EPIC® SENSORS

Temperature sensor & IoTKey® products and services
EPIC® SENSORS production program

Lapp Automaatio has manufactured temperature sensors for more than 20 years. We have wide experience of producing sensors for power plants, Ex-areas, the oil and gas, pulp & paper, machine building, and hygienic industries.

We manufacture vibration-proof resistance and thermocouple sensing elements which are mineral insulated. Our standard product line consists of 25 basic structures, which can be altered according to customer specifications. In addition to the wide standard product range we also provide individual, customer specific total solutions. The principles of our services are high quality sensors, fast deliveries, cost-effectiveness and low risk for the customer.

Our own manufacturing guarantees short delivery times also for application-specific special sensors, for example our range of ATEX and IECEx certified sensors for potentially explosive areas. All demanding precision welding is performed with laser welding equipment at our production facilities in Finland.

PRODUCED EPIC® SENSORS TEMPERATURE SENSORS

• Pt100 (2xPt100, 3xPt100)
• Pt1000
• Thermocouples
• Flanged thermowells
• Pt100 with silicon well
• Cable probes
• Bayonet probes
• Ceramic sensors
• Coated thermowells
• Multi-point temperature sensors
• Ex-approved sensors
• Bearing temperature sensors
• Temperature sensors with magnet
• Immersible temperature sensors
• Customer specific solutions
• Materials used are stainless, acid-proof, and heat-resistant steel, titanium, Hastelloy and polyamids, among others.

5-YEAR WARRANTY

We rely on the craftsmanship and quality of our sensor manufacturing and want this to be beneficial to our customers in planning and maintaining their temperature measuring systems. That’s why we grant a five year product warranty for EPIC® SENSORS temperature sensors.

EPIC® SENSORS PRODUCTION PROGRAM

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We manufacture vibration-proof resistance and thermocouple sensing elements which are mineral insulated. Our standard product line consists of 25 basic structures, which can be altered according to customer specifications. In addition to the wide standard product range we also provide individual, customer specific total solutions. The principles of our services are high quality sensors, fast deliveries, cost-effectiveness and low risk for the customer. Our own manufacturing guarantees short delivery times also for application-specific special sensors, for example our range of ATEX and IECEx certified sensors for potentially explosive areas. All demanding precision welding is performed with laser welding equipment at our production facilities in Finland.
ENERGY AND PULP & PAPER INDUSTRIES
The long tradition of Finnish pulp & paper plants with their self-contained power production, has taught us to deal with extreme materials, temperatures and scale of machinery.
Even in the changing environment, this vast knowledge can be adapted to renewable energy applications and advanced, smart production automation.

OIL, GAS, AND PETROCHEMICAL INDUSTRIES
We have a long history in delivering and manufacturing temperature measurement solutions for oil refineries, bio-diesel plants and the petrochemical industry. We have delivered temperature instrumentation solutions for:
- Columns
- Trace heating
- Reactor temperature measurements (inside reactors, single point, multi-point and surface)
- Furnaces
- Pipelines
- Laboratories
- Oil tanks
- Ethylene plants
- Underground oil reservoirs
- Bio-diesel manufacturing and pyrolysis processes
- Flare temperature measurement.

HYGIENIC INDUSTRY
EPIC® SENSORS temperature sensors can be used in areas where strict hygiene is required and extreme cleaning processes are used.
Our range of temperature sensors include many products designed specifically for hygienic applications. The temperature sensors can be customized for all kinds of cleaning processes. Hygienic solutions are used in the food & beverage, pharmaceutical, and medical equipment industries, and clean room solutions, for example.

MACHINE BUILDING INDUSTRY
We have a wide variety of solutions for the machine building applications.
When measuring temperature in machine building, it is essential to take into account vibration, thermal stability and screening. We have developed sensor variations, which specially suit the machine building designs; confined installation spaces, easy assembly and cost effective solutions.
We have accumulated experience in electric motor stators, different energy chain applications, circuit boards, gear oil & bearing, and transformer measurements, to name a few.
We design and manufacture temperature measurement sensors, no matter how big or small the application.

SENSORS FOR EX-AREAS
EPIC® SENSORS temperature sensors are also manufactured for different kind of potentially explosive areas and zones.
We have implemented temperature measurement applications related to potentially explosive areas for more than ten years. The risk of explosion can be caused by flammable liquids, gases or dust.
Temperature measurements have been made for a variety of devices and applications used in Ex-areas. For example:
- Pipes/tanks
- Trace heating control
- Electrical equipment and components
- Gearboxes
- Pumps and pump/motor combinations.
Solutions can be executed according to the application requirements, with the following protection types:
- Flameproof enclosure Ex db ATEX-certified
- Increased safety Ex e ATEX- / IECEx-certified
- Dust protection by housing Ex tb ATEX- / IECEx-certified.
EPIC® SENSORS PT100 TEMPERATURE SENSORS

- The measurement is based on resistance principle
- The measurement element material is platinum and the resistance value is 100 ohm at 0 °C temperature
- Platinum has a positive resistance temperature factor so the resistance increases with rising temperature
- Resistance variation is according to IEC 60751

One sensor structure can include several Pt100 resistances: 1, 2 or 3 × Pt100 (the most common is 1 × Pt-100)

For different measuring circuits the resistance element can be produced in different versions: 2-, 3- or 4-wire connection, most accurate version is 4-wire connection

Standard version of the industrial Pt100 sensor is vibration proof, additionally it can be produced as an extra vibration proof version for extreme conditions.

VIBRATION PROOF RESISTANCE SENSING ELEMENTS, SHEATH CONSTRUCTION

- Standard sheath material AISI 316L
- Diameter 1.6...8 mm
- 2-, 3- and 4-wire connection + compensation loop
- Precision classes: Class A, B, 1/3 DIN and 1/10 DIN.

CABLE PROBES

- Diameter and length according to specification
- As thermocouples
- As Pt100 probes (1xPt100, 2xPt100, other norms on request)
- 2-, 3- and 4-wire connection (Pt100)
- Precision classes: Class A, B, 1/3 DIN, 1/10 DIN (Pt100) and Class 1 (TC)
- Various coupling options.

TOLERANCE CLASSES FOR PT100 THERMOMETERS ACCORDING TO STANDARD IEC 60751

If the required precision exceeds the values given in precision class A, then class AA will be used or the fractions will be based on class B, for instance:

$$\theta = \frac{\text{modulus of temperature in } ^\circ\text{C}}{3}$$

The fractional values are not valid for the total measurement range, only at point 0 °C.
**THERMOCOUPLES**

EPIC® Sensors thermocouple sensor produces an mV measuring signal, which is proportional to temperature depending on which TC type is used.

**MEASURING PRINCIPLE**

When two wires of different metals or metal alloys (thermo wires) are joined together in one end (hot junction), a thermocouple is formed. The free ends of those wires form a reference point. If there is a temperature difference between hot junction T1 and reference point T2, a thermal electromotive force (voltage) is created in the thermocouple, the level of this voltage is proportional only to temperature difference T1-T2 and to materials, which the thermocouple is formed of (Seebeck effect).

For that reason it is important to have the reference point as stable as possible, when it is moved to a location of standard temperature (reference temperature) using extension wire or insulated thermo wire.

**COLD JUNCTION COMPENSATION (CJC)**

A temperature transmitter or measuring system needs information from the reference point (cold junction) temperature T2. Variations in the reference point temperature are compensated with CJC measuring (Cold Junction Compensation). The temperature transmitters’ CJC measurement can be done by internal measurement or with a resistance sensor (RTD) installed on the connector. If the reference point is far from the transmitter, a separate temperature measurement is required to measure and compensate the temperature at that point.

**VIBRATION-PROOF THERMOCOUPLES, SHEATH CONSTRUCTION**

- Diameter 0.5...8 mm
- Standard sheath material Inconel 600 or AISI 316
- Precision class 1
- Length according to specification.

**TEMPERATURE RANGES AND TOLERANCES OF THERMOCOUPLE TYPES**

<table>
<thead>
<tr>
<th>Type</th>
<th>Accuracy class</th>
<th>Temperature range °C</th>
<th>Constant value °C</th>
<th>Tolerances allowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>1</td>
<td>-40...+350</td>
<td>± 0.5</td>
<td>± 0.004 [t]</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>-40...+350</td>
<td>± 1.0</td>
<td>± 0.0075 [t]</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>-200...+40</td>
<td>± 1.0</td>
<td>± 0.015 [t]</td>
</tr>
<tr>
<td>E</td>
<td>1</td>
<td>-40...+800</td>
<td>± 1.5</td>
<td>± 0.004 [t]</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>-40...+1000</td>
<td>± 2.5</td>
<td>± 0.0075 [t]</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>-200...+40</td>
<td>± 2.5</td>
<td>± 0.015 [t]</td>
</tr>
<tr>
<td>J</td>
<td>1</td>
<td>-40...+750</td>
<td>± 1.5</td>
<td>± 0.004 [t]</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>-40...+730</td>
<td>± 2.5</td>
<td>± 0.0075 [t]</td>
</tr>
<tr>
<td>K and N</td>
<td>1</td>
<td>-40...+1000</td>
<td>± 1.5</td>
<td>± 0.004 [t]</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>-40...+1200</td>
<td>± 2.5</td>
<td>± 0.0075 [t]</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>-200...+40</td>
<td>± 2.5</td>
<td>± 0.015 [t]</td>
</tr>
<tr>
<td>R and S</td>
<td>1</td>
<td>0...+1600</td>
<td>± 1.0</td>
<td>± [1+(t-1100) × 0.003] °C</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0...+1600</td>
<td>± 1.5</td>
<td>± 0.0003 [t]</td>
</tr>
<tr>
<td>L*</td>
<td></td>
<td>200...+400</td>
<td>± 3.0 °C</td>
<td>± 0.75 %</td>
</tr>
</tbody>
</table>

* Type L is defined in standard DIN 43710, all other types in standard IEC 60584.

**THERMO ELEMENT CONNECTIONS**
IOTKEY® PRODUCTS AND SERVICES

WIRELESS FOR INDUSTRIAL APPLICATIONS
• Industry grade turn-key solution for cost efficient wireless measurements
• Fast and simple setup also for retro-fit and temporary installations
• Reliable, long range, low power wireless data communication with excellent immunity to interference even in demanding conditions.

SMARTER MAINTENANCE FOR BETTER PRODUCTIVITY
• Prevent, detect, locate and diagnose problems and failures faster and more efficiently
• Optimize inspection and maintenance intervals, conditions, product life-cycle and warranty costs based on real world up-to-date measurements
• Get more insight with more data - temperature, humidity, pressure level, vibration, oil quality, current, etc.

FUTURE-PROOF FLEXIBILITY
• Use as a stand-alone solution or integrate to existing systems
• Scale up with new sensors, locations and monitoring options
• Simple web-based access to real time data, trends and measurement configurations – anytime and anywhere, also with mobile devices.

APPLICATION EXAMPLES
• Problem diagnostics and preventive maintenance for bearings, pumps, gears, turbines, etc.
• Detection of efficiency drops and maintenance needs in heat exchangers
• Advanced and continuous oil quality monitoring for product maintenance, life cycle and cost optimization
• Environmental measurements and monitoring for warehouses and storage areas, laboratory space, etc.
• Remote monitoring for levels and temperatures in water supply and waste water networks
• Monitoring and improving energy efficiency in district heating systems
• Mobile measuring sets for temporary condition monitoring of machines and production facilities.

IoTKey® TRANSMITTER WLT 310
• Encrypted wireless LoRa communication
• Long range, low power and excellent interference immunity
• 1–3 sensors per transmitter, e.g. temperature, humidity, pressure, vibration, oil quality
• Configurable measuring interval and alarms.

IoTKey® GATEWAY & MONITORING
• Data routing (4G/Ethernet) to IoTKey cloud or any other system
• Real time monitoring, alarms and history data anywhere with any web enabled device
• Configurable dashboard views and measuring parameters.

TYPICAL INDUSTRY SECTORS
MANUFACTURING
ENERGY
WATER & INFRASTRUCTURE

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IoTKey® Transmitter WLT 310 is a LoRaWAN® CertifiedCM product.
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EPIC® SENSORS T-B-ØK / W-B-ØK
Threaded temperature sensor without neck pipe

Features
- according to DIN 43772 form 2
- temperature range -40...+250 °C
- Pt100 or thermocouple as sensing element
- Pt100 accuracy class A as standard delivery
- thermocouple accuracy class 1 as standard delivery
- AISI 316L as standard delivery material, other materials on request
- MI cable structured sensor element
- internal sensor element replaceable on the fly
- tailored solutions according to customer specific needs
- ATEX compatible Ex db version available.

Typical applications
- energy and power plant technology
- process industry
- chemical industry
- machinery and vessel construction
- manufacturing industry.

Drawings

Product code key


Installation examples

Technical data

<table>
<thead>
<tr>
<th>Materials</th>
<th>AISI 316L, maximum temperature +250 °C, temporarily +300 °C, other materials on request</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread</td>
<td>G, R, metric and NPT threads as standard delivery, other threads on request</td>
</tr>
<tr>
<td>Tolerances Pt100 (IEC 60751)</td>
<td>A tolerance ±0.15 + 0.002 x t, operating temperature -100...+450 °C</td>
</tr>
<tr>
<td>B tolerance ±0.3 + 0.005 x t, operating temperature -196...+600 °C</td>
<td></td>
</tr>
<tr>
<td>Tolerances thermocouple (IEC 60584)</td>
<td>Type J tolerance class 1 = -40...375 °C ±1.5 °C, 375...750 °C ±0.004 x t</td>
</tr>
<tr>
<td>Temperature range Pt100</td>
<td>-40...+250 °C</td>
</tr>
<tr>
<td>Temperature range thermocouple</td>
<td>-40...+250 °C</td>
</tr>
<tr>
<td>Approvals</td>
<td>ATEX, RU Ex, EAC, METROLOGICAL PATTERN APPROVAL</td>
</tr>
<tr>
<td>Quality certificate</td>
<td>ISO 9001:2015 issued by DNV</td>
</tr>
<tr>
<td>IP rating</td>
<td>IP65, higher IP rating on request</td>
</tr>
</tbody>
</table>

Example code:

EPIC® SENSORS T-B-Ø / W-B-Ø
Threaded temperature sensor with neck pipe and thermowell

Features
- according to DIN 43772 form 2G
- temperature range -200...+1200 °C
- neck pipe for heat source clearance
- Pt100 or thermocouple as sensing element
- thermowell material according to the application
- Pt100 accuracy class A as standard delivery
- thermocouple accuracy class 1 as standard delivery
- MI cable structured sensor element
- internal sensor element replaceable on the fly
- tailored solutions according to customer specific needs
- ATEX compatible Ex db version available
- neck pipe length 145 mm as standard delivery, other lengths on request.

Typical applications
- energy and power plant technology
- process industry
- chemical industry
- machinery and vessel construction
- manufacturing industry.

Technical data

Materials
AISI 316L, maximum temperature +550 °C, temporarily +600 °C,
EN 1.4841 heat-resistant steel, maximum temperature +1100 °C, temporarily +1200 °C
Other materials on request

Thread
G, R, metric and NPT threads as standard delivery, other threads on request

Tolerances Pt100 (IEC 60751)
A tolerance ±0.15 + 0.002 x t, operating temperature -100...+450 °C
B tolerance ±0.3 + 0.005 x t, operating temperature -196...+600 °C
B 1/3 DIN, tolerance ±1/3 x (0.3 + 0.005 x t), operating temperature -196...+600 °C
B 1/10 DIN, tolerance ±1/10 x (0.3 + 0.005 x t), operating temperature -196...+600 °C

Tolerances thermocouple (IEC 60584)
Type J tolerance class 1 = -40...375 °C ±1.5 °C, 375...750 °C ±0.004 x t
Type K and N tolerance class 1 = -40...375 °C ±1.5 °C, 375...1000 °C ±0.004 x t

Temperature range Pt100
-200...+1500 °C

Approval
ATEX, RU Ex, EAC, METROLOGICAL PATTERN APPROVAL

Quality certificate
ISO 9001:2015 issued by DNV

IP rating
IP65, higher IP rating on request

Product code key

Example code:
W = Pt100 resistance thermometer
2xW = 2 x Pt100 resistance thermometer
T = thermocouple
2xT = 2 x thermocouple
B = threaded sensor type (constant in code)
6, 8, 9, 11, 12 = sensor element outer diameter (ØOD) [mm]
W = connection head B
D/H = connection head with snap lock
D/H/D = high cover connection head with snap lock and double barrel (2x cable gland)
D/W/H = high cover connection head with snap lock and double barrel (2x cable gland)
D/E/D = ATEX-compatible connection head
HST = acid proof connection head
N = connection head N
160 = length, L [mm]
G½" = thread size (all available, also NPT)
4, 3, 2 = Pt100 wire count
K/N = thermocouple type
A/R = Pt100 accuracy class,
1, 2, 3 = thermocouple accuracy classes,
(ex class A as standard delivery)
(ex class 1 as standard delivery)
TR = wires for transmitter connection
CB = with ceramic terminal block
X = additional details on the last line

Installation examples
**EPIC® SENSORS T-F / W-F**

**Flanged temperature sensor**

### Features
- according to DIN 43772 form 2F
- temperature range -200...+1200 °C
- neck pipe for heat source clearance
- AISI 316L as standard delivery material, other materials on request
- Pt 100 or thermocouple as sensing element
- Pt 100 accuracy class A as standard delivery
- thermocouple accuracy class 1 as standard delivery
- Mi cable structured sensor element
- internal sensor element replaceable on the fly
- flange size and type according to customer application
- tailored solutions according to customer specific needs
- ATEX compatible Ex db version also available
- typical neck pipe length 145 mm, other lengths on request.

### Typical applications
- energy and power plant technology
- process industry
- chemical industry
- machinery and vessel construction
- manufacturing industry.

### Technical data

**Thermowell materials**

- AISI 316L, maximum temperature +550 °C, temporarily +600 °C, EN1.4841 heat-resistant steel, maximum temperature +1100 °C, temporarily +1200 °C

**Flange**

- Flat face DIN EN 1092-1, type 05A, other flange types on request

**Tolerances Pt100**

- (IEC 60751)
  - A tolerance ±0.15 + 0.002 x t, operating temperature -100...+450 °C
  - B tolerance ±0.3 + 0.005 x t, operating temperature -196...+600 °C
  - B 1/3 DIN, tolerance ±1/3 x (0.3 + 0.005 x t), operating temperature -196...+600 °C
  - B 1/10 DIN, tolerance ±1/10 x (0.3 + 0.005 x t), operating temperature -196...+600 °C

**Tolerances thermocouple**

- (IEC 60584)
  - Type J tolerance class 1 = -40...375 °C ±1.5 °C, 375...750 °C ±0.004 x t
  - Type K and N tolerance class 1 = -40...375 °C ±1.5 °C, 375...1000 °C ±0.004 x t

**Temperature range Pt100**

- -200...+550 °C

**Temperature range thermocouple**

- -200...+1200 °C, depending on thermocouple type and cooling neck length

- Neck pipe length = 250 mm → temp. max. +750 °C
- Neck pipe length = 300 mm → temp. max. +1000 °C
- Neck pipe length = 350 mm → temp. max. +1200 °C

**Approvals**

- ATEX, RU Ex, EAC, METROLOGICAL PATTERN APPROVAL

**Quality certificate**

- ISO 9001:2015 issued by DNV

**IP rating**

- IP65, higher IP rating on request

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**Drawing**

- Diagram of flanged temperature sensor with labeled parts

**Product code key**


- W = Pt100 resistance thermometer
- 2xD = 2 x Pt100 resistance thermometer
- T = thermocouple
- 2xT = 2 thermocouple
- F = sensor with flange (constant in code)
- 11, 15, 22 = thermowell outer diameter (ØOD) [mm] (other diameters on request)
- B = connection head B
- D/W = connection head with snap lock
- D/W/D = connection head with snap lock and double barrel (2x cable gland)
- D/W/M/H = high cover connection head with snap lock and double barrel (2x cable gland)
- EXD = ATEX-compatible connection head
- HST = acid proof connection head
- N = connection head N
- L = length, L [mm]
- DN25/PN40
- DN50/PN40
- DN80/PN40

**Installation examples**

- Diagrams showing installation examples of flanged temperature sensors
EPIC® SENSORS T-D / W-D
Weldable temperature sensor

Features
- according to DIN 43772 form 4
- temperature range -200...+1200 °C
- neck pipe for heat source clearance
- with weldable thermowell
- AISI 316L as standard delivery material, other materials on request
- Pt 100 or thermocouple as sensing element
- Pt 100 accuracy class A as standard delivery
- thermocouple accuracy class 1 as standard delivery
- Mi cable structured sensor element
- internal sensor element replaceable on the fly
- tailored solutions according to customer specific needs
- ATEX compatible Ex db version also available
- neck pipe length 165 mm as standard delivery, other lengths on request.

Typical applications
- energy and power plant technology
- process industry
- chemical industry
- machinery and vessel construction
- manufacturing industry.

Technical data
Materials
AISI 316L, max. temperature +550 °C, temporarily +600 °C
1.4541/1.7435, max. temperature +550 °C
1.4540/1.7435, max. temperature +550 °C
1.4543/1.7435, max. temperature +550 °C
Other materials available on request, for example:
AISI 31803/1.4462, SMO254/1.4547, AISI304L/1.4307, TiGr2/3.7035, etc.

Thermowell types
D1, D2, D3, D4, D5, D6 with M18x1.5 thread or
D1/S, D2/S, D4/S, D5/S with M14x1.5 thread
According to standard DIN 43772 form 4, other thermowell types on request

Tolerances Pt100
(AEC 60751)
A tolerance ±0.15 + 0.002 x t, operating temperature -100...+450 °C
B tolerance ±0.3 + 0.005 x t, operating temperature -196...+600 °C
According to standard DIN 43772 form 4,
Tolerances thermocouple
(AEC 60584)
Type J tolerance class 1 = -40...375 °C ± 1.5 °C, 375...750 °C ± 0.004 x t
Type K and N tolerance class 1 = -40...375 °C ± 1.5 °C, 375...1000 °C ± 0.004 x t

Temperature range Pt100
-200...+550 °C
Temperature range thermocouple
-200...+1200 °C depending on thermoelement, thermowell material and cooling neck length
Neck pipe length = 250 mm → temp. max. +750 °C
Neck pipe length = 300 mm → temp. max. +1000 °C
Neck pipe length = 350 mm → temp. max. +1200 °C

Approvals
ATEX, RU Ex, EAC, METROLOGICAL PATTERN APPROVAL

Quality certificate
ISO 9001:2015 issued by DNV

IP rating
IP65, higher IP rating on request

Drawing

Product code key


Installation examples
EPIC® SENSORS T-H-12 / W-H-12
Threaded temperature sensor with neck pipe and sensing element

Features
- temperature range -200...+1200 °C
- neck pipe for heat source clearance
- thread attachable to thermowell or process
- Pt 100 or thermocouple as sensing element
- Pt 100 accuracy class A as standard delivery
- thermocouple accuracy class 1 as standard delivery
- MI cable structured sensor element
- internal sensor element replaceable on the fly
- standard delivery length for sensor element is 315, 375 or 435 mm, other lengths available on request
- neck pipe length 165 mm as standard delivery, other lengths on request
- tailored solutions according to customer specific needs
- ATEX compatible Ex db version also available.

Typical applications
- energy and power plant technology
- process industry
- chemical industry
- machinery and vessel construction
- manufacturing industry.

Technical data

<table>
<thead>
<tr>
<th>Thread</th>
<th>M14x1.5 or M18x1.5 thread as standard delivery, other threads on request</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal sensor element diameter</td>
<td>3, 6 or 8 mm</td>
</tr>
<tr>
<td>Tolerances Pt100 (IEC 60751) A tolerance ±0.5 + 0.002 x t, operating temperature -100...+450 °C</td>
<td></td>
</tr>
<tr>
<td>B tolerance ±0.3 + 0.005 x t, operating temperature -196...+600 °C</td>
<td></td>
</tr>
<tr>
<td>B 1/3 DIN, tolerance ±1/3 x (0.3 + 0.005 x t), operating temperature -196...+600 °C</td>
<td></td>
</tr>
<tr>
<td>B 1/10 DIN, tolerance ±1/10 x (0.3 + 0.005 x t), operating temperature -196...+600 °C</td>
<td></td>
</tr>
<tr>
<td>Tolerances thermocouple (IEC 60584) Type J tolerance class 1 = -40...375 °C ± 1.5 °C, 375...750 °C ±0.004 x t</td>
<td></td>
</tr>
<tr>
<td>Type K and N tolerance class 1 = -40...375 °C ± 1.5 °C, 375...1000 °C ±0.004 x t</td>
<td></td>
</tr>
<tr>
<td>Temperature range Pt100</td>
<td>-200...+1200 °C</td>
</tr>
<tr>
<td>Temperature range thermocouple</td>
<td>-200...-1200 °C depending on thermocouple type, thermowell materials and cooling neck length</td>
</tr>
<tr>
<td>Neck pipe length = 250 mm, temp. max. +750 °C</td>
<td></td>
</tr>
<tr>
<td>Neck pipe length = 300 mm, temp. max. +1000 °C</td>
<td></td>
</tr>
<tr>
<td>Neck pipe length = 350 mm, temp. max. +1200 °C</td>
<td></td>
</tr>
<tr>
<td>Approvals</td>
<td>ATEX, RU Ex, EAC, METROLOGICAL PATTERN APPROVAL</td>
</tr>
<tr>
<td>Quality certificate</td>
<td>ISO 9001 2015 issued by DNV</td>
</tr>
<tr>
<td>IP rating</td>
<td>IP65, higher IP rating on request</td>
</tr>
</tbody>
</table>

Installation examples

Drawing

Product code key


Installation examples

Drawing

Product code key

EPIC® SENSORS W-K-F / W-M-F
Indoor/outdoor resistance temperature sensor

Features
- temperature range -40...+80 °C
- Pt100 as sensing element
- Pt100 accuracy class A as standard delivery
- fast response time
- can be supplied with mA transmitter
- available with plastic or metal housing
- tailored solutions according to customer specific needs
- thermocouple versions available on request
- ATEX compatible Ex db -version also available.

Typical applications
- energy and power plant technology
- process industry
- chemical industry
- machinery and vessel construction
- manufacturing industry.

Technical data

<table>
<thead>
<tr>
<th>Enclosure</th>
<th>Plastic enclosure dimensions 120x80x58 mm (W x H x D), Metal enclosure dimensions 80x75x58 mm (W x H x D)</th>
<th>Other enclosures on request</th>
</tr>
</thead>
</table>
| Tolerances Pt100 (IEC 60751) | A tolerance ±0.15 ± 0.002 x t, operating temperature -100...+450 °C  
B tolerance ±0.3 ± 0.005 x t, operating temperature -196...+600 °C  
B 1/3 DIN, tolerance ±1/3 x (0.3 + 0.005 x t), operating temperature -196...+600 °C  
B 1/10 DIN, tolerance ±1/10 x (0.3 + 0.005 x t), operating temperature -196...+600 °C | Other enclosures on request |
| Temperature range Pt100 | -40...+80 °C, other measurement ranges on request | Other enclosures on request |
| Approvals       | ATEX, RU Ex, EAC, METROLOGICAL PATTERN APPROVAL | Other enclosures on request |
| Quality certificate | ISO 9001:2015 issued by DNV | Other enclosures on request |
| IP rating       | IP65, higher IP rating on request | Other enclosures on request |

Product code key


W = Pt100 resistance thermometer
2xW = 2 x Pt100 resistance thermometer
K = plastic enclosure
M = metallic enclosure
F = sensor type (constant in code)
4,3,2 = Pt100 wire count
A, B = Pt100 accuracy class
TR = with ceramic terminal block
CB = additional details on text line

Installation examples

Drawing

Plastic enclosure

Metal enclosure


W = Pt100 resistance thermometer
2xW = 2 x Pt100 resistance thermometer
K = plastic enclosure
M = metallic enclosure
F = sensor type (constant in code)
4,3,2 = Pt100 wire count
A, B = Pt100 accuracy class
TR = with ceramic terminal block
CB = additional details on text line

ATEX Ex d-versions: contact our sales.
**EPIC® SENSORS T-M-Ø / W-M-Ø**

**Mineral insulated element**

**Features**
- similar to DIN 43762
- temperature range: -200...+1200 °C
- Pt 100 or thermocouple as sensing element
- AISI 316L or INCONEL 600 as standard delivery material, other materials on request
- Pt 100 accuracy class A as standard delivery
- thermocouple accuracy class 1 as standard delivery
- MI cable structured sensor element
- bendable
- tailored solutions according to customer specific needs.

**Typical applications**
- energy and power plant technology
- process industry
- chemical industry
- machinery and vessel construction
- manufacturing industry.

**Special applications**
- for very high temperature solutions we can offer special thermocouple inserts with ceramic tubing and platinum wiring up to +1600 °C
- for this type of insert please contact our sales.

---

**Product code key**


- **W** = Pt100 resistance thermometer
- **2xW** = 2 x Pt100 resistance thermometer
- **T** = thermocouple
- **2xT** = 2 x thermocouple
- **M** = mineral insulated sensor [constant in code]
- **3, 6, B** = outer diameter of MI cable (ØOD) [mm] empty
- **empty** = even thickness (as standard delivery)
- **SV** = thick wall in measure end
- **315** = length, L [mm]
- **4, 3, 2** = Pt100 wire count
- **K, N, J** = thermocouple type
- **A, B, A** = Pt100 accuracy class, [class A as standard delivery]
- **1, 2, 3** = thermocouple accuracy class, [class 1 as standard delivery]
- **TR** = wires for transmitter connection
- **CB** = with ceramic terminal block
- **X** = additional details on the text line

---

**Technical data**

**Materials**
- AISI 316L, max. temperature +550 °C, temporarily +600 °C
- INCONEL 600, max. temperature +1100 °C, temporarily +1200 °C
- Other materials on request

**Tolerances Pt100**
- (IEC 60751)
  - A tolerance ±0.15 + 0.002 x t, operating temperature -100...+450 °C
  - B tolerance ±0.3 + 0.005 x t, operating temperature -196...+600 °C
  - B 1/3 DIN, tolerance ±1/3 x (0.3 + 0.005 x t), operating temperature -196...+600 °C
  - B 1/10 DIN, tolerance ±1/10 x (0.3 + 0.005 x t), operating temperature -196...+600 °C

**Tolerances thermocouple**
- (IEC 60584)
  - Type J tolerance class 1 = -40...375 °C ±1.5 °C, 375...750 °C ±0.004 x t
  - Type K and N tolerance class 1 = -40...375 °C ±1.5 °C, 375...1000 °C ±0.004 x t

**Temperature range Pt100**
- -200...+550 °C, depending on sensor housing materials

**Temperature range thermocouple**
- -200...+1200 °C, depending on thermocouple type and sensor housing materials

**Approvals**
- METROLOGICAL PATTERN APPROVAL

**Quality certificate**
- ISO 9001:2015 issued by DNV

**IP rating**
- IP65, higher IP rating on request

---

**Drawing**

- **SV model** (reinforced)
- **Standard model**

---

**Example code**: W – M – 6 – / 315 – 4 – A – TR – X

**W-M-6/315-3-A-TR-X**

Pt100 resistance thermometer for 3 wire measurement, Pt100 with accuracy class A, mineral insulated element with diameter 6 mm and length 315 mm, ceramic block for cable connection.

**T-M-6/SV/1500-K-1-TR**

Thermocouple type K with accuracy class 1, mineral insulated element with diameter 6 mm and length 1500 mm, reinforced structure, connection head has space for housing, mA current transmitter block.
Immersible temperature sensor

Features
- according to DIN 43772 form 1
- temperature range -200...+1200 °C
- AISI 316L/EN1.4044 or heat-resistant steel AISI 446-1/EN1.4749 as typical material, other materials on request
- available with solid tip
- 200 mm as typical length for the solid tip
- Pt 100 or thermocouple as sensing element
- Pt 100 accuracy class A as standard delivery
- thermocouple accuracy class 1 as standard delivery
- M1 cable structured sensor element
- internal sensor element replaceable on the fly
- tailored solutions according to customer specific needs
- ATEX compatible Ex db version also available.

Typical applications
- energy and power plant technology
- process industry
- chemical industry
- machinery and vessel construction
- manufacturing industry.

Technical data
Thermowell material
AISI 316L/EN1.4044 max. temperature +550 °C, temporarily +600 °C,
AISI 446-1/EN1.4749 max. temperature +1100 °C, temporarily +1200 °C
Other materials on request
Thermowell tip material
AISI 316L/EN1.4044 max. temperature +550 °C, temporarily +600 °C,
AISI 446-1/EN1.4749 max. temperature +1100 °C, temporarily +1200 °C
Other materials on request
Tolerances Pt100
(IEC 60751)
A tolerance ±0.15 x 0.002 x t, operating temperature -100...+450 °C
B tolerance ±0.3 + 0.005 x t, operating temperature -196...+600 °C
B 1/3 DIN, tolerance ±1/3 x (0.3 + 0.005 x t), operating temperature -196...+600 °C
Other materials on request
Tolerances thermocouple
(IEC 60584)
Type J tolerance class 1 = ±40...375 °C ± 1.5 °C, 375...750 °C ±0.004 x t
Type K and N tolerance class 1 = ±40...375 °C ±1.5 °C, 375...1000 °C ±0.004 x t
Temperature range Pt100
-200...+1550 °C, depending on housing and thermowell materials
Temperature range thermocouple
-200...+1200 °C, depending on thermocouple type and thermowell materials
Approvals
ATEX, RU Ex, METROLOGICAL PATTERN APPROVAL
Quality certificate
ISO 9001:2015 issued by DNV
IP rating
IP65, higher IP rating on request

Drawing

Product code key
W = Pt100 resistance thermometer
2xW = 2 x Pt100 resistance thermometer
T = thermocouple
2xT = 2 x thermocouple
A = connection head B
D/H = connection head with snap lock
D/H/D = connection head with snap lock and double barrel (2x cable gland)
D/W/H = high cover connection head with snap lock
D/W/H/D = high cover connection head with snap lock and double barrel (2x cable gland)
EXD = ATEX- compatible connection head
HST = acid proof connection head
N = connection head N
empty = without solid tip
U = with solid tip (tip length typically 200 mm)
1000 = length, L [mm]
1.4404 = thermowell or tip material,
1.4749 = other materials on request
4,3,2 = Pt100 wire count
A,B = Pt100 accuracy class,
(class A as standard delivery)
= thermocouple accuracy class,
(class 1 as standard delivery)
= with ceramic terminal block
= wires for transmitter connection
TR = for transmitter connection
CB = with ceramic terminal block
X = additional details on the text line

Installation examples

Technical data

WR-A-22-EXD-500/1.4404-4-A-CB
Pt100 resistance thermometer for 4 wire measurement, Pt100 with accuracy class A, immersible sensor type, 22 mm diameter for sensor element, ATEX compatible housing, without solid tip, sensor length 500 mm, materials AISI316L/EN1.4404, with ceramic block for cable connection.

Features
- according to DIN 43772 form 1
- temperature range -200...+1200 °C
- AISI 316L/EN1.4044 or heat-resistant steel AISI 446-1/EN1.4749 as typical material, other materials on request
- available with solid tip
- 200 mm as typical length for the solid tip
- Pt 100 or thermocouple as sensing element
- Pt 100 accuracy class A as standard delivery
- thermocouple accuracy class 1 as standard delivery
- M1 cable structured sensor element
- internal sensor element replaceable on the fly
- tailored solutions according to customer specific needs
- ATEX compatible Ex db version also available.

Typical applications
- energy and power plant technology
- process industry
- chemical industry
- machinery and vessel construction
- manufacturing industry.
EPIC® SENSORS T-K / T-AK / T-AKK
Immersible thermocouple sensor

Features
- similar to DIN 43733
- temperature range -200...+1600 °C
- thermocouple as sensing element
- thermocouple accuracy class 1 as standard delivery
- ceramic thermowell with C610 or C799 as typical material, other materials on request
- ceramic C610 and C799 are gas-tight materials
- typical neckpipe materials AISI304/316L
- thermo-cement filling in between neckpipe and ceramic
- installation recommendation with weldable flange, adjustable flange or with gas tight compression fitting
- tailored solutions according to customer specific needs
- ATEX compatible Ex db version also available.

Typical applications
- very high temperature applications
- energy and power plant technology
- process industry
- chemical industry
- machinery and vessel construction
- manufacturing industry.

Technical data
Thermowell material
Ceramic C610 max. temperature +1500 °C, gas-tight, medium to good thermal shock resistance
Ceramic C799 max. temperature +1600 °C, gas-tight, medium thermal shock resistance
Other materials on request

Tolerances thermocouple (IEC 60584)
Type J tolerance class 1 = -40...+375 °C ±1.5 °C, +375...+750 °C ±0.004 x t
Type K and N tolerance class 1 = -40...+375 °C ±1.5 °C, +375...+1000 °C ±0.004 x t
Type R and S tolerance class 1 = 0...+1100 °C ±1 °C, 1100...+1600 °C ±0.003(t-1100) °C

Temperature range
-200...+1700 °C, depending on thermocouple type, thermowell material and neck pipe length

Approvals
ATEX, RU Ex, EAC, METROLOGICAL PATTERN APPROVAL

Quality certificate
ISO 9001:2015 issued by DNV

IP rating
IP65, higher IP rating on request

Installation examples


Product code key

Technical data
Thermowell material
Ceramic C610 max. temperature +1500 °C, gas-tight, medium to good thermal shock resistance
Ceramic C799 max. temperature +1600 °C, gas-tight, medium thermal shock resistance
Other materials on request

Drawing
**EPIC® SENSORS T-M-303 / W-M-303 or T-M-302 / W-M-302**

Mineral insulated thermocouple or resistance sensor with cable

**Features**
- according to DIN 43721
- temperature range -200...+1200 °C
- Pt 100 or thermocouple as sensing element
- AISI 316L or INCONEL 600 as standard delivery material, other materials on request
- Pt 100 accuracy class A as standard delivery
- thermocouple accuracy class 1 as standard delivery
- MI cable structured sensor element
- bendable
- vibration proof
- ATEX compatible Ex e version also available.

**Technical data**

**Materials**
- AISI 316L, max. temperature +550 °C, temporarily +600 °C,
- INCONEL 600, max. temperature +1100 °C, temporarily +1200 °C
- Other materials on request
  (Note. max. safe temperature +100 °C for the sealant tube in cable to sensor element transition)

**Cable materials**
- SIL = silicone, max. +180 °C
- Teflon®, max. +205 °C
- GGD = glass silk cable/metal braid jacket, max. +350 °C
- FEP = FEP wire insulation/braid shield/FEP jacket, max. +205 °C
- SDS = silicone wire insulation/braid shield/silicone jacket, only available as 2 wire cable, max. +180 °C
- Teflon® wire insulation/braid shield/Teflon® jacket, max. +205 °C
- Teflon® wire insulation/braid shield/Teflon® jacket, max. +205 °C
- FEP = FEP wire insulation/silicone jacket, max. +180 °C
- FEP = FEP wire insulation/silicone jacket, max. +180 °C

**Tolerances Pt100**
- A tolerance ±0.15 + 0.002 x t, operating temperature -100...+450 °C
- B tolerance ±0.3 + 0.005 x t, operating temperature -196...+600 °C
- B 1/3 DIN, tolerance ±0.3 x (0.3 + 0.005 x t), operating temperature -196...+600 °C
- B 1/10 DIN, tolerance ±0.3 x (0.3 + 0.005 x t), operating temperature -196...+600 °C

**Tolerances thermocouple**
- Type J tolerance class 1 = -40...375 °C ±1.5 °C, 375...750 °C ±0.004 x t
- Type K and N tolerance class 1 = -40...375 °C ±1.5 °C, 375...1000 °C ±0.004 x t

**Temperature range Pt100**
- -200...+550 °C, depending on sensor element and cable material
  (Note. max. safe temperature +100 °C for the sealant tube in cable to sensor element transition)

**Temperature range thermocouple**
- -200...+1200 °C, depending on thermocouple type and other sensor materials
  (Note. maximum safe temperature +100 °C for the sealant tube in cable to sensor element transition)

**Approvals**
- ATEX, RU Ex, EAC, IECEx, METROLOGICAL PATTERN APPROVAL

**Quality certificate**
- ISO 9001:2015 issued by DNV

**IP rating**
- IP65, higher IP rating on request

**Example code:**

**Installation examples**
- Energy and power plant technology
- Process industry
- Chemical industry
- Machinery and vessel construction
- Manufacturing industry
**EPIC® SENSORS T-M-313 or T-M-314**

Mineral insulated thermocouple insert with connector

### Features
- according to DIN 43721
- temperature range -200...+1200 °C
- thermocouple as sensing element
- thermocouple accuracy class 1 as standard delivery
- available with standard STD or mini-plug
- AISI 316L and INCONEL 600 as standard materials, other materials on request
- MI cable structured sensor element
- bendable
- vibration proof
- tailored solutions according to customer specific needs.

### Typical applications
- energy and power plant technology
- process industry
- chemical industry
- machinery and vessel construction
- manufacturing industry.

### Technical data

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Materials</strong></td>
<td>AISI 316L, maximum temperature +550 °C, temporarily +600 °C, INCONEL 600, maximum temperature +1100 °C, temporarily +1200 °C</td>
</tr>
<tr>
<td><strong>Connectors</strong></td>
<td>Construction &quot;313&quot; = connector with round pins, STD Construction &quot;314&quot; = connector with flat pins, mini</td>
</tr>
<tr>
<td><strong>Diameter</strong></td>
<td>0.5 / 1.0 / 1.5 / 2.0 / 3.0 / 4.5 / 6.0 mm (Note: mini connector up to 4.5 mm element diameter)</td>
</tr>
<tr>
<td><strong>Color</strong></td>
<td>According to EN 60584</td>
</tr>
<tr>
<td><strong>Tolerances thermocouple</strong></td>
<td>Type J tolerance class 1: -40...375 °C ±1.5 °C, 375...750 °C ±0.004 x t</td>
</tr>
<tr>
<td></td>
<td>Type K and N tolerance class 1: -40...375 °C ±1.5 °C, 375...1000 °C ±0.004 x t</td>
</tr>
<tr>
<td><strong>Temperature range</strong></td>
<td>thermocouple: -200...+1200 °C, depending on thermocouple type and sensor element material</td>
</tr>
<tr>
<td><strong>Approvals</strong></td>
<td>METROLOGICAL PATTERN APPROVAL</td>
</tr>
<tr>
<td><strong>Quality certificate</strong></td>
<td>ISO 9001:2015 issued by DNV</td>
</tr>
</tbody>
</table>

### Example code:

```
T — M — 313 — 3 / 1000 — K — 1 — X
```

- **T** = thermocouple
- **2xT** = 2 x thermocouple
- **M** = MI cable structured sensor (constant in code)
- **313** = with STD connector
- **314** = with mini connector
- **0.5, 1, 1.5, 2, 3, 4.5, 6** = outer diameter of sensor element (ØOD) [mm] (Note: mini connector up to 4.5 mm element diameter) (other diameters on request)
- **1000** = MI cable length, L [mm]
- **K, N, J** = thermocouple type
- **1, 2, 3** = thermocouple accuracy class, (class 1 as standard delivery)
- **X** = additional details on the text line

### Installation examples

![Installation examples](image-url)
**EPIC® SENSORS T-M-N / W-M-N**

**Mineral insulated insert with connection head**

### Features
- According to DIN 43721
- Temperature range -200...+1200 °C
- AISI 316L or INCONEL 600 as standard delivery material, other materials on request
- Pt100 or thermocouple as sensing element
- Pt100 accuracy class A as standard delivery
- Thermocouple accuracy class 1 as standard delivery
- MI cable structured sensor element
- Bendable
- Vibration proof
- Typically used with compression fitting
- Adjusted immersion length can be achieved
- Tailored solutions according to customer specific needs
- ATEX compatible Ex db version also available.

### Typical applications
- Energy and power plant technology
- Process industry
- Chemical industry
- Machinery and vessel construction
- Manufacturing industry.

### Technical data

#### Materials
- AISI 316L, maximum temperature +550 °C, temporarily +600 °C, INCONEL 600, maximum temperature +1100 °C, temporarily +1200 °C
- Other materials on request

#### Tolerances Pt100 (IEC 60751)
- A tolerance ±0.15 + 0.002 x t, operating temperature -100...+450 °C
- B tolerance ±0.3 + 0.005 x t, operating temperature -196...+600 °C
- B 1/3 DIN, tolerance ±1/3 x (0.3 + 0.005 x t), operating temperature -196...+600 °C
- B 1/10 DIN, tolerance ±1/10 x (0.3 + 0.005 x t), operating temperature -196...+600 °C

#### Tolerances thermocouple (IEC 60584)
- Type J tolerance class 1 = -40...375 °C ±1.5 °C, 375...750 °C ±0.004 x t
- Type K and N tolerance class 1 = -40...375 °C ±1.5 °C, 375...1000 °C ±0.004 x t

#### Temperature range Pt100
- -200...+550 °C, depending on sensor element material and length

#### Temperature range thermocouple
- -40...+1200 °C, depending on thermocouple type, sensor element material and length

#### Approvals
- ATEX, RU Ex, EAC, METROLOGICAL PATTERN APPROVAL

#### Quality certificate
- ISO 9001:2015 issued by DNV

#### IP rating
- IP65, higher IP rating on request

### Drawing

### Product code key

**Example code:** T - M - HST - L / 6 / 1000 - K - 1 - CB - X

**W** = Pt100 resistance thermometer

**2xW** = 2 x Pt100 resistance thermometer

**T** = Thermocouple

**2xT** = 2 x thermocouple

**M** = Mineral insulated sensor (constant in code)

**= length, L [mm]**

**T** — M — HST — L / 6 / 1000 — K — 1 — CB — X

**T** = thermocouple

**W** = Connection head B

**D/H** = Connection head with snap lock

**D/H/D** = connection head with snap lock and double barrel (2x cable gland)

**D/W/H** = High cover connection head with snap lock

**D/W/H/D** = high cover connection head with snap lock and double barrel (2x cable gland)

**EXD** = ATEX-compatible connection head

**HST** = High cover connection head with snap lock and double barrel (2x cable gland)

**N** = connection head N

**-** = no compression fitting

**L** = with height adjustable compression fitting (see installation examples picture)

**6, 8** = Other diameters on request

**1000** = Length L [mm]

**4, 3, 2** = Pt100 wire count

**K, N, J** = Thermocouple type

**A**R = Pt100 accuracy class, (class A as standard delivery)

**1, 2** = Thermocouple accuracy class, (class 1 as standard delivery)

**TR** = Wires for transmitter connection

**CB** = With ceramic terminal block

**X** = additional details on the text line

### Installation examples

**Thermocouple, mineral insulated sensor type with connection head D/W/H, no thread between the sensor element and connection head, no compression fitting in the sensor element, the sensor element’s diameter is 6 mm and length 5000 mm, thermocouple type N with accuracy class 1, connection head suitable for mA current transmitter housing.**
EPIC® SENSORS W-E-6-HST-S / W-E-6-HST-CLAMP
Acid proof temperature sensor for hygienic installation

Features
- temperature range -200...+550 °C
- shaped for hygienic installations
- Pt 100 as sensing element
- Pt100 accuracy class A as standard delivery
- mounting by weldable ball flange or with tri-clamp fitting
- thermowell material according to the application
- MI cable structured inner element
- inner element replaceable on the fly
- vibration proof
- tailored solutions according to customer specific needs.

Typical applications
- food industry
- pharmaceutical industry
- chemical industry
- process industry
- energy and power plant technology
- machinery and vessel construction
- manufacturing industry.

Technical data

Materials
AISI 316 L, max. temperature +550 °C, temporarily +600 °C, other materials on request

Tolerances Pt100 (IEC 60751)

A tolerance ±0.15 + 0.002 x t, operating temperature -100...+450 °C
B tolerance ±0.3 + 0.005 x t, operating temperature -196...+600 °C
B 1/3 DIN, tolerance ±1/3 x (0.3 + 0.005 x t), operating temperature -196...+600 °C
B 1/10 DIN, tolerance ±1/10 x (0.3 + 0.005 x t), operating temperature -196...+600 °C

Temperature range Pt100
-200...+550 °C, depending on materials and neck pipe length

Approvals
METROLOGICAL PATTERN APPROVAL

Quality certificate
ISO 9001:2015 issued by DNV

IP rating
IP65, higher IP rating on request

Product code key


Installation examples
**EPIC® SENSORS T-RO / W-RO**

Pipe surface temperature sensor

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**Features**

- temperature range -200...+550 °C
- fitting for pipes or other cylindrical shapes
- on request, the fitting can be welded on the sensor element at the factory
- sensors with no welded fitting meet the ATEX Ex e, EAC, IECEx, and Russian Ex requirements
- fitting can be supplied as separate item
- Pt 100 or thermocouple as sensing element
- Pt 100 accuracy class A as standard delivery
- thermocouple accuracy class 1 as standard delivery
- AISI 316L as standard delivery material, other materials on request
- Mi cable structured sensor element
- bendable
- vibration proof
- tailored solutions according to customer specific needs.

**Typical applications**

- energy and power plant technology
- process industry
- chemical industry
- machinery and vessel construction
- manufacturing industry.

---

**Technical data**

**Materials**

AISI 316L, max. temperature +550 °C, temporarily +600 °C, other materials on request

(Note: max. safe temperature +100 °C for the sealant tube in cable to sensor element transition)

**Fittings available for pipe sizes**

0 – 1000 mm, other sizes on request

**Cable material**

- SIL = silicone, max. +180 °C
- FEP = Teflon®, max. +205 °C
- GGD = glass silk cable/metal braid jacket, max. +350 °C
- FDF = FEP wire insulation/braid shield/FEP jacket, max. +205 °C
- SDS = silicone wire insulation/braid shield/silicone jacket, only available as 2 wire cable, max. +180 °C
- TDF = Teflon® wire insulation/braid shield/Teflon® jacket, max. +205 °C
- FDS = FEP wire insulation/braid shield/silicone jacket, max. +180 °C
- FS = FEP wire insulation/silicone jacket, max. +180 °C

(Note: max. safe temperature +100 °C for the sealant tube in cable to sensor element transition)

**Tolerances Pt100 (IEC 60751)**

<table>
<thead>
<tr>
<th>Type</th>
<th>Tolerance ±0.15 + 0.002 x t, operating temperature -100...+450 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>tolerance ±0.3 + 0.005 x t, operating temperature -196...+600 °C</td>
</tr>
<tr>
<td>B 1/3 DIN</td>
<td>tolerance ±1/3 x (0.3 + 0.005 x t), operating temperature -196...+600 °C</td>
</tr>
<tr>
<td>B 1/10 DIN</td>
<td>tolerance ±1/10 x (0.3 + 0.005 x t), operating temperature -196...+600 °C</td>
</tr>
</tbody>
</table>

**Tolerances thermocouple (IEC 60584)**

<table>
<thead>
<tr>
<th>Type</th>
<th>Tolerance class 1 = -40...+375 °C ±1 5 °C, 375...+750 °C ±0.004 x t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type K</td>
<td>Tolerance class 1 = -40...+375 °C ±1 5 °C, 375...+1000 °C ±0.004 x t</td>
</tr>
</tbody>
</table>

**Temperature range Pt100**

-200...+550 °C, depending on thermocouple type, materials and neck pipe length

(Note: max. safe temperature +100 °C for the sealant tube in cable to sensor element transition)

**Temperature range thermocouple**

-200...+550 °C, depending on thermocouple type, materials and neck pipe length

(Note: max. safe temperature +100 °C for the sealant tube in cable to sensor element transition)

**Approvals**

ATEX Ex e, EAC, IECEx, and RU Ex with remarks (see features), METROLOGICAL PATTERN APPROVAL

**Quality certificate**

ISO 9001:2015 issued by DNV

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**Drawing**
EPIC® SENSORS T-M-P / W-M-P or T-P / W-P

**Surface temperature sensor**

**Features**
- temperature range -200...+550 °C
- fitting for plane surfaces
- fitting can be welded to sensor element at factory
- sensors with no welded fitting meet the ATEX Ex e, EAC, IECEx, and Russian Ex requirements
- fitting can be supplied as separate item
- installation typically with welding, bolt or steel ties
- Pt 100 or thermocouple as sensing element
- AISI 316L as standard delivery material, other materials on request
- Pt 100 accuracy class A as standard delivery
- thermocouple accuracy class 1 as standard delivery
- MI cable structured
- bendable sensor element
- vibration proof
- tailored solutions according to customer specific needs.

**Typical applications**
- energy and power plant technology
- process industry
- machinery and vessel construction
- manufacturing industry.

**Technical data**

<table>
<thead>
<tr>
<th>Materials</th>
<th>AISI 316L, maximum temperature +550 °C, temporarily +600 °C, other materials on request (Note: max. safe temperature +180 °C for the sealant tube in cable to sensor element transition)</th>
</tr>
</thead>
</table>
| Cable materials    | SIL = silicone, max. +180 °C
FEP = Teflon®, max. +205 °C
GDD = glass braid cable/metal braid jacket, max. +350 °C
PDF = Teflon® wire insulation/braid shield/FEP jacket, max. +205 °C
SDS = silicone wire insulation/braid shield/silicone jacket, only available as 2 wire cable, max. +180 °C
TDT = Teflon® wire insulation/braid shield/Teflon® jacket, max. +205 °C
FDS = FEP wire insulation/braid shield/silicone, max. +180 °C
FS = FEP wire insulation/silicone jacket, max. +180 °C |
| Dimensions         | 5x9x45 (hole Ø5.1 mm), 12x12x50 (hole Ø8.0 mm), other dimensions on request |
| Tolerances Pt100   | (IEC 60751) A tolerance ±0.5 x 0.002 x L, operating temperature -100...+500 °C
B tolerance ±0.3 x 0.005 x L, operating temperature -196...+600 °C
B 1/3 DIN, tolerance ±1/3 x (0.3 x 0.005 x L), operating temperature -196...+600 °C
B 1/10 DIN, tolerance ±1/10 x (0.3 x 0.005 x L), operating temperature -196...+600 °C |
| Tolerances thermocouple | Type J tolerance class 1 = -40...375 °C ±1.5 °C, 375...750 °C ±0.004 x L
Type K and N tolerance class 1 = -40...375 °C ±1.5 °C, 375...1000 °C ±0.004 x L |
| Temperature range Pt100 | -200...+550 °C, depending on thermocouple type, materials and length of the MI cable or sensor element (Note: max. safe temperature +100 °C for the sealant tube in cable to sensor element transition) |
| Temperature range thermocouple | -200...+550 °C, depending on thermocouple type, materials and length of the MI cable or sensor element (Note: max. safe temperature +100 °C for the sealant tube in cable to sensor element transition) |
| Approvals          | ATEX Ex e, EAC, IECEx, and RU Ex with remarks (see features), METROLOGICAL PATTERN APPROVAL |
| Quality certificate | ISO 9001:2015 issued by DNV |

**Drawing**

**Product code key**


**Installation examples**

Steel collar installation

**W-P-5x9x45-6/50-15000/GGD-4-A**
Pt100 resistance thermometer for 4 wire measurement, surface temperature sensor with non-bending structure, sensor element with diameter of Ø4 mm, tip piece dimensions 5x9x45 mm, delivered with 15 meter glass silk cable which has metal braid jacket for mechanical stress reduction, maximum temperature +350°C.

**Installation examples**

Steel collar installation

**Inoculation typically with welding, bolt or steel ties**

**Welded**

**Screw**
EPIC® SENSORS T-CABLE / W-CABLE
Temperature sensor with cable

Features
- temperature range -200...+350 °C
- Pt100 or thermocouple as sensing element
- AISI 316L as standard delivery material, other materials on request
- Pt100 accuracy class A as standard delivery
- thermocouple accuracy class 1 as standard delivery
- ATEX compatible Ex e version available
- tailored solutions according to customer specific needs.

Typical applications
- energy and power plant technology
- process industry
- chemical industry
- machinery and vessel construction
- manufacturing industry.

Technical data

<table>
<thead>
<tr>
<th>Materials</th>
<th>AISI 316L, maximum temperature +300 °C, temporarily +350 °C, other materials on request</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter</td>
<td>3, 4, 5, 6 or 8 mm, other diameters on request</td>
</tr>
<tr>
<td>Cable materials</td>
<td>SIL = silicone, max. +180 °C</td>
</tr>
<tr>
<td></td>
<td>FEP = Teflon®, max. +205 °C</td>
</tr>
<tr>
<td></td>
<td>GGD = glass silk cable/metal braid jacket, max. +350 °C</td>
</tr>
<tr>
<td></td>
<td>FDF = FEP wire insulation/braid shield/FEP jacket, max. +205 °C</td>
</tr>
<tr>
<td></td>
<td>SDS = silicone wire insulation/braid shield/silicone jacket, only available as 2 wire cable, max. +180 °C</td>
</tr>
<tr>
<td></td>
<td>TDT = Teflon® wire insulation/braid shield/ Teflon® jacket, max. +205 °C</td>
</tr>
<tr>
<td></td>
<td>FDS = FEP wire insulation/braid shield/silicone jacket, max. +180 °C</td>
</tr>
</tbody>
</table>

Tolerances Pt100 (IEC 60751)
- A tolerance ±0.15 + 0.002 x t, operating temperature -100...+450 °C
- B tolerance ±0.3 + 0.005 x t, operating temperature -196...+600 °C
- B 1/3 DIN, tolerance ±0.005 x t, operating temperature -196...+600 °C
- B 1/10 DIN, tolerance ±0.005 x t (at 0.3 to 0.5 °C), operating temperature -196...+600 °C

Tolerances thermocouple (IEC 60584)
- Type J tolerance class 1 = ± 0.375 °C ± 1.5 °C, ± 3.75 °C ± 7.5 °C ± 0.004 x t
- Type K and N tolerance class 1 = ± 0.375 °C ± 1.5 °C, ± 3.75 °C ± 7.5 °C ± 1000 °C ± 0.004 x t

Temperature range Pt100
- -200...+350 °C, depending on cable material

Temperature range thermocouple
- -200...+350 °C, depending on thermocouple type and cable material

Approvals
- ATEX, RU Ex, EAC, IECEx, METROLOGICAL PATTERN APPROVAL

Quality certificate
- ISO 9001:2015 issued by DNV

Product code key
- W = Pt100 resistance thermometer
- 2xW = 2 x Pt100 resistance thermometer
- T = thermocouple
- 2xT = 2 x thermocouple
- CABLE = cable sensor (constant in code)
- 3, 4, 5, 6, 8, 12, 13, 15 = outer diameter of sensor element (ØOD) [mm] (other diameters on request)
- 100 = sensor element length, L [mm]
- 5000 = cable length, CL [mm]
- SIL, FEP, GGD, FDF, TDT, SDS, FDS, FS = cable material (for more information, look technical data on first page of the datasheet)
- 4, 3, 2 = Pt100 wire count
- K, N, J = thermocouple type
- A, B = Pt100 accuracy class,
  - (class A as standard delivery)
- L, 2, 3 = thermocouple accuracy class,
  - (class 1 as standard delivery)
- X = additional details on the text line

Example code: W — CABLE — 6 / 100 — 5000 / SIL — 4 — A — X

Installation examples
EPIC® SENSORS T-BAJO / W-BAJO

Bayonet temperature sensor

Features
- temperature range -200...+300 °C
- spring-loaded
- suitable for bearings
- vibration proof
- quick installation due to bayonet connection
- AISI 316L as standard delivery material, other materials on request
- Pt 100 or thermocouple as sensing element
- Pt 100 accuracy class A as standard delivery
- thermocouple accuracy class 1 as standard delivery
- ATEX compatible Ex e version available
- tailored solutions according to customer specific needs.

Typical applications
- energy and power plant technology
- process industry
- chemical industry
- machinery and vessel construction
- manufacturing industry.

Technical data

<table>
<thead>
<tr>
<th>Materials</th>
<th>AISI 316L, max. temperature +250 °C, temporarily +300 °C, other materials on request</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor diameter</td>
<td>6 or 8mm, other diameters on request</td>
</tr>
<tr>
<td>Bayonet cap diameter</td>
<td>12.2 mm, other diameters on request</td>
</tr>
<tr>
<td>Cable material</td>
<td>SIL = silicone, max. +180 °C, FEP = Teflon®, max. +205 °C</td>
</tr>
<tr>
<td></td>
<td>GGD = glass silk cable/metal braid jacket, max. +250 °C</td>
</tr>
<tr>
<td></td>
<td>FDF = FEP wire insulation/braid shield/silicone jacket, only available as 2 wire cable, max. +180 °C</td>
</tr>
<tr>
<td></td>
<td>TDT = Teflon® wire insulation/braid shield/Teflon® jacket, max. +205 °C</td>
</tr>
<tr>
<td></td>
<td>FDS = FEP wire insulation/braid shield/silicone jacket, max. +180 °C</td>
</tr>
<tr>
<td></td>
<td>FS = FEP wire insulation/silicone jacket, max. +180 °C</td>
</tr>
</tbody>
</table>

Tolerances Pt100

(IEC 60751)
A tolerance ±0.15 ± 0.002 x t, operating temperature -100...+450 °C
B tolerance ±0.3 ± 0.005 x t, operating temperature -196...+600 °C
C tolerance ±1/3 ± 0.005 x t, operating temperature -196...+600 °C
D tolerance ±1/10 ± 0.005 x t, operating temperature -196...+600 °C

Tolerances thermocouple

(IEC 60584)
Type J tolerance class 1 = -40...375 °C ± 0.005 °C
Type K and N tolerance class 1 = -40...375 °C ± 0.005 °C

Temperature range Pt100
-200...+300 °C, depending on materials

Temperature range thermocouple
-200...+300 °C, depending on thermocouple type and materials

Approvals
- ATEX, RU Ex, EAC, IECEx, METROLOGICAL PATTERN APPROVAL

Quality certificate
- ISO 9001:2015 issued by DNV

Product code key


Installation example
**EPIC® SENSORS T-MAGN / W-MAGN**

**Magnetic temperature sensor**

### Features
- Temperature range: -200...+350 °C
- Magnet suitable for high temperatures, does not lose magnetism when heated below +450 °C
- Quick installation
- Pt100 or thermocouple as sensing element
- Pt100 accuracy class A as standard delivery
- Thermocouple accuracy class 1 as standard delivery
- AISI 316L as standard delivery material, other materials on request
- Tailored solutions according to customer specific needs.

### Typical applications
- Energy and power plant technology
- Process industry
- Chemical industry
- Machinery and vessel construction
- Manufacturing industry.

### Technical data

<table>
<thead>
<tr>
<th>Materials</th>
<th>AISI 316L, max. temperature +250 °C, temporarily +350 °C, other materials on request</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>Small magnet, external Ø25 mm / height 7 mm, other dimensions on request</td>
</tr>
<tr>
<td></td>
<td>Large magnet, external Ø60 mm / height 15 mm, other dimensions on request</td>
</tr>
</tbody>
</table>
| Cable materials | SIL = silicone, max. +180 °C  
FEP = Teflon®, max. +205 °C  
GGD = glass/silk cable/metal braid jacket, max. +350 °C  
FDF = FEP wire insulation/braid shield/FEP jacket, max. +205 °C  
SDS = silicone wire insulation/braid shield/silicone jacket, only available as 2 wire cable, max. +180 °C  
TDT = Teflon® wire insulation/braid shield/Teflon® jacket, max. +205 °C  
FDS = FEP wire insulation/braid shield/silicone jacket, max. +180 °C  
FS = FEP wire insulation/silicone jacket, max. +180 °C |
| Tolerances Pt100 (IEC 60751) | A tolerance ±0.15 + 0.002 x t, operating temperature -100...+450 °C  
B tolerance ±0.3 + 0.005 x t, operating temperature -196...+600 °C  
B 1/3 DIN, tolerance t/3 x (0.3 + 0.005 x t), operating temperature -196...+600 °C  
B 1/10 DIN, tolerance t/10 x (0.3 + 0.005 x t), operating temperature -196...+600 °C |
| Tolerances thermocouple (IEC 60584) | Type J tolerance class 1 = -40...375 °C ±0.5 °C, 375...750 °C ±0.004 x t  
Type K and N tolerance class 1 = -40...375 °C ±0.5 °C, 375...1000 °C ±0.004 x t |
| Temperature range Pt100 | -200...+350 °C for large magnet, depending on cable material  
-200...+200 °C for small magnet, depending on cable material |
| Temperature range thermocouple | -200...+350 °C for large magnet, depending on cable material  
-200...+200 °C for small magnet, depending on cable material |
| Approvals | METROLOGICAL PATTERN APPROVAL |
| Quality certificate | ISO 9001:2015 issued by DNV |

### Product code key

Example code: \( W \) – MAGN – D25 / 5.5x7 – 5000 / SIL – 4 – A – X

- \( W \) = Pt100 resistance thermometer
- 2xW = 2 x Pt100 resistance thermometer
- T = thermocouple
- 2xT = 2 x thermocouple
- MAGN = magnetic sensor (constant in code)
- D25/5.5x7 = magnet dimensions
- 5000 = cable length, CL [mm]
- SIL, FEP, GSGD, FDF, TDT, SDS, FDS, FS = cable material (for more information, look technical data on first page of the datasheet)
- A, B = Pt100 accuracy class, (class A as standard delivery)
- 1, 2, 3, = thermocouple accuracy class, (class 1 as standard delivery)
- X = additional details on the text line
EPIC® SENSORS T-106 / W-106
Temperature sensor for food industry

Features
- temperature range -200...+300 °C
- sharp tip
- handle
- Pt100 resistance thermometer as sensing element
- Pt100 accuracy class A as standard delivery
- AISI 316L as standard delivery material, other materials on request
- tailored solutions according to customer specific needs.

Typical applications
- food industry
- chemical industry.

Technical data

| Materials | AISI 316L, maximum temperature +250 °C, temporarily +300 °C, other materials on request (Note: plastic covered handle max. temperature +110 °C) |
| Tip diameter | 3, 4 or 6 mm, other diameters and tip shapes on request |
| Handle material | Plastics as standard delivery material, maximum temperature +110 °C Available also in acid proof stainless steel |
| Cable material | SIL = silicone, max. +180 °C FEP = Teflon®, max. +205 °C GGD = glass silk cable/metal braid jacket, max. +350 °C FDF = FEP wire insulation/braid shield/FEP jacket, max. +205 °C SDS = silicone wire insulation/braid shield/silicone jacket, only available as 2 wire cable, max. +180 °C TDF = Teflon® wire insulation/braid shield/Teflon® jacket, max. +205 °C FDS = FEP wire insulation/braid shield/silicone jacket, max. +180 °C|

Tolerances Pt100 (IEC 60751)
- A tolerance ±0.15 ± 0.002 x t, operating temperature -100...+450 °C
- B tolerance ±0.3 ± 0.005 x t, operating temperature -196...+600 °C
- B 1/3 DIN, tolerance ±1/3 x (0.3 ± 0.005 x t), operating temperature -196...+600 °C
- B 1/10 DIN, tolerance ±1/10 x (0.3 ± 0.005 x t), operating temperature -196...+600 °C

Tolerances thermocouple (IEC 60584)
- Type J tolerance class 1 = -40...375 °C ±1.5 °C, 375...750 °C ±0.004 x t
- Type K and N tolerance class 1 = -40...375 °C ±1.5 °C, 375...1000 °C ±0.004 x t

Temperature range Pt100
- -200...+300 °C, depending on material

Temperature range thermocouple
- -200...+300 °C, depending on thermocouple type and material

Approvals
- METROLOGICAL PATTERN APPROVAL

Quality certificate
- ISO 9001:2015 issued by DNV
EPIC® SENSORS T-BTD / W-BTD

Bearing temperature sensor

Features
- Temperature range: -200...+300 °C
- Suitable for bearing temperature measurement
- Flat tip
- Spring-loaded screw for installation
- Pt100 or thermocouple as sensing element
- Pt100 or thermocouple accuracy class A as standard delivery
- Thermocouple accuracy class 1 as standard delivery
- AISI 316L as standard delivery material, other materials on request
- Brass tip as standard delivery material, other tip materials on request
- Tailored solutions according to customer specific needs.

Typical applications
- Machinery
- Motor manufacturing industry
- Gear manufacturing industry.

Technical data

<table>
<thead>
<tr>
<th>Materials</th>
<th>AISI 316L/brass tip, maximum temperature +250 °C, temporarily +300 °C, other materials on request (Note: overall max. temperature according to the cable material)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tip diameter</td>
<td>8 mm, other diameters on request (Note: sensor tube is tapered from tip portion to reduce the heat conduction)</td>
</tr>
</tbody>
</table>
| Cable material     | SIL = silicone, max. +180 °C  
FEP = Teflon®, max. +205 °C  
GGD = glass silk cable/metal braid jacket, max. +350 °C  
TDF = Teflon® wire insulation/braid shield/Teflon® jacket, max. +205 °C  
SDS = silicone wire insulation/braid shield/silicone jacket, only available as 2 wire cable, max. +180 °C  
FDS = FEP wire insulation/braid shield/silicone jacket, max. +180 °C  
FS = FEP wire insulation/silicone jacket, max. +180 °C  
PUR = polyurethane cable, extremely good oil resistance, max. +80 °C (Note: PUR cable available only for this sensor type) |
| Thread             | R3/8" as standard delivery,R1/2" as option, other threads on request                                                                    |
| Tolerances Pt100 (IEC 60751) | A ±0.15 ± 0.002 x t, operating temperature -100...+650 °C  
B ±0.3 ± 0.005 x t, operating temperature -196...+600 °C  
1/3 DIN, tolerance ±1/3 x (0.3 + 0.005 x t), operating temperature -196...+600 °C  
1/10 DIN, tolerance ±1/10 x (0.3 + 0.005 x t), operating temperature -196...+600 °C |
| Tolerances thermocouple (IEC 60584) | Type J tolerance class 1 = -40...375 °C ±1.5 °C, 375...750 °C ±0.004 x t  
Type K and N tolerance class 1 = -40...375 °C ±1.5 °C, 375...1000 °C ±0.004 x t |
| Temperature range Pt100 | -200...+300 °C, depending on cable material                                                                                             |
| Temperature range thermocouple | -40...+250 °C, depending on thermocouple type and cable material                                                                        |
| Approvals          | METROLOGICAL PATTERN APPROVAL                                                                                                          |
| Quality certificate| ISO 9001:2015 issued by DNV                                                                                                             |

Example code: W – BTD – Pt100A – L30 – 4M / SIL – X

- W = Pt100 resistance thermometer
- 2xW = 2 x Pt100 resistance thermometer
- T = thermocouple
- 2xT = 2 x thermocouple
- BTD = bearing sensor (constant in code)
- Pt100A = Pt100, with accuracy class A
- TC-K1 = thermocouple type K, accuracy class 1
- TC-N1 = thermocouple type N, accuracy class 1
- TC-J1 = thermocouple type J, accuracy class 1
- L30 = length [mm]
- 4M = cable length, CL [m]
- SIL, FEP, GDD, FDF, TDF, DDS, FDS, FS, PUR = cable material (for more information, look technical data on first page of the datasheet)
- X = additional details on the text line
EPIC® SENSORS T-MP / W-MP or T-MPT / W-MPT
Multi-point temperature sensor

**Features**
- temperature range -200...+1200 °C
- multi-point measurement
- Pt 100 or thermocouple as sensing element
- AISI 316L or INCONEL 600 as standard delivery material, other materials on request
- available with a connection box
- Pt 100 accuracy class A as standard delivery
- thermocouple accuracy class 1 as standard delivery
- MI cable structured sensor elements
- bendable
- vibration proof structure
- Flexible armoured conduit version available
- changeable measurement elements
- tailored solutions according to customer specific needs.

**Typical applications**
- energy and power plant technology
- process industry
- chemical industry
- machinery and vessel construction
- manufacturing industry.

**Technical data**

<table>
<thead>
<tr>
<th>Materials</th>
<th>AISI 316L, maximum temperature +550 °C, temporarily +600 °C, INCONEL 600, max. temperature +1000 °C, temporarily +1200 °C, other materials on request</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flange material</td>
<td>AISI 316L, max. temperature +550 °C, temporarily +600 °C, other flange materials on request</td>
</tr>
<tr>
<td>Flange type</td>
<td>Flange type according to ANSI, EN 1092-1, other flange types on request</td>
</tr>
<tr>
<td>Diameter of sensor elements</td>
<td>3 or 6 mm, other diameters on request</td>
</tr>
<tr>
<td>Enclosure</td>
<td>Enclosure according to customer specific needs</td>
</tr>
<tr>
<td>Cable material</td>
<td>SIL = silicone, max. +180 °C</td>
</tr>
<tr>
<td></td>
<td>FEP = Teflon®, max. +205 °C</td>
</tr>
<tr>
<td></td>
<td>GGD = glass silk cable/mental braid jacket, max. +350 °C</td>
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<tr>
<td></td>
<td>FDF = FEP wire insulation/braid shield/FEP jacket, max. +205 °C</td>
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<tr>
<td></td>
<td>SDS = silicone wire insulation/braid shield/silicone jacket, only available as 2 wire cable, max. +180 °C</td>
</tr>
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<tr>
<td></td>
<td>FDS = FEP wire insulation/braid shield/silicone jacket, max. +180 °C</td>
</tr>
<tr>
<td></td>
<td>FS = FEP wire insulation/silicone jacket, max. +180 °C</td>
</tr>
<tr>
<td>Tolerances Pt100 (IEC 60751)</td>
<td>A tolerance ±0.15 + 0.002 x t, operating temperature -100...+450 °C</td>
</tr>
<tr>
<td></td>
<td>B tolerance ±0.3 + 0.005 x t, operating temperature -196...+600 °C</td>
</tr>
<tr>
<td></td>
<td>B 1/3 DIN, tolerance ±0.3 + 0.005 x t, operating temperature -196...+600 °C</td>
</tr>
<tr>
<td></td>
<td>B 1/10 DIN, tolerance ±0.03 + 0.0005 x t, operating temperature -196...+600 °C</td>
</tr>
<tr>
<td>Tolerances thermocouple (IEC 60584)</td>
<td>Type J tolerance class 1 = -40...375 °C ±1.5 °C, 375...750 °C ±0.004 x t</td>
</tr>
<tr>
<td></td>
<td>Type K and N tolerance class 1 = -40...375 °C ±1.5 °C, 375...1000 °C ±0.004 x t</td>
</tr>
<tr>
<td>Temperature range Pt100</td>
<td>-200...+550 °C, depending on materials</td>
</tr>
<tr>
<td>Temperature range thermocouple</td>
<td>-200...+1200 °C, depending on thermocouple type, neck pipe length and other materials</td>
</tr>
<tr>
<td>Approvals</td>
<td>METROLOGICAL PATTERN APPROVAL</td>
</tr>
<tr>
<td>Quality certificate</td>
<td>ISO 9001:2015 issued by DNV</td>
</tr>
</tbody>
</table>

**Product code key**


**Drawing**

**Features**
- temperature range -200...+1200 °C
- multi-point measurement
- Pt 100 or thermocouple as sensing element
- available with a connection box
- Pt 100 accuracy class A as standard delivery
- thermocouple accuracy class 1 as standard delivery
- MI cable structured sensor elements
- bendable
- vibration proof structure
- Flexible armoured conduit version available
- changeable measurement elements
- tailored solutions according to customer specific needs.

**Typical applications**
- energy and power plant technology
- process industry
- chemical industry
- machinery and vessel construction
- manufacturing industry.
EPIC® SENSORS T-SCREW / W-SCREW
Threaded temperature sensor with cable

Features
- temperature range -200...+300 °C
- Pt 100 or thermocouple as sensing element
- AISI 316L as standard delivery material, other materials on request
- Pt 100 accuracy class A as standard delivery
- thermocouple accuracy class 1 as standard delivery
- tailored solutions according to customer specific needs.

Typical applications
- energy and power plant technology
- process industry
- chemical industry
- machinery and vessel construction
- manufacturing industry.

Technical data

<table>
<thead>
<tr>
<th>Materials</th>
<th>AISI 316L, maximum temperature +250 °C, temporarily +300 °C, other materials on request (Note: overall max. temperature according to the cable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter</td>
<td>3, 4, 5, 6 or 8 mm, other diameters on request</td>
</tr>
<tr>
<td>Thread size and length</td>
<td>According to request, all sizes and lengths available</td>
</tr>
<tr>
<td>Cable material</td>
<td>SIL = silicone, max. +180 °C</td>
</tr>
<tr>
<td></td>
<td>FEP = Teflon®, max. +205 °C</td>
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<tr>
<td></td>
<td>GGD = glass silk cable/metal braid jacket, max. +350 °C</td>
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<tr>
<td></td>
<td>TDT = Teflon® wire insulation/braid shield/Teflon® jacket, max. +205 °C</td>
</tr>
<tr>
<td></td>
<td>FDS = FEP wire insulation/braid shield/silicone jacket, max. +180 °C</td>
</tr>
<tr>
<td></td>
<td>FS = FEP wire insulation/silicone jacket, max. +180 °C</td>
</tr>
</tbody>
</table>

| Tolerances Pt100 (IEC 60751)     | A tolerance ±0.15 + 0.002 x t, operating temperature -100...+450 °C                                                                   |
|                                  | B tolerance ±0.3 + 0.005 x t, operating temperature -196...+600 °C                                                                     |
|                                  | Type I tolerance class 1 = -40...375 °C ±1.5 °C, 375...750 °C ±0.004 x t                                                              |
|                                  | Type K and N tolerance class 1 = -40...375 °C ±1.5 °C, 375...1000 °C ±0.004 x t                                                       |

| Temperature range Pt100          | -200...+300 °C, depending on material                                                                                                 |
| Temperature range thermocouple   | -200...+300 °C, depending on thermocouple type and material                                                                           |
| Approvals                        | METROLOGICAL PATTERN APPROVAL                                                                                                         |
| Quality certificate              | ISO 9001:2015 2015 by DNV                                                                                                              |

Product code key

Example code: W – SCREW – M6x1 / 10 – 6 – 100 – 5000 / SIL – 4 – A – X
EPIC® SENSORS W-M-TRACE or 2x W-M-TRACE
Trace heating sensor

Features
- temperature range -40...+450 °C, temporarily +550 °C
- temperature range -40...+80 °C for standard delivery enclosure
- Pt100 as sensing element
- Pt100 accuracy class A as standard delivery
- 1 or 2 measurement points
- replaceable sensor elements
- AISI 316L as standard delivery material for the sensor elements, other materials on request
- components are available as ATEX compatible Ex e, however the complete assembly is not ATEX certified
- tailored solutions according to customer specific needs.

Typical applications
- energy and power plant technology
- process industry
- chemical industry
- machinery and vessel construction
- manufacturing industry.

Technical data

<table>
<thead>
<tr>
<th>Materials</th>
<th>AISI 316L, maximum temperature +450 °C, temporarily +550 °C, other materials on request</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerances Pt100 (IEC 60751)</td>
<td>A tolerance ±0.15 ±0.002 x t, operating temperature -100...+450 °C</td>
</tr>
<tr>
<td></td>
<td>B tolerance ±0.3 ±0.005 x t, operating temperature -196...+600 °C</td>
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<tr>
<td></td>
<td>B 1/3 DIN, tolerance ±1/3 x (0.3 ±0.005 x t), operating temperature -196...+600 °C</td>
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<tr>
<td></td>
<td>B 1/10 DIN, tolerance ±1/10 x (0.3 ±0.005 x t), operating temperature -196...+600 °C</td>
</tr>
<tr>
<td>Temperature range Pt100</td>
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<td>II 2 GD Ex e IIC T6</td>
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<tr>
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<td>Ex ID A21 IP66 T 60 °C T amb (max.) -40...+125/550 °C</td>
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<td>Length</td>
<td>1000 or 2000 mm as standard delivery, other lengths on request</td>
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<tr>
<td>Diameter</td>
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<td>Enclosure dimensions</td>
<td>160x160x90 mm (WxHxD)</td>
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<td>Ex e IIC T4 Ga (Ta = -65°C...+90°C)</td>
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<tr>
<td></td>
<td>Ex lb IIC T6 Ga (Ta = -65°C...+90°C)</td>
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<tr>
<td></td>
<td>Ex lb IIC T4 Ga (Ta = -65°C...+90°C)</td>
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<tr>
<td></td>
<td>Ex lb IIC T85°C Db (Ta = -65°C...+48°C, +55°C, +60°C or +65°C)</td>
</tr>
<tr>
<td></td>
<td>Ex lb IIC T100°C Db (Ta = -65°C...+90°C)</td>
</tr>
<tr>
<td>Box temperature range</td>
<td>-40...+80 °C</td>
</tr>
<tr>
<td>Cable glands</td>
<td>Product with 2 sensing elements: 1 x cable gland, M25x1.5, for cable diameters 6-13 mm</td>
</tr>
<tr>
<td></td>
<td>Product with 1 sensing element: 2 x cable gland, M25x1.5, for cable diameter 6-13 mm</td>
</tr>
<tr>
<td>Approvals</td>
<td>ATEX Ex e compatible components, assembly not certified</td>
</tr>
<tr>
<td>Quality certificate</td>
<td>ISO 9001:2015 issued by DNV</td>
</tr>
<tr>
<td>IP rating</td>
<td>IP66 or IP67, other IP rating on request</td>
</tr>
</tbody>
</table>

Product code key


W = Pt100 resistance thermometer
2xW = 2 x Pt100 resistance thermometer
M-TRACE = mineral insulated trace heating sensor (constant in code)
3, 4 = outer diameter of sensor element (2000) [mm]
1000 = sensor element length, L [mm]
4, 3, 2 = Pt100 wire count
A, B = Pt100 accuracy class, (class A as standard delivery)
empty = no Ex e-approval
EX = Ex e-approved
X = additional details on the last line

Installation example
EPIC® SENSORS T-SIL-PATCH / W-SIL-PATCH or 2xT-SIL-PATCH / 2xW-SIL-PATCH

Silicone patch sensor

Features
- temperature range -40...+180 °C
- Pt100 or thermocouple as sensing element
- Pt100 accuracy class A as standard delivery
- thermocouple accuracy class 1 as standard delivery
- EMI shielded version available
- ELASTOSIL® RT 607 A/B silicone material
- aluminum tape on measuring surface as option
- tinned fine stranded copper wires
- supplied with cable or twisted wires
- tailored solutions according to customer specific needs.

Typical Applications
- energy and power plant technology
- process industry
- chemical industry
- machinery and vessel construction
- manufacturing industry.

Technical data

Tolerances Pt100

A tolerance ±0.15 + 0.002 x t, operating temperature -100...+450 °C
B tolerance ±0.3 + 0.005 x t, operating temperature -196...+600 °C
C tolerance ±1/3 x (0.3 + 0.005 x t), operating temperature -196...+600 °C
D tolerance ±1/10 x (0.3 + 0.005 x t), operating temperature -196...+600 °C

Tolerances thermocouple

Type J tolerance class 1 = -40...375 °C ±1.5 °C, 375...1000 °C ±0.004 x t
Type K and N tolerance class 1 = -40...375 °C ±1.5 °C, 375...1000 °C ±0.004 x t

Cable materials

SIL = silicone, max. +180 °C
FEP = Teflon®, max. +205 °C
GGD = glass silk cable/metal braid jacket, max. +350 °C
SDS = silicone wire insulation/braid shield/silicone jacket, only available as 2 wire cable, max. +180 °C
TDF = Teflon® wire insulation/braid shield/Teflon® jacket, max. +205 °C
FDS = FEP wire insulation/braid shield/silicone jacket, max. +180 °C
FS = FEP wire insulation/silicone jacket, max. +180 °C
CON = no cable, individual single wires, FEP wire insulation, max. +205 °C

Wire materials

2 wires = FEP insulated twisted wires 2x0,22/+200 °C
3 wires = FEP insulated twisted wires 3x0,22/+205 °C
4 wires = FEP insulated twisted wires 4x0,22/+205 °C

Temperature range
-40...+180 °C

(Nota: range is for silicone sensor head, cable range according to selection)

Approvals
METROLOGICAL PATTERN APPROVAL

Quality certificate
ISO 9001:2015 issued by DNV

IP rating
IP65, higher IP rating on request
EPIC® SENSORS nxT-MP-303
Mineral insulated temperature sensor for multipoint measurement

Features
- according to DIN 43721
- temperature range: -200...+1200 °C
- AISI 316L or INCONEL 600 as standard delivery material, other materials on request
- customer specific lengths
- customer specific amount of measurement points
- MI cable structured sensor element
- bendable
- vibration proof
- thermocouple as sensing element
- thermocouple accuracy class 1 as standard delivery
- EMI shielded version available.

Typical applications
- steel industry, chill moulds
- energy and power plant technology
- process industry
- chemical industry
- machinery and vessel construction
- manufacturing industry.

Technical data

Materials
- AISI 316L, maximum temperature +550 °C, temporarily +600 °C, INCONEL 600, maximum temperature +1100 °C, temporarily +1200 °C
Other materials on request
(Note: max. safe temperature +100 °C for the sealant tube in cable to sensor element transition)

Tolerances thermocouple
- Type J tolerance class 1 = -40...375 °C ±1,5 °C, 375...750 °C ±0,004 x t
- Types K and N tolerance class 1 = -40...375 °C ±1,5 °C, 375...1000 °C ±0,004 x t

Cable materials
- SIL = silicone, max. +180 °C
- FEP = Teflon®, max. +205 °C
- GSD = glass silk cable/metal braid jacket, max. +350 °C
- FDF = FEP wire insulation/braid shield/FEP jacket, max. +205 °C
- SDS = silicone wire insulation/braid shield/silicone jacket, only available as 2 wire cable, max. +180 °C
- TDT = Teflon® wire insulation/braid shield/Teflon® jacket, max. +205 °C
- FDS = FEP wire insulation/braid shield/silicone jacket, max. +180 °C
- FS = FEP wire insulation/silicone jacket, max. +180 °C
(Note: max. safe temperature +100 °C for the sealant tube in cable to sensor element transition)

Temperature range
- 200...+1200 °C depending on thermocouple type and cable material
(Note: max. safe temperature +100 °C for the sealant tube in cable to sensor element transition)

Quality certificate
- ISO 9001:2015 issued by DNV

IP rating
- IP65, higher IP rating on request

Product code key


nxT = n x thermocouple
(n = amount of measurement points)

MP-303 = multipoint sensor (constant in code)

2.7 = outer diameter of sensor element (ØOD) [mm]

2750 = MI cable (sensor 1) length, L [mm]

5000 = cable length, CL [mm]

AISI = AISI316L, max. temp. +550 °C

INCO = Inconel 600, max. temp. +1100 °C

SIL = silicone, max. +180 °C

FEP = Teflon®, max. +205 °C

GDD, FDF = FEP wire insulation/braid shield/FEP jacket, max. +205 °C

SDS = silicone wire insulation/braid shield/silicone jacket, only available as 2 wire cable, max. +180 °C

TDT = Teflon® wire insulation/braid shield/Teflon® jacket, max. +205 °C

FDS = FEP wire insulation/braid shield/silicone jacket, max. +180 °C

FS = FEP wire insulation/silicone jacket, max. +180 °C

Temperature range -200...+1200 °C depending on thermocouple type and cable material

Quality certificate ISO 9001:2015 issued by DNV

IP rating IP65, higher IP rating on request

(n = amount of measurement points)

x = additional details on the text line
The IoTKey® WLT 310 transmitter has two inputs for:

- Temperature and Lin. R measurements.
- One or two of the temperature sensor inputs can be configured as thermocouple sensor inputs. TC inputs can also detect an open sensor.
- One or two of the temperature sensor inputs can be configured as thermopile sensor inputs. Thermocouple input, TC (S1/S2) -200…+800 °C.

The main power supply is a C sized Lithium primary cell battery, 3.6 V nominal 8.5 Ah. The device operates also on an external, 12 or 24 V DC power supply.

The expected lifetime is more than 10 years in temperature range -40…+80 °C. The battery life time depends of configuration (typically min. 1-2 years).

**Technical data**

<table>
<thead>
<tr>
<th>Weight</th>
<th>39 g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>25 mm</td>
</tr>
<tr>
<td>Diameter</td>
<td>57 mm</td>
</tr>
<tr>
<td>Wire size</td>
<td>1 x 1.0 mm² stranded wire</td>
</tr>
</tbody>
</table>

The product is CE marked, and the compliance standards are:

- **EMC**
  - EN 61326-1:2013 and EN 301489
- **RF**
  - EN 300 220-1v2.15.1
- **Vibration**
  - EN 60068-2-6

**WLT 310 is a LoRaWAN® Certified product.**

**Connection examples**

- **Lin. R TC humidity**
- **Lin. R TC mA V**
- **RTD TC humidity**
- **RTD TC mA V**

**Assembly examples**

- **A. Battery**
- **B. Ext. supply 12/24VDC**
- **C. Ext. supply gnd**
- **D. TC**
- **E. Humidity sensor gnd**
- **F. Humidity sensor out**
- **G. Humidity sensor 5V/10V**
- **H. mA and V input gnd**
- **I. mA and V input +**
- **J. Lin. R 4wr**
- **K. Lin. R 3wr**
- **L. Lin. R 2wr**
- **M. RTD 4wr**
- **N. RTD 3wr**
- **O. RTD 2wr**

**NOTE! Channel S1 and S2 are identical.**

**Technical data**

- **Humidity sensor input (AUX)**
  - **Humidity measurement range**
    - 0…100 % RH
  - **Voltage measurement range**
    - 0…10 V (0 - 11 V)
  - **Temperature coefficient**
    - ≤ ±0.1 % / °C
  - **Supply for humidity sensor**
    - 5 V and 10 V
  - **Output voltage accuracy**
    - ≤ ± 5 %
  - **Maximum load**
    - 1 mA

The supply generation circuit is switched on only during the humidity measurement (under SW control).

**Power supply**

- **Battery**
  - main power supply is a C size Lithium primary cell battery, 3.6 V nominal 8.5 Ah
  - the battery input is polarity protected
  - battery life time depends of configuration (typically min. 1-2 years)
  - electricity consumption < 100 mA.

- **External power supply**
  - the device operates on external nominal 12 or 24 V DC supply
  - the operating voltage range is 9 to 40 V (12-24V more than ± 30 %)
  - the power supply is isolated from the inputs. The isolation between power supply/inputs is 1500 Vrms.
  - inputs are not isolated from each other!
  - electricity consumption < 70 mA.

**Environmental specifications**

- **Operating temperature range when powered by battery**
  - -25 to +60 °C
- **Operating temperature range when powered by external DC supply**
  - -40 to +80 °C
- **Humidity**
  - RH for device
    - < 90 %, non-condensing
  - Storage
    - < 95 %, non-condensing
  - Transportation
    - < 95 %, non-condensing
- **Plastic casing / protection class**
  - IP20
- **Vibration resistance**
  - certification No 2.4 class (DNV Standard)

**Temperature sensor inputs**

- **Pt100/Pt1000 input, RTD (S1/S2)**
  - One or two of the temperature sensor inputs can be configured as Pt100/Pt1000 inputs. The type can be configured to 2, 3 and 4 wires. Inputs can also detect a short and open sensor.
  - **Temperature measurement range**
    - -200…+800 °C
  - **Measurement accuracy**
    - ≤ ±0.3 °C
  - **Temperature coefficient**
    - ≤ ±0.01% / °C

- **Thermocouple types**
  - E, J, K, N, R, S, T, B, L and U are supported
  - **Measurement accuracy**
    - ≤ ±1 °C, temperature coefficient ≤ ±0.05 °C / °C
  - **Cold junction temperature (CJC)**
    - -40…+80 °C
  - **Accuracy**
    - ≤ ± 1°C

**Resistance measurement range**

- **0-3757 ohm**
- **Linear resistance, Lin. R input (S1/S2)**
  - **Temperature measurement range**
    - -200…+1825 °C
  - **Measurement accuracy**
    - ≤ ± 0.1 % of span
  - **Temperature coefficient**
    - ≤ ± 0.01% / °C

**Linear resistance, Lin. R input (S1/S2)**

- **Resistance measurement range**
  - 0-3757 ohm
- **Measurement accuracy**
  - ≤ ± 0.1 % of span
- **Temperature coefficient**
  - ≤ ± 0.01% / °C

**Analog input (AUX)**

- **Current / Voltage input**
  - The analog input can be configured as voltage or current input, or as humidity sensor input.
  - **Current measurement range**
    - 0…20 mA (0 - 23mA)
  - **Measurement accuracy**
    - ≤ ± 0.5 % of span
  - **Temperature coefficient**
    - ≤ ± 0.01% / °C

- **Voltage measurement range**
  - 0…10 V (0 - 11 V)
  - **Measurement accuracy**
    - ≤ ±0.5 % of span
  - **Temperature coefficient**
    - ≤ ± 0.01% / °C
THERMOWELLS WITH FLANGE

Flanged thermowells are used when it must be possible to replace the thermowell during process maintenance. Thanks to flanged thermowells, all welding work can be avoided.

Thermowells with flanges, as components (without sensing elements), according to DIN 43772 Form 2F.

IMMERSIBLE THERMOWELLS

Immersion thermowells are used for e.g. in channel sensors. The immersion depth can be adjusted upon installation with gas-tight threaded couplings or adjustable flanges.

With special TC sensing elements and heat-resistant well materials, the measuring range can reach as high as +1200 °C.

To increase wear resistance, the wells can be manufactured as a solid tip version (code key letter U).

Other types, dimensions and materials are quoted upon request.

<table>
<thead>
<tr>
<th>Product number</th>
<th>Type</th>
<th>For sensing element diameter/length [mm]</th>
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</thead>
<tbody>
<tr>
<td>915188</td>
<td>F-11-D/H-250-DN25/PN40</td>
<td>6/400</td>
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<tr>
<td>91220269</td>
<td>F-11-D/H-1000-DN25/PN40</td>
<td>6/1155</td>
</tr>
</tbody>
</table>

Other types and dimensions are quoted upon request.

Flanged sensors/wells can also be coated to increase acid resistance features.

<table>
<thead>
<tr>
<th>Product number</th>
<th>Type</th>
<th>For sensing element diameter/length [mm]</th>
<th>Note</th>
</tr>
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<tbody>
<tr>
<td>9151891</td>
<td>A-15-D/H-500</td>
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<td>91518916</td>
<td>A-15-D/H-710</td>
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<td>A-15-D/H-1000</td>
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<td>91518924</td>
<td>A-15-D/H-1400</td>
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<td>A-15-D/H-500/1.4841</td>
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<td>A-22-D/H-1400/253MA/8/735</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other types, dimensions and materials are quoted upon request.
**THREADED THERMOWELL**

- AISI 316L as standard delivery material, other materials on request
- length according to customer needs
- suitable for housing MI cable structured sensor element
- thread fittings for process or enclosure attachment
- HEX key shape for tightening purposes
- special coatings available
- tailored solutions according to customer specific needs.

**THREADED WELLS WITH COOLING NECK**

Threaded thermowells with a cooling neck are used on pipes/containers which are insulated. The cooling neck's length should be selected so that the sensor head is left outside the insulation layer. Another reason for using a cooling neck, is to increase the distance from the hot measurement point to the coupling head, which often has a transmitter installed.

Threaded wells with cooling neck, as components (without sensing elements), according to DIN 43772 Form 2G, are available according to the below table:

<table>
<thead>
<tr>
<th>Product number</th>
<th>Type</th>
<th>For sensing element diameter/length [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>915180</td>
<td>B-9-D/H-100-G½</td>
<td>6/255</td>
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<td>B-9-D/H-160-G½</td>
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<td>B-9-D/H-250-G½</td>
<td>6/405</td>
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<td>915183</td>
<td>B-9-D/H-400-G½</td>
<td>6/555</td>
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<td>916865</td>
<td>B-11-D/H-250-G½</td>
<td>6/405</td>
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<td>6/555</td>
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<td>915184</td>
<td>B-11-D/H-160-R1</td>
<td>8/335</td>
</tr>
</tbody>
</table>

**PRODUCT CODE KEY**

Example code: TPIE — G½ / G½ — 9 / 100 — X

- TPIE = thermowell type (constant in code)
- G½ = thread 1, external thread
- G½ = thread 2, internal thread
- 9 = external diameter (ØOD)
- 100 = immersion depth, L [mm]
- X = additional details on the text line

**THREADED WELLS WITHOUT COOLING NECK**

Threaded thermowells without a cooling neck are used when there is no insulation layer on the surface of installation thread. A connection head with a transmitter or cable close to the thread is not exposed to high temperatures.

Threaded wells without cooling neck, as components (without sensing elements), according to DIN 43772 Form 2.

<table>
<thead>
<tr>
<th>Product number</th>
<th>Type</th>
<th>For sensing element diameter/length [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>915112</td>
<td>B-8K-NA-50-G½</td>
<td>3/95</td>
</tr>
<tr>
<td>915176</td>
<td>B-8K-NA-100-G½</td>
<td>3/145</td>
</tr>
<tr>
<td>915176</td>
<td>B-9K-D/H-100-G½</td>
<td>6/145</td>
</tr>
<tr>
<td>915177</td>
<td>B-9K-D/H-160-G½</td>
<td>6/205</td>
</tr>
</tbody>
</table>
COATING MATERIALS

We can manufacture all metal surface sensors or thermowells, also with special coatings.

- FEP known as Teflon®, good for low temperatures, exhaust gases or various acids, resistant to sunlight
- PFA very similar to FEP, slightly better than FEP in thermal stability and resistance to high temperatures
- METCO hard metal coating, specially for applications where sensors are exposed to grinding, like crude oil pipes (sand/stones), rock wool blasting etc.
- DIAMALLOY corrosion protection, hard surface
- STELLITE® no 6 - good wear resistance
- Other materials upon request.

The allowed temperatures vary from -200 ... + 1200 °C, depending on the material.

THE MOST COMMON SENSOR TYPES FOR COATING

- 1 Threaded temperature sensor without cooling neck
- 2 Threaded temperature sensor with cooling neck
- 3 Flanged temperature sensor
- 8 Immersible temperature sensor.
COOLING NECK AND CONNECTION HEAD FOR WELDED THERMOWELLS

If the process already has a welded thermowell, a suitable cooling neck and connection head can be purchased as a separate component. Cooling necks have outer threads which can be applied to D-wells:
- M14×1,5 for D1S and D4S
- M18×1,5 for D1, D4 and D5

Cooling necks and connection heads, as components (without wells, without sensing elements):

<table>
<thead>
<tr>
<th>Product number</th>
<th>Type and inner thread</th>
<th>Overall length [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1025314</td>
<td>G1/2&quot;</td>
<td>L=30</td>
</tr>
<tr>
<td>1002689</td>
<td>G1/2&quot;</td>
<td>L=70</td>
</tr>
<tr>
<td>1003144</td>
<td>G1/2&quot;</td>
<td>L=100</td>
</tr>
<tr>
<td>1028994</td>
<td>G1&quot;</td>
<td>L=70</td>
</tr>
</tbody>
</table>

Other materials and sizes are quoted upon request.

Gas-tight threaded couplings are used with 15 mm or 22 mm diameter wells, when a threaded connection is needed, and it is necessary to adjust the sensor immersion depth. A gas-tight coupling has Teflon® ferrules inside. As the coupling is tightened, the ferrule is pressed on the thermowell surface. The connection is gas-tight, but not pressure-resistant.

<table>
<thead>
<tr>
<th>Product number</th>
<th>Type - thread - inner diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>917347</td>
<td>Gas-tight threaded coupling G1&quot;-15mm</td>
</tr>
<tr>
<td>999562</td>
<td>Gas-tight threaded coupling G1&quot;-22mm</td>
</tr>
</tbody>
</table>

Other types are quoted upon request.

Compression fittings are used with sensing inserts or sensors when thermowells are not needed. The immersion depth of the sensor can be adjusted when installed. The compression fitting has a metal ferrule inside. The ferrule is made of stainless steel SS316L (other materials and sizes upon request). Single or double ferrules are used depending on the inner diameter. By tightening the compression fitting, the ferrule is permanently pressed on the sensing element. This connection is pressure-resistant.

<table>
<thead>
<tr>
<th>Product number</th>
<th>Type - thread - inner diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>875823</td>
<td>Compression fitting G1/8-6mm</td>
</tr>
<tr>
<td>1001171</td>
<td>Compression fitting G1/8-12mm</td>
</tr>
<tr>
<td>914413</td>
<td>Compression fitting G1/8-15mm</td>
</tr>
<tr>
<td>1010922</td>
<td>Compression fitting G1/8-1.5mm</td>
</tr>
<tr>
<td>918998</td>
<td>Compression fitting G1/8-3mm</td>
</tr>
<tr>
<td>918997</td>
<td>Compression fitting G1/8-4.5mm</td>
</tr>
<tr>
<td>920701</td>
<td>Compression fitting G1/8-6mm</td>
</tr>
<tr>
<td>9208587</td>
<td>Compression fitting G1/8-1.5mm</td>
</tr>
<tr>
<td>919178</td>
<td>Compression fitting G1/8-3mm</td>
</tr>
<tr>
<td>1090957</td>
<td>Compression fitting G1/8-1mm</td>
</tr>
<tr>
<td>10632720</td>
<td>Compression fitting M10x1.5mm</td>
</tr>
<tr>
<td>911908</td>
<td>Compression fitting M10x1.5mm</td>
</tr>
<tr>
<td>1040461</td>
<td>Compression fitting M10x1.5mm</td>
</tr>
<tr>
<td>914237</td>
<td>Compression fitting NPT1/4-3mm</td>
</tr>
<tr>
<td>1066586</td>
<td>Compression fitting NPT1/4-4mm</td>
</tr>
<tr>
<td>1001559</td>
<td>Compression fitting NPT1/8-3mm</td>
</tr>
<tr>
<td>1066584</td>
<td>Compression fitting NPT1/8-4mm</td>
</tr>
</tbody>
</table>

Other types are quoted upon request.

WELDED ROOT SLEEVES FOR WELDED THERMOWELLS

The root sleeve is first welded on the process pipe or container, and then bored to precise inner dimensions. After that the D1S/D4S/D5 type thermowell is welded on the root sleeve. The root sleeve material needs to be the same as the welded thermowell.

<table>
<thead>
<tr>
<th>Product number</th>
<th>Type</th>
<th>For well type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1025309</td>
<td>18-K</td>
<td>D1S and D4S</td>
</tr>
<tr>
<td>1025312</td>
<td>18-L</td>
<td>D1S and D4S</td>
</tr>
<tr>
<td>1025313</td>
<td>18-M</td>
<td>D1S and D4S</td>
</tr>
<tr>
<td>918338</td>
<td>18-O</td>
<td>D1S and D4S</td>
</tr>
<tr>
<td>912333</td>
<td>24-K</td>
<td>D1, D4 and D5</td>
</tr>
<tr>
<td>912331</td>
<td>24-L</td>
<td>D1, D4 and D5</td>
</tr>
<tr>
<td>912332</td>
<td>24-M</td>
<td>D1, D4 and D5</td>
</tr>
<tr>
<td>912334</td>
<td>24-O</td>
<td>D1, D4 and D5</td>
</tr>
</tbody>
</table>

Product number Type For well types
915312 H-12-D/H-165/M18x1,5 D1, D4 and D5
915313 H-12-D/H-165/M18x1,5 D1S and D4S

A cooling neck, and connection head equipped with a sensing element - without a welded thermowell - is presented on datasheet 5. A cooling neck, and connection head equipped with a sensing element and with a welded well is presented on datasheet 4.

Compression fittings are used with sensing inserts or sensors when thermowells are not needed. The immersion depth of the sensor can be adjusted when installed. The compression fitting has a metal ferrule inside. The ferrule is made of stainless steel SS316L (other materials and sizes upon request). Single or double ferrules are used depending on the inner diameter. By tightening the compression fitting, the ferrule is permanently pressed on the sensing element. This connection is pressure-resistant.

<table>
<thead>
<tr>
<th>Product number</th>
<th>Type - thread - inner diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>875823</td>
<td>Compression fitting G1/8-6mm</td>
</tr>
<tr>
<td>1001171</td>
<td>Compression fitting G1/8-12mm</td>
</tr>
<tr>
<td>914413</td>
<td>Compression fitting G1/8-15mm</td>
</tr>
<tr>
<td>1010922</td>
<td>Compression fitting G1/8-1.5mm</td>
</tr>
<tr>
<td>918998</td>
<td>Compression fitting G1/8-3mm</td>
</tr>
<tr>
<td>918997</td>
<td>Compression fitting G1/8-4.5mm</td>
</tr>
<tr>
<td>920701</td>
<td>Compression fitting G1/8-6mm</td>
</tr>
<tr>
<td>9208587</td>
<td>Compression fitting G1/8-1.5mm</td>
</tr>
<tr>
<td>919178</td>
<td>Compression fitting G1/8-3mm</td>
</tr>
<tr>
<td>1090957</td>
<td>Compression fitting G1/8-1mm</td>
</tr>
<tr>
<td>10632720</td>
<td>Compression fitting M10x1.5mm</td>
</tr>
<tr>
<td>911908</td>
<td>Compression fitting M10x1.5mm</td>
</tr>
<tr>
<td>1040461</td>
<td>Compression fitting M10x1.5mm</td>
</tr>
<tr>
<td>914237</td>
<td>Compression fitting NPT1/4-3mm</td>
</tr>
<tr>
<td>1066586</td>
<td>Compression fitting NPT1/4-4mm</td>
</tr>
<tr>
<td>1001559</td>
<td>Compression fitting NPT1/8-3mm</td>
</tr>
<tr>
<td>1066584</td>
<td>Compression fitting NPT1/8-4mm</td>
</tr>
</tbody>
</table>

Other types are quoted upon request.
CONNECTION HEADS
Connection heads for EPIC® SENSORS temperature sensors can be purchased as accessories. The D/H types come with a quick release clip and blue epoxy varnish finishing as standard, but other connection heads for different applications are also available.

<table>
<thead>
<tr>
<th>Product number</th>
<th>Type</th>
<th>Code key letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1018378</td>
<td>Adjustable</td>
<td></td>
</tr>
<tr>
<td>1018382</td>
<td>Adjustable</td>
<td></td>
</tr>
<tr>
<td>1018383</td>
<td>Adjustable</td>
<td></td>
</tr>
<tr>
<td>911984</td>
<td>Welded</td>
<td></td>
</tr>
<tr>
<td>911985</td>
<td>Welded</td>
<td></td>
</tr>
<tr>
<td>911986</td>
<td>Welded</td>
<td></td>
</tr>
</tbody>
</table>

Other sizes are quoted upon request.

ADJUSTABLE FLANGES
Welded and adjustable flanges are mainly used for installing different sized thermowells. The flange design allows adjusting of the sensor immersion depth. Thanks to the design, the sensor can be mounted precisely in the process, at just the right depth.

<table>
<thead>
<tr>
<th>Product number</th>
<th>Type</th>
<th>Code key letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1020864</td>
<td>SS316 M24</td>
<td></td>
</tr>
<tr>
<td>911970</td>
<td>BL M24</td>
<td></td>
</tr>
<tr>
<td>1027082</td>
<td>NA M24 Epoxy</td>
<td></td>
</tr>
<tr>
<td>1006145</td>
<td>DAN/H M24 Epoxy</td>
<td></td>
</tr>
<tr>
<td>917962</td>
<td>DAN/H</td>
<td></td>
</tr>
<tr>
<td>1006146</td>
<td>DAN/W/H M24 Epoxy</td>
<td></td>
</tr>
<tr>
<td>11000999</td>
<td>DAN/W/H</td>
<td></td>
</tr>
<tr>
<td>5105631</td>
<td>XD-AB M20x1,5 ATEX</td>
<td></td>
</tr>
<tr>
<td>1078902</td>
<td>LAA 32,5MM Epoxy</td>
<td></td>
</tr>
</tbody>
</table>

CLAMP FITTING
- AISI 316L as standard delivery material, other materials on request
- clamping fitting for process pipe attachment
- thread fitting for enclosure attachment
- available for various pipe sizes
- special coatings available
- tailored solutions according to customer specific needs.

Material | AISI 316L, maximum temperature +550 °C, temporarily +600 °C, other materials on request
Thread | typically G½, G, R, NPT, M available as standard delivery, other threads on request

CLAMP SIZES

<table>
<thead>
<tr>
<th>ØD (mm)</th>
<th>L (mm)</th>
<th>T (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>Ød (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2½ in</td>
<td>21,3</td>
<td>80</td>
<td>2</td>
<td>25</td>
<td>44</td>
</tr>
<tr>
<td>2½ in</td>
<td>21,3</td>
<td>150</td>
<td>2</td>
<td>25</td>
<td>44</td>
</tr>
<tr>
<td>2½ in</td>
<td>21,3</td>
<td>270</td>
<td>2</td>
<td>25</td>
<td>44</td>
</tr>
<tr>
<td>2½ in</td>
<td>21,3</td>
<td>520</td>
<td>2</td>
<td>25</td>
<td>44</td>
</tr>
<tr>
<td>2½ in</td>
<td>26,9</td>
<td>80</td>
<td>3</td>
<td>32</td>
<td>52</td>
</tr>
<tr>
<td>3 in</td>
<td>33,7</td>
<td>150</td>
<td>3</td>
<td>25</td>
<td>57</td>
</tr>
<tr>
<td>3 in</td>
<td>50,3</td>
<td>150</td>
<td>3</td>
<td>40</td>
<td>91</td>
</tr>
<tr>
<td>4 in</td>
<td>64,3</td>
<td>150</td>
<td>4</td>
<td>40</td>
<td>206</td>
</tr>
<tr>
<td>4 in</td>
<td>168,3</td>
<td>270</td>
<td>4</td>
<td>40</td>
<td>206</td>
</tr>
<tr>
<td>1½ in</td>
<td>33,7</td>
<td>80</td>
<td>3</td>
<td>30</td>
<td>156</td>
</tr>
<tr>
<td>1½ in</td>
<td>88,9</td>
<td>80</td>
<td>3</td>
<td>40</td>
<td>120</td>
</tr>
<tr>
<td>1½ in</td>
<td>154,3</td>
<td>80</td>
<td>3</td>
<td>30</td>
<td>156</td>
</tr>
<tr>
<td>1½ in</td>
<td>168,3</td>
<td>80</td>
<td>4</td>
<td>40</td>
<td>206</td>
</tr>
<tr>
<td>2 in</td>
<td>219,1</td>
<td>80</td>
<td>4</td>
<td>40</td>
<td>262</td>
</tr>
<tr>
<td>2 in</td>
<td>60,3</td>
<td>80</td>
<td>3</td>
<td>40</td>
<td>91</td>
</tr>
<tr>
<td>2 in</td>
<td>273,0</td>
<td>80</td>
<td>4</td>
<td>50</td>
<td>316</td>
</tr>
</tbody>
</table>

PRODUCT CODE KEY
Example code: TPIE-PANTA – ½” - G½ / 270 – X

TPIE-PANTA = fitting type (constant in code)
½” = clamp diameter in inches (ØD) [in]
G½ = thread (G½ as standard delivery)
270 = neck pipe length, L [mm]
X = additional details on the text line
**MINI CONNECTORS FOR THERMOCOUPLES**

The connectors are available with male and female contacts and are always made of materials suitable for that type of thermocouple. The color of the connector housing depends on the type of thermocouple, e.g. the type K connector is normally green because the type K cable is green according to the IEC 60584 standard.

There are two different thermocouple connector sizes available, the standard type (STD) and the compact type (MINI).

<table>
<thead>
<tr>
<th>Products number</th>
<th>Type</th>
<th>Designation</th>
<th>Number of cores and wire sizes</th>
<th>Colors +/–/ sheath</th>
<th>Outer diameter mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>911476</td>
<td>J-STD-Female</td>
<td>NiCr/Ni 2G ST 2G K</td>
<td>2x1.5</td>
<td>grn/wht/grn</td>
<td>7.50 (±0.15)</td>
</tr>
<tr>
<td>911475</td>
<td>J-STD-Male</td>
<td>NiCr/Ni 2G ST 2G K</td>
<td>3x(2x1.5)</td>
<td>grn/wht/grn</td>
<td>9.50 (±0.15)</td>
</tr>
<tr>
<td>911477</td>
<td>J-MINI-Female</td>
<td>NiCr/Ni 2G ST 2G K</td>
<td>6x(2x1.5)</td>
<td>grn/wht/grn</td>
<td>13.40 (±0.15)</td>
</tr>
<tr>
<td>911478</td>
<td>J-MINI-Male</td>
<td>NiCr/Ni 2G ST 2G K</td>
<td>8x(2x1.5)</td>
<td>grn/wht/grn</td>
<td>14.90 (±0.15)</td>
</tr>
<tr>
<td>911440</td>
<td>K-STD-Female</td>
<td>NiCr/Ni 2G ST 2G K</td>
<td>2x1.5</td>
<td>ora/wht/ora</td>
<td>7.50 (±0.15)</td>
</tr>
<tr>
<td>911439</td>
<td>K-STD-Male</td>
<td>NiCr/Ni 2G ST 2G K</td>
<td>2x(2x1.5)</td>
<td>ora/wht/ora</td>
<td>8.50 (±0.15)</td>
</tr>
<tr>
<td>911442</td>
<td>K-MINI-Female</td>
<td>NiCr/Ni 2G ST 2G K</td>
<td>2x1.5</td>
<td>bck/wht/bck</td>
<td>7.50 (±0.15)</td>
</tr>
<tr>
<td>911441</td>
<td>K-MINI-Male</td>
<td>NiCr/Ni 2G ST 2G K</td>
<td>2x(2x1.5)</td>
<td>bck/wht/bck</td>
<td>7.50 (±0.15)</td>
</tr>
<tr>
<td>1089977</td>
<td>N-STD-Female</td>
<td>NiCr/Ni 2G ST 2G K</td>
<td>2x1.5</td>
<td>grn/wht/grn</td>
<td>7.50 (±0.15)</td>
</tr>
<tr>
<td>1089978</td>
<td>N-STD-Male</td>
<td>NiCr/Ni 2G ST 2G K</td>
<td>2x(2x1.5)</td>
<td>grn/wht/grn</td>
<td>8.50 (±0.15)</td>
</tr>
<tr>
<td>1023763</td>
<td>S-STD-Female</td>
<td>NiCr/Ni 2G ST 2G K</td>
<td>2x1.5</td>
<td>bck/wht/bck</td>
<td>7.50 (±0.15)</td>
</tr>
<tr>
<td>1083322</td>
<td>S-STD-Male</td>
<td>NiCr/Ni 2G ST 2G K</td>
<td>2x(2x1.5)</td>
<td>bck/wht/bck</td>
<td>8.50 (±0.15)</td>
</tr>
<tr>
<td>1023764</td>
<td>S-STD-Female</td>
<td>NiCr/Ni 2G ST 2G K</td>
<td>2x1.5</td>
<td>bck/wht/bck</td>
<td>7.50 (±0.15)</td>
</tr>
<tr>
<td>1083323</td>
<td>S-STD-Male</td>
<td>NiCr/Ni 2G ST 2G K</td>
<td>2x(2x1.5)</td>
<td>bck/wht/bck</td>
<td>8.50 (±0.15)</td>
</tr>
<tr>
<td>1017789</td>
<td>Cable clamps for STD connectors</td>
<td>NiCr/Ni 2G ST 2G K</td>
<td>2x1.5</td>
<td>bck/wht/bck</td>
<td>7.50 (±0.15)</td>
</tr>
</tbody>
</table>

Other types are quoted upon request.

**COMPENSATING CABLES FOR THERMOCOUPLE SENSORS**

The thermocouple between the hot and cold ends of the sensor, must use the correct cable to avoid measurement errors due to different materials. The cables used are either extension cable type (X) or compensation cable type (C).

Our stock items are silicon insulated compensating cables according to the IEC 60584 standard, with a maximum temperature of +180 °C. The cable structure of the one pair cables for a J, K and S type thermocouple sensor is $2 \times 1.5 \text{ mm}^2$.

**Stock items**

<table>
<thead>
<tr>
<th>Product number</th>
<th>Designation</th>
<th>Number of cores and wire sizes</th>
<th>Colors +/–/ sheath</th>
<th>Outer diameter mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>903242</td>
<td>NiCr/Ni 2G ST 2G K</td>
<td>2x1.5</td>
<td>grn/wht/grn</td>
<td>7.50 (±0.15)</td>
</tr>
<tr>
<td>1084278</td>
<td>NiCr/Ni 2G ST 2G K</td>
<td>3x(2x1.5)</td>
<td>grn/wht/grn</td>
<td>9.50 (±0.15)</td>
</tr>
<tr>
<td>911884</td>
<td>NiCr/Ni 2G ST 2G K</td>
<td>6x(2x1.5)</td>
<td>grn/wht/grn</td>
<td>13.40 (±0.15)</td>
</tr>
<tr>
<td>1084281</td>
<td>NiCr/Ni 2G ST 2G K</td>
<td>8x(2x1.5)</td>
<td>grn/wht/grn</td>
<td>14.90 (±0.15)</td>
</tr>
<tr>
<td>903256</td>
<td>PtRh/Pl 2G ST 2G S</td>
<td>2x1.5</td>
<td>ora/wht/ora</td>
<td>7.50 (±0.15)</td>
</tr>
<tr>
<td>1002534</td>
<td>PtRh/Pl 2G ST 2G S</td>
<td>2x(2x1.5)</td>
<td>ora/wht/ora</td>
<td>8.50 (±0.15)</td>
</tr>
<tr>
<td>903257</td>
<td>Fe/CuNi 2G ST 2G J</td>
<td>2x1.5 SIL</td>
<td>bck/wht/bck</td>
<td>7.50 (±0.15)</td>
</tr>
<tr>
<td>1210658</td>
<td>NiSiNiSi 2G ST 2G N</td>
<td>2x1.5</td>
<td>bck/wht/bck</td>
<td>7.50 (±0.15)</td>
</tr>
</tbody>
</table>

Color abbreviations: bck = black, grn = green, ora = orange, pnk = pink, wht = white. Other cable types and wire structures can be delivered on request.
Thermocouple Cable Standards (Color Codes)

New standards:

<table>
<thead>
<tr>
<th>Thermo Type</th>
<th>IEC 584</th>
<th>DIN 43714</th>
<th>ANSI MC 96.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>NiCr-Ni / K</td>
<td>+ green</td>
<td>+ green</td>
<td>+ yellow</td>
</tr>
<tr>
<td>KCA: Fe-CuNi</td>
<td>+ white</td>
<td>+ green</td>
<td>- red</td>
</tr>
<tr>
<td></td>
<td>Jacket:</td>
<td>Jacket:</td>
<td>Jacket: red</td>
</tr>
<tr>
<td>Fe-CuNi / L</td>
<td>+ red</td>
<td>+ red</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ blue</td>
<td>+ blue</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jacket:</td>
<td>Jacket:</td>
<td></td>
</tr>
<tr>
<td>Fe-CuNi / J</td>
<td>+ black</td>
<td>+ white</td>
<td>+ black</td>
</tr>
<tr>
<td></td>
<td>+ white</td>
<td>+ red</td>
<td>+ black</td>
</tr>
<tr>
<td></td>
<td>Jacket:</td>
<td>+ red</td>
<td>Jacket: black</td>
</tr>
<tr>
<td>Pt10Rh-Pt / S</td>
<td>+ orange</td>
<td>+ white</td>
<td>+ black</td>
</tr>
<tr>
<td>SCA: E-Cu/A-Cu</td>
<td>+ white</td>
<td>+ white</td>
<td>+ red</td>
</tr>
<tr>
<td></td>
<td>Jacket:</td>
<td>Jacket:</td>
<td>Jacket: green</td>
</tr>
<tr>
<td>Pt13Rh-Pt / R</td>
<td>+ orange</td>
<td>+ white</td>
<td>+ black</td>
</tr>
<tr>
<td>RCA: E-Cu/A-Cu</td>
<td>+ white</td>
<td>+ white</td>
<td>+ red</td>
</tr>
<tr>
<td></td>
<td>Jacket:</td>
<td>Jacket:</td>
<td>Jacket: green</td>
</tr>
<tr>
<td>Pt30Rh-Pt6Rh / B</td>
<td>+ grey</td>
<td>+ white</td>
<td>+ grey</td>
</tr>
<tr>
<td>BC: S-Cu/E-Cu</td>
<td>+ white</td>
<td>+ white</td>
<td>+ red</td>
</tr>
<tr>
<td></td>
<td>Jacket:</td>
<td>Jacket:</td>
<td>Jacket: grey</td>
</tr>
<tr>
<td>NiCrOx-Nisil / N</td>
<td>+ pink</td>
<td>+ white</td>
<td></td>
</tr>
<tr>
<td>NC: Cu-CuNi</td>
<td>+ white</td>
<td>+ white</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jacket:</td>
<td>+ white</td>
<td></td>
</tr>
<tr>
<td>Cu-CuNi / U</td>
<td>+ red</td>
<td>+ brown</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ brown</td>
<td>+ brown</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jacket:</td>
<td>+ brown</td>
<td></td>
</tr>
<tr>
<td>Cu-CuNi / T</td>
<td>+ brown</td>
<td>+ white</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ white</td>
<td>+ brown</td>
<td></td>
</tr>
<tr>
<td>NiCr-CuNi / E</td>
<td>+ purple</td>
<td>+ white</td>
<td>+ purple</td>
</tr>
<tr>
<td></td>
<td>+ white</td>
<td>+ purple</td>
<td>+ red</td>
</tr>
<tr>
<td></td>
<td>Jacket:</td>
<td>+ purple</td>
<td>+ red</td>
</tr>
</tbody>
</table>

**Factory Calibration**

Factory calibrations are done with two calibration ovens, which perform in a temperature range of -25…+660 °C.
- Factory calibration is recommended to be done in two measuring points minimum.
- More calibration points can be used depending on the calibration temperature range.
- Factory calibration can be done for RTD and TC sensors.
- The minimum length of the sensor to be calibrated is 255 mm. This limitation does not apply to cable sensors.
- Factory calibration can be executed for sensors with an outer diameter of 3 mm, 4 mm, 6 mm, 8 mm or 10 mm.
- The calibration devices are able to work with single sensors or a combination of a sensor and transmitter together.
- In the factory calibration service, customers get a calibration certificate which includes customer data, product data and calibration results with a measuring data table and graph.
- If the factory calibration is not an adequate proof of measuring value deviation, we can, on customers’ behalf have the sensors (and transmitters) send to an accredited laboratory for a third party laboratory calibration.

**What is Calibration?**

Temperature sensor deviation in individual points of a measuring range is defined by comparing the readout of the sensor to be calibrated to another reference sensor, of which the readout accuracy is known. The objective of the calibration is to define the deviation between a measured value and a corresponding reference value.

**Why Calibrate?**

Through calibration you can achieve many advantages besides measuring accuracy, for example:
- Traceability for temperature measuring results
- Certainty for temperature measuring results
- Optimizing production process quality, consistency and efficiency
- Energy savings due to process control driven by accurate measurements
- Reduced pollution due process control driven by accurate measurements
- Savings in material costs
- Minimizing risk of unexpected repairs and changes of process machinery and sensors.

Design and Engineering

We can assist you with designing, engineering and documenting of temperature sensors. Whether it is a detailed feature of one sensor or a complete solution, our know-how and practical experience are at your disposal.

Power plant applications

We have experience in designing special temperature measurement applications for power plants and their boilers. We have implemented many different measurement applications for soda, fluidized bed and grate boilers as well as waste incineration plants.

Metal processing applications

Temperature measurement for very demanding conditions in the different stages of metal processing is also our expertise. Ceramic and various coated thermowells and their special applications have been executed in collaboration with customers.

Chemical industry applications

Highly corrosion-resistant temperature measurement in demanding conditions of the chemical industry is our specialty. We have decades experience in designing multi-point temperature measurement for different types of tanks and basins.

We have even designed a specific product suitable for trace heating temperature measurement. The trace heating sensor is qualified for high temperatures of MI-heating and explosive atmospheres.

Mechanical engineering applications

Customized and tailor-made temperature sensors according to customers’ specifications are our know-how at its best.

Modeling

3D models can be created of any application as we use SolidWorks and AutoCAD design software. Just send us information of the desired measuring application and we are happy to help you.