1EC 7MC2900-2EC 7MC2900-3EC |
| X 15 CrNiSi 25 20, material no. 1.4841 Ø 22 x 2 mm (Ø 0.87 x 0.08 inch), 1.05 kg (2.31 lb), dished Nominal length/thermowell length in mm (inch): • 1 000 (39.4)/1 020 (40.2) | 7MC2900-3FA |
| CrAl 205 (Kantal AF), material no. 1.4767 Ø 22 x 2 mm (Ø 0.87 x 0.05 inch), 0.55 ... 1.10 kg (1.21 ... 2.42 lb) Nominal length/thermowell length in mm (inch): • 500 (19.7)/520 (20.5) • 710 (28.0)/730 (28.7) • 1 000 (39.4)/1 020 (40.2) | 7MC2900-1HA 7MC2900-2HA 7MC2900-3HA |

Thermocouple elements for straight thermocouples according to EN 50446

| | Article No. |
|--|--|
| Base thermocouple with isolating pipe Wire diameter 3 mm (0.12 inch) Ni Cr/Ni, up to 1 000 °C (max. 1 300 °C), (up to 1 832 °F (max. 2 372 °F)) 0.55 ... 2.10 kg (1.21 ... 4.63 lb) Nominal length L1/Thermowell length L2 in mm (inch): • 500 (19.7)/540 (21.3) • 710 (28.0)/750 (29.5) • 1 000 (39.4)/1 040 (40.9) | 7MC2903-1CA 7MC2903-2CA 7MC2903-3CA |

Connection heads for straight thermocouples

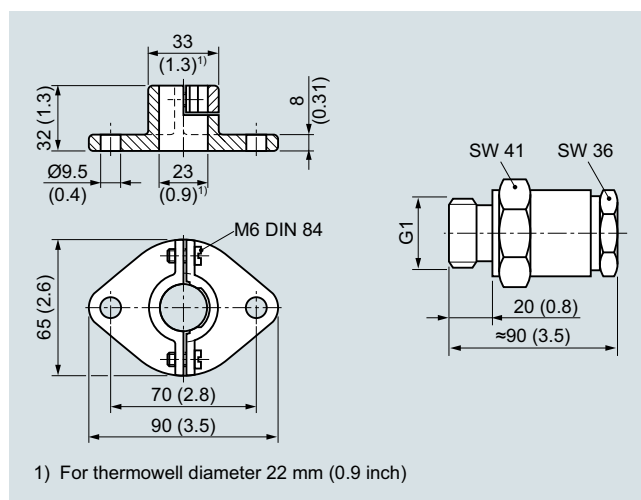
| | Article No. |
|--|--|
| Connection head, type A (without terminal base and terminals) , 1 cable entry, degree of protection IP53, 0.35 kg (0.77 lb) Light metal casting, screw-on cover, for thermowell diameter in mm (inch) (hole = thermowell diameter +0.5 mm) (0.02 inch) • 22 (0.87) • 26 (1.02) | 7MC2905-1AA 7MC2905-1BA |
| Light metal, high spring flap, for thermowell diameter in mm (inch) (hole = thermowell diameter +0.5 mm) (0.02 inch) • 22 (0.87) • 26 (1.02) | 7MC2905-4AA 7MC2905-4BA |

Installation accessories for connection heads for straight thermocouples

- Terminal base
- Terminal
- Sealing rings
- Washer
- Stop flange
- Threaded sleeve

| | Article No. |
|---|--|
| Terminal base without terminals for base thermocouples; 0.06 kg (0.13 lb) | 7MC2998-1AA |
| Terminal for base thermocouples; 0.01 kg (0.02 lb) | 7MC2998-1BA |
| Set of sealing rings (100 units) for the lid of the connection head; 0.01 kg (0.02 lb) | 7MC2998-1CA |
| Set of washers (100 units) for the terminal base; 0.01 kg (0.02 lb) | 7MC2998-1CB |
| Stop flange, adjustable, from GTW For thermowell outer diameter 22 mm (0.87 inch); 0.35 kg (0.77 lb) For thermowell outer diameter 26 mm (1.02 inch); 0.32 kg (0.71 lb) | 7MC2998-2CB 7MC2998-2CC |
| Threaded sleeve, gas-tight up to 1 bar (14.5 psi), adjustable, material no. 1.0718, with seal; 0.40 kg (0.88 lb) For thermowell outer diameter 22 mm (0.87 inch), G1 For thermowell outer diameter 26 mm (1.02 inch), G1 | 7MC2998-2DB 7MC2998-2DC |

Dimensional drawings



Mounting flange to DIN 43734 (left) and threaded sleeve (right) for installing straight thermocouples, dimensions in mm (inches)