### Product overview

#### Transmitters for mounting in sensor head
- SITRANS TH100, two-wire system (Pt100)
- SITRANS TH200, two-wire system universal
- SITRANS TH300, two-wire system universal, HART
- SITRANS TH400, fieldbus transmitter

#### Transmitters for rail mounting
- SITRANS TR200, two-wire system universal
- SITRANS TR300, two-wire system universal, HART

#### Transmitter for field mounting with temperature sensor
- SITRANS TF2, Digital display thermometer
- SITRANS TF, two-wire system
- SITRANS TF, fieldbus transmitter

#### Field indicator
- SITRANS TF, Field indicator for 4 to 20 mA

You can download all instructions, catalogs and certificates for SITRANS T free of charge at the following Internet address:

[www.siemens.com/sitranst](http://www.siemens.com/sitranst)
## Overview

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<td>Zone 2, zone 1, zone 0</td>
<td>3/4</td>
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<td>Zone 2, zone 1</td>
<td>Zone 2, zone 1, zone 0</td>
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<td>Zone 2, zone 1</td>
<td>Zone 2, zone 1, zone 0</td>
<td>3/13</td>
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<tr>
<td>SITRANS TH400 &lt;br&gt;Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 0.9 V &lt;br&gt;• Fieldbus transmitter &lt;br&gt;• PROFIBUS PA &lt;br&gt;• FOUNDATION Fieldbus</td>
<td>Zone 2, zone 1, zone 21</td>
<td>Zone 2, zone 1, zone 0, zone 21, zone 20</td>
<td>3/19</td>
</tr>
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<td>Application</td>
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<td>Page</td>
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</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------------</td>
<td>------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>Transmitters for temperature for rail mounting</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| SITRANS TR200 | Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.1 V  
- Two-wire system  
- Universal | Zone 2, zone 1, zone 21 | Zone 2, zone 1, zone 0, zone 21, zone 20 | 3/24 | SIPROM T |
| SITRANS TR300 | Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.1 V  
- Two-wire system  
- Universal, HART | Zone 2, zone 1, zone 21 | Zone 2, zone 1, zone 0, zone 21, zone 20 | 3/30 | SIMATIC PDM |
| Transmitter for temperature for field mounting | | | |
| SITRANS TF2 | Digital display thermometer  
- Transmitter with LCD display and mounted Pt100 | - | - | 3/36 | Local programming using push-buttons |
| SITRANS TF | Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.1 V  
- In field housing for heavy industrial use | Zone 2, zone 1 | Zone 2, zone 1, zone 0 | 3/39 | Depends on mounted transmitter TH200/TH300 |
| SITRANS TF | Fieldbus transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 0.8 V  
- In field enclosure for heavy industrial use  
- PROFIBUS PA  
- FOUNDATION fieldbus | Zone 2, Zone 1 | Zone 2, Zone 1, Zone 0 | 3/46 | SIMATIC PDM for PROFIBUS PA |
| Field indicator for 4 to 20 mA signals | | | |
| SITRANS TF | Field indicator for 4 to 20 mA signals  
Display of units can be user-defined | Zone 2, zone 1 | - | 3/39 | - |
Overview

The SITRANS TH100 dispenses with electrical isolation and universal sensor connection to provide a low-cost alternative for Pt100 measurements.

For the parameterization, the SIPROM T software is used in combination with the modem for SITRANS TH100/TH200.

Its extremely compact design makes the SITRANS TH100 ideal for the retrofitting of measuring points or for the use of analog transmitters.

The transmitter is available as a non-Ex version as well as for use in potentially explosive atmospheres.

Benefits

- Two-wire transmitter
- Assembly in connection head type B (DIN 43729) or larger, or on a standard DIN rail
- Can be programmed, which means that the sensor connection, measuring range, etc. can also be programmed
- Intrinsically-safe version for use in potentially explosive areas

Application

Used in conjunction with Pt100 resistance thermometers, the SITRANS TH100 transmitters are ideal for measuring temperatures in all industries. Due to its compact size it can be installed in the connection head type B (DIN 43729) or larger.

The output signal is a direct current from 4 to 20 mA that is proportional to the temperature.

Parameterization is implemented over the PC using the parameterization software SIPROM T and the modem for SITRANS TH100/TH200. If you already have a "modem for SITRANS TK" (Order No. 7NG3190-6KB), you can continue using this to parameterize the SITRANS TH100.

Transmitters of the "intrinsically-safe" type of protection can be installed within potentially explosive atmospheres. The devices comply with the Directive 94/9/EC (ATEX), as well as FM and CSA regulations.

Function

Mode of operation

The measured signal supplied by a Pt100 resistance thermometer (2, 3 or 4-wire system) is amplified in the input stage. The voltage, which is proportional to the input variable, is then converted into digital signals by a multiplexer in an analog/digital converter. They are converted in the microcontroller in accordance with the sensor characteristics and further parameters (measuring range, damping, ambient temperature etc.).

The signal prepared in this way is converted in a digital/analog converter into a load-independent direct current of 4 to 20 mA.

An EMC filter protects the input and output circuits against electromagnetic interferences.
### Technical specifications

**Input**

- **Resistance thermometer**
  - **Measured variable:** Temperature
  - **Sensor type:** PT100 to IEC 60751
  - **Characteristic:** Temperature-linear
  - **Type of connection:** 2, 3 or 4-wire circuit
  - **Resolution:** 14 bit
  - **Measuring accuracy**
    - Span <250 °C (450 °F): <0.25 °C (0.45 °F)
    - Span >250 °C (450 °F): <0.1% of span
  - **Repeatability:** <0.1 °C (0.18 °F)
  - **Measuring current:** approx. 0.4 mA
  - **Measuring cycle:** <0.7 s
  - **Range:** -200 ... +850 °C (-328 ... +1562 °F)
  - **Measured span:** 25 ... 1050 °C (77 ... 1922 °F)
  - **Unit:** °C or °F
  - **Offset:** programmable:
    - -100 ... +100 °C (-180 ... +180 °F)
  - **Line resistance:** Max. 20 Ω (total from feeder and return conductor)
  - **Noise rejection:** 50 and 60 Hz

**Output**

- **Output signal:** 4 ... 20 mA, two-wire
- **Power supply:** 8.5 ... 36 V DC (30 V for Ex)
- **Max. load:** U_{aux} = 8.5 V / 0.023 A
- **Overrange:** 3.6 ... 23 mA, continuously adjustable (default value: 3.84 ... 20.5 mA)
- **Error signal (in the event of sensor breakage):** 3.6 ... 23 mA, continuously adjustable (default value: 3.6 mA or 22.8 mA)
- **Damping time:** 0 ... 30 s (default value: 0 s)
- **Protection:** Against reversed polarity
- **Resolution:** 12 bit
- **Accuracy at 23 °C (73.4 °F):** <0.1% of span
- **Temperature effect:** <0.1%/10 °C (0.1%/18 °F)
- **Effect of auxiliary power:** <0.01% of span/V
- **Effect of load impedance:** <0.025% of max. span/100
- **Long-term drift**
  - in the first month: <0.025% of max. span
  - after one year: <0.035% of max. span
  - after 5 years: <0.05% of max. span

**Ambient temperature**

- **Ambient temperature range:** -40 ... +85 °C (-40 ... +185 °F)
- **Storage temperature range:** -40 ... +85 °C (-40 ... +185 °F)
- **Relative humidity:** 98%, with condensation
- **Electromagnetic compatibility:** According to EN 61326 and NAMUR NE21

**Design**

- **Approx. weight:** 50 g
- **Dimensions:** See dimension drawing
- **Material:** Molded plastic
- **Cross-section of cables:** Max. 2.5 mm² (AWG 13)
- **Degree of protection to EN 60529**
  - **Enclosure:** IP40
  - **Terminals:** IP00

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**Certificate and approvals**

- **Explosion protection ATEX**
  - PTB 05 ATEX 2049X
  - II 1G Ex ia IIC T6/T4
  - II 2G Ex ia IIC T6/T4
  - III 2G Ex nAL IIC T6/T4
  - 3.6 ... 23 mA, continuously adjustable (default value: 3.84 ... 20.5 mA)
  - "Operating equipment that is non-ignitable and has limited energy" type of protection

**Software requirements for SIPROM T**

- **PC operating system:** Windows ME, 2000 and XP, also Windows 95, 98 and 98SE, but only in connection with RS-232 modem.

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**Selection and Ordering data**

<table>
<thead>
<tr>
<th>Order-No.</th>
<th>SITRANS TH100 temperature transmitters for Pt100</th>
</tr>
</thead>
<tbody>
<tr>
<td>7NG3211-0NN00</td>
<td>Without explosion protection</td>
</tr>
<tr>
<td>7NG3211-0AN00</td>
<td>With explosion protection, &quot;Intrinsic safety&quot; and for zone 2</td>
</tr>
<tr>
<td>7NG3211-0BN00</td>
<td>&quot;Operating equipment that is non-ignitable and has limited energy&quot; type of protection</td>
</tr>
</tbody>
</table>

**Further designs**

- Please add "-Z" to Order No. and specify Order code(s)
- **Customer-defined operating data**
- **Test protocol (5 measuring points)**

**Accessories**

- **Order-No.**
  - 7NG3092-8KU: With USB connection
  - 7NG3092-8KM: With RS 232 connection
  - A5E00364512: With documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software
  - 7NG3092-8KA: DIN rail adapters for head transmitters (Quantity delivered: 5 units)

**Modem for SITRANS TH100 and TH200 incl.**

- **SIPROM T parameterization software**
  - with USB connection
  - with RS 232 connection

**CD for measuring instruments for temperature (Quantity delivered: 5 units)**

- Available ex stock.

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1) Y01: Please specify all data that does not correspond to factory settings (see below).

C) Subject to export regulations AL: N, ECCN: EAR99.

G) Subject to export regulations AL: N, ECCN: 5D992B1.

**Power supply units** see "SITRANS I supply units and input isolators".

**Factory setting**

- **Pt100 (IEC 751) with three-wire circuit**
- **Measuring range:** 0 ... 100 °C (32 ... 212 °F)
- **Error signal in the event of sensor breakage:** 22.8 mA
- **Sensor offset:** 0 °C (0 °F)
- **Damping:** 0.0 s
SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

**SITRANS TH100**

two-wire system (Pt100)

### Dimensional drawings

![Dimensional drawing of SITRANS TH100](image)

- Internal diameter: 44 (1.73) mm
- Center hole: 6.3 (0.25) mm
- Mounting screw: M4x25

**SITRANS TH100, dimensions in mm (inch)**

### Schematics

![Schematics of SITRANS TH100](image)

- **Two-wire system**  
  (parameterizable line resistance)

- **Three-wire system**  
  (auxiliary power supply $U_{aux}$, output current $I_{out}$)

- **Four-wire system**  
  (Pt100 sensor for connection, see sensor connection assignment)

**SITRANS TH100, sensor connection assignment**

### Mounting on DIN rail

![Mounting of SITRANS TH100 on DIN rail](image)

**DIN rail adaptor, dimensions in mm (inch)**

- 14 (0.55) mm
- 50.5 (1.99) mm
- 33 (1.30) mm
- 89.6 (3.5) mm
Overview

Ultra flexible - with the universal SITRANS TH200 transmitter
- Two-wire devices for 4 to 20 mA
- Mounting in the connection head of the temperature sensor
- Universal input for virtually any type of temperature sensor
- Configurable over PC

Benefits
- Compact design
- Flexible mounting and center hole allow you to select your preferred type of installation
- Electrically isolated
- Test sockets for multimeters
- Diagnostics LED (green/red)
- Sensor monitoring open circuits and short-circuits
- Self-monitoring

Application
SITRANS TH200 transmitters can be used in all industrial sectors. Due to their compact size they can be installed in the connection head type B (DIN 43729) or larger. The following sensors/signal sources can be connected over their universal input module:
- Resistance thermometers (two, three or four-wire system)
- Thermocouple elements
- Resistance-based sensors and DC voltage sources
The output signal is a direct current from 4 to 20 mA in accordance with the sensor characteristic.
Transmitters of the "intrinsically-safe" type of protection can be installed within potentially explosive atmospheres. The devices comply with the Directive 94/9/EC (ATEX), as well as FM and CSA regulations.

Function
The SITRANS TH200 is configured over a PC. A USB or RS 232 modem is linked to the output terminals for this purpose. The configuration data can now be edited using the SIPROM T software tool. The configuration data are then permanently stored in the non-volatile memory (EEPROM).
Once the sensors and power supply have been correctly connected, the transmitter outputs a temperature-linear output signal and the diagnostics LED displays a green light. In the case of a sensor short-circuit, the LED flashes red, an internal device fault is indicated by a steady red light.
The test socket can be used to connect an ammeter at any time for monitoring purposes and plausibility checks. The output current can be read without any interruption, or even without opening the current loop.

SITRANS TH200/TH300 function diagram
## Technical specifications

### Input

**Resistance thermometer**

<table>
<thead>
<tr>
<th>Measured variable</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor type</td>
<td></td>
</tr>
<tr>
<td>• to IEC 60751</td>
<td>Pt25 to Pt1000</td>
</tr>
<tr>
<td>• to JIS C 1604; a = 0.00399 K⁻¹</td>
<td>Pt25 to Pt1000</td>
</tr>
<tr>
<td>• to IEC 60751</td>
<td>Ni25 to Ni1000</td>
</tr>
<tr>
<td>• Special type</td>
<td>over special characteristic (max. 30 points)</td>
</tr>
<tr>
<td>Sensor factor</td>
<td>0.25 ... 10 (adaptation of the basic type, e.g. Pt100 to version Pt25 ... Pt1000)</td>
</tr>
<tr>
<td>Units</td>
<td>°C or °F</td>
</tr>
</tbody>
</table>

### Connection

<table>
<thead>
<tr>
<th>Standard connection</th>
<th>1 resistance thermometer (RTD) in 2-wire, 3-wire or 4-wire system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation of average value</td>
<td>2 identical resistance thermometers in 2-wire system for generation of average temperature</td>
</tr>
<tr>
<td>Generation of difference</td>
<td>2 identical resistance thermometers (RTD) in 2-wire system (RTD 1 – RTD 2 or RTD 2 – RTD 1)</td>
</tr>
</tbody>
</table>

### Interface

<table>
<thead>
<tr>
<th>Two-wire system</th>
<th>Parameterizable line resistance ≤ 100 Ω (loop resistance)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three-wire system</td>
<td>No balancing required</td>
</tr>
<tr>
<td>Four-wire system</td>
<td>No balancing required</td>
</tr>
<tr>
<td>Sensor current</td>
<td>≤ 0.45 mA</td>
</tr>
<tr>
<td>Response time</td>
<td>≤ 250 ms for 1 sensor with open-circuit monitoring</td>
</tr>
<tr>
<td>Open-circuit monitoring</td>
<td>can be switched off</td>
</tr>
<tr>
<td>Short-circuit monitoring</td>
<td>can be switched off (value is adjustable)</td>
</tr>
</tbody>
</table>

### Measuring range

| Parameterizable (see table "Digital measuring errors") |

### Min. measured span

| 10 °C (18 °F) |

### Characteristic curve

Temperature-linear or special characteristic

### Resistance-based sensors

**Measured variable**

<table>
<thead>
<tr>
<th>Actual resistance</th>
</tr>
</thead>
</table>

**Sensor type**

<table>
<thead>
<tr>
<th>Resistance-based, potentiometers</th>
</tr>
</thead>
</table>

**Units**

| Ω |

### Connection

<table>
<thead>
<tr>
<th>Standard connection</th>
<th>1 thermocouple element (TC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation of average value</td>
<td>2 thermocouple elements (TC)</td>
</tr>
<tr>
<td>Generation of difference</td>
<td>2 thermocouple elements (TC)</td>
</tr>
</tbody>
</table>

### Response time

<table>
<thead>
<tr>
<th>≤ 250 ms for 1 sensor with open-circuit monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open-circuit monitoring</td>
</tr>
</tbody>
</table>

### Cold junction compensation

<table>
<thead>
<tr>
<th>With integrated Pt100 resistance thermometer</th>
</tr>
</thead>
</table>

### Measuring range

| Parameterizable (see table "Digital measuring errors") |

### Min. measured span

| Min. 50 ... 100 °C (90 ... 180 °F) |

### Characteristic curve

Temperature-linear or special characteristic

### mV sensor

**Measured variable**

| DC voltage |
| DC voltage source (DC voltage source possible over an externally connected resistor) |

**Sensor type**

| mV |

**Units**

<table>
<thead>
<tr>
<th>≤ 250 ms for 1 sensor with open-circuit monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open-circuit monitoring</td>
</tr>
<tr>
<td>Short-circuit monitoring</td>
</tr>
</tbody>
</table>
SITRANS T measuring instruments for temperature
Transmitters for mounting in sensor head

SITRANS TH200
Two-wire system, universal

Certificates and approvals

- Explosion protection ATEX
  - EC type test certificate: PTB 05 ATEX 2040X
  - "Intrinsic safety" type of protection
    - II 1 G Ex ia IIC T6/T4
    - II 2 (1) G Ex ib/ia IIC T6/T4
  - "Operating equipment that is non-ignitable and has limited energy" type of protection
    - II 3 G Ex nL IIC T6/T4
    - II 3 G Ex nA IIC T6/T4

- Explosion protection to FM for USA
  - FM approval: FM 3024169
  - Degree of protection
    - IS/Cl I, II, III/Div 1/ GP ABCDEFG T6, T5, T4
    - IS/Cl I/ZN 0/AEx ia IIC T6, T5, T4
    - NI/Cl I, II, III/Div 2/ GP ABCD T6, T5, T4
    - NI/Cl I/ZN 2/IIC T6, T5, T4

Software requirements for SIPROM T

- PC operating system: Windows ME, 2000 and XP; also Windows 95, 98 and 98 SE, but only in connection with RS 232 modem.

Factory setting:
- Pt100 (IEC 751) with three-wire circuit
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping: 0.0 s

Digital measuring errors

Resistance thermometer

<table>
<thead>
<tr>
<th>Input</th>
<th>Measuring range</th>
<th>Min. measured span</th>
<th>Digital accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>°C (°F)</td>
<td>°C (°F)</td>
<td>°C (°F)</td>
<td>°C (°F)</td>
</tr>
<tr>
<td>to IEC 60751</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pt25</td>
<td>-200 ... +850</td>
<td>-328 ... +1562</td>
<td>10 (18)</td>
</tr>
<tr>
<td>Pt50</td>
<td>-200 ... +850</td>
<td>-328 ... +1562</td>
<td>10 (18)</td>
</tr>
<tr>
<td>Pt100 ... Pt200</td>
<td>-200 ... +850</td>
<td>-328 ... +1562</td>
<td>10 (18)</td>
</tr>
<tr>
<td>Pt500</td>
<td>-200 ... +850</td>
<td>-328 ... +1562</td>
<td>10 (18)</td>
</tr>
<tr>
<td>Pt1000</td>
<td>-200 ... +350</td>
<td>-328 ... +662</td>
<td>10 (18)</td>
</tr>
<tr>
<td>to JIS C1604-81</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pt25</td>
<td>-200 ... +649</td>
<td>-328 ... +1200</td>
<td>10 (18)</td>
</tr>
<tr>
<td>Pt50</td>
<td>-200 ... +649</td>
<td>-328 ... +1200</td>
<td>10 (18)</td>
</tr>
<tr>
<td>Pt100 ... Pt200</td>
<td>-200 ... +649</td>
<td>-328 ... +1200</td>
<td>10 (18)</td>
</tr>
<tr>
<td>Pt500</td>
<td>-200 ... +649</td>
<td>-328 ... +1200</td>
<td>10 (18)</td>
</tr>
<tr>
<td>Pt1000</td>
<td>-200 ... +350</td>
<td>-328 ... +662</td>
<td>10 (18)</td>
</tr>
<tr>
<td>Ni 25 to Ni1000</td>
<td>-60 ... +250</td>
<td>-76 ... +482</td>
<td>10 (18)</td>
</tr>
</tbody>
</table>

Design

- Material: Molded plastic
- Weight: 50 g (0.11 lb)
- Dimensions: See "Dimensional drawings"
- Cross-section of cables: Max. 2.5 mm² (AWG 13)
- Degree of protection to IEC 60529
  - Enclosure: IP40
  - Terminals: IP00
SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

SITRANS TH200
two-wire system, universal

Resistance-based sensors

<table>
<thead>
<tr>
<th>Input</th>
<th>Measuring range</th>
<th>Min. measured span</th>
<th>Digital accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance</td>
<td>0 ... 390</td>
<td>5</td>
<td>0.05</td>
</tr>
<tr>
<td>Resistance</td>
<td>0 ... 2200</td>
<td>25</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Thermocouple elements

<table>
<thead>
<tr>
<th>Input</th>
<th>Measuring range</th>
<th>Min. measured span</th>
<th>Digital accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>°C</td>
<td>°C (°F)</td>
<td>°C (°F)</td>
<td>°C (°F)</td>
</tr>
<tr>
<td>Type B</td>
<td>0 ... 1820</td>
<td>100 (180)</td>
<td>2 (3.60)</td>
</tr>
<tr>
<td>Type C (W5)</td>
<td>0 ... 2300</td>
<td>100 (180)</td>
<td>2 (3.60)</td>
</tr>
<tr>
<td>Type D (W3)</td>
<td>0 ... 2300</td>
<td>100 (180)</td>
<td>1 (1.80)</td>
</tr>
<tr>
<td>Type E</td>
<td>-200 ... +1000</td>
<td>50 (90)</td>
<td>1 (1.80)</td>
</tr>
<tr>
<td>Type J</td>
<td>-210 ... +1200</td>
<td>50 (90)</td>
<td>1 (1.80)</td>
</tr>
<tr>
<td>Type K</td>
<td>-230 ... +1370</td>
<td>50 (90)</td>
<td>1 (1.80)</td>
</tr>
<tr>
<td>Type L</td>
<td>-200 ... +900</td>
<td>50 (90)</td>
<td>1 (1.80)</td>
</tr>
<tr>
<td>Type N</td>
<td>-200 ... +1300</td>
<td>50 (90)</td>
<td>1 (1.80)</td>
</tr>
<tr>
<td>Type R</td>
<td>-50 ... +1760</td>
<td>100 (180)</td>
<td>2 (3.60)</td>
</tr>
<tr>
<td>Type S</td>
<td>-50 ... +1760</td>
<td>100 (180)</td>
<td>2 (3.60)</td>
</tr>
<tr>
<td>Type T</td>
<td>-200 ... +400</td>
<td>40 (72)</td>
<td>1 (1.80)</td>
</tr>
<tr>
<td>Type U</td>
<td>-200 ... +600</td>
<td>50 (90)</td>
<td>2 (3.60)</td>
</tr>
</tbody>
</table>

The digital accuracy is the accuracy after the analog/digital conversion including linearization and calculation of the measured value.

An additional error is generated in the output current 4 to 20 mA as a result of the digital/analog conversion of 0.1% of the set span (digital-analog error).

The total error under reference conditions at the analog output is the sum from the digital error and the digital-analog error (poss. with the addition of cold junction errors in the case of thermocouple measurements).

mV sensor

<table>
<thead>
<tr>
<th>Input</th>
<th>Measuring range</th>
<th>Min. measured span</th>
<th>Digital accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>mV sensor</td>
<td>-10 ... +70</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>mV sensor</td>
<td>-100 ... +1100</td>
<td>20</td>
<td>400</td>
</tr>
</tbody>
</table>

The digital accuracy is the accuracy after the analog/digital conversion including linearization and calculation of the measured value.

Further designs

Temperature transmitter SITRANS TH200
for installation in the connection head type B (DIN 43729)
2-wire connection 4 ... 20 mA, programmable, with electrical isolation
- Without explosion protection
- With explosion protection
  - acc. to ATEX
  - acc. to FM (cFMUS)

Selection and Ordering Data

<table>
<thead>
<tr>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>7NG3211-1NN00</td>
</tr>
<tr>
<td>7NG3211-1AN00</td>
</tr>
<tr>
<td>7NG3211-1BN00</td>
</tr>
</tbody>
</table>

Order code

Customer-specific setting of operating data (specify operating data in plain text)

Y01

Further designs

Please add “-Z” to Order No. and specify Order code(s)

Accessories

Modem for SITRANS TH100, TH200 and TR200 incl.
SIPROM T parameterization software
- With USB connection
- With RS 232 connection

CD for measuring instruments for temperature
with documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software

DIN rail adapters for head transmitters
(Quantity delivered: 5 units)

Available ex stock.

1) Y01: Please specify all data that does not correspond to factory settings (see below).

C) Subject to export regulations AL: N, ECCN: EAR99.
G) Subject to export regulations AL: N, ECCN: 5D992B1.
Power supply units see “SITRANS I supply units and isolation amplifiers”.

Factory setting:
- Pt100 (IEC 751) with three-wire circuit
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

Available ex stock.

1) Y01: Please specify all data that does not correspond to factory settings (see below).
Dimensional drawings

**Mounting on DIN rail**

SITRANS TH200, mounting of transmitter on DIN rail

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Ø 44</td>
<td>(1.73)</td>
</tr>
<tr>
<td>(2) 33</td>
<td>(1.30)</td>
</tr>
<tr>
<td>(3) 26.3</td>
<td>(1.04)</td>
</tr>
</tbody>
</table>

1(+), 2(-) Auxiliary power supply $U_{aux}$, output current $I_{out}$
3, 4, 5 and 6 Pt100 sensor (for connections, see Sensor connection assignment)
Test (+), Test (-) Measurement of the output current with a multimeter
(1) Test terminal
(2) Mounting screw M4x30
(3) LED for operation indication
(4) Internal diameter of center hole 6.3 (0.25)

SITRANS TH200, dimensions and pin assignment, dimensions in mm (inch)
SITRANS T measuring instruments for temperature
Transmitters for mounting in sensor head

SITRANS TH200
two-wire system, universal

Schematics

Resistance thermometer

Resistance

Thermocouple

Resistance thermometer

Resistance

Thermocouple

<table>
<thead>
<tr>
<th>Two-wire system</th>
<th>Two-wire system</th>
<th>Cold junction compensation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three-wire system</td>
<td>Three-wire system</td>
<td>Internal/fixed value</td>
</tr>
<tr>
<td>Four-wire system</td>
<td>Four-wire system</td>
<td>Cold junction compensation with external Pt100 in two-wire system</td>
</tr>
<tr>
<td>Generation of average value / difference</td>
<td>Generation of average value / difference</td>
<td></td>
</tr>
<tr>
<td>Generation of average value / difference with internal cold junction compensation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Programmable line resistance for the purpose of correction.

Voltage measurement

Current measurement

Connection of auxiliary power supply (U_{aux})

SITRANS TH200, sensor connection assignment
Overview

"HART" to beat - the universal SITRANS TH300 transmitter
- Two-wire devices for 4 to 20 mA, HART
- Mounting in the connection head of the temperature sensor
- Universal input for virtually any type of temperature sensor
- Configurable over HART

Benefits
- Compact design
- Flexible mounting and center hole allow you to select your preferred type of installation
- Electrically isolated
- Test sockets for multimeters
- Diagnostics LED (green/red)
- Sensor monitoring open circuits and short-circuits
- Self-monitoring
- Configuration status stored in EEPROM

Application
SITRANS TH300 transmitters can be used in all industrial sectors. Due to their compact size they can be installed in the connection head type B (DIN 43729) or larger. The following sensors/signal sources can be connected over their universal input module:
- Resistance thermometers (two, three or four-wire system)
- Thermocouple elements
- Resistance-based sensors and DC voltage sources

The output signal is a direct current from 4 to 20 mA in accordance with the sensor characteristic, superimposed by the digital HART signal.

Transmitters of the "intrinsically-safe" type of protection can be installed within potentially explosive atmospheres. The devices comply with the Directive 94/9/EC (ATEX), as well as FM and CSA regulations.

Function
The SITRANS TH300 is configured over HART. This can be done using a handheld communicator or even more conveniently with a HART modem and the SIMATIC PDM parameterization software. The configuration data are then permanently stored in the non-volatile memory (EEPROM).

Once the sensors and power supply have been correctly connected, the transmitter outputs a temperature-linear output signal and the diagnostics LED displays a green light. In the case of a sensor short-circuit, the LED flashes red, an internal device fault is indicated by a steady red light.

The test socket can be used to connect an ammeter at any time for monitoring purposes and plausibility checks. The output current can be read without any interruption, or even without opening the current loop.
## Technical specifications

### Input

<table>
<thead>
<tr>
<th>Resistance thermometer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured variable</td>
</tr>
<tr>
<td>Sensor type</td>
</tr>
<tr>
<td>- to IEC 60751</td>
</tr>
<tr>
<td>- to JIS C 1604; a = 0.00392 K⁻¹</td>
</tr>
<tr>
<td>- to IEC 60751</td>
</tr>
<tr>
<td>- Special type</td>
</tr>
<tr>
<td>Sensor factor</td>
</tr>
<tr>
<td>Units</td>
</tr>
</tbody>
</table>

### Connection

- Standard connection: 1 resistance thermometer (RTD) in 2-wire, 3-wire or 4-wire system
- Generation of average value: 2 identical resistance thermometers in 2-wire system for generation of average temperature
- Generation of difference: 2 identical resistance thermometers (RTD) in 2-wire system (RTD 1 – RTD 2 or RTD 2 – RTD 1)

### Interface

- Two-wire system: Parameterizable line resistance ≤ 100 Ω (loop resistance)
- Three-wire system: No balancing required
- Four-wire system: No balancing required

### Resistance-based sensors

<table>
<thead>
<tr>
<th>Measured variable</th>
<th>Resistance-based, potentiometers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor type</td>
<td></td>
</tr>
<tr>
<td>Units</td>
<td>Ω</td>
</tr>
</tbody>
</table>

### Measuring range

- Parameterizable (see table "Digital measuring errors")

### Min. measured span

- 10 °C (18 °F)

### Characteristic curve

- Temperature-linear or special characteristic

### Open-circuit monitoring

- can be switched off

### Short-circuit monitoring

- can be switched off (value is adjustable)

### Thermocouples

<table>
<thead>
<tr>
<th>Measured variable</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor type (thermocouples)</td>
<td></td>
</tr>
<tr>
<td>- Type B</td>
<td>Pt30Rh-Pt6Rh to DIN IEC 584</td>
</tr>
<tr>
<td>- Type C</td>
<td>W5%-Re to ASTM 988</td>
</tr>
<tr>
<td>- Type D</td>
<td>W3%-Re to ASTM 988</td>
</tr>
<tr>
<td>- Type E</td>
<td>NiO-CuNi to DIN IEC 584</td>
</tr>
<tr>
<td>- Type F</td>
<td>Fe-CuNi to DIN IEC 584</td>
</tr>
<tr>
<td>- Type G</td>
<td>NiCr-Ni to DIN IEC 584</td>
</tr>
<tr>
<td>- Type H</td>
<td>Fe-CuNi to DIN 43710</td>
</tr>
<tr>
<td>- Type I</td>
<td>NiCrSi-NiSi to DIN IEC 584</td>
</tr>
<tr>
<td>- Type J</td>
<td>Pt13Rh-Pt to DIN IEC 584</td>
</tr>
<tr>
<td>- Type K</td>
<td>Pt10Rh-Pt to DIN IEC 584</td>
</tr>
<tr>
<td>- Type L</td>
<td>Cu-CuNi to DIN IEC 584</td>
</tr>
<tr>
<td>- Type M</td>
<td>Cu-CuNi to DIN 43710</td>
</tr>
</tbody>
</table>

### Connection

- Standard connection: 1 thermocouple (TC)
- Generation of average value: 2 thermocouples (TC)
- Generation of difference: 2 thermocouples (TC) TC1 – TC2 or TC2 – TC1

### Response time

- ≤ 250 ms for 1 sensor with open-circuit monitoring

### Cold junction compensation

- Internal: With integrated Pt100 resistance thermometer
- External: With external Pt100 IEC 60571 (2-wire or 3-wire connection)

### Measuring range

- Parameterizable (see table "Digital measuring errors")

### Min. measured span

- Min. 50 ... 199 °C (90 ... 180 °F)

### Characteristic curve

- Temperature-linear or special characteristic

### mV sensor

<table>
<thead>
<tr>
<th>Measured variable</th>
<th>DC voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor type</td>
<td>DC voltage source (DC voltage source possible over an externally connected resistor)</td>
</tr>
</tbody>
</table>

### Units

- Response time: ≤ 250 ms for 1 sensor with open-circuit monitoring

### Open-circuit monitoring

- can be switched off

### Short-circuit monitoring

- can be switched off (value is adjustable)
### Measuring accuracy

#### Digital measuring errors

Reference conditions

- **Auxiliary power supply**: 24 V ± 1%
- **Load**: 500 Ω
- **Storage temperature**: 23 °C
- **Warming-up time**: > 5 min

**Error in the analog output (digital/analog converter)**: < 0.1% of span

**Error due to internal cold junction**: < 0.5 °C (0.9 °F)

**Temperature effect**: < 0.1% of max. span/10 °C (18 °F)

**Power supply effect**: < 0.005% of span/V

**Effect of load impedance**: < 0.012% of span/100 Ω

**Long-term drift**

- **in the first month**: < 0.02% of max. span
- **after one year**: < 0.03% of max. span
- **after 5 years**: < 0.04% of max. span

### Rated conditions

#### Ambient temperature

- **Ambient temperature range**: -40 ... +85 °C (-40 ... 185 °F)
- **Storage temperature range**: -40 ... +85 °C (-40 ... 185 °F)
- **Relative humidity**: < 98% with condensation

#### Electromagnetic compatibility

- acc. to EN 61326 and NE21

### Construction

- **Material**: Molded plastic
- **Weight**: 50 g (0.11 lb)
- **Dimensions**: See "Dimensional drawings"
- **Cross-section of cables**: Max. 2.5 mm² (AWG 13)
- **Degree of protection to IEC 60529**
  - **Enclosure**: IP40
  - **Terminals**: IP00

### Cross-section of cables

- Ni 25 to Ni1000: -60 ... +250 (-76 ... +482)
SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

SITRANS TH300
two-wire system, universal, HART

Resistance-based sensors

<table>
<thead>
<tr>
<th>Input</th>
<th>Measuring range</th>
<th>Min. measured span</th>
<th>Digital accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance</td>
<td>0 ... 390</td>
<td>5</td>
<td>0.05</td>
</tr>
<tr>
<td>Resistance</td>
<td>0 ... 2200</td>
<td>25</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Thermocouple elements

<table>
<thead>
<tr>
<th>Input</th>
<th>Measuring range</th>
<th>Min. measured span</th>
<th>Digital accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type B</td>
<td>0 ... 1820</td>
<td>100 (180)</td>
<td>2 (^1) (3.60) (^1)</td>
</tr>
<tr>
<td>Type E</td>
<td>-200 ... +1000</td>
<td>50 (90)</td>
<td>1 (1.80)</td>
</tr>
<tr>
<td>Type K</td>
<td>-230 ... +1370</td>
<td>50 (90)</td>
<td>1 (1.80)</td>
</tr>
<tr>
<td>Type L</td>
<td>-200 ... +900</td>
<td>50 (90)</td>
<td>1 (1.80)</td>
</tr>
<tr>
<td>Type R</td>
<td>-50 ... +1760</td>
<td>100 (180)</td>
<td>2 (3.60)</td>
</tr>
<tr>
<td>Type S</td>
<td>-50 ... +1760</td>
<td>100 (180)</td>
<td>2 (3.60)</td>
</tr>
<tr>
<td>Type T</td>
<td>-200 ... +400</td>
<td>40 (72)</td>
<td>1 (1.80)</td>
</tr>
<tr>
<td>Type U</td>
<td>-200 ... +600</td>
<td>50 (90)</td>
<td>2 (3.60)</td>
</tr>
</tbody>
</table>

\(^1\) The digital accuracy in the range 0 to 300 °C (32 to 572 °F) is 3 °C (5.4 °F).
\(^2\) The digital accuracy in the range 1750 to 2300 °C (3182 to 4172 °F) is 2 °C (3.6 °F).

mV sensor

<table>
<thead>
<tr>
<th>Input</th>
<th>Measuring range</th>
<th>Min. measured span</th>
<th>Digital accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>mV sensor</td>
<td>-10 ... +70</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>mV sensor</td>
<td>-100 ... +1100</td>
<td>20</td>
<td>400</td>
</tr>
</tbody>
</table>

The digital accuracy is the accuracy after the analog/digital conversion including linearization and calculation of the measured value.

An additional error is generated in the output current 4 to 20 mA as a result of the digital/analog conversion of 0.1% of the set span (digital-analog error).

The total error under reference conditions at the analog output is the sum from the digital error and the digital-analog error (possible with the addition of cold junction errors in the case of thermocouple measurements).

Selection and Ordering Data

<table>
<thead>
<tr>
<th>Temperature transmitter SITRANS TH300 for installation in the connection head type B (DIN 43729) 2-wire connection 4 ... 20 mA, communication-capable acc. to HART, with electrical isolation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Without explosion protection C)</td>
</tr>
<tr>
<td>• With explosion protection C) acc. to ATEX</td>
</tr>
<tr>
<td>• acc. to FM (cFM US)</td>
</tr>
<tr>
<td>Order No.</td>
</tr>
<tr>
<td>7NG3212-0NN00</td>
</tr>
<tr>
<td>7NG3212-0AN00</td>
</tr>
<tr>
<td>7NG3212-0BN00</td>
</tr>
</tbody>
</table>

Further designs

Please add “-Z” to Order No. and specify Order code(s).

Customer-specific setting of operating data (specify operating data in plain text) with test protocol (5 measuring points)

Order code

Y01\(^1\)

C11

Accessories

CD for measuring instruments for temperature with documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software

Order No.

A5E00364512

HART modem

• With RS 232 connection

• With USB connection

SIMATIC PDM operating software

See Section 9

DIN rail adapters for head transmitters (Quantity delivered: 5 units)

Available ex stock.

\(^1\) Y01: Please specify all data that does not correspond to factory settings (see below).

Order code

7MF4997-1DA

7MF4997-1DB

7NG3092-8KA
**Dimensional drawings**

SITRANS TH300, dimensions and pin assignment, dimensions in mm (inch)

- **1(+) and 2(-)** Auxiliary power supply \( U_{\text{aux}} \), output current \( I_{\text{out}} \)
- **3, 4, 5 and 6** Pt100 sensor (for connections, see Sensor connection assignment)
- **Test (+), Test (-)** Measurement of the output current with a multimeter

1. Test terminal
2. Mounting screw M4x30
3. LED for operation indication
4. Internal diameter of center hole 6.3 (0.25)

**Mounting on DIN rail**

SITRANS TH300, mounting of transmitter on DIN rail

DIN rail adapter, dimensions in mm (inch)
SITRANS T measuring instruments for temperature
Transmitters for mounting in sensor head

SITRANS TH300
two-wire system, universal, HART

Schematics

Resistance thermometer

Resistance

Thermocouple

Two-tone system

Two-tone system

Cold junction compensation
Internal/fix value

Cold junction compensation with
external Pt100 in two-wire system

Cold junction compensation with
external Pt100 in three-wire system

Generation of average value / difference

Generation of average value / difference

Generation of average value / difference
with internal cold junction compensation

Voltage measurement

Current measurement

Connection of auxiliary power supply (Uaux)

SITRANS TH200/TH300, sensor connection assignment

1) Programmable line resistance for the purpose of correction.
### Overview

#### SITRANS TH400 fieldbus transmitters

**Versions:**
- for FOUNDATION Fieldbus and
- for PROFIBUS PA

The SITRANS TH400 temperature transmitter is a small field bus transmitter for mounting in the connection head of form B. Extensive functionality enables the temperature transmitter to be precisely adapted to the plant’s requirements. Operation is very simple in spite of the numerous setting options. Thanks to its universal concept it can be used in all industries and is easy to integrate in Totally Integrated Automation applications.

Transmitters of the "intrinsically-safe" type of protection can be installed within potentially explosive atmospheres. The devices comply with the Directive 94/9/EC (ATEX), as well as FM and CSA regulations.

Installing SITRANS TH400 in temperature sensors turns them into complete, bus-capable measuring points; compact - and in a single device.

### Application

- Linearized temperature measurement with resistance thermometers or thermocouple elements
- Differential, mean-value or redundant temperature measurement with resistance thermometers or thermocouple elements
- Linear resistance and bipolar millivolt measurements
- Differential, mean-value or redundant resistance and bipolar millivolt measurements

### Function

**Features**
- Mounting in connection head, type B, to DIN 43729, or larger
- Polarity-neutral bus connection
- 24-bit analog-digital converter for high resolution
- Electrically isolated
- Intrinsically-safe version for use in potentially explosive areas
- Special characteristic
- Sensor redundancy

- Transmitter with PROFIBUS PA communication
  - Function blocks: 2 x analog
- Transmitter with FOUNDATION Fieldbus communication
  - Function blocks: 2 x analog and 1 x PID
  - Functionality: Basic or LAS

**Mode of operation**

The following function plan explains the mode of operation of the transmitter.

The only difference between the two versions of the SITRANS TH400 (7NG3214-... and 7NG3215-...) is the type of fieldbus protocol used (PROFIBUS PA or FOUNDATION fieldbus).

![SITRANS TH400 function diagram](image-url)
**SITRANS T measuring instruments for temperature**

**Transmitters for mounting in sensor head**

**SITRANS TH400**
fieldbus transmitter

### System communication

**SITRANS TH400, communication interface**

### Technical specifications

**Input**
- Analog-to-digital conversion
  - Measurement rate: < 50 ms
  - Resolution: 24 Bit

**Resistance thermometer**
- Pt25 ... Pt1000 to IEC 60751/JIS C 1604
  - Measuring range: -200 ... +850 °C (-328 ... +1562 °F)
- Ni25 ... Ni1000 to DIN 43760
  - Measuring range: -60 ... +250 °C (-76 ... +482 °F)
- Cu10 ... Cu1000, α = 0.00427
  - Measuring range: -50 ... +200 °C (-58 ... +392 °F)

**Line resistance per sensor cable**
- Max. 50 Ω
  - Sensor current: Nominal 0.2 mA

**Sensor fault detection**
- Sensor break detection: Yes
- Sensor short-circuit detection: Yes, < 15 Ω

**Resistance-based sensors**
- Measuring range: 0 Ω ... 10 kΩ
  - Line resistance per sensor cable: Max. 50 Ω
  - Sensor current: Nominal 0.2 mA

**Sensor fault detection**
- Sensor break detection: Yes
- Sensor short-circuit detection: Yes, < 15 Ω

### Thermocouple

- Measuring range
  - Type B: 400 ... 1820 °C (752 ... 3308 °F)
  - Type E: -100 ... +1000 °C (-148 ... 1832 °F)
  - Type J: -100 ... +1000 °C (-148 ... 1832 °F)
  - Type K: -100 ... +1200 °C (-148 ... +2192 °F)
  - Type N: -180 ... +1300 °C (-292 ... 2372 °F)
  - Type R: -50 ... +1760 °C (-58 ... +3200 °F)
  - Type S: -50 ... +1760 °C (-58 ... +3200 °F)
  - Type T: -200 ... +400 °C (-328 ... +752 °F)

- to DIN 43710
  - Type L: -200 ... +900 °C (-328 ... +1652 °F)
  - Type U: -200 ... +600 °C (-328 ... +1112 °F)

- to ASTM E988-90
  - Type W3: 0 ... 2300 °C (32 ... 4172 °F)
  - Type W5: 0 ... 2300 °C (32 ... 4172 °F)

**External cold junction compensation**
- -40 ... +135 °C (-40 ... +275 °F)

**Sensor fault detection**
- Sensor break detection: Yes
- Sensor short-circuit detection: Yes, < 3 mV
- Sensor current in the event of open-circuit monitoring: 4 μA

**mV sensor - voltage input**
- Measuring range: -800 ... +800 mV
- Input resistance: 10 MΩ

### Output

- Filter time (programmable): 0 ... 60 s
- Update time: < 400 ms

### Measuring accuracy

Accuracy is defined as the higher value of general values and basic values.

**General values**
- Type of input: Absolute accuracy
  - Temperature coefficient

**Basic values**
- Type of input: Basic accuracy
  - Temperature coefficient

### Reference conditions

- **Warming-up time**: 30 s
- **Signal-to-noise ratio**: Min. 60 dB
- **Calibration condition**: 20 ... 28 °C (68 ... 82 °F)
SITRANS T measuring instruments for temperature
Transmitters for mounting in sensor head

SITRANS TH400 fieldbus transmitter

Rated conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>Permissible ambient temperature</td>
</tr>
<tr>
<td></td>
<td>-40 ... +85 °C (-40 ... +185 °F)</td>
</tr>
<tr>
<td>Permissible storage temperature</td>
<td>-40 ... +85 °C (-40 ... +185 °F)</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>≤ 98%, with condensation</td>
</tr>
</tbody>
</table>

Electrical testing

-• without Ex                  Input against output 1 kV eff
-• with Ex                     Input against output 500 V eff

Mechanical testing

-• Vibrations (DIN class B) to IEC 60068-2-6 and IEC 60068-2-64
  4 g/2 ... 100 Hz

Electromagnetic compatibility

-• EMC noise voltage influence < ±0,1% of span
-• Extended EMC noise immunity: NAMUR NE 21, criterion A, Burst
  ≤ ±1% of span
-• EN 61326

Design

| Material                  | Molded plastic                        |
|                         | Weight                                 | 55 g (0.12 lb)           |
| Dimensions              | Cross-section of cables                | Max. 2.5 mm² (AWG 13)    |
| Degree of protection    | • Transmitter enclosure                  | IP 40                  |
|                         | • Terminal                              | IP 00                  |

Auxiliary power supply

| Power supply            | DC 9.0 ... 32 V                           |
|                         | DC 9.0 ... 30 V                           |
|                         | DC 9.0 ... 17.5 V                         |
| Max. increase in power consumption in the event of a fault | < 11 mA                                      |
|                          | < 7 mA                                    |

Certificate and approvals

Explosion protection ATEX

-• EC type test certificate KEMA 06 ATEX 0264 X
  II 1 GD Ex ia IIC T4 ... T6
  T65 °C ... T105 °C
  II 2(1) GD Ex ib [ia] IIC T4 ... T6
  T65 °C ... T105 °C

Explosion protection FM for USA

-• FM approval
-• Degree of protection
  • IS/Cl I/Div 1/Groups ABCD T4, T5, T6, FISCO
  • IS/Cl I/ZN 0/Ex ia, IIC T4, T5, T6, FISCO
  • NI/Cl I/Div 2/Groups ABCD T4, T5, T6, FNICO

Explosion protection CSA for Canada

-• CSA approval CSA 186385
-• Degree of protection
  • IS/Cl I/Groups ABCD T4, T5, T6
  • Ex ia IIC T4/T5/T6
  • Ex ib [ia] IIC T4/T5/T6
  • CI I/Div 2/Groups ABCD T4, T5, T6
  • Ex nA IIC T4/T5/T6
  • CI I/ZN 2/ AEx nA II T4, T5, T6

Communication

Parameterization interface

-• Standard, Ex nA, Ex nL and NI
-• ATEX, FM, UL and CSA
-• In FISCO/FNICO installation

Power consumption < 11 mA
Max. increase in power consumption in the event of a fault < 7 mA

Factory setting for SITRANS TH400 PA and SITRANS TH400 FF

| Sensor                  | Pth100 (IEC) |
| Type of connection      | Three-wire system |
| Unit                    | °C |
| Failure mode            | Last valid value |
| Filter time             | 0 s |

| Only for SITRANS TH400 PA | PA address 126 |
|                          | PROFIBUS Ident No. Manufacturer-specific |

| Only for SITRANS TH400 FF | Node address 22 |
**Selection and Ordering data**

<table>
<thead>
<tr>
<th>Temperature transmitter</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SITRANS TH400 for installation in the sensor head, with electrical isolation, order instruction manual separately.</td>
<td></td>
</tr>
<tr>
<td>• Bus-capable to PROFIBUS PA</td>
<td></td>
</tr>
<tr>
<td>- without explosion protection or EEx n or NI</td>
<td>7NG3214-0NN00</td>
</tr>
<tr>
<td>- with explosion protection „intrinsic safety to ATEX/FM/CSA“</td>
<td>7NG3214-0AN00</td>
</tr>
<tr>
<td>• Bus-capable to FOUNDATION Fieldbus</td>
<td></td>
</tr>
<tr>
<td>- without explosion protection or EEx n or NI</td>
<td>7NG3215-0NN00</td>
</tr>
<tr>
<td>- with explosion protection „intrinsic safety to ATEX/FM/CSA“</td>
<td>7NG3215-0AN00</td>
</tr>
</tbody>
</table>

**Further designs**

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

- Customer-specific setting of operating data (specify in plain text) Y01
- With test protocol (5 measuring points) C11

**Accessories**

<table>
<thead>
<tr>
<th>CD for measuring instruments for temperature</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>with documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software</td>
<td>A5E0364512</td>
</tr>
</tbody>
</table>

**SIMATIC PDM operating software**

see chapter 9

**DIN rail adapters for head transmitters**

(Quantity delivered: 5 units)

- 7NG3092-8KA

For additional PA components see catalog IK PI

1) Y01: Please specify all data that does not correspond to factory settings (see below).
2) Can only be ordered together with Y01 (it is essential to specify the measuring range).

G) Subject to export regulations AL: N, ECCN: 5D992B1.

**Factory setting:**

- for SITRANS TH400 PA:
  - Pt100 (IEC 751) with three-wire circuit
  - Unit: °C
  - Failure mode: Last valid value
  - Filter time: 0 s
  - PA address: 126
  - PROFIBUS Ident No.: Manufacturer-specific

- for SITRANS TH400 FF:
  - Pt100 (IEC 751) with three-wire circuit
  - Unit: °C
  - Failure mode: Last valid value
  - Filter time: 0 s
  - Node address: 22
SITRANS T measuring instruments for temperature
Transmitters for mounting in sensor head

SITRANS TH400
fieldbus transmitter

Schematics

**Resistance thermometer**
- Two-wire system
- Three-wire system
- Four-wire system
- Mean-value/differential or redundancy generation
  - 2 x two-wire system
- Mean-value/differential or redundancy generation
  - 1 sensor in two-wire system
  - 1 sensor in three-wire system

**Thermocouple**
- Internal cold junction compensation
- Cold junction compensation with external Pt100 in two-wire system
- Cold junction compensation with external Pt100 in three-wire system
- Mean value, differential or redundancy generation with internal cold junction compensation

**Resistance**
- Two-wire system
- Three-wire system
- Four-wire system
- Mean value, differential or redundancy generation
  - 1 resistor in two-wire system
  - 1 resistor in three-wire system

**Voltage measurement**
- One voltage source
- Measurement of mean value, differential and redundancy with 2 voltage sources

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SITRANS TH400, sensor connection assignment

---

*Programmable line resistance for the purpose of correction.*
SITRANS T measuring instruments for temperature

Transmitters for rail mounting

SITRANS TR200
two-wire system, universal

Overview

Ultra flexible - with the universal SITRANS TR200 transmitter
- Two-wire devices for 4 to 20 mA
- Enclosure for rail mounting
- Universal input for virtually any type of temperature sensor
- Configurable over PC

Benefits
- Compact design
- Electrically isolated
- Test sockets for multimeters
- Diagnostics LED (green/red)
- Sensor monitoring open circuits and short-circuits
- Self-monitoring
- Configuration status stored in EEPROM
- Expanded diagnostic functions, such as slave pointer, operating hours counter, etc.
- Special characteristic
- Electromagnetic compatibility to EN 61326 and NE21

Application

SITRANS TR200 transmitters can be used in all industrial sectors. Their compact design enables simple mounting on standard DIN rails on-site in protective boxes or in control cabinets. The following sensors/signal sources can be connected over their universal input module:
- Resistance thermometers (two, three or four-wire system)
- Thermocouple elements
- Resistance-based sensors and DC voltage sources

The output signal is a direct current from 4 to 20 mA in accordance with the sensor characteristic.

Transmitters of the "intrinsically-safe" type of protection can be installed within potentially explosive atmospheres. The devices comply with the Directive 94/9/EC (ATEX).

Function

The SITRANS TR200 is configured over a PC. A USB or RS 232 modem is linked to the output terminals for this purpose. The configuration data can now be edited using the SIPROM T software tool. The configuration data are then permanently stored in the non-volatile memory (EEPROM).

Once the sensors and power supply have been correctly connected, the transmitter outputs a temperature-linear output signal and the diagnostics LED displays a green light. In the case of a sensor short-circuit, the LED flashes red, an internal device fault is indicated by a steady red light.

The test socket can be used to connect an ammeter at any time for monitoring purposes and plausibility checks. The output current can be read without any interruption, or even without opening the current loop.
Technical specifications

Input

Resistance thermometer

- Measured variable: Temperature
- Sensor type:
  - to IEC 60751: Pt25 to Pt1000
  - to JIS C 1604: a = 0.00392 K⁻¹, Pt25 to Pt1000
  - to IEC 60751: Ni25 to Ni1000
  - Special type: Over special characteristic (max. 30 points)
- Sensor factor: 0.25 ... 10 (adaptation of the basic type, e.g. Pt100 to version Pt25 ... Pt1000)
- Units: °C or °F

Connection

- Standard connection: 1 resistance thermometer (RTD) in 2-wire, 3-wire or 4-wire system
- Generation of average value: 2 identical resistance thermometers in 2-wire system for generation of average temperature
- Generation of difference: 2 identical resistance thermometers (RTD) in 2-wire system (RTD 1 – RTD 2 or RTD 2 – RTD 1)

Interface

- Two-wire system: Parameterizable line resistance ≤ 100 Ω (loop resistance)
- Three-wire system: No balancing required
- Four-wire system: No balancing required
- Sensor current: ≤ 0.45 mA
- Response time $T_{63}$: ≤ 250 ms for 1 sensor with open-circuit monitoring
- Open-circuit monitoring: Always active (cannot be disabled)
- Short-circuit monitoring: Can be switched off (value is adjustable)
- Measuring range: Parameterizable, max. 0 ... 2200 Ω (see Table "Digital measuring errors")
- Min. measured span: 5 ... 25 Ω (see Table "Digital measuring errors")
- Characteristic curve: Resistance-linear or special characteristic

Thermocouple elements

- Measured variable: Temperature
- Sensor type (thermocouples):
  - Type B: Pt30Rh-Pt6Rh to DIN IEC 584
  - Type C: W5%-Re to ASTM 988
  - Type D: W3%-Re to ASTM 988
  - Type E: NiCr-CuNi to DIN IEC 584
  - Type J: Fe-CuNi to DIN IEC 584
  - Type K: NiCr-Ni to DIN IEC 584
  - Type L: Fe-CuNi to DIN IEC 584
  - Type N: NiCrSi-NiSi to DIN IEC 584
  - Type R: Pt13Rh-Pt to DIN IEC 584
  - Type S: Pt10Rh-Pt to DIN IEC 584
  - Type T: Cu-CuNi to DIN IEC 584
  - Type U: Cu-CuNi to DIN 43710
- Units: °C or °F

Connection

- Standard connection: 1 thermocouple element (TC)
- Generation of average value: 2 identical thermocouple elements (TC)
- Generation of difference: 2 identical thermocouple elements (TC) TC1 – TC2 or TC2 – TC1
- Response time $T_{63}$: ≤ 250 ms for 1 sensor with open-circuit monitoring
- Open-circuit monitoring: Can be switched off

Cold junction compensation

- Internal: With integrated Pt100 resistance thermometer
- External: With external Pt100 IEC 60571 (2-wire or 3-wire connection)
- External fixed: Cold junction temperature can be set as fixed value
- Measuring range: Parameterizable (see Table "Digital measuring errors")
- Min. measured span: Min. 50 ... 100 °C (90 ... 180 °F) (see Table "Digital measuring errors")
- Characteristic curve: Temperature-linear or special characteristic

mV sensor

- Measured variable: DC voltage
- Sensor type (DC voltage source possible over an externally connected resistor)
- Units: mV
- Response time $T_{63}$: ≤ 250 ms for 1 sensor with open-circuit monitoring
SITRANS T measuring instruments for temperature

Transmitters for rail mounting

**SITRANS TR200 two-wire system, universal**

Open-circuit monitoring Can be switched off
Measuring range Parameterizable max. -100 ... 1100 mV
Min. measured span 2 mV or 20 mV
Overload capability of the input -1.5 ... +3.5 V DC
Input resistance ≥ 1 MΩ
Characteristic curve Voltage-linear or special characteric

**Output**
Output signal 4 ... 20 mA, 2-wire
Auxiliary power supply 11 ... 35 V DC (to 30 V with Ex)
Max. load \(U_{aux} - 11 V\)/0.023 A
Overrange 3.6 ... 23 mA, infinitely adjustable (default value: 22.8 mA)
Error signal (e.g. in the event of sensor breakage) 3.6 ... 23 mA, infinitely adjustable (default range: 3.84 mA ... 20.50 mA)
Sample cycle 0.25 s
Damping Software filter 1st order 0 ... 30 s (parameterizable)
Protection Against reversed polarity
Electricaly isolated Input against output (1 kVeff)

**Measuring accuracy**
Digital measuring errors See Table "Digital measuring errors"
Reference conditions
- Auxiliary power supply 24 V ± 1 %
- Load 500 Ω
- Ambient temperature 23 °C
- Warming-up time > 5 min
Error in the analog output (digital/analog converter) < 0.1 % of span
Error due to internal cold junction < 0.55 °C (0.9 °F)
Temperature effect < 0.1 % of max. span/10 °C (18 °F)
Power supply effect < 0.005 % of span/V
Effect of load impedance < 0.012 % of span/100 Ω
Long-term drift
- in the first month < 0.02 % of max. span
- after one year < 0.03 % of max. span
- after 5 years < 0.04 % of max. span

**Rated conditions**
Ambient conditions
- Ambient temperature range -40 ... +85 °C (-40 ... +185 °F)
- Relative humidity < 98 %, with condensation
- Electromagnetic compatibility According to EN 61326 and NAMUR NE21

**Design**
Material Plastic, electronic module potted
Weight 122 g
Dimensions See "Dimensional drawings"
Cross-section of cables Max. 2.5 mm² (AWG 13)
Degree of protection to IEC 60529 IP20

**Certificates and approvals**
Explosion protection ATEX
EC type test certificate PTB 07 ATEX 2032X
- "Intrinsic safety" type of protection II 2(1) G Ex ia/ib IIC T6/T4
  II 3(1) G Ex ia/ib IIC T6/T4
  II 2(1) D Ex iaD/ibD 20/21 T115 °C
- Type of protection, "equipment has limited energy" III 3 G Ex nL IIC T6/T4
- Type of protection, "equipment is non-arcing" II 3 G Ex nA IIC T6/T4

**Software requirements for SIPROM T**
PC operating system Windows ME, 2000 and XP; also Windows 95, 98 and 98 SE, but only in connection with RS 232 modern.

**Factory setting**
- Pt100 (IEC 751) with three-wire circuit
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

**Digital measuring errors**
Resistance thermometer

<table>
<thead>
<tr>
<th>Input</th>
<th>Measuring range</th>
<th>Min. measured span</th>
<th>Digital accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>°C (°F)</td>
<td>°C (°F)</td>
<td>°C (°F)</td>
<td></td>
</tr>
<tr>
<td>to IEC 60751</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pt25</td>
<td>-200 ... +850 (-328 ... +1562)</td>
<td>10 (18)</td>
<td>0.2 (0.36)</td>
</tr>
<tr>
<td>Pt50</td>
<td>-200 ... +850 (-328 ... +1562)</td>
<td>10 (18)</td>
<td>0.15 (0.27)</td>
</tr>
<tr>
<td>Pt100 ... Pt200</td>
<td>-200 ... +850 (-328 ... +1562)</td>
<td>10 (18)</td>
<td>0.1 (0.18)</td>
</tr>
<tr>
<td>Pt500</td>
<td>-200 ... +850 (-328 ... +1562)</td>
<td>10 (18)</td>
<td>0.15 (0.27)</td>
</tr>
<tr>
<td>Pt1000</td>
<td>-200 ... +350 (-328 ... +662)</td>
<td>10 (18)</td>
<td>0.15 (0.27)</td>
</tr>
<tr>
<td>to JIS C1604-81</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pt25</td>
<td>-200 ... +649 (-328 ... +1200)</td>
<td>10 (18)</td>
<td>0.2 (0.36)</td>
</tr>
<tr>
<td>Pt50</td>
<td>-200 ... +649 (-328 ... +1200)</td>
<td>10 (18)</td>
<td>0.15 (0.27)</td>
</tr>
<tr>
<td>Pt100 ... Pt200</td>
<td>-200 ... +649 (-328 ... +1200)</td>
<td>10 (18)</td>
<td>0.1 (0.18)</td>
</tr>
<tr>
<td>Pt500</td>
<td>-200 ... +649 (-328 ... +1200)</td>
<td>10 (18)</td>
<td>0.15 (0.27)</td>
</tr>
<tr>
<td>Pt1000</td>
<td>-200 ... +350 (-328 ... +662)</td>
<td>10 (18)</td>
<td>0.15 (0.27)</td>
</tr>
</tbody>
</table>

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Resistance-based sensors

<table>
<thead>
<tr>
<th>Input</th>
<th>Measuring range</th>
<th>Min. measured span</th>
<th>Digital accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance</td>
<td>0 ... 390</td>
<td>5</td>
<td>0.05</td>
</tr>
<tr>
<td>Resistance</td>
<td>0 ... 2200</td>
<td>25</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Thermocouple elements

<table>
<thead>
<tr>
<th>Input</th>
<th>Measuring range</th>
<th>Min. measured span</th>
<th>Digital accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type B</td>
<td>0 ... 1820°C (32 ... 3308°F)</td>
<td>100</td>
<td>1 (1.80)</td>
</tr>
<tr>
<td>Type C (W5)</td>
<td>0 ... 2300°C (32 ... 4172°F)</td>
<td>100</td>
<td>2 (3.60)</td>
</tr>
<tr>
<td>Type D (W3)</td>
<td>0 ... 2300°C (32 ... 4172°F)</td>
<td>100</td>
<td>1 (1.80)</td>
</tr>
</tbody>
</table>

mV sensor

<table>
<thead>
<tr>
<th>Input</th>
<th>Measuring range</th>
<th>Min. measured span</th>
<th>Digital accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>mV sensor</td>
<td>-10 ... +70 mV</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>mV sensor</td>
<td>-100 ... +1100 mV</td>
<td>20</td>
<td>400</td>
</tr>
</tbody>
</table>

The digital accuracy is the accuracy after the analog/digital conversion including linearization and calculation of the measured value.

An additional error is generated in the output current 4 to 20 mA as a result of the digital/analog conversion of 0.1% of the set span (digital-analog error).

The total error under reference conditions at the analog output is the sum from the digital error and the digital-analog error (poss. with the addition of cold junction errors in the case of thermocouple measurements).
SITRANS T measuring instruments for temperature

Transmitters for rail mounting

SITRANS TR200
two-wire system, universal

Dimensional drawings

SITRANS TR200, dimensions in mm (inch)

Schematics

SITRANS pin assignment, TR200

Assignments
1 (+) and 2 (-) Test terminals (Test) for measurement of the output current with a multimeter
3 (+) and 4 (-) Power supply U_{aux}, Output current I_{out}
5, 6, 7 and 8 Sensor assignment, see schematics
### SITRANS TR200, sensor connection assignment

<table>
<thead>
<tr>
<th>Resistance thermometer</th>
<th>Resistance</th>
<th>Thermocouple</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Two-wire system" /></td>
<td><img src="image2" alt="Two-wire system" /></td>
<td><img src="image3" alt="Cold junction compensation" /></td>
</tr>
<tr>
<td><img src="image4" alt="Three-wire system" /></td>
<td><img src="image5" alt="Three-wire system" /></td>
<td><img src="image6" alt="Cold junction compensation with external Pt100 in two-wire system" /></td>
</tr>
<tr>
<td><img src="image7" alt="Four-wire system" /></td>
<td><img src="image8" alt="Four-wire system" /></td>
<td><img src="image9" alt="Cold junction compensation with external Pt100 in three-wire system" /></td>
</tr>
<tr>
<td><img src="image10" alt="Generation of average value/difference" /></td>
<td><img src="image11" alt="Generation of average value/difference" /></td>
<td><img src="image12" alt="Generation of average value/difference with internal cold junction compensation" /></td>
</tr>
</tbody>
</table>

1) Programmable line resistance for the purpose of correction.

<table>
<thead>
<tr>
<th>Voltage measurement</th>
<th>Current measurement</th>
<th>Test terminals</th>
<th>Power supply/ 4 ... 20 mA (U_{aux})</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image13" alt="Voltage measurement" /></td>
<td><img src="image14" alt="Current measurement" /></td>
<td><img src="image15" alt="Test terminals" /></td>
<td><img src="image16" alt="Power supply/ 4 ... 20 mA (U_{aux})" /></td>
</tr>
</tbody>
</table>

SITRANS TR200, sensor connection assignment
SITRANS T measuring instruments for temperature

Transmitters for rail mounting

SITRANS TR300

two-wire system, universal, HART

Overview

"HART" to beat - the universal SITRANS TR300 transmitter

- Two-wire devices for 4 to 20 mA, HART
- Device for rail mounting
- Universal input for virtually any type of temperature sensor
- Configurable over HART

Benefits

- Compact design
- Electrically isolated
- Test sockets for multimeters
- Diagnostics LED (green/red)
- Sensor monitoring open circuits and short-circuits
- Self-monitoring
- Configuration status stored in EEPROM
- Expanded diagnostic functions, such as slave pointer, operating hours counter etc.
- Special characteristic
- Electromagnetic compatibility to EN 61326 and NE21

Application

SITRANS TR300 transmitters can be used in all industrial sectors. Their compact design enables simple mounting on standard DIN rails on-site in protective boxes or in control cabinets. The following sensors/signal sources can be connected over their universal input module:
- Resistance thermometers (two, three or four-wire system)
- Thermocouple elements
- Resistance-based sensors and DC voltage sources

The output signal is a direct current from 4 to 20 mA in accordance with the sensor characteristic, superimposed by the digital HART signal.

Transmitters of the "intrinsically-safe" type of protection can be installed within potentially explosive atmospheres. The devices comply with the Directive 94/9/EC (ATEX).

Function

The SITRANS TR300 is configured over HART. This can be done using a handheld communicator or even more conveniently with a HART modem and the SIMATIC PDM parameterization software. The configuration data are then permanently stored in the non-volatile memory (EEPROM).

Once the sensors and power supply have been correctly connected, the transmitter outputs a temperature-linear output signal and the diagnostics LED displays a green light. In the case of a sensor short-circuit, the LED flashes red, an internal device fault is indicated by a steady red light.

The test socket can be used to connect an ammeter at any time for monitoring purposes and plausibility checks. The output current can be read without any interruption, or even without opening the current loop.

SITRANS TR300 function diagram
Technical specifications

**Input**

**Resistance thermometer**

- **Measured variable**: Temperature
- **Sensor type**
  - to IEC 60751: Pt25 to Pt1000
  - to JIS C 1604; a=0.00392 K⁻¹: Pt25 to Pt1000
  - to IEC 60751: Ni25 to Ni1000
- **Special type**: over special characteristic (max. 30 points)
- **Sensor factor**: 0.25 ... 10 (adaptation of the basic type, e.g. Pt100 to version Pt25 ... Pt1000)
- **Units**: °C or °F

**Connection**

- **Standard connection**: 1 resistance thermometer (RTD) in 2-wire, 3-wire or 4-wire system
- **Generation of average value**: 2 identical resistance thermometers in 2-wire system for generation of average temperature
- **Generation of difference**: 2 identical resistance thermometers (RTD) in 2-wire system (RTD 1 – RTD 2 or RTD 2 – RTD 1)

**Interface**

- **Two-wire system**: Parameterizable line resistance ≤ 100 Ω (loop resistance)
- **Three-wire system**: No balancing required
- **Four-wire system**: No balancing required
- **Sensor current**: ≤ 0.45 mA
- **Response time T63**: ≤ 250 ms for 1 sensor with open-circuit monitoring
- **Open-circuit monitoring**: Can be switched off
- **Short-circuit monitoring**: Can be switched off (value is adjustable)
- **Range**: Parameterizable, max. 0 ... 2200 Ω (see Table "Digital measuring errors")
- **Min. measured span**: 5 Ω ... 25 Ω (see Table "Digital measuring errors")
- **Characteristic**: Resistance-linear or special characteristic

**Thermocouple elements**

- **Measured variable**: Temperature
- **Sensor type (thermocouples)**
  - Type B: Pt30Rh-Pt6Rh to DIN IEC 584
  - Type C: W5%-Re to ASTM 988
  - Type D: W3%-Re to ASTM 988
  - Type E: NiCr-CuNi to DIN IEC 584
  - Type J: Fe-CuNi to DIN IEC 584
  - Type K: NiCr-Ni to DIN IEC 584
  - Type L: Fe-CuNi to DIN 43710
  - Type N: NiCrSi-NiSi to DIN IEC 584
  - Type R: Pt13Rh-Pt to DIN IEC 584
  - Type S: Pt10Rh-Pt to DIN IEC 584
  - Type T: Cu-CuNi to DIN IEC 584
  - Type U: Cu-CuNi to DIN 43710
- **Units**: °C or °F

**Response time**

- ≤ 250 ms for 1 sensor with open-circuit monitoring

**Open-circuit monitoring**

- Can be switched off

**Short-circuit monitoring**

- Can be switched off (value is adjustable)

**Range**

- Parameterizable, max. 0 ... 2200 Ω (see Table "Digital measuring errors")

**Min. measured span**

- 5 Ω ... 25 Ω (see Table "Digital measuring errors")

**Characteristic**

- Resistance-linear or special characteristic

**mV Sensor**

- **Measured variable**: DC voltage
- **Sensor type**: DC voltage source (DC voltage source possible over an externally connected resistor)
- **Units**: mV
- **Response time T63**: ≤ 250 ms for 1 sensor with open-circuit monitoring
- **Open-circuit monitoring**: Can be switched off
- **Short-circuit monitoring**: Can be switched off (value is adjustable)

**Response time T63**

- ≤ 250 ms for 1 sensor with open-circuit monitoring

**Open-circuit monitoring**

- Can be switched off

**Short-circuit monitoring**

- Can be switched off (value is adjustable)
SITRANS T measuring instruments for temperature

Transmitters for rail mounting

SITRANS TR300

two-wire system, universal, HART

<table>
<thead>
<tr>
<th>Range</th>
<th>-10 ... 70 mV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. measured span</td>
<td>2 mV or 20 mV</td>
</tr>
<tr>
<td>Overload capacity of the input</td>
<td>-1.5 ... +3.5 V DC</td>
</tr>
<tr>
<td>Input resistance</td>
<td>≥ 1 MΩ</td>
</tr>
<tr>
<td>Characteristic</td>
<td>Voltage-linear or special characteristic</td>
</tr>
</tbody>
</table>

Output

- Output signal: 4 ... 20 mA, 2-wire
- Communication acc. to HART Rev. 5.9
- Power supply: 11 ... 35 V DC (to 30 V with EEX)
- Max. load: (Uaux – 11 V)/0.023 A
- Overrange: 3.6 ... 23 mA, continuously adjustable (default range: 3.84 ... 20.50 mA)
- Error signal (e.g. in the event of sensor breakage): 3.6 ... 23 mA, continuously adjustable (default value: 22.8 mA)
- Sample cycle: 0.25 s nominal
- Damping: Software filter 1st order 0 ... 30 s (parameterizable)
- Protection: Against reversed polarity
- Electrically isolated: Input against output (1 kVeff)

Measuring accuracy

- Digital measuring errors: See Table "Digital measuring errors"
- Reference conditions:
  - Power supply: 24 V ± 1%
  - Load: 500 Ω
  - Storage temperature: 23 °C
  - Warming-up time: > 5 min
  - Error in the analog output (digital/analog converter): < 0.1 % of span
  - Error due to internal cold junction: < 0.5 °C (0.9 °F)
  - Temperature effect: < 0.1% der max. span/10°C (18 °F)
  - Power supply effect: < 0.005% of span/V
  - Effect of load impedance: < 0.012% of span/100 Ω
  - Long-term drift:
    - in the first month: < 0.02% of max. span
    - after one year: < 0.03% of max. span
    - after 5 years: < 0.04% of max. span

Certification and approvals

- Explosion protection ATEX
- EC type test certificate: PTB 07 ATEX 2032X
- "Intrinsic safety" type of protection: II 2(1) G Ex ia/lb IIC T6/T4, II 3(1) G Ex ia/ic IIC T6/T4, II 2(1) D Ex iaD/ibD 20/21 T115 °C
- Type of protection, "equipment has limited energy":
  - II 3 G Ex nL IIC T6/T4
- Type of protection, "equipment is non-arcing":
  - II 3 G Ex na IIC T6/T4

Software requirements for SIPROM T

- PC operating system:
  - Windows ME, 2000 and XP: also Windows 95, 98 and 98 SE, but only in connection with RS 232 modem.
- Factory setting:
  - Pt100 (IEC 751) with three-wire circuit
  - Measuring range: 0 ... 100 °C (32 ... 212 °F)
  - Fault current: 22.8 mA
  - Sensor offset: 0 °C (0 °F)
  - Damping: 0.0 s

Digital measuring errors

<table>
<thead>
<tr>
<th>Input</th>
<th>Range</th>
<th>Min. measured span</th>
<th>Digital accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>°C (°F)</td>
<td>°C (°F)</td>
<td>°C (°F)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>to IEC 60751</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pt25</td>
<td>-200 ... +850</td>
<td>10 (18)</td>
<td>0.2 (0.36)</td>
</tr>
<tr>
<td></td>
<td>(-328 ... +1562)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pt50</td>
<td>-200 ... +850</td>
<td>10 (18)</td>
<td>0.15 (0.27)</td>
</tr>
<tr>
<td></td>
<td>(-328 ... +1562)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pt100 ... Pt200</td>
<td>-200 ... +850</td>
<td>10 (18)</td>
<td>0.1 (0.18)</td>
</tr>
<tr>
<td></td>
<td>(-328 ... +1562)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pt500</td>
<td>-200 ... +850</td>
<td>10 (18)</td>
<td>0.15 (0.27)</td>
</tr>
<tr>
<td></td>
<td>(-328 ... +1562)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pt1000</td>
<td>-200 ... +350</td>
<td>10 (18)</td>
<td>0.15 (0.27)</td>
</tr>
<tr>
<td></td>
<td>(-328 ... +662)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>to JIS C1604-81</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pt25</td>
<td>-200 ... +649</td>
<td>10 (18)</td>
<td>0.2 (0.36)</td>
</tr>
<tr>
<td></td>
<td>(-328 ... +1200)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pt50</td>
<td>-200 ... +649</td>
<td>10 (18)</td>
<td>0.15 (0.27)</td>
</tr>
<tr>
<td></td>
<td>(-328 ... +1200)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pt100 ... Pt200</td>
<td>-200 ... +649</td>
<td>10 (18)</td>
<td>0.1 (0.18)</td>
</tr>
<tr>
<td></td>
<td>(-328 ... +1200)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pt500</td>
<td>-200 ... +649</td>
<td>10 (18)</td>
<td>0.15 (0.27)</td>
</tr>
<tr>
<td></td>
<td>(-328 ... +1200)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pt1000</td>
<td>-200 ... +350</td>
<td>10 (18)</td>
<td>0.15 (0.27)</td>
</tr>
<tr>
<td></td>
<td>(-328 ... +662)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ni 25 to Ni1000</td>
<td>-60 ... +250</td>
<td>10 (18)</td>
<td>0.1 (0.18)</td>
</tr>
<tr>
<td></td>
<td>(-76 ... +482)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Design

- Material: Molded plastic
- Approx. weight: 50 g (0.11 lb)
- Dimensions: See "Dimension drawings"
- Cross-section of cables: Max. 2.5 mm² (AWG 13)
- Degree of protection to EN 60529:
  - Enclosure: IP40
  - Terminals: IP00
Reduction-based sensors

<table>
<thead>
<tr>
<th>Input</th>
<th>Range (Ω)</th>
<th>Min. measured span (Ω)</th>
<th>Digital accuracy (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance</td>
<td>0 to 390</td>
<td>5</td>
<td>0.05</td>
</tr>
<tr>
<td>Resistance</td>
<td>0 to 2200</td>
<td>25</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Thermocouple elements

<table>
<thead>
<tr>
<th>Input</th>
<th>Measuring range (°C)</th>
<th>Min. measured span (°C)</th>
<th>Digital accuracy (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type B</td>
<td>0 to 1380 (32 to 3308)</td>
<td>100 (180)</td>
<td>2 (3.6)</td>
</tr>
<tr>
<td>Type C</td>
<td>0 to 2300 (32 to 4172)</td>
<td>100 (180)</td>
<td>2 (3.6)</td>
</tr>
<tr>
<td>Type D</td>
<td>0 to 2300 (32 to 4172)</td>
<td>100 (180)</td>
<td>2 (3.6)</td>
</tr>
<tr>
<td>Type E</td>
<td>-200 to +1000 (-328 to +1832)</td>
<td>50 (90)</td>
<td>1 (1.8)</td>
</tr>
<tr>
<td>Type J</td>
<td>-210 to +1200 (-346 to +2192)</td>
<td>50 (90)</td>
<td>1 (1.8)</td>
</tr>
<tr>
<td>Type K</td>
<td>-230 to +1370 (-382 to +2498)</td>
<td>50 (90)</td>
<td>1 (1.8)</td>
</tr>
<tr>
<td>Type L</td>
<td>-200 to +900 (-328 to +1652)</td>
<td>50 (90)</td>
<td>1 (1.8)</td>
</tr>
<tr>
<td>Type N</td>
<td>-200 to +1300 (-328 to +2372)</td>
<td>50 (90)</td>
<td>1 (1.8)</td>
</tr>
<tr>
<td>Type R</td>
<td>-50 to +1760 (-68 to +3200)</td>
<td>100 (180)</td>
<td>2 (3.6)</td>
</tr>
<tr>
<td>Type S</td>
<td>-50 to +1760 (-68 to +3200)</td>
<td>100 (180)</td>
<td>2 (3.6)</td>
</tr>
<tr>
<td>Type T</td>
<td>-200 to +400 (-328 to +752)</td>
<td>40 (72)</td>
<td>1 (1.8)</td>
</tr>
<tr>
<td>Type U</td>
<td>-200 to +600 (-328 to +1112)</td>
<td>50 (90)</td>
<td>2 (3.6)</td>
</tr>
</tbody>
</table>

1) The digital accuracy in the range 0 to 300 °C (32 to 572 °F) is 3 °C (5.4 °F).
2) The digital accuracy in the range 1750 to 2300 °C (3182 to 4172 °F) is 2 °C (3.6 °F).

mV Sensor

<table>
<thead>
<tr>
<th>Input</th>
<th>Range (mV)</th>
<th>Min. measured span (mV)</th>
<th>Digital accuracy (µV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>mV Sensor</td>
<td>-10 to +70</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>mV Sensor</td>
<td>-100 to +1100</td>
<td>20</td>
<td>400</td>
</tr>
</tbody>
</table>

The digital accuracy is the accuracy after the analog/digital conversion including linearization and calculation of the measured value.

An additional error is generated in the output current 4 to 20 mA as a result of the digital/analog conversion of 0.1% of the set span (digital-analog error).

The total error under reference conditions at the analog output is the sum from the digital error and the digital-analog error (poss. with the addition of cold junction errors in the case of thermocouple measurements).

Selection and Ordering Data

**Temperature transmitter SITRANS TR300**

- For mounting on a standard DIN rail, two-wire system, 4 ... 20 mA, HART, with electrical isolation, with documentation on CD
- Without explosion protection
  - Order No: 7NG3033-0JN00
- With explosion protection to ATEX
  - Order No: 7NG3033-1JN00

Further design:

- Please add "-Z" to Order No. and specify Order code(s)
- Customer-specific setting of operating data (specify operating data in plain text) with test protocol (5 measuring points)

Accessories

- CD for measuring instruments for temperature
  - Order No: G5E00364512
  - Available ex stock (see Section 9) with documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software

HART modem

- With RS 232 connection
  - Order No: 7MF4997-1DA
- With USB connection
  - Order No: 7MF4997-1DB

SIMATIC PDM operating software

- Available ex stock (see Section 9)

Factory setting:

- Pt100 (IEC 751) with three-wire circuit
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s
SITRANS T measuring instruments for temperature
Transmitters for rail mounting

SITRANS TR300
two-wire system, universal, HART

Dimensional drawings

SITRANS TR300, dimensions in mm (inch)

Schematics

Assignments
1 (+) and 2 (-)  Test terminals (Test) for measurement of the output current with a multimeter
3 (+) and 4 (-)  Power supply $U_{aux}$, Output current $I_{out}$
5, 6, 7 and 8  Sensor assignment, see schematics

SITRANS TR300, pin assignment
SITRANS T measuring instruments for temperature
Transmitters for rail mounting

SITRANS TR300
two-wire system, universal, HART

Resistance thermometer

Resistance

Thermocouple

Resistance thermometer

Resistance

Thermocouple

Two-wire system ¹)

Two-wire system ¹)

Cold junction compensation
Internal/ fixed value

Three-wire system

Three-wire system

Cold junction compensation with external Pt100 in two-wire system ¹)

Four-wire system

Four-wire system

Cold junction compensation with external Pt100 in three-wire system

Generation of average value/difference ¹)

Generation of average value/difference ¹)

Generation of average value / difference
with internal cold junction compensation

¹) Programmable line resistance for the purpose of correction.

Voltage measurement

Current measurement

Test terminals

Power supply/
4 ... 20 mA (U_{aux})

SITRANS TR300, sensor connection assignment
The temperature transmitter SITRANS TF2 integrates three elements in one device:
- a Pt100 resistance thermometer in a stainless steel protective tube,
- a stainless steel housing with a high degree of protection, and
- a built-in transmitter with LCD and three pushbuttons for parameterization.

It is used to indicate and monitor the temperature measured at the point of installation.

The SITRANS TF2 is available in an axial and a radial version.

**Benefits**
- Robust stainless steel housing with two connection versions
- High measuring accuracy
- Precise display with a resolution of \( 1/100 \, ^\circ \text{C} \) in the highest measuring range
- Measuring ranges from -50 to +200 °C (-58 ... +392 °F) parameterizable
- Customer-specific lengths and materials possible for the protective tube
- Stainless steel protective tube with high resistance to chemicals
- Signaling of limit violation in the LCD as well as with a red LED

**Application**
The SITRANS TF2 is used for indicating and monitoring a temperature variable at the point of installation. Applications are all process engineering branches, e.g.:
- Chemical industry
- Energy industry
- Long-distance heating
- Water supply
- Sewage works
- Food industry
- Steelworks and the cement industry
- Pharmaceutical industry
- Biotechnology

**Design**
The SITRANS TF2 has a stainless steel housing (diam. 80 mm) with protective glass. The stainless steel protective tube with screw socket contains the temperature sensor Pt100. By using stainless steel for the protective tube it displays high chemical resistance, which means that the temperature sensor is well protected against external effects.

The protective tube is supplied as standard in lengths of 170 mm or 260 mm; a customer-specific version is also possible. Similarly, the protective tube can be supplied in the material of the customer’s choice.

At the rear of the housing is the electrical connection for the voltage supply using a current loop of 4 to 20 mA. The connection is made with plug connectors to EN 175301-803A.

At the front of the housing is the 5-digit display behind a glass cover. Underneath the display are the 3 pushbuttons for parameterizing the SITRANS TF2. Above the display are a green and a red LED for indicating the operating status.

The SITRANS TF2 is available in two versions (see "Dimensional drawings"):
- In the radial version (type A) the display is fitted in parallel with the protective tube. The display can be rotated by up to ±120° relative to the protective tube.
- In the axial version (type B) the display is at right angles to the protective tube. The display can be rotated by 360° relative to the protective tube.

**Function**

**Mode of operation**

The outside lying temperature sensor Pt100 is supplied with current from the constant current course \( I_c \). A temperature-related voltage drop is thus created over the sensor.

The voltage drop is converted on the analog/digital converter (A/D) and the voltage/current transformer (U/I) into a temperature-linear current signal \( I_{\text{out}} \) (4 to 20 mA).

In the microcontroller (\( \mu \text{C} \)) the digital signal is linearized and evaluated in accordance with the data saved in the EEPROM. The processed data are shown in the display.

In addition the values are converted on the digital/analog converter (D/A) and the voltage/current transformer (U/I) into a temperature-linear current signal \( I_{\text{out}} \) (4 to 20 mA).
Display

The SITRANS TF2 has a 5-digit display behind a glass cover. The following data are shown on the display:

- measured temperature
- unit (°C, °F, °R or K and mA or %)
- limit violation, indicated by LED and arrow symbols in the display

Settings

The SITRANS TF2 is set using the 3 pushbuttons behind the glass cover underneath the display.

The pushbutton ‘M’ is used to selected the operating mode. Following modes of operation are available:

- Measured value
- Password
- Unit of measurement
- Start of scale and end
- Upper and lower limit value
- Offset
- Output current calibration
- Upper and lower current saturation limit
- Electrical damping

The other two pushbuttons are used to set the values in the individual operating modes.

Monitoring

Two LED indicators are fitted above the display to monitor the set range and the status:

- The green LED signals that the measured temperature lies within the set limits.
- The red LED lights up when the measured temperature lies outside the set limits and when there is an error.

### Technical specifications

<table>
<thead>
<tr>
<th>Measuring principle</th>
<th>Resistance thermometer</th>
<th>Pt100 class B acc. to DIN IEC 751</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>Measured variable</td>
<td>Temperature</td>
</tr>
<tr>
<td></td>
<td>Max. measuring range</td>
<td>-50 °C ... +200 °C (-58 ... +392 °F)</td>
</tr>
<tr>
<td></td>
<td>Min. measured span</td>
<td>50 K (90 °F)</td>
</tr>
<tr>
<td>Output</td>
<td>Output signal</td>
<td>4 ... 20 mA, 2-wire</td>
</tr>
<tr>
<td></td>
<td>Lower current limit</td>
<td>min. 3.6 mA</td>
</tr>
<tr>
<td></td>
<td>Upper current limit</td>
<td>max. 23 mA</td>
</tr>
<tr>
<td></td>
<td>Output protected against</td>
<td>reversed polarity, overvoltage and short-circuiting</td>
</tr>
<tr>
<td></td>
<td>max. load</td>
<td>(U_H – 12 V) / 0.023 A</td>
</tr>
<tr>
<td></td>
<td>Voltage measurement</td>
<td>Temperature-linear</td>
</tr>
<tr>
<td>Measuring accuracy</td>
<td>Error in measurement at 23 °C ± 5 K (73.4 ± 9 °F)</td>
<td>&lt; ± (0.45 K + 0.2% of full-scale value in K + 1 digit in K)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt; ± (0.81 °F + 0.2% of full-scale value in °F + 1 digit in °F)</td>
</tr>
<tr>
<td></td>
<td>Measuring cycle time</td>
<td>≤ 100 ms</td>
</tr>
<tr>
<td></td>
<td>Temperature effect</td>
<td>&lt; ± 0.15%/10 K (&lt; ± 0.15%/18 °F)</td>
</tr>
<tr>
<td></td>
<td>Power supply effect</td>
<td>&lt; ± 0.01% of full-scale value/V</td>
</tr>
<tr>
<td></td>
<td>Vibration influence</td>
<td>&lt; ± 0.05%/g to 500 Hz in all directions (to IEC 68-2-64)</td>
</tr>
</tbody>
</table>

### Rated conditions

| Ambient conditions | Ambient temperature | -25 ... +85 °C (-13 ... +185 °F) |
|                   | Temperature range for best readability | -10 ... +70 °C (14 ... 158 °F) |
|                   | Storage temperature | -40 ... +85 °C (-40 ... +185 °F) |
|                   | Degree of protection | IP65 to EN 60529 |
|                   | Electromagnetic compatibility | EN 61326/A2 Appendix A (2001) |

### Displays and controls

| Display | LCD, max. 5 digits, digit height 9 mm (0.354 inch) |
|         | Resolution at max. measuring range | 0.01 °C (0.01 °F) |
|         | Decimal point | Freely parameterizable |
|         | Limit values | Freely parameterizable |
|         | Limit violation display | Red LED and message on LCD (↓ symbol / ↑ symbol in case of limit violation in upward/downward direction) |
|         | Parameterization | With 3 pushbuttons |
| Units   | mA or % or Ω or physical variable: °C, °F, °R, K |
| Damping | Between 0.1 and 100 s (increment: 0.1 s) freely parameterizable |

### Design

| Weight | 0.7 kg (= 1.54 lb) |
| Non-wetted parts materials | Diam. 80 mm (diam. 3.15 inch), stainless steel, mat. No. 1.4016 |
| Field housing | Stainless steel, mat. No. 14016 with glass |
| Cover | To DIN 43772 form 8 (March 2000), diam. 14 x 1.5 mm (diam. 0.55 x 0.06 inch) |
| - Material | Stainless steel (mat. No. 1.4571/316Ti) |
| - Material | Stainless steel (mat. No. 1.4571/316Ti) |
| Protective tube | Length to fit the ordered protective tube, stainless steel |
| Protective tube screw socket | G½B to DIN 3852-2 form A or ½”-14 NPT |
| - Material | Stainless steel (mat. No. 1.4571/316Ti) |
| Measuring insert | Length of the protective tube(U_p) see Ordering data |
| Connection of display to the protective tube | Using 2-pole plug connector made of plastic with M16x1.5-cable entry to EN 175301-803A or ½”-14 NPT |
| Electrical connection | Terminal voltage on temperature transmitter (U_H) 12 ... 30 V DC |
| Power supply | max. 0.15%/10 K (< ± 0.15%/18 °F) |
| Operating limits | Pressure | max. 40 bar (580 psi) |
SITRANS T measuring instruments for temperature

Transmitter for field mounting with temperature sensor

SITRANS TF2
Digital display thermometer

### Selection and Ordering Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Order No.</th>
<th>Order Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature transmitter SITRANS TF2, field device</td>
<td>7NG3 1 4 0</td>
<td></td>
</tr>
<tr>
<td>Display/cable entry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Radial version (type A), parallel to protective tube/M16x1.5</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>• Axial version (type B), at right angles to protective tube/M16x1.5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>• Radial version (type A), parallel to protective tube/½”-NPT</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>• Axial version (type B), at right angles to protective tube/½”-NPT</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Process connection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Connection shank G½B</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>• Connection shank ½”-14 NPT</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>• Other version (on request) add Order code and plain text: connection shank:</td>
<td>Z</td>
<td>J1 Y</td>
</tr>
<tr>
<td>Length of the protective tube (U₁)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 170 mm (6.70 inch)</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>• 260 mm (10.24 inch)</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>• 4.5” (114 mm)</td>
<td>K</td>
<td></td>
</tr>
<tr>
<td>• 7.5” (190 mm)</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>• 10.5” (266 mm)</td>
<td>T</td>
<td></td>
</tr>
<tr>
<td>• Other version (on request) add Order code and plain text: length:</td>
<td>Z</td>
<td>K1 Y</td>
</tr>
<tr>
<td>Material of the protective tube</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Stainless steel (mat. No. 1.4571/316Ti)</td>
<td>0</td>
<td>L1 Y</td>
</tr>
<tr>
<td>• Other version (on request) add Order code and plain text: mat. No.:</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

Available ex stock

### Dimensional Drawings

SITRANS TF2, dimensions in mm (inches)

### Schematics

SITRANS TF2, connection diagram

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Overview

Our field devices for heavy industrial use

- HART, Universal
- 4 to 20 mA, universal
- Field indicator for 4 to 20 mA signals

The temperature transmitter SITRANS TF works where others feel uncomfortable.

Benefits

- Universal use
  - as transmitter for resistance thermometer, thermocouple or mV signal
  - as field indicator for any 4 to 20 mA signals
- Local sensing of measured values over digital display
- Rugged two-chamber enclosure in die-cast aluminium or stainless steel
- Type of protection IP67
- Test terminals for direct read-out of the output signal without breaking the current loop
- Can be mounted elsewhere if the measuring point
  - is not easily accessible
  - is subject to high temperatures
  - is subject to vibrations from the system
  - or if you want to avoid long neck tubes and/or protective tubes
- Can be mounted directly on American-design sensors
- Wide range of approvals for use in potentially explosive atmospheres, "Intrinsically safe, non-sparking and flameproof" type of protection, for Europe and USA.

Application

SITRANS TF can be used everywhere where temperatures need to be measured under particularly adverse conditions, or where a convenient local display is ideal. Which is why users from all industries have opted for this field device. The rugged enclosure protects the electronics. The stainless steel model is even resistant to sea water and other aggressive elements. The inner workings offer high measuring accuracy, universal input and a wide range of diagnostic options.

Function

Configuration

The communication capability over the HART protocol V 5.9 of the SITRANS TF with an integrated SITRANS TH300 permits parameterization using a PC or HART communicator (hand-held communicator). The SIMATIC PDM makes it easy.

Parameterization is carried out using a PC for SITRANS TF - with the integrated and programmable SITRANS TH200. Available for this purpose are a special modem and the software tool SIPROM T.

Mode of operation

Mode of operation of SITRANS TF as temperature transmitter

The sensor signal, whether resistance thermometer, thermocouple or mV signal, is amplified and linearized. Sensor and output side are electrically isolated. An internal cold junction is integrated for measurements with thermocouples.

The device outputs a temperature-linear direct current of 4 to 20 mA. As well as the analog transmission of measured values from 4 to 20 mA, the HART model also supports digital communication for online diagnostics, measured value transmission and configuration.

SITRANS TF automatically detects when a sensor should be interrupted or is indicating a short-circuit. The practical test terminals allow direct measurement of 4 to 20 mA signals over an ammeter without interrupting the output current loop.

Mode of operation of SITRANS TF as field indicator

Any 4 to 20 mA signal can be applied to the generous terminal block. As well as a range of predefined measurement units, the adjustable indicator also supports the input of customized units. This means that any 4 to 20 mA signal can be represented as any type of unit, e.g. pressure, flow rate, filling level or temperature.
Transmitter for field mounting / field indicator

**SITRANS TF - Transmitter, two-wire system and SITRANS TF - Field indicator for 4 to 20 mA**

### Technical specifications

#### Input

- **Resistance thermometer**
  - **Measured variable**: Temperature
  - **Sensor type**:
    - to IEC 60751: Pt25 to Pt1000
    - to JIS C 1604: Pt25 to Pt1000
    - to IEC 60751: Ni25 to Ni1000
  - **Units**: °C and °F
  - **Connection**:
    - Normal connection: 1 resistance thermometer (RTD) in 2-wire, 3-wire or 4-wire system
    - Generation of average value: Series or parallel connection of several resistance thermometers in a two-wire system for the generation of average temperatures or for adaptation to other device types
    - Generation of difference: 2 resistance thermometers (RTD) in 2-wire system (RTD 1 – RTD 2 or RTD 2 – RTD 1)
  - **Interface**:
    - Two-wire system: Parameterizable line resistance ≤ 100 Ω (loop resistance)
    - Three-wire system: No balancing required
    - Four-wire system: No balancing required
  - **Sensor current**: ≤ 0.45 mA
  - **Response time**: ≤ 250 ms for 1 sensor with open-circuit monitoring
  - **Open-circuit monitoring**: Can be switched off
  - **Short-circuit monitoring**: Can be switched off (value is adjustable)

- **Resistance-based sensors**
  - **Measured variable**: Actual resistance
  - **Sensor type**: Resistance-based, potentiometers
  - **Units**: Ω
  - **Connection**:
    - Normal connection: 1 resistance-based sensor (R) in 2-wire, 3-wire or 4-wire system
    - Generation of average value: 2 resistance-based sensors in 2-wire system for generation of average value
    - Generation of difference: 2 resistance-based sensor in 2-wire system (R 1 – R 2 or R 2 – R 1)
  - **Interface**:
    - Two-wire system: Parameterizable line resistance ≤ 100 Ω (loop resistance)
    - Three-wire system: No balancing required
    - Four-wire system: No balancing required
    - Sensor current: ≤ 0.45 mA
    - Response time: ≤ 250 ms for 1 sensor with open-circuit monitoring
    - Open-circuit monitoring: Can be switched off
    - Short-circuit monitoring: Can be switched off (value is adjustable)

- **Thermocouple**
  - **Measured variable**: Temperature
  - **Sensor type (thermocouples)**:
    - Type B: Pt30Rh-Pt6Rh to DIN IEC 584
    - Type C: W5%-Re to ASTM 988
    - Type D: W3%-Re to ASTM 988
    - Type E: NiCr-CuNi to DIN IEC 584
    - Type J: Fe-CuNi to DIN IEC 584
    - Type K: NiCr-Ni to DIN IEC 584
    - Type L: Fe-CuNi to DIN 43710
    - Type N: NiCrSi-NiSi to DIN IEC 584
    - Type R: Pt13Rh-Pt to DIN IEC 584
    - Type S: Pt10Rh-Pt to DIN IEC 584
    - Type T: Cu-CuNi to DIN IEC 584
    - Type U: Cu-CuNi to DIN 43710
  - **Units**: °C or °F
  - **Connection**:
    - Standard connection: 1 thermocouple (TC)
    - Generation of average value: 2 thermocouples (TC)
    - Generation of difference: 2 thermocouples (TC) (TC 1 – TC 2 or TC 2 – TC 1)
  - **Response time**: ≤ 250 ms for 1 sensor with open-circuit monitoring
  - **Open-circuit monitoring**: Can be switched off
  - **Cold junction compensation**:
    - Internal: With integrated Pt100 resistance thermometer
    - External: With external Pt100 IEC 60571 (2-wire or 3-wire connection)
    - External fixed: Cold junction temperature can be set as fixed value
  - **Measuring range**: Parameterizable (see table “Digital measuring errors”)
  - **Min. measured span**: Min. 50 ... 100 °C (90 ... 180 °F)
  - **Characteristic**: Temperature-linear or special characteristic

- **mV Sensor**
  - **Measured variable**: DC voltage
  - **Sensor type**: DC voltage source (DC voltage source possible over an externally connected resistor)
  - **Units**: mV
  - **Response time**: ≤ 250 ms for 1 sensor with open-circuit monitoring
  - **Open-circuit monitoring**: Can be switched off
  - **Short-circuit monitoring**: Can be switched off (value is adjustable)
  - **Measuring range**: -10 ... +70 mV
    - -100 ... +1100 mV
  - **Min. measured span**: 2 mV or 20 mV
  - **Input resistance**: ≥ 1 MΩ
  - **Characteristic**: Voltage-linear or special characteristic
Output
Output signal 4 ... 20 mA, 2-wire
Communication with SITRANS TH300 to HART Rev. 5.9

Digital display
Digital display (optional) in current loop
Display max. 5 digits
Digit height 9 mm (0.35")
Display range -99999 ... +99999
Units Any (max. 5 char.)
Setting: With 3 pushbuttons
Zero point, upper range value and unit
Load voltage 2.1 V

Measuring accuracy
Digital measuring errors See table "Dig. measuring errors"
Reference conditions
• Auxiliary power supply 24 V ± 1 %
• Load 500 Ω
• Storage temperature 23 °C (73.4 °F)
• Warming-up time > 5 min
Error in the analog output (digital/analog converter) < 0.1% of span
Error due to internal cold junction < 0.5 °C (0.9 °F)
Temperature effect < 0.1% of max. span/10 °C (18 °F)
Power supply effect < 0.005% of span/V
Long-term drift
• in the first month < 0.02% of max. span
• after one year < 0.03% of max. span
• after 5 years < 0.04% of max. span

Rated conditions
Ambient temperature
Storage temperature -40 ... +85 °C (-40 ... +185 °F)
Condensation Permissible
Electromagnetic compatibility According to EN 61326 and NAMUR NE21
Degree of protection to EN 60529 IP67

Design
Approx. weight Approx. 1.5 kg (3.3 lb), without options
Dimensions See "Dimensional drawings"
Enclosure material Die-cast aluminum, low in copper, GD-AlSi 12 or stainless steel, polyester-based lacquer, stainless steel rating plate
Electrical connection, sensor connection Screw terminals, cable inlet via M20 x 1.5 or ½-14 NPT threaded gland
Mounting bracket (optional) Steel, galvanized and chrome-plated or stainless steel

Power supply
Without digital display 11 ... 35 V DC (30 V with Ex)
With digital display 13.1 ... 35 V DC (30 V with Ex)
Electrically isolated Between input and output
• Test voltage $U_{test} = 1$ kV, 50 Hz, 1 min

Certificate and approvals
Explosion protection ATEX
• "Intrinsically-safe" type of protection With digital indicator:
  II 2 (1) G Ex ia IIC T4
  II 2 (1) G Ex ia IIC T6
Without digital indicator:
  II 2 (1) G Ex ia IIC T6
  - EC type test certificate ZELM 99 ATEX 0007
• "Operating equipment that is non-sparking and has limited energy for zone 2" type of protection
  - EC type test certificate ZELM 99 ATEX 0007
• Flame-proof enclosure type of protection
  II 2 G Ex d IIC T5/T6
  - EC type test certificate CESI 99 ATEX 079
Explosion protection to FM Certificate of Compliance 3017742
• Identification (XP, DIP, NI, S)
  XP / I / 1/BCD / T5 Ta = 85 °C (185 °F), T6 Ta = 50 °C (112 °F), Type 4X
  DIP / II, III / 1 / EFG / T5 Ta = 85 °C (185 °F), T6 Ta = 50 °C (112 °F), Type 4X
  NI / I / 2 / ABCD / T5 Ta = 85 °C (185 °F), T6 Ta = 50 °C (112 °F), Type 4X
  S / II, III / 2 / FG / T5 Ta = 85 °C (185 °F), T6 Ta = 50 °C (112 °F), Type 4X

Hardware and software requirements
• For the parameterization software SIPROM T for SITRANS TH200
  - Personal computer PC with CD-ROM drive and USB/RS 232 interface
  - PC operating system Windows 98, NT, 2000, XP
• For the parameterization software SIMATIC PDM for SITRANS TH300 See chapter 9, "Software", "SIMATIC PDM"

Communication
Load for HART connection 230 ... 1100 Ω
• Two-core shielded ≤ 3.0 km (1.86 mi)
• Multi-core shielded ≤ 1.5 km (0.93 mi)
Protocol HART protocol, version 5.x

Factory setting (transmitter):
• Pt100 (IEC 751) with three-wire circuit
• Measuring range: 0 ... 100 °C (32 ... 212 °F)
• Fault current 22.8 mA
• Sensor offset: 0 °C (0 °F)
• Damping 0.0 s
SITRANS T measuring instruments for temperature
Transmitter for field mounting / field indicator

SITRANS TF - Transmitter, two-wire system
and SITRANS TF - Field indicator for 4 to 20 mA

Digital measuring errors
Resistance thermometer

<table>
<thead>
<tr>
<th>Input</th>
<th>Measuring range</th>
<th>Min. measured span</th>
<th>Digital accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>°C (°F)</td>
<td>°C (°F)</td>
<td>°C (°F)</td>
</tr>
<tr>
<td>according to IEC 60751</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pt25</td>
<td>-200 ... + 850 (-328 ... +1562)</td>
<td>10 (18)</td>
<td>0,2 (0.36)</td>
</tr>
<tr>
<td>Pt50</td>
<td>-200 ... + 850 (-328 ... +1562)</td>
<td>10 (18)</td>
<td>0,15 (0.27)</td>
</tr>
<tr>
<td>Pt100 ... Pt200</td>
<td>-200 ... + 850 (-328 ... +1562)</td>
<td>10 (18)</td>
<td>0,1 (0.18)</td>
</tr>
<tr>
<td>Pt500</td>
<td>-200 ... + 850 (-328 ... +1562)</td>
<td>10 (18)</td>
<td>0,15 (0.27)</td>
</tr>
<tr>
<td>Pt1000</td>
<td>-200 ... + 350 (-328 ... +662)</td>
<td>10 (18)</td>
<td>0,15 (0.27)</td>
</tr>
</tbody>
</table>

according to JIS C1604-81

<table>
<thead>
<tr>
<th>Input</th>
<th>Measuring range</th>
<th>Min. measured span</th>
<th>Digital accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>°C (°F)</td>
<td>°C (°F)</td>
<td>°C (°F)</td>
</tr>
<tr>
<td>Pt25</td>
<td>-200 ... + 649 (-328 ... +1200)</td>
<td>10 (18)</td>
<td>0,2 (0.36)</td>
</tr>
<tr>
<td>Pt50</td>
<td>-200 ... + 649 (-328 ... +1200)</td>
<td>10 (18)</td>
<td>0,15 (0.27)</td>
</tr>
<tr>
<td>Pt100 ... Pt200</td>
<td>-200 ... + 649 (-328 ... +1200)</td>
<td>10 (18)</td>
<td>0,1 (0.18)</td>
</tr>
<tr>
<td>Pt500</td>
<td>-200 ... + 649 (-328 ... +1200)</td>
<td>10 (18)</td>
<td>0,15 (0.27)</td>
</tr>
<tr>
<td>Pt1000</td>
<td>-200 ... + 350 (-328 ... +662)</td>
<td>10 (18)</td>
<td>0,15 (0.27)</td>
</tr>
</tbody>
</table>

Ni 25 ... Ni1000 | -60 ... + 250 (-76 ... +482) | 10 (18) | 0,1 (0.18) |

Resistance-based sensors

<table>
<thead>
<tr>
<th>Input</th>
<th>Measuring range</th>
<th>Min. measured span</th>
<th>Digital accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ω</td>
<td>Ω</td>
<td>Ω</td>
</tr>
<tr>
<td>Resistance</td>
<td>0 ... 390</td>
<td>5</td>
<td>0,05</td>
</tr>
<tr>
<td>Resistance</td>
<td>0 ... 2200</td>
<td>25</td>
<td>0,25</td>
</tr>
</tbody>
</table>

Thermocouple elements

<table>
<thead>
<tr>
<th>Input</th>
<th>Measuring range</th>
<th>Min. measured span</th>
<th>Digital accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>°C (°F)</td>
<td>°C (°F)</td>
<td>°C (°F)</td>
</tr>
<tr>
<td>Type B</td>
<td>0 ... 1820 (32 ... 3308)</td>
<td>100 (180)</td>
<td>2 (3.60)</td>
</tr>
<tr>
<td>Type C (W5)</td>
<td>0 ... 2300 (32 ... 4172)</td>
<td>100 (180)</td>
<td>2 (3.60)</td>
</tr>
<tr>
<td>Type D (W3)</td>
<td>0 ... 2300 (32 ... 4172)</td>
<td>100 (180)</td>
<td>1 (1.80)</td>
</tr>
<tr>
<td>Type E</td>
<td>-200 ... +1000 (-328 ... +1832)</td>
<td>50 (90)</td>
<td>1 (1.80)</td>
</tr>
<tr>
<td>Type J</td>
<td>-210 ... +1200 (-346 ... +2192)</td>
<td>50 (90)</td>
<td>1 (1.80)</td>
</tr>
<tr>
<td>Type K</td>
<td>-230 ... +1370 (-382 ... +2498)</td>
<td>50 (90)</td>
<td>1 (1.80)</td>
</tr>
<tr>
<td>Type L</td>
<td>-200 ... +900 (-328 ... +1652)</td>
<td>50 (90)</td>
<td>1 (1.80)</td>
</tr>
<tr>
<td>Type N</td>
<td>-200 ... +1300 (-328 ... +2372)</td>
<td>50 (90)</td>
<td>1 (1.80)</td>
</tr>
<tr>
<td>Type R</td>
<td>-50 ... +1760 (-58 ... +3200)</td>
<td>100 (180)</td>
<td>2 (3.60)</td>
</tr>
<tr>
<td>Type S</td>
<td>-50 ... +1760 (-58 ... +3200)</td>
<td>100 (180)</td>
<td>2 (3.60)</td>
</tr>
<tr>
<td>Type T</td>
<td>-200 ... +400 (-328 ... +752)</td>
<td>40 (72)</td>
<td>1 (1.80)</td>
</tr>
<tr>
<td>Type U</td>
<td>-200 ... +600 (-328 ... +1112)</td>
<td>50 (90)</td>
<td>2 (3.60)</td>
</tr>
</tbody>
</table>

Type B - The digital accuracy in the range 0 to 300 °C (32 to 572 °F) is 3 °C (5.4 °F).
Type C - The digital accuracy in the range 0 to 300 °C (32 to 572 °F) is 2 °C (3.6 °F).
Type D - The digital accuracy in the range 1750 to 2300 °C (3182 to 4172 °F) is 2 °C (3.6 °F).

mV sensors

<table>
<thead>
<tr>
<th>Input</th>
<th>Measuring range</th>
<th>Min. measured span</th>
<th>Digital accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mV</td>
<td>mV</td>
<td>μV</td>
</tr>
<tr>
<td>mV sensors</td>
<td>-10 ... +70</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>mV sensors</td>
<td>-100 ... +1100</td>
<td>20</td>
<td>400</td>
</tr>
</tbody>
</table>

The digital accuracy is the accuracy after the analog/digital conversion including linearization and calculation of the measured value.

An additional error is generated in the output current 4 to 20 mA as a result of the digital/analog conversion of 0.1% of the set span (digital-analog error).

The total error under reference conditions at the analog output is the sum from the digital error and the digital-analog error (poss. with the addition of cold junction errors in the case of thermocouple measurements).
Dimensional drawings

SITRANS TF, dimensions in mm (inches)

1 Sensor connection (screwed gland M20x1,5 or ½-14 NPT)
2 Blanking plug
3 Electrical connection (screwed gland M20x1,5 or ½-14 NPT)
4 Terminal side, output signal
5 Terminal side, sensor

6 Protective cover (without function)
7 Mounting bracket (option) with clamp for securing to a vertical or horizontal pipe
8 Cover with window for digital display

a: max. 164 (6.46) (M20x1,5)
max. 189 (7.44) (½-14 NPT)
b: max. 25 (0.98) (M20x1,5)
max. 50 (1.97) (½-14 NPT)

*) Dimensions for stainless steel enclosure

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## Selection and Ordering data

### Temperature transmitter in field housing

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Two-wire system 4 ... 20 mA, with electrical isolation, with documentation on CD-ROM</th>
</tr>
</thead>
<tbody>
<tr>
<td>D) 7NG313</td>
<td></td>
</tr>
</tbody>
</table>

### Integrated transmitter

- **SITRANS TH200**: programmable
  - without Ex protection
  - with EEx ia
  - with EEx nAL for zone 2
  - total device SITRANS TF EEx d\(^1\)
  - total device SITRANS TF according to FM (XP, DIP, NI, S)\(^1\)
- **SITRANS TH300**: communication capability according to HART V 5.9
  - without Ex-protection
  - with EEx ia
  - with EEx nAL for zone 2
  - total device SITRANS TF EEx d\(^1\)
  - total device SITRANS TF according to FM (XP, DIP, NI, S)\(^1\)

### SITRANS TF field indicator

<table>
<thead>
<tr>
<th>Order No.</th>
<th>for 4 ... 20 mA signals, with documentation on CD-ROM</th>
</tr>
</thead>
<tbody>
<tr>
<td>D) 7NG313</td>
<td></td>
</tr>
</tbody>
</table>

### Accessories

- **Modem for SITRANS TH200**
  - incl. parameterization software T
    - with USB interface
      - 7NG3092-8KU
    - with RS 232 interface
      - 7NG3092-8KM
- **CD for measuring instruments**
  - for temperature
    - with documentation in German, English, French, Spanish, Italian, and Portuguese, and parameterization software SITRANS TF (included in delivery with SITRANS TF)
    - 4SE0364512
- **HART modem**
  - with RS 232 interface
    - 7MF4997-1DA
  - with USB interface
    - 7MF4997-1DB
- **SIMATIC PDM parameterization software**
  - see chap. 9
  - also for SITRANS TH300

### Mounting bracket and securing parts

- made of steel for 7NG313.-..B..
  - 7MF4997-1AC
- made of steel for 7NG313.-..C..
  - 7MF4997-1AB
- made of stainless steel for 7NG313.-..B..
  - 7MF4997-1AJ
- made of stainless steel for 7NG313.-..C..
  - 7MF4997-1AH
- **Digital indicator\(^1\)**
  - 7MF4997-1BS

\(^1\) It is not possible to upgrade devices with Ex protection

### Enclosure

- die-cast aluminium
  - A
- stainless steel precision casting
  - E

### Connections/cable inlet

- screwed glands M20x1.5
  - B
- screwed glands ½-14 NPT
  - C

### Digital indicator

- without
  - 0
- with
  - 1

### Mounting bracket and securing parts

- without
  - 0
- made of steel
  - 1
- made of stainless steel
  - 2

### Further designs

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

### Customer-specific setting of operating data

<table>
<thead>
<tr>
<th>Order code</th>
<th>Y 01(^2)</th>
</tr>
</thead>
</table>

### Inscription on measuring-point label

| Meas. point description (max. 16 char.) | Y 22\(^3\) |
| Meas. point text (max. 27 char.) | Y 23\(^3\) |

### Test protocol (5 measuring points)

| Test protocol | Y 24\(^3\) |

---

1) Without cable gland.
2) Y01: Please specify all data that does not correspond to factory settings (see above) (e.g. Y01 = thermocouple element type K; internal cold junction, 0 ... 800 °C; fault current 3.6 mA).
3) Y22, Y23, Y24: If no order is placed for Y01, these data are only noted on the measuring point label and are not programmed in the transmitter.

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SITRANS T measuring instruments for temperature
Transmitter for field mounting / field indicator

SITRANS TF - Transmitter, two-wire system
and SITRANS TF - Field indicator for 4 to 20 mA

### Schematics

<table>
<thead>
<tr>
<th>Resistance thermometer</th>
<th>Resistance</th>
<th>Thermocouple</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-wire system (^1)</td>
<td>Two-wire system (^5)</td>
<td>Cold junction compensation Internal/fixed value</td>
</tr>
<tr>
<td>Three-wire system</td>
<td>Three-wire system</td>
<td>Cold junction compensation with external Pt100 in two-wire system (^1)</td>
</tr>
<tr>
<td>Four-wire system</td>
<td>Four-wire system</td>
<td>Cold junction compensation with external Pt100 in three-wire system</td>
</tr>
<tr>
<td>Generation of average value / difference (^1)</td>
<td>Generation of average value / difference (^1)</td>
<td>Generation of average value / difference with internal cold junction compensation</td>
</tr>
</tbody>
</table>

\(^1\) Programmable line resistance for the purpose of correction.

**Voltage measurement**

**Current measurement**

SITRANS TF; sensor connection assignment
Our field devices for heavy industrial use

- FOUNDATION fieldbus
- PROFIBUS PA

The SITRANS TF temperature transmitter works where others can’t cope.

Benefits

- For universal use as a transmitter for resistance thermometers, thermocouple elements, Ω or mV signals
- Rugged two-chamber enclosure in die-cast aluminium or stainless steel
- Degree of protection IP67
- Can be mounted elsewhere if the measuring point
  - is not easily accessible
  - is subject to high temperatures
  - is subject to vibrations from the system
  - or if you want to avoid long neck tubes and/or protective tubes
- Can be mounted directly on American-design sensors

Application

The SITRANS TF can be used everywhere where temperatures need to be measured under particularly harsh conditions. Which is why users from all industries have opted for this field device. The rugged enclosure protects the electronics. The stainless steel model is even resistant to sea water and other aggressive elements. The inner workings offer high measuring accuracy, universal input and a wide range of diagnostic options.

Function

Features

General

- Polarity-neutral bus connection
- 24-bit analog-digital converter for high resolution
- Electrically isolated
- Version for use in hazardous areas
- Special characteristic
- Sensor redundancy

Transmitter with PROFIBUS PA communication

- Function blocks: 2 x analog

Transmitter with FOUNDATION fieldbus communication

- Function blocks: 2 x analog and 1 x PID
- Functionality: Basic or LAS

Mode of operation

The following function diagram explains the mode of operation of the transmitter.

The only difference between the two versions of the SITRANS TF (7NG3137-... and 7NG3138-...) is the type of field bus protocol used (PROFIBUS PA or FOUNDATION fieldbus).
SITRANS T measuring instruments for temperature
Transmitter for field mounting

**System communication**

- BUS terminator
- PROFIBUS PA
- FOUNDATION Fieldbus
- Segment coupler

**Technical specifications**

**Input**
- Analog/digital conversion
  - Measurement rate: < 50 ms
  - Resolution: 24-bit
- Resistance thermometer
  - Pt25 ... Pt1000 to IEC 60751/JIS C 1604
    - Measuring range: -200 ... +850 °C (-328 ... +1562 °F)
  - Ni25 ... Ni1000 to DIN 43760
    - Measuring range: -60 ... +250 °C (-76 ... +482 °F)
  - Cu10 ... Cu1000, α = 0.00427
    - Measuring range: -50 ... +200 °C (-58 ... +392 °F)
- Line resistance per sensor cable: Max. 50 Ω
- Sensor current: Nominal 0.2 mA
- Sensor break detection: Yes
- Sensor short-circuit detection: Yes, < 15 Ω

**Resistance-based sensors**
- Measuring range: 0 Ω ... 10 kΩ
- Line resistance per sensor cable: Max. 50 Ω
- Sensor current: Nominal 0.2 mA
- Sensor break detection: Yes
- Sensor short-circuit detection: Yes, < 15 Ω

**Thermocouple**
- to IEC 584
  - Type B: Measuring range: 400 ... 1820 °C (752 ... 3308 °F)
  - Type E: Measuring range: -100 ... +1000 °C (-148 ... +1832 °F)

**Output**
- Filter time (programmable): 0 ... 60 s
- Update time: < 400 ms

**Measuring accuracy**

Accuracy is defined as the higher value of general values and basic values.

<table>
<thead>
<tr>
<th>Type of input</th>
<th>Absolute accuracy</th>
<th>Temperature coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>≤ ±0.05 % of measured value</td>
<td>≤ ±0.002 % of measured value/°C</td>
</tr>
</tbody>
</table>

**Basic values**

<table>
<thead>
<tr>
<th>Type of input</th>
<th>Basic accuracy</th>
<th>Temperature coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt100 and Pt1000</td>
<td>≤ ±0.1 °C</td>
<td>≤ ±0.002 °C/°C</td>
</tr>
<tr>
<td>Ni100</td>
<td>≤ ±0.15 °C</td>
<td>≤ ±0.002 °C/°C</td>
</tr>
<tr>
<td>Cu10</td>
<td>≤ ±1.3 °C</td>
<td>≤ ±0.02 °C/°C</td>
</tr>
<tr>
<td>Resistance-based sensors</td>
<td>≤ ±0.05 °Ω</td>
<td>≤ ±0.002 °Ω/°C</td>
</tr>
<tr>
<td>Voltage source</td>
<td>≤ ±0.10 μV</td>
<td>≤ ±0.2 μV/°C</td>
</tr>
<tr>
<td>Thermocouple, type: E, J, K, L, N, T, U</td>
<td>≤ ±0.5 °C</td>
<td>≤ ±0.01 °C/°C</td>
</tr>
<tr>
<td>Thermocouple, type: B, R, S, W3, W5</td>
<td>≤ ±0.5 °C</td>
<td>≤ ±0.025 °C/°C</td>
</tr>
<tr>
<td>Cold junction compensation</td>
<td>≤ ±0.5 °C</td>
<td></td>
</tr>
</tbody>
</table>

**Reference conditions**
- Warming-up time: 30 s
- Signal-to-noise ratio: Min. 60 dB
- Calibration condition: 20 ... 28 °C (68 ... 82 °F)
SITRANS T measuring instruments for temperature

Transmitter for field mounting

SITRANS TF, fieldbus transmitters

Conditions of use

Ambient conditions
Permissible ambient temperature -40 ... +85 °C (-40 ... +185 °F)
Permissible storage temperature -40 ... +85 °C (-40 ... +185 °F)
Relative humidity ≤ 98 %, with condensation

Insulation resistance
• Test voltage 500 V AC for 60 s
• Continuous operation 50 V AC/75 V DC

Electromagnetic Compatibility
NAMUR NE21
EMC 2004/108/EC Emission and Noise Immunity

EN 61326-1, EN 61326-2-5

Design

Weight Approx. 1.5 kg (3.3 lb) without options
Dimensions See "Dimensional drawings"
Enclosure materials • Die-cast aluminium, low in copper, GD-AlSi 12 or stainless steel
• Polyester-based lacquer for GD AlSi 12 enclosure
• Stainless steel rating plate

Electrical connection, sensor connection
• screw terminals
• Cable inlet via M20 x 1.5 or ½-14 NPT screwed gland
• Bus connection with M12 plug (optional)

Mounting bracket (optional) Steel, galvanized and chromed-plated or stainless steel

Degree of protection IP67 to EN 60529

Auxiliary power supply

Power supply
• Standard, Ex “d”, Ex “nA”, Ex “nL”, XP, NI
• Ex “ia”, Ex “ib” 10.0 ... 30 V DC
• In FISCO/FNICO installations 10.0 ... 17.5 V DC

Power consumption < 11 mA
Max. increase in power consumption in the event of a fault < 7 mA

Certificates and approvals

Explosion protection ATEX
EC type test certificate ZELM 99 ATEX 0007
II 2(1) G Ex ia IIC T4/T6

Conformity statement ZELM 07 ATEX 3349
II 3 G Ex nA [nL] IIC T4/T6
II 3 G Ex nL IIC T4/T6

EC type test certificate CESI 99 ATEX 079
II 2 G Ex d IIC T5/T6

Explosion protection: FM for USA

FM approval FM 3017742
Type of protection XP, DIP, NI and S (version 7NG313x-5xxxx)

Communication

Parameterization interface
• PROFIBUS PA connection
  - Protocol A&D profile, Version 3.0
  - Protocol EN 50170 Volume 2
  - Address (for delivery) 126
  - Function blocks 2 x analog

• FOUNDATION fieldbus connection
  - Protocol FF protocol
  - Protocol FF design specifications
  - Functionality Basic or LAS
  - Version ITK 4.6
  - Function blocks 2 x analog and 1 x PID

Factory setting

for SITRANS TH400 PA
Sensor Pt100 (IEC)
Type of connection 3-wire circuit
Unit °C
Failure mode Last valid value
Filter time 0 s
PA address 126

PROFIBUS Ident No. Manufacturer-specific

for SITRANS TH400 FF
Sensor Pt100 (IEC)
Type of connection 3-wire circuit
Unit °C
Failure mode Last valid value
Filter time 0 s
Node address 22
SITRANS T measuring instruments for temperature
Transmitter for field mounting

<table>
<thead>
<tr>
<th>Selection and ordering data</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature transmitter in field enclosure</td>
<td>7N313-00</td>
</tr>
<tr>
<td>Integrated transmitter</td>
<td></td>
</tr>
<tr>
<td>• SITRANS TH400 with PROFIBUS PA</td>
<td></td>
</tr>
<tr>
<td>- without Ex protection</td>
<td>70</td>
</tr>
<tr>
<td>- with Ex ia (ATEX)</td>
<td>71</td>
</tr>
<tr>
<td>- with Ex nAL for zone 2 (ATEX)</td>
<td>72</td>
</tr>
<tr>
<td>- total device SITRANS TF EEEx d¹</td>
<td>74</td>
</tr>
<tr>
<td>- total device SITRANS TF according to FM (XP, DIP, NI, S)² (available soon)</td>
<td>75</td>
</tr>
<tr>
<td>• SITRANS TH400, with FOUNDATION fieldbus</td>
<td></td>
</tr>
<tr>
<td>- without Ex protection</td>
<td>80</td>
</tr>
<tr>
<td>- with Ex ia (ATEX)</td>
<td>81</td>
</tr>
<tr>
<td>- with Ex nAL for zone 2 (ATEX)</td>
<td>82</td>
</tr>
<tr>
<td>- total device SITRANS TF EEEx d¹</td>
<td>84</td>
</tr>
<tr>
<td>- total device SITRANS TF according to FM (XP, DIP, NI, S)² (available soon)</td>
<td>85</td>
</tr>
<tr>
<td>Enclosure</td>
<td></td>
</tr>
<tr>
<td>• die-cast aluminium</td>
<td>A</td>
</tr>
<tr>
<td>• stainless steel precision casting</td>
<td>E</td>
</tr>
<tr>
<td>Connections/cable inlet</td>
<td></td>
</tr>
<tr>
<td>• screwed glands M20x1.5</td>
<td>B</td>
</tr>
<tr>
<td>• screwed gland s ½-14 NPT</td>
<td>C</td>
</tr>
<tr>
<td>Mounting bracket and fastening parts</td>
<td></td>
</tr>
<tr>
<td>• none</td>
<td>0</td>
</tr>
<tr>
<td>• made of steel</td>
<td>1</td>
</tr>
<tr>
<td>• stainless steel</td>
<td>2</td>
</tr>
<tr>
<td>Further designs</td>
<td></td>
</tr>
</tbody>
</table>

Order code

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

Customer-specific operating data

Inscription on measuring point label |
• Measuring point number/TAG (max. 32 char.) | Y01² |
• Measuring point description (max. 32 char.) | Y15³ |
• Bus address | Y23³ |
| Y25³ |

Test report (5 measuring points) | C11⁴ |

Bus connection |
• M12 plug (metal), without mating connector | M005 |
• M12 plug (metal), with mating connector | M015 |

Order No.

Accessories

CD for measuring instruments for temperature with documentation in German, English, French, Spanish, Italian and Portuguese, and parameterization software SIPROM T (included in delivery with SITRANS TF) | A5E00364512 |

SIMATIC PDM parameterization software also for SITRANS TF with TH400 PA |

Mounting bracket and fastening parts |
• Made of steel for 7NG313.-..B.. | 7MF4997-1AC |
• Made of steel for 7NG313.-..C.. | 7MF4997-1AB |
• Made of stainless steel for 7NG313.-..B.. | 7MF4997-1AJ |
• Made of stainless steel for 7NG313.-..C.. | 7MF4997-1AH |

Available ex stock.

Factory setting:

• for SITRANS TH400 PA:
  - Pt100 (IEC) with 3-wire circuit
  - Unit: °C
  - Failure mode: last valid value
  - Filter time: 0 s
  - PA address: 126
  - PROFIBUS Ident No.: manufacturer-specific

• for SITRANS TH400 FF:
  - Pt100 (IEC) with 3-wire circuit
  - Unit: °C
  - Failure mode: last valid value
  - Filter time: 0 s
  - Node address: 22

1) Without cable gland.
2) Y01: Please specify all data that does not correspond to factory settings (see above) (e.g. Y01 = thermocouple element type K), internal cold junction.
3) Y15, Y23, Y25. If no order is placed for Y01, these data are only noted on the measuring point label and are not programme in the transmitter.
4) Can only be ordered together with Y01 (it is essential to specify the measuring range).
5) Not available for explosion protection EEEx d or XP.

Subject to export regulations AL: N, ECCN: 5D992B1.
SITRANS T measuring instruments for temperature
Transmitter for field mounting
SITRANS TF, fieldbus transmitters

Dimensional drawings

1 Sensor connection (screwed gland M20x1,5 or ½-14 NPT)
2 Blanking plug
3 Electrical connection (screwed plug M20x1,5 orr ½-14 NPT), optional M12 plug
4 Terminal side, bus connection
5 Terminal side, sensor
6 Protective cover (without function)
7 Mounting bracket (optional) with clamp securing to a vertical or horizontal pipe

SITRANS TF with TH400, dimensions in mm (inches)
SITRANS T measuring instruments for temperature
Transmitter for field mounting
SITRANS TF, fieldbus transmitters

Schematics

### Resistance thermometer
- **Two-wire system**:
  - Internal cold junction compensation

### Thermocouple
- **Cold junction compensation with external Pt100**
  - In two-wire system

### Resistance
- **Two-wire system**:  
- **Three-wire system**:  
- **Four-wire system**:  
- **Mean-value/differential or redundancy generation**
  - 2 x two-wire system
  - 1 sensor in two-wire system
  - 1 sensor in three-wire system

### Voltage measurement
- **One voltage source**:  
- **Measurement of mean value, differential and redundancy with 2 voltage sources**:  

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*Programmable line resistance for the purpose of correction.*
SITRANS T measuring instruments for temperature