Overview

The field transmitter for tough industrial duty

The temperature transmitter SITRANS TF works where others feel uncomfortable. These field transmitters are equipped namely with protection type IP68.

SITRANS TF comes in robust die-cast aluminium or in durable stainless steel. It converts signals from resistance thermometers, resistance-based sensors, thermocouples and voltage-based sensors into a load-independent direct current corresponding to the sensor characteristic. The offset mounted sensor prevents the transmitter from heating up at high temperature. Vibrations and oscillations due to long neck tubes and protective do not occur with SITRANS TF.

In the case of hard to reach measuring points you can mount the SITRANS TF in offset positions offering easy access and have the measured value shown on the freely programmable digital indicator.

The SITRANS TF can be used in a version without a transmitter as a user-friendly indicating device for all 4 to 20 mA signals.

All versions of the SITRANS TF are also available in an intrinsically safe or flameproof design.

Application

SITRANS TF temperature transmitters with "Non incendive" type protection can be operated within potentially explosive atmospheres (zone 2).
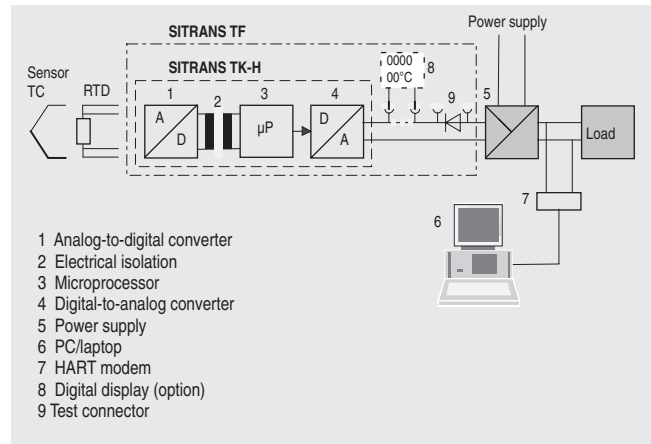
SITRANS TF temperature transmitters with "Non incendive" or "Flame-proof enclosure" type protection can be operated within potentially explosive atmospheres (zone 1).

Function

The communication capability via the HART protocol V 5.7 of the S ITRANS TF permits parameterization using a PC or HART communicator (hand-held communicator).

Parameterization is carried out using a PC for SITRANS TF with the integrated and programmable SITRANS TK.

Mode of operation

1 Analog-to-digital converter
2 Electrical isolation
3 Microprocessor
4 Digital-to-analog converter
5 Power supply
6 PC/laptop
7 HART modem
8 Digital display (option)
9 Test connector

Operating principle: SITRANS TF with an integrated SITRANS TK-H and digital display

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 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 75	Ni25 ... Ni1000
	Cu25 ... Cu1000
Voltage measurement	Temperature-linear
Type of connection	2, 3 or 4-wire circuit

Resistance-based sensors

Measured variable	Ohmic impedance
Measuring range limits	2200 Ω
Voltage measurement	Resistance-linear or programmable (TK)
Type of connection	2, 3 or 4-wire circuit

3

Technical specifications (continued)

Thermocouple elements

Measured variable	Temperature
Sensor type	
• Acc. to DIN IEC 584-1	Type B, E, J, K, R, S, T
• Acc. to DIN 43710	Type L, U
• Acc. to BS 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 (TK)
Overload capacity of the input	-0.5 ... +35 V DC
Input resistance	≥ 1 MΩ

Output

Output signal	4 ... 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	±0.01%/°C (0.0056%/°F), typ. ±0.003%/°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

Rated conditions

Ambient conditions

Ambient temperature	-40 ... +85 °C (-40 ... +185 °F)
Condensation	Permissible
Electromagnetic compatibility	
• Interference immunity	According to EN 50 082-2 and NAMUR NE21
• Emitted interference	Acc. to EN 50 081-2
Degree of protection to EN 60 529	IP68

Design

Weight	Approx. 1.5 kg (3.3 lb) (without options)
Dimensions	see "Dimension drawings"
Enclosure material	Die-cast aluminum, low in copper, GD-AlSi 12, 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
Digital display (optional)	In current loop
Display	Max. 5 digits
Display range	-99 999 ... + 99 999
Units	Any
Setting: Zero point, upper range value and unit	With 3 keys

Power supply

Without digital display	
• For SITRANS TK	6.5 ... 35 V DC (28 V for EEx ia)
• For SITRANS TK-H	12 ... 35 V DC (28 V for EEx ia)
With digital display	
• For SITRANS TK	9.3 ... 35 V DC (28 V for EEx ia)
• For SITRANS TK-H	14.8 ... 35 V DC (28 V for EEx ia)
Electrical isolation	Between input and output
• Test voltage	U_{eff} = 3.75 kV, 50 Hz, 1 min
• Insulation	500 V AC

Certificate and approvals

Explosion protection ATEX	
• "Intrinsic. safe" type of protection	II 2 (1) G EEx ia IIC T4
- EC-Type Examination Certificate	ZELM 99 ATEX 0007
• "Flame-proof enclosure" type of protection	II 2 G EEx d IIC T5/6
- EC-Type Examination Certificate	CESI 99 ATEX 079
Explosion protection (German Technical Inspectorate)	
• Ex tested for zone 2n	
- Conformity statement	In preparation
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 parameteriz. software SIPROM TK for SITRANS TK

Personal computer	• CPU of type 486 upwards, compatible with industrial standard • 3.5" diskette drive • Hard disk with 5 MB vacant space • min. 4 MB RAM • VGA graphics adapter (or compatible) with at least 16 colors • One vacant serial port • Mouse or compatible pointing device and printer (recommended)
PC operating system	MS-DOS V 5.0 upwards, MS-Windows V 3.1 upwards
SIMATIC PDM for SITRANS TK-H	see Chapter 9

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
• Output with sensor breakage: 23 mA

SITRANS TF
two-wire system

■ Technical specifications (continued)

Digital measuring errors

Resistance-based sensors

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

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)
Ni25 ... Ni1000	-50 ... +250 (-58 ... +482)	10 (18)	0.1 (0.18)
Cu25 ... Cu1000	-50 ... +250 (-58 ... +482)	10 (18)	0.1 (0.18)

Voltage source

Input	Measured span	Min. measured span	Digital accuracy
	mV	mV	µV
mV Sensor	-10 ... +70	2	40
mV Sensor	-100 ... +1100	20	400

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 (72)	1 (1.8)
Type U	-200 ... +600 (-328 ... +1112)	50 (90)	1 (1.8)

3

■ Dimensional drawings

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)

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

SITRANS TF, dimensions in mm (inches)

SITRANS TF
two-wire system

Selection and ordering data	Order No.						
Temperature transmitter in field housing	**7 N G 3 1 3 ■ - ■ ■ ■ ■ ■**						
Two-wire system 4 ... 20 mA, with electrical isolation, with instruction manual							
Integrated transmitter							
• SITRANS TK, programmable							
- without Ex protection		1	0				
- with EEx ia		1	1				
- total device SITRANS TF EEx d [1]		1	4				
- total device SITRANS TF according to FM (XP, DIP, NI, S) [1]		1	5				
• SITRANS TK-H, communication capability according to HART V 5.x							
- without Ex protection		2	0				
- with EEx ia		2	1				
- total device SITRANS TF EEx d [1]		2	4				
- total device SITRANS TF according to FM (XP, DIP, NI, S) [1]		2	5				
SITRANS TF field indicator	**7 N G 3 1 3 - ■ ■ ■ ■ ■**						
with instruction manual							
• without Ex protection		0	0	1			
• with EEx ia		0	1	1			
• total device SITRANS TF EEx d [1]		0	4	1			
• total device SITRANS TF according to FM (XP, DIP, NI, S) [1]		0	5	1			
Housing							
• die-cast aluminium					A		
• stainless steel precision casting					E		
Connections/cable inlet							
• screwed glands M20x1.5						B	
• screwed gland s 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	Order code
Please add "-**Z**" to Order No. and specify Order code(s) and plain text.	
Inscription on measuring-point label	
• measuring range (max. 27 characters)	**Y 2 2**
• meas. point description (max. 16 char.)	**Y 2 3**
• measuring-point text (max. 27 charac.)	**Y 2 4**
Customer-specific setting of operating data	**Y 0 1**

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

[1] Without cable gland.

Accessories	Order No.
SIPROM TK parameterization software for SITRANS TK German/English/French	► 7NG3190-8KB
Modem for SITRANS TK	► 7NG3190-6KB
Instruction Manual SITRANS TF German/English (included in delivery)	A5E00046014
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)
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

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

► Available ex stock.

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

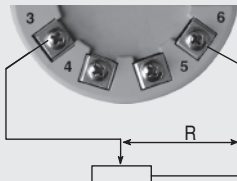[1] Upgrading of devices with Ex protection is not possible
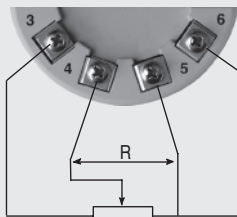
3

Schematics
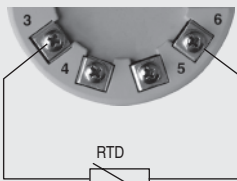
Potentiometer

No compensation[1])
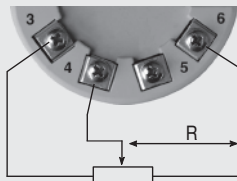
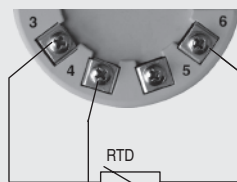Three-wire compensation for transfer resistance[2])

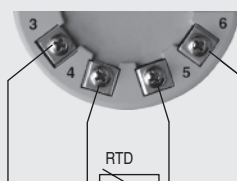Four-wire compensation for line and transfer resistance[2])
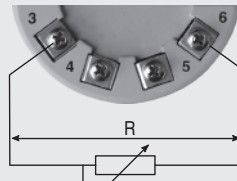
Resistance-thermometer

No line compensation[1])
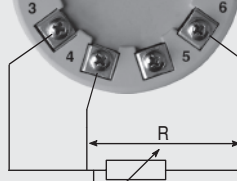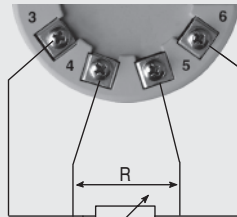
Three-wire line compensation

Four-wire line compensation
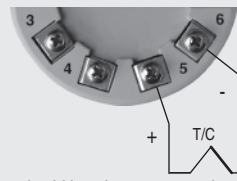
Resistance
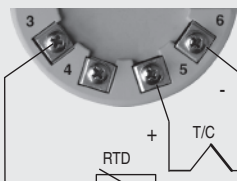
No compensation[1])
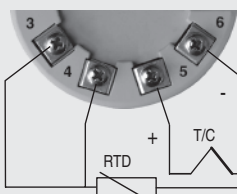
Three-wire line compensation

Four-wire line compensation

Thermo couple

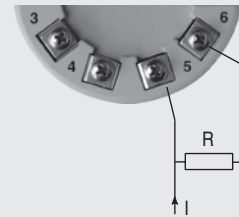Internal cold junction compensation (CJC)

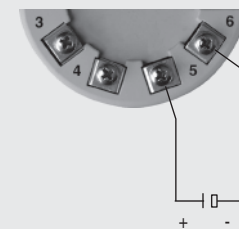External CJC
No line compensation[1])

External CJC
Three-wire line compensation

Current measurement

Voltage measurement

Note:
Line resistance (per wire in the case of 3 or 4-wire connections)
T > 600 °C (> 1112 °F): max. 10 Ω
T < 600 °C (< 1112 °F): max. 30 Ω

[1]) Line resistance for compensation is programmable.
[2]) Resistance between start of resistance and sliding contact.

Sensor connection assignment