Temperature Sensors
Industrial Temperature Measurement in Fluids and Gases
Temperature Measurement – Overview

In order to operate machinery and equipment efficiently and safely, temperature has to be controlled continuously as a critical size in many industrial processes. Electronic temperature sensors and transmitters prove to be a reliable and practical solution for temperature detection not only due to their high accuracy and reproducibility, but also through a variety of interfaces to the process and to the operator.

In industrial applications, temperature is measured with resistance thermometers or thermocouples. Resistance thermometers accomplish this task via temperature-sensitive electrical thermostors. A distinction is made between PTC thermostors, whose resistance increases with increasing temperature and NTC thermostors with opposite behavior.

In combination with numerous connection options and variable output signals, the Turck portfolio guarantees maximum flexibility in terms of temperature measurement.

**Ease of use**

In addition of two buttons for quick menu scrolling, the TS series features a recessed button for secure storing of modified values.

**Accuracy**

Thanks to an accuracy of 0.2 k, only a few types of temperature sensors are needed to handle many different applications.

**Mounting flexibility**

A rotatable sensor body with chamfered display, whose reading can be reversed by 180° degrees, can be mounted in many positions.

**Plant safety**

The rugged stainless steel housing, excellent EMC properties and protection class IP67 provide highest operational safety.
TS series

Through features such as easy programming, flexible process connection and a well readable display, the TS series provides everything you need to optimize your application.

TTM series

The compact sensors of the TTM series are available either with integrated probe or with a standard M12 plug connection to mount probes.

T-Gage

The infrared sensors of the T-Gage series measure temperatures contactless in a range between 0 and +300 °C and at wavelengths between 8 and 14 μm.

TP series

A further important device of the product portfolio is the IP67 rated Pt 100 resistance thermometer, used for temperatures between -50 and +500 °C. With regard to the temperature probes of the TP series, the user can choose from a comprehensive range of different probe lengths and diameters. When using a thermowell for protection, the temperature sensor can be adapted to critical application conditions.

IMS interface modules

The 1 and 2-channel IMS modules (Interface Modul Small) are only 6.2 mm slim and offer functions such as galvanic isolation, signal conditioning and temperature measurement.

IM interface modules

The 18 mm and 27 mm devices of the IM series can also be screwed on a panel. Thanks to a great variety of functions, these interface modules are suitable for many applications. In addition, the IM modules are equipped with a universal power supply unit that provides 20...250 VUC or 20...250 VAC/20...125 VDC for use with Ex-devices.

IMX Interface modules

The new IMX12 interface modules offer up to two temperature input channels with a width of 12.5 mm. Extensive parameterization options allow adaptation to a wide range of applications. In addition to resistance temperature probes, thermocouples can also be connected.
Flexibility in any Applikation

Evaluation

End tip

Process connection

Process

TS-516
IM34
IMS
IMX12
Compact Probe TP-103
Special Probe TP-104
Cable Probe TP-306

Compression Fitting CF-...
TC Series

- Accuracy ± 0.2 K
- Sensor rotatable by 320°
- Connection of temperature probes via M12 x 1 male
- Stainless steel 1.4305 (AISI 303)
- Permanent display of temperature (°C, °F, K, Ω)
- Storage of max/min values
- Protection class IP67

The processing units of the TS-400/TS-500 series are incorporated in a non-rotatable, rugged stainless steel housing. A standard M12 x 1 plug connection is available for TP temperature probes. The display indicates the temperature during normal operation and guides the operator through the programming menu. We offer sensors with switching outputs or with a combination of switching and analog outputs.

<table>
<thead>
<tr>
<th>Functional principle</th>
<th>Mechanical version</th>
<th>Electrical version</th>
</tr>
</thead>
<tbody>
<tr>
<td>TS</td>
<td>5 00</td>
<td>LI2UPN 8 X</td>
</tr>
<tr>
<td>Design</td>
<td>TS</td>
<td></td>
</tr>
<tr>
<td>TS</td>
<td>temperature sensor</td>
<td></td>
</tr>
<tr>
<td>Process connection</td>
<td>00</td>
<td>LED display</td>
</tr>
<tr>
<td>without process</td>
<td></td>
<td></td>
</tr>
<tr>
<td>connection temperature probe via M12 x 1 male</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Operating voltage</td>
<td></td>
</tr>
<tr>
<td>G½&quot; with integrated probe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>8</td>
<td>15 (18)…30 VDC</td>
</tr>
<tr>
<td>½&quot; NPT with integrated probe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>only with design 5</td>
<td>Output type</td>
<td></td>
</tr>
<tr>
<td>adjustable, with display non-rotatable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2UPN</td>
<td>2 Schaltausgänge</td>
</tr>
<tr>
<td>adjustable, with display non-rotatable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>LUUPN</td>
<td>Schalt- und Spannungsausgang</td>
</tr>
<tr>
<td>H1 1 4 1</td>
<td>LI2UPN</td>
<td>Strom- und Schaltausgang</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electrical connection: male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment</td>
</tr>
<tr>
<td>Belegung nach Norm</td>
</tr>
<tr>
<td>andere: Sonderbelegung</td>
</tr>
<tr>
<td>standard assignment</td>
</tr>
<tr>
<td>other</td>
</tr>
<tr>
<td>special assignments</td>
</tr>
<tr>
<td>Connector type</td>
</tr>
<tr>
<td>straight</td>
</tr>
<tr>
<td>Connector type</td>
</tr>
<tr>
<td>M12 x 1 male</td>
</tr>
</tbody>
</table>
TTM Series

- Accuracy ± 0.2 K
- Protection class IP67
- Stainless steel 1.4404 (AISI 316L)
- Analog current output 4…20 mA (2-wire)
- Adjustment range -210…+650 °C

Miniature sensors of the TTM series fit in the most confined spaces and measure temperatures precisely via the integrated processor and the Platinium class A measuring element. Being only 25 mm longer and 1.5 mm wider than a standard M12 x 1 male, the fully encapsulated TTM without processor provide an output signal of 4…20 mA in 2-wire technology. We also provide customized solutions on request.
The core element of the TP series is a Pt100 measuring resistor in 4-wire technology. All probes feature a standard M12 x 1 connection to the processing unit.

### Electrical connection

- **Assignment**: 0 special assignment, 1 standard assignment
- **Number of contacts**: 4 four
- **Connector type**: 1 straight
- **Connector type**: H1 M12 x 1 male

### Probe length

- **Probe length mm**:
  - L013: 13 mm (only 103A)
  - L024: 24 mm (only 103A)
  - L035: 35 mm (only 504A)
  - L100: 100 mm
  - L150: 150 mm
  - L200: 200 mm
  - L250: 250 mm
  - L300: 300 mm
  - L1000: 1000 mm
  - L2000: 2000 mm
  - L5000: 5000 mm
  - Customized lengths on request!
IM34

- Temperature measuring amplifiers, 1-channel, mounting on DIN rail
- Input for Pt100/ Ni100 resistors in 2, 3 or 4-wire technology, variable resistors, thermocouples and millivolt signals
- With intrinsically safe input circuits Ex ia, for zone 2, additional limit value relay required
- Current output of 0/4...20 mA.
- Galvanic isolation between input circuits and output circuits and supply voltage
- Parametrized via PACTware™
- HART® transmission
- Universal operating voltage
- Removable terminal blocks, reverse-polarity protected

The IM34 temperature measuring amplifiers are designed to evaluate temperature-dependent changes of Ni100/ Pt100 resistors, thermocouples B, E, J, K, L, N, R, S, T or low voltage in a range of -160...+160 mV and to output them as temperature linear current signals 0/4...20 mA. Types with relay output are additionally available for monitoring of limit values. The devices are parametrized via FDT/DTM.

The following adjustments can be made: 2, 3, or 4-wire technology, measuring range, wire-break monitoring, output behaviour in the event of input circuit failure, internal or external cold junction compensation, temperature unit and mode (resistance, thermocouple, low voltage and line compensation).

### IM34 Design

<table>
<thead>
<tr>
<th>IM34 Design</th>
<th>-</th>
<th>1</th>
<th>2</th>
<th>1</th>
<th>-</th>
<th>Ex</th>
<th>24VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>Ex</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>interface module</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>temperature measuring amplifier</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Output type

- R relay switching output
- I current output 0/4...20 mA
- C computer parametrizable (FDT/DTM)
- D Display
- H HART®

### Power supply

- 24 VDC power supply 24 VDC
- no details universal power supply unit

### Device class

- Ex associated equipment with intrinsically safe field current circuits (non-Ex no details)
IMX12-TI

- Temperature measuring amplifier, single and dual channel, DIN rail mounting in a narrow 12.5 mm housing
- For connecting resistance thermometers in 2/3/4-wire circuit, thermocouples and millivolt signals
- Extensive international Ex approvals, Can be used in functionally safe circuits up to SIL2
- Versions with limit relays and intrinsically safe input circuits; can be mounted in zone 2
- Current output 4...20 mA as current source or sink parameterisable
- Galvanic isolation of input, output circuits and supply voltage
- Parametriebar via FDT/DTM e.g. PACTware
- Supply voltage range 10...30 VDC
- Removable terminal blocks, selectable as screw or spring-type terminals

The new interface device family IMX12 now also offers a temperature measuring amplifier. With a width of only 12.5 mm, the new IMX12-TI is the narrowest 2-channel EX temperature amplifier on the market. Besides the high channel density, the IMX12-TI offers very good precision and high functionality.

The temperature amplifier can be optimally adapted to the respective application via the established FDT/DTM technology.

As with all devices of the IMX12 family, the type of terminals can be selected. The Power Bridge system is optionally available to facilitate installation.
T-Gage

- Short response time of 75 ms
- User-friendly programming
- Compact design
- Rugged, fully encapsulated construction
- Available with cable or 5-pole M12 x 1 male
- Target need not be moved to be detected
- Alarm output for maximum signal
- Programmable for rising or dropping analog characteristic

The T-GAGE is a passively operating device, used for analog temperature measurement. It measures the temperature of objects in a defined range and emits a proportional voltage. Unlike other photoelectric sensors, the T-GAGE doesn’t emit light but only measures the infrared radiation of objects. This sensor is thus perfectly suited for monitoring the temperature of hot objects, such as injection-moulded parts or bakery products, but also metals, bottles or rubbers. To avoid overload, the T-GAGE is also used for monitoring the temperature of conveyor-belt rollers. The sensor can also be used in applications of the food industry to monitor cold objects, such as ice cream or milk products for example.
THW Series

- Thermowells
- Stainless steel 1.4404 (AISI 316L)
- Pressure-resistant up to 600 bar
- Probes fixed in place with compression fitting
- Rugged construction

THW thermowells are used to protect probes against environmental influences. They are available in different material qualities and for many requirements. Standard thermowells are made of 1.4404 stainless steel and designed for individual sensors.

**THW - 3 - G1/8 - A4 - L013**

**Functional principle**
- Thermowell THW

**Probe diameter**
- Probe diameter
  - 3 mm
  - 6 mm

**Material**
- Material A4 Stainless steel AISI 316L/1.4404

**Process connection**
- Process connection
  - G1/8 G1/8" male thread
  - N1/8 1/8" NPT male thread
  - G1/4 G1/4" male thread
  - N1/4 1/4" NPT male thread
  - G1/2 G1/2" male thread
  - N1/2 1/2" NPT male thread
  - TRI3/4 3/4"-Tri-Clamp
  - DN25K DN25 dairy screw connection DIN 11851

**Immersion depth**
- Probe length mm
  - L050 50 mm
  - L100 100 mm
  - L150 150 mm
  - L200 200 mm
  - L250 250 mm
  - L300 300 mm

Customized lengths on request!
CF Series

- Compression fittings for temperature probes with different process connections
- Stainless steel 1.4404 (AISI 316L)
- Pressure-resistant up to 100 bar
- Probes fixed in place with compression fitting

Compression fittings are always used when temperature probes have direct contact with a medium. A liquid and gas-tight connection is established by means of a compression fitting installed between the process and the environment.

<table>
<thead>
<tr>
<th>CF</th>
<th>M</th>
<th>3</th>
<th>G1/8</th>
<th>A4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CF</strong></td>
<td>Functional principle</td>
<td><strong>M</strong></td>
<td><strong>3</strong></td>
<td><strong>A4</strong></td>
</tr>
<tr>
<td>Threaded adapter</td>
<td>Cutting ring material</td>
<td>Material</td>
<td>Probe diameter</td>
<td></td>
</tr>
<tr>
<td>CF</td>
<td>1.4404 (AISI 316L)</td>
<td>3 mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| G1/8 | Process connection | **A4** | Material | |
|------|-------------------|-------|----------|
| G1/8 | G7/8" male thread | A4 | stainless steel AISI 316L/1.4404 |
| N1/8 | 1/8" NPT male thread |
| G1/4 | G14" male thread |
| N1/4 | 1/4"-NPT male thread |
| G1/2 | G5/8" male thread |
| N1/2 | 5/8"-NPT male thread |
Accessories

With the available product-specific accessories, the sensors can be mounted almost anywhere. We offer the right accessories for operation and installation of the temperature sensors.

This includes accessories for simple and safe mounting of temperature probes.

<table>
<thead>
<tr>
<th>TP-MZ-001</th>
<th>TP-MZ-002</th>
<th>TP-MZ-003</th>
<th>TP-MZ-004</th>
<th>TP-MZ-005</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="weld-on-plate" /></td>
<td><img src="image2" alt="wall mounting kit TP series" /></td>
<td><img src="image3" alt="barrel holder" /></td>
<td><img src="image4" alt="clamp sleeve" /></td>
<td><img src="image5" alt="wall bushing" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PTS-Cover</th>
<th>PTS-MB-34</th>
<th>PK-P-MZ-001</th>
<th>USB-2-IOL-0002</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image6" alt="PTS-Cover" /></td>
<td><img src="image7" alt="PTS-MB-34" /></td>
<td><img src="image8" alt="PK-P-MZ-001" /></td>
<td><img src="image9" alt="USB-2-IOL-0002" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Closure Cap for TS Series</th>
<th>Mounting Kit TP-103A</th>
<th>IO-Link USB Master</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image10" alt="Closure Cap for TS Series" /></td>
<td><img src="image11" alt="Mounting Kit TP-103A" /></td>
<td><img src="image12" alt="IO-Link USB Master" /></td>
</tr>
</tbody>
</table>
Fluid Sensors Portfolio
Sensors for pressure, flow, temperature, level control and capacitive position sensing

In addition to pressure sensors, Turck offers an extensive portfolio of sensors for the monitoring of flow velocity, filling level as well as temperature and capacitive position sensing.

**Flow sensors/Flow meters**

The failure of flow leads, often and inevitably, in almost all applications of production and process technology to significant impairments and outages. The monitoring of the flow plays an essential role. Turck offers different flow monitoring systems from universal to the special use.

**Temperature measurement**

In order to operate machinery and equipment efficiently and safely, temperature has to be controlled continuously as a critical size in many industrial processes. In combination with numerous connection options and variable output signals, the Turck portfolio guarantees maximum flexibility in terms of pressure measurement.

**Level control**

For level detection in liquids or solids, Turck offers special level sensors that detect levels according to the capacitive measuring principle or continuously monitor the filling level. Like all fluid sensors from Turck, the level sensors are also very robust, reliable and resistant to aggressive operating conditions.
Over 30 subsidiaries and 60 representatives worldwide!

www.turck.com