

# SITRANS T measuring instruments for temperature

## SITRANS T transmitters for mounting in sensor head

### SITRANS TK/TK-H Two-wire system

#### Overview



**The smart solution – The transmitter with the same capabilities as a SITRANS TK and a standardized HART interface.**

This universal transmitter integrates your temperature measurement in the TIA concept (Totally Integrated Automation). This makes central engineering possible, bringing you time and cost benefits.

SIMATIC PDM or another HART programming tool can be used for the configuration. The transmitter provides electrical isolation and enables the connection of resistance thermometers, resistance-based sensors, thermocouples and voltage-based sensors.

#### Application

SITRANS TK/TK-H temperature transmitters with "Non incandive" type protection can be mounted within potentially explosive atmospheres (zone 2).

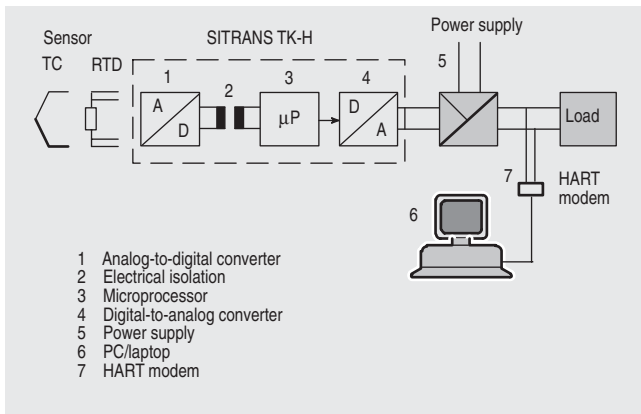
SITRANS TK/TK-H temperature transmitters with "Flame-proof enclosure" type protection can be mounted within potentially explosive atmospheres (zone 1).

#### Function

The SITRANS TK/TK-H temperature transmitter converts the signals from resistance thermometers, resistance-based sensors, thermocouples or voltage sensors into a load-independent direct current corresponding to the sensor characteristic. As a result of its compact design, the transmitter fits in the sensor head type B (DIN 43 729).

The communication capability via the HART protocol V 5.x of the SITRANS TK-H permits parameterization using a PC or HART communicator (hand-held communicator). Parameterization is carried out using a PC for the programmable SITRANS TK-L.

#### Mode of operation



The signal supplied by a resistance-based sensor (two, three or four-wire circuit) or a thermocouple element is amplified in the input stage. The voltage proportional to the input variable is then converted into digital signals in the analog/digital converter (1). These signals are forwarded electrically isolated (2) to the microprocessor (3). They are converted there in accordance with the sensor characteristic and further parameters (damping, ambient temperature etc.).

The signal prepared in this way is converted in the digital/analog converter (4) into a load-independent direct current (4 to 20 mA). The power supply (5) is located in the output signal circuit.

The SITRANS TK-H transmitter is parameterized and operated using a PC (6) connected to the two-wire line via the interface module for SIPROM software (HART modem, 7). A hand-held communicator can also be used for this purpose. The signals needed for communication in conformity with the HART r protocol V 5.7 are superimposed on the output current in accordance with the frequency shift keying (Frequency Shift Keying, FSK) method.

#### Technical specifications

##### Input

###### Resistance thermometer

Measured variable	Temperature
Sensor type	
• Acc. to DIN IEC 751	Pt25 ... Pt1000
• Acc. to JIS C 1604	Pt25 ... Pt1000
• Acc. to DIN IEC 751	Ni25 ... Ni1000
	Cu25 ... Cu1000
Voltage measurement	Temperature-linear
Type of connection	Two, three or four-wire system

###### Resistance-based sensors

Measured variable	Ohmic impedance
Measuring range limits	2200 $\Omega$
Voltage measurement	Resistance-linear or programmable (TK)
Type of connection	Two, three or four-wire system

###### Thermocouple elements

Measured variable	Temperature
Sensor type	
• Acc. to DIN IEC 584-1	Type B, E, J, K, R, S, T
• Acc. to DIN 43 710	Type L, U
• Acc. to DIN 4937	Type N
• Acc. to ASTM 988	Type C, D
Voltage measurement	Temperature-linear
Cold junction compensation	Internal, external with Pt100 or external with a fixed value

###### mV Sensor

Measured variable	DC voltage
Measuring range limits	1100 mV
Voltage measurement	Voltage-linear or programmable
Overload capacity of the input	-0.5 ... +35 V DC
Input resistance	$\geq 1 \text{ M}\Omega$

##### Output

Output signal	4 to 20 mA, 2-wire
Communication for SITRANS TK-H	Acc. to HART V 5.x

##### Measuring accuracy

Digital measuring errors	See "Digital measuring errors"
Error in the analog output	< 0.1% of span
Error in the internal cold junction	< 0.5 K (0.9 °F)
Temperature drift	$\pm 0.01\%/^{\circ}\text{C}$ (0.0056%/°F), typ. $\pm 0.003\%/^{\circ}\text{C}$ (0.0016%/°F)
Influence of the power supply on the span and zero point	< 0.005% of span/V
Long-term drift	< 0.03% in first month

# SITRANS T measuring instruments for temperature

## SITRANS T transmitters for mounting in sensor head

### SITRANS TK/TK-H Two-wire system

#### Technical specifications (continued)

##### Rated conditions

###### Ambient conditions

Ambient temperature	-40 ... +85 °C (-40 ... 185 °F)
Relative humidity	< 98%, with condensation
Electromagnetic compatibility	
• Interference immunity	Acc. to EN 61 326
• Emitted interference	Acc. to EN 50 081-2

##### Design

Weight	50 g (0.11 lb)
Dimensions	see "Dimension drawings"
Material	Moulded plastic

##### Power supply

For SITRANS TK	6.5 ... 35 V DC (30 V for EEx ia)
For SITRANS TK-H	8 ... 35 V DC (30 V for EEx ia)
Electrical isolation	Between input and output
• Test voltage	$U_{eff} = 3.75 \text{ kV}$ , 50 Hz, 1 min
• Insulation	500 V AC

##### Certificate and approvals

###### Explosion protection ATEX

• "Intrinsic. safe" type of protection	II 1 G EEx ia IIC T5/T6
- EC-Type Examination Certificate for TK and TK-H	DEMKO 03 ATEX 134603X
• Ex tested for zone 2n	II 3 G EEx nA IIC T5/T6
- Conformity statement	DEMKO 03 ATEX 134604X
Explosion protection to FM	Certificate of Compliance 3017742
• Identification (IS, I, NI)	<ul style="list-style-type: none"> <li>• IS / I / 1 / ABCDEFG / T5 Ta = 85 °C (185 °F), T6 Ta = 50 °C (112 °F)</li> <li>• I / 0 / AEx ia / IIC / T5 Ta = 85 °C (185 °F), T6 Ta = 50 °C (112 °F)</li> <li>• NI / I / 2 / ABCD / T5 Ta = 85 °C (185 °F), T6 Ta = 50 °C (112 °F)</li> </ul>
• Entity parameters	nach "control drawing" A5E00226012B $U_i = 30 \text{ V}$ , $I_i = 100 \text{ mA}$ , $P_i = 0,75 \text{ W}$ , $C_i = 5 \text{ nF}$ , $L_i = 15 \mu\text{H}$

##### Hardware and software requirements for the parameterization software SIPROM TK for SITRANS TK

Personal computer	<ul style="list-style-type: none"> <li>• CPU of type 486 upwards, compatible with industrial standard</li> <li>• 3.5" diskette drive</li> <li>• Hard disk with 5 MB vacant space</li> <li>• min. 4 MB RAM</li> <li>• VGA graphics adapter (or compatible) with at least 16 colors</li> <li>• One vacant serial port</li> <li>• Mouse or compatible pointing device and printer (recommended)</li> </ul>
PC operating system	MS-DOS V 5.0 upwards, MS-Windows V 3.1 upwards
SIMATIC PDM for SITRANS TK-H	see Chapter 9

##### Factory setting:

- Pt100 (IEC 751) with three-wire circuit
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Output with sensor breakage: 23 mA

#### Digital measuring errors

##### Resistance thermometer

Input	Measured range	Min. measured span	Digital accuracy
	°C (°F)	°C (°F)	°C (°F)
Pt25 ... Pt500	-200 ... + 850 (-328 ... +1562)	10 (18)	0.1 (0.18)
Pt501 ... Pt1000 IEC	-200 ... + 350 (-328 ... +662)	10 (18)	0.1 (0.18)
Ni 25 ... Ni1000	-50 ... + 250 (-58 ... +482)	10 (18)	0.1 (0.18)
Cu25 ... Cu1000	-50 ... + 200 (-58 ... +392)	10 (18)	0.1 (0.18)

##### Resistance-based sensors

Input	Measured range	Min. measured span	Digital accuracy
	$\Omega$	$\Omega$	$\Omega$
Resistance	0 ... 390	5	0.05
Resistance	0 ... 2200	25	0.25

##### Thermocouple elements

Input	Measured range	Min. measured span	Digital accuracy
	°C (°F)	°C (°F)	°C (°F)
Type B	+500 ... +1820 (+932 ... +3308)	50 (90)	2 (3.6)
Type C	0 ... +2300 (+32 ... +4172)	100 (180)	2 (3.6)
Type D	0 ... +2300 (+32 ... +4172)	100 (180)	2 (3.6)
Type E	-250 ... +900 (-418 ... +1652)	50 (90)	1 (1.8)
Type J	-210 ... +1200 (-346 ... +2192)	50 (90)	1 (1.8)
Type K	-230 ... +1370 (-382 ... +2498)	50 (90)	1 (1.8)
Type L	-200 ... +900 (-328 ... +1652)	50 (90)	1 (1.8)
Type N	-200 ... +1300 (-328 ... +2372)	50 (90)	1 (1.8)
Type R	0 ... +1750 (+32 ... +3182)	100 (180)	2 (3.6)
Type S	0 ... +1750 (+32 ... +3182)	100 (180)	2 (3.6)
Type T	-220 ... +400 (-364 ... +752)	40 (7.2)	1 (1.8)
Type U	-200 ... +600 (-328 ... +1112)	50 (90)	1 (1.8)

##### mV Sensor

Input	Measured range	Min. measured span	Digital accuracy
	mV	mV	$\mu\text{V}$
mV Sensor	-10 ... +70	2	40
mV Sensor	-100 ... +1100	20	400

# SITRANS T measuring instruments for temperature

## SITRANS T transmitters for mounting in sensor head

**SITRANS TK/TK-H**  
Two-wire system

3

### Selection and ordering data

Order No.

#### Temperature transmitter SITRANS TK

for installation in sensor head type B (DIN 43729); two-wire system 4 ... 20 mA; with electrical isolation

- without explosion protection ▶ **7NG3120-1JN01**
- with explosion protection Ex n for zone 2 ▶ **7NG3121-1JN01**
- with explosion protection ATEX (EEx ia) and FM (IS, I, NI) ▶ **7NG3122-1JN01**

#### Temperature transmitter SITRANS TK-H

for installation in sensor head type B (DIN 43729); two-wire system 4 ... 20 mA; capable of communication according to HART V 5.x with electrical isolation

- without explosion protection ▶ **7NG3120-2JN01**
- with explosion protection Ex n for zone 2 ▶ **7NG3121-2JN01**
- with explosion protection ATEX (EEx ia) and FM (IS, I, NI) ▶ **7NG3122-2JN01**

#### Further designs

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

- Customer-specific setting of operating data
- Test protocol (5 measuring points)

#### Order code

**Y01**  
**C11**

### Accessories

Order No.

**SIPROM TK parameterization software** for SITRANS TK, German/English/French

▶ **7NG3190-8KB**

**Modem for SITRANS TK**

▶ **7NG3190-6KB**

**Instruction Manual for SITRANS TK/TK-H** German/English (not included in delivery of the device)

▶ **A5E00226012**

**DIN rail adaptor**

for head mounted transmitters (set of 5 pcs.)

▶ **7NG3092-8KA**

**SIMATIC PDM parameterization software** also for SITRANS TK-H

see Chapter 9

#### HART modem

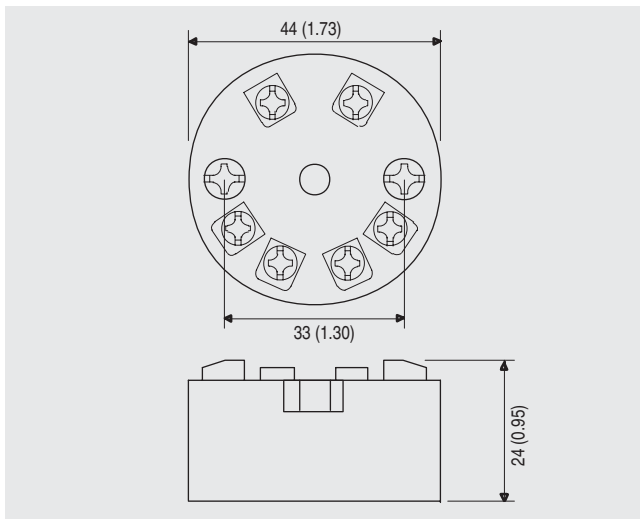
- with RS232 interface ▶ **7MF4997-1DA**  
D)
- with USB interface ▶ **7MF4997-1DB**  
D)

▶ Available ex stock.

D) Subject to export regulations AL:N, ECCN: EAR99H.

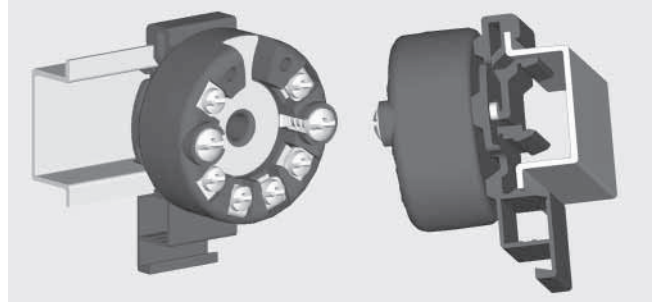
Power supply units see "SITRANS I supply units and input isolators".

### Dimensional drawings

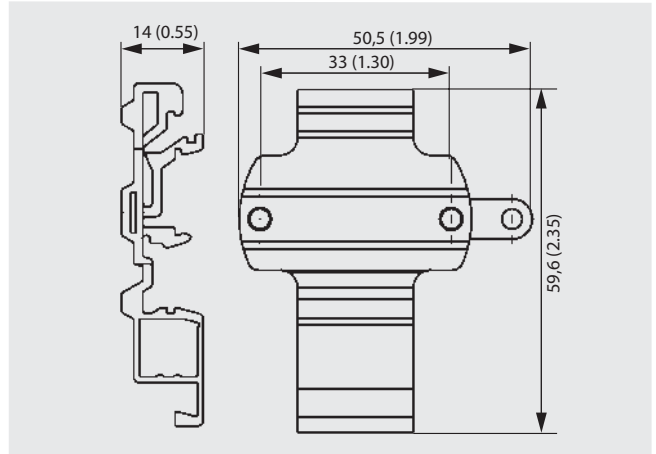


SITRANS TK/TK-H, dimensions in mm (inches)

### Mounting on DIN rail

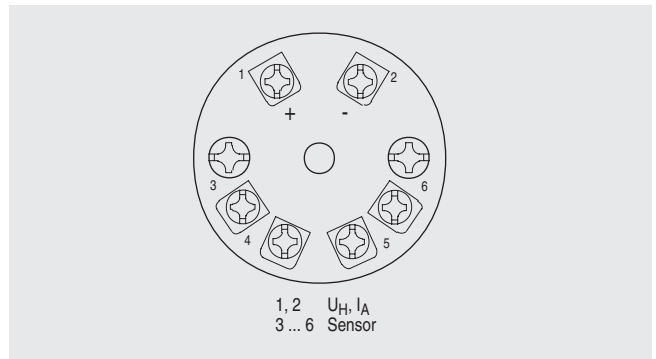


Mounting of transmitter on DIN rail, schematic diagram



DIN rail adaptor, dimensions in mm (inch)

### Schematics



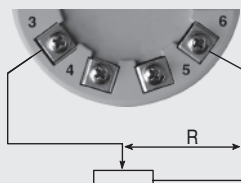
Pin assignment

# SITRANS T measuring instruments for temperature

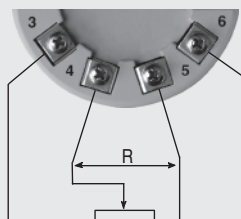
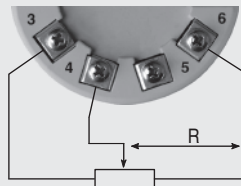
## SITRANS T transmitters for mounting in sensor head

### SITRANS TK/TK-H Two-wire system

#### Potentiometer

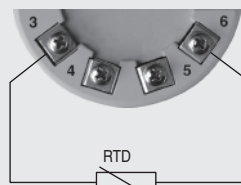


No compensation<sup>1)</sup>

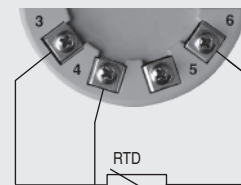


Four-wire compensation for line and transfer resistance<sup>2)</sup>

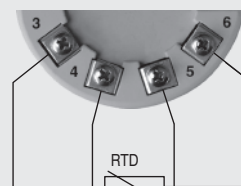
#### Resistance thermometer



No line compensation<sup>1)</sup>

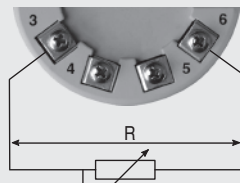


Three-wire line compensation

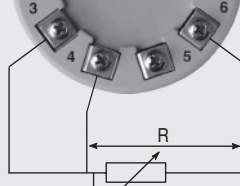


Four-wire line compensation

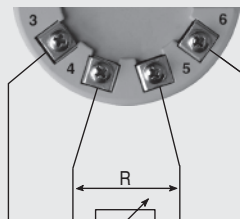
#### Resistance



No compensation<sup>1)</sup>



Three-wire line compensation

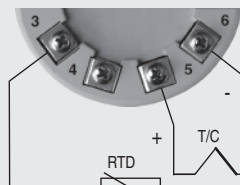


Four-wire line compensation

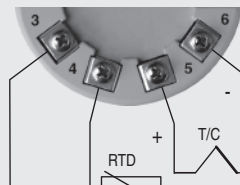
#### Thermocouple



Internal cold junction compensation (CJC)

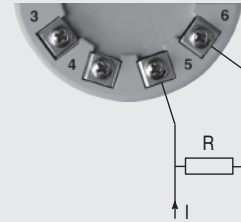


External CJC-compensation  
No line compensation<sup>1)</sup>

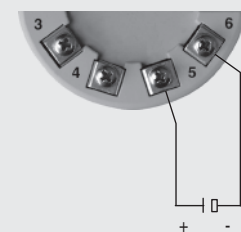


External CJC-compensation  
Three-wire line compensation

#### Current measurement



#### Voltage measurement



Note:  
Line resistance (per wire in the case of three- and four-wire connections)  
T > 600 °C (> 1112 °F): max. 10 Ω  
T < 600 °C (> 1112 °F): max. 30 Ω

<sup>1)</sup> Line resistance for compensation is programmable.

<sup>2)</sup> Resistance between start of resistance and sliding contact.

Sensor connection assignment