

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

SITRANS T Measuring instruments for temperature







Product overview

Overview

Application		Mounting of transmitter with Ex protection		Page	Software for parameterization
Transmitters for temperature for mounting in sensor heads					
		Transmitter	Sensor		
	SITRANS TH100 Transmitters for Pt100 <ul style="list-style-type: none">• Mounting in sensor head	Zone 2, zone 1	Zone 2, zone 1, zone 0	3/6	SIPROM T
	SITRANS TH200 Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.1 V <ul style="list-style-type: none">• Two-wire system• Universal	Zone 2, zone 1	Zone 2, zone 1, zone 0	3/9	SIPROM T
	SITRANS TH300 Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.1 V <ul style="list-style-type: none">• Two-wire system• Universal• HART	Zone 2, zone 1	Zone 2, zone 1, zone 0	3/15	SIMATIC PDM
	SITRANS TH400 Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 0.9 V <ul style="list-style-type: none">• Fieldbus transmitter• PROFIBUS PA• FOUNDATION Fieldbus	Zone 2, zone 1, zone 21	Zone 2, zone 1, zone 0, zone 21, zone 20	3/21	SIMATIC PDM for TH 400 with PROFIBUS PA
Transmitters for temperature for rail mounting					
	SITRANS TR200 Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.1 V <ul style="list-style-type: none">• Two-wire system• Universal	Zone 2, zone 1, zone 21	Zone 2, zone 1, zone 0, zone 21, zone 20	3/26	SIPROM T
	SITRANS TR300 Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.1 V <ul style="list-style-type: none">• Two-wire system• Universal,• HART	Zone 2, zone 1, zone 21	Zone 2, zone 1, zone 0, zone 21, zone 20	3/32	SIMATIC PDM

SITRANS T Measuring instruments for temperature

Product overview

Application		Mounting of transmitter with Ex protection		Page	Software for parameterization
		Transmitter	Sensor		
	SITRANS TW Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples, DC voltages and DC currents for: <ul style="list-style-type: none"> • Four-wire system 	Safe area	Zone 1, zone 0, zone 21, zone 20	3/38	SIMATIC PDM
Transmitter for temperature for field mounting					
	SITRANS TF2 Digital display thermometer <ul style="list-style-type: none"> • Transmitter with LCD display and mounted Pt100 	-	-	3/50	Local programming using keys
	SITRANS TF280 Transmitters for connection to resistance-based sensors <ul style="list-style-type: none"> • In field housing for heavy industrial use • Battery power supply • WirelessHART 	-	-	3/53	<ul style="list-style-type: none"> • SIMATIC PDM via WirelessHART • SIMATIC PDM local with HARTmodem • Local programming using push buttons
	SITRANS TF Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.1 V <ul style="list-style-type: none"> • In field housing for heavy industrial use 	Zone 2, zone 1	Zone 2, zone 1, zone 0	3/58	Depends on mounted transmitter TH200/TH300
	SITRANS TF Fieldbus transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 0.8 V <ul style="list-style-type: none"> • In field enclosure for heavy industrial use • PROFIBUS PA • FOUNDATION fieldbus 	Zone 2, Zone 1	Zone 2, Zone 1, Zone 0	3/65	SIMATIC PDM for PROFIBUS PA
Field indicator for 4 to 20 mA signals					
	SITRANS TF Field indicator for 4 to 20 mA signals Display of units can be user-defined	Zone 2, zone 1	-	3/58	-

SITRANS T Measuring instruments for temperature

Product overview

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	Device	Largest measuring range	Page
Resistance thermometers			
	Temperature transmitters factory-installed in connection head of a resistance thermometer (selection list) <ul style="list-style-type: none"> • SITRANS TH400 PA or FF • SITRANS TH200/TH300 • SITRANS TH100 		3/75
	Flue gas resistance thermometers	-50 ... +600 °C (-58 ... +1112 °F)	3/77
	Low-pressure screw-in resistance thermometers <ul style="list-style-type: none"> • Without neck tube • With neck tube 	-50 ... +400 °C (-58 ... +752 °F) -50 ... +600 °C (-58 ... +1112 °F)	3/78
	High-pressure screw-in resistance thermometers	-50 ... +600 °C (-58 ... +1112 °F)	3/80
	High-pressure welding-type resistance thermometers	-50 ... 550 °C (-58 ... +1022 °F)	3/81
	Flange-type resistance thermometers	-50 ... +600 °C (-58 ... +1112 °F)	3/82
	Resistance thermometers for damp rooms	-30 ... +60 °C (-22 ... +140 °F)	3/84

SITRANS T Measuring instruments for temperature

Product overview

	Device	Largest measuring range	Page
Thermocouples			
	Temperature transmitters factory-installed in connection head of a thermocouple (selection list) <ul style="list-style-type: none"> • SITRANS TH400 PA or FF • SITRANS TH200/TH300 		3/94
	Straight thermocouples	0 ... 1250 °C (32 ... 2282 °F)	3/96
	Jacket thermocouples with extension lead	0 ... 1100 °C (32 ... 2012 °F)	3/99
	Jacket thermocouples with connection head, form B	0 ... 1100 °C (32 ... 2012 °F)	3/100
	Jacket thermocouples with socket	0 ... 1100 °C (32 ... 2012 °F)	3/101
Resistance thermometers for food, pharmaceuticals and biotechnology			
	Resistance thermometers <ul style="list-style-type: none"> • For installation in pipelines and tanks • For temperature measurements with hygienic requirements 	- 50 ... + 400 °C (-58 ... +752 °F)	3/103
	Resistance thermometers with clamp-on system The temperature sensors with pipe collar are primarily used for temperature monitoring in sterile applications in the food and pharmaceutical industries.	- 20 ... + 200 °C (- 4 ... + 392 °F)	3/107

SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

SITRANS TH100 two-wire system (Pt100)

Overview



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

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

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

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

Benefits

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

Application

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

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

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

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

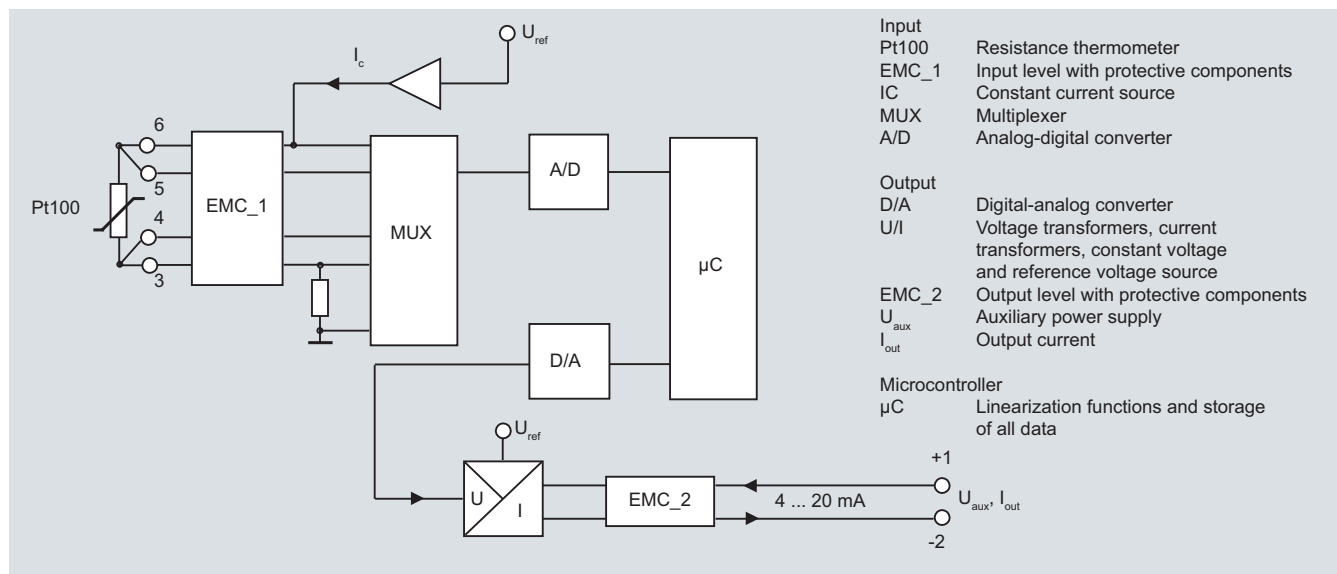
Function

Mode of operation

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

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

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



SITRANS TH100, function diagram

SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

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

Design

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	
EC type test certificate	PTB 05 ATEX 2049X
• 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
Explosion protection to FM for USA and Canada (cFM _{US})	
• FM approval	PID 3024169
• Degree of protection	IS/CI I, II, III/Div 1/GP ABCDEFG T4, T5, T6 IS/CI I/ZN 0, 1/AEx ia IIC T4, T5, T6 NI/CI I, II, III/Div 2/GP ABCDFG T4, T5, T6 CI I/ZN 2/GP IIC T4,T5,T6

Softw. requirements for SIPROM T

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

	Order-No.
SITRANS TH100 temp. transmitters for Pt100 For installation in the connection head, Type B (DIN 43729). Two-wire system 4 ... 20 mA, programmable, without electrical isolation	
• Without explosion protection	► C) 7NG3211-0NN00
• With explosion protection, "Intrinsic safety" and for zone 2	
- to ATEX	► C) 7NG3211-0AN00
- to FM (cFM _{US})	► C) 7NG3211-0BN00
Further designs Please add "-Z" to Order No. and specify Order code(s)	Order code
Customer-defined operating data	Y01¹⁾
Test protocol (5 measuring points)	C11
Accessories	Order-No.
Modem for SITRANS TH100 and TH200 incl. SIPROM T parameterization software	
• with USB connection	► C) 7NG3092-8KU
• with RS 232 connection	► C) 7NG3092-8KM
CD for meas. 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
4-wire connection cable 150 mm, for sensor connections when using head transmitters in the high hinged cover (set with 5 units)	7NG3092-8KC

► Available ex stock.

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

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

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

Factory setting:

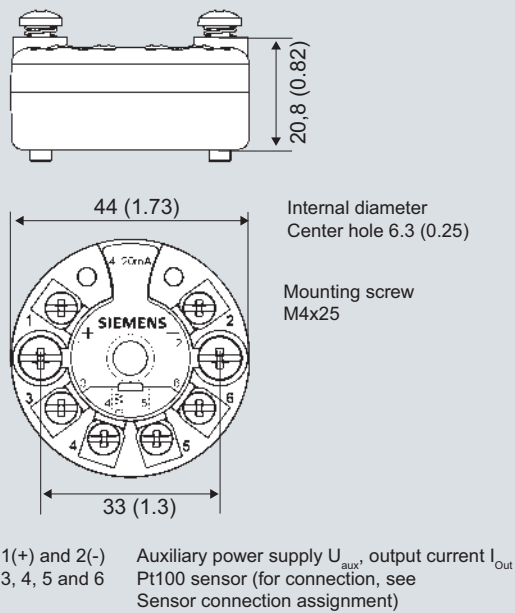
- Pt100 (IEC 751) with three-wire circuit
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Error signal in the event of sensor breakage: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

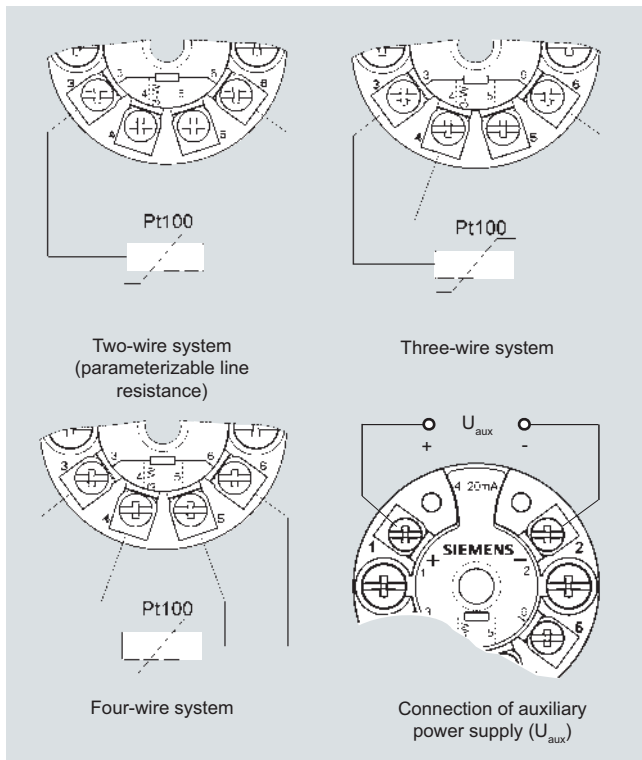
SITRANS TH100 two-wire system (Pt100)

Dimensional drawings



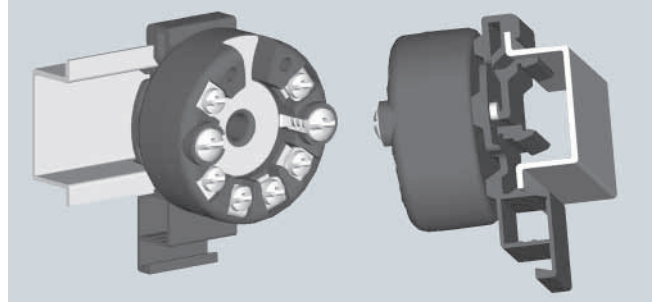
SITRANS TH100, dimensions in mm (inch)

Schematics

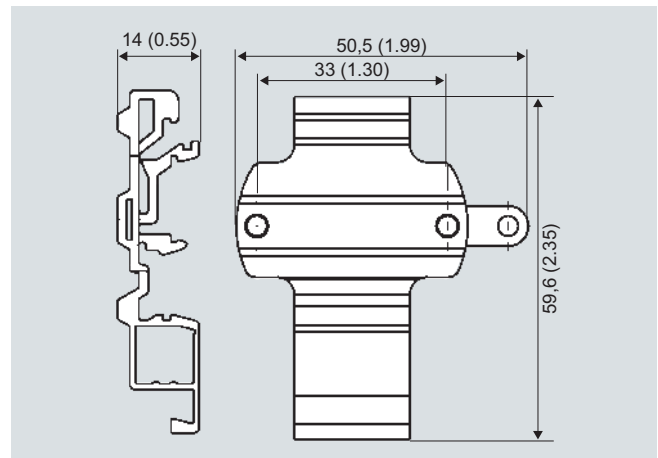


SITRANS TH100, sensor connection assignment

Mounting on DIN rail



SITRANS TH100, mounting of transmitter on DIN rail



DIN rail adaptor, dimensions in mm (inch)

SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

SITRANS TH200
two-wire system, universal

Overview



Ultra flexible - with the universal SITRANS TH200 transmitter

- Two-wire devices for 4 to 20 mA
- Mounting in the connection head of the temperature sensor
- Universal input for virtually any type of temperature sensor
- Configurable over PC

Benefits

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

- SIL 2 (with order code C20)
- Expanded diagnostic functions, such as slave pointer, operating hours counter, etc.
- Special characteristic
- Electromagnetic compatibility to EN 61326 and NE21

Application

SITRANS TH200 transmitters can be used in all industrial sectors. Due to their compact size they can be installed in the connection head type B (DIN 43729) or larger. The following sensors/signal sources can be connected over their universal input module:

- Resistance thermometers (two, three or four-wire system)
- Thermocouple elements
- Resistance-based sensors and DC voltage sources

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

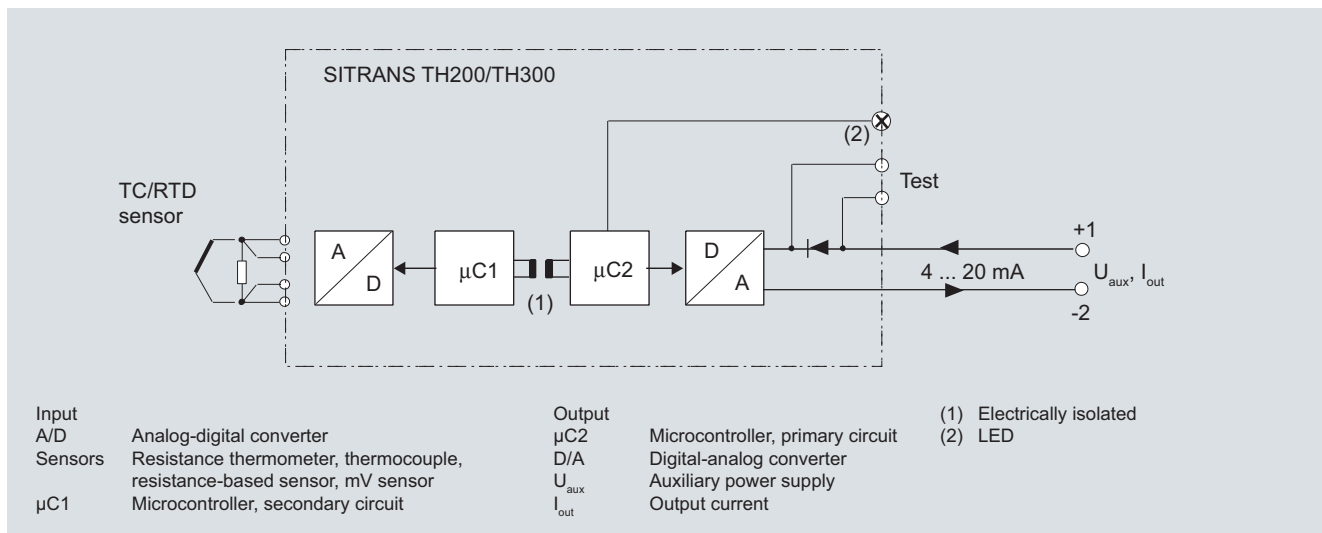
Transmitters of the "intrinsically-safe" type of protection can be installed within potentially explosive atmospheres. The devices comply with the Directive 94/9/EC (ATEX), as well as FM and CSA regulations.

Function

The SITRANS TH200 is configured over a PC. A USB or RS 232 modem is linked to the output terminals for this purpose. The configuration data can now be edited using the SIPROM T software tool. The configuration data are then permanently stored in the non-volatile memory (EEPROM).

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

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



SITRANS TH200 function diagram

SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

SITRANS TH200

two-wire system, universal

Technical specifications

Input

Resistance thermometer

Measured variable	Temperature
Sensor type	<ul style="list-style-type: none"> • to IEC 60751 • to JIS C 1604; $\alpha = 0.00392 \text{ K}^{-1}$ • to IEC 60751 • Special type
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 $\leq 100 \Omega$ (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	$\leq 0.45 \text{ mA}$
Response time	$\leq 250 \text{ ms}$ for 1 sensor with open-circuit monitoring
Open-circuit monitoring	can be switched off
Short-circuit monitoring	can be switched off (value is adjustable)
Measuring range	Parameterizable (see table "Digital measuring errors")
Min. measured span	10 °C (18 °F)
Characteristic curve	Temperature-linear or special characteristic

Resistance-based sensors

Measured variable	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 $\leq 100 \Omega$ (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	$\leq 0.45 \text{ mA}$
Response time	$\leq 250 \text{ ms}$ for 1 sensor with open-circuit monitoring

Open-circuit monitoring

Short-circuit monitoring

Measuring range

Min. measured span

Characteristic curve

Thermocouple elements

Measured variable

Sensor type (thermocouples)

• Type B

• Type C

• Type D

• Type E

• Type J

• Type K

• Type L

• Type N

• Type R

• Type S

• Type T

• Type U

Units

Connection

• Standard connection

• Generation of average value

• Generation of difference

Response time

Open-circuit monitoring

Cold junction compensation

• Internal

• External

• External fixed

Measuring range

Min. measured span

Characteristic curve

mV sensor

Measured variable

Sensor type

Units

Response time

Open-circuit monitoring

Short-circuit monitoring

can be switched off

can be switched off (value is adjustable)

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

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

Resistance-linear or special characteristic

Temperature

Pt30Rh-Pt6Rh to DIN IEC 584

W5 %-Re to ASTM 988

W3 %-Re to ASTM 988

NiCr-CuNi to DIN IEC 584

Fe-CuNi to DIN IEC 584

NiCr-Ni to DIN IEC 584

Fe-CuNi to DIN 43710

NiCrSi-NiSi to DIN IEC 584

Pt13Rh-Pt to DIN IEC 584

Pt10Rh-Pt to DIN IEC 584

Cu-CuNi to DIN IEC 584

Cu-CuNi to DIN 43710

°C or °F

1 thermocouple element (TC)

2 thermocouple elements (TC)

2 thermocouple elements (TC) TC1 – TC2 or TC2 – TC1)

$\leq 250 \text{ ms}$ for 1 sensor with open-circuit monitoring

can be switched off

With integrated Pt100 resistance thermometer

With external Pt100 IEC 60571 (2-wire or 3-wire connection)

Cold junction temperature can be set as fixed value

Parameterizable (see table "Digital measuring errors")

Min. 50 ... 100 °C (90 ... 180 °F) (see table "Digital measuring errors")

Temperature-linear or special characteristic

DC voltage

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

mV

$\leq 250 \text{ ms}$ for 1 sensor with open-circuit monitoring

can be switched off

can be switched off (value is adjustable)

SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

SITRANS TH200
two-wire system, universal

Measuring range	-10 ... +70 mV -100 ... +1100 mV
Min. measured span	2 mV or 20 mV
Overload capability of the input	-1.5 ... +3.5 V DC
Input resistance	≥ 1 MΩ
Characteristic curve	Voltage-linear or special characteristic
Output	
Output signal	4 ... 20 mA, 2-wire
Auxiliary 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, infinitely adjustable (default range: 3.8 mA ... 20.50 mA)
Error signal (e.g. in the event of sensor breakage)	3.6 ... 23 mA, infinitely 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	
• Auxiliary power supply	24 V ± 1 %
• Load	500 Ω
• Ambient temperature	23 °C
• Warming-up time	> 5 min
Error in the analog output (digital/analog converter)	< 0.025 % of span
Error due to internal cold junction	< 0.5 °C (0.9 °F)
Temperature effect	< 0.1 % of max. span/10 °C (18 °F)
Power supply effect	< 0.001 % of span/V
Effect of load impedance	< 0.002 % of span/100 Ω
Long-term drift	
• in the first month	< 0.02 % of max. span
• after one year	< 0.2 % of max. span
• after 5 years	< 0.3 % of max. span
Rated conditions	
<u>Ambient conditions</u>	
Ambient temperature range	-40 ... +85 °C (-40 ... 185 °F)
Storage temperature range	-40 ... +85 °C (-40 ... 185 °F)
Relative humidity	< 98 %, with condensation
Electromagnetic compatibility	acc. to EN 61326 and NE21
Design	
Material	Molded plastic
Weight	50 g (0.11 lb)
Dimensions	See "Dimensional drawings"
Cross-section of cables	Max. 2.5 mm ² (AWG 13)
Degree of protection to IEC 60529	
• Enclosure	IP40
• Terminals	IP00

Certificates and approvals

Explosion protection ATEX

EC type test certificate

• "Intrinsic safety" type of protection

• "Operating equipment that is non-ignitable and has limited energy" type of protection

Explosion protection to FM for USA

• FM approval

• Degree of protection

Explosion protection to FM for Canada (cFM_{US})

• FM approval

• Degree of protection

Software requirements for SIPROM T

PC operating system

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	Measuring range	Min. measured span		Digital accuracy	
	°C (°F)	°C	(°F)	°C	(°F)
<u>to IEC 60751</u>					
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)
<u>to JIS C1604-81</u>					
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 to Ni1000	-60 ... +250 (-76 ... +482)	10	(18)	0,1	(0.18)

SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

SITRANS TH200

two-wire system, universal

Resistance-based sensors

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

Thermocouple elements

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

¹⁾ The digital accuracy in the range 0 to 300 °C (32 to 572 °F) is 3 °C (5.4 °F).

²⁾ The digital accuracy in the range 1750 to 2300 °C (3182 to 4172 °F) is 2 °C (3.6 °F).

mV sensor

Input	Measuring 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 the connection head type B (DIN 43729) 2-wire connection 4 ... 20 mA, programmable, with electrical isolation	
• Without explosion protection	▶ 7NG3211-1NN00
• With explosion protection	
- acc. to ATEX	▶ 7NG3211-1AN00
- acc. to FM (cFM _{US})	▶ 7NG3211-1BN00
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)	Y01¹⁾
with test protocol (5 measuring points)	C11
SIL 2 (functional safety)	C20
Accessories	Order No.
Modem for SITRANS TH100, TH200 and TR200 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	
DIN rail adapters for head transmitters (Quantity delivered: 5 units)	▶ 7NG3092-8KA
4-wire connection cable 150 mm, for sensor connections when using head transmitters in the high hinged cover (set with 5 units)	7NG3092-8KC
▶ Available ex stock.	

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

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

Power supply units see "SITRANS I supply units and isolation amplifiers".

Factory setting:

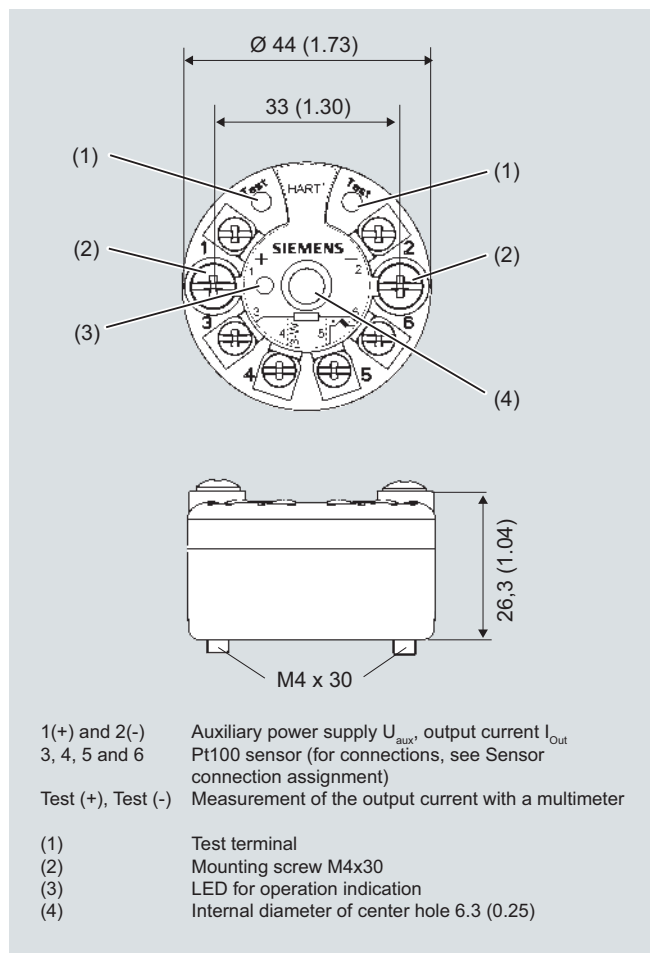
- Pt100 (IEC 751) with three-wire circuit
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

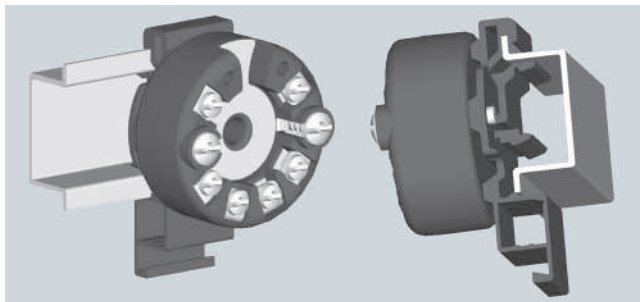
SITRANS TH200
two-wire system, universal

Dimensional drawings

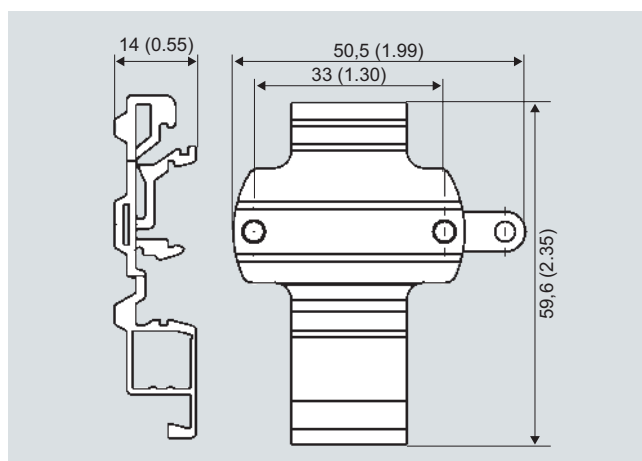


SITRANS TH200, dimensions and pin assignment, dimensions in mm (inch)

Mounting on DIN rail



SITRANS TH200, mounting of transmitter on DIN rail



DIN rail adaptor, dimensions in mm (inch)

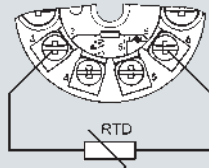
SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

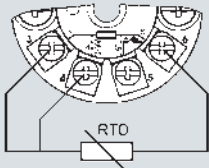
SITRANS TH200
two-wire system, universal

Schematics

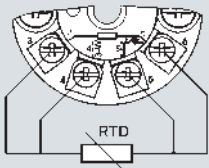
Resistance thermometer



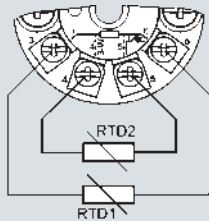
Two-wire system ¹⁾



Three-wire system



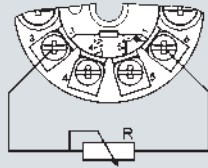
Four-wire system



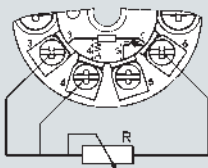
Generation of average value / difference ¹⁾

¹⁾ Programmable line resistance for the purpose of correction.

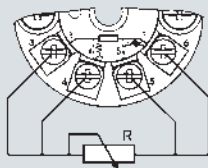
Resistance



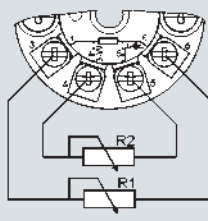
Two-wire system ¹⁾



Three-wire system

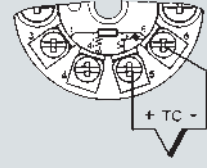


Four-wire system

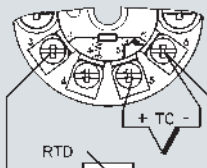


Generation of average value / difference ¹⁾

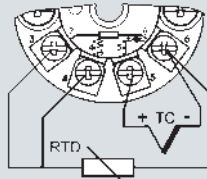
Thermocouple



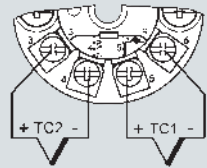
Cold junction compensation
Internal/fixed value



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

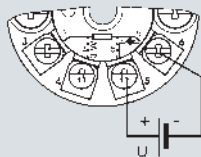


Cold junction compensation with
external Pt100 in three-wire system

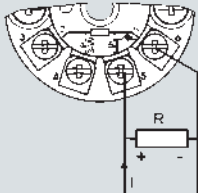


Generation of average value / difference
with internal cold junction compensation

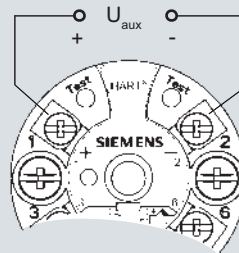
Voltage measurement



Current measurement



Connection of auxiliary power supply (U_{aux})



SITRANS TH200, sensor connection assignment

SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

SITRANS TH300
two-wire system, universal, HART

Overview



"HART" to beat - the universal SITRANS TH300 transmitter

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

Benefits

- Compact design
- Flexible mounting and center hole allow you to select your preferred type of installation
- Electrically isolated
- Test sockets for multimeters
- Diagnostics LED (green/red)
- Sensor monitoring open circuits and short-circuits
- Self-monitoring
- Configuration status stored in EEPROM
- SIL 2 (with order code C20)
- Expanded diagnostic functions, such as slave pointer, operating hours counter, etc.
- Special characteristic
- Electromagnetic compatibility to EN 61326 and NE21

Application

SITRANS TH300 transmitters can be used in all industrial sectors. Due to their compact size they can be installed in the connection head type B (DIN 43729) or larger. The following sensors/signal sources can be connected over their universal input module:

- Resistance thermometers (two, three or four-wire system)
- Thermocouple elements
- Resistance-based sensors and DC voltage sources

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

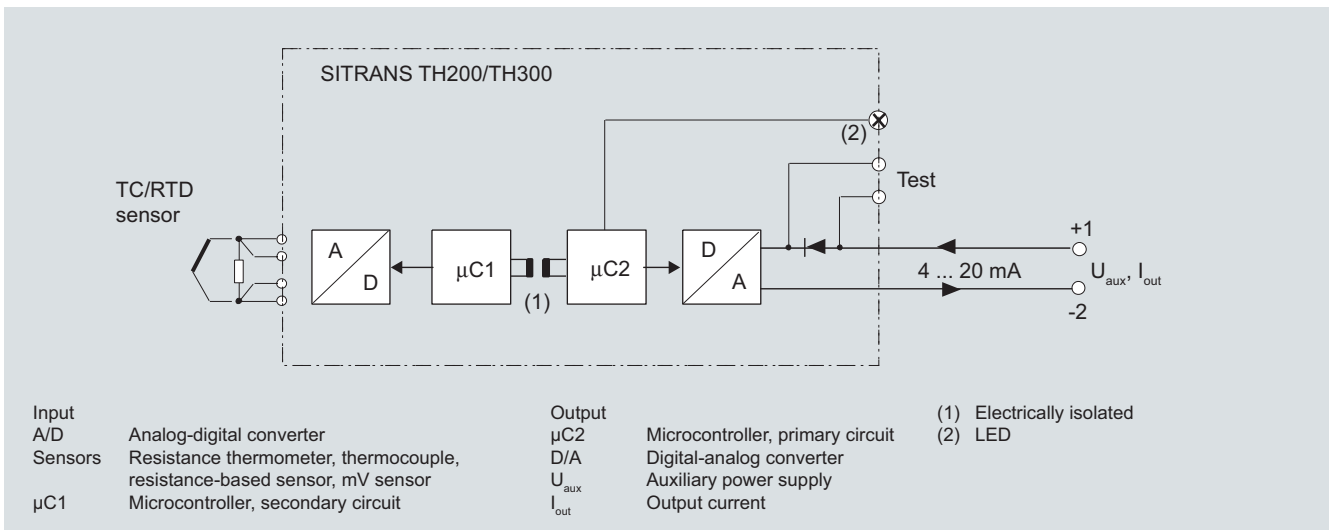
Transmitters of the "intrinsically-safe" type of protection can be installed within potentially explosive atmospheres. The devices comply with the Directive 94/9/EC (ATEX), as well as FM and CSA regulations.

Function

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

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

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



SITRANS TH 300 function diagram

SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

SITRANS TH300

two-wire system, universal, HART

Technical specifications

Input

Resistance thermometer

Measured variable	Temperature
Sensor type	
• to IEC 60751	Pt25 ... Pt1000
• to JIS C 1604; $\alpha = 0.00392 \text{ K}^{-1}$	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 $\leq 100 \Omega$ (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	$\leq 0.45 \text{ mA}$
Response time	$\leq 250 \text{ ms}$ for 1 sensor with open-circuit monitoring
Open-circuit monitoring	can be switched off
Short-circuit monitoring	can be switched off (value is adjustable)
Measuring range	Parameterizable (see table "Digital measuring errors")
Min. measured span	10 °C (18 °F)
Characteristic curve	Temperature-linear or special characteristic

Resistance-based sensors

Measured variable	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 $\leq 100 \Omega$ (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	$\leq 0.45 \text{ mA}$
Response time	$\leq 250 \text{ ms}$ for 1 sensor with open-circuit monitoring

Open-circuit monitoring	can be switched off
Short-circuit monitoring	can be switched off (value is adjustable)
Measuring range	Parameterizable, max. 0 ... 2200 Ω (see Table "Digital measuring errors")
Min. measured span	5 ... 25 Ω (see Table "Digital measuring errors")
Characteristic curve	Resistance-linear or special characteristic
<u>Thermocouples</u>	
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	$\leq 250 \text{ ms}$ for 1 sensor with open-circuit monitoring
Open-circuit monitoring	can be switched off
Cold junction compensation	
• Internal	With integrated Pt100 resistance thermometer
• External	With external Pt100 IEC 60571 (2-wire or 3-wire connection)
• External fixed	Cold junction temperature can be set as fixed value
Measuring range	Parameterizable (see table "Digital measuring errors")
Min. measured span	Min. 50 ... 199 °C (90 ... 180 °F) (see table "Digital measuring errors")
Characteristic curve	Temperature-linear or special characteristic
<u>mV sensor</u>	
Measured variable	DC voltage
Sensor type	DC voltage source (DC voltage source possible over an externally connected resistor)
Units	mV
Response time	$\leq 250 \text{ ms}$ for 1 sensor with open-circuit monitoring
Open-circuit monitoring	can be switched off
Short-circuit monitoring	can be switched off (value is adjustable)

SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

SITRANS TH300
two-wire system, universal, HART

Measuring 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 curve	Voltage-linear or special characteristic
Output	
Output signal	4 ... 20 mA, 2-wire with communication to HART Rev. 5.9
Auxiliary 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: 3.8 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	
• Auxiliary power supply	24 V ± 1 %
• Load	500 Ω
• Storage temperature	23 °C
• Warming-up time	> 5 min
Error in the analog output (digital/analog converter)	< 0.025 % of span
Error due to internal cold junction	< 0.5 °C (0.9 °F)
Temperature effect	< 0.1 % of max. span/10 °C (18 °F)
Power supply effect	< 0.001 % of span/V
Effect of load impedance	< 0.002 % of span/100 Ω
Long-term drift	
• in the first month	< 0.02 % of max. span
• after one year	< 0.2 % of max. span
• after 5 years	< 0.3 % of max. span
Rated conditions	
<u>Ambient temperature</u>	
Ambient temperature range	-40 ... +85 °C (-40 ... 185 °F)
Storage temperature range	-40 ... +85 °C (-40 ... 185 °F)
Relative humidity	< 98 %, with condensation
Electromagnetic compatibility	acc. to EN 61326 and NE21
Construction	
Material	Molded plastic
Weight	50 g (0.11 lb)
Dimensions	See "Dimensional drawings"
Cross-section of cables	Max. 2.5 mm ² (AWG 13)
Degree of protection to IEC 60529	
• Enclosure	IP40
• Terminals	IP00

Certificate and approvals

Explosion protection ATEX

EC type test certificate

- "Intrinsic safety" type of protection
- "Operating equipment that is non-ignitable and has limited energy" type of protection

Explosion protection to FM for USA

- FM approval
- Degree of protection

Explosion protection to FM for Canada (cFM_{US})

- FM approval
- Degree of protection

PTB 05 ATEX 2040X

II 1 G Ex ia IIC T6/T4
II 2 (1) G Ex ib/ia IIC T6/T4

II 3 G Ex nL IIC T6/T4
II 3 G Ex nA IIC T6/T4

FM 3024169

IS/CI I, II, III/Div 1/
GP ABCDEFG T6, T5, T4

IS/CI I/ZN 0/AEx ia IIC
T6, T5, T4

NI/CI I, II, III/Div 2,
GP ABCDEFG T6, T5, T4

NI/CI I/ZN 2/IIC T6, T5, T4

FM 3024169C

IS/CI I/ZN 0/Ex ia IIC T6, T5, T4

NI/CI I/ZN 2/Ex nAL IIC T6, T5, T4

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	Measuring range	Min. mea- sured span		Digital accu- racy	
	°C (°F)	°C	(°F)	°C	(°F)
<u>to IEC 60751</u>					
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)
<u>to JIS C1604-81</u>					
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 to Ni1000	-60 ... +250 (-76 ... +482)	10	(18)	0.1	(0.18)

SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

SITRANS TH300

two-wire system, universal, HART

Resistance-based sensors

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

Thermocouple elements

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

¹⁾ The digital accuracy in the range 0 to 300 °C (32 to 572 °F) is 3 °C (5.4 °F).

²⁾ The digital accuracy in the range 1750 to 2300 °C (3182 to 4172 °F) is 2 °C (3.6 °F).

mV sensor

Input	Measuring 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 TH300	
for installation in the connection head type B (DIN 43729) 2-wire connection 4 ... 20 mA, communication-capable acc. to HART, with electrical isolation	
• Without explosion protection	► 7NG3212-0NN00
• With explosion protection	
- acc. to ATEX	► 7NG3212-0AN00
- acc. 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)	Y01¹⁾
with test protocol (5 measuring points)	C11
SIL 2 (functional safety)	C20
Accessories	Order No.
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	► 7MF4997-1DA
• With USB connection	► 7MF4997-1DB
SIMATIC PDM operating software	See Section 9
DIN rail adapters for head transmitters (Quantity delivered: 5 units)	► 7NG3092-8KA
4-wire connection cable 150 mm, for sensor connections when using head transmitters in the high hinged cover (set with 5 units)	7NG3092-8KC

► Available ex stock.

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

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

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

Power supply units see "SITRANS I supply units and isolation amplifiers".

Factory setting:

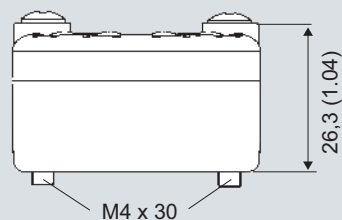
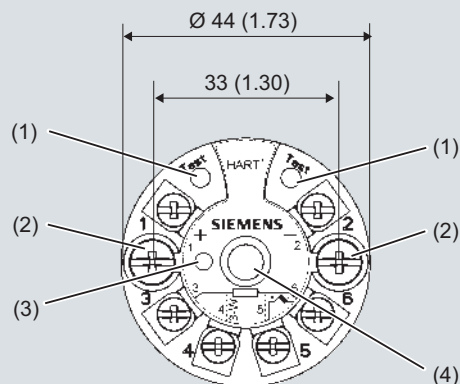
- Pt100 (IEC 751) with three-wire circuit
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

SITRANS TH300
two-wire system, universal, HART

Dimensional drawings

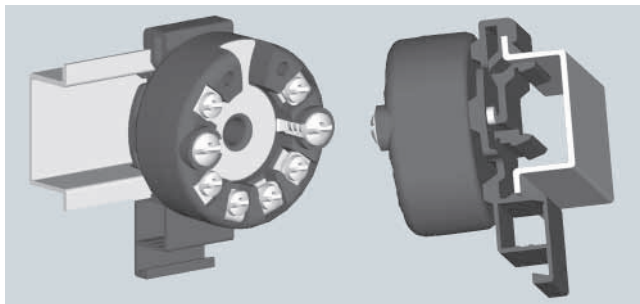


- 1(+) and 2(-) Auxiliary power supply U_{aux} , output current I_{out}
 3, 4, 5 and 6 Pt100 sensor (for connections, see Sensor connection assignment)
 Test (+), Test (-) Measurement of the output current with a multimeter

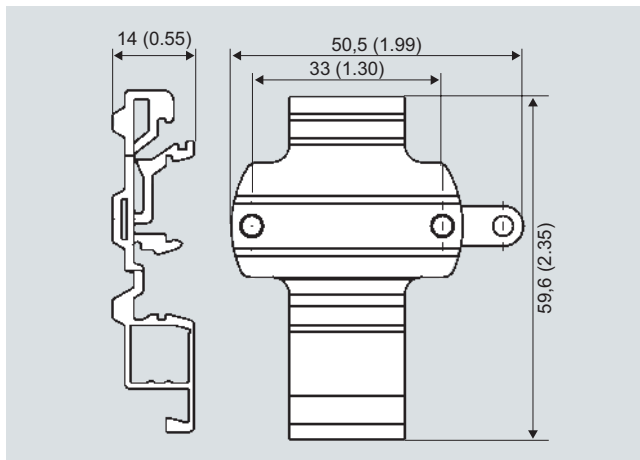
- (1) Test terminal
 (2) Mounting screw M4x30
 (3) LED for operation indication
 (4) Internal diameter of center hole 6.3 (0.25)

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

Mounting on DIN rail



SITRANS TH300, mounting of transmitter on DIN rail



DIN rail adapter, dimensions in mm (inch)

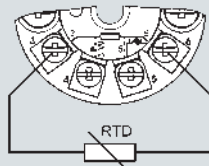
SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

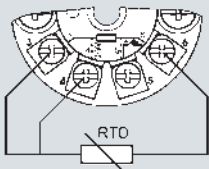
SITRANS TH300
two-wire system, universal, HART

Schematics

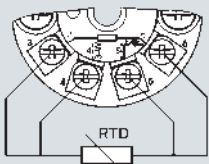
Resistance thermometer



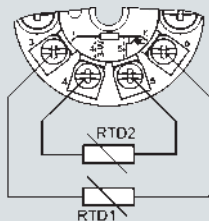
Two-wire system ¹⁾



Three-wire system



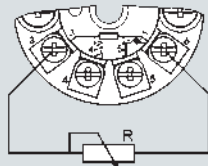
Four-wire system



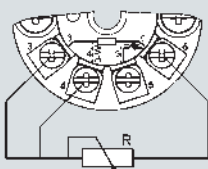
Generation of average value / difference ¹⁾

¹⁾ Programmable line resistance for the purpose of correction.

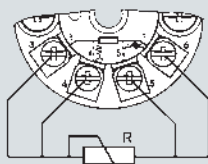
Resistance



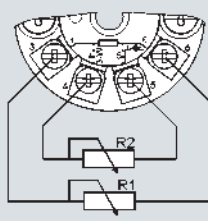
Two-wire system ¹⁾



Three-wire system

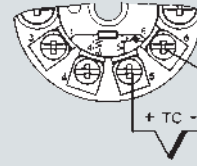


Four-wire system

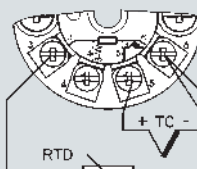


Generation of average value / difference ¹⁾

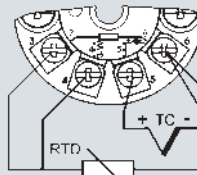
Thermocouple



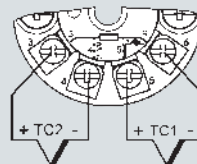
Cold junction compensation
Internal/fixed value



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

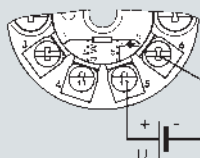


Cold junction compensation with
external Pt100 in three-wire system

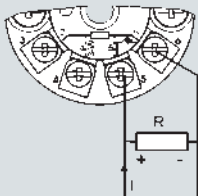


Generation of average value / difference
with internal cold junction compensation

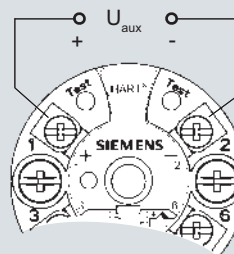
Voltage measurement



Current measurement



Connection of auxiliary power supply (U_{aux})



SITRANS TH200/TH300, sensor connection assignment

SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

SITRANS TH400
fieldbus transmitter

Overview



SITRANS TH400 fieldbus transmitters

Versions:

- for FOUNDATION Fieldbus and
- for PROFIBUS PA

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

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

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

Application

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

Function

Features

common

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

Transmitter with PROFIBUS PA communication

- Function blocks: 2 x analog

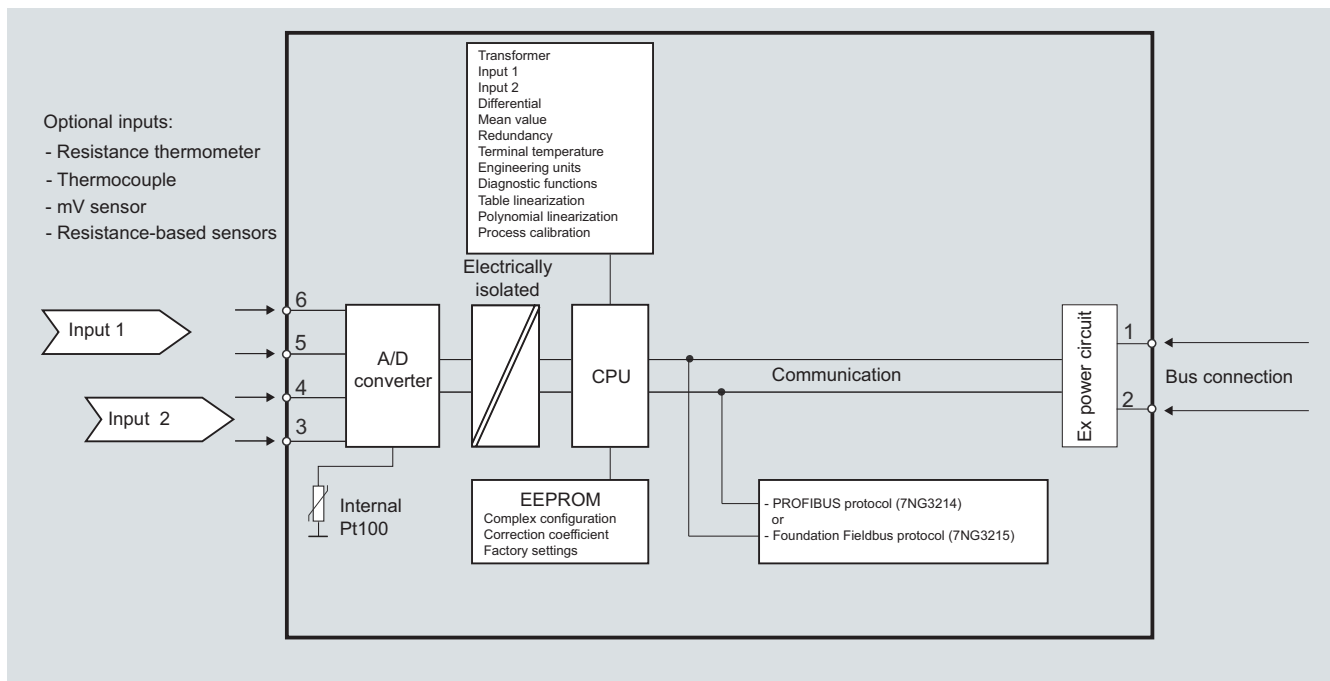
Transmitter with FOUNDATION Fieldbus communication

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

Mode of operation

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

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



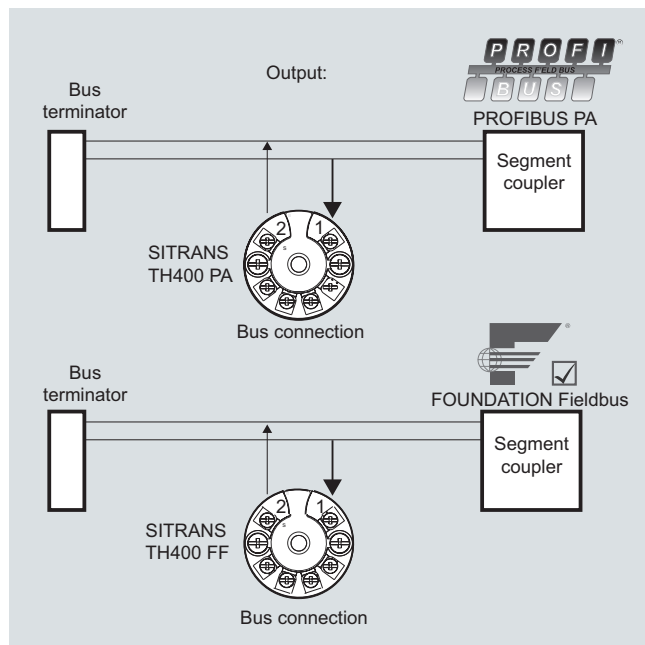
SITRANS TH400, function diagram

SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

SITRANS TH400 fieldbus transmitter

System communication



SITRANS TH400, communication interface

Technical specifications

Input

Analog-to-digital conversion

- Measurement rate < 50 ms
- Resolution 24 Bit

Resistance thermometer

Pt25 ... Pt1000 to IEC 60751/JIS C 1604

- Measuring range -200 ... +850 °C (-328 ... +1562 °F)

Ni25 ... Ni1000 to DIN 43760

- Measuring range -60 ... +250 °C (-76 ... +482 °F)

Cu10 ... Cu1000, $\alpha = 0,00427$

- Measuring range -50 ... +200 °C (-58 ... +392 °F)

Line resistance per sensor cable Max. 50 Ω

Sensor current Nominal 0.2 mA

Sensor fault detection

- Sensor break detection Yes
- Sensor short-circuit detection Yes, < 15 Ω

Resistance-based sensors

Measuring range 0 Ω ... 10 k Ω Line resistance per sensor cable Max. 50 Ω

Sensor current Nominal 0.2 mA

Sensor fault detection

- Sensor break detection Yes
- Sensor short-circuit detection Yes, < 15 Ω

Thermocouple

to IEC 584

- Type B
- Type E
- Type J
- Type K
- Type N
- Type R
- Type S
- Type T

to DIN 43710

- Type L
- Type U

to ASTM E988-90

- Type W3
- Type W5

External cold junction compensation

Sensor fault detection

- Sensor break detection Yes
- Sensor short-circuit detection Yes, < 3 mV
- Sensor current in the event of open-circuit monitoring 4 μ A

mV sensor - voltage input

Measuring range -800 ... +800 mV

Input resistance 10 M Ω

Output

Filter time (programmable) 0 ... 60 s

Update time < 400 ms

Measuring accuracy

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

General values

Type of input	Absolute accuracy	Temperature coefficient
All	$\leq \pm 0,05$ % of measured value	$\leq \pm 0,002$ % of measured value/°C

Basic values

Type of input	Basic accuracy	Temperature coefficient
Pt100 and Pt1000	$\leq \pm 0.1$ °C	$\leq \pm 0.002$ °C/°C
Ni100	$\leq \pm 0.15$ °C	$\leq \pm 0.002$ °C/°C
Cu10	$\leq \pm 1.3$ °C	$\leq \pm 0.02$ °C/°C
Resistance-based sensors	$\leq \pm 0.05$ Ω	$\leq \pm 0.002$ Ω /°C
Voltage source	$\leq \pm 10$ μ V	$\leq \pm 0.2$ μ V/°C
Thermal element, type: E, J, K, L, N, T, U	$\leq \pm 0.5$ °C	$\leq \pm 0.01$ °C/°C
Thermal element, type: B, R, S, W3, W5	$\leq \pm 1$ °C	$\leq \pm 0.025$ °C/°C
Cold junction compensation	$\leq \pm 0.5$ °C	

Reference conditions

Warming-up time	30 s
Signal-to-noise ratio	Min. 60 dB
Calibration condition	20 ... 28 °C (68 ... 82 °F)

SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

SITRANS TH400 fieldbus transmitter

Rated conditions

Ambient temperature

Permissible ambient temperature -40 ... +85 °C (-40 ... +185 °F)

Permissible storage temperature -40 ... +85 °C (-40 ... +185 °F)

Relative humidity ≤ 98 %, with condensation

Electrically isolated

• without Ex

• with Ex

Mechanical testing

• Vibrations (DIN class B) to

Input against output 1 kV_{eff}

Input against output 500 V_{eff}

IEC 60068-2-6 and
IEC 60068-2-64
4 g/2 ... 100 Hz

Electromagnetic compatibility

EMC noise voltage influence

< ±0,1 % of span

Extended EMC noise immunity:
NAMUR NE 21, criterion A, Burst

< ±1 % of span

EMC 2004/108/EC Emission and

Noise Immunity to

EN 61326

Design

Material

Molded plastic

Weight

55 g (0.12 lb)

Dimensions

See "Dimensional drawings"

Cross-section of cables

Max. 2.5 mm² (AWG 13)

Degree of protection

• Transmitter enclosure

IP40

• Terminal

IP00

Auxiliary power supply

Power supply

• Standard, Ex nA, Ex nL and NI

DC 9.0 ... 32 V

• ATEX, FM, UL and CSA

DC 9.0 ... 30 V

• In FISCO/FNICO installation

DC 9.0 ... 17.5 V

Power consumption

< 11 mA

Max. increase in power consumption
in the event of a fault

< 7 mA

Certificate and approvals

Explosion protection ATEX

EC type test certificate

• "Intrinsic safety" type of protection

KEMA 06 ATEX 0264 X

II 1 GD EEx ia IIC T4 ... T6
T65 °C ... T105 °C
II 2(1) GD EEx ib [ia] IIC T4 ... T6
T65 °C ... T105 °C

EC type test certificate

KEMA 06 ATEX 0263 X

• "Operating equipment that is non-ignitable" type of protection

II 3 G EEx nA[nL] IIC T4 ... T6
II 3 G EEx nL IIC T4 ... T6

Explosion protection FM for USA

• FM approval

FM 3027985

• Degree of protection

• IS/CI I/Div 1/Groups ABCD
T4, T5, T6, FISCO

Explosion protection CSA for
Canada

• IS/CI I/ZN 0/AEx ia, IIC
T4, T5, T6, FISCO

• NI/CI I/Div 2/Groups ABCD
T4, T5, T6, FNICO

• CSA approval

CSA 1861385

• Degree of protection

• IS/CI I/Groups ABCD T4, T5, T6

• Ex ia IIC T4/T5/T6
Ex ib [ia] IIC T4/T5/T6

• CI I/Div 2/Groups ABCD
T4, T5, T6

• Ex nA IIC T4/T5/T6
CI I/ZN 2/ AEx nA II T4, T5, T6

Communication

Parameterization interface

• PROFIBUS PA connection

- Protocol

Profile 3.0

- Address (for delivery)

126

• FOUNDATION Fieldbus connection

- Protocol

FF Protocol

- Functionality

Basic or LAS

- Version

ITK 4.6

- Function blocks

2 x Analog and 1 x PID

Factory setting for SITRANS TH400 PA and SITRANS TH400 FF

Sensor

Pt100 (IEC)

Type of connection

Three-wire system

Unit

°C

Failure mode

Last valid value

Filter time

0 s

only for SITRANS TH400 PA

PA address

126

PROFIBUS Ident No.

Manufacturer-specific

only for SITRANS TH400 FF

Node address

22

SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

SITRANS TH400 fieldbus transmitter

Selection and Ordering data

Order No.

Temperature transmitter SITRANS TH400

for installation in the sensor head, with electrical isolation, order instruction manual separately.

- Bus-capable to PROFIBUS PA
 - without explosion protection or EEx n or NI ▶ **7NG3214-0NN00**
 - with explosion protection „intrinsic safety to ATEX/FM/CSA“ ▶ **7NG3214-0AN00**
- Bus-capable to FOUNDATION Fieldbus
 - without explosion protection or EEx n or NI ▶ **7NG3215-0NN00**
 - with explosion protection „intrinsic safety to ATEX/FM/CSA“ ▶ **7NG3215-0AN00**

Further designs

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

- Customer-specific setting of operating data (specify in plain text) **Y01**¹⁾
- With test protocol (5 measuring points) **C11**²⁾

Accessories

Order No.

CD for measuring instruments for temperature

with documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software

SIMATIC PDM operating software

see chapter 9

DIN rail adapters for head transmitters

(Quantity delivered: 5 units)

7NG3092-8KA

4-wire connection cable

150 mm, for sensor connections when using head transmitters in the high hinged cover (set with 5 units)

7NG3092-8KC

For additional PA components

see catalog IK PI

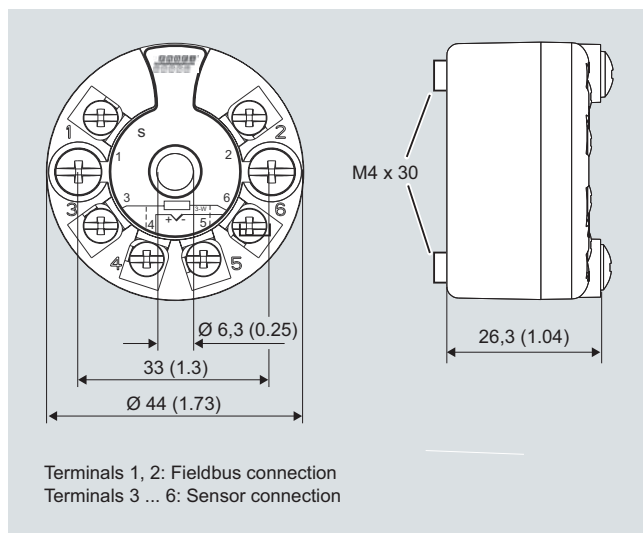
▶ Available ex stock.

- ¹⁾ Y01: Please specify all data that does not correspond to factory settings (see below).
²⁾ Can only be ordered together with Y01 (it is essential to specify the measuring range).
 C) Subject to export regulations AL: N, ECCN: EAR99.

Factory setting:

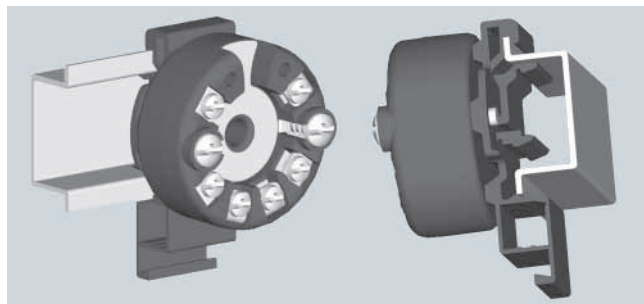
- for SITRANS TH400 PA:
 - Pt100 (IEC 751) with three-wire circuit
 - Unit: °C
 - Failure mode: Last valid value
 - Filter time: 0 s
 - PA address: 126
 - PROFIBUS Ident No.: Manufacturer-specific
- for SITRANS TH400 FF:
 - Pt100 (IEC 751) with three-wire circuit
 - Unit: °C
 - Failure mode: Last valid value
 - Filter time: 0 s
 - Node address: 22

Dimensional drawings

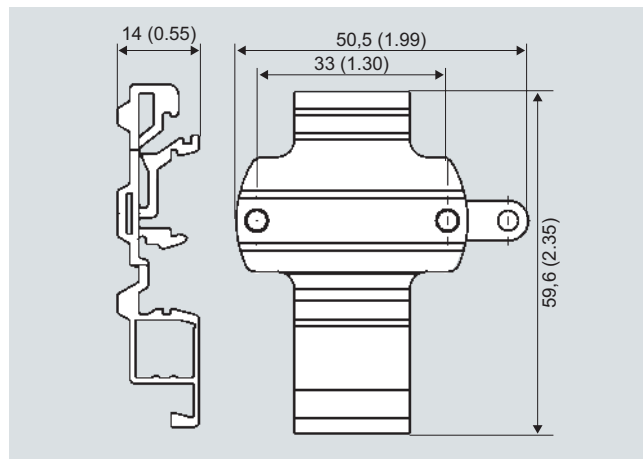


SITRANS TH400 dimensions in mm (inches) and connections

Mounting on DIN rail



SITRANS TH400, mounting of transmitter on DIN rail



DIN rail adapter, dimensions in mm (inch)

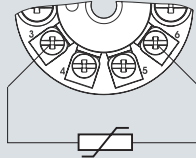
SITRANS T measuring instruments for temperature

Transmitters for mounting in sensor head

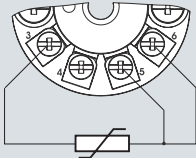
SITRANS TH400
fieldbus transmitter

Schematics

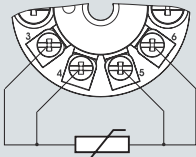
Resistance thermometer



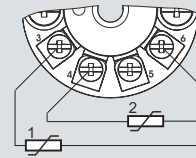
Two-wire system ¹⁾



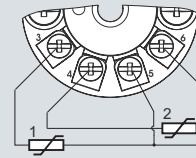
Three-wire system



Four-wire system

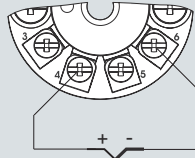


Mean-value/differential or redundancy generation
2 x two-wire system ¹⁾

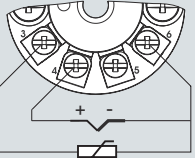


Mean-value/differential or redundancy generation
1 sensor in two-wire system ¹⁾
1 sensor in three-wire system

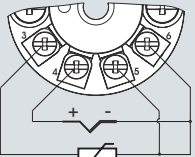
Thermocouple



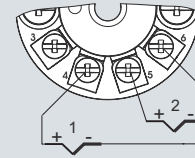
Internal cold junction compensation



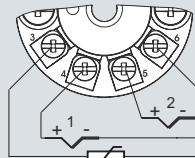
Cold junction compensation with external Pt100 in two-wire system ¹⁾



Cold junction compensation with external Pt100 in three-wire system

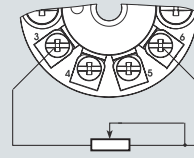


Mean value, differential or redundancy generation with internal cold junction compensation

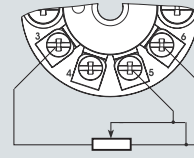


Mean value, differential or redundancy generation and cold junction compensation with internal Pt100 in two-wire system ¹⁾

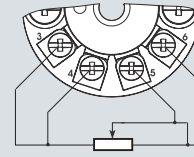
Resistance



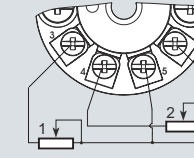
Two-wire system ¹⁾



Three-wire system

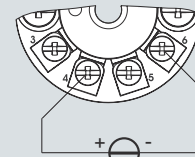


Four-wire system

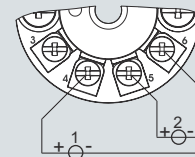


Mean value, differential or redundancy generation
1 resistor in two-wire system ¹⁾
1 resistor in three-wire system

Voltage measurement



One voltage source



Measurement of mean value, differential and redundancy with 2 voltage sources

¹⁾ Programmable line resistance for the purpose of correction.

SITRANS T measuring instruments for temperature

Transmitters for rail mounting

SITRANS TR200 two-wire system, universal

Overview



Ultra flexible - with the universal SITRANS TR200 transmitter

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

Benefits

- Compact design
- Electrically isolated
- Test sockets for multimeters
- Diagnostics LED (green/red)
- Sensor monitoring open circuits and short-circuits
- Self-monitoring
- Configuration status stored in EEPROM
- Expanded diagnostic functions, such as slave pointer, operating hours counter, etc.
- Special characteristic
- Electromagnetic compatibility to EN 61326 and NE21
- SIL 2 (with order code C20)

Application

SITRANS TR200 transmitters can be used in all industrial sectors. Their compact design enables simple mounting on standard DIN rails on-site in protective boxes or in control cabinets. The following sensors/signal sources can be connected over their universal input module:

- Resistance thermometers (two, three or four-wire system)
- Thermocouple elements
- Resistance-based sensors and DC voltage sources

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

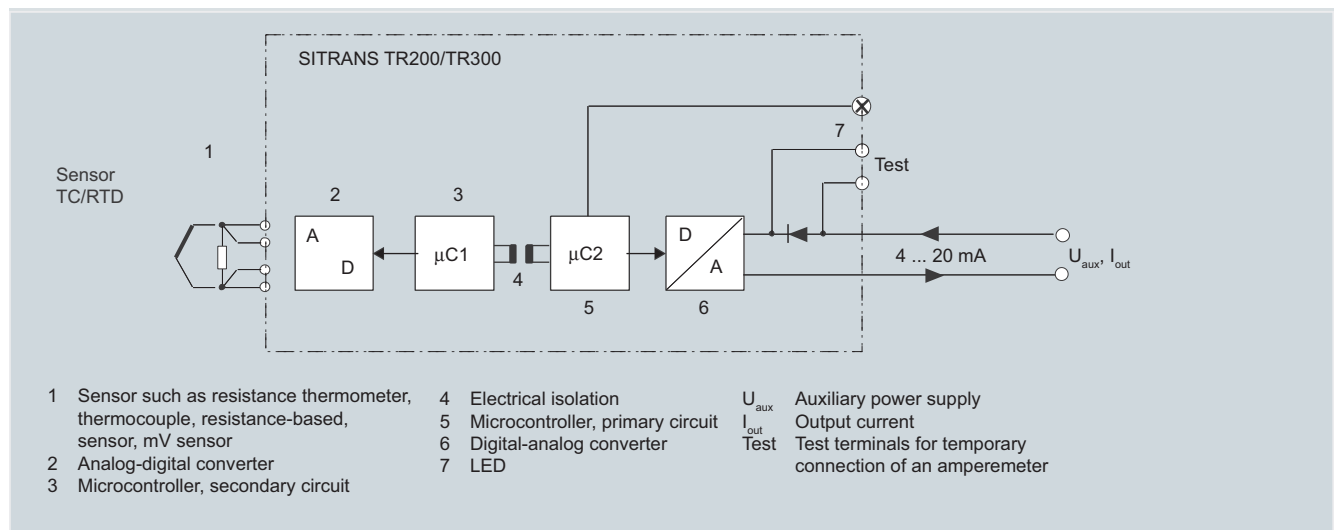
Transmitters of the "intrinsically-safe" type of protection can be installed within potentially explosive atmospheres. The devices comply with the Directive 94/9/EC (ATEX).

Function

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

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

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



SITRANS TR200 function diagram

SITRANS T measuring instruments for temperature

Transmitters for rail mounting

SITRANS TR200
two-wire system, universal

Technical specifications

Input

Resistance thermometer

Measured variable	Temperature
Sensor type	<ul style="list-style-type: none"> • to IEC 60751 • to JIS C 1604; $\alpha=0.00392\text{ K}^{-1}$ • to IEC 60751 • Special type
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 $\leq 100\ \Omega$ (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	$\leq 0.45\text{ mA}$
Response time T_{63}	$\leq 250\text{ ms}$ for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Always active (cannot be disabled)
Short-circuit monitoring	Can be switched off (value is adjustable)
Measuring range	Parameterizable (see table "Digital measuring errors")
Min. measured span	10 °C (18 °F)
Characteristic curve	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 $\leq 100\ \Omega$ (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	$\leq 0.45\text{ mA}$
Response time T_{63}	$\leq 250\text{ ms}$ for 1 sensor with open-circuit monitoring

Open-circuit monitoring

Short-circuit monitoring

Measuring range

Min. measured span

Characteristic curve

Thermocouple elements

Measured variable

Sensor type (thermocouples)

• Type B

• Type C

• Type D

• Type E

• Type J

• Type K

• Type L

• Type N

• Type R

• Type S

• Type T

• Type U

Units

Connection

• Standard connection

• Generation of average value

• Generation of difference

Response time T_{63}

Open-circuit monitoring

Cold junction compensation

• Internal

• External

• External fixed

Measuring range

Min. measured span

Characteristic curve

mV sensor

Measured variable

Sensor type

Units

Response time T_{63}

Open-circuit monitoring

Always active (cannot be disabled)

Can be switched off (value is adjustable)

Parameterizable, max. 0 ... 2200 Ω (see Table "Digital measuring errors")5 ... 25 Ω (see Table "Digital measuring errors")

Resistance-linear or special characteristic

Temperature

Pt30Rh-Pt6Rh to DIN IEC 584

W5 %-Re to ASTM 988

W3 %-Re to ASTM 988

NiCr-CuNi to DIN IEC 584

Fe-CuNi to DIN IEC 584

NiCr-Ni to DIN IEC 584

Fe-CuNi to DIN 43710

NiCrSi-NiSi to DIN IEC 584

Pt13Rh-Pt to DIN IEC 584

Pt10Rh-Pt to DIN IEC 584

Cu-CuNi to DIN IEC 584

Cu-CuNi to DIN 43710

°C or °F

1 thermocouple element (TC)

2 identical thermocouple elements (TC)

2 identical thermocouple elements (TC) TC1 – TC2 or TC2 – TC1

 $\leq 250\text{ ms}$ for 1 sensor with open-circuit monitoring

Can be switched off

With integrated Pt100 resistance thermometer

With external Pt100 IEC 60571 (2-wire or 3-wire connection)

Cold junction temperature can be set as fixed value

Parameterizable (see table "Digital measuring errors")

Min. 50 ... 100 °C (90 ... 180 °F) (see table "Digital measuring errors")

Temperature-linear or special characteristic

DC voltage

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

mV

 $\leq 250\text{ ms}$ for 1 sensor with open-circuit monitoring

Can be switched off

SITRANS T measuring instruments for temperature

Transmitters for rail mounting

SITRANS TR200

two-wire system, universal

Measuring range	Parameterizable max. -100 ... 1100 mV
Min. measured span	2 mV or 20 mV
Overload capability of the input	-1.5 ... +3.5 V DC
Input resistance	≥ 1 MΩ
Characteristic curve	Voltage-linear or special characteristic
Output	
Output signal	4 ... 20 mA, 2-wire
Auxiliary power supply	11 ... 35 V DC (to 30 V with Ex)
Max. load	(U _{aux} - 11 V)/0.023 A
Overrange	3.6 ... 23 mA, infinitely adjustable (default range: 3.84 mA ... 20.50 mA)
Error signal (e.g. in the event of sensor breakage)	3.6 ... 23 mA, infinitely adjustable (default value: 22.8 mA)
Sample cycle	0.25 s
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	
• Auxiliary power supply	24 V ± 1 %
• Load	500 Ω
• Ambient temperature	23 °C
• Warming-up time	> 5 min
Error in the analog output (digital/analog converter)	< 0.025 % of span
Error due to internal cold junction	< 0.55 °C (0.9 °F)
Temperature effect	< 0.1 % of max. span/10 °C (18 °F)
Power supply effect	< 0.001 % of span/V
Effect of load impedance	< 0.002 % of span/100 Ω
Long-term drift	
• in the first month	< 0.02 % of max. span
• after one year	< 0.2 % of max. span
• after 5 years	< 0.3 % of max. span
Rated conditions	
<u>Ambient conditions</u>	
Ambient temperature range	-40 ... +85 °C (-40 ... +185 °F)
Storage temperature range	-40 ... +85 °C (-40 ... +185 °F)
Relative humidity	< 98 %, with condensation
Electromagnetic compatibility	According to EN 61326 and NAMUR NE21
Design	
Material	Plastic, electronic module potted
Weight	122 g
Dimensions	See "Dimensional drawings"
Cross-section of cables	Max. 2.5 mm ² (AWG 13)
Degree of protection to IEC 60529	
• Enclosure	IP20

Certificates and approvals

Explosion protection ATEX

EC type test certificate

• "Intrinsic safety" type of protection

• Type of protection, "equipment has limited energy"

• Type of protection, "equipment is non-arcing"

Software requirements for SIPROM T

PC operating system

PTB 07 ATEX 2032X

II 2(1) G Ex ia/ib IIC T6/T4

II 3(1) G Ex ia/ic IIC T6/T4

II 2(1) D Ex iaD/ibD 20/21 T115 °C

II 3 G Ex nL IIC T6/T4

II 3 G Ex nA IIC T6/T4

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	Measuring range	Min. measured span		Digital accuracy	
	°C (°F)	°C	(°F)	°C	(°F)
<u>to IEC 60751</u>					
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)
<u>to JIS C1604-81</u>					
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 to Ni1000	-60 ... +250 (-76 ... +482)	10	(18)	0.1	(0.18)

SITRANS T measuring instruments for temperature

Transmitters for rail mounting

SITRANS TR200
two-wire system, universal

Resistance-based sensors

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

Thermocouple elements

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

¹⁾ The digital accuracy in the range 0 to 300 °C (32 to 572 °F) is 3 °C (5.4 °F).

²⁾ The digital accuracy in the range 1750 to 2300 °C (3182 to 4172 °F) is 2 °C (3.6 °F).

mV sensor

Input	Measuring 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 TR200 for mounting on a standard DIN rail, two-wire system, 4 to 20 mA, programmable, with electrical isolation, with documentation on CD • Without explosion protection ▶ 7NG3032-0JN00 D) • With explosion protection to ATEX ▶ 7NG3032-1JN00 D)
Further designs Please add "-Z" to Order No. and specify Order code(s) Customer-specific setting of operating data (specify operating data in plain text) with test protocol (5 measuring points) C11 SIL 2 (functional safety) C20
Accessories Order No. Modem for SITRANS TH100, TH200 and TR200 incl. SIPROM T parameterization software • With USB connection ▶ 7NG3092-8KU C) • With RS 232 connection ▶ 7NG3092-8KM C) CD for measuring instruments for temperature ▶ A5E00364512 with documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software ▶ Available ex stock.

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

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

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

Power supply units see "SITRANS I supply units and isolation amplifiers".

Factory setting:

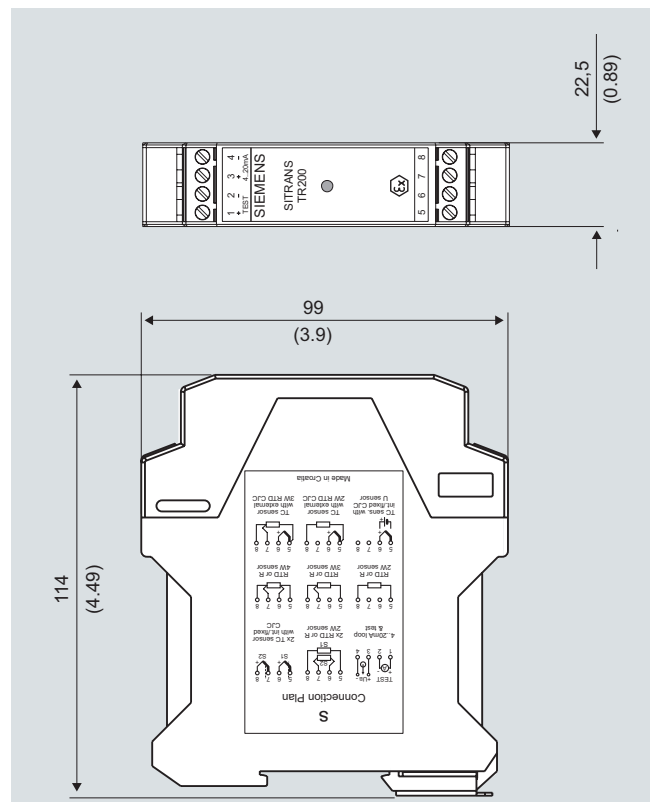
- Pt100 (IEC 751) with three-wire circuit
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

SITRANS T measuring instruments for temperature

Transmitters for rail mounting

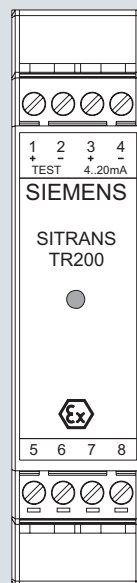
SITRANS TR200
two-wire system, universal

Dimensional drawings



SITRANS TR200, dimensions in mm (inch)

Schematics



Assignments

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

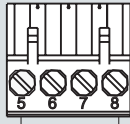
SITRANS pin assignment, TR200

SITRANS T measuring instruments for temperature

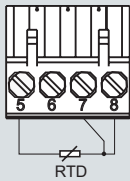
Transmitters for rail mounting

SITRANS TR200
two-wire system, universal

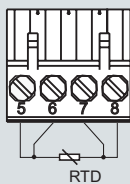
Resistance thermometer



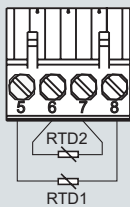
Two-wire system ¹⁾



Three-wire system

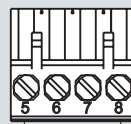


Four-wire system

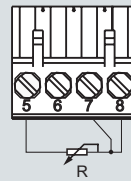


Generation of average value/difference ¹⁾

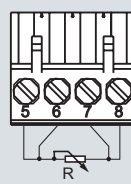
Resistance



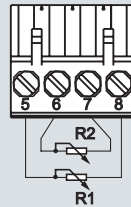
Two-wire system ¹⁾



Three-wire system

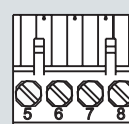


Four-wire system

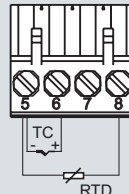


Generation of average value/difference ¹⁾

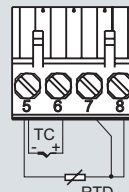
Thermocouple



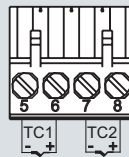
Cold junction compensation
Internal/fixed value



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

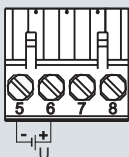


Cold junction compensation with
external Pt100 in three-wire system

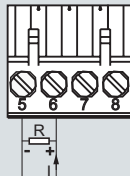


Generation of average value / difference
with internal cold junction compensation

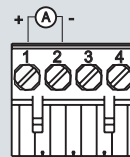
Voltage measurement



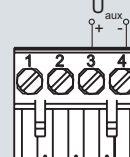
Current measurement



Test terminals



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



SITRANS TR200, sensor connection assignment

SITRANS T measuring instruments for temperature

Transmitters for rail mounting

SITRANS TR300

two-wire system, universal, HART

Overview



"HART" to beat - the universal SITRANS TR300 transmitter

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

Benefits

- Compact design
- Electrically isolated
- Test sockets for multimeters
- Diagnostics LED (green/red)
- Sensor monitoring open circuits and short-circuits
- Self-monitoring
- Configuration status stored in EEPROM
- Expanded diagnostic functions, such as slave pointer, operating hours counter etc.
- Special characteristic
- Electromagnetic compatibility to EN 61326 and NE21
- SIL 2 (with order code C20)

Application

SITRANS TR300 transmitters can be used in all industrial sectors. Their compact design enables simple mounting on standard DIN rails on-site in protective boxes or in control cabinets. The following sensors/signal sources can be connected over their universal input module:

- Resistance thermometers (two, three or four-wire system)
- Thermocouple elements
- Resistance-based sensors and DC voltage sources

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

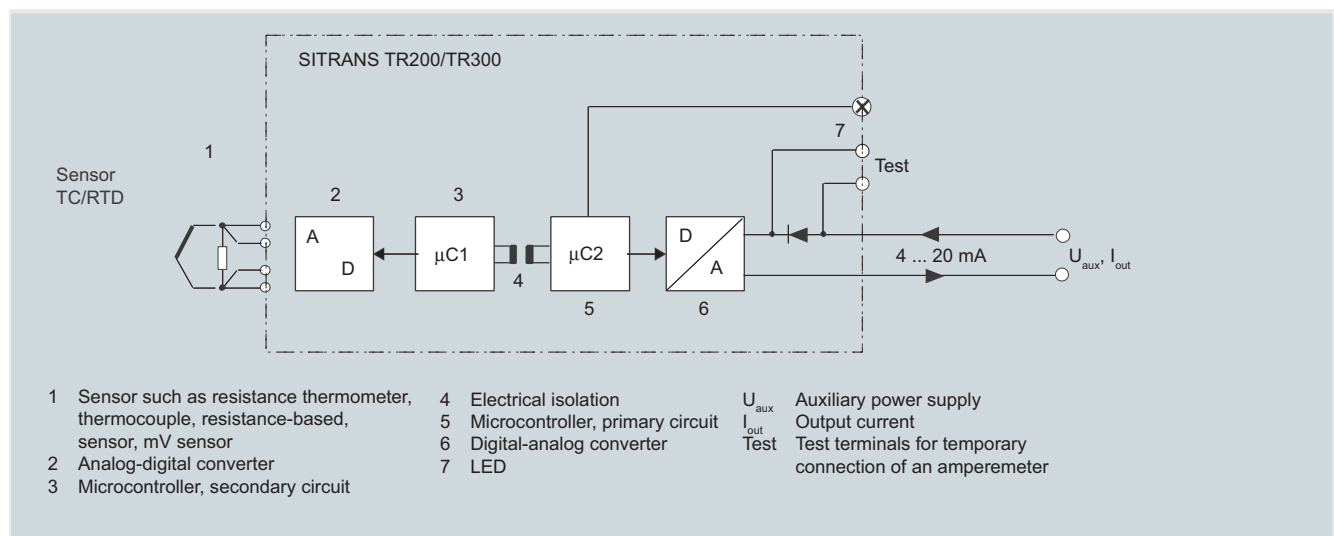
Transmitters of the "intrinsically-safe" type of protection can be installed within potentially explosive atmospheres. The devices comply with the Directive 94/9/EC (ATEX).

Function

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

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

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



SITRANS TR300 function diagram

SITRANS T measuring instruments for temperature

Transmitters for rail mounting

SITRANS TR300
two-wire system, universal, HART

Technical specifications

Input

Resistance thermometer

Measured variable	Temperature
Sensor type	<ul style="list-style-type: none"> • to IEC 60751 Pt25 ... Pt1000 • to JIS C 1604; $\alpha=0.00392$ 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 $\leq 100 \Omega$ (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time T_{63}	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	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 $\leq 100 \Omega$ (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time T_{63}	≤ 250 ms for 1 sensor with open-circuit monitoring

Open-circuit monitoring	Can be switched off
Short-circuit monitoring	Can be switched off (value is adjustable)
Range	Parameterizable, max. 0 ... 2200 Ω (see Table "Digital measuring errors")
Min. measured span	5 Ω ... 25 Ω (see Table "Digital measuring errors")
Characteristic	Resistance-linear or special characteristic
<u>Thermocouple elements</u>	
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 ... 199 °C (90 ... 180 °F) (see table "Digital measuring errors")
Characteristic	Temperature-linear or special characteristic
<u>mV Sensor</u>	
Measured variable	DC voltage
Sensor type	DC voltage source (DC voltage source possible over an externally connected resistor)
Units	mV
Response time T_{63}	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Can be switched off
Short-circuit monitoring	Can be switched off (value is adjustable)

SITRANS T measuring instruments for temperature

Transmitters for rail mounting

SITRANS TR300

two-wire system, universal, HART

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 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 ... 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 Ω
• Storage temperature	23 °C
• Warming-up time	> 5 min
Error in the analog output (digital/analog converter)	< 0.025 % 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	< 0.001 % of span/V
Effect of load impedance	< 0.002 % of span/100 Ω
Long-term drift	
• in the first month	< 0.02 % of max. span
• after one year	< 0.2 % of max. span
• after 5 years	< 0.3 % of max. span
Rated conditions	
<u>Ambient temperature</u>	
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
Design	
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

Certificate and approvals

Explosion protection ATEX

EC type test certificate

• "Intrinsic safety" type of protection

• Type of protection, "equipment has limited energy"

• Type of protection, "equipment is non-arcing"

Software requirements for SIPROM T

PC operating system:

PTB 07 ATEX 2032X

II 2(1) G Ex ia/ib IIC T6/T4

II 3(1) G Ex ia/ic IIC T6/T4

II 2(1) D Ex iaD/ibD 20/21 T115 °C

II 3 G Ex nL IIC T6/T4

II 3 G Ex nA IIC T6/T4

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)
<u>to IEC 60751</u>					
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)
<u>to JIS C1604-81</u>					
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 measuring instruments for temperature

Transmitters for rail mounting

SITRANS TR300
two-wire system, universal, HART

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

¹⁾ The digital accuracy in the range 0 to 300 °C (32 to 572 °F) is 3 °C (5.4 °F).

²⁾ The digital accuracy in the range 1750 to 2300 °C (3182 to 4172 °F) is 2 °C (3.6 °F).

mV Sensor

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 TR300

for mounting on a standard DIN rail,
two-wire system, 4 ... 20 mA, HART,
with electrical isolation, with docu-
mentation on CD

- Without explosion protection ▶ **7NG3033-0JN00**
D)
- With explosion protection to ATEX ▶ **7NG3033-1JN00**
D)

Further designs

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

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

with test protocol (5 measuring
points)

SIL 2 (functional safety)

Accessories

CD for measuring instruments for temperature

with documentation in German,
English, French, Spanish, Italian,
Portuguese and SIPROM T
parameterization software

HART modem

- With RS 232 connection ▶ **7MF4997-1DA**
D)
- With USB connection ▶ **7MF4997-1DB**
D)

SIMATIC PDM operating software

▶ Available ex stock.

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

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

Power supply units see "SITRANS I supply units and isolation amplifiers".

Factory setting:

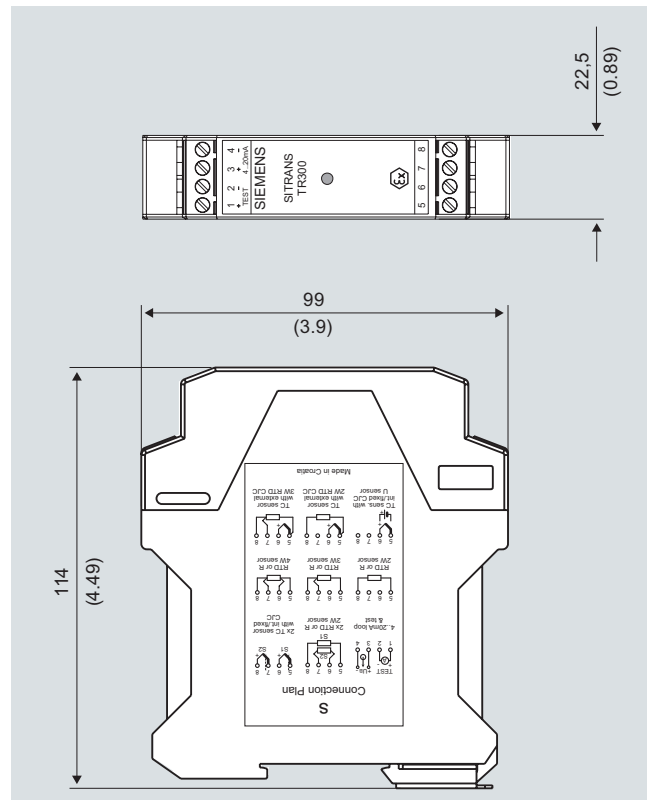
- Pt100 (IEC 751) with three-wire circuit
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

SITRANS T measuring instruments for temperature

Transmitters for rail mounting

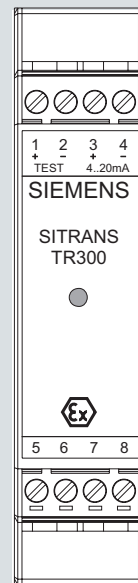
SITRANS TR300
two-wire system, universal, HART

Dimensional drawings



SITRANS TR300, dimensions in mm (inch)

Schematics



Assignments

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

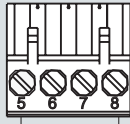
SITRANS TR300, pin assignment

SITRANS T measuring instruments for temperature

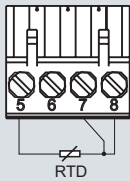
Transmitters for rail mounting

SITRANS TR300
two-wire system, universal, HART

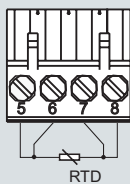
Resistance thermometer



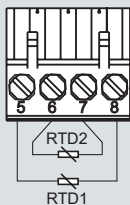
Two-wire system ¹⁾



Three-wire system



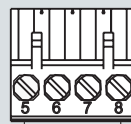
Four-wire system



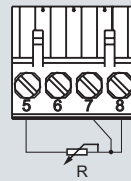
Generation of average value/difference ¹⁾

¹⁾ Programmable line resistance for the purpose of correction.

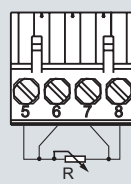
Resistance



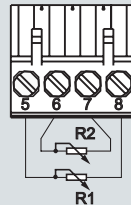
Two-wire system ¹⁾



Three-wire system

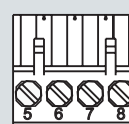


Four-wire system

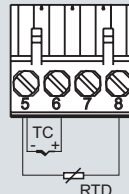


Generation of average value/difference ¹⁾

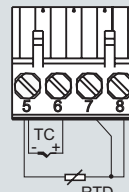
Thermocouple



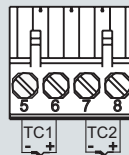
Cold junction compensation
Internal/fixed value



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

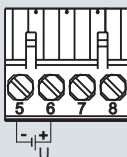


Cold junction compensation with
external Pt100 in three-wire system

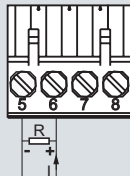


Generation of average value / difference
with internal cold junction compensation

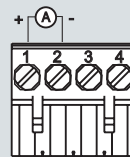
Voltage measurement



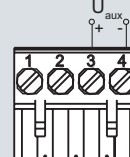
Current measurement



Test terminals



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



SITRANS TR300, sensor connection assignment

SITRANS T measuring instruments for temperature

Transmitters for rail mounting

SITRANS TW four-wire system, universal, HART

Overview



The user-friendly transmitters for the control room

The SITRANS TW universal transmitter is a further development of the service-proven SITRANS T for the 4-wire system in a mounting rail housing. With numerous new functions it sets new standards for temperature transmitters.

With its diagnostics and simulation functions the SITRANS TW provides the necessary insight during commissioning and operation. And using its HART interface the SITRANS TW can be conveniently adapted with SIMATIC PDM to every measurement task.

All SITRANS TW control room devices are available in a non-intrinsically safe version as well as in an intrinsically safe version for use with the most stringent requirements.

Application

The SITRANS TW transmitter is a four-wire rail-mounted device with a universal input circuit for connection to the following sensors and signal sources:

- Resistance thermometers
- Thermocouple elements
- Resistance-based sensors/potentiometers
- mV sensors
- As special version:
 - V sources
 - Current sources

The 4-wire rail-mounted SITRANS TW transmitter wire is designed for control room installation. It must not be mounted in potentially explosive atmospheres.

All SITRANS TW control room devices are available in a non-intrinsically safe version as well as in an intrinsically safe version for use with the most stringent requirements.

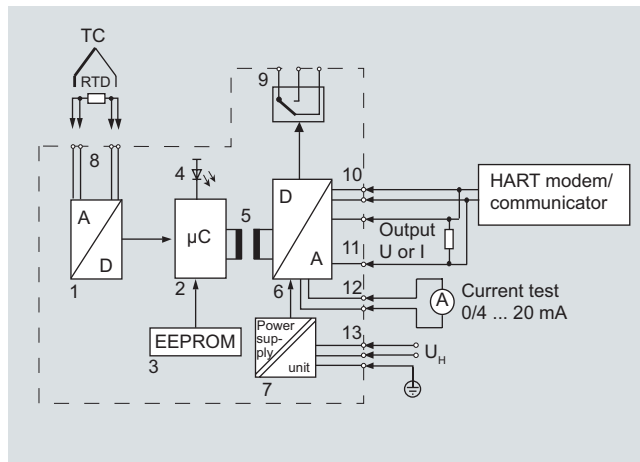
Function

Features

- Transmitter in four-wire system with HART interface
- Housing can be mounted on 35 mm rail or 32 mm G rail
- Screw plug connector
- All circuits electrically isolated
- Output signal: 0/4 to 20 mA or 0/2 to 10 V
- Power supplies: 115/230 V AC/DC or 24 V AC/DC
- Explosion protection [Ex ia] or [Ex ib] for measurements with sensors in the hazardous area
- Temperature-linear characteristic for all temperature sensors

- Temperature-linear characteristic can be selected for all temperature sensors
- Automatic correction of zero and span
- Monitoring of sensor and cable for open-circuit and short-circuit
- Sensor fault and/or limit can be output via an optional sensor fault/limit monitor
- Hardware write protection for HART communication
- Diagnostic functions
- Slave pointer functions

Mode of operation



The signal output by a resistance-based sensor (two-wire, three-wire, four-wire system), voltage source, current source or thermocouple is converted by the analog-to-digital converter (1, function diagram) into a digital signal. This is evaluated in the microcontroller (2), corrected according to the sensor characteristic, and converted by the digital-to-analog converter (6) into an output current (0/4 to 20 mA) or output voltage (0/2 to 10 V). The sensor characteristics as well as the electronics data and the data for the transmitter parameters are stored in the non-volatile memory (3).

AC or DC voltages can be used as the power supply (13). Any terminal connections are possible for the power supply as a result of the bridge rectifier in the power supply unit. The PE conductor is required for safety reasons.

A HART modem or a HART communicator permit parameterization of the transmitter using a protocol according to the HART specification. The transmitter can be directly parameterized at the point of measurement via the HART output terminals (10).

The operation indicator (4) identifies a fault-free or faulty operating state of the transmitter. The limit monitor (9) enables the signaling of sensor faults and/or limit violations. In the case of a current output, the current can be checked on a meter connected to test socket (12).

Diagnosis and simulation functions

The SITRANS TW comes with extensive diagnosis and simulation functions.

Physical values can be defined with the simulation function. It is thus possible to check the complete signal path from the sensor input to inside the control system without additional equipment. The slave pointer functions are used to record the minimum and maximum of the plant's process variable.

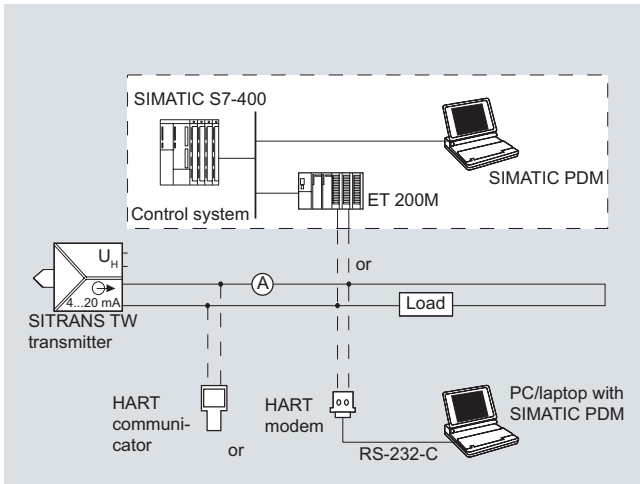
SITRANS T measuring instruments for temperature

Transmitters for rail mounting

SITRANS TW
four-wire system, universal, HART

Integration

System configuration



Possible system configurations

The SITRANS TW transmitter as a four-wire rail-mounted device can be used in a number of system configurations: as a stand-alone version or as part of a complex system environment, e.g. with SIMATIC S7. All device functions are available via HART communication.

Communication options through the HART interface:

- HART communicator
- HART modem connected to PC/laptop on which the appropriate software is available, e.g. SIMATIC PDM
- HART-compatible control system (e.g. SIMATIC S7-400 with ET 200M)

Technical specifications

Input

Selectable filters to suppress the line frequency

50 Hz, 60 Hz, also 10 Hz for special applications (line frequency filter is similar with measuring frequency)

Resistance thermometer

Measured variable

Temperature

Measured range

Parameterizable

Measured span

Min. 25 °C (45 °F) x 1/scaling factor

Sensor type

- DIN IEC 751
- Acc. to JIS C 1604-81
- Acc. to DIN 43760
- Special type ($R_{RTD} \leq 500 \Omega$)

Pt100 (DIN IEC 751)

Pt100 (JIS C1604-81)

Ni100 (DIN 43760)

Multiples or parts of the defined characteristic values can be parameterized (e.g. Pt500, Ni120)

Voltage measurement

Temperature-linear, resistance-linear or customer-specific

Type of connection

- Normal connection
- Sum or parallel connection
- Mean-value or differential connection

Connection

2, 3 or 4-wire circuit

Measuring range limits

Depending on type of connected thermometer (defined range of resistance thermometer)

Sensor breakage monitoring

Monitoring of all connections for open-circuit (function can be switched off)

Sensor short-circuit monitoring

Parameterizable response threshold (function can be switched off)

Resistance-based sensors, potentiometers

Measured variable

Ohmic impedance

Measured range

Parameterizable

Measured span

Min. 10 Ω

Voltage measurement

Resistance-linear or customer-specific

Type of connection

- Normal connection
- Differential connection
- Mean-value connection

Connection

2, 3 or 4-wire circuit

Input range

0 ... 6000 Ω ;
with mean-value and difference circuits: 0 ... 3000 Ω ;

Sensor breakage monitoring

Monitoring of all connections for open-circuit (function can be switched off)

Sensor short-circuit monitoring

Parameterizable response threshold (function can be switched off)

SITRANS T measuring instruments for temperature

Transmitters for rail mounting

SITRANS TW four-wire system, universal, HART

Thermocouple elements

Measured variable	Temperature
Measured range	Parameterizable
Measured span	Min. 50 °C (32.22 °F) x 1/scaling factor
Measuring range limits	Depend. on type of thermocouple element
Thermocouple	
• Type B	Pt30 %Rh/Pt6 %Rh (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	Pt13 %Rh/Pt (DIN IEC 584)
• Type S	Pt10 %Rh/Pt (DIN IEC 584)
• Type T	Cu/CuNi (DIN IEC 584)
• Type U	Cu/CuNi (DIN 43710)

	Special type (-10 mV ≤ UTC ≤ 100 mV)
Voltage measurement	Temperature-linear, voltage-linear or customer-specific
Type of connection	<ul style="list-style-type: none"> • Normal connection • Sum connection • Mean-value connection • Differential connection

Cold junction compensation	None, internal measurement, external measurement or predefined fixed value
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Sensor breakage monitoring	Function can be switched off
----------------------------	------------------------------

mV sensors

Measured variable	DC voltage
Measured range	Parameterizable
Measured span	Min. 4 mV
Input range	-120 ... +1000 mV
Voltage measurement	Voltage-linear or customer-specific
Overload capacity of inputs	Max. ± 3.5 V
Input resistance	≥ 1 MΩ
Sensor current	Approx. 180 μA
Sensor breakage monitoring	Function can be switched off

V sources

Measured variable	DC voltage
Measured range	Parameterizable
Voltage measurement	Voltage-linear or customer-specific
Input range/min. span	
• Devices with 7NG3242-xxxx1 or 7NG3242-xxxx 0 with U/I plug	-1.2 V ... +10 V/0.04 V
• Devices with 7NG3242-xxxx2	-12 V ... +100 V/0.4 V
• Devices with 7NG3242-xxxx3	-120 V ... +140 V/4.0 V
Sensor breakage monitoring	Not possible

μA, mA sources

Measured variable	DC voltage
Measured range	Parameterizable
Voltage measurement	Current-linear or customer-specific
Input range/min. span	
• Devices with 7NG3242-xxxx4	-12 μA ... +100 μA/0.4 μA
• Devices with 7NG3242-xxxx5	-120 μA ... +1000 μA/4 μA
• Devices with 7NG3242-xxxx6	-1.2 mA ... +10 mA/0.04 mA
• Devices with 7NG3242-xxxx7 or 7NG3242-xxxx 0 with U/I plug	-12 mA ... +100 mA/0.4 mA
• Devices with 7NG3242-xxxx8	-120 mA ... +1000 mA/4 mA
Sensor breakage monitoring	Not possible

Output

<u>Output signal</u>	Load-independent direct current 0/4 ... 20 mA, can be switched to load-independent DC voltage 0/2 ... 10 V using plug-in jumpers.
Current 0/4 ... 20 mA	
• Overrange	-0.5 ... +23.0 mA, continuously adjustable
• Output range following sensor fault	-0.5 ... +23.0 mA, continuously adjustable
• Load	≤ 650 Ω
• Open-circuit voltage	≤ 30 V
Voltage 0/2 ... 10 V	
• Overrange	-0.25 ... +10.75 V, continuously adjustable
• Output range following sensor fault	-0.25 ... +10.75 V, continuously adjustable
• Load resistance	≥ 1 kΩ
• Load capacitance	≤ 10 nF
• Short-circuit voltage	≤ 100 mA (not permanently short-circuit-proof)
• Electrical damping	
- Adjustable time constant T_{63}	0 ... 100 s, in steps of 0.1 s
• Current source/voltage source	Continuously adjustable within the total operating range

Sensor fault/limit signalling

Operation indicator	Flashing signal
• Limit violation	Flashing frequency 5 Hz
• Overrange	Flashing frequency 1 Hz
Relay output	Either as NO or NC contact with 1 changeover contact
• Switching capacity	≤ 150 W, ≤ 625 VA
• Switching voltage	≤ 125 V DC, ≤ 250 V AC
• Switching current	≤ DC 2.5 A
Overrange	Signalling of sensor or line breakage and sensor short-circuit
Limit monitoring	
• Operating delay	0 ... 10 s
• Monitoring functions of limit module	<ul style="list-style-type: none"> • Sensor fault (breakage and/or short-circuit) • Lower and upper limit • Window (combination of lower and upper limits) • Limit and sensor fault detection can be combined
• Hysteresis	Parameterizable between 0 and 100 % of measuring range

SITRANS T measuring instruments for temperature

Transmitters for rail mounting

SITRANS TW
four-wire system, universal, HART

3

Power supply	
Universal power supply unit	115/230 V AC/DC or 24 V AC/DC
Tolerance range for power supply	
• With 115/230 V AC/DC PSU	80 ... 300 V DC; 90 ... 250 V AC
• With 24 V AC/DC PSU	18 ... 80 V DC; 20.4 ... 55.2 V AC (in each case interruption-resistant up to 20 ms in the complete tolerance range)
Tolerance range for mains frequency	47 ... 63 Hz
Power consumption with	
• 230 V AC	≤ 5 VA
• 230 V DC	≤ 5 W
• 24 V AC	≤ 5 VA
• 24 V DC	≤ 5 W
Electrical isolation	
Electrically isolated circuits	Input, output, power supply and sensor fault/limit monitoring output are electrically isolated from one another. The HART interface is electrically connected to the output.
Working voltage between all electrically isolated circuits	The voltage U_{eff} between any two terminals must not exceed 300 V
Measuring accuracy	
Measurement error	
• Error in the internal cold junction	$\leq 3^\circ\text{C} \pm 0,1^\circ\text{C}/10^\circ\text{C}$ ($\leq 5,4^\circ\text{F} \pm 0,18^\circ\text{F}/18^\circ\text{F}$)
• Error of external cold junction terminal 7NG3092-8AV	$\leq 0,5^\circ\text{C} \pm 0,1^\circ\text{C}/10^\circ\text{C}$ ($\leq 0,9^\circ\text{F} \pm 0,18^\circ\text{F}/18^\circ\text{F}$)
• Digital output	See "Digital error"
• Analog output I_{AN} or U_{AN}	$\leq 0,05\%$ of span in addition to digital error
Influencing effects (referred to the digital output)	Compared to the max. span:
• Temperature drift	$\leq 0,08\%/10^\circ\text{C}$ ($\leq 0,08\%/18^\circ\text{F}$) $\leq 0,2\%$ in the range $-10 \dots +60^\circ\text{C}$ ($14 \dots 140^\circ\text{F}$)
• Long-term drift	$\leq 0,1\%$ /year
Influencing effects referred to the analog output I_{AN} or U_{AN}	Compared to the span:
• Temperature drift	$\leq 0,08\%/10^\circ\text{C}$ ($\leq 0,08\%/18^\circ\text{F}$) $\leq 0,2\%$ in the range $-10 \dots +60^\circ\text{C}$ ($14 \dots 140^\circ\text{F}$)
• Power supply	$\leq 0,05\%/10\text{ V}$
• Load with current output	$\leq 0,05\%$ with change from $50 \dots 650\ \Omega$
• Load with voltage output	$\leq 0,1\%$ with change in load current from $0 \dots 10\text{ mA}$
• Long-term drift (start-of-scale value, span)	$\leq 0,03\%$ /month
Response time (T_{63} without electrical damping)	$\leq 0,2\text{ s}$
Electromagnetic compatibility	
	According to EN 61326 and NAMUR NE21
Certificate and approvals	
ATEX	To DIN EN 50014: 1997, EN 50020: 1994
Intrinsic safety to EN 50 020	
• for 7NG3242-xAxxx	II (1) G D [Ex ia/ib] IIB
• for 7NG3242-xBxxx	II (1) G D [Ex ia/ib] IIC
EC-Type Examination Certificate	TÜV (German Technical Inspectorate) 01 ATEX 1675

Rated conditions	
<u>Installation conditions</u>	
Location (for devices with explosion protection)	
• Transmitters	Outside the potentially explosive atmosphere
• Sensor	Within the potentially explosive atmosphere zone 1 (also in zone 0 in conjunction with the prescribed protection requirements for the sensor)
<u>Ambient conditions</u>	
Permissible ambient temperature	$-25 \dots +70^\circ\text{C}$ ($-13 \dots +158^\circ\text{F}$)
Permissible storage temperature	$-40 \dots +85^\circ\text{C}$ ($-40 \dots +185^\circ\text{F}$)
Climatic class	
• Relative humidity	5 ... 95 %, no condensation
Design	
Weight	Approx. 0.24 kg (0.53 lb)
Enclosure material	PBT, glass-fibre reinforced
Degree of protection to IEC 529	IP20
Degree of protection to VDE 0100	Protection class I
Type of installation	35-mm top hat rail (1.38 inch) (DIN EN 50022) or 32-mm G-type rail (1.26 inch) (DIN EN 50035)
Electrical connection/process connection	Screw plug connectors, max. $2,5\text{ mm}^2$ (0.01 inch ²)
Parameterization interface	
Protocol	HART, version 5.9
Load with connection of	
• HART communicator	230 ... 650 Ω
• HART modem	230 ... 500 Ω
Software for PC/laptop	SIMATIC PDM version V5.1 and later

SITRANS T measuring instruments for temperature

Transmitters for rail mounting

SITRANS TW four-wire system, universal, HART

Digital error

Resistance thermometer

Input	Measured range	Max. permissible line resistance	Digital error
	°C (°F)	Ω	°C (°F)
DIN IEC 751			
• Pt10	-200 ... +850 (-328 ... +1562)	20	3.0 (5.4)
• Pt50	-200 ... +850 (-328 ... +1562)	50	0.6 (1.1)
• Pt100	-200 ... +850 (-328 ... +1562)	100	0.3 (0.5)
• Pt200	-200 ... +850 (-328 ... +1562)	100	0.6 (1.1)
• Pt500	-200 ... +850 (-328 ... +1562)	100	1.0 (1.8)
• Pt1000	-200 ... +850 (-328 ... +1562)	100	1.0 (1.8)
JIS C 1604-81			
• Pt10	-200 ... +649 (-328 ... +1200)	20	3.0 (5.4)
• Pt50	-200 ... +649 (-328 ... +1200)	50	0.6 (1.1)
• Pt100	-200 ... +649 (-328 ... +1200)	100	0.3 (0.5)
DIN 43760			
• Ni50	-60 ... +250 (-76 ... +482)	50	0.3 (0.5)
• Ni100	-60 ... +250 (-76 ... +482)	100	0.3 (0.5)
• Ni120	-60 ... +250 (-76 ... +482)	100	0.3 (0.5)
• Ni1000	-60 ... +250 (-76 ... +482)	100	0.3 (0.5)

Resistance-based sensors

Input	Measured range	Max. permissible line resistance	Digital error
	Ω	Ω	Ω
Resistance (linear)	0 ... 24	5	0.08
	0 ... 47	15	0.06
	0 ... 94	30	0.06
	0 ... 188	50	0.08
	0 ... 375	100	0.1
	0 ... 750	100	0.2
	0 ... 1500	75	1.0
	0 ... 3000	100	1.0
	0 ... 6000	100	2.0

Thermocouple elements

Input	Measured range	Digital error ¹⁾
	°C (°F)	°C (°F)
Type B	0 ... +1820 (+32 ... +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 ... +1200 (-346 ... +2192)	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⁾ Accuracy data refer to the largest error in the complete measuring range

Voltage/current sources

Input	Measuring range	Digital error
mV sources (linear)	mV	μV
	-1 ... +16	35
	-3 ... +32	20
	-7 ... +65	20
	-15 ... +131	50
	-31 ... +262	100
	-63 ... +525	200
	-120 ... +1000	300
V sources (linear)	V	mV
	-1.2 ... +10	3
	-12 ... +100	30
	-120 ... +140	300
μA/mA sources (linear)	μA/mA	μA
	-12 ... +100 μA	0.05
	-120 ... +1000 μA	0.5
	-1.2 ... +10 mA	5
	-12 ... +100 mA	50
	-120 ... +1000 mA	500

SITRANS T measuring instruments for temperature

Transmitters for rail mounting

SITRANS TW
four-wire system, universal, HART

Ordering examples

Desired transmitter	Parameter:		Ordering design
	Standard	Special	
Example 1: SITRANS TW, transmitter in four-wire system <ul style="list-style-type: none"> • with explosion protection ATEX • 230 V AC/DC power supply • current output • without sensor fault/limit monitor <ul style="list-style-type: none"> - Sensor PT100, three-wire circuit - Measuring range 0 ... 150 °C - Temperature-linear characteristic - Filter time 1 s - Output 4 ... 20 mA, line filter 50 Hz - Output driven to full-scale in event of like breakage 			7NG3242-1AA00 (stock item)
Example 2: SITRANS TW, transmitter in four-wire system <ul style="list-style-type: none"> • without explosion protection • 24 V AC/DC power supply • Voltage output • Sensor fault/limit monitor <ul style="list-style-type: none"> - Rating plate in English - Sensor NiCr/Ni, type K - Cold junction internal - Measuring range 0 ... 950 °C - Temperature-linear characteristic - Filter time 1 s - Output 0 ... 10 V, line filter 50 Hz - Output driven to full-scale in event of like breakage - Limit monitoring switched off 		S76 A05 Y30 H10	7NG3242-0BB10-Z Y01 + S76 + A05 + Y30 + H10 Y01: see Order code Y30: MA=0; ME= 950; D=C
Example 3: SITRANS TW, transmitter in four-wire system <ul style="list-style-type: none"> • without explosion protection • 24 V AC/DC power supply • Current output • without sensor fault/limit monitor <ul style="list-style-type: none"> - Voltage input, measuring range -1.2 V ... +10 V - Measuring range 0 ... 5 V - Source-proportional characteristic - Filter time 10 s - Output 0 ... 20 mA, line filter 60 Hz - No monitoring for sensor fault 		A40 Y32 G07 H11 J03	7NG3242-0BA01-Z Y01 + A40 + Y32 + G07 + H11 + J03 Y01: see Order code Y32: MA=0; ME= 5; D=V

Ordering information

The order number structure shown below is used to specify a fully functioning transmitter. The selection of the operating data (type of source, measuring range, characteristic etc.) is made according to the following rules:

- Operating data already set in factory to default values:
The default settings can be obtained from the list of parameterizable operating data (see "Special operating data"). The presets can be modified by the customer to match the requirements precisely.
- Operating data set on delivery according to customer requirements:
Supplement the Order No. by "-Z" and add the Order code "Y01". The operating data to be set can be obtained from the list of parameterize operating data. The Order codes A ■■ to K ■■ for operating data to be set need only be specified in the order if they deviate from the default setting.
The default setting is used if no Order code is specified for operating data.

The selected parameters are printed on the transmitter's rating plate.

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Transmitters for rail mounting

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Selection and Ordering data	Order No.
SITRANS TW universal transmitter ▶ for rail mounting, in four-wire system (order instruction manual separately)	7 NG 3 2 4 2 -
Explosion protection	
• without ▶	0
• for inputs [EEx ia] or [EEx ib] ▶	1
Power supply	
• 115/230 V AC/DC ▶	A
• 24 V AC/DC ▶	B
Output signal	
• 0/4 ... 20 mA (can be switched to 0/2 ... 10 V) ▶	A
• 0/2 ... 10 V (can be switched to 0/4 ... 20 mA) ▶	B
Sensor fault/limit monitor	
• without (retrofitting not possible) ▶	0
• relay with changeover contact ▶	1
Input for	
• Temperature sensor, resistance-based sensor and mV sensor with measuring range -120 ... +1000 mV DC and with U/I plug	0
• Voltage input (V sources) ¹⁾ Measuring range: - DC -1.2 ... +10 V	1
- DC -12 ... +100 V (not Ex version)	2
- DC -120 ... +140 V (not Ex version)	3
• Current input (µA, mA sources) ¹⁾ Measuring range: - DC -12 ... +100 µA	4
- DC -120 ... +1000 µA	5
- DC -1.2 ... +10 mA	6
- DC -12 ... +100 mA	7
- DC -120 ... +1000 mA	8
Further designs Please add "-Z" to Order No. and specify Order code(s) (see "List of parameterizable operating data").	Order code
• Customer-specific setting of operating data (see "List of parameterizable operating data") Note: specify in plain text: „see Order code“	Y01
• Meas. point description (max. 16 char.)	Y23
• Text on front of device (max. 32 char.)	Y24
• HART tag (max. 8 characters)	Y25
• with test report	P01
• with shorting plug to HART communication for 0 mA or 0 V	S01
• with plug for external cold junction compensation	S02
• with U/I plug (-1.2 ... +10 V DC or -12 ... +100 mA)	S03
Language of rating plate (together with Y01 order code only)	
• Italian	S72
• English	S76
• French	S77
• Spanish	S78

¹⁾ Observe max. values with Ex version.

▶ Available ex stock.

Selection and Ordering data	Order No.
Accessories	
CD for measuring instruments for temperature ▶ with documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software	A5E00364512
Instruction Manual for SITRANS TW	
• German/English ▶	A5E00054075
• French/Italian/Spanish ▶	A5E00064515
Cold junction terminal ▶	7NG3092-8AV
U/I plug (-1.2 ... +10 V DC pr -12 ... +100 mA) ▶	7NG3092-8AW
SIMATIC PDM operating software	see Chapter 9
HART modem	
• with RS232 interface ▶	7MF4997-1DA D)
• with USB interface ▶	7MF4997-1DB D)

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

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List of parameterizable operating data (Order codes A ■■ + B ■■ ... E ■■)

Operating data acc. to default setting

Order No. with Order code: 7NG3242 - ■■■■■-Z Y01

Order codes: A ■ ■ ... E ■ ■

[illegible]

mV, V and μ A, mA sensors ⁹⁾

A 4 0 Meas. range with Order No. 7NG 3242 - -Z Y01

E 50

0	-120 ... +1000 mV	
1	-1,2 ... +10 V ¹⁰⁾	
2	-12 ... +100 V ¹⁰⁾	
3	-120 ... +140 V ¹⁰⁾	
4	-12 ... +100 μA ¹⁰⁾	
5	-120 ... +1000 μA ¹⁰⁾	
6	-1,2 ... +10 mA ¹⁰⁾	
7	-12 ... +100 mA ¹⁰⁾	
8	-120 ... +1000 mA ¹⁰⁾	
	Special range ⁷⁾	Y 3 2

- 1) n = number of thermocouple elements to be connected in series
- 2) See „Circuit diagrams“ for meaning of type circuit
- 3) Line resistance of channels 1 and 2, for max. permissible line resistance see „Technical specifications“ (only with C32, not with C33 and C34)
- 4) n = number of resistance thermometers to be connected in series
- 5) $1/n$ = number of resistance thermometers to be connected in parallel
- 6) Combination of series and parallel connection of resistance thermometers
- 7) Operating data: see „Special operating data“
- 8) This range does not apply to mean-value and difference circuits.
- 9) The max. permissible currents and voltages according to conformity certificate must be observed in devices with explosion protection.
- 10) Without detection of line breakage

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List of parameterizable operating data (Order codes F ■ ■ ■ ... K ■ ■ ■)

Operating data according to default setting			Order No. with Order code: 7NG3242 - ■■■■■ -Z Y01									
Order codes: F ■■■ ... K ■■■			■ ■ ■	+	■ ■ ■	+	■ ■ ■	+	■ ■ ■	+	■ ■ ■	
Sensor												
Thermocouple elements				Voltage measurement		Filter time ¹⁾		Output signal and line filter ²⁾		Failure signal		Limit monitor ³⁾
Type	Temperature range											
B: Pt30 %Rh/	0 ... 1820 °C	A 0 0	Temperature-linear	F 0 0	0 s	G 0 0	4 ... 20 mA/	with line break-age/fault:	to full scale	J 0 0	Limit monitoring ineffective (but sensor fault signalling with closed-circuit operation)	K 0 0
C: W5 %Re	0 ... 2300 °C	A 0 1			0.1 s	G 0 1	2 ... 10 V					
D: W3 %Re	0 ... 2300 °C	A 0 2	Voltage-linear	F 1 0	0.2 s	G 0 2	with line filter:	hold last value	J 0 2			
E: NiCr/CuNi	-200 ... +1000 °C	A 0 3			0.5 s	G 0 3	50 Hz			H 0 0		
J: Fe/CuNi (IEC)	-210 ... +1200 °C	A 0 4	1 s	G 0 4	60 Hz	H 0 1	no monitoring	J 0 3				
K: NiCr/Ni	-200 ... +1372 °C	A 0 5	2 s	G 0 5	10 Hz ⁴⁾	H 0 2			Safety value ⁵⁾	Y 6 0		
L: Fe/CuNi (DIN)	-200 ... +900 °C	A 0 6	5 s	G 0 6	0 ... 20 mA/	H 1 0	Effective ⁵⁾	Y 7 0				
N: NiCrSi/NiSi	-200 ... +1300 °C	A 0 7			10 s				G 0 7	0 ... 10 V		
R: Pt13 %Rh/Pt	-50 ... +1760 °C	A 0 8	20 s	G 0 8	with line filter:	50 Hz	Safety value ⁵⁾	Y 6 0				
S: Pt10 %Rh/Pt	-50 ... +1760 °C	A 0 9	50 s	G 0 9	50 Hz							
T: Cu/CuNi (IEC)	-200 ... +400 °C	A 1 0	100 s	G 1 0	60 Hz	H 1 1	Safety value ⁵⁾	Y 6 1				
U: Cu/CuNi (DIN)	-200 ... +600 °C	A 1 1	Special time ⁵⁾	Y 5 0	10 Hz	H 1 2						
Resistance thermometer (max. permissible line resistances see „Technical specifications“)			Voltage measurement		Filter time ¹⁾		Output signal and line filter ²⁾		Failure signal		Limit monitor ³⁾	
Pt100 (DIN IEC)	-200 ... +850 °C	A 2 0	Temperature-linear	F 0 0	same as for thermocouple elements	same as for thermocouple elements	with line break-age/fault:	to full scale	J 0 0	same as for thermocouple elements		
Pt100 (JIS)	-200 ... +649 °C	A 2 1										
Ni100 (DIN)	-60 ... +250 °C	A 2 2	Resistance-linear	F 2 0							to start of scale	J 0 1
											no monitoring	J 0 3
					Safety value ⁵⁾	Y 6 0						
					with line break-age or short-circuit/fault:		to full scale	J 1 0				
					to start of scale	J 1 1						
					hold last value	J 1 2						
					no monitoring	J 1 3						
					Safety value ⁵⁾	Y 6 1						
Resistance-based sensors, potentiometers (max. permissible line resistances see „Technical specifications“)			Voltage measurement		Filter time ¹⁾		Output signal and line filter ²⁾		Failure signal		Limit monitor ³⁾	
		A 3 0	Resistance-linear	F 2 0	same as for thermocouple elements	same as for thermocouple elements	with line break-age/fault:	to full scale	J 0 0	same as for thermocouple elements		
											to start of scale	J 0 1
											no monitoring	J 0 3
					Safety value ⁵⁾	Y 6 0						
mV, V and μA, mA sources			A 4 0	Voltage measurement		Filter time ¹⁾		Output signal and line filter ²⁾		Failure signal		Limit monitor ³⁾
	</											

¹⁾ Software filter to smooth the result

²⁾ Filter to suppress line disturbances on the measured signal.

³⁾ If signalling relay present

⁴⁾ for special applications

⁵⁾ Operating data: see „Special operating data“

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Special operating data

Order code	Plain text required	Options
Y00	N=□□.□□	Factor N for multiplication with the characteristic values of resistance thermometers Range of values: 0.10 to 10.00 1. Example: 3 x Pt500 parallel: N = 5/3 = 1.667; 2. Example: Ni120: N = 1.2
Y10	TV=□□□□.□□ D=□	Temperature TV of the fixed cold junction Dimension; range of values: C, K, F, R
Y11	RL=□□□□.□□	Line resistance RL in Ω for compensation of cold junction line of external Pt100 DIN IEC 751 Range of values: 0.00 to 100.00
Y20	RL1=□□□□.□□ RL2=□□□□.□□	Line resistances RL of channel 1 (RL1) and channel 2 (RL2) in Ω if the resistance thermometer or the resistance-based sensor is connected in a two-wire system Range of values depending on type of sensor: 0.00 to 100.00
Y30	MA=□□□□.□□ ME=□□□□.□□ D=□	Start-of-scale value MA and full-scale value ME for thermocouples and resistance thermometers (Range of values depending on type of sensor) Dimension, range of values: C, K, F, R)
Y31	MA=□□□□.□□ ME=□□□□.□□	Start-of-scale value MA and full-scale value ME for resistance-based sensors or potentiometers in Ω Range of values: 0.00 to 6,000.00
Y32	MA=□□□□.□□ ME=□□□□.□□ D=□□	Start-of-scale value MA and full-scale value ME for mV, V, μ A and mA sources Range of values depending on type of sensor: -120.00 to 1,000.00 Dimension (mV entered as MV, V as V, μ A as UA, mA as MA)
Y50	T63=□□□.□	Response time T63 of software filter in s Range of values: 0.0 to 100.0 Safety value S of signal output in mA or in V corresponding to the set type of output. Range of values - with current output: -0.50 to 23.00 - with voltage output: -0.25 to 10.75
Y60	S=□□.□□	Safety value S with line breakage of sensor
Y61	S=□□.□□	Safety value S with line breakage or short-circuit of sensor
Y70	UG=□□□□.□□ OG=□□□□.□□ H=□□□□.□□ K=□ A=□ T=□□.□	Lower limit value (dimension as defined by measuring range) Upper limit value (dimension as defined by measuring range) Hysteresis (dimension as defined by measuring range) Switch on/off combination of limit function and sensor fault detection; J=on; N=off (standard: J) Type of relay output: A=open-circuit operation; R=closed-circuit operation (standard: R) Switching delay T of relay output in s Range of values: 0.0 to 10.0 (standard: 0.0)

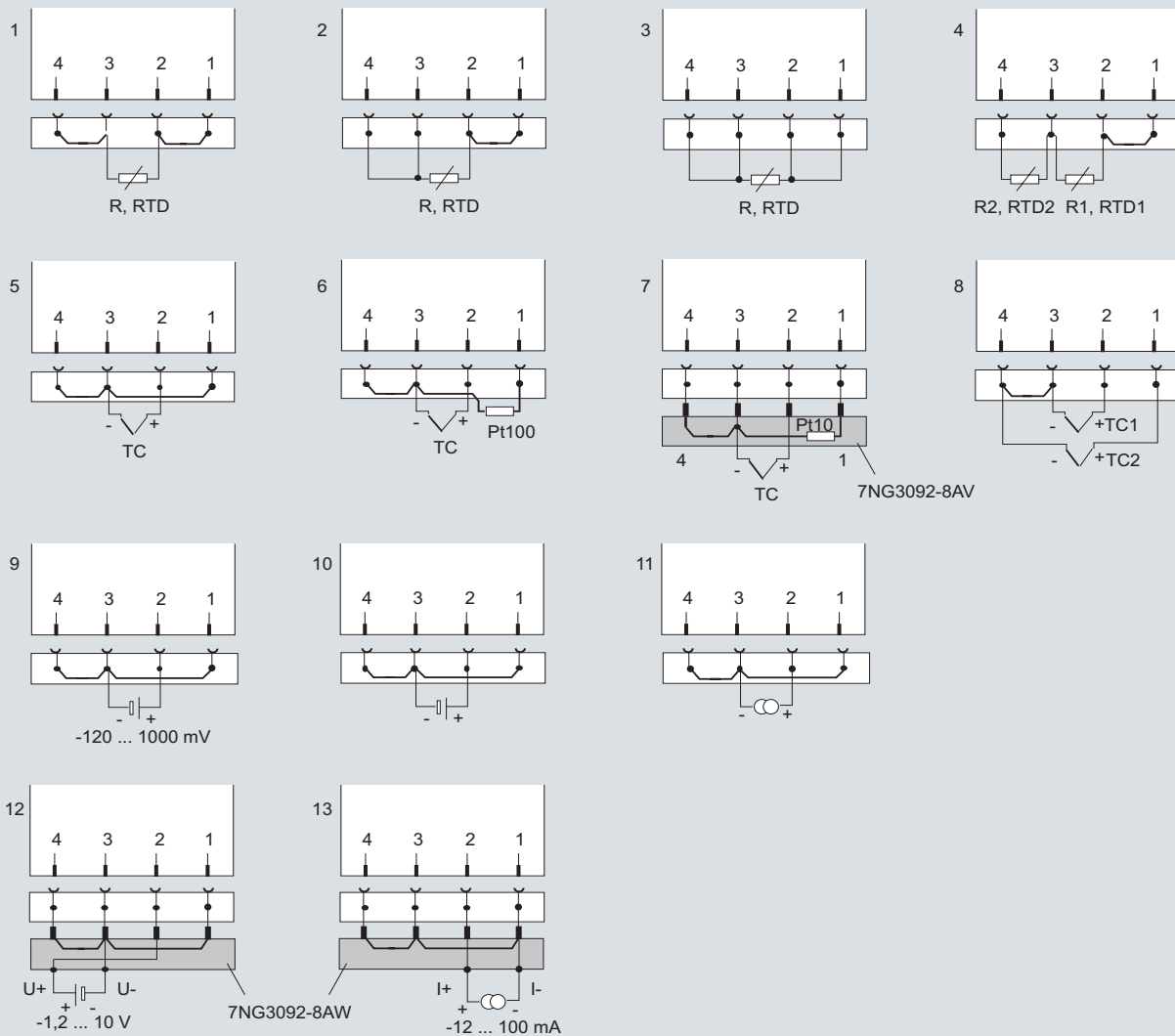
SITRANS T measuring instruments for temperature

Transmitters for rail mounting

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Schematics

Sensor input connections



Resistance thermometers, resistance-based sensors, potentiometers:

- 1 Two-wire system; resistance can be parameterized for line compensation
- 2 Three-wire system
- 3 Four-wire system
- 4 Difference/mean-value circuit; 2 resistors can be parameterized for line compensation

Thermocouples:

- 5 Determination of cold junction temperature using built-in Pt100 or fixed reference temperature
- 6 Determination of cold junction temperature using external Pt100; resistance can be parameterized for line compensation
- 7 Determination of cold junction temperature using cold junction terminal 7NG3092-8AV
- 8 Difference/mean-value circuit with internal cold junction temperature

Further sources:

- 9 mV sources with two-wire system (7NG3242-xxxx0)
- 10 V sources with two-wire system (7NG3242-xxxx[1-3])
- 11 mA/mA sources with two-wire system (7NG3242-xxxx[4-8])
- 12 Voltage measurement -1,2 to 10 V with U/I plug 7NG3092-8AV (7NG3242-xxxx0)
- 13 Current measurement -12 to 100 mA with U/I plug 7NG3092-8AV (7NG3242-xxxx0)

Connection diagram for the input signal

Channel 1 is the measured variable between the terminals 2 and 3 on the input plug. With a difference or mean-value circuit, the calculation of the measured value is defined by the type of measurement. Otherwise the measured value is determined via channel 1. The following code is used for the type of measurement:

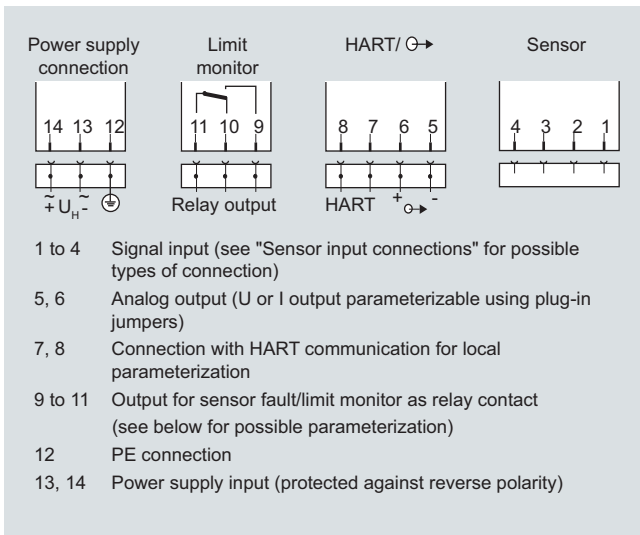
Type of measurement	Calculation of measured value
Single channel	Channel 1
Differential connection 1	Channel 1 - Channel 2
Differential connection 2	Channel 2 - Channel 1
Mean-value 1	$\frac{1}{2} \cdot (\text{Channel 1} + \text{Channel 2})$

The short-circuit jumpers shown in the circuits must be inserted in the respective system on site.

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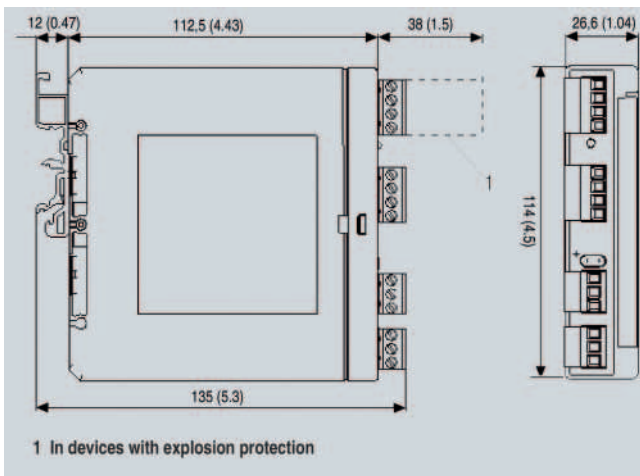


Connection diagram for power supply, input and outputs

Relay output

	Connected terminals
Closed-circuit operation (relay opens when error)	
• Device switched off	10 and 11
• Device switched on and no error	9 and 11
• Device switched on and error	10 and 11
Open-circuit operation (relay closes when error)	
• Device switched off	10 and 11
• Device switched on and no error	10 and 11
• Device switched on and error	9 and 11

Dimensional drawings



Dimensions for control room mounting, rail mounting in mm (inches)

SITRANS T measuring instruments for temperature

Transmitter for field mounting with temperature sensor

SITRANS TF2 Digital display thermometer

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.

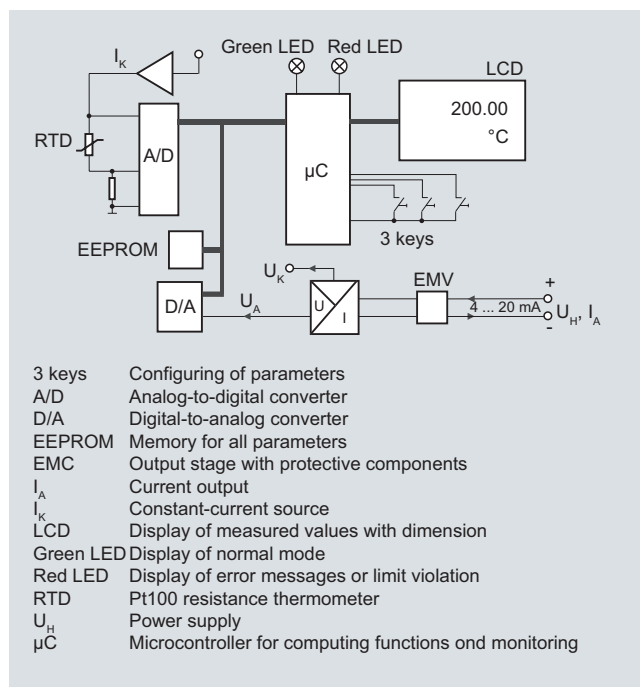
At the front of the housing is the 5-digit display behind a glass cover. Underneath the display are the 3 keys for parameterizing the SITRANS TF2. Above the display are a green and a red LED for indicating the operating status.

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 $\pm 120^\circ$ relative to the protective tube.
- In the axial version (type B) the display is at right angles to the protective tube. The display can be rotated by 360° relative to the protective tube.

Function

Mode of operation



The outside lying temperature sensor Pt100 is supplied with current from the constant current source 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).

SITRANS T measuring instruments for temperature

Transmitter for field mounting with temperature sensor

SITRANS TF2 Digital display thermometer

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. 1.4016 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)
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SITRANS T measuring instruments for temperature

Transmitter for field mounting with temperature sensor

SITRANS TF2

Digital display thermometer

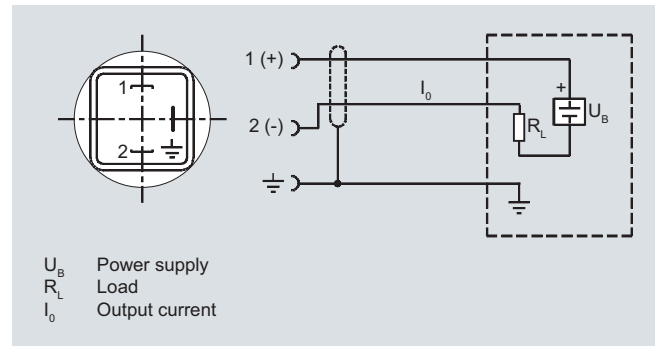
Selection and ordering data	Order No.	Order code
Temperature transmitter SITRANS TF2, field device Temperature transmitter with LCD in stainless steel housing, degree of protection IP65, stainless steel protective tube, resistance thermometer with Pt100 sensor, measuring range -50 ... +200 °C (-58 ... +392 °F), local parameterization, output signal 4 ... 20 mA	7 NG 3 1 4 0 -	
Display/cable entry <ul style="list-style-type: none"> Radial version (type A), parallel to protective tube/M16x1.5 Axial version (type B), at right angles to protective tube/M16x1.5 Radial version (type A), parallel to protective tube/½"-NPT Axial version (type B), at right angles to protective tube/½"-NPT 	1 2 3 4	
Process connection <ul style="list-style-type: none"> Connection shank G½B Connection shank ½"-14 NPT Other version (on request) add Order code and plain text: connection shank: ... 	A B Z	J 1 Y
Length of the protective tube (U₁) <ul style="list-style-type: none"> 170 mm (6.70 inch) 260 mm (10.24 inch) 4.5" (114 mm) 7.5" (190 mm) 10.5" (266 mm) Other version (on request) add Order code and plain text: length: ... 	A B K P T Z	K 1 Y
Material of the protective tube <ul style="list-style-type: none"> Stainless steel (mat. No. 1.4571/316Ti) Other version (on request) add Order code and plain text: mat. No.: ... 	0 9	L 1 Y

► Available ex stock

Selection and ordering data

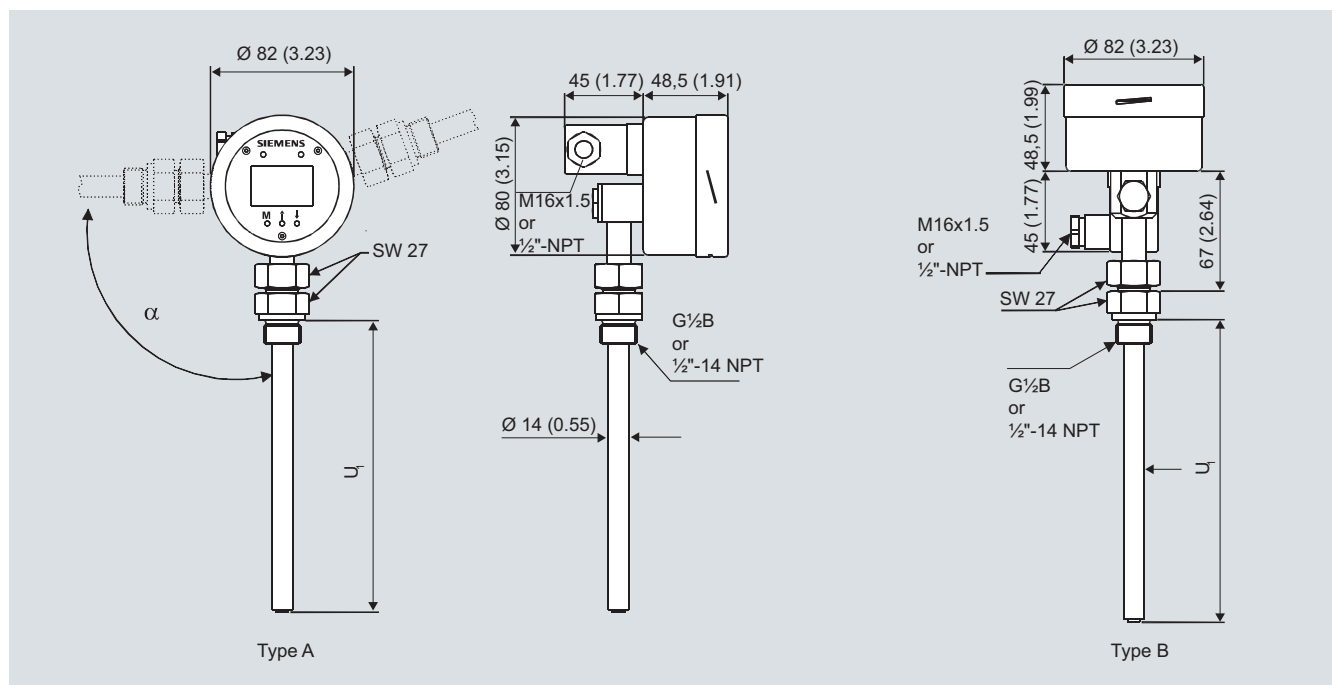
Further design Manufacturer's test certificate M to DIN 55340, Part 18 and ISO 8402 (calibration certificate 3 points), add "-Z" to Order No. and Order code.	Order code C11
Manufacturer's test certificate M to DIN 55340, Part 18 and ISO 8402 (calibration certificate 1 point) supplied later, specify factory no. of transmitter.	Order No. 7MF1564-8CC11
Additional data Add "-Z" to Order No. and specify Order code and plain text	Order code
Measuring range to be set Y01:	Y01
Measuring point label made of stainless steel, please specify inscription in plain text.	Y15

Schematics



SITRANS TF2, connection diagram

Dimensional drawings



SITRANS TF2, dimensions in mm (inches)

SITRANS T measuring instruments for temperature

Transmitter for field mounting with temperature sensor

SITRANS TF280
WirelessHART

Overview



SITRANS TF280 for flexible and cost-effective temperature measurements

- Supports the WirelessHART standard (HART V 7.1)
- Very high security level for wireless data transmission
- Built-in local user interface (LUI) with 3-button operation
- Optimum representation and readability using graphical display (104 x 80 pixels) with integrated backlight
- Stand-by (deep sleep phase) mode can be turned on and off with push of a button
- Battery power supply
- Battery life time up to 5 years
- Extend battery life time with HART modem interface which can be switch off
- Optimized power consumption through new design, and increase in battery life time
- Simple configuration thanks to SIMATIC PDM
- Housing meets IP65 degree of protection
- Supports all Pt100 sensors as per IEC 751/DIN EN 60751

Benefits

The SITRANS TF280 is a temperature transmitter that features Wireless HART as the standard communication interface.

Also available is a wired interface to connect a HART modem:

- Flexible temperature measurement
- Save costs on wiring at difficult installation conditions. Wireless technology offers cost advantages in cases where extensive wiring costs would normally apply.
- It enables additional hitherto unfeasible measuring points, particularly for monitoring purposes
- Easy installation also on moveable equipment parts
- Enables cost-effective temporary measurements, for example for process optimizations.
- Optimum solution in addition to wired communication and for system solutions in process automation

Application

The SITRANS TF280 is a WirelessHART field device for temperature measurement with a Pt100 sensor.

This sensor can be installed directly on the field device, or connected at an offset with a cable connection. On the wireless communication side, the transmitter supports the WirelessHART standard. A HART modem can be connected to the transmitter particularly for initial parameterization.

It can be used in all industries and applications in non-explosive areas.

Design

The SITRANS TF280 has a robust aluminum enclosure and is suitable for outside use. It conforms with the IP65 safety class.

The operation temperature range is -40 to +80 °C (-40 to +176 °F). Power supply is provided through an integrated battery, which is available as an accessory. The device is only approved for operation with this battery.

The antenna features a rotatable joint which can be used for directional alignment. Wireless signals can thus be optimally received and transmitted.

A special highlight is the possibility to operate directly on the device with 3 push buttons. It perfectly matches the strategy of all new Siemens field devices.

Using the device's push buttons, it is easy to turn the HART modem interface of the device on and off. The device can be put to passive status and reactivated at any time. This helps to extend the life time of the battery.

The SITRANS TF280 transmitter features a cable gland or a Pt100 sensor including protective piping.

Function

The SITRANS TF280 can join to a WirelessHART network. It can be parameterized and operated through this network. Measured process values are transmitted via the network to the SIEMENS IE/WSN-PA LINK.

Field device data received by the IE/WSN-PA LINK is transmitted to the connected systems, for example the process control system SIMATIC PCS 7. For an introduction of WirelessHART, please see the FI 01 catalogue Sec. 9 or www.siemens.com/wirelesshart.

Detailed information on IE/WSN-PA LINK can be found in the FI 01 catalogue Sec. 9 or www.siemens.com/wirelesshart.

Integration

Connecting to SIMATIC PCS 7

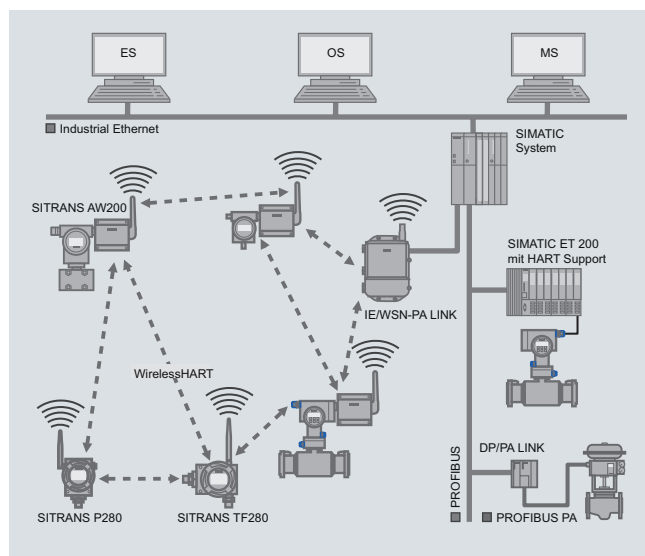
The integration of field devices in SIMATIC PCS 7 and other process control systems can be now done seamlessly and cost-effectively with wireless technology, especially in situations where high wiring costs may be expected. Of particular interest are measuring points which are to be added and for which no wiring is available.

Where larger distances between the IE/WSN-PA LINK and control systems need to be overcome, this connection can also be implemented on a wireless and cost-effective basis using the SCALANCE W series of products.

SITRANS T measuring instruments for temperature

Transmitter for field mounting with temperature sensor

SITRANS TF280 WirelessHART



Integration of a meshed network into SIMATIC PCS 7

Configuration

Configuration of the SITRANS TF280 transmitter may be carried out as follows:

- Initial commissioning for the SITRANS TF280 with SIMATIC PDM is generally carried out via a HART modem or the integrated local user interface, since the network ID and join Key must be set up on the device before it can be accepted and integrated into the WirelessHART network.
- Once it is integrated into the network, the device can be conveniently operated with the WirelessHART network or onsite with a HART modem or via the local user interface.

Technical specifications

The SITRANS TF280 can be mechanically installed in two ways:

- Direct at the measuring point with a M20x1.5 thread. A connection to other threads can be done via the adapter.
- Remotely from the Pt100 sensor, which is connected to the transmitter via a cable

Input

Sensor

- Sensor type: Pt100 as per IEC 751/DIN EN 60751
- Connection: Two, three or four-wire system
- Measuring range: -200 ... +850 °C (-328 ... 1560 °F)
- Cable length SITRANS TF280 and Pt100 sensor element: ≤ 3 m

Measuring accuracy

- Accuracy: < 0.5 % of the measuring range or 0.5 °C
- Long-term drift: < 0.035 % of the measuring range in first year
- Ambient temperature effect: < 0.1 °C/10 K

Rated conditions

- Ambient temperature: -40 ... +80 °C (-40 ... +176 °F)
- Storage temperature: -40 ... +85 °C (-40 ... +185 °F)
- Relative humidity: <95%
- Climatic class: 4K4H in accordance with EN 60721-3-4 (stationary use at locations not protected against weather)

Degree of protection	IP65/NEMA 4
Max. permissible temperature at transmitter for directly mounted Pt100	80 °C (176 °F)
Design	
Enclosure	Die-cast aluminum
Shock resistance	in accordance with DIN EN 60068-2-29 / 03.95
Resistance to vibration	DIN EN 60068-2-6/12.07 20 ≤ f ≤ 2000 Hz 0.01 g ² /Hz
Weight	• without battery: 1.5 kg (3.3 lb) • with battery: 1.6 kg (3.5 lb)
Dimensions (W x H x D)	See Dimensional drawing
Thread for cable gland/sensor connection	M20x1.5 other threads via adapter
Cable between transmitter and sensor element	≤ 3 m für two-, three- or four-wire connections Cable resistance < 1 Ω (setting range in mΩ 0...9999)
Sensor break	Recognized
Displays and controls	
Display (with illumination)	
• Size of display	104 x 80 pixels
• Number of digits	Adjustable
• Number of spaces after comma	Adjustable
Setting options	• on site with 3 push buttons • with SIMATIC PDM or HART Communicator
Auxiliary power	
Battery	3.6 V DC
Communication	
Wireless standard	WirelessHART V7.1 conforming
Transmission frequency band	2.4 GHz (ISM-Band)
Range under reference conditions	Up to 250 m (line of sight) in outside areas Up to 50 m (greatly dependent on obstacles) in Inside areas
Communication interfaces	• HART communication with HART modem • WirelessHART
Certificates and approvals	
Wireless communication approvals	R&TTE FCC
Classification according to pressure equipment directive (PED 97/23/EC)	This device does not fall under the pressure equipment directive:

SITRANS T measuring instruments for temperature

Transmitter for field mounting with temperature sensor

SITRANS TF280
WirelessHART

Selection and ordering data	Order No.
SITRANS TF280 WirelessHART Temperature transmitter (Required battery not included with delivery, see accessories)	7MP11110-0A
Connections/cable entry Cable gland M20x1.5 Sensor pipe with Pt100, G½" male thread, pre-mounted and connected	C D
Display Digital display, visible	1
Enclosure Die-cast aluminum	1
Explosion protection Not included	A
Antenna Variable, attached to device	A
Further designs Please add "-Z" to Order No. and specify Order code(s) and plain text.	Order code
Measuring point number (TAG Nr.) max. 16 digits entered in plain text Y15:	Y15
Measuring point message max. 27 characters entered in plain text: Y16:	Y16
Accessories	Order No.
Lithium battery for SITRANS TF280/P280	7MP1990-0AA00
Mounting bracket, steel	7MF4997-1AC
Mounting bracket, stainless steel	7MF4997-1AJ
Cover, die-cast aluminum, without window	7MF4997-1BB
Cover, die-cast aluminum, with window	7MF4997-1BE
Thread adapter M20x1.5 (male thread) on ½-14 NP (female thread) ¹⁾	7MP1990-0BA00
Thread adapter M20x1.5 (male thread) on G½B (female thread) ¹⁾	7MP1990-0BB00
IE/WSN-PA Link	see Sec. 9
HART modem with RS232 interface	7MF4997-1DA
HART modem with USB interface	7MF4997-1DB
SIMATIC PDM	see Sec. 9

▶ Available ex stock

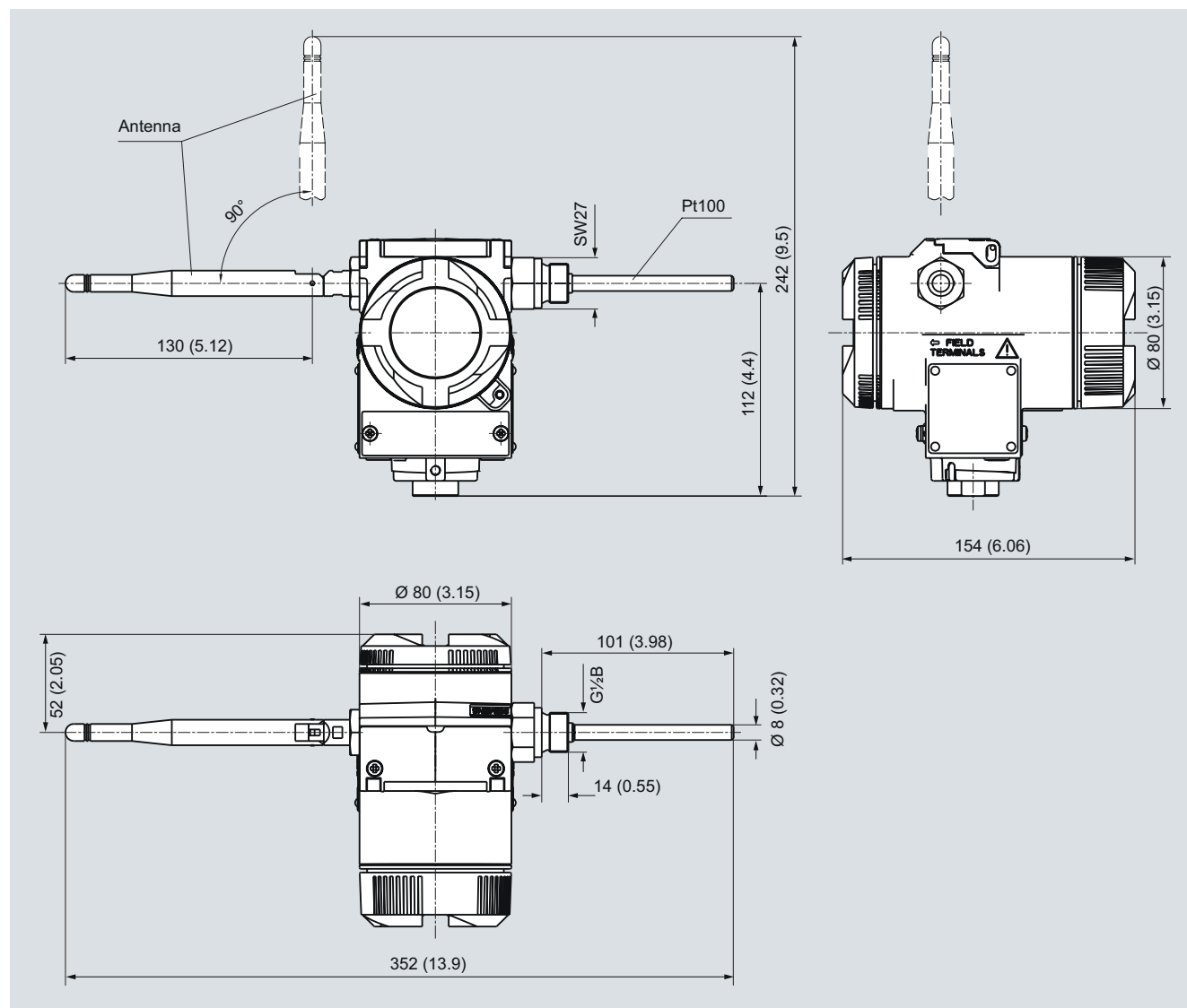
1) Available soon

SITRANS T measuring instruments for temperature

Transmitter for field mounting with temperature sensor

SITRANS TF280
WirelessHART

Dimensional drawings

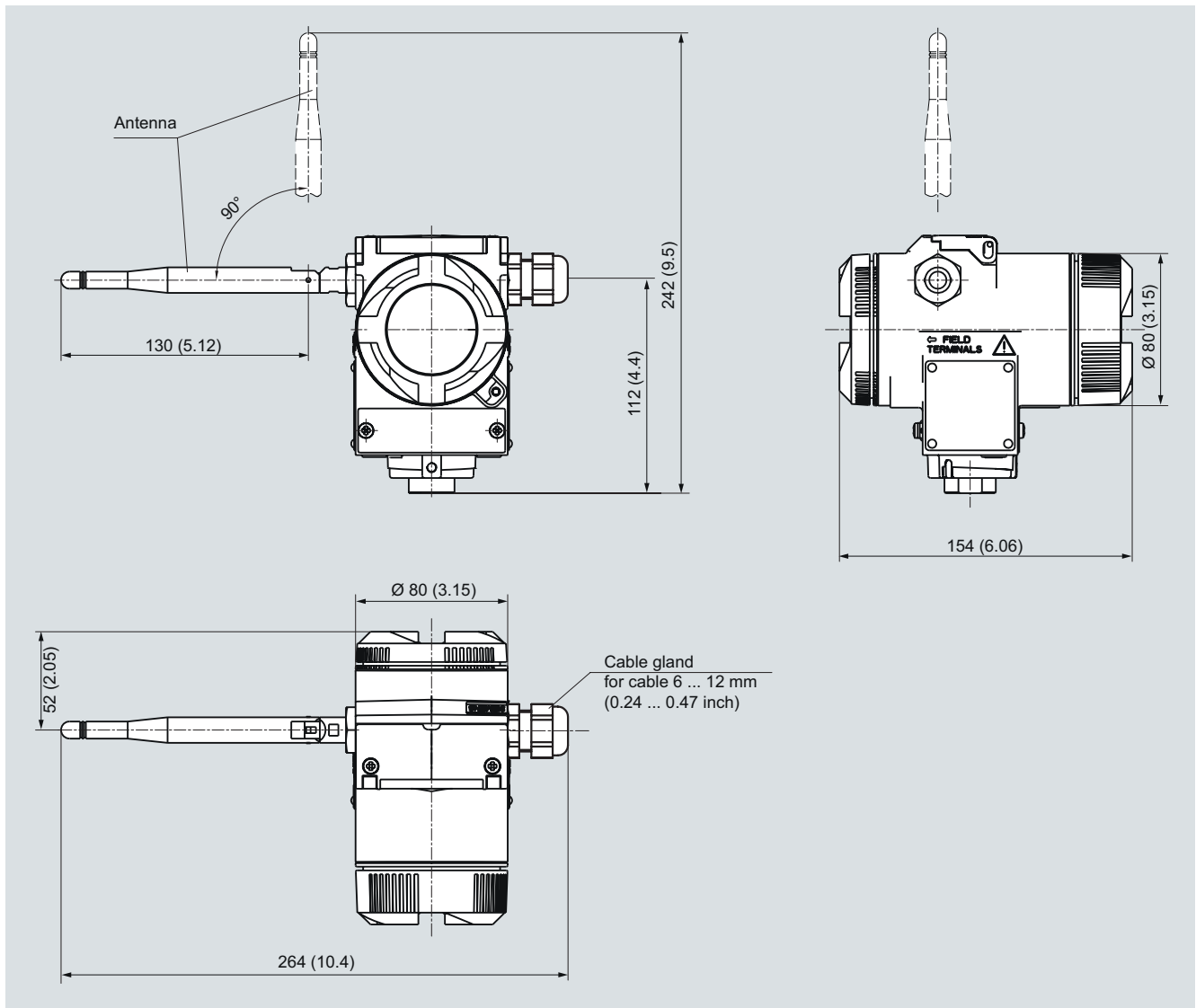


SITRANS TF280 WirelessHART temperature transmitter with Pt100, dimensions in mm (inch)

SITRANS T measuring instruments for temperature

Transmitter for field mounting with temperature sensor

SITRANS TF280
WirelessHART



SITRANS TF280 WirelessHART temperature transmitter, dimensions in mm (inch)

SITRANS T measuring instruments for temperature

Transmitter for field mounting/field indicator

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

Overview



Our field devices for heavy industrial use

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

The temperature transmitter SITRANS TF works where others feel uncomfortable.

Benefits

- Universal use
 - as transmitter for resistance thermometer, thermoelement, Ω or mV signal
 - as field indicator for any 4 to 20 mA signals
- Local sensing of measured values over digital display
- Rugged two-chamber enclosure in die-cast aluminium or stainless steel
- Type of protection IP67
- Test terminals for direct read-out of the output signal without breaking the current loop
- Can be mounted elsewhere if the measuring point
 - is not easily accessible
 - is subject to high temperatures
 - is subject to vibrations from the system
 - or if you want to avoid long neck tubes and/or protective tubes
- Can be mounted directly on American-design sensors
- Wide range of approvals for use in potentially explosive atmospheres. "Intrinsically safe, non-sparking and flameproof" type of protection, for Europe and USA.
- SIL 2 (with order code C20)

Application

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

Function

Configuration

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

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

Mode of operation

Mode of operation of SITRANS TF as temperature transmitter

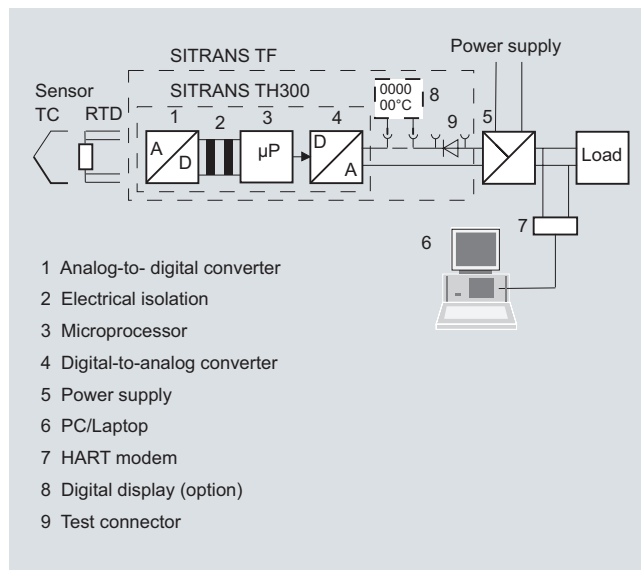
The sensor signal, whether resistance thermometer, thermocouple or Ω and/or V signal, is amplified and linearized. Sensor and output side are electrically isolated. An internal cold junction is integrated for measurements with thermocouples.

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

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

Mode of operation of SITRANS TF as field indicator

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



Operating principle: SITRANS TF with an integrated transmitter and digital display

SITRANS T measuring instruments for temperature

Transmitter for field mounting/field indicator

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

Technical specifications

Input

Resistance thermometer

Measured variable	Temperature
Sensor type	Pt25 ... Pt1000 Pt25 ... Pt1000 Ni25 ... Ni1000
• to IEC 60751 • to JIS C 1604; $\alpha=0.00392$ K-1 • to IEC 60751	
Units	°C and °F
Connection	
• Normal connection	1 resistance thermometer (RTD) in 2-wire, 3-wire or 4-wire system
• Generation of average value	Series or parallel connection of several resistance thermometers in a two-wire system for the generation of average temperatures or for adaptation to other device types
• Generation of difference	2 resistance thermometers (RTD) in 2-wire system (RTD 1 – RTD 2 or RTD 2 – RTD 1)
Interface	
• Two-wire system	Parameterizable line resistance $\leq 100 \Omega$ (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Can be switched off
Short-circuit monitoring	Can be switched off (value is adjustable)
Measuring 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-based sensor in 2-wire system (R 1 – R 2 or R 2 – R 1)
Interface	
• Two-wire system	Parameterizable line resistance $\leq 100 \Omega$ (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Can be switched off
Short-circuit monitoring	Can be switched off (value is adjustable)

Measuring range	Parameterizable (see table "Digital measuring errors")
Min. measured span	5 ... 25 Ω (see table "Digital measuring errors")
Characteristic	Resistance-linear or special characteristic
<u>Thermocouple</u>	
Measured variable	Temperature
Sensor type (thermocouples)	
• Type B	Pt30Rh-Pt6Rh to DIN IEC 584
• Type C	W5 %-Re to ASTM 988
• Type D	W3 %-Re to ASTM 988
• Type E	NiCr-CuNi to DIN IEC 584
• Type J	Fe-CuNi to DIN IEC 584
• Type K	NiCr-Ni to DIN IEC 584
• Type L	Fe-CuNi to DIN 43710
• Type N	NiCrSi-NiSi to DIN IEC 584
• Type R	Pt13Rh-Pt to DIN IEC 584
• Type S	Pt10Rh-Pt to DIN IEC 584
• Type T	Cu-CuNi to DIN IEC 584
• Type U	Cu-CuNi to DIN 43710
Units	°C or °F
Connection	
• Standard connection	1 thermocouple (TC)
• Generation of average value	2 thermocouples (TC)
• Generation of difference	2 thermocouples (TC) (TC 1 – TC 2 or TC 2 – TC 1)
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Can be switched off
Cold junction compensation	
• Internal	With integrated Pt100 resistance thermometer
• External	With external Pt100 IEC 60571 (2-wire or 3-wire connection)
• External fixed	Cold junction temperature can be set as fixed value
Measuring range	Parameterizable (see table "Digital measuring errors")
Min. measured span	Min. 50 ... 100 °C (90 ... 180 °F) (see table "Digital measuring errors")
Characteristic	Temperature-linear or special characteristic
<u>mV Sensor</u>	
Measured variable	DC voltage
Sensor type	DC voltage source (DC voltage source possible over an externally connected resistor)
Units	mV
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Can be switched off
Short-circuit monitoring	Can be switched off (value is adjustable)
Measuring range	-10 ... +70 mV -100 ... +1100 mV
Min. measured span	2 mV or 20 mV
Overload capacity of the input	-1.5 ... +3.5 V DC
Input resistance	≥ 1 M Ω
Characteristic	Voltage-linear or spec. characteristic

SITRANS T measuring instruments for temperature

Transmitter for field mounting/field indicator

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

Output

Output signal	4 ... 20 mA, 2-wire
Communication with SITRANS TH300	to HART Rev. 5.9

Digital display

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

Measuring accuracy

Digital measuring errors	See table "Dig. measuring errors"
Reference conditions	
• Auxiliary power supply	24 V ± 1 %
• Load	500 Ω
• Storage temperature	23 °C (73.4 °F)
• Warming-up time	> 5 min
Error in the analog output (digital/analog converter)	< 0.025 % of span
Error due to internal cold junction	< 0.5 °C (0.9 °F)
Temperature effect	< 0.1 % of max. span/10 °C (18 °F)
Power supply effect	< 0.001 % of span/V
Effect of load impedance	< 0.002 % of span/100 Ω
Long-term drift	
• in the first month	< 0.02 % of max. span
• after one year	< 0.2 % of max. span
• after 5 years	< 0.3 % of max. span

Rated conditions

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

Design

Approx. weight	Approx. 1.5 kg (3.3 lb), without options
Dimensions	See "Dimensional drawings"
Enclosure material	Die-cast aluminum, low in copper, GD-AISI 12 or stainless steel, polyester-based lacquer, stainless steel rating plate
Electrical connection, sensor connection	Screw terminals, cable inlet via M20 x 1.5 or 1/2-14 NPT threaded gland
Mounting bracket (optional)	Steel, galvanized and chrome-plated or stainless steel

Power supply

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

Certificate and approvals

Explosion protection ATEX

- "Intrinsically-safe" type of protection

- EC type test certificate

- "Operating equipment that is non-sparking and has limited energy for zone 2" type of protection

- EC type test certificate

- Flame-proof enclosure" type of protection

- EC type test certificate

Explosion protection to FM

- Identification (XP, DIP, NI, S)

With digital indicator:
II 2 (1) G EEx ia IIC T4

Without digital indicator:
II 2 (1) G EEx ia IIC T6

ZELM 99 ATEX 0007

II 3G EEx nAL IIC T6/T4

ZELM 99 ATEX 0007

II 2 G EEx d IIC T5/T6

CESI 99 ATEX 079

Certificate of Compliance 3017742

- XP / I / 1 / BCD / T5 Ta = 85 °C (185 °F), T6 Ta = 50 °C (112 °F), Type 4X

- DIP / II, III / 1 / EFG / T5 Ta = 85 °C (185 °F), T6 Ta = 50 °C (112 °F), Type 4X

- NI / I / 2 / ABCD / T5 Ta = 85 °C (185 °F), T6 Ta = 50 °C (112 °F), Type 4X

- S / II, III / 2 / FG / T5 Ta = 85 °C (185 °F), T6 Ta = 50 °C (112 °F), Type 4X

Hardware and software requirements

- For the parameterization software SIPROM T for SITRANS TH200

- Personal computer

PC with CD-ROM drive and USB/RS 232 interface

- PC operating system

Windows 98, NT, 2000, XP

- For the parameterization software SIMATIC PDM for SITRANS TH300

See chapter 9, "Software", "SIMATIC PDM"

Communication

Load for HART connection

230 ... 1100 Ω

- Two-core shielded

≤ 3.0 km (1.86 mi)

- Multi-core shielded

≤ 1.5 km (0.93 mi)

Protocol

HART protocol, version 5.x

Factory setting (transmitter):

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

SITRANS T measuring instruments for temperature

Transmitter for field mounting/field indicator

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

Digital measuring errors

Resistance thermometer

Input	Measuring range	Min. mea- sured span		Digital accuracy	
	°C (°F)	°C	(°F)	°C	(°F)
according 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)
according 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)

Resistance-based sensors

Input	Measuring range	Min. mea- sured span	Digital accuracy
	Ω	Ω	Ω
Resistance	0 ... 390	5	0,05
Resistance	0 ... 2200	25	0,25

Thermocouple elements

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

¹⁾ The digital accuracy in the range 0 to 300 °C (32 to 572 °F) is 3 °C (5.4 °F).

²⁾ The digital accuracy in the range 1750 to 2300 °C (3182 to 4172 °F) is 2 °C (3.6 °F).

mV sensors

Input	Measuring range	Min. mea- sured span	Digital accuracy
	mV	mV	μV
mV sensors	-10 ... +70	2	40
mV sensors	-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).

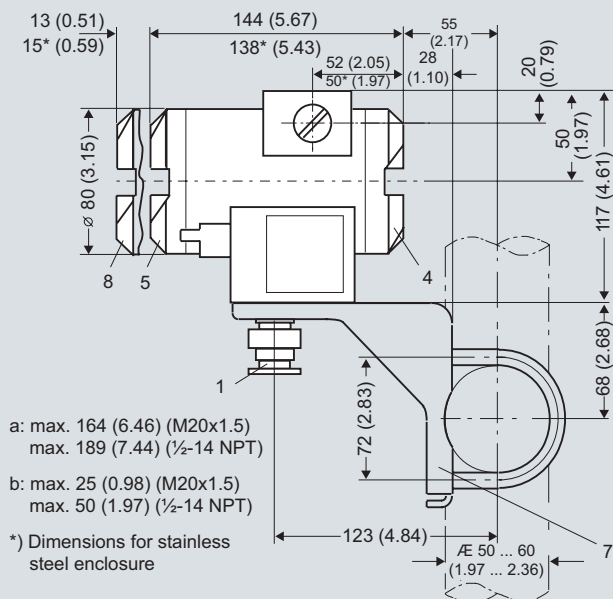
The total error under reference conditions at the analog output is the sum from the digital error and the digital-analog error (poss. with the addition of cold junction errors in the case of thermocouple measurements).

SITRANS T measuring instruments for temperature

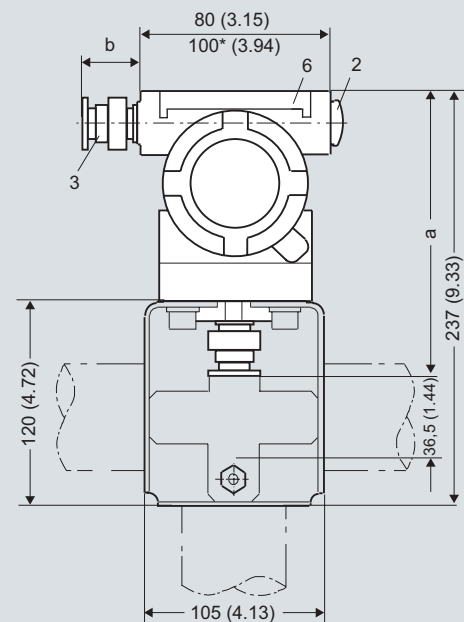
Transmitter for field mounting/field indicator

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

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 measuring instruments for temperature

Transmitter for field mounting/field indicator

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

Selection and Ordering data	Order No.
Temperature transmitter in field housing D) 7 NG 3 1 3 - - - - - Two-wire system 4 ... 20 mA, with electrical isolation, with documentation on CD-ROM	
Integrated transmitter • SITRANS TH200, programmable - without Ex protection 5 0 - with EEx ia 5 1 - with EEx nAL for zone 2 5 2 - total device SITRANS TF EEx d ¹⁾ 5 4 - total device SITRANS TF according to FM (XP, DIP, NI, S) ¹⁾ 5 5 • SITRANS TH300, communication capability according to HART V 5.9 - without Ex-protection 6 0 - with EEx ia 6 1 - with EEx nAL for zone 2 6 2 - total device SITRANS TF EEx d ¹⁾ 6 4 - total device SITRANS TF according to FM (XP, DIP, NI, S) ¹⁾ 6 5	
SITRANS TF field indicator 7 NG 3 1 3 - - - - - for 4 ... 20 mA signals, with documentation on CD-ROM	
• without Ex-protection 0 0 1 • with EEx ia 0 1 1 • with EEx nAL for zone 2 0 2 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	
Enclosure • die-cast aluminium A • stainless steel precision casting E	
Connections/cable inlet • screwed glands M20x1.5 B • screwed glands ½-14 NPT C	
Digital indicator • without 0 • with 1	
Mounting bracket and securing parts • without 0 • made of steel 1 • made of stainless steel 2	
Further designs Please add "-Z" to Order No. and specify Order code(s) and plain text.	Order code
Customer-specific setting of operating data Y 0 1 ²⁾	
Inscription on measuring-point label • measuring range (max. 27 characters) Y 2 2 ³⁾ • meas. point description (max. 16 char.) Y 2 3 ³⁾ • measuring point text (max. 27 char.) Y 2 4 ³⁾	
Test protocol (5 measuring points) C 1 1 ⁴⁾	
SIL 2 (functional safety) C 2 0 ⁵⁾	

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

¹⁾ Without cable gland.

²⁾ Y01: Please specify all data that does not correspond to factory settings (see above) (e.g. Y01 = thermocouple element type K; internal cold junction; 0 ... 800 °C; fault current 3.6 mA).

³⁾ Y22, Y23, Y24: If no order is placed for Y01, these data are only noted on the measuring point label and are not programmed in the transmitter.

⁴⁾ Can only be ordered together with Y01.

⁵⁾ Only with 7NG3135-... and 7NG3136-...

Selection and Ordering data	Order No.
Accessories Modem for SITRANS TH200 incl. parameterization software T • with USB interface ▶ 7NG3092-8KU C) • with RS 232 interface ▶ 7NG3092-8KM C)	
CD for measuring instruments for temperature ▶ A5E00364512 with documentation in German, English, French, Spanish, Italian and Portuguese, and parameterization software SIPROM T (included in delivery with SITRANS TF)	
HART modem • with RS 232 interface ▶ 7MF4997-1DA D) • with USB interface ▶ 7MF4997-1DB D)	
SIMATIC PDM parameterization software also for SITRANS TH300 Mounting bracket and securing parts • made of steel for 7NG313-...B.. 7MF4997-1AC • made of steel for 7NG313-...C.. 7MF4997-1AB • made of stainless steel for 7NG313-...B.. ▶ 7MF4997-1AJ • made of stainless steel for 7NG313-...C.. 7MF4997-1AH	see chap. 9
Digital indicator¹⁾ 7MF4997-1BS	
Connection board A5E02226423	

▶ Available ex stock.

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

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

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

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

Factory setting (transmitter):

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

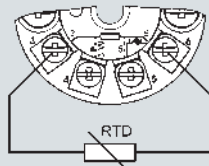
SITRANS T measuring instruments for temperature

Transmitter for field mounting/field indicator

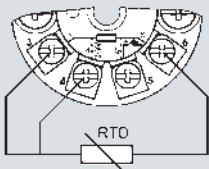
SITRANS TF - Transmitter, two-wire system and
- Field indicator for 4 to 20 mA

Schematics

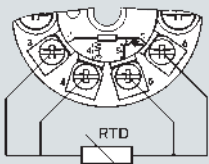
Resistance thermometer



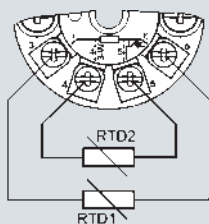
Two-wire system ¹⁾



Three-wire system



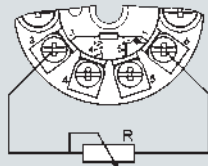
Four-wire system



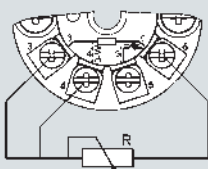
Generation of average value / difference ¹⁾

¹⁾ Programmable line resistance for the purpose of correction.

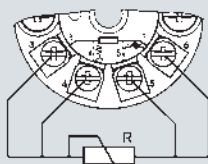
Resistance



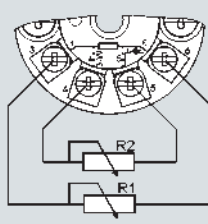
Two-wire system ¹⁾



Three-wire system

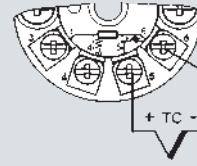


Four-wire system

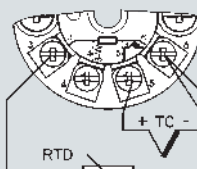


Generation of average value / difference ¹⁾

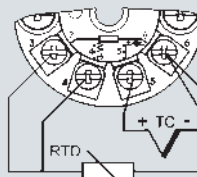
Thermocouple



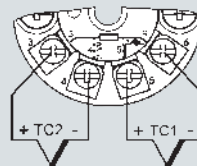
Cold junction compensation
Internal/fixed value



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

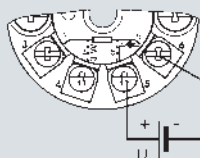


Cold junction compensation with
external Pt100 in three-wire system

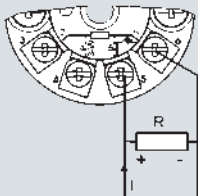


Generation of average value / difference
with internal cold junction compensation

Voltage measurement



Current measurement



SITRANS TF, sensor connection assignment

SITRANS T measuring instruments for temperature

Transmitter for field mounting with temperature sensor

SITRANS TF fieldbus transmitters

Overview



Our field devices for heavy industrial use

- FOUNDATION fieldbus
- PROFIBUS PA

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

Benefits

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

- Wide range of approvals for use in potentially explosive atmospheres. "Intrinsically safe, non-sparking and flameproof" type of protection, for Europe and USA

Application

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

Function

Features

General

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

Transmitter with PROFIBUS PA communication

- Function blocks: 2 x analog

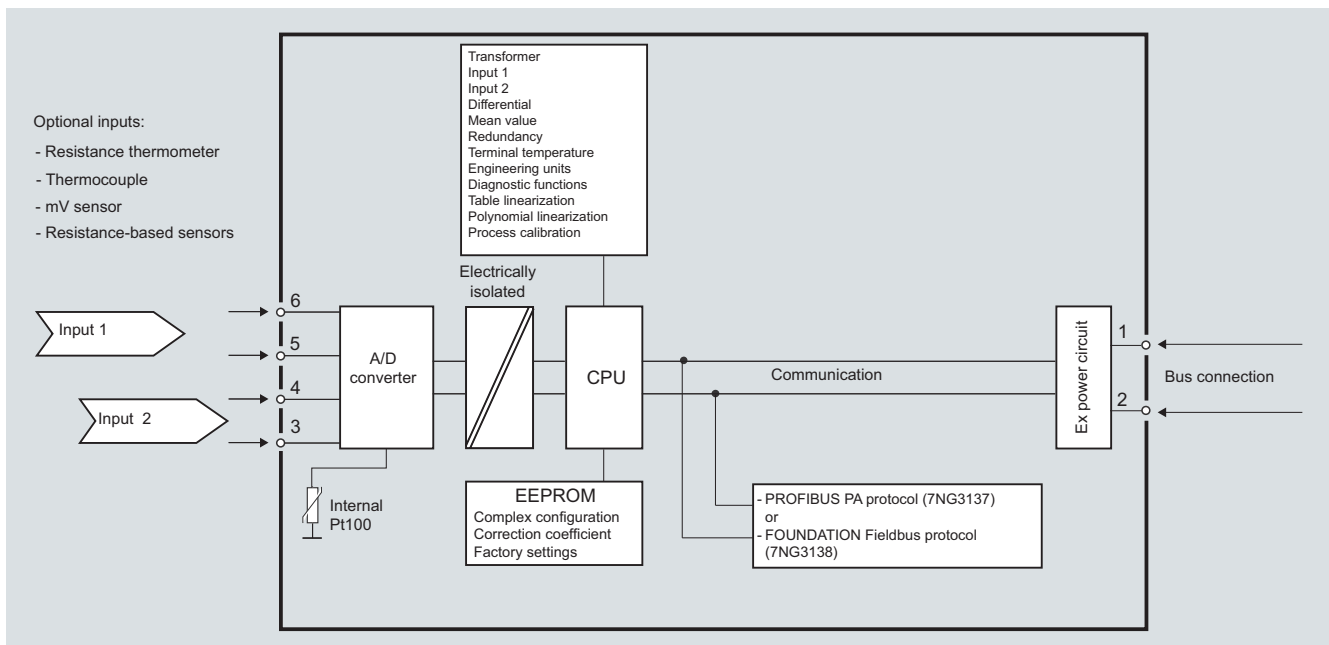
Transmitter with FOUNDATION fieldbus communication

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

Mode of operation

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

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



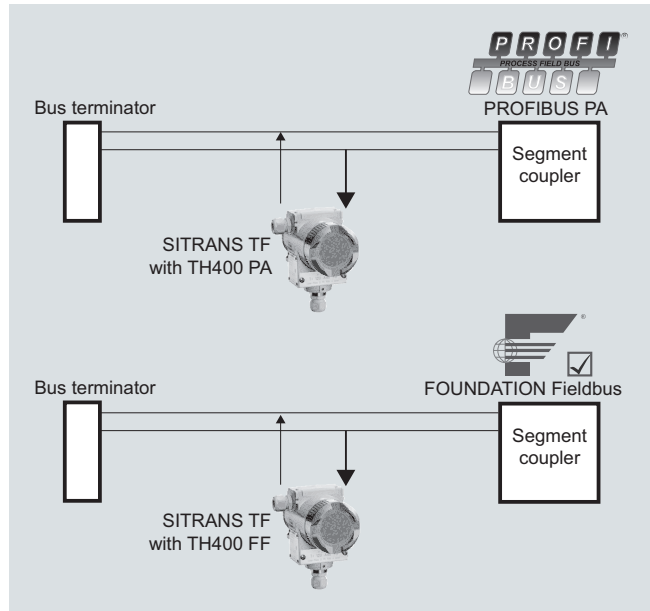
SITRANS TF with TH400, function diagram

SITRANS T measuring instruments for temperature

Transmitter for field mounting with temperature sensor

SITRANS TF fieldbus transmitters

System communication



SITRANS TF with TH400, communication interface

Technical specifications

Input

Analog/digital conversion

- Measurement rate < 50 ms
- Resolution 24-bit

Resistance thermometer

Pt25 ... Pt1000 to IEC 60751/JIS C 1604

- Measuring range -200 ... +850 °C (-328 ... +1562 °F)
- Ni25 ... Ni1000 to DIN 43760
- Measuring range -60 ... +250 °C (-76 ... +482 °F)
- Cu10 ... Cu1000, $\alpha = 0.00427$
- Measuring range -50 ... +200 °C (-58 ... +392 °F)
- Line resistance per sensor cable Max. 50 Ω
- Sensor current Nominal 0.2 mA

Sensor fault detection

- Sensor break detection Yes
- Sensor short-circuit detection Yes, < 15 Ω

Resistance-based sensors

- Measuring range 0 Ω ... 10 k Ω
- Line resistance per sensor cable Max. 50 Ω
- Sensor current Nominal 0.2 mA
- Sensor fault detection
- Sensor break detection Yes
- Sensor short-circuit detection Yes, < 15 Ω

Thermocouple

To IEC 584

- Type B
 - Type E
 - Type J
 - Type K
 - Type N
 - Type R
 - Type S
 - Type T
- to DIN 43710

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

to ASTM E988-90

- Type W3 0 ... 2300 °C (32 ... 4172 °F)
- Type W5 0 ... 2300 °C (32 ... 4172 °F)

External cold junction compensation

Sensor fault detection

- Sensor break detection Yes
- Sensor short-circuit detection Yes, < 3 mV
- Sensor current in the event of open-circuit monitoring 4 μ A

mV sensor - voltage input

- Measuring range -800 ... +800 mV
- Input resistance 10 M Ω

Output

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

Measuring accuracy

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

General values

Type of input	Absolute accuracy	Temperature coefficient
All	$\leq \pm 0.05$ % of measured value	$\leq \pm 0.002$ % of measured value/°C

Basic values

Type of input	Basic accuracy	Temperature coefficient
Pt100 and Pt1000	$\leq \pm 0.1$ °C	$\leq \pm 0.002$ °C/°C
Ni100	$\leq \pm 0.15$ °C	$\leq \pm 0.002$ °C/°C
Cu10	$\leq \pm 1.3$ °C	$\leq \pm 0.02$ °C/°C
Resistance-based sensors	$\leq \pm 0.05$ Ω	$\leq \pm 0.002$ Ω /°C
Voltage source	$\leq \pm 10$ μ V	$\leq \pm 0.2$ μ V/°C
Thermocouple, type: E, J, K, L, N, T, U	$\leq \pm 0.5$ °C	$\leq \pm 0.01$ °C/°C
Thermocouple, type: B, R, S, W3, W5	$\leq \pm 1$ °C	$\leq \pm 0.025$ °C/°C
Cold junction compensation	$\leq \pm 0.5$ °C	

SITRANS T measuring instruments for temperature

Transmitter for field mounting with temperature sensor

SITRANS TF fieldbus transmitters

<u>Reference conditions</u>	
Warming-up time	30 s
Signal-to-noise ratio	Min. 60 dB
Calibration condition	20 ... 28 °C (68 ... 82 °F)
Conditions of use	
<u>Ambient conditions</u>	
Permissible ambient temperature	-40 ... +85 °C (-40 ... +185 °F)
Permissible storage temperature	-40 ... +85 °C (-40 ... +185 °F)
Relative humidity	≤ 98 %, with condensation
<u>Insulation resistance</u>	
• Test voltage	500 V AC for 60 s
• Continuous operation	50 V AC/75 V DC
<u>Electromagnetic Compatibility</u>	
NAMUR	NE21
EMC 2004/108/EC Emission and Noise Immunity	EN 61326-1, EN 61326-2-5
Design	
Weight	Approx. 1.5 kg (3.3 lb) without options
Dimensions	See "Dimensional drawings"
Enclosure materials	<ul style="list-style-type: none"> • Die-cast aluminium, low in copper, GD-AlSi 12 or stainless steel • Polyester-based lacquer for GD AlSi 12 enclosure • Stainless steel rating plate
Electrical connection, sensor connection	<ul style="list-style-type: none"> • screw terminals • Cable inlet via M20 x 1.5 or 1/2-14 NPT screwed gland • Bus connection with M12 plug (optional)
Mounting bracket (optional)	Steel, galvanized and chrome-plated or stainless steel
Degree of protection	IP67 to EN 60529
Auxiliary power supply	
Power supply	
• Standard, Ex "d", Ex "nA", Ex "nL", XP, NI	10.0 ... 32 V DC
• Ex "ia", Ex "ib"	10.0 ... 30 V DC
• In FISCO/FNICO installations	10.0 ... 17.5 V DC
Power consumption	< 11 mA
Max. increase in power consumption in the event of a fault	< 7 mA
Certificates and approvals	
Explosion protection ATEX	
EC type test certificate	ZELM 99 ATEX 0007
• Type of protection "intrinsic safety i" (version: 7NG313x-1xxxx)	II 2(1) G Ex ia IIC T4/T6
Conformity statement	ZELM 07 ATEX 3349
• "Operating equipment that is non-ignitable and has limited energy" type of protection (version: 7NG313x-2xxxx)	II 3 G Ex nA [nL] IIC T4/T6 II 3 G Ex nL IIC T4/T6
EC type test certificate	CESI 99 ATEX 079
• "Flame-proof enclosure" type of protection (version: 7NG313x-4xxxx)	II 2 G Ex d IIC T5/T6

Explosion protection: FM for USA

- FM approval FM 3017742
- Type of protection XP, DIP, NI and S (version 7NG313x-5xxxx)
 - XP / I / 1 / BCD / T5,T6; Type 4X
 - DIP / II, III / 1 / EFG / T5,T6; Type 4X
 - NI / I / 2 / ABCD / T5,T6; Type 4X
 - S / II, III / 2 / FG T5,T6; Type 4X

CommunicationParameterization interface

- PROFIBUS PA connection
 - Protocol A&D profile, Version 3.0
 - Protocol EN 50170 Volume 2
 - Address (for delivery) 126
 - Function blocks 2 x analog
- FOUNDATION fieldbus connection
 - Protocol FF protocol
 - Protocol FF design specifications
 - Functionality Basic or LAS
 - Version ITK 4.6
 - Function blocks 2 x analog and 1 x PID

Factory settingFor SITRANS TH400 PA

Sensor	Pt100 (IEC)
Type of connection	3-wire circuit
Unit	°C
Failure mode	Last valid value
Filter time	0 s
PA address	126
PROFIBUS Ident No.	Manufacturer-specific

For SITRANS TH400 FF

Sensor	Pt100 (IEC)
Type of connection	3-wire circuit
Unit	°C
Failure mode	Last valid value
Filter time	0 s
Node address	22

SITRANS T measuring instruments for temperature

Transmitter for field mounting with temperature sensor

SITRANS TF fieldbus transmitters

Selection and ordering data	Order No.
Temperature transmitter in field enclosure with fieldbus communication and electrical isolation, with documentation on CD	7 NG 3 1 3 - - - 0
Integrated transmitter	
• SITRANS TH400 with PROFIBUS PA	
- without Ex protection	7 0
- with EEx ia (ATEX)	7 1
- with EEx nAL for zone 2 (ATEX)	7 2
- total device SITRANS TF EEx d ¹⁾	7 4
- total device SITRANS TF according to FM (XP, DIP, NI, S) ¹⁾ (available soon)	7 5
• SITRANS TH400, with FOUNDATION fieldbus	
- without Ex protection	8 0
- with EEx ia (ATEX)	8 1
- with EEx nAL for zone 2 (ATEX)	8 2
- total device SITRANS TF EEx d ¹⁾	8 4
- total device SITRANS TF according to FM (XP, DIP, NI, S) ¹⁾ (available soon)	8 5
Enclosure	
• die-cast aluminium	A
• stainless steel precision casting	E
Connections/cable inlet	
• screwed glands M20x1.5	B
• screwed glands 1/2-14 NPT	C
Mounting bracket and fastening parts	
• none	0
• made of steel	1
• stainless steel	2
Further designs	Order code
Please add "-Z" to Order No. and specify Order code(s) and plain text.	
Customer-specific operating data	Y01²⁾
Inscription on measuring point label	
• Measuring point number/TAG (max. 32 char.)	Y15³⁾
• Measuring point description (max. 32 char.)	Y23³⁾
• Bus address	Y25³⁾
Test report (5 measuring points)	C11⁴⁾
Bus connection	
• M12 plug (metal), without mating connector	M00⁵⁾
• M12 plug (metal), with mating connector	M01⁵⁾

¹⁾ Without cable gland.

²⁾ Y01: Please specify all data that does not correspond to factory settings (see above) (e.g. Y01 = thermocouple element type K; internal cold junction; PA address: 15).

³⁾ Y15, Y23, Y25: If no order is placed for Y01, these data are only noted on the measuring point label and are not programmed in the transmitter.

⁴⁾ Can only be ordered together with Y01 (it is essential to specify the measuring range).

⁵⁾ Not available for explosion protection EEx d or XP.

Selection and ordering data	Order No.
Accessories	
CD for measuring instruments for temperature with documentation in German, English, French, Spanish, Italian and Portuguese, and parameterization software SIPROM T (included in delivery with SITRANS TF)	A5E00364512
SIMATIC PDM parameterization software also for SITRANS TF with TH400 PA	see Sec. 9
Mounting bracket and fastening parts	
• Made of steel for 7NG313.-..B..	7MF4997-1AC
• Made of steel for 7NG313.-..C..	7MF4997-1AB
• Made of stainless steel for 7NG313.-..B..	7MF4997-1AJ
• Made of stainless steel for 7NG313.-..C..	7MF4997-1AH
Connection board	A5E02391790

► Available ex stock.

Factory setting:

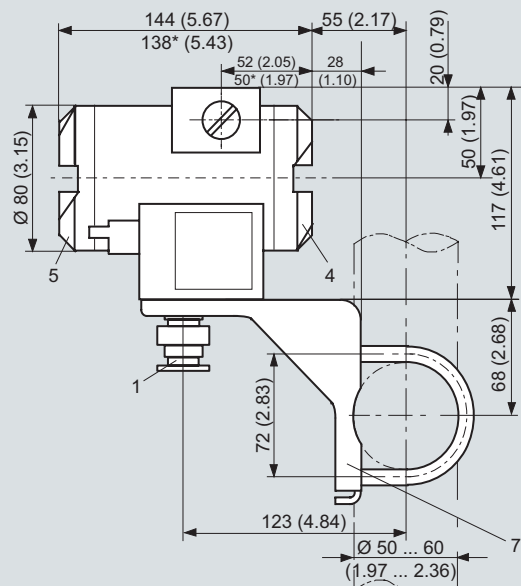
- for SITRANS TH400 PA:
 - Pt100 (IEC) with 3-wire circuit
 - Unit: °C
 - Failure mode: last valid value
 - Filter time: 0 s
 - PA address: 126
 - PROFIBUS Ident No.: manufacturer-specific
- for SITRANS TH400 FF:
 - Pt100 (IEC) with 3-wire circuit
 - Unit: °C
 - Failure mode: last valid value
 - Filter time: 0 s
 - Node address: 22

SITRANS T measuring instruments for temperature

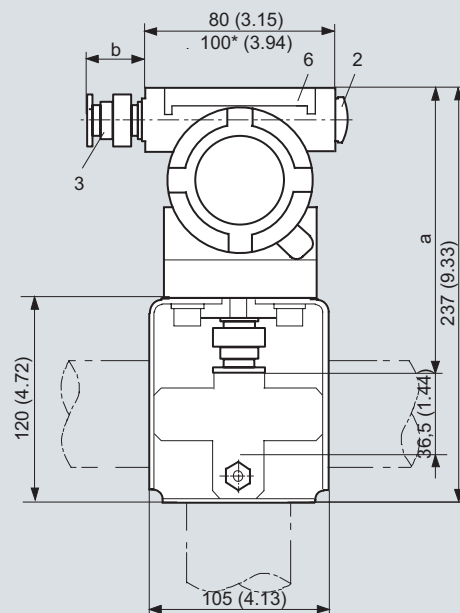
Transmitter for field mounting with temperature sensor

SITRANS TF
fieldbus transmitters

Dimensional drawings



- 1 Sensor connection (screwed gland M20x1,5 or ½-14 NPT)
- 2 Blanking plug
- 3 Electrical connection (screwed plug M20x1,5 or ½-14 NPT), optional M12 plug
- 4 Terminal side, bus connection



- 5 Terminal side, sensor
- 6 Protective cover (without function)
- 7 Mounting bracket (optional) with clamp securing to a vertical or horizontal pipe

SITRANS TF with TH400, dimensions in mm (inches)

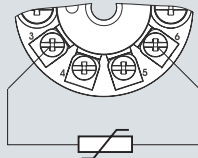
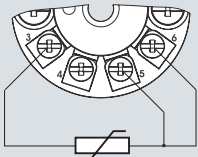
SITRANS T measuring instruments for temperature

Transmitter for field mounting with temperature sensor

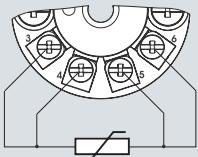
SITRANS TF fieldbus transmitters

Schematics

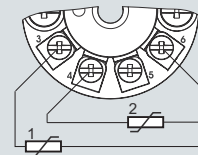
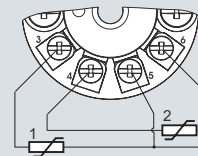
Resistance thermometer

Two-wire system ¹⁾

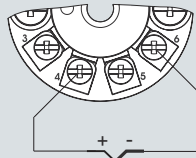
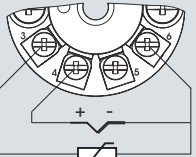
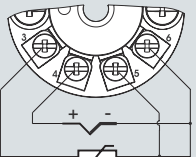
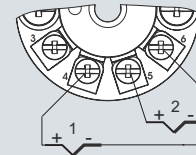
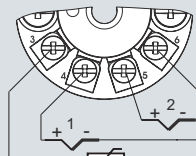
Three-wire system



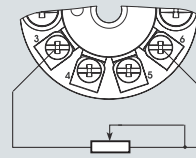
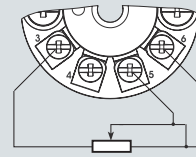
Four-wire system

Mean-value/differential or
redundancy generation
2 x two-wire system ¹⁾Mean-value/differential or
redundancy generation
1 sensor in two-wire system ¹⁾
1 sensor in three-wire system

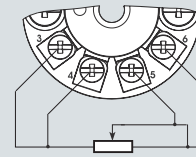
Thermocouple

Internal
cold junction compensationCold junction compensation
with external Pt100 in two-wire system ¹⁾Cold junction compensation
with external Pt100 in three-wire systemMean value, differential or
redundancy generation with internal
cold junction compensationMean value, differential or
redundancy generation and
cold junction compensation
with internal Pt100
in two-wire system ¹⁾

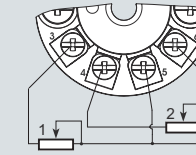
Resistance

Two-wire system ¹⁾

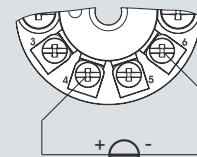
Three-wire system



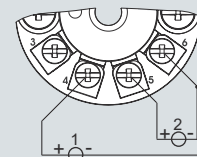
Four-wire system

Mean value, differential or redundancy generation
1 resistor in two-wire system ¹⁾
1 resistor in three-wire system

Voltage measurement



One voltage source

Measurement of mean value, differential and
redundancy with 2 voltage sources

¹⁾ Programmable line resistance for the purpose of correction.

SITRANS T measuring instruments for temperature

Resistance thermometers

Technical description

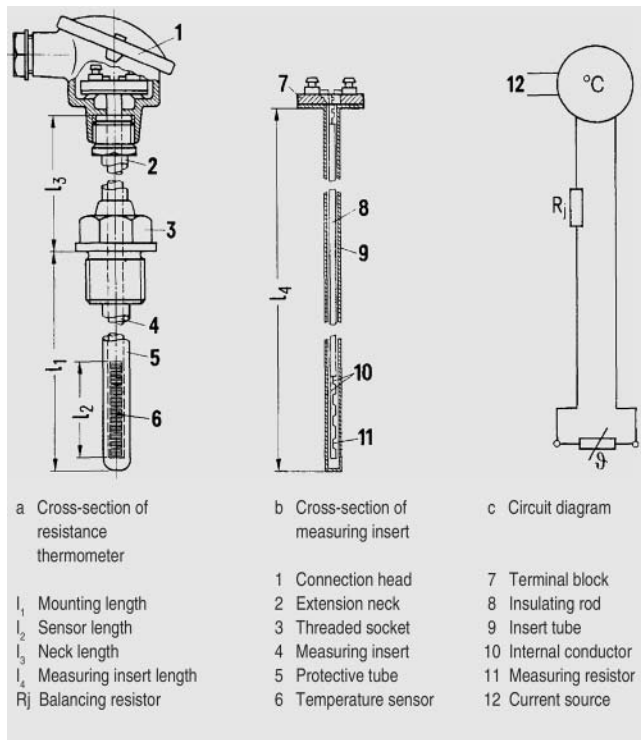
Design

A resistance thermometer comprises

- the measuring resistor (metal; platinum, Pt or nickel, Ni) and
- the mounting and connection parts required in each case.

In the standard version, the measuring resistors are embedded in ceramic. In the case of special vibration resistance requirements, the Pt measuring resistors are double-wound and fused into glass.

- Measuring resistors of class B are supplied. A range of resistors of class A or 1/3 to 1/10 class B is available on request.
- Single and double resistance thermometers are available.



Components and circuitry of a resistance thermometer

To protect the measuring resistor for industrial measurements and to enable easy replacement, it is fixed in a measuring insert (4) which in turn is fitted in a protective tube (5). The measuring insert is spring-mounted in the connection head (1) of the protective tube using two screws. The internal conductor (10) in the measuring insert connects the measuring resistor (11) to the terminals on the terminal block.

Depending on the measuring range and the accuracy required, the thermometers are connected in two-wire, three-wire or four-wire systems to the output devices.

The measuring inserts are therefore available with two, three or four internal conductors. If the resistance of the internal conductor is negligibly small, measuring inserts with only two internal conductors can be used for the three-wire and four-wire systems.

Exact balancing of the internal conductor under operating conditions is only possible with three conductors. If the resistance of the internal conductor is greater than 0.2Ω , its magnitude is indicated on the mounting flange of the measuring insert.

Function

Measuring resistor

Measuring resistors	Measuring resistors are suitable for temperatures from
Made of platinum	-200 ... +850 °C (-328 ... +1562 °F)
Made of nickel	-60 ... +150 °C (-76 ... 302 °F), briefly up to 180 °C (356 °F)

The measuring resistor changes with the temperature in accordance with a certain reproducible series of calibration data (see the table "Calibration data for platinum measuring resistors (to DIN EN 60751)" under "Technical data").

The changes in resistance are transmitted as changes in voltage to indicators, recorders or controllers directly via copper wires or via transmitters. The type of measuring circuit depends on the instrument to be connected and the required measuring range. The measuring resistors are balanced at 0 °C (32 °F) to $100 \Omega \pm 0.12 \Omega$. The calibration values of the resistors (i.e. the dependence of the resistor on the temperature) and the permissible deviations are specified in DIN EN 60751 (IEC 751) (see the table "Error limits according to DIN EN 60751" under "Technical Specifications").

Measuring resistors of class B are supplied. A range of resistors of class A or 1/3 to 1/10 class B is available on request.

Measuring principle of the resistance temperature measurement

The thermometer is heated up by the thermometer current compared to the material to be measured. The heating-up error thus produced increases with the square of the thermometer current and linearly with the resistance of the measuring resistor. Apart from the magnitude of the thermometer current, the error depends on the design of the thermometer and on the heat transfer between the protective tube and the medium. A high measuring power is required for output instruments operating according to the deflection method. To keep the heating-up error within permissible limits, the thermometer current should not be greater than 10 mA in this case.

When measuring the temperature of gases with very small flow velocities, a considerably greater heating-up error occurs than in measurements with very fast gases or liquids. The heating-up error is negligibly small with high flow velocities.

Protection fitting/protective tubes

Suitable protective fittings are used for installation in pipelines, tanks etc. depending on the mechanical or chemical requirements.

The materials for the protective tubes or combinations of different protective tube materials must be carefully selected in order to meet the requirements due to static pressure, flow and temperature. Furthermore, the indication response should be as fast as possible.

Installation examples with the suitable protective tube materials can be found under "Technical data" in the table "Installation examples and material of protective tubes".

The type of installation of the protective tubes depends on the application. The protective tubes are screwed into the pipelines in the case of operating pressures up to approx. 90 bar. Tapered protective tubes which can be welded in are available for higher pressures. Thermometers for measuring furnace temperatures are fixed using flanges.

Owing to the different operating conditions, no guarantee can be given for protective fittings. The manufacturer is responsible for damages and measuring errors caused by wrong installation in compliance with the General Terms of Delivery if the instruments have been installed by the manufacturer and if the specifications for the operating conditions furnished by the customer were correct and sufficiently detailed.

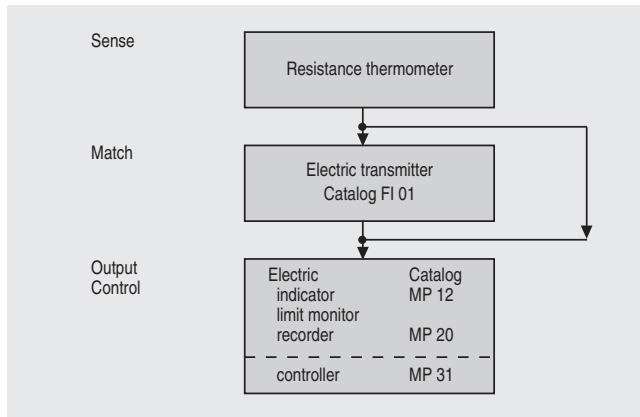
SITRANS T measuring instruments for temperature

Resistance thermometers

Technical description

Integration

Instrument combination for measuring and controlling temperature



Instrument combination with resistance thermometer as sensor

Installation examples and materials of protective tubes

Measuring point	Max. operating temp. °C (°F)	Protective tube material name	No.
-----------------	---------------------------------	----------------------------------	-----

A. Steam power plants

Water and steam lines (Screw-in and welding-type thermometers)	300 (572)	Bronze Sn Bz 6 (only for water)	2.1020
	400 (752)	St 35.8	1.0305
	540 (1004)	13 CrMo 44	1.7335
	570 (1058)	10 CrMo 9 10	1.7380
Flue gas	550 (1022)	St 35.8, enamelled	1.0305
Pulverized coal/air mixture line	100 (212)	St 35.8 (with baffle rod)	1.0305
Water treatment	30 (86)	X 6 CrNiTi 18 10 or	1.4541
		X 6 CrNiMoTi 17 122	1.4571

B. Paper mills

In paper pulp (cylindrical paper mills, hand-made paper, refiner)	60 (140)	X 6 CrNiMoTi 17 122	1.4571
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C. Pulp production

For all tanks with internal lining: only flange-type thermometers			
1. Sulfite pulp			
Boiling acid in vat, peetz tank and acid tower	150 (302)	X 6 CrNiMoTi 17 122	1.4571
Hypochlorite tower, alkali tower	40 (104)	X 6 CrNiMoTi 17 122	1.4571
Sulphite lye evaporation, heat exchanger, preheater and lye collecting tank	140 (284)	X 6 CrNiMoTi 17 122	1.4571
2. Sulfate pulp			
Vat, lye heater	In vat 180 (356) otherwise 80 (176)	X 6 CrNiTi 18 10 or	1.4541
Black, green and white lye tanks		X 6 CrNiMoTi Ti 17 122	1.4571
Cellulose multiple-stage bleaching (moist chloric gases present)	40 (104)	Hastelloy C (59 Ni; 16 Mo; 15,5 Cr; 5,5 Fe; 3,8 W) or X 6 CrNiMoTi 17 122 with Ti protective sleeve	1.4571
Sulfate lye evaporation, heat exchanger, preheater and lye collecting tank	140 (284)	X 6 CrNiMoTi 17 122	1.4571

Measuring point	Max. operating temp. °C (°F)	Protective tube material name	No.
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D. Dye works

Jigger, automatic yarn skein dyeing machine	110 (230)	X 6 CrNiMoTi 17 122	1.4571
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E. Food and drink industries

1. Breweries

Brewing water	80 (176)	Bronze Sn Bz 6 or X 6 CrNiTi 18 10	2.1020
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Mash

• Hot wort	100 (212)	Bronze or X 6 CrNiTi 18 10	1.4541
• Cold wort	4 (39,2)	X 6 CrNiTi 18 10	1.4541

2. Sugar factories

Salt removal in sugar juice	100 (212)	X 6 CrNiTi 18 10	1.4541
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3. Cereals production

Salt removal in whey	20 (68)	X 6 CrNiTi 18 10	1.4541
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4. Malt houses

Steeping water	100 (212)	Bronze Sn Bz 6	2.1020
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5. Yeast production

Yeast cooling	4 (39,2)	X 6 CrNiTi 18 10	1.4541
Yeast fermentation	33 (91,4)	X 6 CrNiMoTi 17 122	1.4571

F. Chemical and petrochemical industries

Corrosion-resistant steel, material Nos. 1.4541 and 1.4571, can be used for many applications. The numerous substances to be measured in these industrial branches render it sometimes difficult to recommend suitable protective tube materials. If required, please contact our representatives in these cases.

SITRANS T measuring instruments for temperature

Resistance thermometers

Protective tubes installation

Technical specifications

Calibration data for platinum measuring resistors (to DIN EN 60751)

°C	(°F)	Ω
-200	(-328)	18.52
-180	(-292)	27.10
-160	(-256)	35.34
-140	(-220)	43.88
-120	(-184)	52.11
-100	(-148)	60.26
-80	(-112)	68.33
-60	(-76)	76.33
-40	(-40)	84.27
-30	(-22)	88.22
-20	(-4)	92.16
-10	(14)	96.09
0	(32)	100.00
10	(50)	103.90
20	(68)	107.79
30	(86)	111.67
40	(104)	115.54
50	(122)	119.40
60	(140)	123.24
80	(176)	130.90
100	(212)	138.51
120	(248)	146.07
140	(284)	153.58
160	(320)	161.05
180	(356)	168.48
200	(392)	175.86
220	(428)	183.19
240	(464)	190.47
260	(500)	197.71
280	(536)	204.90
300	(572)	212.05
320	(608)	219.15
340	(644)	226.21
360	(680)	233.21
380	(716)	240.18
400	(752)	247.09
420	(788)	253.96
440	(824)	260.78
460	(860)	267.56
480	(896)	274.29
500	(932)	280.98
520	(968)	287.62
540	(1004)	294.21
560	(1040)	300.75
580	(1076)	307.25
600	(1112)	313.71
620	(1148)	320.12
640	(1184)	326.48
660	(1220)	332.79
700	(1292)	345.28
750	(1382)	360.64
800	(1472)	375.70
850	(1562)	390.48

Error limits acc. to DIN EN 60 751

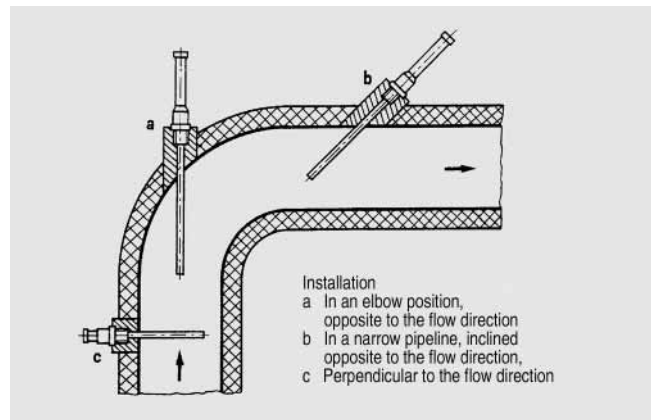
The resistance thermometers are divided into two classes according to their error limits:

Class	Error limits in °C
A	$0,15 + 0,002 t ^{1)}$
B	$0,3 + 0,005 t $

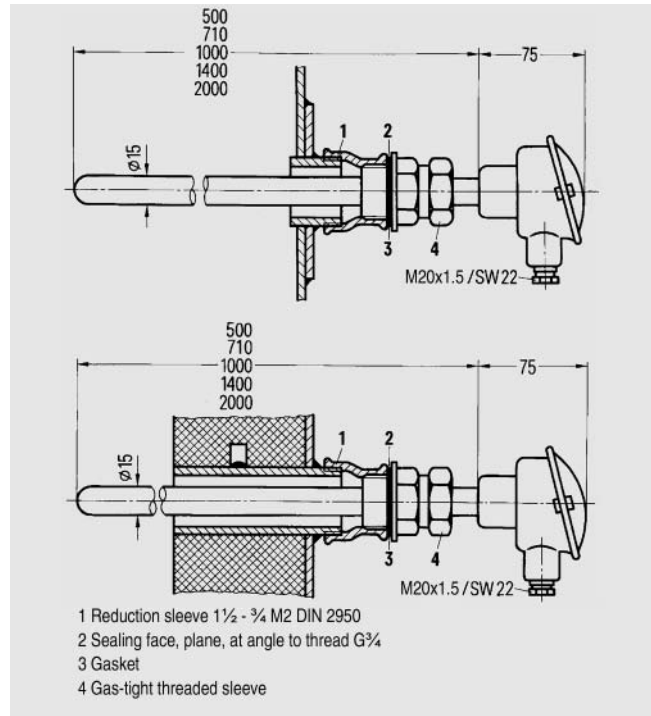
1) $|t|$ is the numerical value of the temperature in °C without consideration of the sign

Integration

Protective tubes in a pipeline



Flue gas resistance thermometer



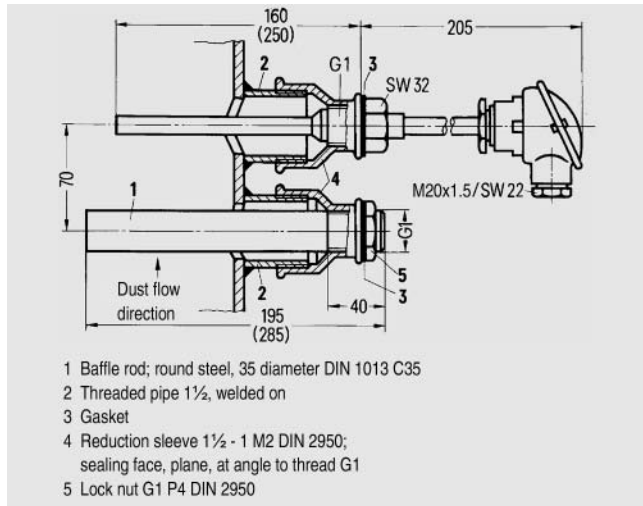
Fitted in a sheet-metal duct (top) and a flue gas duct (bottom)

SITRANS T measuring instruments for temperature

Resistance thermometers

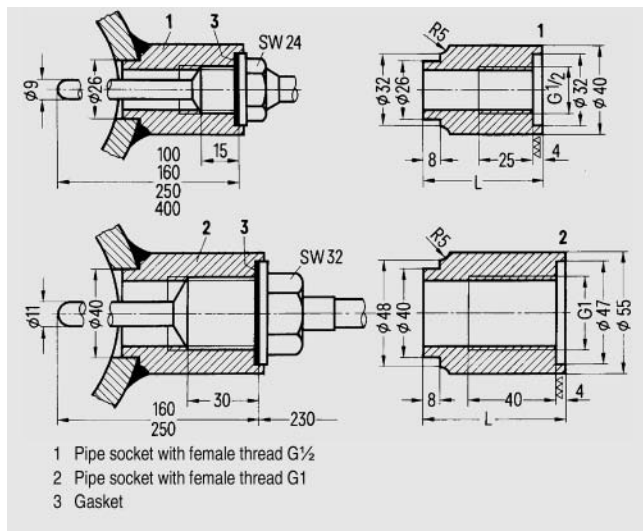
Protective tubes installation

Screw-in resistance thermometer



In a pulverized coal line, with baffle rod

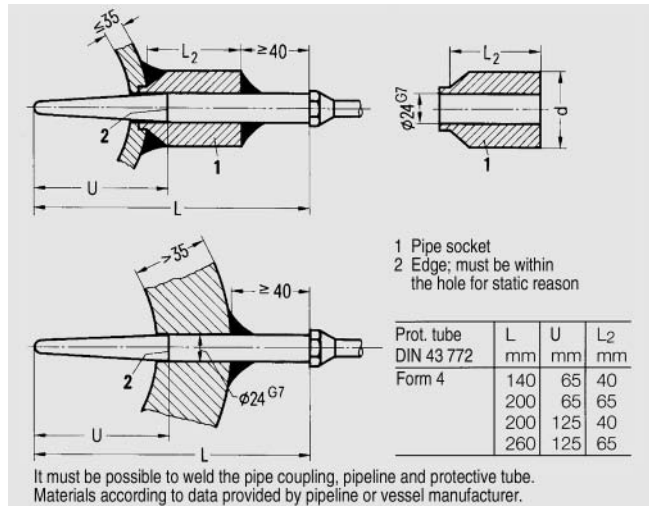
Screw-in protective tubes, mounted



At top for low-pressure, with screw socket G 1/2; at bottom for high-pressure, with screw socket G 1

It must be possible to weld the pipe coupling and pipeline. Material according to data provided by pipeline or vessel manufacturer.

Welding-type protective tubes, mounted



Top: Wall thickness ≤ 35 mm; mounting using welded coupling; bottom: Wall thickness > 35 mm

SITRANS T measuring instruments for temperature

Resistance thermometers

Temperature transmitters
for mounting in the connection head

Overview



The following temperature transmitters are available for mounting in the connection head:

SITRANS TH100

Programmable two-wire temperature transmitter (4 to 20 mA), without electrical isolation, only for Pt100 resistance thermometers.

SITRANS TH200

Programmable two-wire temperature transmitter (4 to 20 mA), electrical isolation for resistance thermometers and thermocouple elements.

SITRANS TH300

Two-wire temperature transmitter with HART communication (4 to 20 mA), electrical isolation for resistance thermometers and thermocouple elements.

SITRANS TH400

Temperature transmitter with PROFIBUS PA or FOUNDATION Fieldbus connection, electrical isolation for resistance thermometers and thermocouple elements.

Note:

- SITRANS TH100/TH200/TH300/TH400 can be fitted instead of the terminal block or in the high hinged cover. Additional fitting only possible in high hinged cover.
- If using intrinsically-safe temperature sensors any installed temperature transmitters must also be intrinsically-safe.

Selection and Ordering Data

Detailed information on the transmitters can be found for the respective products under "Transmitters for temperature".

Transmitter to be fitted	Order code
To order the sensor with a built-in temperature transmitter, add "-Z" to the Order No. of the sensor, and supplement by the following Order code:	
• SITRANS TH100, only for Pt100	
- without Ex	T10
- EEx ia IIC and EEx n for zone 2	T11
- FM	T13
• SITRANS TH200	
- without Ex	T20
- EEx ia IIC and EEx n for zone 2	T21
- FM (IS, I, NI)	T23
• SITRANS TH300	
- without Ex	T30
- EEx ia IIC und EEx n for zone 2	T31
- FM (IS, I, NI)	T33
• SITRANS TH400 PA	
- without Ex	T40
- EEx ia	T41
• SITRANS TH400 FF	
- without Ex	T45
- EEx ia	T46
Customer-specific setting of the built-in transmitter (specify settings in plain text)	Y11¹⁾

¹⁾ For TH400 FF available soon

SITRANS T measuring instruments for temperature

Resistance thermometers

Questionnaire for temperature sensors (resistance thermometers and thermocouples)

General information

Customer:
 Address:
 Contact partner:
 Purchasing dept.:
 Sales dept.:
 Process dept.:
 Inquiry:
 Quotation:
 Place and date:

Tel.:
 Tel.:
 Tel.:

Operating conditions

1. Application:
(e.g. exhaust gas measurement)
2. Location:
(e.g. pipe bend, tank)
3. Mounting position:
(e.g. vertical, 45° against flow)
4. Temperature (measuring point):
 Operating temperature:
 Temperature range:
5. Medium:
6. Pressure:
 Nominal pressure:
 Operating pressure:
7. Flow:
8. Vibrations:
9. Miscellaneous:
(e.g. vessel or pipe materials, PTFE lining)

Ambient conditions

(e.g. seawater atmosphere, chemical plant)
 Definition:

Special information

1. Mounting of temperature transmitter in connection head:

2. Packaging regulations:

Miscellaneous

Please additionally provide the following: rough sketch, installation diagram, section of drawing, photo

Sensor design

1. Measuring element
(type and standard) (e.g. Pt100 or TC type K)
 - 1.1. Tolerance:
 - 1.2. Design:
(e.g. Pt100 or 2, 3 or 4-wire system)
 - 1.3. Degree of protection/type of protection:
2. Protective fitting:
 - 2.1. Protective tube:
(dimensions/material)
 - 2.2. Mounting:
(dimensions/material)
 - 2.3. Neck tube:
(dimensions/material)
 - 2.4. Mounting length/nominal length:
3. Material certificates:
4. Connection:
 - 4.1. Connection head/box:
 - 4.2. Cable:
(dimensions/insulation/standard)
 - 4.3. Other:
5. Tests:

6. Accessories:

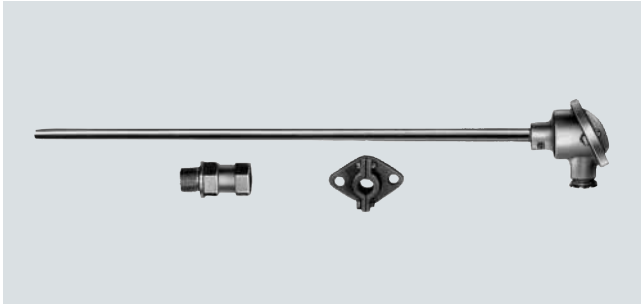
7. Supplementary requirements:

SITRANS T measuring instruments for temperature

Resistance thermometers

Flue gas resistance thermometers with connection head

Overview



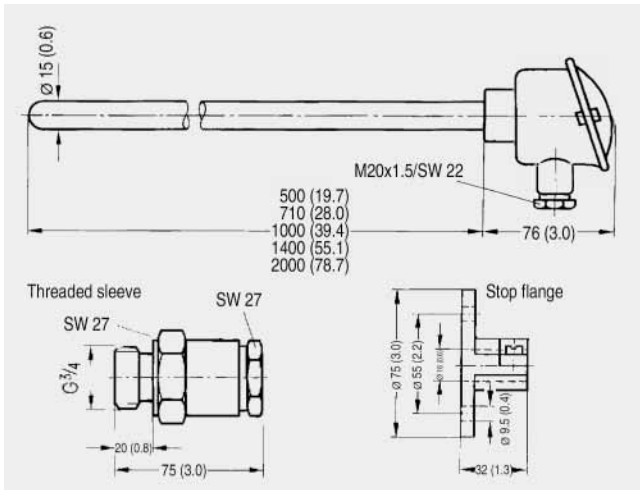
The flue gas resistance thermometer with connection head is suitable for the temperature range from -50 to +600 °C (-58 to +1112 °F) and can also be supplied with a built-in temperature transmitter.

Please order mounting flange or threaded sleeve separately.

Technical specifications

Design	According to DIN 43764: Thermometer without mount
Protective tube	
• Form	1, DIN 43772; cylindrical, 15 mm diameter (0.59 inch), wall thickness 3 mm (0.12 inch), seamless
• Material	St 35.8, mat. No. 1.0305, enamelled
• Loading capacity	1 bar (14.5 psi) above atmospheric, to DIN 43772
Measuring insert	Replaceable, with measuring insert tube (8 mm diameter (0.31 inch)) made of stainless steel; terminal block with clamping springs

Dimensional drawings



Flue gas resistance thermometer with connection head, dimensions in mm (inches)

Selection and Ordering data

Order No.

Flue gas resistance thermometer

Measuring resistor (winding) embedded in ceramic
1 Pt100 measuring resistor, three-wire circuit

Mounting length/ mm (inch):	Weight/ kg (lb):
• 500 (19.7)	0.9 (1.98)
• 710 (28.0)	1.1 (2.43)
• 1000 (39.4)	1.5 (3.31)
• 1400 (55.1)	1.9 (4.19)
• 2000 (78.7)	2.7 (5.95)

7MC1000-1BA2
7MC1000-2BA2
7MC1000-3BA2
7MC1000-4BA2
7MC1000-5BA2

Connection head, form B,

made of cast light alloy, with 1 cable inlet and

- screw cover
- standard hinged cover
- high hinged cover

1
4
6

Further designs

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

Order code

- Different design (mounting length, protective tube material etc.), specify in plain text.
- TAG plate made of stainless steel specify TAG No. in plain text
- Calibration carried out at one point, specify desired temperature in plain text (order equivalent number of times for several calibration points).

Y01
Y15
Y33

Accessories

Order No.

Mounting flange

Adjustable, to DIN 43734;
Material: GTW 35, mat. No. 0.8035, for protective tube diameter 15 mm (0.59 inch), 0.3 kg (0.66 lb)

7MC2998-5CA

Gas-tight threaded sleeve

Material: 9 SMnPb 28
Material No. 1.0718, for protective tube diameter 15 mm (0.59 inch), 0.4 kg (0.88 lb)

- G $\frac{3}{4}$ internal thread with gasket
- G $\frac{1}{2}$ internal thread with gasket

7MC2998-5DA
7MC2998-5DC

To order a temperature transmitter installed in the connection head, see "Temperature transmitters for installation in the connection head" (page 3/75).

Individual parts: Measuring inserts, see "Accessories".

SITRANS T measuring instruments for temperature

Resistance thermometers

Low-pressure screw-in resistance thermometers with connection head, without neck tube

Overview

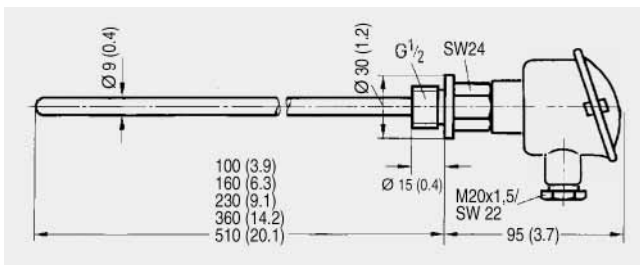


The low-pressure screw-in resistance thermometer with connection head (no neck tube) is suitable for the temperature range from -50 to +400 °C (-58 to +752 °F) and can also be supplied with a built-in temperature transmitter.

Technical specifications

Design	According to DIN 43765: Screw-in thermometer
Protective tube	
• Form	Similar to 2G, DIN 43772; cylindrical, 9 mm (0.35 inch) diameter, wall thickness 1 mm (0.04 inch)
• Loading capacity	to 20 bar (290.1 psi) (loading capacity dependent on material, temperature, flow rate, mounting length etc., see DIN 43772 for details)
Screw socket	G $\frac{1}{2}$; suitable is gasket 21 x 26, similar to form C or D, DIN 7603
Measuring insert	Replaceable, with measuring insert tube (6 mm diameter (0.24 inch) made of stainless steel; terminal block with clamping springs
Response times (to VDI/VDE 3 522)	
• In water with flow velocity $v = 0.4$ m/s (1.31 ft/s)	$t_{0.5} = 25$ s, $t_{0.9} = 75$ s
• In air with flow velocity $v = 1$ m/s (3.28 ft/s)	$t_{0.5} = 2$ min, $t_{0.9} = 6.3$ min
Explosion protection	II 1/2G EEx ia IIC T4/T6

Dimensional drawings



Low-pressure screw-in resistance thermometer with connection head, without neck tube, dimensions in mm (inches)

Selection and Ordering data

Order No.

Low-pressure screw-in resistance thermometer with connection head, without neck tube

Protective tube and screw socket
X 6 CrNiMoTi 17 122, mat. No. 1.4571
Protective tube to DIN 43,772,
form: similar to 2G
Measuring resistors embedded in ceramic,
one Pt100 measuring resistor: three-wire
circuit, Two Pt100 measuring resistors:
two-wire circuit

Measuring insert not explosion protected

One Pt100 measuring resistor,

Mounting length U ₁ / mm (inch):	Weight/ kg (lb):
• 100 (3.9)	0.6 (1.32)
• 160 (6.3)	0.7 (1.54)
• 230 (9.1)	0.8 (1.76)
• 360 (14.2)	0.9 (1.98)
• 510 (20.1)	1.0 (2.20)

► 7MC1006-1DA1
7MC1006-2DA1
7MC1006-3DA1
7MC1006-4DA1
7MC1006-5DA1

Two Pt100 measuring resistors

Mounting length U ₁ / mm (inch):	Weight/ kg (lb):
• 100 (3.9)	0.6 (1.32)
• 160 (6.3)	0.71 (1.57)
• 230 (9.1)	0.81 (1.79)
• 360 (14.2)	0.91 (2.01)
• 510 (20.1)	1.01 (2.23)

► 7MC1006-1DB1
7MC1006-2DB1
7MC1006-3DB1
7MC1006-4DB1
7MC1006-5DB1

Measuring insert with explosion protection

One Pt100 measuring resistor

Mounting length U ₁ / mm (inch):	Weight/ kg (lb):
• 100 (3.9)	0.6 (1.32)
• 160 (6.3)	0.7 (1.54)
• 230 (9.1)	0.8 (1.76)
• 360 (14.2)	0.9 (1.98)
• 510 (20.1)	1.0 (2.20)

► 7MC1006-1DE1
7MC1006-2DE1
7MC1006-3DE1
7MC1006-4DE1
7MC1006-5DE1

Two Pt100 measuring resistors

Mounting length U ₁ / mm (inch):	Weight/ kg (lb):
• 100 (3.9)	0.6 (1.32)
• 160 (6.3)	0.71 (1.57)
• 230 (9.1)	0.81 (1.79)
• 360 (14.2)	0.91 (2.01)
• 510 (20.1)	1.01 (2.23)

► 7MC1006-1DF1
7MC1006-2DF1
7MC1006-3DF1
7MC1006-4DF1
7MC1006-5DF1

Connection head, form B,

- made of cast light alloy,
with 1 cable inlet and
 - screw cover
 - standard hinged cover
 - high hinged cover
- made of stainless steel,
with 1 cable inlet and screw cover

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Further designs

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

Order code

- Different design (mounting length, protective tube material etc.), specify in plain text.
- TAG plate made of stainless steel
specify TAG No. in plain text
- Calibration carried out at one point, specify
desired temperature in plain text (order
equivalent number of times for several
calibration points).

Y01
Y15
Y33

► Available ex stock

To order a temperature transmitter installed in the connection head, see "Temperature transmitters for installation in the connection head" (page 3/75).

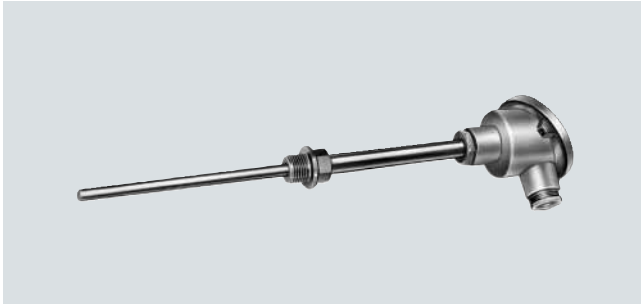
Individual parts: Measuring inserts and connection heads, see "Accessories".

SITRANS T measuring instruments for temperature

Resistance thermometers

Low-pressure screw-in resistance thermometers with connection head, with neck tube

Overview

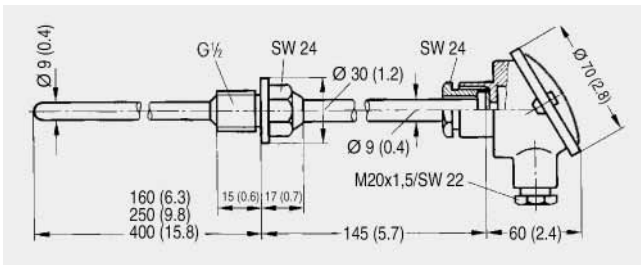


The low-pressure screw-in resistance thermometer with connection head and neck tube is suitable for the temperature range from -50 to +600 °C (-58 to +1112 °F) and can also be supplied with a built-in temperature transmitter.

Technical specifications

Design	According to DIN 43765: Screw-in thermometer
Protective tube	
• Form	2G, DIN 43772; cylindrical, 9 mm (0.35 inch) diameter, wall thickness 1 mm (0.04 inch)
• Loading capacity	to 20 bar (290.1 psi) (loading capacity dependent on material, temperature, flow rate, mounting length etc., see DIN 43772 for details)
Screw socket	G½; suitable is gasket 21 x 26, similar to form C or D, DIN 7603
Measuring insert	Replaceable, with measuring insert tube (6 mm diameter (0.24 inch) made of stainless steel; terminal block with clamping springs
Response times (to VDI/VDE 3 522)	
• In water with flow velocity $v = 0.4$ m/s (1.31 ft/s)	$t_{0.5} = 25$ s, $t_{0.9} = 75$ s
• In air with flow velocity $v = 1$ m/s (3.28 ft/s)	$t_{0.5} = 2$ min, $t_{0.9} = 6.3$ min
Explosion protection	II 1/2G EEx ia IIC T4/T6

Dimensional drawings



Low-pressure screw-in resistance thermometer with neck tube, dimensions in mm (inches)

Selection and Ordering data

Order No.

Low-pressure screw-in resistance thermometer with connection head and neck tube

Protective tube and screw socket
X 6 CrNiMoTi 17 122, mat. No. 1.4571
Protective tube to DIN 43772,
form: 2G
Measuring resistors embedded in ceramic,
one Pt100 measuring resistor: three-wire
circuit, Two Pt100 measuring resistors:
two-wire circuit

Measuring insert not explosion protected

One Pt100 measuring resistor

Mounting length U_1 / mm (inch):	Weight/ kg (lb):
• 160 (6.3)	0.8 (1.76)
• 250 (9.84)	0.9 (1.98)
• 400 (15.7)	1.0 (2.20)

7MC1007-5DA1 ■
7MC1007-6DA1 ■
7MC1007-7DA1 ■

Two Pt100 measuring resistors

Mounting length U_1 / mm (inch):	Weight/ kg (lb):
• 160 (6.3)	0.9 (1.98)
• 250 (9.84)	1.0 (2.20)
• 400 (15.7)	1.1 (2.43)

7MC1007-5DB1 ■
7MC1007-6DB1 ■
7MC1007-7DB1 ■

Measuring insert with explosion protection

One Pt100 measuring resistor

Mounting length U_1 / mm (inch):	Weight/ kg (lb):
• 160 (6.3)	0.8 (1.76)
• 250 (9.84)	0.9 (1.98)
• 400 (15.7)	1.0 (2.20)

7MC1007-5DE1 ■
7MC1007-6DE1 ■
7MC1007-7DE1 ■

Two Pt100 measuring resistors

Mounting length U_1 / mm (inch):	Weight/ kg (lb):
• 160 (6.3)	0.9 (1.98)
• 250 (9.84)	1.0 (2.20)
• 400 (15.7)	1.1 (2.43)

7MC1007-5DF1 ■
7MC1007-6DF1 ■
7MC1007-7DF1 ■

Connection head, form B,

- made of cast light alloy,
with 1 cable inlet and
 - screw cover
 - standard hinged cover
 - high hinged cover
- made of stainless steel,
with 1 cable inlet and screw cover

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Further designs

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

Order code

- Different design (mounting length, protective tube material etc.), specify in plain text.
- TAG plate made of stainless steel
specify TAG No. in plain text
- Calibration carried out at one point, specify
desired temperature in plain text (order
equivalent number of times for several
calibration points).

Y01
Y15
Y33

To order a temperature transmitter installed in the connection head, see "Temperature transmitters for installation in the connection head" (page 3/75).

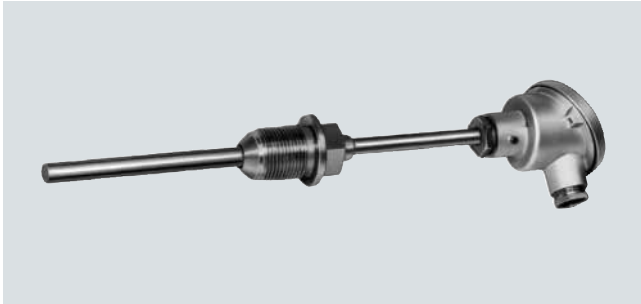
Individual parts: Measuring inserts and connection heads, see "Accessories".

SITRANS T measuring instruments for temperature

Resistance thermometers

High-pressure screw-in resistance thermometers

Overview

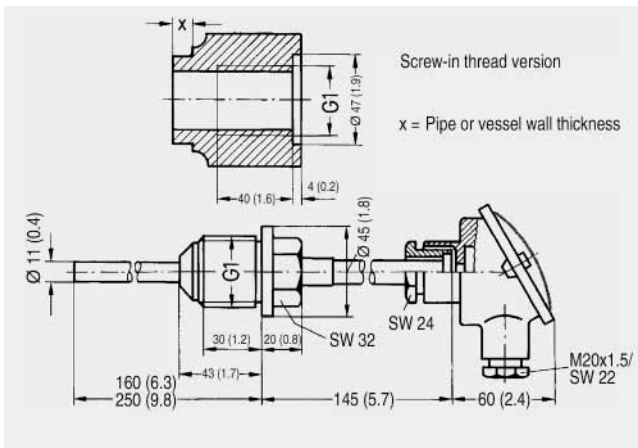


The high-pressure screw-in resistance thermometer with connection head and neck tube is suitable for the temperature range from -50 to +600 °C (-58 to +1112 °F) and can also be supplied with a built-in temperature transmitter.

Technical specifications

Design	According to DIN 43765: Screw-in thermometer
Protective tube	
• Form	2G, DIN 43772; cylindrical, 11 mm (0.43 inch) diameter, wall thickness 2 mm (0.08 inch)
• Loading capacity	to 50 bar (725.2 psi) (loading capacity dependent on material, temperature, flow rate, mounting length etc., see DIN 43772 for details)
Screw socket	G1; suitable is gasket 33 x 39, similar to form C or D, DIN 7603
Measuring insert	Replaceable, with measuring insert tube (6 mm diameter (0.24 inch) made of stainless steel; terminal block with clamp- ing springs
Response times (to VDI/VDE 3 522)	
• In water with flow velocity $v = 0.4 \text{ m/s}$ (1.31 ft/s)	$t_{0.5} = 32 \text{ s}$, $t_{0.9} = 96 \text{ s}$
• In air with flow velocity $v = 1 \text{ m/s}$ (3.28 ft/s)	$t_{0.5} = 2.2 \text{ min}$, $t_{0.9} = 6.8 \text{ min}$

Dimensional drawings



High-pressure screw-in resistance thermometer with neck tube, dimensions in mm (inches)

Selection and Ordering data

Order No.

High-pressure screw-in resistance thermometer with connection head and neck tube

Protective tube and screw socket
X 6 CrNiMoTi 17 122, mat. No. 1.4571
Protective tube to DIN 43772,
form: 2G

One Pt100 measuring resistor

embedded in ceramic, three-wire circuit

Mounting length U_1 / mm (inch):	Weight/ kg (lb):
• 160 (6.3)	0.83 (1.83)
• 250 (9.84)	0.93 (2.05)

7MC1008-6DA1

7MC1008-7DA1

Two Pt100 measuring resistors

embedded in ceramic, two-wire circuit

Mounting length U_1 / mm (inch):	Weight/ kg (lb):
• 160 (6.3)	0.86 (1.20)
• 250 (9.84)	0.94 (2.07)

7MC1008-6DB1

7MC1008-7DB1

Connection head, form B,

- made of cast light alloy,
with 1 cable inlet and
 - screw cover
 - standard hinged cover
 - high hinged cover
- made of stainless steel,
with 1 cable inlet and screw cover

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Further designs

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

Order code

- Different design (mounting length, protec-
tive tube material etc.), specify in plain text.
- TAG plate made of stainless steel
specify TAG No. in plain text
- Calibration carried out at one point, specify
desired temperature in plain text (order
equivalent number of times for several
calibration points).

Y01

Y15

Y33

To order a temperature transmitter installed in the connection head, see "Temperature transmitters for installation in the connection head" (page 3/75).

Individual parts: Measuring inserts and connection heads, see "Accessories".

SITRANS T measuring instruments for temperature

Resistance thermometers

High-pressure welding-type resistance thermometers

Overview

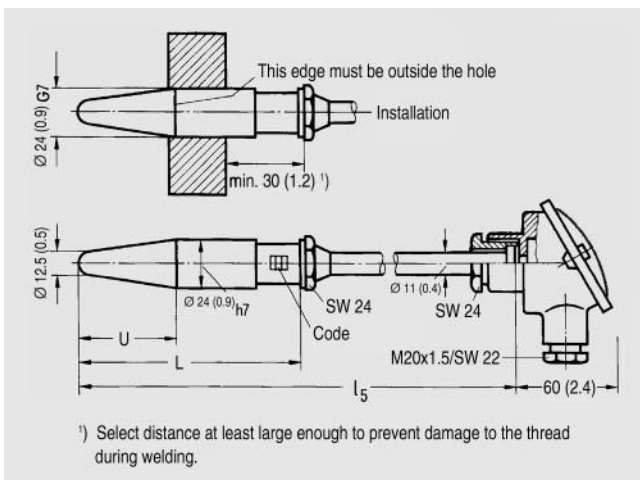


The high-pressure welding type resistance thermometer with connection head and neck tube is suitable for the temperature range from -50 to 540 or 550 °C (-58 to 1004 or 1022 °F) and can also be supplied with a built-in temperature transmitter.

Technical specifications

Design	According to DIN 43767: Welding-type thermometer
Protective tube	
• Form	4, DIN 43772; tapered, for welding in; with female thread M18 x 1.5 for neck tube
• Loading capacity	to 450 bar (6527 psi) (loading capacity dependent on material, temperature, flow rate, mounting length etc., see DIN 43772 for details)
Neck tube	Stainless steel, unscrewable
Measuring insert	Replaceable, with measuring insert tube made of stainless steel; terminal block with clamping springs
Response times (to VDI/VDE 3 522)	
• In water with flow velocity $v = 0.4 \text{ m/s}$ (1.31 ft/s)	$t_{0.5} = 25 \text{ s}$, $t_{0.9} = 80 \text{ s}$
Explosion protection	II 1/2G EEx ia IIC T4/T6

Dimensional drawings



High-pressure welding-type resistance thermometer with connection head and neck tube, dimensions in mm (inches)

Selection and Ordering data

Order No.

High-pressure welding-type resistance thermometer

Measuring resistor: Winding embedded in ceramic, protective tube to DIN 43772, form 4

1 Pt100 measuring resistor/three-wire circuit

- Measuring insert not explosion protected
 - max. 540 °C (1004 °F), protective tube 13 CrMo 44, mat. No. 1.7335
 - max. 550 °C (1022 °F), protective tube X 6 CrNiMoTi 17 122, mat. No. 1.4571
- Measuring insert with explosion protection
 - max. 550 °C (1022 °F), protective tube X 6 CrNiMoTi 17 122, mat. No. 1.4571

7MC1010 - GA 2

7MC1010 - FA 2

7MC1010 - FE 2

2 Pt100 measuring resistors/two-wire circuit

- Measuring insert not explosion protected
 - max. 540 °C (1004 °F), protective tube 13 CrMo 44, mat. No. 1.7335
 - max. 550 °C (1022 °F), protective tube X 6 CrNiMoTi 17 122, mat. No. 1.4571
- Measuring insert with explosion protection
 - max. 550 °C (1022 °F), protective tube X 6 CrNiMoTi 17 122, mat. No. 1.4571

7MC1010 - GB 2

7MC1010 - FB 2

7MC1010 - FF 2

Mounting length U	Protective tube length L	Total length without connection head l_5	Weight with one/two measuring resistors	
mm (inch)	mm (inch)	mm (inch)	kg (lb)	
		305 (12.0)	0.78 (1.7)/ 0.79 (1.7)	1
	140 (5.5)	365 (14.4)	0.82 (1.8)/ 0.83 (1.8)	2
65 (2.6)		395 (15.6)	0.85 (1.9)/ 0.86 (1.9)	3
		365 (14.4)	0.95 (2.1)/ 0.96 (2.1)	4
	200 (7.9)	395 (15.6)	0.98 (2.2)/ 1.00 (2.2)	5
		365 (14.4)	0.95 (2.1)/ 0.96 (2.1)	6
	200 (7.9)	395 (15.6)	0.98 (2.2)/ 1.00 (2.2)	7
125 (4.9)		395 (15.6)	1.15 (2.5)/ 1.20 (2.7)	8

Connection head, form B

- made of cast light alloy, with 1 cable bushing and
 - screw cover
 - standard hinged cover
 - high hinged cover
- made of stainless steel, with 1 cable bushing and screw cover

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Further designs

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

Order code

- Different design (mounting length, protective tube material etc.), specify in plain text.
- TAG plate made of stainless steel specify TAG No. in plain text
- Calibration carried out at one point, specify desired temperature in plain text (order equivalent number of times for several calibration points).

Y01

Y15

Y33

To order a temperature transmitter installed in the connection head, see "Temperature transmitters for installation in the connection head" (page 3/75).

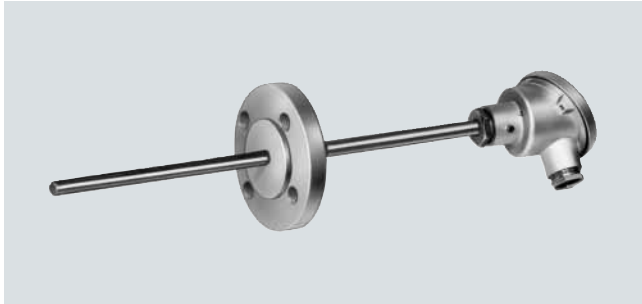
Individual parts: Measuring inserts and connection heads, see "Accessories".

SITRANS T measuring instruments for temperature

Resistance thermometers

Flange-type resistance thermometer with connection head

Overview

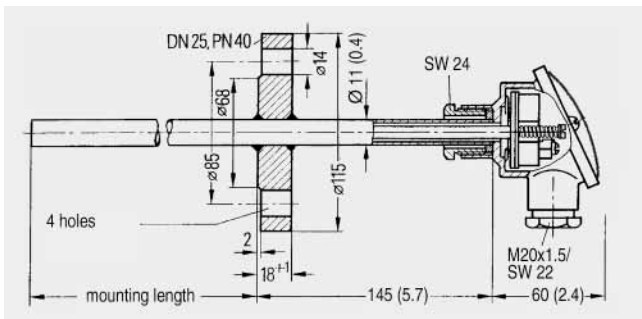


The flange-type resistance thermometer with connection head can be installed in tanks and pipelines; it is suitable for a temperature range from -50 to +600 °C (-58 to +1112 °F) and can also be supplied with a built-in temperature transmitter.

Technical specifications

Protective tube	
• Form	2F, DIN 43772; cylindrical, 11 mm (0.43 inch) diameter, wall thickness 2 mm (0.08 inch)
• Material	X 6 CrNiMoTi 17 122, mat. No. 1.4571
• Loading capacity	to 40 bar (580 psi) (loading capacity dependent on material, temperature, flow rate, mounting length etc., see DIN 43772 for details)
Flange	Nominal diameter DN 25, nominal pressure PN 40 (ASME on request)
Measuring insert	Replaceable, with measuring insert tube (6 mm diameter (0.24 inch) made of stainless steel; terminal block with clamping springs
Response times (to VDI/VDE 3 522)	
• In water with flow velocity $v = 0.4$ m/s (1.31 ft/s)	$t_{0.5} = 32$ s, $t_{0.9} = 96$ s
• In air with flow velocity $v = 1$ m/s (3.28 ft/s)	$t_{0.5} = 2.2$ min, $t_{0.9} = 6.8$ min
Explosion protection	II 1/2G EEx ia IIC T4/T6

Dimensional drawings



Flange-type resistance thermometer with connection head, dimensions in mm (inches)

Selection and Ordering data

Order No.

Flange-type resistance thermometer With connection head

Protective tube to DIN 43772, form: 2F
one Pt100 measuring resistor: three-wire circuit, two Pt100 measuring resistors: two-wire circuit

Measuring insert not explosion protected

One Pt100 measuring resistor

Mounting length/ mm (inch):	Weight/ kg (lb):
• 160 (6.3)	1.5 (3.31)
• 250 (9.84)	1.5 (3.31)

► 7MC1017-1FA1
7MC1017-2FA1

Two Pt100 measuring resistors

Mounting length/ mm (inch):	Weight/ kg (lb):
• 160 (6.3)	1.6 (3.53)
• 250 (9.84)	1.6 (3.53)

7MC1017-1FB1
7MC1017-2FB1

Measuring insert with explosion protection

One Pt100 measuring resistor

Mounting length/ mm (inch):	Weight/ kg (lb):
• 160 (6.3)	1.5 (3.31)
• 250 (9.84)	1.5 (3.31)

► 7MC1017-1FE1
7MC1017-2FE1

Two Pt100 measuring resistors

Mounting length/ mm (inch):	Weight/ kg (lb):
• 160 (6.3)	1.6 (3.53)
• 250 (9.84)	1.6 (3.53)

7MC1017-1FF1
7MC1017-2FF1

Connection head, form B

- made of cast light alloy, with 1 cable inlet and
 - screw cover
 - standard hinged cover
 - high hinged cover
- made of stainless steel, with 1 cable inlet and screw cover

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Further designs

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

Order code

- Different design (mounting length, protective tube material etc.), specify in plain text. **Y01**
- TAG plate made of stainless steel specify TAG No. in plain text **Y15**
- Calibration carried out at one point, specify desired temperature in plain text (order equivalent number of times for several calibration points). **Y33**

► Available ex stock

To order a temperature transmitter installed in the connection head, see "Temperature transmitters for installation in the connection head" (page 3/75).

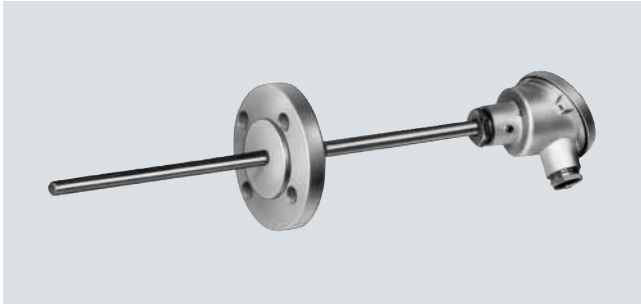
Individual parts: Measuring inserts and connection heads, see "Accessories".

SITRANS T measuring instruments for temperature

Resistance thermometers

Flange-type resistance thermometer with reduced response time, with connection

Overview

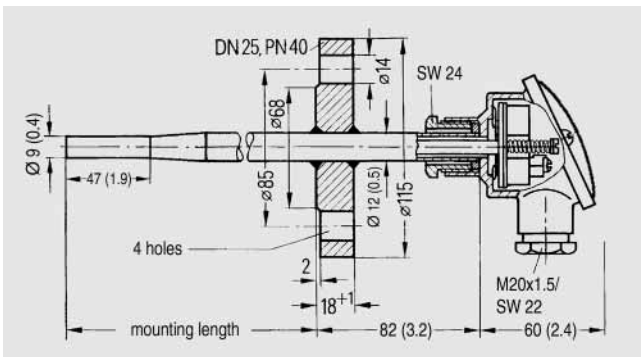


The flange-type resistance thermometer with connection head with reduced response time can be installed in tanks and pipelines; it is suitable for a temperature range from -50 to +600 °C (-58 to +1112 °F). The sensor is also available with a built-in temperature transmitter.

Technical specifications

Protective tube	
• Form	3, DIN 43772; cylindrical, 12 mm (0.47 inch) diameter, wall thickness 2.5 mm (0.1 inch), tapered towards tip; tip cylindrical over length of 47 mm (1.85 inch), 9 mm (0.35 inch) diameter, wall thickness 1.5 mm (0.06 inch)
• Material	X 6 CrNiMoTi 17 122, mat. No. 1.4571
• Loading capacity	to 40 bar (580 psi) (loading capacity dependent on material, temperature, flow rate, mounting length etc., see DIN 43772 for details)
Flange	Nominal diameter DN 25, nominal pressure PN 40 (ASME on request)
Measuring insert	Replaceable, with measuring insert tube (6 mm diameter (0.24 inch) made of stainless steel; terminal block with clamping springs
Response times (to VDI/VDE 3 522)	
• In water with flow velocity $v = 0.4$ m/s (1.31 ft/s)	$t_{0.5} = 22$ s, $t_{0.9} = 66$ s
• In air with flow velocity $v = 1$ m/s (3.28 ft/s)	$t_{0.5} = 2.1$ min, $t_{0.9} = 6.5$ min
Explosion protection	II 1/2G EEx ia IIC T4/T6

Dimensional drawings



Flange-type resistance thermometer with reduced response time; with connection head, dimensions in mm (inches)

Selection and Ordering data

Order No.

Flange-type resistance thermometer with reduced response time with connection head

Protective tube to DIN 43772, form: 3
one Pt100 measuring resistor: three-wire circuit, two Pt100 measuring resistors: two-wire circuit

Measuring insert not explosion protected

One Pt100 measuring resistor

Mounting length/ mm (inch):	Weight/ kg (lb):
• 225 (8.9)	1.5 (3.31)
• 285 (11.2)	1.5 (3.31)
• 345 (13.6)	1.5 (3.31)

7MC1041-1AA0
7MC1041-2AA0
7MC1041-3AA0

Two Pt100 measuring resistors

Mounting length/ mm (inch):	Weight/ kg (lb):
• 225 (8.9)	1.6 (3.53)
• 285 (11.2)	1.6 (3.53)
• 345 (13.6)	1.6 (3.53)

7MC1041-1AB0
7MC1041-2AB0
7MC1041-3AB0

Measuring insert with explosion protection

One Pt100 measuring resistor

Mounting length/ mm (inch):	Weight/ kg (lb):
• 225 (8.9)	1.5 (3.31)
• 285 (11.2)	1.5 (3.31)
• 345 (13.6)	1.5 (3.31)

7MC1041-1EA0
7MC1041-2EA0
7MC1041-3EA0

Two Pt100 measuring resistors

Mounting length/ mm (inch):	Weight/ kg (lb):
• 225 (8.9)	1.6 (3.53)
• 285 (11.2)	1.6 (3.53)
• 345 (13.6)	1.6 (3.53)

7MC1041-1EB0
7MC1041-2EB0
7MC1041-3EB0

Connection head, form B

- made of cast light alloy, with 1 cable inlet and
 - screw cover
 - standard hinged cover
 - high hinged cover
- made of stainless steel, with 1 cable inlet and screw cover

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Further designs

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

Order code

- Different design (mounting length, protective tube material etc.), specify in plain text.
- TAG plate made of stainless steel specify TAG No. in plain text
- Calibration carried out at one point, specify desired temperature in plain text (order equivalent number of times for several calibration points).

Y01
Y15
Y33

To order a temperature transmitter installed in the connection head, see "Temperature transmitters for installation in the connection head" (page 3/75).

Individual parts: Measuring inserts and connection heads, see "Accessories".

SITRANS T measuring instruments for temperature

Resistance thermometers

Resistant thermometers for damp rooms

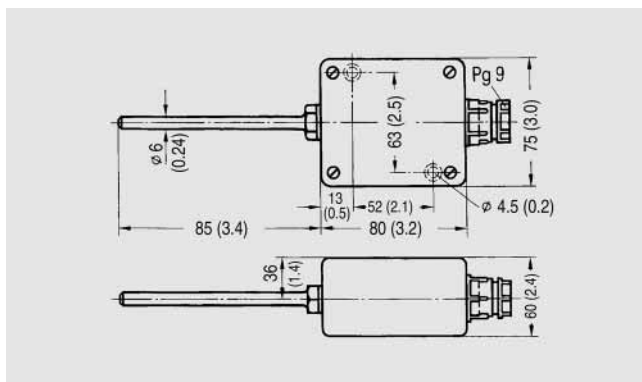
Overview

The resistance thermometer for damp rooms is suitable for a temperature range from -30 to +60 °C (-22 to +140 °F).

Technical specifications

Protective tube	Made of stainless steel
Connection head	Made of cast light alloy, with cable bushing; made of plastic on request
Measuring insert	1 or 2 Pt measuring resistors to DIN EN 60751, connection in three-wire or two-wire system, class B
Degree of protection	IP65 acc. to DIN EN 60529

Dimensional drawings



Resistance thermometer for moist rooms, dimensions in mm (inches)

Selection and Ordering data

Order No.

Resistance thermometer for damp rooms

stainless steel protective tube

- with one Pt100 measuring resistor 0.1 kg (0.22 kg)
- with two Pt100 measuring resistors 0.1 kg (0.22 kg)

► 7MC1027-1AA

7MC1027-1AB

Further designs

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

Order code

- Different design (mounting length, protective tube material etc.), specify in plain text. Y01
- TAG plate made of stainless steel specify TAG No. in plain text Y15
- Calibration carried out at one point, specify desired temperature in plain text (order equivalent number of times for several calibration points). Y33

► Available ex stock

To order a temperature transmitter installed in the connection head, see "Temperature transmitters for installation in the connection head" (page 3/75).

Note:

Additional fitting of head mounted transmitter of SITRANS TH series is possible.

SITRANS T measuring instruments for temperature

Resistance thermometers

Accessories
Measuring inserts, not explosion protected

Design

Components (design to DIN 43762)

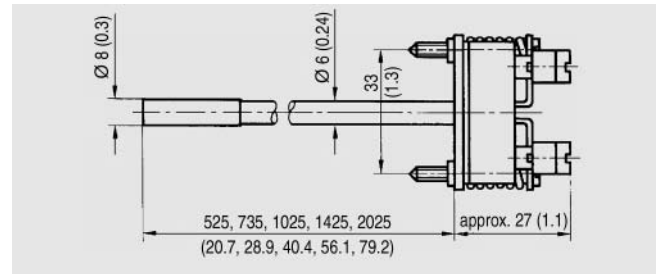
- Measuring insert with resistor,
- insert tube with retaining plate,
- terminal block with clamping springs and 2 or 3 internal conductors of Cu-Ni sheathed wire for each Pt100 measuring resistor.

The resistance of the internal conductors is stated on the measuring insert if it is greater than 0.2 Ω.

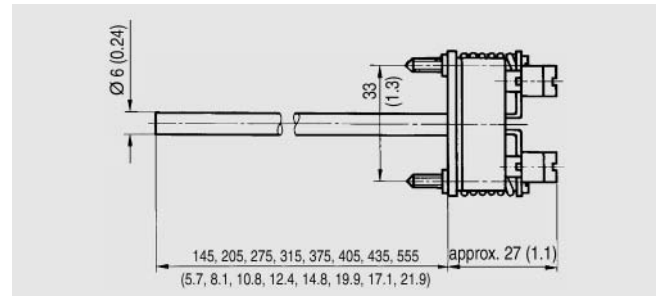
The measuring inserts have a filling of Al₂O₃ powder which surrounds the measuring resistor and the internal conductors and results in a high vibration resistance (for temperatures up to 600 °C (1112 °F)). The winding is embedded in a ceramic body.

If the vibrations at the measuring location are greater than normal, the special vibration-proof measuring inserts should be used (for temperatures up to 450 °C (842 °F)). The measuring resistor is embedded in an homogeneous, fused glass body.

Dimensional drawings



Measuring insert for flue gas resistance thermometers, dimensions in mm (inches)



Measuring insert for low-pressure, high-pressure and flange-type resistance thermometers, dimensions in mm (inches)

Selection and Ordering data

Order No.

Measuring insert for flue gas resistance thermometer 7MC1000

for temperatures to 600 °C (1112 °F), stainless steel measuring insert tube
Measuring resistor: Winding embedded in ceramic

Measuring insert not explosion protected

One Pt100 measuring resistor/three-wire circuit

Measuring insert length mm (inch):	Mounting length of the resistance thermometer mm (inch):	Weight kg (lb):	
• 525 (20.7)	500 (19.7)	0.22 (0.49)	7MC1900-1EA
• 735 (28.9)	710 (28.0)	0.27 (0.60)	7MC1900-2EA
• 1025 (40.4)	1000 (39.4)	0.32 (0.71)	7MC1900-3EA
• 1425 (56.1)	1400 (55.1)	0.42 (0.93)	7MC1900-4EA
• 2025 (79.7)	2000 (78.7)	0.62 (1.37)	7MC1900-5EA

Selection and Ordering data

Order No.

Measuring insert for low-pressure, high-pressure and flange-type resistance thermometers

Measuring resistor: Winding embedded in ceramic (max. 600 °C (1112 °F))

Measuring insert not explosion protected

One Pt100 measuring resistor/three-wire circuit

Measuring insert length	Screw-in thermometer without neck tube, 7MC1006	Screw-in thermometer with neck tube, 7MC1007 and 7MC1008	Screw-in thermometer 7MC1010	Flange-type thermometer 7MC1017	Flange-type thermometer 7MC1041	Weight	
mm (inch)	mm (inch)	mm (inch)	Total length without connection head mm (inch)	Mounting length mm (inch)	Mounting length mm (inch)	kg (lb)	
• 145 (5.7)	100 (3.9)	–	–	–	–	0.15 (0.33)	7MC1910-1JA
• 205 (8.1)	160 (6.3)	–	–	–	–	0.16 (0.35)	7MC1910-2JA
• 275 (10.8)	230 (9.1)	–	–	–	–	0.17 (0.37)	7MC1910-3JA
• 315 (12.4)	–	160 (6.3)	305 (12.0)	160 (6.3)	225 (8.9)	0.18 (0.40)	7MC1910-4JA
• 375 (14.8)	–	–	365 (14.4)	–	285 (11.2)	0.19 (0.42)	7MC1910-5JA
• 405 (15.9)	360 (14.2)	250 (9.8)	395 (15.6)	250 (9.8)	–	0.20 (0.44)	7MC1910-6JA
• 435 (17.1)	–	–	–	–	345 (13.6)	0.20 (0.44)	7MC1910-8JA
• 555 (21.1)	510 (20.1)	400 (15.8)	–	–	–	0.21 (0.46)	7MC1910-7JA

SITRANS T measuring instruments for temperature

Resistance thermometers

Accessories

Measuring inserts, not explosion protected

Selection and Ordering data

Order No.

Measuring insert for low-pressure, high-pressure and flange-type resistance thermometers

Measuring resistor: Winding embedded in ceramic (max. 600 °C (1112 °F))

Two Pt100 measuring resistors/three-wire circuit

Measuring insert length	Screw-in thermometer without neck tube, 7MC1006	Screw-in thermometer with neck tube, 7MC1007 and 7MC1008	Screw-in thermometer 7MC1010	Flange-type thermometer 7MC1017	Flange-type thermometer 7MC1041	Weight	
	Mounting length	Mounting length	Total length without connection head	Mounting length	Mounting length		
mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	kg (lb)	
• 145 (5.7)	100 (3.9)	–	–	–	–	0.15 (0.33)	7MC1910-1JB
• 205 (8.1)	160 (6.3)	–	–	–	–	0.16 (0.35)	7MC1910-2JB
• 275 (10.8)	230 (9.1)	–	–	–	–	0.17 (0.37)	7MC1910-3JB
• 315 (12.4)	–	160 (6.3)	305 (12.0)	160 (6.3)	225 (8.9)	0.18 (0.40)	7MC1910-4JB
• 375 (14.8)	–	–	365 (14.4)	–	285 (11.2)	0.19 (0.42)	7MC1910-5JB
• 405 (15.9)	360 (14.2)	250 (9.8)	395 (15.6)	250 (9.8)	–	0.20 (0.44)	7MC1910-6JB
• 435 (17.1)	–	–	–	–	345 (13.6)	0.20 (0.44)	7MC1910-8JB
• 555 (21.1)	510 (20.1)	400 (15.8)	–	–	–	0.21 (0.46)	7MC1910-7JB

Further measuring inserts on request.

Technical specifications

An explosion protected measuring insert is suitable for installation in a protective fitting and for connection to a certified intrinsically-safe circuit of category "ia" or "ib".

The measuring insert may only be used if the protective fitting has the degree of protection IP20 according to DIN 40050.

Design

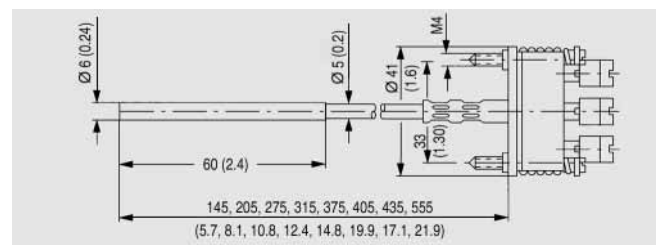
The measuring resistor is fitted in a 60 mm (2.36 inch) long stainless steel sleeve with an outer diameter of 6 mm (0.24 inch). The sleeve and the sheath of the supply cable are welded. The sheath of the supply cable is also made of stainless steel, and its outer diameter is 5 mm (0.2 inch).

The conductors are made of special copper and are embedded in highly compacted magnesium oxide powder. The connection points between the measuring resistor and the conductors are additionally isolated. The conductors are potted in the terminal base.

The rating plate is located underneath the retaining plate.

Measuring temperature	-200 ... +450 °C (-328 ... +842 °F) The temperature depends on the maximum measuring current which can flow in the connected measuring circuit if an error occurs.
Resistance of internal conductor	Per measuring circuit, i.e. for both conductors of the two-wire system: 0.17 Ω/m measuring insert
Resistance of measuring insert	≥ 1000 MΩ at room temperature
Outer diameter of sleeve	6 mm (0.24 inch)
Explosion protection	II 2G EEx ia IIC T4/T6

Dimensional drawings



Explosion protected measuring insert for resistance thermometers,
dimensions in mm (inches)

Selection and Ordering data

Order No.

Measuring insert for low-pressure, high-pressure and flange-type resistance thermometers

Stainless steel measuring insert

Measuring resistor: Winding embedded in ceramic (max. 450 °C (842 °F))

Outer diameter of sleeve: 6 mm (0.24 inch)

Measuring insert with explosion protection

One Pt100 measuring resistor/three-wire circuit

Measuring insert length	Screw-in thermometer without neck tube, 7MC1006	Screw-in thermometer with neck tube, 7MC1007	Screw-in thermometer 7MC1010	Flange-type thermometer 7MC1017	Flange-type thermometer 7MC1041	Weight	
	Mounting length	Mounting length	Total length without connection head	Mounting length	Mounting length		
mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	kg (lb)	
• 145 (5.7)	100 (3.9)	—	—	—	—	0.15 (0.33)	7MC1913-1AA22
• 205 (8.1)	160 (6.3)	—	—	—	—	0.16 (0.35)	7MC1913-2AA22
• 275 (10.8)	230 (9.1)	—	—	—	—	0.17 (0.37)	7MC1913-3AA22
• 315 (12.4)	—	160 (6.3)	305 (12.0)	160 (6.3)	225 (8.9)	0.18 (0.40)	7MC1913-4AA22
• 375 (14.8)	—	—	365 (14.4)	—	285 (11.2)	0.19 (0.42)	7MC1913-5AA22
• 405 (15.9)	360 (14.2)	250 (9.8)	395 (15.6)	250 (9.8)	—	0.20 (0.44)	7MC1913-6AA22
• 435 (17.1)	—	—	—	—	345 (13.6)	0.20 (0.44)	7MC1913-7AA22
• 555 (21.1)	510 (20.1)	400 (15.8)	—	—	—	0.21 (0.46)	7MC1913-8AA22

Two Pt100 measuring resistors/two-wire circuit

Measuring insert length	Screw-in thermometer without neck tube, 7MC1006	Screw-in thermometer with neck tube, 7MC1007
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	Mounting length	Mounting length	Total length without connection head	Mounting length	Mounting length		
mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	kg (lb)	
• 145 (5.7)	100 (3.9)	–	–	–	–	0.15 (0.33)	7MC1913-1AB12
• 205 (8.1)	160 (6.3)	–	–	–	–	0.16 (0.35)	7MC1913-2AB12
• 275 (10.8)	230 (9.1)	–	–	–	–	0.17 (0.37)	7MC1913-3AB12
• 315 (12.4)	–	160 (6.3)	305 (12.0)	160 (6.3)	225 (8.9)	0.18 (0.40)	7MC1913-4AB12
• 375 (14.8)	–	–	365 (14.4)	–	285 (11.2)	0.19 (0.42)	7MC1913-5AB12
• 405 (15.9)	360 (14.2)	250 (9.8)	395 (15.6)	250 (9.8)	–	0.20 (0.44)	7MC1913-6AB12
• 435 (17.1)	–	–	–	–	345 (13.6)	0.20 (0.44)	7MC1913-7AB12
• 555 (21.1)	510 (20.1)	400 (15.8)	–	–	–	0.21 (0.46)	7MC1913-8AB12

Further measuring inserts on request.

SITRANS T measuring instruments for temperature

Resistance thermometers

Accessories – Welding-type protective tubes, neck tubes and connection heads

Welding-type protective tube

Welding-type protective tube for high-pressure resistance thermometers to DIN 43 767, without neck tube, without connection head

- Tapered shank with cylindrical welding stubs
- For measuring insert tube with 6 mm (0.24 inch)
- OD female thread M18 x 1.5 (including steel screw plug)

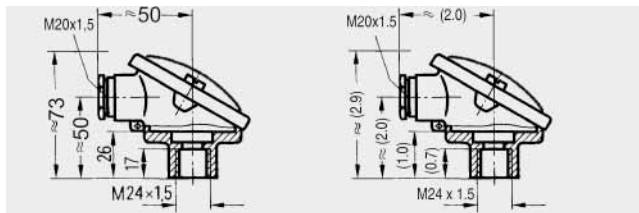
Neck tube

Neck tube for high-pressure screw-in resistance thermometer

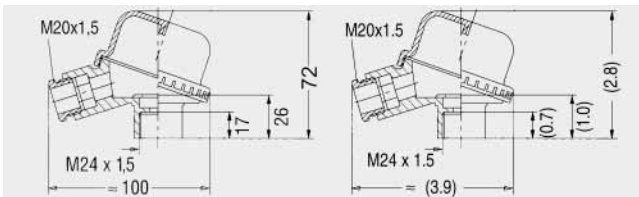
- Made of stainless steel, mat. No. 1.4571
- With threads at both ends
- For measuring insert tube with 6 mm (0.24 inch) OD

Dimensional drawings

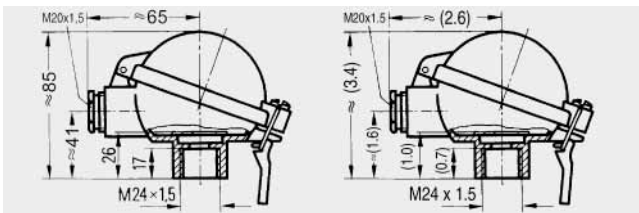
Connection heads for low and high-pressure resistance thermometers, flue gas and flange-type resistance thermometers



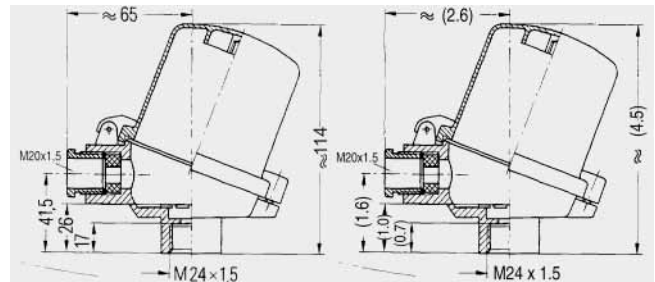
Connection head, form B, degree of protection IP54, made of cast light alloy, with screw cover, dimensions in mm (inches)



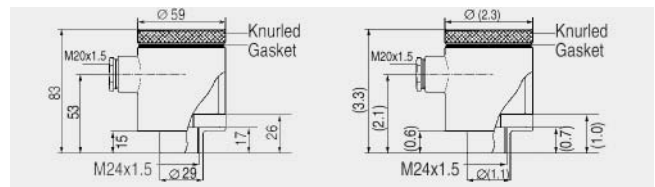
Connection head, form B, degree of protection IP54, made of plastic, with screw cover, dimensions in mm (inches)



Connection head, form B, degree of protection IP65, made of cast light alloy, with standard hinged cover, dimensions in mm (inches)



Connection head, form B, degree of protection IP65, made of cast light alloy, with high hinged cover, dimensions in mm (inches)



Connection head, form B-VA, degree of protection IP65, made of stainless steel, with screw cover, dimensions in mm (inches)

SITRANS T measuring instruments for temperature

Resistance thermometers

Accessories – Welding-type protective tubes, neck tubes and connection heads

3

Selection and Ordering data			Order No.
Welding protective tube for high-pressure resistance thermometers according to DIN 43767, without neck tube, without connection head tapered shank with cylindrical welding stub, for measuring insert tube with 6 mm (0.24 inch) OD; female thread M18 x 1.5 (including steel screw plug)			
Up to 540 °C (1004 °F) Protective tube to DIN 43772, form 4 made of 13 CrMo 44, mat. No. 1.7335			
Mounting length U mm (inch)	Protective tube length L mm (inch)	Weight mm (inch)	
• 65 (2.56)	140 (5.51)	0.3 (0.66)	7MC1905-1GA
• 65 (2.56)	200 (7.87)	0.5 (1.1)	7MC1905-2GA
• 125 (4.92)	200 (7.87)	0.5 (1.1)	7MC1905-3GA
• 125 (4.92)	260 (10.24)	0.6 (1.32)	7MC1905-4GA
Up to 550 °C (1022 °F) Protective tube to DIN 43772, form 4 made of 6 CrNiMoTi 17122, mat. No. 1.4571			
Mounting length U mm (inch)	Protective tube length L mm (inch)	Weight kg (lb)	
• 65 (2.56)	140 (5.51)	0.3 (0.66)	7MC1905-1DA
• 65 (2.56)	200 (7.87)	0.5 (1.1)	7MC1905-2DA
• 125 (4.92)	200 (7.87)	0.5 (1.1)	7MC1905-3DA
• 125 (4.92)	260 (10.24)	0.6 (1.32)	7MC1905-4DA

Selection and Ordering data			Order No.
Neck tube for high-pressure screw-in resistance thermometer made of stainless steel, mat. No. 1.4571, with thread at both ends, for measuring insert tube with 6 mm (0.24 inch) OD			
Neck tube length mm (inch)	Total length of the resistance thermometer, without connection head mm (inch)	Protective tube length mm (inch)	Weight kg (lb)
• 135 (5.31)	395 (15.55)	260 (10.24)	0.14 (0.31)
• 165 (6.50)	305/365 (12.01/14.37)	140/200 (5.51/7.87)	0.15 (0.33)
• 195 (7.68)	395 (15.55)	200 (7.87)	0.18 (0.40)
• 225 (8.86)	365 (14.37)	140 (5.51)	0.20 (0.44)
• 255 (10.04)	395 (15.55)	140 (5.51)	0.22 (0.49)
			7MC1906-1AA
			7MC1906-2AA
			7MC1906-3AA
			7MC1906-4AA
			7MC1906-5AA

Selection and Ordering data		Order No.
Connection heads for low-pressure, high-pressure, flue gas and flange-type resistance thermometers		
Connection head, form B, degree of protection IP54		
• made of cast light alloy, with screw cover and with 1 cable bushing, weight: 0.14 kg (0.31 lb)		7MC1907-1BA
• made of plastic, with screw cover and with 1 cable bushing, weight: 0.08 kg (0.18 lb)		7MC1907-1BK
Connection head, form B, degree of protection IP65 Weight: 0.3 kg (0.66 lb)		
• made of cast light alloy, with standard hinged cover and with 1 cable bushing		7MC1907-1BF
• made of cast light alloy, with high hinged cover and with 1 cable bushing		7MC1907-1BL
Connection head, form B-VA, degree of protection IP65		
• made of stainless steel, with screw cover and with 1 cable bushing, weight: 0.65 kg (1.43 lb)		7MC1907-1BV
Accessories for connection head, form B, degree of protection IP65		
• Quick-release clamp (degree of protection of connection head reduced to IP54) Weight: 0.02 kg (0.04 lb)		7MC1907-1BS

Connection heads with a drilled hole of 15.5 mm diameter (0.61 inch) instead of the female thread M24 x 1.5 on request.

SITRANS T measuring instruments for temperature

Thermocouples

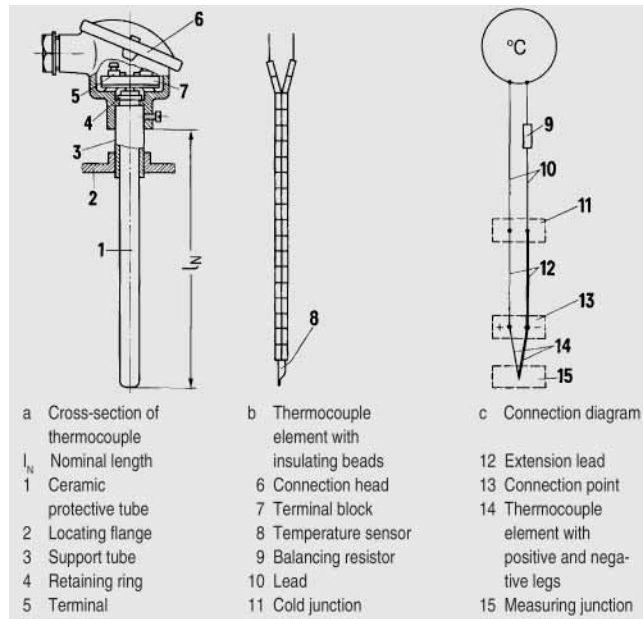
Technical description

Design

A thermocouple comprises

- The thermocouple element (sensor) and
- The mounting and connection parts required in each case.

The thermocouple element is formed by two conductors of dissimilar metals or metal alloys which are soldered or welded together at one end, the measuring junction:



Thermocouple element

Function

Measuring principle of the thermocouple element

If the measuring junction is exposed to a temperature different from that at the free ends of the thermocouple, a voltage (the thermoelectric voltage, Seebeck effect) is produced at these free ends. The magnitude of the thermoelectric voltage depends on the difference in temperature between the measuring junction and the free ends, and on the combination of materials in the thermocouple. Since a thermocouple always measures a temperature difference, the free ends of the thermocouple must be connected to a reference junction (cold junction) and held constant at a known temperature.

Calibration data for thermoelectric voltages and permissible deviations

The calibration data and the permissible deviations for commonly used thermocouples are defined (see Technical Data, Table "Calibration data for thermoelectric voltages and error limits").

The thermocouples Cu-CuNi and Fe-CuNi to DIN 43710 are used for replacement purposes. Thermocouples of class 2 are supplied as standard. For more accurate measurements, thermocouples are available with half the DIN tolerance or with a test certificate. The tolerances only apply to the condition upon delivery.

During operation at high temperatures, the tolerances of the thermocouples may change due to absorption of foreign matter, oxidation or evaporation of alloy components.

Mode of operation

The thermocouples are extended from the connection point to a point whose temperature is as constant as possible (the cold junction) by means of extension leads.

The extension leads have the same color code as the associated thermocouple elements; the positive pole is marked in red. Correct polarity must be ensured since otherwise large errors will occur. Up to 200 °C, the same calibration data and tolerances apply to the extension leads as to the corresponding thermocouples.

The influence of temperature changes at the cold junction can be balanced by means of a compensating circuit, e.g. a compensating box. The reference temperature is 0 (32 °F) or 20 °C (68 °F).

It is also possible to keep the cold junctions at a constant temperature of 50, 60 or 70 °C (122, 140 or 158 °F) using a thermostat (for several measuring junctions).

The connections from the cold junction to the measuring or process instrument are made using copper leads. With energy-consuming instruments such as indicators or multipoint recorders, the complete measuring circuit (thermocouple, extension lead and copper lead) must be balanced in the operating condition using a resistor. SITRANS T transmitters and KOMPENSOGRAPH servo recorders for connection to thermocouple elements have a built-in compensating circuit for balancing the effect of the ambient temperature on the cold junction. Lead balancing is not necessary in this case because of the high input impedance.

Protection fitting/protective tubes

The thermocouple can be protected against mechanical stress and chemical attack by a ceramic or metal protective tube which may be mounted using flanges, screwed glands or by welding into the pipeline or tank. The thermocouple element terminates in the connection head.

Installation examples with specification of the recommended thermocouples and protective tube materials are listed on pages "Technical Data" and "Installation Examples".

Owing to the different operating conditions, no guarantee can be given for protective fittings. The manufacturer is responsible for damages and measuring errors caused by wrong installation in compliance with the General Terms of Delivery if the instruments have been installed by the manufacturer and if the specifications for the operating conditions furnished by the customer were correct and sufficiently detailed.

Thermocouple elements are very compatible since it is almost always possible to adapt them in shape and size to the particular problem. The temperature-responsive part is almost point-shaped. Thermocouple elements are therefore particularly suitable for measuring rapidly changing temperatures.

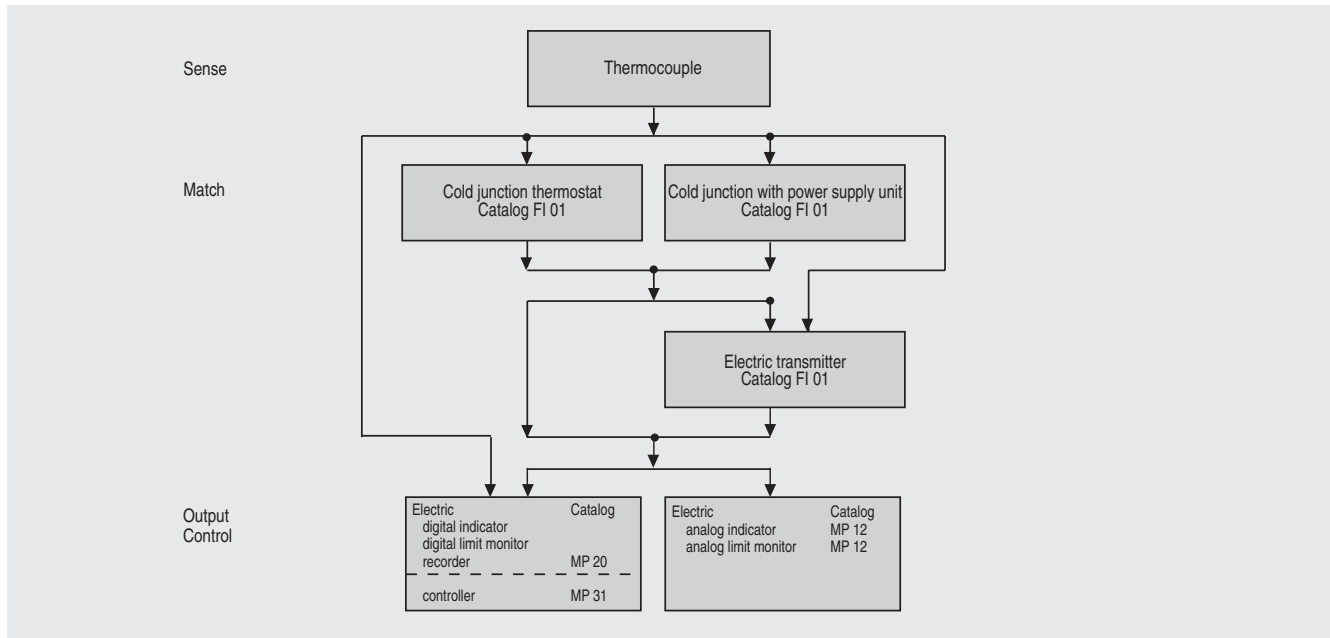
SITRANS T measuring instruments for temperature

Thermocouples

Technical description

Integration

Instrument combination for measuring and controlling temperature, with thermocouple element as sensor



Installation examples with specification of appropriate thermocouples and protective tubes

Measuring point	Permissible operating temperature °C (°F)	Thermo- couple	Protective tube
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A. Iron and steel works

1. Blast furnace

Hot blast	1000 (1832)	Ni Cr/Ni	Open protective tube X 10 CrAl 24, mat. No. 1.4762, bare soldering point, cemented
Crude gas	300 (572)	Ni Cr/Ni	X 10 CrAl 24, mat. No. 1.4762, dished

2. Air preheater

Dome	1200 (2192)	Pt 10% Rh/Pt	Outside: X 15 CrNiSi 24 19, mat. No. 1.4841, Inside: KER 710
Exhaust gas	300 (572)	Ni Cr/Ni	St 35.8, mat. No. 1.0305, seamless, enamelled

3. Open-hearth furnace

Exhaust gas ducts	600 (1112)	Ni Cr/Ni	X 10 CrAl 24, mat. No. 1.4762, dished
Checkers	1350 (2462)	Pt 10% Rh/Pt	Outside: Silicon car- bide Inside: KER 710
Melt (for short periods)	1600 (2912)	Pt 10% Rh/Pt	Immersion-type ther- mocouple element of special design

4. Soaking pit

Furnace cham- ber	1350 (2462)	Pt 10% Rh/Pt	Outside: Silicon car- bide Inside: KER 710
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Measuring point	Permissible operating temperature °C (°F)	Thermo- couple	Protective tube
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Exhaust gas before or behind recuperator	1000 (1832)	Ni Cr/Ni	X 10 CrAl 24, mat. No. 1.4762, dished; installation with gas-tight screw socket
Combustion air behind recuper- ator	700 (1292)	Ni Cr/Ni	X 10 CrAl 24, mat. No. 1.4762, dished; installation with gas-tight screw socket

5. Pusher, rotating hearth furnace, and other types of rolling mill furnace

Preheating zone	800 (1472)	Pt 10% Rh/Pt or Ni Cr/Ni	Outside: Silicon carbide Inside: KER 710 or outside: Silicon car- bide Inside: KER 610
Heating zone	1250 (2282)	Pt 10% Rh/Pt	As above
Soaking zone	1350 (2462)	Pt 10% Rh/P	Outside: Silicon carbide Inside: KER 710
Exhaust gas before air recu- perator	900 (1652)	Ni Cr/Ni	X 10 CrAl 24, mat. No. 1.4762, dished; installation with gas-tight screw socket
Exhaust gas before and behind gas recuperator	700 (1292)	Ni Cr/Ni	As above or KER 610
Preheated air behind recuper- ator	700 (1292)	Ni Cr/Ni	As above

SITRANS T measuring instruments for temperature

Thermocouples

Technical description

Installation examples with specification of appropriate thermocouples and protective tubes (continued)

Measuring point	Permissible operating temperature °C (°F)	Thermo-couple	Protective tube
6. Annealing furnace, roller-hearth furnace			
Furnace chamber	800 (1472)	Ni Cr/Ni	X 10 CrAl 24, mat. No. 1.4762, dished
Exhaust gas duct	600 (1112)	Ni Cr/Ni	As above
7. Bell-type anneal. furn.			
Directly heated furnace	950 (1742)	Ni Cr/Ni	X 10 CrAl 24, mat. No. 1.4762, dished
Stack for tin plates	600 ... 900 (1112 ... 1652)	Ni Cr/Ni	Special design, bare thermocouple element with thermal contact plate
Stack for motor-car body sheet	700 ... 920 (1292 ... 1688)	Ni Cr/Ni	As above
Protective gas	650 (1202)	Ni Cr/Ni	Bare thermocouple element
8. Sinter belts			
(Sucking boxes)	400 (752)	Fe/Cu Ni	(Jacket thermocouple element) X 10 CrAl 24, mat. No. 1.4762
For temperature maximum computing circuit	400, 500 (752, 932)	Fe/Cu Ni	As above, with double thermocouple
9. Tinning plants			
Palm nut oil, pickling vat, tin bath	650 (1202)	Ni Cr/Ni	St 35.8, mat. No. 1.0305, seamless, enamelled
10. Zinc coating plants			
Zinc bath	480 (896)	Fe/Cu Ni	St 35.8, mat. No. 1.0305, seamless
11. Heat treatment plants			
11.1 In gases			
Tempering furnaces	550 (1022)	Ni Cr/Ni	St 35.8, mat. No. 1.0305, seamless
Annealing in oxidizing gases containing sulphur and carbon	1050 (1922)	Pt 10% Rh/Pt (Ni Cr/Ni)	Outside: X 10 CrAl 24, mat. No. 1.4762, dished Inside: KER 710
	1200 (2192)	Pt 10% Rh/Pt	Outside: X 10 CrAl 24, mat. No. 1.4762, dished Inside: KER 710
Annealing in reducing gases containing sulphur	1200 (2192)	Pt 10% Rh/Pt	As above
Annealing in nitrogen-containing gases poor in oxygen, also nitriding furnaces with ammonia	1200 (2192)	Pt 10% Rh/Pt	Outside: X 15 CrNiSi 24 19, mat. No. 1.4841, dished; Inside: KER 710

Measuring point	Permissible operating temperature °C (°F)	Thermo-couple	Protective tube
11.2 In hardening shop baths (protective tubes bored from the solid are recommended)			
Salt and nitre	550 (1022)	Ni Cr/Ni	Soft iron, mat. No. 1.1003
Cyanogen	950 (1742)	Ni Cr/Ni	Soft iron or X 15 CrNiSi 24 19, mat. No. 1.4841
Baths containing chloride	1050 (1922)	Pt 10% Rh/Pt	Outside: X 10 CrAl 24, mat. No. 1.4762, Inside: KER 710
Lead baths	1200 (2192)	Pt 10% Rh/P	Outside: Chromium nickel alloy NiCr 60 15, mat. No. 2.4867, Inside: KER 710; bored from the solid
Barium chloride baths	1300 (2372)	Pt 10% Rh/Pt	Outside: Chromium nickel alloy NiCr 60 15, mat. No. 2.4867, Inside: KER 710;
B. Metallurgical plants (only limited life time in molten metals)			
Copper melt	1250 (2282)	Pt 10% Rh/Pt	Outside: X 10 CrSi 29, mat. No. 1.4772, bored from the solid Inside: KER 710
Exhaust of copper melting furnaces	1300 (2372)	Pt 10% Rh/Pt	Outside: Silicon carbide Inside: KER 710
Brass melts	900 (1652)	Ni Cr/Ni	X 10 CrAl 29, mat. No. 1.4772, bored from the solid
Aluminium melts	700 (1292)	Ni Cr/Ni	Pearlite iron GG 22, bored from the solid
Die-casting, magnesium	700 (1292)	Ni Cr/Ni	Soft iron, mat. No. 1.1003, bored from the solid
Bearing metal, lead and tin melting houses	600 (1112)	Fe/Cu Ni	St 35.8, mat. No. 1.0305, seamless, enamelled
Lead foundries	700 (1292)	Fe/Cu Ni	Chromium nickel alloy NiCr 60 15, mat. No. 2.4867, bored from the solid
Zinc foundries	480 (878)	Fe/Cu Ni	St 35.8, mat. No. 1.0305, seamless
	600 (1112)	Fe/Cu Ni	Silicon carbide
Exhaust gases of zinc melting furnaces	1300 (2372)	Pt 10% Rh/Pt	Outside: Silicon carbide Inside: KER 710
C. Ceramic industry			
Ring kiln for standard bricks	800 ... 1100 (1472 ... 2012)	Ni Cr/Ni	X 10 CrAl 24, mat. No. 1.4762, dished
Ring kiln for clinkers, retort furnace, tunnel furnace, glazing kiln	1200 ... 1300 (2192 ... 2372)	Pt 10% Rh/Pt	Outside and Inside: KER 710

SITRANS T measuring instruments for temperature

Thermocouples

Technical description

Installation examples with specification of appropriate thermocouples and protective tubes (continued)

Measuring point	Permissible operating temperature °C (°F)	Thermo-couple	Protective tube
D. Glass industry			
1. Glass trough furnace			
Checkers of the regenerative chambers, above	1300 (2372)	Pt 10% Rh/Pt	Outside: KER 530 Inside: KER 710
Checkers of the regenerative chambers, below	600 (1112)	Ni Cr/Ni	Thermocouple porcelain
Lateral walls, roof, bottom (in drilled channels down to 50 mm below the bath)	1550 (2822) 1400 (2552)	Pt 30% Rh/ Pt 6% Rh	Outside and Inside: KER 710
Leer	800 (1472)	Ni Cr/Ni	X 10 CrAl 24, mat. No. 1.4762, dished
Annealing furnace	1200 (2192)	Pt 10% Rh/Pt	KER 710
2. Pot furnace			
	1500 (2732)	Pt 30% Rh/ Pt 6% Rh	Outside and Inside: KER 710
3. Gas generators			
Crude gas	750 (1382)	Ni Cr/Ni	X 10 CrAl 24, mat. No. 1.4762, dished
Rotary grate (Grate head)	180 ... 200 (356 ... 392) For short periods: 500 ... 1000 (932 ... 1832)	Fe/Cu Ni	Special design on request (to be manufactured on site according to specifications)
E. Cement industry Rotary kilns			
Secondary air at cooler	900 (1652)	Ni Cr/Ni	X 10 CrAl 24, mat. No. 1.4762
Hot chamber	900 (1652)	Ni Cr/Ni	X 10 CrAl 24, mat. No. 1.4762
Drying chamber	400 (752)	Fe/Cu Ni	St 35.8, mat. No. 1.0305, or similar, enamelled
F. Cellulose factories			
Sulphur combustion furnaces, pyrite burner	to 1500 (2732)	Pt 30% Rh/ Pt 6% Rh	Outside: Silicon carbide Inside: KER 710
Behind waste heat boiler	600 (1112)	Ni Cr/Ni	X 10 CrAl 24, mat. No. 1.4762

Measuring point	Permissible operating temperature °C (°F)	Thermo-couple	Protective tube
G. Steam power parts			
Water and steam lines (screw-in and welding-type thermocouple elements)			
Screw-in thermocouple element	300 (572)	Fe/Cu Ni	Sn Bz 6 bronze, to DIN 1726 (only for air or water)
Screw-in thermocouple element	400 (752)	Fe/Cu Ni	St 35.8, mat. No. 1.0305
Screw-in thermocouple element	500 (932)	Fe/Cu Ni	113 CrMo 44, mat. No. 1.7335
Welding-type thermocouple element	540 (1004)	Fe/Cu Ni	113 CrMo 44, mat. No. 1.7335
Welding-type thermocouple element	570 (1058)	Ni Cr/Ni	10 CrMo 9 10, mat. No. 1.7380
	750 (1382)	Fe/Cu Ni (Ni Cr/Ni)	X 8 CrMoNb 16 16, mat. No. 1.4981
Flue gas	1000 (1832)	Pt 10% Rh/Pt	Megapyr, Cr Al 20 5, mat. No. 1.4767 or outside: X 10 CrAl 24, mat. No. 1.4762, Inside: KER 710 St
	600 (1112)	(Ni Cr/Ni)	St 35.8, mat. No. 1.0305, enamelled
Pulverized coal/air mixture line	100 (212)	Fe/Cu Ni	St 35.8, mat. No. 1.0305, (with baffle rod)

Technical specifications

Thermocouple designations to DIN 43710 and DIN IEC 584

DIN 43710, release 12.85

Cu-CuNi	Type U
Fe-CuNi	Type L

DIN IEC 60584

Cu/Cu Ni	Type T
Fe/Cu Ni	Type J
Ni Cr/Ni	Type K
Ni Cr Si-NiSi	Type N
Pt 10% Rh/Pt	Type S
Pt 13% Rh/Pt	Type R
Pt 30% Rh/ Pt 6% Rh	Type B

SITRANS T measuring instruments for temperature

Thermocouples

Temperature transmitters for mounting in the connection head

Overview



The following temperature transmitters are available for mounting in the connection head:

SITRANS TH200

Programmable two-wire temperature transmitter (4 to 20 mA), electrical isolation for resistance thermometers and thermocouple elements.

SITRANS TH300

Two-wire temperature transmitter with HART communication (4 to 20 mA), electrical isolation for resistance thermometers and thermocouple elements.

SITRANS TH400

Temperature transmitter with PROFIBUS-PA or FOUNDATION fieldbus connection, electrical isolation for resistance thermometers and thermocouple elements.

Note:

- SITRANS TH200/TH300/TH400 can be fitted instead of the terminal block (not with 7MC2000-.....) or in the high hinged cover. Additional fitting only possible in high hinged cover.
- If using intrinsically-safe temperature sensors any installed temperature transmitters must also be intrinsically-safe.

Selection and Ordering Data

Detailed information on the transmitters can be found for the respective products under "Transmitters for temperature".

Transmitter to be fitted	Order code
To order the sensor with a built-in temperature transmitter, add "-Z" to the Order No. of the sensor, and supplement by the following Order code:	
• SITRANS TH200	
- without Ex	T20
- EEx ia IIC and EEx n for zone 2	T21
- FM (IS, I, NI)	T23
• SITRANS TH300	
- without Ex	T30
- EEx ia IIC und EEx n for zone 2	T31
- FM (IS, I, NI)	T33
• SITRANS TH400 PA	
- without Ex	T40
- EEx ia	T41
• SITRANS TH400 FF	
- without Ex	T45
- EEx ia	T46
Customer-specific setting of the built-in transmitter (specify settings in plain text)	Y11¹⁾

¹⁾ For TH400 FF available soon.

SITRANS T measuring instruments for temperature

Thermocouples

Questionnaire for temperature sensors
(resistance thermometers and thermocouples)

General information

Customer:
 Address:
 Contact partner:
 Purchasing dept.:
 Sales dept.:
 Process dept.:
 Inquiry:
 Quotation:
 Place and date:

Tel.:
 Tel.:
 Tel.:

Operating conditions

1. Application:
(e.g. exhaust gas measurement)
2. Location:
(e.g. pipe bend, tank)
3. Mounting position:
(e.g. vertical, 45° against flow)
4. Temperature (measuring point):
 Operating temperature:
 Temperature range:
5. Medium:
6. Pressure:
 Nominal pressure:
 Operating pressure:
7. Flow:
8. Vibrations:
9. Miscellaneous:
(e.g. vessel or pipe materials, PTFE lining)

Ambient conditions

(e.g. seawater atmosphere, chemical plant)

Definition:

Special information

1. Mounting of temperature transmitter in connection head:

2. Packaging regulations:

Miscellaneous

Please additionally provide the following: rough sketch, installation diagram, section of drawing, photo

Sensor design

1. Measuring element
(type and standard) (e.g. Pt100 or TC type K)
 - 1.1. Tolerance:
 - 1.2. Design:
(e.g. Pt100 or 2, 3 or 4-wire system)
 - 1.3. Degree of protection/type of protection:
2. Protective fitting:
 - 2.1. Protective tube:
(dimensions/material)
 - 2.2. Mounting:
(dimensions/material)
 - 2.3. Neck tube:
(dimensions/material)
 - 2.4. Mounting length/nominal length:
3. Material certificates:
4. Connection:
 - 4.1. Connection head/box:
 - 4.2. Cable:
(dimensions/insulation/standard)
 - 4.3. Other:
5. Tests:

6. Accessories:

7. Supplementary requirements:

SITRANS T measuring instruments for temperature

Thermocouples

Straight thermocouples to DIN 43733, with connection head

Overview

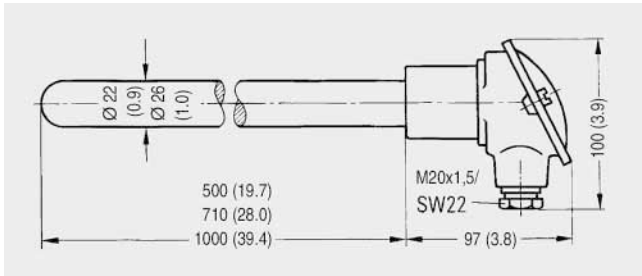


The straight thermocouple together with a metal protective tube is suitable for temperatures from 0 to 1250 °C (32 to 2282 °F) and can be supplied with a built-in temperature transmitter.

Technical specifications

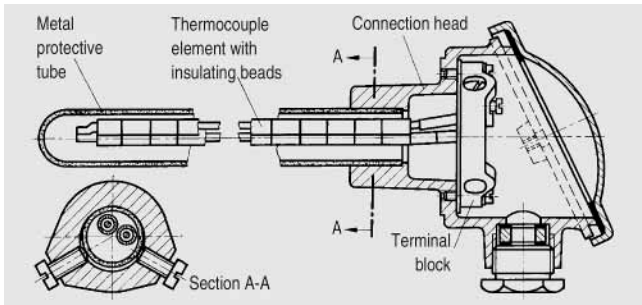
Thermocouples	Ni Cr/Ni type K
• Number	1 or 2
• Leg diameter	2 ... 3 mm (0.08 ... 0.12 inch)
• Insulation of legs	Insulating beads
Protective tube	Metal
Connection head	Form A, DIN 43729; made of cast light alloy, with one cable bushing

Dimensional drawings



Straight thermocouple, dimensions in mm (inches)

Design



Straight thermocouple with base-metal element Ni Cr/Ni with metal protective tube

Selection and Ordering data

Order No.

Straight thermocouple with Ni Cr/Ni thermocouple (type K) with metallic protective tube

to 1000 °C (1832 °F)

X 10 CrAl 24, mat. No. 1.4762

22 mm Ø x 2 mm (0.87 inch x 0.079 inch)

1 thermocouple

Leg diameter 2 mm (0.08 inch)

Weight: 1.1 ... 2.9 kg (2.4 ... 6.4 lb)

Nominal length in mm (inch):

- 500 (19.7)
- 710 (28.0)
- 1000 (39.4)

2 thermocouples

Leg diameter 2 mm (0.08 inch)

Weight: 1.1 ... 3.2 kg (2.4 ... 7.0 lb)

Nominal length in mm (inch):

- 500 (19.7)
- 710 (28.0)
- 1000 (39.4)

7MC2000 - 1DC0 ■
7MC2000 - 2DC0 ■
7MC2000 - 3DC0 ■

to 1100 °C (2012 °F)

X 18 CrNi 28, material No. 1.4749

26 mm Ø x 4 mm (1.02 inch x 0.16 inch)

1 thermocouple

Leg diameter 3 mm (0.12 inch)

Weight: 1.3 ... 2.2 kg (2.7 ... 4.8 lb)

Nominal length in mm (inch):

- 500 (19.7)
- 710 (28.0)
- 1000 (39.4)

2 thermocouples

Leg diameter 3 mm (0.12 inch)

Weight: 1.4 ... 2.4 kg (3.1 ... 5.3 lb)

Nominal length in mm (inch):

- 500 (19.7)
- 710 (28.0)
- 1000 (39.4)

7MC2000 - 1EC0 ■
7MC2000 - 2EC0 ■
7MC2000 - 3EC0 ■

to 1200 °C (2192 °F)

X 15 CrNi Si 24 19, material No. 1.4841

22 mm Ø x 2 mm (0.87 inch x 0.079 inch)

1 thermocouple

Leg diameter 2 mm (0.08 inch)

Weight: 1.7 ... 2.9 kg (3.7 ... 6.4 lb)

Nominal length in mm (inch):

- 500 (19.7)
- 710 (28.0)
- 1000 (39.4)

2 thermocouples

Leg diameter 2 mm (0.08 inch)

Weight: 1.9 ... 3.1 kg (4.2 ... 6.8 lb)

Nominal length in mm (inch):

- 500 (19.7)
- 710 (28.0)
- 1000 (39.4)

7MC2000 - 1FC0 ■
7MC2000 - 2FC0 ■
7MC2000 - 3FC0 ■

To 1250 °C (2282 °F)

CrAl 205 (Megapyr), material No. 1.4767

22 mm Ø x 2 mm (0.87 inch x 0.079 inch)

1 thermocouple

Leg diameter 3 mm (0.12 inch)

Weight: 1 ... 2.9 kg (2.2 ... 6.4 lb)

Nominal length in mm (inch):

- 500 (19.7)
- 710 (28.0)
- 1000 (39.4)

2 thermocouples

Leg diameter 3 mm (0.12 inch)

Weight: 1.1 ... 3.2 kg (2.4 ... 7.0 lb)

Nominal length in mm (inch):

- 500 (19.7)
- 710 (28.0)
- 1000 (39.4)

7MC2000 - 1HC0 ■
7MC2000 - 2HC0 ■
7MC2000 - 3HC0 ■

Connection head, form A,

- made of cast light alloy, with 1 cable inlet and
 - screw cover
 - high hinged cover

7MC2000 - 1HD0 ■
7MC2000 - 2HD0 ■
7MC2000 - 3HD0 ■

SITRANS T measuring instruments for temperature

Thermocouples

Straight thermocouples Individual parts and accessories

Selection and Ordering data	Order No.
Straight thermocouple with Ni Cr/Ni thermocouple (type K) for temperatures to 1250 °C (2282 °F); with metallic protective tube	
Further designs Please add "-Z" to Order No. and specify Order code(s) and plain text.	Order code
<ul style="list-style-type: none"> • Different design (mounting length, protective tube material etc.), specify in plain text. • TAG plate made of stainless steel specify TAG No. in plain text • Calibration carried out at one point, specify desired temperature in plain text (order equivalent number of times for several calibration points). 	Y01 Y15 Y33

To order a temperature transmitter installed in the connection head, see "Temperature transmitters for installation in the connection head" (page 3/94).

Installation of a transmitter is only possible here in the versions with a high hinged cover (7MC2000-....6).

Selection and Ordering data	Order No.
Metallic protective tubes for straight thermocouple elements according to DIN 43733	
X 10 CrAl 24, material No. 1.4762 Ø 22 mm x 2 mm (Ø 0.87 inch x 0.08 inch), 0.55 ... 1.10 kg (1.21 ... 2.42 lb), dished Nominal length Protective tube length in mm (inch): in mm (inch): • 500 (19.7) 520 (20.5) • 710 (28.0) 730 (28.7) • 1000 (39.4) 1020 (40.2)	7MC2900-1DA 7MC2900-2DA 7MC2900-3DA
X 10 CrAl 24, material No. 1.4749 Ø 26 mm x 4 mm (Ø 1.02 inch x 0.16 inch), 1.25 ... 2.20 kg (2.76 ... 4.85 lb), dished Nominal length Protective tube length in mm (inch): in mm (inch): • 500 (19.7) 520 (20.5) • 710 (28.0) 730 (28.7) • 1000 (39.4) 1020 (40.2)	7MC2900-1EC 7MC2900-2EC 7MC2900-3EC
X 15 CrNiSi 25 20, material No. 1.4841 Ø 22 mm x 2 mm (Ø 0.87 inch x 0.08 inch), 1.05 kg (2.31 lb), dished Nominal length Protective tube length in mm (inch): in mm (inch): • 1000 (39.4) 1020 (40.2)	7MC2900-3FA
CrAl 205 (Megapyr), material No. 1.4767 Ø 22 mm x 2 mm (Ø 0.87 inch x 0.05 inch), 0.55 ... 1.10 kg (1.21 ... 2.42 lb) Nominal length Protective tube length in mm (inch): in mm (inch): • 500 (19.7) 520 (20.5) • 710 (28.0) 730 (28.7) • 1000 (39.4) 1020 (40.2)	7MC2900-1HA 7MC2900-2HA 7MC2900-3HA

Selection and Ordering data	Order No.
Thermocouples elements for straight thermocouple according to DIN 43733	
Base-metal thermocouple with insulating beads Wire diameter 3 mm (0.12 inch) Ni Cr/Ni, to 1000 °C (maximal 1300 °C), (to 1832 °F (max. 2372 °F)) 0.55 ... 2.10 kg (1.21 ... 4.63 lb) Nominal length <i>L</i> 1 in Thermocouple length <i>L</i> 2 in mm (inch): mm (inch): • 500 (19.7) 540 (21.3) • 710 (28.0) 750 (29.5) • 1000 (39.4) 1040 (40.9)	7MC2903-1CA 7MC2903-2CA 7MC2903-3CA

SITRANS T measuring instruments for temperature

Thermocouples

Straight thermocouples Individual parts and accessories

Connection heads

Connection head, form A (without terminal block and terminals) for protective tube diameter (bore = protective tube diameter +0.5 mm (0.02 inch))

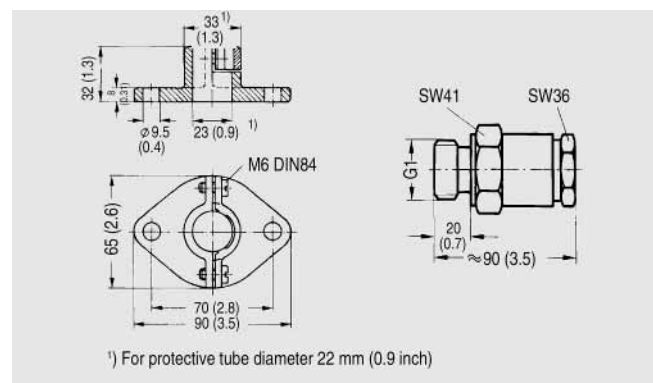
Selection and Ordering data	Order No.
Connection head, form A, (without terminal block and terminals) 1 Cable inlet, degree of protection IP53, 0.35 kg (0.77 lb)	
Cast light alloy fastener, unscrewable for protective tube diameter in mm (inch) (bore = protective tube diam. +0.5 mm) (0.02 inch): <ul style="list-style-type: none"> • 22 (0.87) • 26 (1.02) 	7MC2905-1AA 7MC2905-1BA
Cast light alloy high hinged cover for protective tube diameter in mm (inch) (bore = protective tube diam. +0.5 mm) (0.02 inch): <ul style="list-style-type: none"> • 22 (0.87) • 26 (1.02) 	7MC2905-4AA 7MC2905-4BA

Mounting accessories for connection heads

- Terminal block
- Terminal
- Set of gaskets
- Set of washers
- Mounting flange
- Threaded sleeve

Selection and Ordering data	Order No.
Mounting accessories	
Terminal block without terminals for base-metal thermocouples; 0.06 kg (0.13 lb)	7MC2998-1AA
Terminal for base-metal thermocouples; 0.01 kg (0.02 lb)	7MC2998-1BA
Set of gaskets (100 off) for the connection head cover; 0.01 kg (0.02 lb)	7MC2998-1CA
Set of washers (100 off) for the terminal block; 0.01 kg (0.02 lb)	7MC2998-1CB
Mounting flange, adjustable; made of GTW <ul style="list-style-type: none"> • for protective tube outer diameters 22 mm (0.87 inch); 0.35 kg (0.77 lb) • for protective tube outer diameters 26 mm (1.02 inch); 0.32 kg (0.71 lb) 	7MC2998-2CB 7MC2998-2CC
Threaded sleeve Gas-tight up to 1 bar (14.5 psi), adjustable, material No. 1.0718, with gasket; 0.40 kg (0.88 lb) <ul style="list-style-type: none"> • for protective tube outer diameters 22 mm (0.87 inch), G1 • for protective tube outer diameters 26 mm (1.02 inch), G1 	7MC2998-2DB 7MC2998-2DC

Dimensional drawings



Mounting flange to DIN 43734 (left) and threaded sleeve (right) for installing straight thermocouples, dimensions in mm (inches)

SITRANS T measuring instruments for temperature

Thermocouples

Jacket thermocouples with extension lead

Overview

The jacket thermocouple with extension lead is suitable for a temperature range from 0 to 700, 1000 or 1100 °C (32 to 1292, 1832 or 2012 °F); a temperature of 80 to 260 °C (176 to 500 °F) is permissible for the extension lead.

Technical specifications

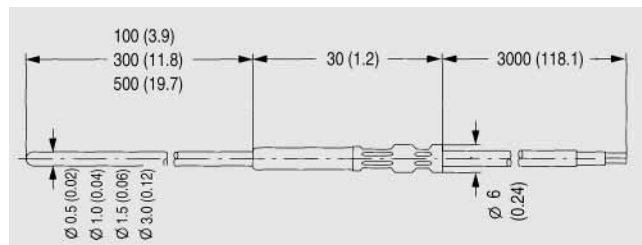
Thermocouple	Ni Cr/Ni, type K, one off
Jacket	
• Form	Outer diameter 0.5, 1.0, 1.5 or 3 mm (0.02, 0.04, 0.06 or 0.12 inch)
• Minimum bending radius	fivefold outer diameter
• Material	Inconel; NiCr 15 Fe, mat. No. 2.4816

Extension lead

- Number of conductors: 2
- Conductor cross-section: 0.22 mm² (0.00034 inch²)
- Length: 3 m (9.84 ft)

Type	Max. temperature °C (°F)	Conductor material	Insulation	
			single	common
L2SS	180 (356)	Ni Cr/Ni	Silicon	Silicon
L2KK	80 (176)	Ni Cr/Ni	PVC	PVC
L2TGD	260 (500)	Ni Cr/Ni	PTFE	Glass-filament and external stainless steel braiding

Dimensional drawings



Jacket thermocouple with extension lead, dimensions in mm (inches)

Selection and Ordering data

Order No.

Jacket thermocouple element with extension lead

Maximum temperature of medium 700 °C (1292 °F), jacket outer diameter 0.5 mm (0.02 inch)

Extension lead type L2KK
Nominal length in mm (inch):
• 300 (11.8)

7MC2027-2BA10

Maximum temperature of medium 1000 °C (1832 °F), jacket outer diameter 1 mm (0.04 inch)

Extension lead type L2SS
Nominal length in mm (inch):
• 100 (3.94)
• 300 (11.8)
• 500 (19.7)

7MC2027-1AA20
7MC2027-2AA20
7MC2027-3AA20

Extension lead type L2KK
Nominal length in mm (inch):
• 100 (3.94)
• 300 (11.8)
• 500 (19.7)

7MC2027-1BA20
7MC2027-2BA20
7MC2027-3BA20

Maximum temperature of medium 1100 °C (2012 °F), jacket outer diameter 1.5 mm (0.06 inch)

Extension lead type L2SS
Nominal length in mm (inch):
• 100 (3.94)
• 300 (11.8)
• 500 (19.7)

7MC2027-1AA30
7MC2027-2AA30
7MC2027-3AA30

Extension lead type L2KK
Nominal length in mm (inch):
• 100 (3.94)
• 300 (11.8)
• 500 (19.7)

7MC2027-1BA30
7MC2027-2BA30
7MC2027-3BA30

Jacket outer diameter 3.0 mm (0.12 inch)

Extension lead type L2SS
Nominal length in mm (inch):
• 100 (3.94)
• 300 (11.8)
• 500 (19.7)

7MC2027-1AA40
7MC2027-2AA40
7MC2027-3AA40

Extension lead type L2KK
Nominal length in mm (inch):
• 100 (3.94)
• 300 (11.8)
• 500 (19.7)

7MC2027-1BA40
7MC2027-2BA40
7MC2027-3BA40

Extension lead type L2TGD
Nominal length in mm (inch):
• 100 (3.94)
• 300 (11.8)
• 500 (19.7)

7MC2027-1CA40
7MC2027-2CA40
7MC2027-3CA40

Further designs

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

Order code

- Different design (mounting length, protective tube material etc.), specify in plain text.
- TAG plate made of stainless steel specify TAG No. in plain text
- Calibration carried out at one point, specify desired temperature in plain text (order equivalent number of times for several calibration points).

Y01

Y15

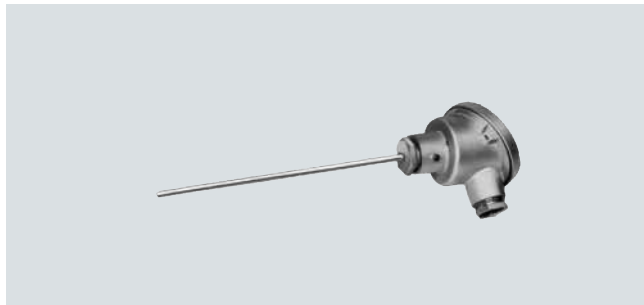
Y33

SITRANS T measuring instruments for temperature

Thermocouples

Jacket thermocouples with connection head, form B

Overview



The jacket thermocouple with connection head, form B is suitable for the temperature range from 0 to 800 or 1,100 °C (32 to 1472 or 2012 °F) and can also be supplied with a built-in temperature transmitter.

Technical specifications

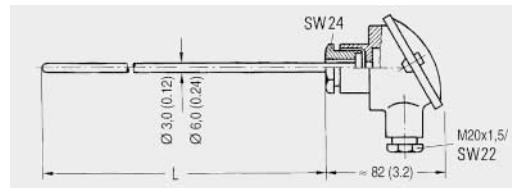
Thermocouple	Fe/Cu Ni, Fe-CuNi or Ni Cr/Ni
Jacket	Measuring junction insulated from base of jacket
• Material	X 6 CrNiTi 18 10, mat. No. 1.4541 Inconel
• Temperature	Up to 800 °C (1472 °F) Up to 1100 °C (2012 °F)
Connection head	Form B to DIN 43729
• Material	Cast light alloy
• Temperature	-30 ... +100 °C (-22 ... +212 °F) is permissible
• Cable inlet	For cables up to 15 mm (0.59 inch) diameter
• Terminal block	Without clamping springs

Thermocouple

- Insulation resistance between conductors and jacket: $\geq 1000 \text{ M}\Omega/\text{m}$ at 20 °C ($\geq 305 \text{ M}\Omega/\text{ft}$ at 68 °F)
- Minimum bending radius: 5 x outer diameter of jacket
- Leak resistance of measuring junction: Tested at 40 bar (580 psi)

Thermo-couple	Jacket		No. of thermo-couples	Thermo-couple wire diameter	Resistance (for double conductor)
	Outer diameter	Wall thickness			
	mm (inch)	mm (inch)		mm (inch)	Ω/m (Ω/ft)
Fe/Cu Ni (type J) and Fe-CuNi (type L)	3.0 (0.12)	0.42 (0.017)	1	0.54 (0.02)	2.7 (8.9)
		0.42 (0.017)	2	0.48 (0.02)	3.5 (11.5)
	6.0 (0.24)	0.55 (0.022)	1	1.07 (0.04)	0.66 (2.2)
		0.89 (0.035)	2	0.81 (0.03)	1.14 (3.7)
Ni Cr/Ni (type K)	3.0 (0.12)	0.42 (0.017)	1	0.54 (0.02)	4.3 (14.1)
		0.42 (0.017)	2	0.48 (0.02)	5.5 (18.0)
	6.0 (0.24)	0.55 (0.022)	1	1.07 (0.04)	1.12 (3.7)
		0.89 (0.035)	2	0.81 (0.03)	1.94 (6.4)

Dimensional drawings



Jacket thermocouple with connection head, form B, made of cast light alloy, dimensions in mm (inches)

Selection and Ordering data	Order No.
Jacket thermocouple element with connection head, form B	
Fe/Cu Ni type J thermocouple Jacket made of X 6 CrNiTi 18 10, material No. 1.4541, temperature up to 800 °C (1472 °F) 1 thermocouple Jacket outer diameter/mm (inch): • 3.0 (0.12) • 6.0 (0.24) 2 thermocouples Jacket outer diameter/mm (inch): • 3.0 (0.12) • 6.0 (0.24)	7MC2021-2CE-Z 7MC2021-4CE-Z 7MC2021-2CF-Z 7MC2021-4CF-Z
Fe/Cu Ni type L thermocouple Jacket made of X 6 CrNiTi 18 10, material No. 1.4541, temperature up to 800 °C (1472 °F) 1 thermocouple Jacket outer diameter/mm (inch): • 3.0 (0.12) • 6.0 (0.24) 2 thermocouples Jacket outer diameter/mm (inch): • 3.0 (0.12) • 6.0 (0.24)	7MC2021-2CA-Z 7MC2021-4CA-Z 7MC2021-2CB-Z 7MC2021-4CB-Z
Ni Cr/Ni type K thermocouple Jacket made of Inconel, temperature up to 1,100 °C (2012 °F) 1 thermocouple Jacket outer diameter/mm (inch): • 3.0 (0.12) • 6.0 (0.24) 2 thermocouples Jacket outer diameter/mm (inch): • 3.0 (0.12) • 6.0 (0.24)	7MC2021-2LC-Z 7MC2021-4LC-Z 7MC2021-2LD-Z 7MC2021-4LD-Z
Further designs Please specify Order code(s) and plain text.	Order code
• Length L in m (ft) - 0.25 (0.82) - 1 (3.28) - 5 (16.4) - 10 (32.8) • Different design (mounting length, protective tube material etc.), specify in plain text. • TAG plate made of stainless steel specify TAG No. in plain text • Calibration carried out at one point, specify desired temperature in plain text (order equivalent number of times for several calibration points).	A01 A02 A03 A04 Y01 Y15 Y33

To order a temp. transmitter installed in the connection head, see "Temp. transm. for installation in the connection head" (page 3/94).

Note: SITRANS T3K PA can only be used in a connection head with high hinged cover. Can be ordered als special version (...-Z Y01).

Example of ordering:

The following is required:

- Jacket thermocouple element
jacket made of X 6 CrNiTi 18 10; outer diameter 3.0 mm (0.12 inch);
- with 1 Fe/Cu Ni thermocouple, type J; nominal length 5 m (16.4 ft)

Order as follows:

1 jacket thermocouple

7MC2021-2CE-Z A03

SITRANS T measuring instruments for temperature

Thermocouples

Jacket thermocouples with socket

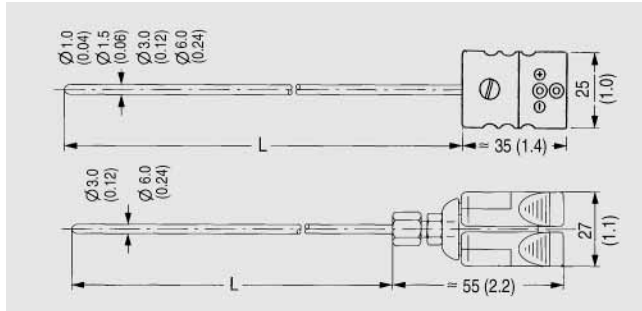
Overview

The sensor is suitable for a temperature range from 0 to 800, 1000 or 1100 °C (32 to 1472, 1832 or 2012 °F); a maximum temperature of 130 °C (266 °F) is permissible for the plug connection.

Technical specifications

Thermocouple	Ni Cr/Ni
Jacket	
• Material	X 6 CrNiTi 18 10, mat. No. 1.4541 Inconel, NiCr 15 Fe, mat. No. 2.4816
• Temperature	Up to 800 °C (1472 °F) Up to 1100 °C (2012 °F)
Coupling socket	
• Housing	Made of polyamide
• Contact	Made of temperature-resistant material
• Coupling plug	See "Jacket thermocouples", "Individual parts"; incorrect connection impossible

Dimensional drawings



Jacket thermocouple with socket; at top with one thermocouple, at bottom with two thermocouples; dimensions in mm (inches)

Selection and Ordering data

Order No.

Jacket thermocouple element with coupling socket

Ni Cr/Ni type K thermocouple

Jacket material No. 1.4541

Temperature of medium 800 °C (1472 °F)

1 thermocouple

Jacket outer dia./ mm (inch):

- 3.0 (0.12) 0.3 (0.98)
- 3.0 (0.12) 0.5 (1.64)

7MC2028-1AC31
7MC2028-2AC31

2 thermocouples

Jacket outer dia./ mm (inch):

- 3.0 (0.12) 0.3 (0.98)
- 3.0 (0.12) 0.5 (1.64)
- 6.0 (0.24) 0.3 (0.98)
- 6.0 (0.24) 0.5 (1.64)

7MC2028-1AD31
7MC2028-2AD31
7MC2028-1AD41
7MC2028-2AD41

Jacket material No. 2.4816

Temperature of medium 1000 °C (1832 °F)

1 thermocouple

Jacket outer diameter/mm (inch):

- 1.0 (0.04) 0.3 (0.98)
- 1.0 (0.04) 0.5 (1.64)

7MC2028-1AC12
7MC2028-2AC12

Jacket material No. 2.4816

Temperature of medium 1100 °C (2012 °F)

1 thermocouple

Jacket outer dia./ mm (inch):

- 1.5 (0.06) 0.3 (0.98)
- 1.5 (0.06) 0.5 (1.64)
- 3.0 (0.12) 0.3 (0.98)
- 3.0 (0.12) 0.5 (1.64)
- 6.0 (0.24) 0.3 (0.98)
- 6.0 (0.24) 0.5 (1.64)

7MC2028-1AC22
7MC2028-2AC22
7MC2028-1AC32
7MC2028-2AC32
7MC2028-1AC42
7MC2028-2AC42

2 thermocouples

Jacket outer dia./ mm (inch):

- 3.0 (0.12) 0.3 (0.98)
- 3.0 (0.12) 0.5 (1.64)
- 6.0 (0.24) 0.3 (0.98)
- 6.0 (0.24) 0.5 (1.64)

7MC2028-1AD32
7MC2028-2AD32
7MC2028-1AD42
7MC2028-2AD42

Further designs

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

Order code

- Different design (mounting length, protective tube material etc.), specify in plain text. **Y01**
- TAG plate made of stainless steel specify TAG No. in plain text **Y15**
- Calibration carried out at one point, specify desired temperature in plain text (order equivalent number of times for several calibration points). **Y33**

Different designs (mounting length, protective tube material etc.) on request: Add Order code "**Y01**" and specify in plain text.

(Please order coupling plug separately (see "Individual parts"))

SITRANS T measuring instruments for temperature

Thermocouples

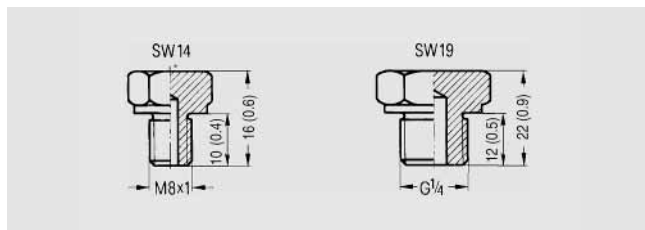
Individual parts

Selection and Ordering data	Order No.
Extension lead for jacket thermocouple with coupling socket (7MC2028); twisted cores for Ni Cr/Ni thermocouple, color code: green	
Outer diameter 4 mm (0.16 inch) PVC isolation Number of conductors and cross-section: 2 x 0.22 mm ² (2 x 0.00034 inch ²) Temperature range -20 ... +80 °C (-4 ... +176 °F)	7MC2921-1AC-Z
Outer diameter 4 mm (0.16 inch) Silicone-silicone isolation Number of conductors and cross-section: 2 x 0.22 mm ² (2 x 0.00034 inch ²) Silicone-silicone isolation Temperature range -40 ... +180 °C (-40 ... +356 °F)	7MC2921-2AC-Z
Outer diameter 6 mm (0.24 inch) PVC isolation Number of conductors and cross-section: 4 x 0.22 mm ² (2 x 0.00034 inch ²) Temperature range -20 ... +80 °C (-4 ... +176 °F)	7MC2921-3AC-Z
Outer diameter 6 mm (0.24 inch) Silicone-silicone isolation Number of conductors and cross-section: 4 x 0.22 mm ² (2 x 0.00034 inch ²) Temperature range -40 ... +180 °C (-40 ... +356 °F)	7MC2921-4AC-Z
Further designs Please specify Order code(s) and plain text.	Order code
• Length of extension lead in m (ft) - 0.25 (0.82) - 1 (3.28) - 5 (16.4) - 10 (32.8)	A01 A02 A03 A04

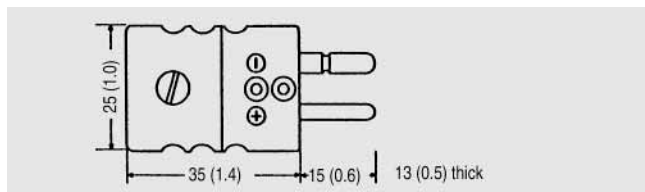
Other individual parts

- Screw nipple
- Compression joint
- Coupling socket
- Coupling plug

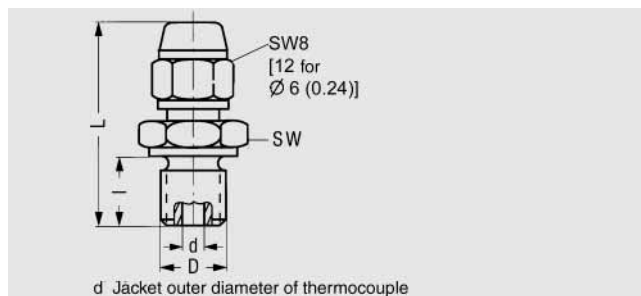
Dimensional drawings



Screw nipple with M8 x 1 thread (left) or G¹/₄ (right), dimensions in mm (inches)

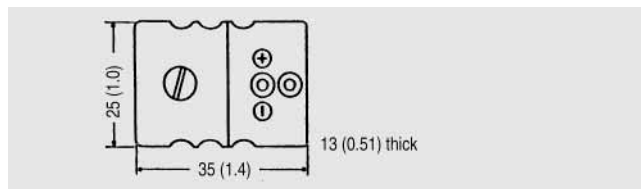


Coupling plug, dimensions in mm (inches)



d	D	I	L	SW
mm (inch)		mm (inch)	mm (inch)	
1,5 (0.06)	M8x1	8 (0.3)	32 (1.3)	12
3,0 (0.12)	M8x1	8 (0.3)	32 (1.3)	12
6,0 (0.24)	G ¹ / ₄	10 (0.4)	48 (1.9)	19

Compression joint with M8 x 1 or G¹/₄ thread dimensions in mm (inches)



Coupling socket, dimensions in mm (inches)

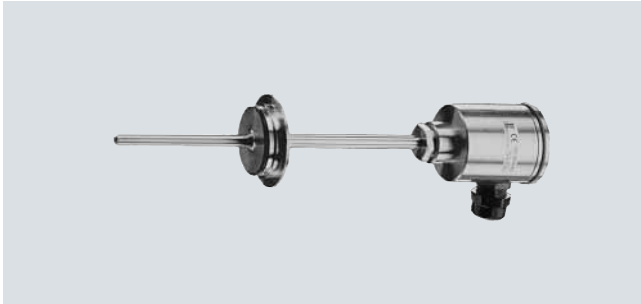
Selection and Ordering data	Order No.
Screw nipple for soldering jacket thermocouple elements The screw nipple has a centering hole and must be drilled according to the outer diameter of the jacket thermocouple element. The thermocouple must be protected from excessive heat when soldering (e.g. by blowing with air).	
• with M8 x 1 thread, for jacket outer diameter up to 3.0 mm (0.12 inch); 0.01 kg (0.02 lb) • with G ¹ / ₄ thread, for all jacket outer diameters listed in the catalog, 0.02 kg (0.04 lb)	7MC2922-1EA 7MC2922-1FB
Compression joint, gas-tight Temperature up to 350 °C (662 °F) Pressure-tight up to 80 bar (1160 psi) Subsequent release and movement is not possible, material X6 CrNi Mo Ti 17-122, material No 1.4571; tapered ring like compression joint	
• Thread M8 x 1; 0.03 kg (0.06 lb) - jacket outer diameter 1.5 mm (0.06 inch) - jacket outer diameter 3.0 mm (0.12 inch) • Thread G ¹ / ₄ ; 0.04 kg (0.08 lb) - jacket outer diameter 6 mm (0.24 inch)	7MC2922-3AA 7MC2922-3BA 7MC2922-3DB
Coupling socket of jacket thermocouple 7MC2028 (one per element); for Ni Cr/Ni thermocouple element, type K; 0.05 kg (0.11 lb)	7MC2922-4BB
Coupling plug matching the jacket thermocouple 7MC2028 with socket; one plug is required per thermocouple element; for Ni Cr/Ni thermocouple, type K; 0.05 kg (0.11 lb)	7MC2922-4BD

SITRANS T measuring instruments for temperature

Resistance thermometers for food, pharmaceuticals and biotechnology

Resistance thermometers for installation in pipelines and tanks

Overview



The resistance thermometer is designed for installation in tanks and pipelines as well as for the measurement of temperature with hygiene requirements. The usual process connections are available. The rugged design means that it is suitable for a wide range of process applications in the food, pharmaceutical and biotechnology industries. The resistance thermometer is also available with a built-in transmitter. A versatile range of head transmitters is available for this application.

Design

- Pt100 measuring resistor
- Stainless steel measuring insert
- Replaceable measuring insert
- Process connections for food/pharmaceuticals/biotechnology
- Hygiene version, design corresponds to EHEDG recommendations
- Fast response available with reduced tip
- Transmitter can be integrated (4 to 20 mA or PROFIBUS PA)

The resistance thermometer has a replaceable measuring insert. The measuring insert contains either one or two Pt100 measuring resistors which are connected to the base in the connection head with a two-wire, three-wire or four-wire system. The change in resistance dependent on the measured temperature can be recorded by a transmitter and converted into a standardized signal.

Technical specifications

Design	Replaceable measuring insert with connection head and protection fitting
Connection head	Either: <ul style="list-style-type: none"> • Form B standard, screw cover, stainless steel 1.4301, IP67 • Form B, cover with 2 slotted screws, aluminium, IP54, standard • Form B, screw cover, plastic, IP54 (BK) • Form B, hinged cover with slotted screws, aluminium, IP65 (BUZ) • Form B, hinged cover with quick-release, aluminium, IP65 (BUS) • Form B, high hinged cover with slotted screw, aluminium, IP65 (BUZH)
Protective tube	Stainless steel 1.4404/316L 6 or 9 mm (0.24 or 0.35 inch) diam., optionally with tapered tip, see Selection and Ordering data for mounting length U1
Measuring insert	Stainless steel, replaceable Pt100 measuring resistor to DIN 43762 Rigid design or as jacket element (mineral-insulated, flexible, increased vibration resistance)
Accuracy of measuring resistor	Class A according to DIN EN 60751
Integration of transmitter	Suitable Pt100 transmitters for head mounting can be fitted in the connection head, see Selection and Ordering data
Process connections	<ul style="list-style-type: none"> • DIN 11851 with slotted union nut • Clamp connection to DIN 32676 • Clamp connection to ISO 2852 • Tri-clamp • Varivent • Sanitary nozzle • Neumo BioControl • Spherical welding-type sleeve cyl./sph. 30 x 40 mm (1.18 x 1.57 inch) • Aseptic connections The gasket is not included in the standard scope of delivery! Further process connections on request. Process connection material: Stainless steel 1.4404/316L
Surface properties	
• Standard	Surface roughness Ra < 1.5 µm (5.9 x 10 ⁻⁵ inch)
• Hygiene	Surface roughness Ra < 0.8 µm (3.1 x 10 ⁻⁵ inch)
• Welded seam	< 1.5 µm (5.9 x 10 ⁻⁵ inch)

SITRANS T measuring instruments for temperature

Resistance thermometers for food, pharmaceuticals and biotechnology

Resistance thermometers for installation in pipelines and tanks

Selection and Ordering data

Order No. Order code

Pt100 resistance thermometer for food, pharmaceuticals and biotechnology

7 MC 8 0 0 5 -

0 - 0

Connection head

- Form B, cast light alloy, screw cover, IP54, cable gland
- Form B, plastic, screw cover, IP54, cable gland
- Form BUZ, cast light alloy, screw cover, IP65, cable gland
- Form BUZH, cast light alloy, high hinged cover, IP 65, cable gland
- Form B, stainless steel, standard, IP67, cable gland
- Special version:
(add Order code and plain text)

1
2
3
4
5
9

H 1 Y

Process connection, material 1.4404/316L

- Milk pipe union to DIN 11851 with slotted union nut and nominal diameter/pressure
 - DN 25 / PN 40
 - DN 32 / PN 40
 - DN 40 / PN 40
 - DN 50 / PN 25
- Clamp connection:

AA
AB
AC
AD

ISO 2852	DIN 32676	Tri-Clamp	Outer diameter D
–	–	1/2" / 3/4"	25.0 mm
DN 25/33.7/38	DN 25/32/40	1", 1 1/2"	50.5 mm
DN 40/51	DN 50	2"	64.0 mm
DN 63.5	–	2 1/2"	77.5 mm
DN 88.9	DN 80	–	106.0 mm

CA
CB
CC
CD
CE

- Varivent connection (Tuchenhagen)
 - D = 50 mm (1.97 inch), for Varivent housing DN 25 and DN 1"
 - D = 68 mm (2.68 inch), for Varivent housing DN 40 ... DN 125 and 1 1/2" ... 6"

KU
KV

- NEUMO/BioControl with O-Ring
 - Size 25
 - Size 50
 - Size 65

BA
BB
BC

Sanitary nozzle

- DN 25 with hexagon union nut G 1 1/4", mounting length 40 mm (1.57"), diameter 24.8 mm (0.98") incl. O-ring

JA

Welding piece

- (sphere diameter 30 x 40 mm (1.2 x 1.6 inch) long)

LA

Special version:

- Type of screwed gland and nominal diameter (add Order code and plain text)

ZA

J 1 Y

Protective tube

- Ø F1=6 mm (0.24 inch)
- Ø F1=9 mm (0.35 inch)
- Ø F1=9 mm (0.35 inch)
- Ø F1=9 mm (0.35 inch) tapered tip
- F3=5 Ø x 20 mm (0.2 x 0.79 inch)
- Special version:
(add Order code and plain text)

1

2

3

4

9

Measuring insert

- Ø 3/3.2 mm, (0.12/0.13 inch) miner. insul.
- Ø 6 mm (0.24 inch)
- Ø 6 mm (0.24 inch) miner. insul.
- Ø 3/3.2 mm, (0.12/0.12 inch) miner. insul.

L 1 Y

Selection and Ordering data

Order No. Order code

Pt100 resistance thermometer for food, pharmaceuticals and biotechnology

7 MC 8 0 0 5 -

0 - 0

Neck tube length M

- 80 mm (3.15 inch)
- 145 mm (5.71 inch)
- Special version:
(add Order code and plain text)

1
2
9

N 1 Y

Mounting length U1

- 15 mm (0.59 inch)
- 35 mm (1.38 inch)
- 50 mm (1.97 inch)
- 100 mm (3.94 inch)
- 160 mm (6.30 inch)
- 250 mm (9.84 inch)
- 400 mm (15.75 inch)
- 4 inch
- 6 inch
- 9 inch
- Special version:
(add Order code and plain text)

B
C
D
E
F
G
H
J
K
L
Z

P 1 Y

Sensor

Thin-film technology:
measuring range -50 ... +400 °C
(-58 ... +752 °F)

- 1 x Pt100, class A, three-wire
- 2 x Pt100, class A, three-wire
- 1 x Pt100, class A, four-wire
- Special version:
(add Order code and plain text)

F
G
H
Z

Q 1 Y

Further designs

Add "-Z" to Order No. and add Order code.

Order code

- Process connection completely electropolished
- Hygiene version
($R_a < 0.8 \mu\text{m}$ (3.1 x 10⁻⁵ inch))
- Certificates
 - Roughness depth measurement R_a certified by factory certificate to EN 10204-3.1B
 - Material certificate to EN 10204-3.1
- Specify special version in plain text
- TAG plate made of stainless steel specify TAG No. in plain text
- Test report (at 0, 50 and 100%) specify measuring range in plain text

P01

H01

C18

C19

Y01

Y15

Y33

To order a temperature transmitter installed in the connection head, see "Temperature transmitters for installation in the connection head" (page 3/75).

SITRANS T measuring instruments for temperature

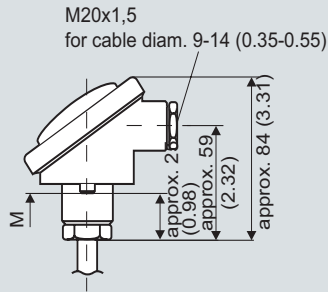
Resistance thermometers for food, pharmaceuticals and biotechnology

Resistance thermometers
for installation in pipelines and tanks

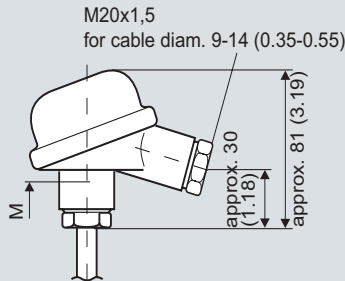
Dimensional drawings

Connection heads

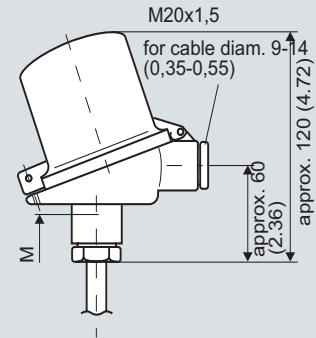
Form B, cover with 2
slotted screws,
Mat. Aluminium, IP 54



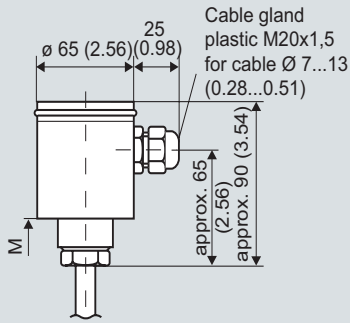
Form B, screw cover
plastic, IP 54 (BK)



Form B, high hinged cover with
slotted screw, aluminium,
IP 65 (BUZH)



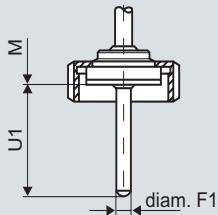
Form B, standard, screw cover,
stainless steel 1.4301, IP 67



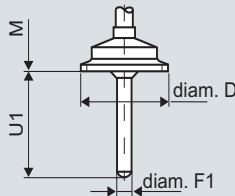
Neck tube length M up to sealing face

Process connections

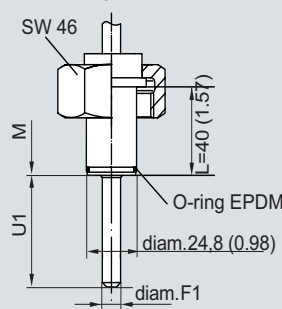
Tapered nipple with slotted nut
DIN 11 851 or aseptic
to DIN 11 864
DN 25 to 50 (1" to 2½")



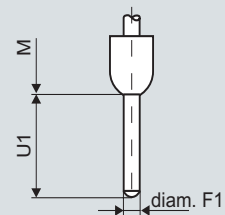
Clamp connection
to DIN 32 676
or ISO 2852, TRI-clamp
DN 8 to 80 (1" to 3")



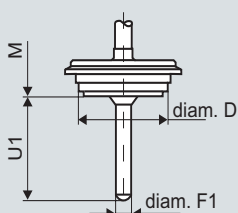
Sanitary nozzle DN25
with hexagon union nut



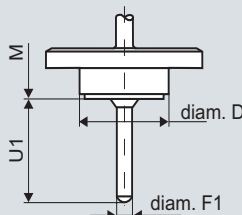
Spherical welding-type sleeve
Sphere 30 x 40 mm (1.18 x 1.57 in)



Varivent connection
D 50 for Varivent housing DN 25 and 1"
D 68 for Varivent housing DN 40 to DN 125
and 1½" to 6"



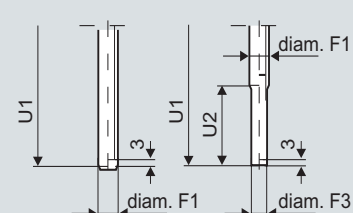
Neuma BioControl
Size 25 D-30.5 diam.
Size 50 D-50 diam.
Size 65 D-68 diam.



Protective tube based on DIN 43 772

Form 2

Similar to form 3
tapered tip



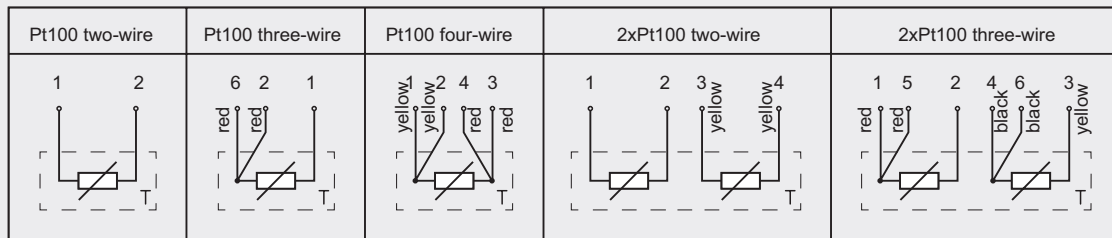
Connection heads and process connections, dimensions in mm (inches)

SITRANS T measuring instruments for temperature

Resistance thermometers for food, pharmaceuticals and biotechnology

Resistance thermometers
for installation in pipelines and tanks

Schematics



Connection diagram

SITRANS T measuring instruments for temperature

Resistance thermometers for food, pharmaceuticals and biotechnology

Resistance thermometers with clamp-on system

Overview



The innovative and improved clamp-on temperature measurement system offers measuring features that were previously only achievable using inline techniques.

- For pipe diameters of 4 to 57 mm (0.16 to 2.24 inch), optionally up to 200 mm (7.9 inch)
- Replaceable measuring insert
- All common output signals
- Intrinsically safe Ex versions
- Hygienic design acc. to EHEDG

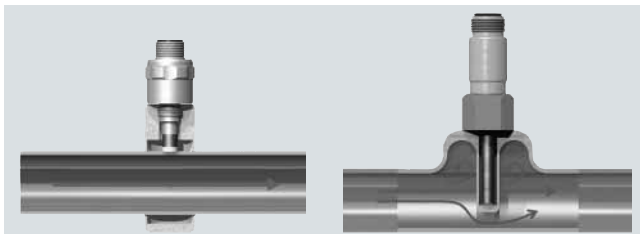
Benefits

- Fast response times and high-precision
- Temperature measurements with no dead-leg, turbulence-free
- Decoupling of ambient temperature influences, errors in measurement approx. 0.2 %/10K
- Can be recalibrated
- Cost savings during installation and operation. No welding in, easy to dismantle for recalibration

Application

The innovative clamp-on temperature measuring system is primarily used for temperature monitoring and process control in the food and pharmaceutical industries, particularly for sterilization processes.

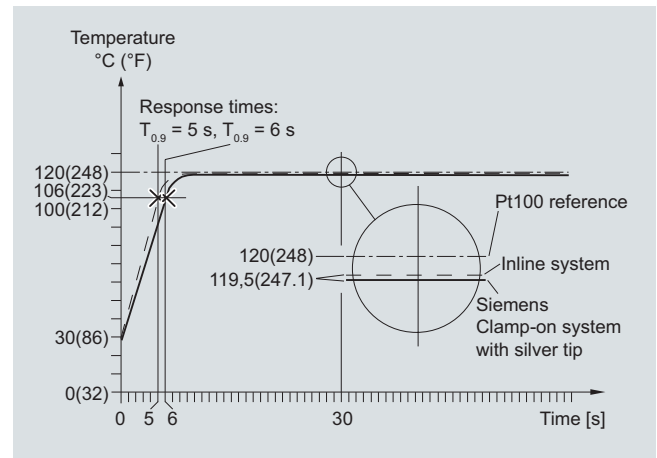
It completely replaces the commonly used inline measurement system, without having any of the inherent disadvantages: opening of pipelines during assembly, high costs for assembly and qualification of welded connections, flow and hygienic problems.



Siemens clamp-on

Conventional inline measurement

Measurement technology is comparable with inline measurements.



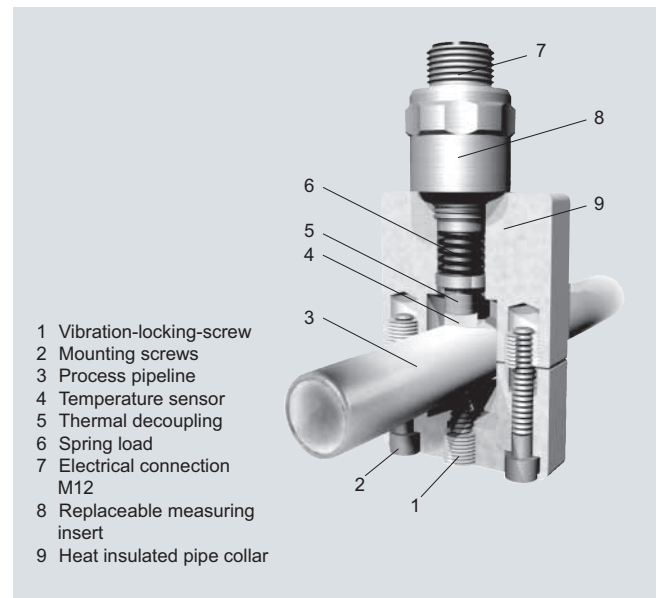
Sample application showing pipeline 13 x 1.5 mm (0.51 x 0.06 inch) made of stainless steel using heat-conductive-compound.

Design

Temperature measurement is carried out over a modified and quick-response Pt100 measuring element, which is positioned and insulated over a pipe collar made of heat-resistant plastic.

The measuring insert contains a special temperature sensor tip made of silver, which is pressed evenly onto the pipeline by means of a spring.

The compulsory guide of the replaceable measuring insert ensures even pressure contact on the pipeline, which ensures a reproducible measuring result.



Integration

The device either provides the Pt100 sensor signal direct or, in the version with connection head for the standard signals 4 to 20 mA as well, HART, PROFIBUS PA and FOUNDATION Fieldbus. This ensures easy integration in an existing device concept.

SITRANS T measuring instruments for temperature

Resistance thermometers for food, pharmaceuticals and biotechnology

Resistance thermometers with clamp-on system

Configuration

In order to ensure selection of the right device, it is necessary to know the pipe diameter of the process tube. For special sizes, first select the correct collar size and specify the required size in plain text. Space-saving versions for narrow installation conditions (e.g. pipe bundles) are also available (latch-fastening version).

The required output signal can be selected, as described under "Integration". The cable gland for the stainless steel enclosure may vary from the standard version. There are a range of intrinsically safe versions available for explosion protection acc. to ATEX, both for gases and for dust. For the correct assignment after recalibration, both the collar and the measuring insert are marked with the serial number and pipe diameter. These data can also be engraved if required. Furthermore, customers can select the setting for the transmitter, a TAG marking and the option of 4-wire circuit.

We recommend using heat-conductive-compound.

Programming

PROFIBUS PA versions are connected to the bus and configured using the SIMATIC PDM operating software. FOUNDATION Fieldbus devices are configured over AMS. The HART version can be configured over a handheld or over a HART modem in conjunction with SIMATIC PDM or AMS.

For 4 to 20 mA devices without HART protocol, a special modem and the SIPROM T operating software is required. We recommend using the USB version of the modem. The USB interface also provides the power supply.

Technical specifications

Input

Measured variable	Temperature
Measuring range	-20 °C ... +160 °C (-4 °F ... +320 °F)
Measuring resistor	1 x Pt100 acc. EN 60751, Class A in 3-wire version

Output

• Sensor signal	Pt100
• Current signal	4 ... 20 mA
HART	4 ... 20 mA, digitally superimposed HART signal
PROFIBUS PA and FOUNDATION Fieldbus	Digital bus signal

Measuring accuracy

Response time/accuracy (see sample application under "Applications")	$T_{0.9} = 6 \text{ s}$ / approx. 0.5 °C (0.9°F), standard version
Reference conditions	
• Pipeline	13 x 1.5 mm (0.51 x 0.06 inch) made of stainless steel using heat-conductive-compound.
• Ambient temperature	20 °C (68 °F)
• Medium	water, 120 °C (248 °F)
• Flow rate	3 m/s (9.84 ft/s)

Conditions of use

Nominal pipe diameters	Suitable for all common nominal pipe diameters 4 ... 57 mm (0.16 ... 2.24 inch). Special versions up to 200 mm (7.87 inch) possible (tension band version)
Degree of protection	IP65 acc. to EN 60529 (IP65 for pipe collar and IP67 for electrical connection)

Design

Electrical connection	<ul style="list-style-type: none"> • Connector M12 x 1.5 for direct sensor signal • Connection head made of stainless steel Mat. No. 1.4305 with polyamide cable gland for cable diameter 3 ... 6.5 mm (0.12 ... 0.26 inch)
Weight	
• Versions with round connector M12	
- Pipe diameter 4 ... 17.2 mm (0.16 ... 0.7 inch)	Approx. 100 g (0.22 lb)
- Pipe diameter 18 ... 38 mm (0.7 ... 1.5 inch)	Approx. 200 g (0.44 lb)
- Pipe diameter 38 ... 57 mm (1.5 ... 2.24 inch)	Approx. 250 g (0.55 lb)
• Versions with stainless steel connection head	
- Pipe diameter 13.5 ... 17.2 mm (0.53 ... 0.7 inch)	Approx. 300 g (0.66 lb)
- Pipe diameter 18 ... 38 mm (0.7 ... 1.5 inch)	Approx. 400 g (0.88 lb)
- Pipe diameter 38 ... 57 mm (1.5 ... 2.24 inch)	Approx. 450 g (0.99 lb)
Measuring insert	<ul style="list-style-type: none"> • Special measuring insert made of stainless steel; hygienic design • Measuring element made of silver, thermal decoupling through plastic insert • Measuring insert screwed into collar with spring load. Use heat-conductive-compound (see accessories) prior to mounting the device.
Pipe collar	
• Material	Temperature resistant high-performance plastic with integrated insulating system in the hygienic design
• Ambient temperature influence	Approx. 0.2 %/10 K
Certificates and approvals (available soon)	
Explosion protection ATEX	
EC type test certificate	
Type of protection "intrinsic safety i"	<ul style="list-style-type: none"> • II 1 G Ex ia IIC T6/T5/T4 • II 2 G Ex ib IIC T6/T5/T4 • II 1 D Ex iaD 20 T89°C • II 2 D Ex ibD 21 T121°C
Interface	$U_i \leq 30 \text{ V}$, $P_i \leq 200 \text{ mW}$ C_i and L_i are negligibly small.

SITRANS T measuring instruments for temperature

Resistance thermometers for food, pharmaceuticals and biotechnology

Resistance thermometers with clamp-on system

Selection and ordering data		Order no.	Order code
Pipe collar Pt100 thermometer		7MC8016-0	0
Type of connection			A
Connector M12 x 1			B
Connection head form B, stainless steel			
Outer pipe; mm (inch)	Collar size; mm (inch)		
4 (0.16)	50 x 35 x 20 (1.97 x 1.38 x 0.79)	A1	
6 (0.24)		B1	
6,35 (0.25)		C1	
8 (0.31)		D1	
9,35 (0.37)		E1	
10 (0.39)		F1	
10,2 (F)		G1	
10,3 (0.41)		H1	
12 (0.47)		J1	
12,7 (0.50)		K1	
13 (0.51)		L1	
13,5 (0.53)		M1	
13,7 (0.54)		N1	
14 (0.55)		P1	
15,88 (0.62)		Q1	
16 (0.63)		R1	
17,2 (0.68)		S1	
18,0 (0.71)	70 x 70 x 20 (2.76 x 2.76 x 0.79)	A2	
19,0 (0.74)		B2	
19,05 (0.75)		C2	
20,0 (0.79)		D2	
21,3 (0.84)		E2	
22,0 (0.87)		F2	
23,0 (0.90)		G2	
24,0 (0.94)		H2	
25,0 (0.98)		J2	
25,4 (1.00)		K2	
26,7 (1.05)		L2	
26,9 (1.06)		M2	
28,0 (1.10)		N2	
29,0 (1.14)		P2	
30,0 (1.18)		Q2	
31,8 (1.25)		R2	
32,0 (1.26)	90 x 85 x 20 (3.54 x 3.35 x 0.79)	S2	
33,4 (1.31)		T2	
33,7 (1.33)		U2	
34,0 (1.34)		V2	
35,0 (1.38)		W2	
36,0 (1.42)		X2	
38,0 (1.49)		Y2	
38,1 (1.50)		A3	
41,0 (1.61)		B3	
42,4 (1.67)		C3	
44,5 (1.75)		D3	
48,3 (1.90)		E3	
50,8 (2.00)		F3	
53,0 (2.09)		G3	
54,0 (2.13)		H3	
57,0 (2.24)		J3	
Special size ¹⁾		Z0	K1 Y

Selection and ordering data		Ord. code
Further designs		
Add "-Z" to Order No. and specify Order Code.		
Transmitter (only connection type available: connection head)		
TH100		T10
TH100 Ex		T11
TH200		T20
TH200 Ex		T21
TH300		T30
TH300 Ex		T31
TH400 PA		T40
TH400 PA Ex		T41
TH400 FF		T45
TH400 FF Ex		T46
Customer-specific setting of the built-in transmitter (specify settings in plain text)		Y11
(for technical specifications of the transmitter, see chapter "SITRANS T measuring instruments for temperature")		
Other cable gland (only for connection head)		
Polyamide for cable diameter 4,5 ... 10 mm (0.18 ... 0.39 inch)		K02
Stainless steel for cable diameter 3 ... 6,5 mm (0.12 ... 0.25 inch)		K03
Round connector M12 x 1		K11
With explosion protection "Intrinsic safety" (available soon)		
II 1G Ex ia IIC T6/T5/T4		E11
II 2G Ex ib IIC T6/T5/T4		E12
II 1 D Ex iaD 20 T89°C		E13
II 2 D Ex ibD 21 T121°C		E14
Deviating pipe; mm (inches)	Collar size; mm (inch)	
4 ... 17,9 (0.16 ... 0.70)	50 x 35 (1.97 x 1.38)	S11
18 ... 38 (0.71 ... 1.49)	70 x 70 (2.76 x 2.76)	S12
38,1 ... 57 (1.5 ... 2.24)	90 x 85 (3.54 x 3.35)	S13
Larger nominal diameters on request		S19
Space-saving mounting (latch fastening)		
Outer pipe; mm (inch):		
6 ... 17,2 (0.24 ... 0.68)		S21
18 ... 35 (0.71 ... 1.38)		S22
38 ... 50,8 (1.45 ... 2.00)		S23
Further Options		
Assignment marking, engraving instead of adhesive label (Serial number and pipe diameter on plug and plastic block)		L11
Sensor 4-wire connection		L14
Heat-conductive-compound, silicone-free, syringe 3 g		L15
Suffixes		
Please add "-Z" to Order No. and specify Order code(s) and plain text.		
Different design specify in plain text		Y01
TAG plate made of stainless steel (specify TAG No. in plain text)		Y15
Test report at 50 % and 100 % (specify the measuring range in plain text)		Y33

- ¹⁾ Special sizes for pipe outer diameters: In order to process "Z0" special sizes, the following two additional items of information are essential:
- the required diameter specified in plain text under "K1Y"
 - Selection of the corresponding pipe collar or latch fastener size
- Order codes "S11" to "S23")

SITRANS T measuring instruments for temperature

Resistance thermometers for food, pharmaceuticals and biotechnology

Resistance thermometers with clamp-on system

Selection and Ordering data

Order No.

Accessories

Modem for SITRANS TH100 and TH200

incl. parameterization software SIPROM T

- With USB connection C) **7NG3092-8KU**
- With RS 232 connection C) **7NG3092-8KM**

HART modem

- With RS 232 connection D) **7MF4997-1DA**
- With USB connection D) **7MF4997-1DB**

SIMATIC PDM operating software,
see "Communication and Software"

CD for measuring instruments for temperature G) **A5E00364512**

with documentation in German, English, French,
Spanisch, Italian, Portuguese and SIPROM T param-
eterization software

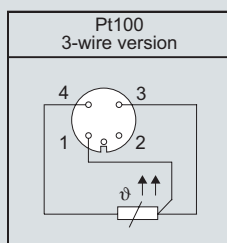
C) Subject to export regulations AL:N, ECCN: EAR99

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

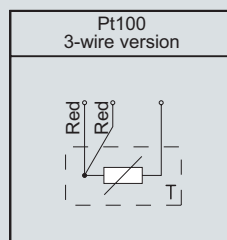
G) Subject to export regulations AL:N, ECCN: 5D992B1

Power supply units see "SITRANS I supply units and isolation amplifiers".

Schematics



Connection diagram for round connector M12 x 1, 4-pole



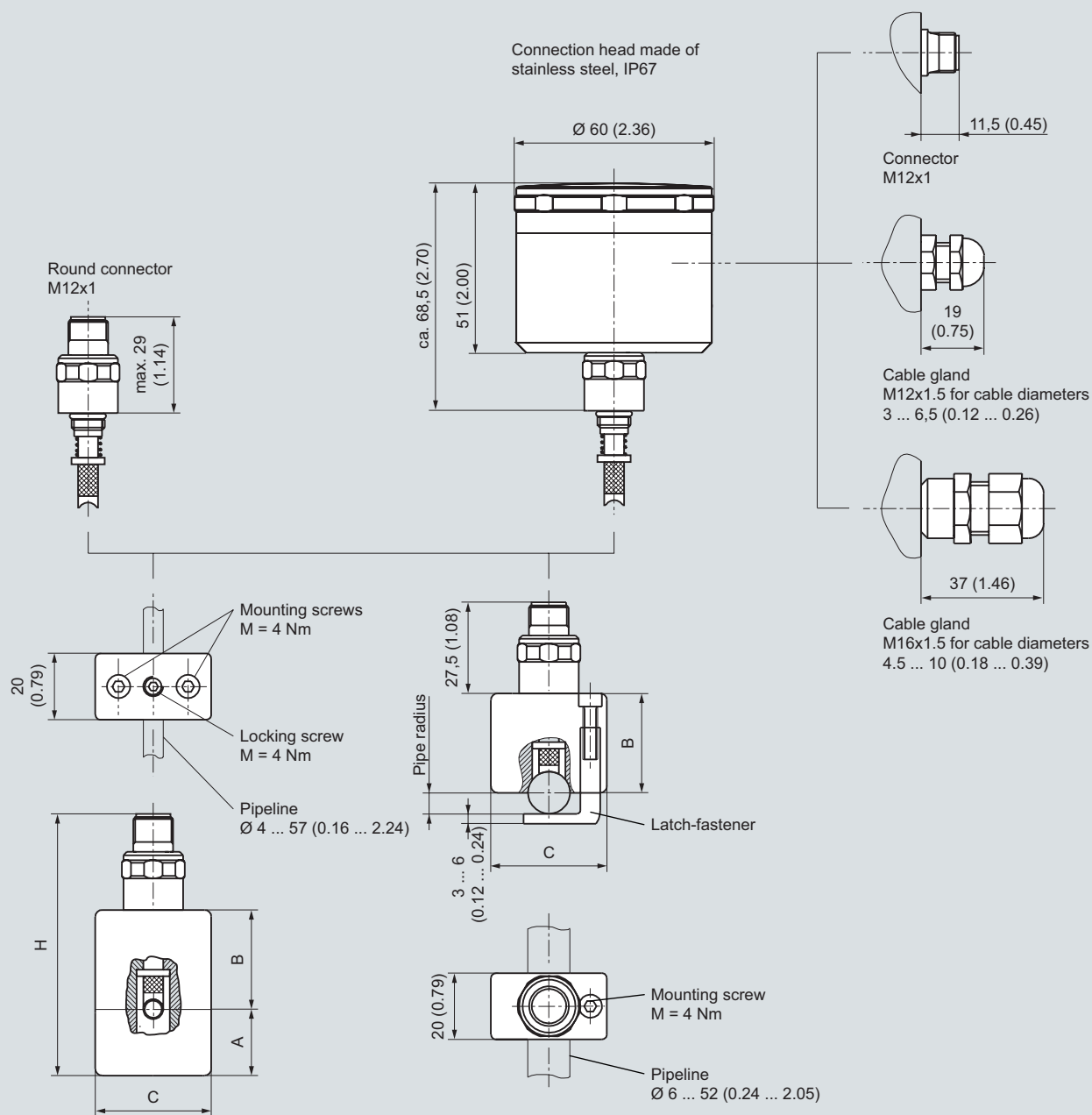
Connection diagram for connection head or cable gland

SITRANS T measuring instruments for temperature

Resistance thermometers for food, pharmaceuticals and biotechnology

Resistance thermometers
with clamp-on system

Dimensional drawings



Pipe diameter	A	B	C	H
4 ... 17,2 (0.16 ... 0.68)	20 (0.79)	30 (1.18)	35 (1.38)	79 (3.11)
18 ... 38 (0.71 ... 1.49)	30 (1.18)	40 (1.57)	70 (2.76)	99 (3.90)
38,1 ... 57 (1.50 ... 2.24)	40 (1.57)	50 (1.97)	85 (3.35)	119 (4.68)

Standard version

Pipe diameter	B	C
6 ... 17,2 (0.24 ... 0.68)	30 (1.18)	35 (1.38)
18 ... 35 (0.71 ... 1.38)	40 (1.57)	60 (2.36)
38 ... 50,8 (1.50 ... 2.00)	50 (1.97)	80 (3.15)

Latch fastener version

Resistance thermometers in clamp-on technique, connector, connection head, cable gland, versions, dimensions in mm (inch)

SITRANS T measuring instruments for temperature