SITRANS T
measuring instruments for temperature

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You can download all instructions, catalogs and certificates for SITRANS T free of charge at the following Internet address:
www.siemens.com/sitranst

Product overview

Overview

	Application	Mounting of transmitter with Ex protection		Page	Software for parameterization
Two-wire system					
	**SITRANS TH100** Transmitters for Pt100 • Mounting in sensor head	Zone 2, zone 1	Zone 2, zone 1, zone 0	3/8	SIPROM T
	**SITRANS TH200/TH300** Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.1 V • Mounting in sensor head	Zone 2, zone 1	Zone 2, zone 1, zone 0	3/11	SIPROM T for SITRANS TH200, SIMATIC PDM for SITRANS TH300
	**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	3/17	Depends on mounted transmitter TK/TK-H
	**SITRANS TF2** • Transmitter with LCD display and mounted Pt100	-	-	3/22	Local programming using keys
PROFIBUS PA system					
	**SITRANS T3K PA** Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.1 V • Mounting in sensor head	Zone 1	Zone 1, zone 0	3/3	SIMATIC PDM

Overview

The bus-capable transmitter with Profibus PA interface in accordance with profile 3

You can use this bus-capable device with PROFIBUS PA interface in all branches and integrate it (like the SITRANS TK / TK-H) in keeping with the Totally Integrated Automation concept.

SITRANS T3K PA converts signals from resistance thermometers, resistance-based sensors, thermocouples and voltage sensors into digital signals. The measured value from the microprocessor is then made available with status as a quality specification and other parameters electrically isolated on PROFIBUS PA. Sensor, limit values, failure response etc. can be programmed. SITRANS T3K PA thus provides you with various diagnosis and simulation options.

Great safety

The current consumption amounts to less than 11 mA. For safety, the bus current is limited in the event of an error to less than 14 mA, and an EMC filter prevents malfunctions in the case of electromagnetic interference. Intrinsically safe versions are available for this device too. EEx ia and EEx ib.

Fast and error-free parameterization

SITRANS T3K PA fits in the connection head type B with raised cover. Parameterization is performed with the user-friendly software package SIMATIC PDM.

Application

The SITRANS T3K PA temperature transmitter can be used in all branches. The following sensors/signal sources can be connected via its universal input module:

- Resistance thermometer
- Thermocouple
- Resistance-based sensors/potentiometers
- DC voltage sources.

The useful data are provided on PROFIBUS PA.

SITRANS T3K PA with the "Non-incendive" type of protection can be mounted within potentially explosive atmospheres (zone 2).

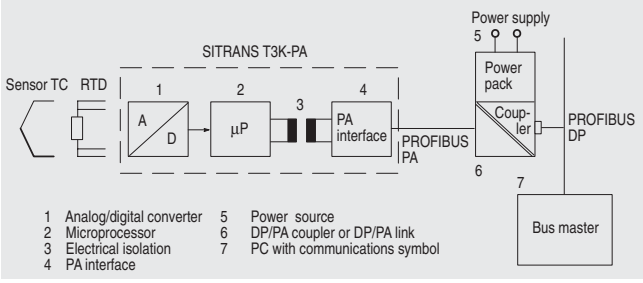
SITRANS T3K PA with the "Intrinsically safe" type of protection can be mounted within potentially explosive atmospheres (zone 1) and used for feeding sensors in zone 0. The conformity declarations comply with the European standard (ATEX) or with the American standard (FM).

Function

Features

- Temperature transmitters with bus connection according to DIN 61158-2 and EN 50170, part 4
- Data transmission and transmitter supply via common bus link
- Assembly in connection head type B (or larger, DIN 43729) with raised cover
- Can communicate via PROFIBUS PA (profile B, version 3.0); sensor, measuring range and much more can therefore be programmed .
- Quality data for the measured values: Status and limit values
- Fixed bus current limiting in the event of an error
- Electrical isolation (test voltage 500 V AC)
- Intrinsically safe version for use in potentially explosive areas

Mode of operation

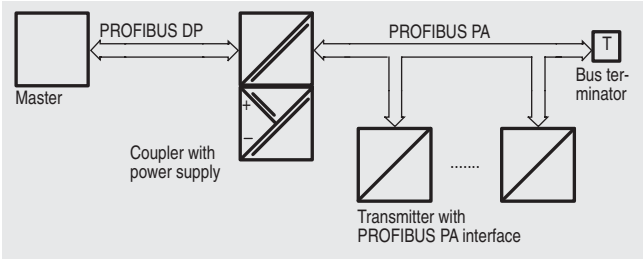


The signal supplied by a resistance-based sensor (two, three or four-wire circuit) or thermocouple element is amplified in the input stage. The voltage proportional to the input variable is then converted into digital signals by the analog/digital converter (1). The microprocessor (2) converts the digital signals in accordance with the sensor characteristic. Furthermore, the microprocessor interprets the bus commands, initiates device-internal actions and provides electrically-isolated (3) measured values, status and device data on the bus.

Integrated device protection functions:

- Electrical current limiting:
  avoids bus overloading in the event of a fault. the data traffic of the other, correctly operating nodes is maintained.
- Reverse polarity protection:
  allows the bus lines to be connected as required
- EMC filter:
  Prevents malfunctions in the case of electromagnetic interference

Parameterization



Communication via PROFIBUS PA interface

The parameterization of SITRANS T3K PA is performed by a master with the help of signals which are transmitted through PROFIBUS DP. These signals are converted by a SIMATIC DP/PA coupler with power supply (5, 6) into a signal for PROFIBUS PA. A bus terminator is required for cable lengths over 2 m. SIMATIC PDM is preferably used as parameterization software.

SITRANS T3K PA with PROFIBUS PA connection

Technical specifications

Input	
Selectable filters to suppress the line frequency	Selectable for 50/60 Hz (also 10 Hz for special applications)
Resistance thermometer	
Measured variable	Temperature
Measured range	Depending on type of connected sensor (defined sensor range)
Sensor type	
• Acc. to DIN IEC 751, DIN 43760, JIS C 1604-97, BS 1904	Pt10, Pt50, Pt100, Pt200, Pt1000
• Acc. to JIS C 1604-81	Pt10, Pt50, Pt100
• Acc. to DIN 43760	Ni50, Ni100, Ni120, Ni1000
Voltage measurement	Temperature-linear
Type of connection	Standard (logic channel 1), generation of average value or difference (of 2 channels)
Sensor current	≤ 0.55 mA
Resistance-based sensors	
Measured variable	Ohmic impedance
Measured range	9 resistance measuring ranges can be selected: • 0 ... 24 Ω • 0 ... 47 Ω • 0 ... 94 Ω • 0 ... 188 Ω • 0 ... 375 Ω • 0 ... 750 Ω • 0 ... 1500 Ω • 0 ... 3000 Ω • 0 ... 6000 Ω
Sensor type	Linear: 1 resistance-based senor in two, three or four-wire circuit
Voltage measurement	Resistance-linear
Type of connection	Standard (logic channel 1), generation of average value or difference (of 2 channels)
Sensor current	≤ 0.55 mA
Thermocouple elements	
Measured variable	Temperature
Measured range	Depending on type of connected sensor (defined sensor range)
Sensor type	Thermocouples • Type B: Pt30Rh-Pt6Rh (DIN IEC 584) • Type C: W5-Re (ASTM 988) • Type D: W3-Re (ASTM 988) • Type E: NiCr-CuNi (DIN IEC 584) • Type J: Fe-CuNi (DIN IEC 584) • Type K: NiCr-Ni (DIN IEC 584) • Type L: Fe-CuNi (DIN 43710) • Type N: NiCrSi-NiSi (DIN IEC 584) • Type R: Pt13Rh-Pt (DIN IEC 584) • Type S: Pt10Rh-Pt (DIN IEC 584) • Type T: Cu-CuNi (DIN 43710) • Type U: Cu-CuNi (DIN 43710)
Voltage measurement	Temperature-linear
Type of connection	Standard with 1 thermocouple with cold junction compensation (logic channel 1) or generation of difference or average value
Cold junction compensation	Type specification for • No compensation (2 channels) • Internal acquisition with integrated or external sensor: a manufacturer-specific PA parameter must be set for the "external sensor" case (default value: internal sensor) • Externally specified cold junction temperature can be set as a fixed value
mV Sensor	
Measured variable	DC voltage
Measured range	7 voltage measuring ranges can be selected: • - 1 ... +16 mV • -3 ... +32 mV • -7 ... +65 mV • -15 ... +131 mV • -31 ... +262 mV • -63 ... +525 mV • -120 ... +1000 mV
Sensor type	Linear
Voltage measurement	Voltage-linear
Type of connection	Normal connection with 1 mV sensor (logic channel 1)
Overload capacity of the input	max. 3.5 mV
Input resistance	≥ 1 MΩ
Sensor current	180 µA
Output	Digital bus signal
Bus voltage	• 9 ... 32 V (without Ex protection) • 9 ... 24 V for intrinsically safe operation (see Ex certificate) Active internal inductance L_i < 10 nH (acc. to FISCO model) Active internal capacitance C_i < 5 nF (acc. to FISCO model)
Communication	
• C2 connections	Four connections to master class 2 are supported; automatic connection setup 60 s after break in communication; response time to mater message typ. 10 ms
• Device profile	PROFIBUS PA profile B, version 3.0, more than 200 parameters
• Device address	126 when delivered
Temperature units	°C, °K, °F, °R parameterizable (°R (Rankine) = absolute °F)
Measuring accuracy	
Influencing effects	
• Error in the internal cold junction	< 0.25 °C (0.45 °F) ± 0.1%/10 °C (18 °F)
• Temperature drift	± 0.05%/10 °C (18 °F) FSR, 0.1% between -10 and +60 °C (14 and 140 °F)
• Influence of the power supply on the span	< 0.005%/V FSR
• Long-term drift	< 0.1%/year

• Measurement error	More information can be found in the table "Measurement error"
Rated conditions	
Ambient conditions	
Permitted temperatures	
• Ambient temperature	
- at T4	-40 to +85 °C (-40 to +185 °F)
- With intrinsically-safe operation (T6)	-40 to +60 °C (-40 to +140 °F)
• Storage temperature	-40 to +95 °C (-40 to +203 °F)
Relative humidity	≤ 98%, with condensation
Electromagnetic compatibility	According to EN 61326 and NAMUR NE21
Design	
Weight	250 g (0.55 lb)
Dimensions	see "Dimension drawings"
Enclosure material	Plastic PA6 (polyam., molded GF 20)
Electrical connection	Plug-in screw terminal, max. 2.5 mm^2 (0.01 $inch^2$)
Power supply	
Supply voltage	Bus infeed 9 to 32 V (9 to 24 for Ex version)
Current consumption of device	11 mA
Max. excess current in the event of a fault	$I_{max} \leq 3$ mA
Electrical isolation	Input and output are electrically isolated
Test voltage	500 V AC, 50 Hz, 1 min.
Certificate and approvals	
ATEX	
• "Intrinsic. safe" type of protection	II (1) 2G EEx ia IIB/IIC T4/T5/T6 II (1) 2G EEx ib IIB/IIC T4/T5/T6
• EC-Type Examination Certificate	ZELM 99 ATEX 0001
FM	
• Explosion protection to FM	IS/I/1/ABCD/T6, I/O/ AEx ia /IIC/T6, NI/I/2/ABCD/T6

Factory setting:

- Pt100 (IEC 751) with three-wire circuit
- PROFIBUS address: 126

Measurement error

Resistance thermometer

Input	Measured range	Max. parameterizable line resistance	Measurement error
	°C (°F)	Ω	°C (°F)
IEC 751, DIN 43760, JIS C 1604-97, MS 1904			
• Pt10 DIN-IEC	-200 ... +850 (-328 ... +1562)	2.35	1.5 (2.7)
• Pt50 DIN-IEC	-200 ... +850 (-328 ... +1562)	9.4	0.3 (0.54)
• Pt100 DIN-IEC	-200 ... +850 (-328 ... +1562)	18.75	0.15 (0.27)
• Pt200 DIN-IEC	-200 ... +850 (-328 ... +1562)	37.5	0.3 (0.54)
• Pt500 DIN-IEC	-200 ... +850 (-328 ... +1562)	37.5	0.5 (0.9)
• Pt1000 DIN-IEC	-200 ... +850 (-328 ... +1562)	300	0.5 (0.9)
JIS C 1604-81			
• Pt10	-200 ... +649 (-328 ... +1200)	2.35	1.5 (2.7)
• Pt50	-200 ... +649 (-328 ... +1200)	9.4	0.3 (0.54)
• Pt100	-200 ... +649 (-328 ... +1200)	18.75	0.15 (0.27)
DIN 43 760			
• Ni50	-60 ... +250 (-76 ... +482)	9.4	0.15 (0.27)
• Ni100	-60 ... +250 (-76 ... +482)	18.75	0.15 (0.27)
• Ni120	-60 ... +250 (-76 ... +482)	18.75	0.15 (0.27)
• Ni1000	-60 ... +250 (-76 ... +482)	150	0.15 (0.27)

Resistance-based sensors

Input	Measured range	Max. parameterizable line resistance	Measurement error
	Ω	Ω	Ω
Resistance	0 ... 24	1.2	0.04
	0 ... 47	2.35	0.03
	0 ... 94	4.7	0.03
	0 ... 188	9.4	0.04
	0 ... 375	18.75	0.05
	0 ... 750	37.5	0.1
	0 ... 1500	75	0.7
	0 ... 3000	150	0.4
	0 ... 6000	300	1.2

Thermocouple elements

Input	Measured range		Measurement error [1]	
	°C	(°F)	°C	(°F)
Type B	100 ... +1820	(+212 ... +3308)	3	(5.4)
Type C	0 ... +2300	(+32 ... +4172)	2	(3.6)
Type D	0 ... +2300	(+32 ... +4172)	1	(1.8)
Type E	-200 ... +1000	(-328 ... +1832)	1	(1.8)
Type J	-210 ... +800	(-346 ... +1472)	1	(1.8)
Type K	-200 ... +1372	(-328 ... +2502)	1	(1.8)
Type L	-200 ... +900	(-328 ... +1652)	2	(3.6)
Type N	-200 ... +1300	(-328 ... +2372)	1	(1.8)
Type R	-50 ... +1760	(-58 ... +3200)	2	(3.6)
Type S	-50 ... +1760	(-58 ... +3200)	2	(3.6)
Type T	-200 ... +400	(-328 ... +752)	1	(1.8)
Type U	-200 ... +600	(-328 ... +1112)	2	(3.6)

[1] Specified accuracy value refers to the largest error of the total measuring range.

SITRANS T transmitters for mounting in sensor head

SITRANS T3K PA with PROFIBUS PA connection

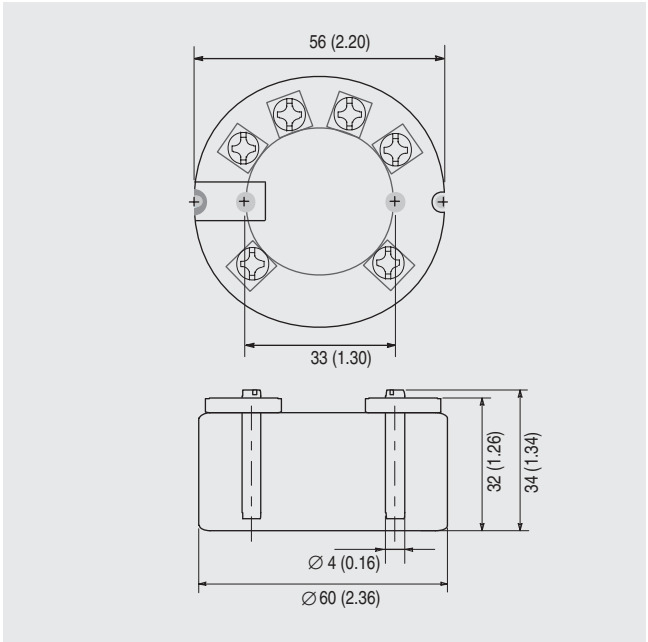
Voltage/current sources

Input	Measuring range	Measurement error
	mV	µV
mV Sensor	-1 ... +16	10
	-3 ... +32	10
	-7 ... +65	10
	-15 ... +131	25
	-31 ... +262	50
	-63 ... +525	100
	-120 ... +1000	150

Selection and Ordering data		Order No.
Temperature transmitter SITRANS T3K PA with PROFIBUS PA for installation in the sensor head, with electrical isolation (order instruction manual separately).		
• without explosion protection	►	**7NG3213-0NN00**
• with explosion protection EEx ia/ib (ATEX)	►	**7NG3213-1NN00**
• with explosion protection (FM) intrinsic safety	►	**7NG3213-3NN00**
Further designs Please add "**-Z**" to Order No. and specify Order code(s) and plain text.		Order code
• Customer-specific setting of operating data		**Y01**
Accessories		Order No.
Instruction manual for SITRANS T3K PA (German/English)	►	**C79000-B7174-C55**
DIN rail adapter for head mouted transmitters (set of 5 pcs.)	►	**7NG3092-8KA**
SIMATIC PDM operating software		**see chapter 9**
for additional PA components		**see catalog IK PI**

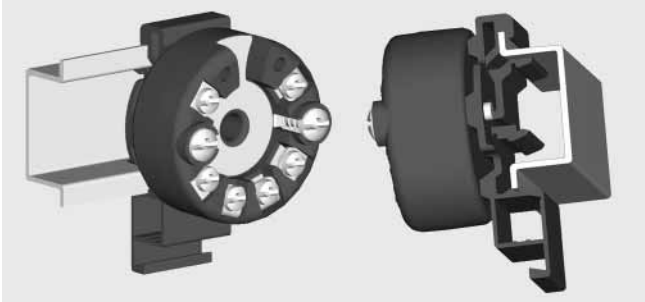
► Available ex stock.

Dimensional drawings

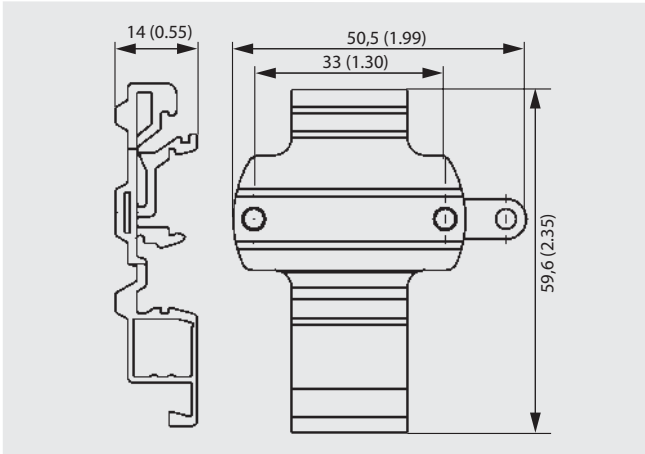


SITRANS T3K PA, dimensions in mm (inches)

Mounting on DIN rail

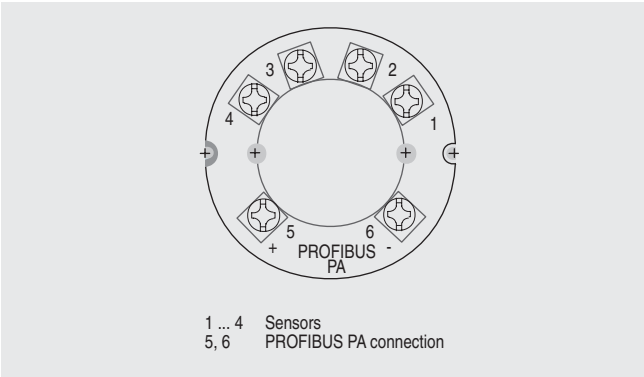


Mounting of transmitter on DIN rail, schematic diagram



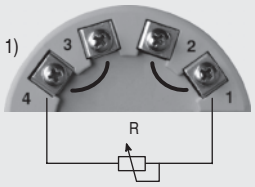
DIN rail adaptor, dimensions in mm (inch)

Schematics

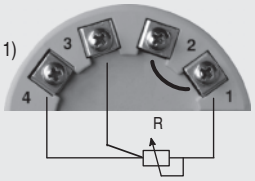


Connection diagram

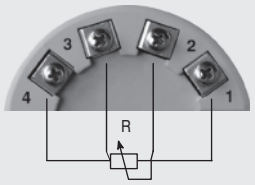
Resistance



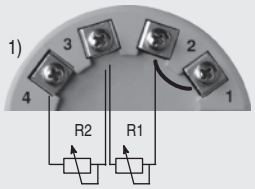
Two-wire circuit: resistor can be programmed for line compensation



Three-wire circuit

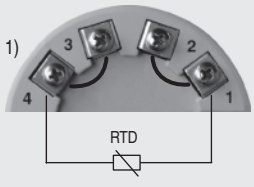


Four-wire circuit

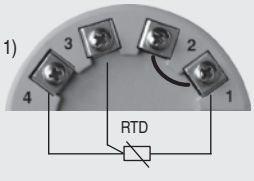


Difference/average value circuit: 2 resistors can be programmed for line compensation

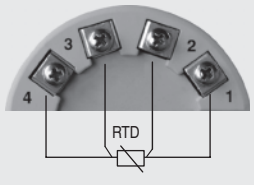
Resistance thermometer



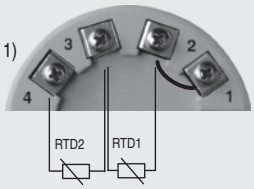
Two-wire circuit: resistor can be programmed for line compensation



Three-wire circuit

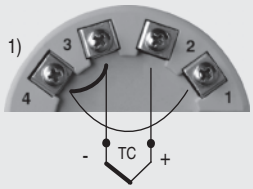


Four-wire circuit

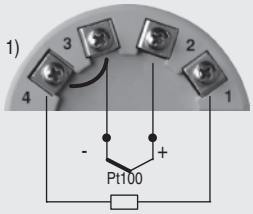


Difference/average value circuit 2 resistors can be programmed for line compensation

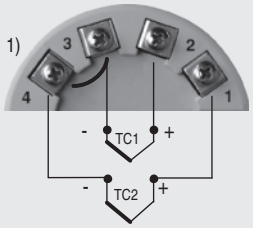
Thermocouple



Determination of cold junction temperature with built-in Pt100 or external reference temperature

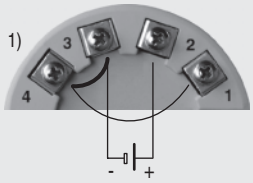


Determination of cold junction temperature with external Pt100 resistor can be programmed for line compensation



Difference/average value circuit with internal cold junction temperature

mV sensor



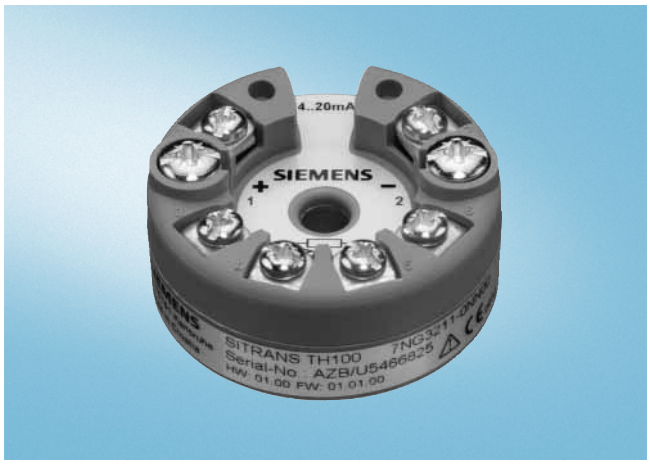
Two-wire circuit

1) **Important !**
Fit short-circuit jumpers on site.

Sensor connection assignment

SITRANS TH100, two-wire system (Pt100)

Overview



The SITRANS TH100 without electrical isolation and without universal sensor connection provides 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.

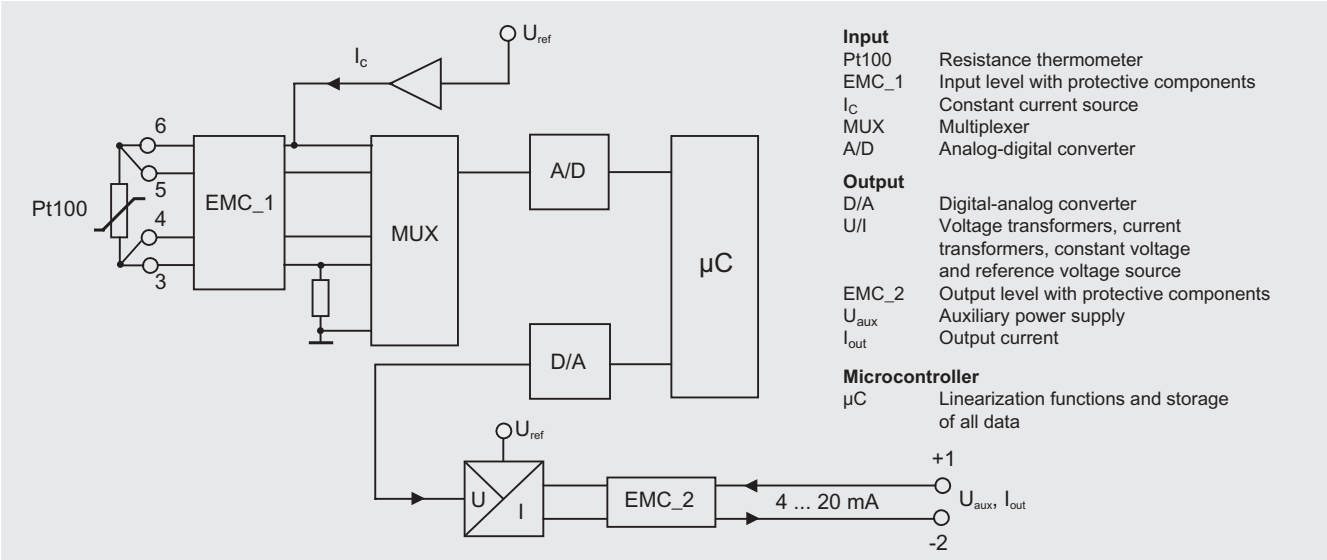
Function

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.



SITRANS TH100, function diagram

SITRANS TH100, two-wire system (Pt100)

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

Construction

Approx. weight	50 g
Dimensions	See dimension drawing
Material	Molded plastic
Cross-section of cables	Max. 2.5 mm^2 (AWG 13)
Degree of protection to EN 60529	
• Enclosure	IP40
• Terminals	IP00

Certificate and approvals

Explosion protection ATEX	
• Intrinsically-safe" type of protection	II 1G EEx ia IIC T6/T4 II 2(1)G EEx ia/ib IIC T6/T4
• „Operating equipment that is non-ignitable and has limited energy“ type of protection	II 3G EEx nAL IIC T6/T4
- EC type test certificate	PTB 05 ATEX 2049X
Explosion protection to FM for USA and Canada (cFM_{US})	
• FM approval	PID 3024169
• Degree of protection	IS Cl I, II, III, Div 1, GP ABCDEFG T4/T5/T6 IS Cl I, ZN 0, 1 AEx ia IIC T4/T5/T6 NI Cl I, II, III, Div 2, GP ABCDFG T4/T5/T6 Cl I, ZN 2, GP IIC T4/T5/T6

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.

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

Selection and Ordering data

	Order-No.
SITRANS TH100 temperature transmitters for Pt100 For installation in the connection head, Type B (DIN 43729) Two-wire system 4 ... 20 mA, programmable, without electrical isolation	
• Not explosion-proof ►	**7NG3211-0NN00**
• With explosion protection, "Intrinsic safety" and for zone 2	
- to ATEX ►	**7NG3211-0AN00**
- to FM (cFM_{US}) ►	**7NG3211-0BN00**
Further designs Please add "-Z" to Order No. and specify Order code(s)	Order code
Customer-defined operating data	**Y01**
Test protocol (5 measuring points)	**C11**
Accessories	Order-No.
Modem for SITRANS TH100 and TH200 incl. SIPROM T parameterization software	
• with USB connection ►	**7NG3092-8KU**
• with RS 232 connection ►	**7NG3092-8KM**
CD for measuring instruments for temperature ► With documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software	**A5E00364512**
DIN rail adapters for head transmitters ► (Quantity delivered: 5 units)	**7NG3092-8KA**

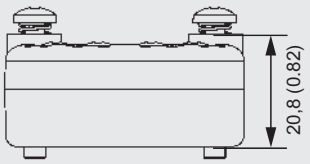
► Available ex stock.

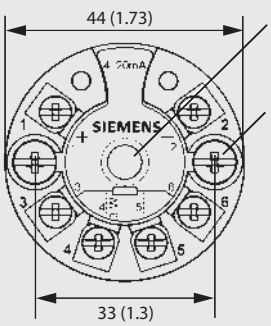
Power supply units see "SITRANS I supply units and input isolators".

3

SITRANS TH100, two-wire system (Pt100)

Dimensional drawings

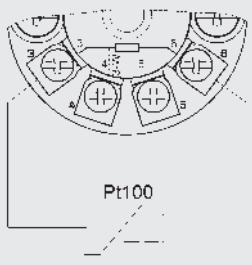




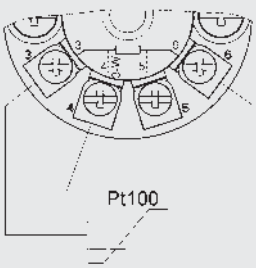
1(+) and 2(-) Auxiliary power supply U_{aux}, output current I_{Out}
3, 4, 5 and 6 Pt100 sensor (for connection, see Sensor connection assignment)

SITRANS TH100, dimensions in mm (inch)

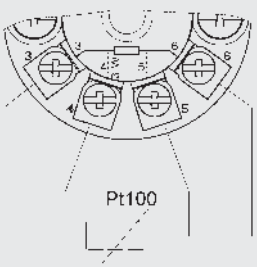
Schematics



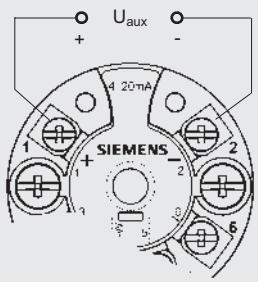
Two-wire system (parameterizable line resistance)



Three-wire system



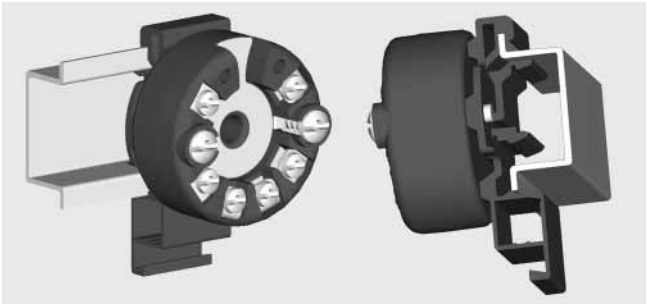
Four-wire system



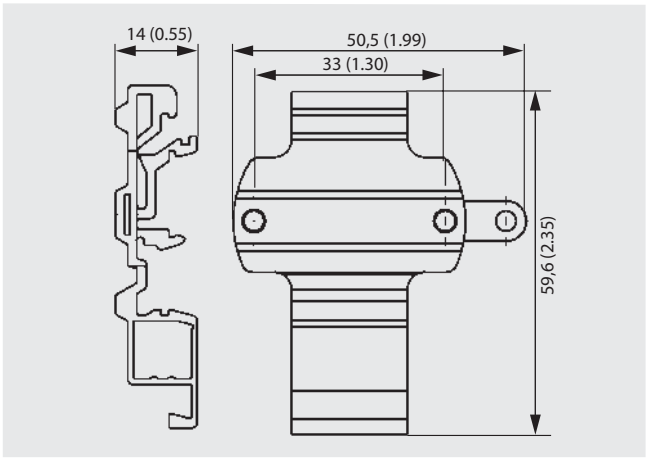
Connection of auxiliary power supply (U_{aux})

SITRANS TH100, sensor connection assignment

Mounting on DIN rail



SITRANS TH100, mounting of transmitter on DIN rail



DIN rail adaptor, dimensions in mm (inch)

Overview

The smart solution - The transmitter SITRANS TH300 with the same capabilities as a SITRANS TH200 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.

Benefits

- Two-wire transmitter
- Assembly in connection head type B (DIN 43729) or larger, or on a standard DIN rail
- Communication-capable (HART protocol rev. 5.9 for SITRANS TH300, proprietary protocol for SITRANS TH200); this enables programming of sensor connection, measuring range, etc.
- Electrically isolated
- Intrinsically-safe version for use in potentially explosive areas
- Two additional test pins for connection of a multimeter support the measurement of the current signal without interrupting the current loop
- Operational status indication (LED green or red)
- Special characteristic
- Diagnostic functions with SITRANS TH300 (slave pointer, operating hours counter, simulation)

Application

The SITRANS TH200 and SITRANS TH300 transmitters can be used in all industries. 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 thermometer
- Thermocouple elements
- Resistance-based sensors/potentiometers
- DC voltage sources

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

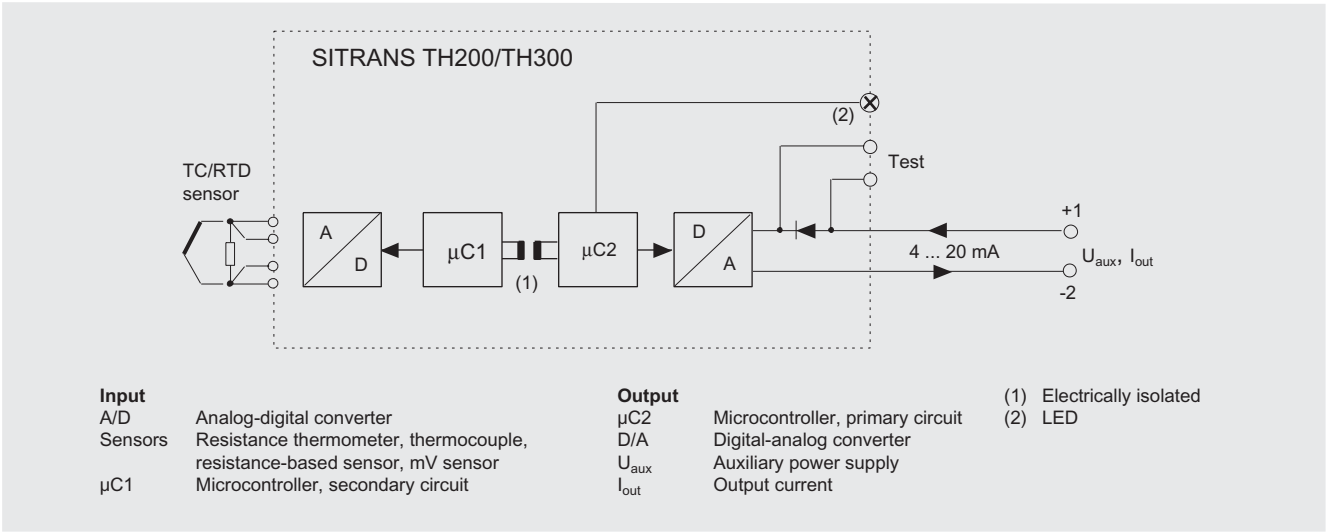
Transmitters of the "Intrinsically-safe" type of protection can be installed within potentially explosive atmospheres (zone 0). The declarations of conformity comply with the IEC standard.

Function

Mode of operation

The signal output by a resistance-based sensor (two-wire, three-wire or four-wire system) or thermocouple is converted into a digital signal by an analog-to-digital converter. This is then evaluated in a microcontroller (C1), corrected in accordance with the sensor characteristic and transmitted to the microcontroller (C2) over the electrical isolation. There, the analog output value is calculated, the function status is determined over LED, and the communication data are preprocessed Over a digital/analog converter, the measured value is then converted to an output current of 4 to 20 mA. The power supply is located in the output signal circuit.

The SITRANS TH200 and SITRANS TH300 are parameterized and operated using a PC, which is connected to the two-wire system over a suitable interface module (SIPROM T modem or HART modem). A hand-held communicator can also be used to parameterize the SITRANS TH300. The signals required for communication according to the HART protocol rev. 5.9 are superimposed on the current signal in accordance with the FSK method (Frequency Shift Keying). The data specific to the transmitter and the data for parameterization are stored in two non-volatile memories (EEPROM).



Function diagram for SITRANS TH200 and SITRANS TH300

SITRANS TH200/TH300, two-wire system

3

Technical specifications

Input

Resistance thermometer

Measured variable	Temperature
Sensor type	
• to IEC 60751	Pt25 ... Pt1000
• to JIS C 1604; a=0.00392 K-1	Pt25 ... Pt1000
• to IEC 60751	Ni25 ... 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 (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45mA
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 (see table "Digital measuring errors")
Min. measured span	10 °C (18 °F)
Characteristic	Temperature-linear or special characteristic

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 thermometers in 2-wire system (R1 - R2 or R2 - R1)
Interface	
• Two-wire system	Parameterizable line resistance 100 (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45mA
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 Ω ... 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
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
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
Range	Parameterizable (see table "Digital measuring errors")
Min. measured span	Min. 50 ... 100 °C (90 ... 180 °F) (see table "Digital measuring errors")
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)
Range	-10 ... 70 mV -100 1100 mV
Min. measured span	2 mV or 20 mV

Overload capacity of the input	-1.5 ... +3.5 V DC
Input resistance	≥ 1 MΩ
Characteristic	Voltage-linear or special characteristic

Output

Output signal	4 ... 20 mA, 2-wire
	With SITRANS TH300, additional communication acc. to HART Rev. 5.9
Power supply	11 ... 35 V DC (to 30 V with EEx)
Max. load	$(U_{aux}$ - 11 V)/0.023 A
Overrange	3.6 ... 23 mA, continuously adjustable (default range: 3.84 mA ... 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 kV_{eff})

Measuring accuracy

Digital measuring errors	See Table "Digital measuring errors"
Reference conditions	
• Power supply	24 V ± 1%
• Load	500
• Storage temperature	23 °C
• Warming-up time	> 5 min
Error in the analog ouput (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

Rated conditions

Ambient temperature	
Storage temperature	-40 ... +85 °C (-40 ... 185 °F)
Functional temperature	-40 ... +85 °C (-40 ... 185 °F)
Relative humidity	< 98%, with condensation
Electromagnetic compatibility	acc. to DIN EN 61326 and NE21

Construction

Material	Molded plastic
Approx. weight	50 g (0.11 lb)
Dimensions	See "Dimension drawings"
Cross-section of cables	Max. 2.5 mm^2 (AWG 13)
Degree of protection to EN 60529	
• Enclosure	IP40
• Terminals	IP00

Certificates and approvals

Explosion protection ATEX	
• "Intrinsically-safe" type of protection	II 1G EEx ia IIC T6/T4 II 2(1)G EEx ia/ib IIC T6/T4
• "Operating equipment that is non-ignitable and has limited energy" type of protection	II 3G EEx nAL IIC T6/T4
- EC type test certificate	PTB 05 ATEX 2040X
Explosion protection to FM for USA and Canada (cFMUS)	
• FM approval	PID 3024169
• Degree of protection	IS Cl I, II, III, Div 1, GP ABCDEFG T4/T5/T6 IS Cl I, ZN 0, 1 AEx ia IIC T4/T5/T6 NI Cl I, II, III, Div 2, GP ABCDFG T4/T5/T6 Cl I, ZN2, GP IIC T4/T5/T6

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

Input	Range	Min. measured span		Digital accuracy	
	°C/(°F)	°C	(°F)	°C	(°F)
To IEC 60751					
Pt25	-200 ... + 850 (-328 ... +1562)	10	(18)	0,2	(0.36)
Pt50	-200 ... + 850 (-328 ... +1562)	10	(18)	0,15	(0.27)
Pt100 ... Pt200	-200 ... + 850 (-328 ... +1562)	10	(18)	0,1	(0.18)
Pt500	-200 ... + 850 (-328 ... +1562)	10	(18)	0,15	(0.27)
Pt1000	-200 ... + 350 (-328 ... +662)	10	(18)	0,15	(0.27)
To JIS C1604-81					
Pt25	-200 ... + 649 (-328 ... +1200)	10	(18)	0,2	(0.36)
Pt50	-200 ... + 649 (-328 ... +1200)	10	(18)	0,15	(0.27)
Pt100 ... Pt200	-200 ... + 649 (-328 ... +1200)	10	(18)	0,1	(0.18)
Pt500	-200 ... + 649 (-328 ... +1200)	10	(18)	0,15	(0.27)
Pt1000	-200 ... + 350 (-328 ... +662)	10	(18)	0,15	(0.27)
Ni 25 ... Ni1000	-60 ... + 250 (-76 ... +482)	10	(18)	0,1	(0.18)

SITRANS T transmitters for mounting in sensor head

SITRANS TH200/TH300, two-wire system

Resistance-based sensors

Input	Range	Min. measured span	Digital accuracy
	Ω	Ω	Ω
Resistance	0 ... 390	5	0,05
Resistance	0 ... 2200	25	0,25

Thermocouple elements

Input	Range	Min. measured span		Digital accuracy	
	°C/(°F)	°C	(°F)	°C	(°F)
Type B	0 ... 1820 (32 ... 3308)	100	(180)	2	(5.4)
Type C (W5)	0 ... 2300 (32 ... 4172)	100	(180)	2	(3.6)
Type D (W3)	0 ... 2300 (32 ... 4172)	100	(180)	2	(3.6)
Type E	-200 ... +1000 (-328 ... +1832)	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	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.6)
Type S	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.6)
Type T	-200 ... +400 (-328 ... +752)	40	(72)	1	(1.8)
Type U	-200 ... +600 (-328 ... +1112)	50	(90)	2	(3.6)

mV Sensor

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

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

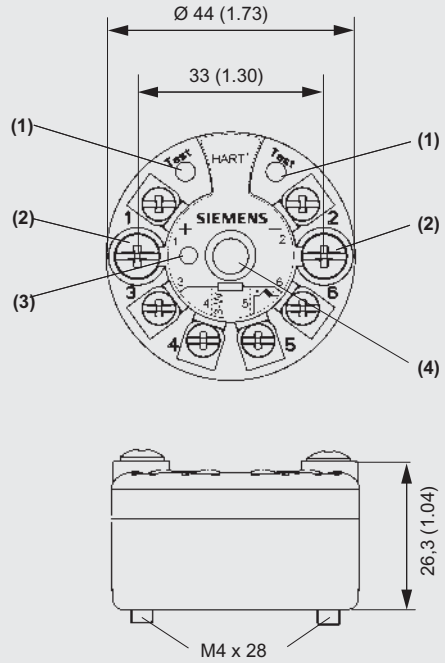
		Order No.
Temperature transmitter SITRANS TH200		
For installation in connection head, type B (DIN 43729) Two-wire system 4 ... 20 mA, programmable, with electrical isolation		
• Not explosion-proof	▶	**7NG3211-1NN00**
• With explosion protection, "Intrinsic safety" and zone 2		
- to ATEX	▶	**7NG3211-1AN00**
- to FM (cFM$_{US}$)	▶	**7NG3211-1BN00**
Temperature transmitter SITRANS TH300		
For installation in connection head, type B (DIN 43729) Two-wire system 4 ... 20 mA, communication-capable acc. to HART, with electrical isolation		
• Not explosion-proof	▶	**7NG3212-0NN00**
• With explosion protection; type of protection: "Intrinsic safety" and EEx n		
- to ATEX	▶	**7NG3212-0AN00**
- to FM (cFM$_{US}$)	▶	**7NG3212-0BN00**
Further designs		Order code
Please add "-Z" to Order No. and specify Order code(s)		
Customer-specific setting of operating data (specify operating data in plain text)		**Y01**
With test protocol (5 measuring points)		**C11**
Accessories		Order No.
Modem for SITRANS TH100 and TH200 incl. SIPROM T parameterization software		
• With USB connection	▶	**7NG3092-8KU**
• With RS 232 connection	▶	**7NG3092-8KM**
CD for measuring instruments for temperature	▶	**A5E00364512**
With documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software		
HART modem		
• With RS 232 connection	▶ D)	**7MF4997-1DA**
• With USB connection	▶ D)	**7MF4997-1DB**
SIMATIC PDM operating software		**See Chapter 9**
DIN rail adapters for head transmitters (Quantity delivered: 5 units)	▶	**7NG3092-8KA**

▶ Available ex stock.

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

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

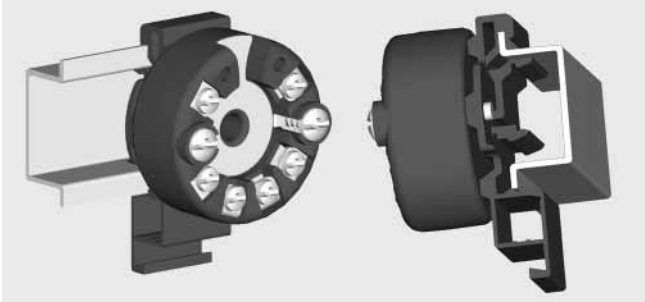
Dimensional drawings



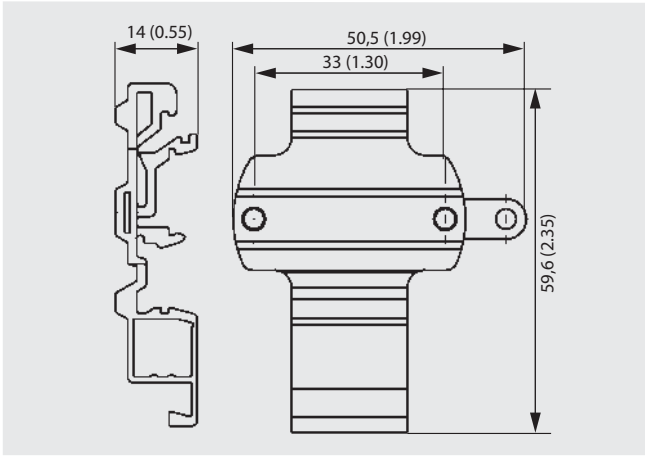
1(+) and 2(-)	Auxiliary power supply U_{aux}, output current I_{Out}
3, 4, 5 and 6	Pt100 sensor (for connections, see Sensor connection assignment)
Test (+), Test (-)	Measurement of the output current with a multimeter
(1)	Test terminal
(2)	Mounting screw M4x28
(3)	LED for operation indication
(4)	Internal diameter of center hole 6.3 (0.25)

SITRANS TH200/TH300, dimensions and pin assignment, dimensions in mm (inch)

Mounting on DIN rail



SITRANS TH200/TH300, mounting of transmitter on DIN rail

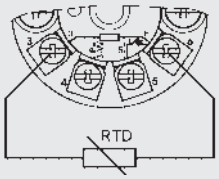


DIN rail adaptor, dimensions in mm (inch)

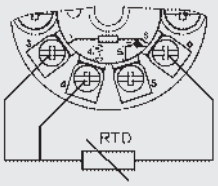
SITRANS TH200/TH300, two-wire system

Schematics

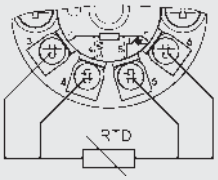
Resistance thermometer



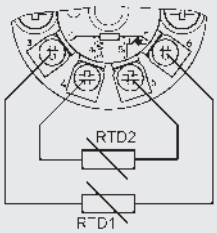
Two-wire system [1]



Three-wire system

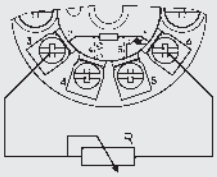


Four-wire system

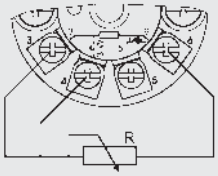


Generation of average value / difference [1]

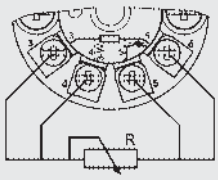
Resistance



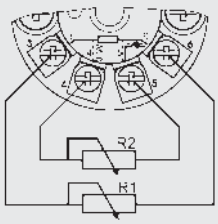
Two-wire system [1]



Three-wire system

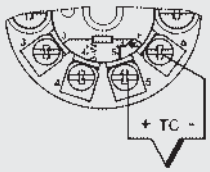


Four-wire system

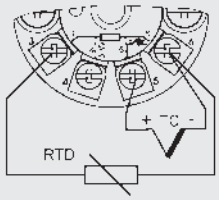


Generation of average value / difference [1]

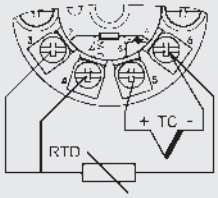
Thermocouple



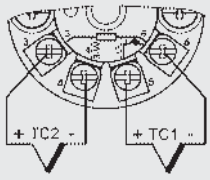
Cold junction compensation
Internal/fixed value



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



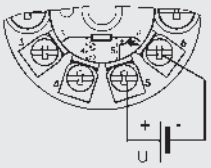
Cold junction compensation with external Pt100 in three-wire system



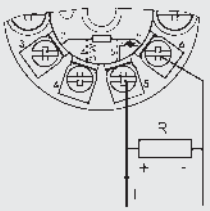
Generation of average value / difference with internal cold junction compensation

[1] Programmable line resistance for the purpose of correction.

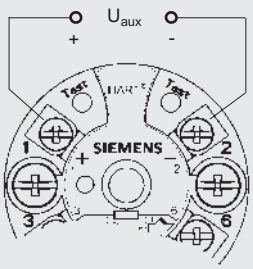
Voltage measurement



Current measurement



Connection of auxiliary power supply (U_{aux})



SITRANS TH200/TH300, sensor connection assignment

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).

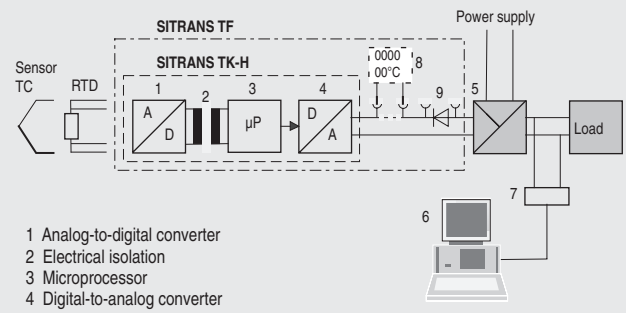
SITRANS TF temperature transmitters with "Non incendive" or "Flame-proof enclosure" type protection can be operated within potentially explosive atmospheres (zone 1).

Function

The communication capability via the HART protocol V 5.7 of the SITRANS 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



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

SITRANS T transmitter for field mounting / field indicator

SITRANS TF two-wire system

Thermocouple elements	
Measured variable	Temperature
Sensor type	
• Acc. to DIN IEC 584-1	Type B, E, J, K, N, R, S, T
• Acc. to DIN 43710	Type L, U
• 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 parameterization 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

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)

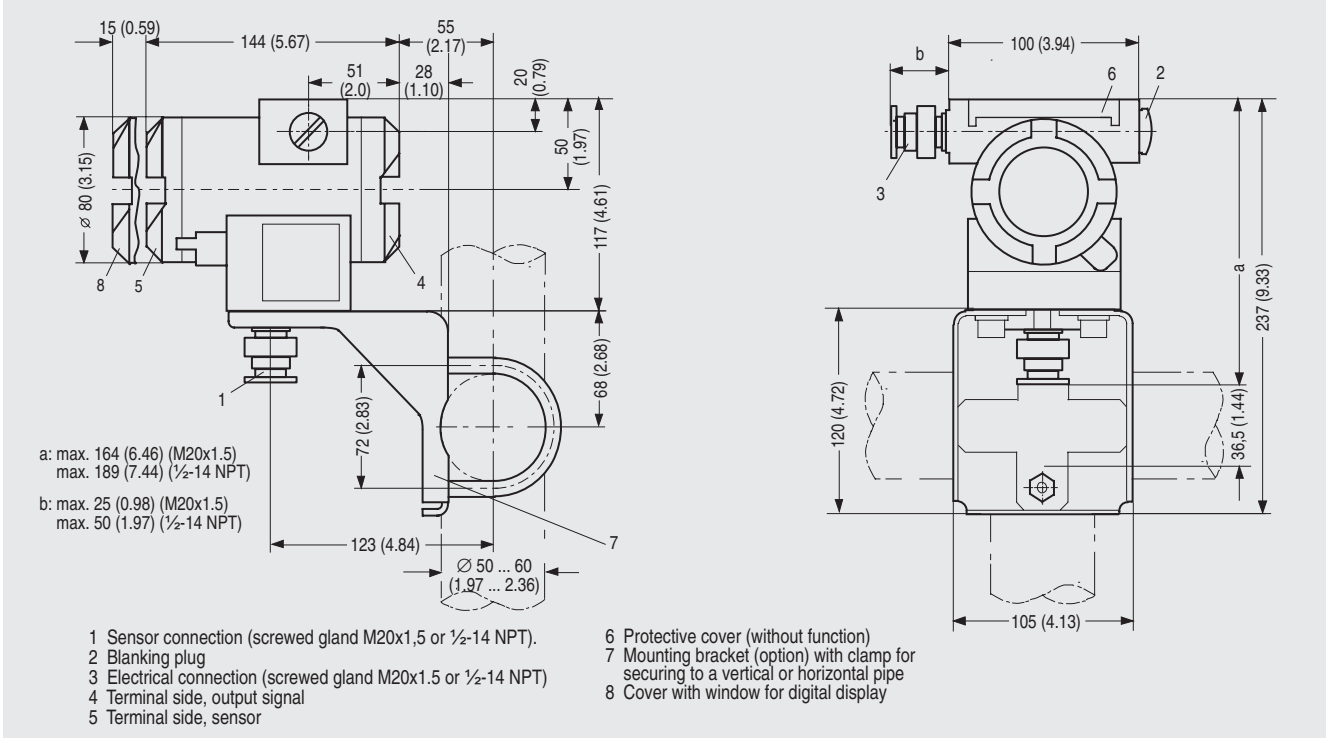
Voltage source

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)

Dimensional drawings



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 T transmitter for field mounting / field indicator

SITRANS TF
two-wire system

Selection and Ordering data	Order No.						
Temperature transmitter in field housing	**7NG313**	**-**					
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 with instruction manual	**7NG313**	**-**					
• 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)	**Y22**						
• meas. point description (max. 16 char.)	**Y23**						
• measuring-point text (max. 27 charac.)	**Y24**						
Customer-specific setting of operating data	**Y01**						

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

[1] Without cable gland.

Selection and Ordering data		Order No.
Accessories		
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	▶ D)	**7MF4997-1DA**
• with USB interface	▶ D)	**7MF4997-1DB**
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.

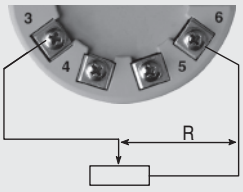
▶ Available ex stock.

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

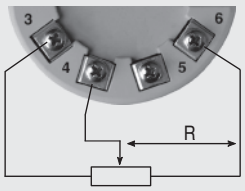
[1] Upgrading of devices with Ex protection is not possible

Schematics

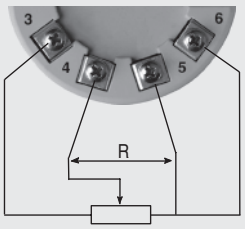
Potentiometer



No compensation[1])

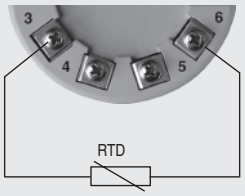


Three-wire compensation for transfer resistance[2])

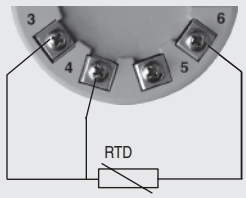


Four-wire compensation for line and transfer resistance[2])

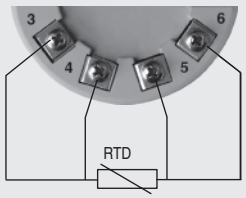
Resistance-thermometer



No line compensation[1])

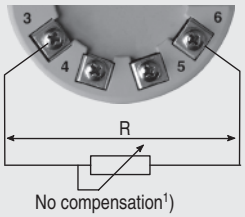


Three-wire line compensation

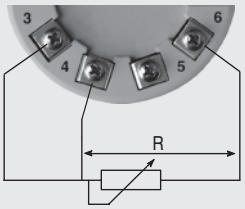


Four-wire line compensation

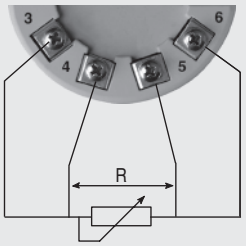
Resistance



No compensation[1])

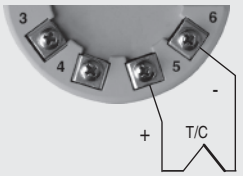


Three-wire line compensation

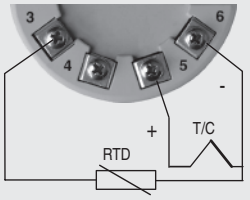


Four-wire line compensation

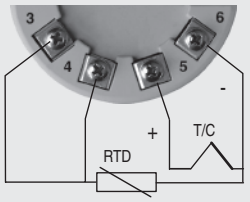
Thermo couple



Internal cold junction compensation (CJC)

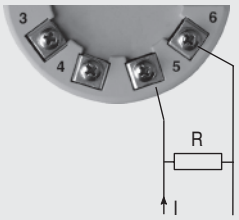


External CJC
No line compensation[1])

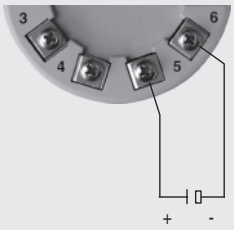


External CJC
Three-wire line compensation

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

SITRANS T transmitter for field mounting with temperature sensor

SITRANS TF2
two-wire system

Overview

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 keys 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 $^1/_{100}$ °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.

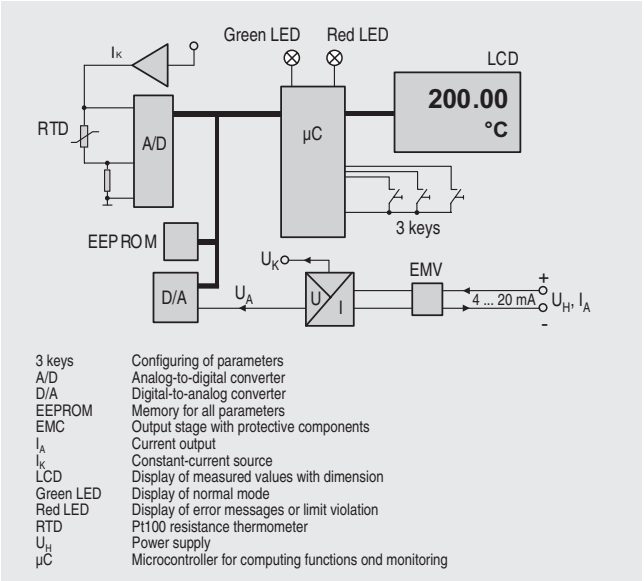
At the front of the housing is the 5-digit display behind a glass cover. Underneath the display are the 3 keys for parameterizing the SITRANS TF2. Above the display are a green and a red LED for indicating the operating status.

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



3 keys	Configuring of parameters
A/D	Analog-to-digital converter
D/A	Digital-to-analog converter
EEPROM	Memory for all parameters
EMC	Output stage with protective components
I_A	Current output
I_K	Constant-current source
LCD	Display of measured values with dimension
Green LED	Display of normal mode
Red LED	Display of error messages or limit violation
RTD	Pt100 resistance thermometer
U_H	Power supply
µC	Microcontroller for computing functions ond monitoring

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

The voltage drop is converted on the analog/digital converter (A/D) into a digital signal.

In the microcontroller (µC) 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_A (4 to 20 mA).

Display

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 input keys behind the glass cover underneath the display.

The key "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 keys 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

Measuring principle	
Resistance thermometer	Pt100 class B acc. to DIN IEC 751
Input	
Measured variable	Temperature
Max. measuring range	-50 °C ... +200 °C (-58 ... +392 °F)
Min. measured span	50 K (90 °F)
Output	
Output signal	4 ... 20 mA, 2-wire
Lower current limit	min. 3.6 mA
Upper current limit	max. 23 mA
Output protected against	reversed polarity, overvoltage and short-circuiting
max. load	$(U_H - 12\ V) / 0.023\ A$
Voltage measurement	Temperature-linear
Measuring accuracy	
Error in measurement at 23 °C ± 5 K (73.4 ± 9 °F)	< ± (0.45 K + 0.2% of full-scale value in K + 1 digit in K) (< ± (0.81 °F + 0.2% of full-scale value in °F + 1 digit in °F)
Measuring cycle time	≤ 100 ms
Temperature effect	< ± 0.15%/10 K (< ± 0.15%/18 °F)
Power supply effect	< ±0,01% of full-scale value / V
Vibration influence	< ±0.05%/g to 500 Hz in all directions (to IEC 68-2-64)

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 keys
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	
• Field housing	Diam. 80 mm (diam. 3.15 inch), stainless steel, mat. No. 1.4016
• Cover	Stainless steel, mat. No. 14016 with glass
Wetted parts materials	
• Protective tube	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)
• 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 to fit the ordered protective tube, stainless steel
Connection of display to the protective tube	radial (type A), can be swiveled by max. ±120° (α)
	axial (type B), can be swiveled by max. ± 360°
Length of the protective tube(U_1)	see Ordering data
Electrical connection	Using 2-pole plug connector made of plastic with M16x1.5-cable entry to EN 175301-803A or ½"-14 NPT
Power supply	
Terminal voltage on temperature transmitter (U_H)	12 ... 30 V DC
Operating limits	
Pressure	max. 40 bar (580 psi)

SITRANS T transmitter for field mounting with temperature sensor

SITRANS TF2
two-wire system

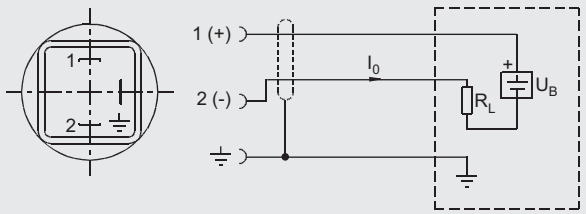
3

Selection and ordering data	Order No.	Order code
Temperature transmitter SITRANS TF2, field device Temperature transmitter with LCD in stainless steel housing, degree of protection IP65, stainless steel protective tube, resistance thermometer with Pt100 sensor, measuring range -50 ... +200 °C (-58 ... +392 °F), local parameterization, output signal 4 ... 20 mA	7NG3140-	
	0	
Display / cable entry		
▶ • Radial version (type A), parallel to protective tube / M16x1.5	1	
• Axial version (type B), at right angles to protective tube / M16x1.5	2	
• Radial version (type A), parallel to protective tube / ½"-NPT	3	
• Axial version (type B), at right angles to protective tube / ½"-NPT	4	
Process connection		
▶ • Connection shank G½B	A	
• Connection shank ½"-14 NPT	B	
• Other version (on request) add Order code and plain text: connection shank: ...	Z	J 1 Y
Length of the protective tube (U_1)		
▶ • 170 mm (6.70 inch)	A	
▶ • 260 mm (10.24 inch)	B	
• 4.5" (114 mm)	K	
• 7.5" (190 mm)	P	
• 10.5" (266 mm)	T	
• Other version (on request) add Order code and plain text: length: ...	Z	K 1 Y
Material of the protective tube		
▶ • Stainless steel (mat. No. 1.4571/316Ti)	0	
• Other version (on request) add Order code and plain text: mat. No.: ...	9	L 1 Y

▶ Available ex stock

Selection and ordering data	
Further design	Order code
Manufacturer's test certificate M to DIN 55340, Part 18 and ISO 8402 (calibration certificate), add "-Z" to Order No. and Order code.	**C11**
	Order No.
Manufacturer's test certificate M to DIN 55340, Part 18 and ISO 8402 (calibration certificate) supplied later, specify factory no. of transmitter.	**7MF1564-8CC11**
Additional data	Order code
Add „-Z" to Order No. and specify Order code and plain text	
Measuring range to be set Y01:	**Y01**

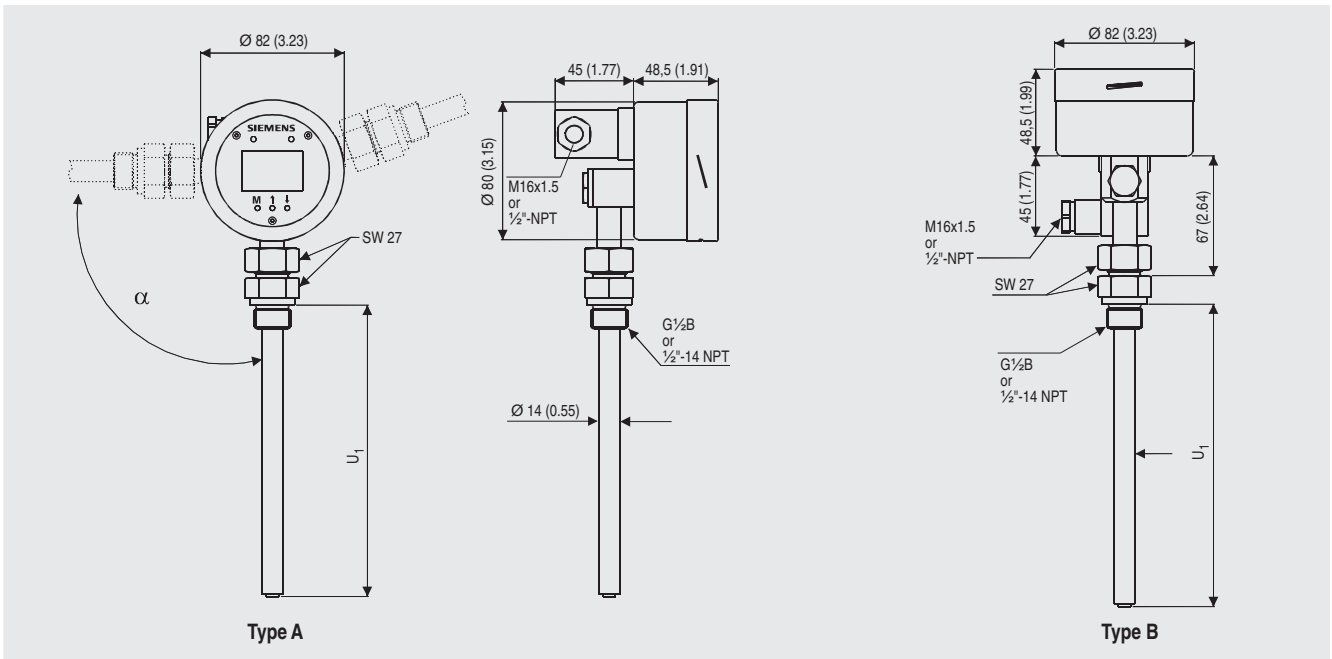
Schematics



U_B Power supply
R_L Load
I_0 Output current

SITRANS TF2, connection diagram

Dimensional drawings



SITRANS TF2, dimensions in mm (inches)