Temperature Measurement

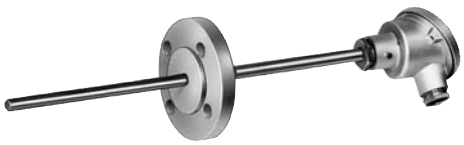
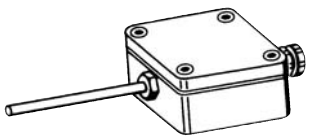
You can download all instructions, catalogs and certificates for SITRANS T free of charge at the following Internet address:
www.siemens.com/sitranst

Overview

	Application	Mounting of transmitter with Ex protection		Page	Software for parameterization
		Transmitter	Sensor		
Temperature transmitter for head mounting					
	**SITRANS TH100** Transmitters for Pt100 • Two-wire system	zone 2 and zone 1	zone 2, zone 1 and 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 • Two-wire system • Universal	zone 2 and zone 1	zone 2, zone 1 and 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 • Two-wire system • Universal • HART	zone 2 and zone 1	zone 2, zone 1 and zone 0	3/16	SIMATIC PDM
	**SITRANS TH400** Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 0.9 V • Fieldbus transmitters • PROFIBUS PA • FOUNDATION fieldbus	zone 2, zone 1 and zone 21	zone 2, zone 1, zone 0, zone 21, zone 20	3/23	SIMATIC PDM for TH 400 with PROFIBUS PA
Temperature transmitters for rail mounting					
	**SITRANS TR200** Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.1 V • Two-wire system • Universal	zone 2, zone 1 and zone 21	zone 2, zone 1, zone 0, zone 21, zone 20	3/28	SIPROM T
	**SITRANS TR300** Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.1 V • Two-wire system • Universal • HART	zone 2, zone 1 and zone 21	zone 2, zone 1, zone 0, zone 21, zone 20	3/34	SIMATIC PDM

	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: • Four-wire system	Safe area	zone 1, zone 0, zone 21, zone 20	3/40	SIMATIC PDM
Temperature transmitters for field mounting					
	**SITRANS TF280** Transmitter for connection to resistance-based sensor • In field enclosure for heavy industrial use • battery-operated • WirelessHART	-	-	3/52	Local operation via buttons SIMATIC PDM local with HART modem and wireless via WirelessHART
	**SITRANS TF** Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.1 V • In field enclosure for heavy industrial use • HART, Universal	Zone 2 and zone 1	zone 2, zone 1 and zone 0	3/57	depending on the installed TH200/TH300 transmitter
	**SITRANS TF** Fieldbus transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 0.8 V • In field enclosure for heavy industrial use • PROFIBUS PA • FOUNDATION fieldbus	Zone 2 and zone 1	zone 2, zone 1 and zone 0	3/64	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 and zone 1	-	3/57	--

Product overview

	Measuring instrument	Largest measuring range	Page
Resistance thermometer			
	Temperature transmitters factory-installed in connection head of a resistance thermometer (selection list) • SITRANS TH400 PA or FF • SITRANS TH200/TH300 • SITRANS TH100		3/74
	Flue gas resistance thermometers	-50 ... +600 °C (-58 ... +1112 °F)	3/76
	Low-pressure screw-in resistance thermometers • Without neck tube • With neck tube	 -50 ... +400 °C (-58 ... +752 °F) -50 ... +600 °C (-58 ... +1112 °F)	3/77
	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)	3/84
	Resistance thermometers for damp rooms	-30 ... +60 °C (-22 ... +140 °F)	3/85

	Measuring instrument	Largest measuring range	Page
Thermocouples			
	Temperature transmitters factory-installed in connection head of a thermocouple (selection list) • SITRANS TH400 PA or FF • SITRANS TH200/TH300		3/95
	Straight thermocouples	0 ... 1250 °C (32 ... 2282 °F)	3/97
	Jacket thermocouples with extension lead	0 ... 1100 °C (32 ... 2012 °F)	3/100
	Jacket thermocouples with connection head, form B	0 ... 1100 °C (32 ... 2012 °F)	3/101
	Jacket thermocouples with socket	0 ... 1100 °C (32 ... 2012 °F)	3/102
Resistance thermometers for food, pharmaceuticals and biotechnology			
	Resistance thermometer • For installation in pipelines and tanks • For temperature measurements with hygienic requirements	-50 ... +400 °C (-58 ... +752 °F)	3/104
	Resistance thermometer 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 ... +160 °C (-4 ... +320 °F)	3/108

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.

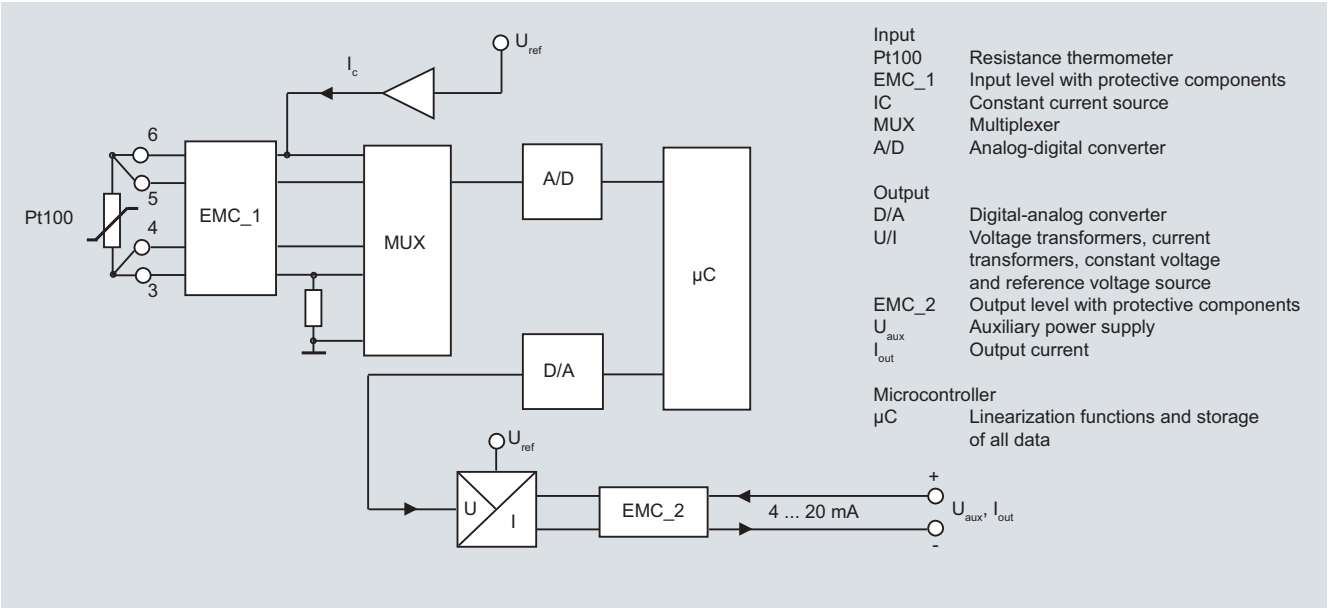
Function

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

Technical specifications

Input	
Resistance thermometer	
Measured variable	Temperature
Sensor type	PT100 to IEC 60751
Characteristic curve	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
Measuring range	-200 ... +850 °C -328 ... +1562 °F)
Measuring 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
Auxiliary power	8.5 ... 36 V DC (30 V for Ex)
Max. load	$(U_{aux}$ - 8.5 V)/0.023 A
Overrange	3.6 ... 23 mA, infinitely adjustable (default range: 3.84 ... 20.5 mA)
Error signal (following sensor fault) (conforming to NE43)	3.6 ... 23 mA, infinitely adjustable (default range: 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 Ω
Long-term drift	• < 0.025 % of the max. span in the first month • < 0.035 % of the max. span after one year • < 0.05 % of the max. span after 5 years
Ambient conditions	
Ambient temperature range	-40 ... +85 °C (-40 ... +185 °F)
Storage temperature range	-40 ... +85 °C (-40 ... +185 °F)
Relative humidity	98 %, with condensation
Electromagnetic compatibility	According to EN 61326 and NAMUR NE21
Construction	
Weight	50 g
Dimensions	See dimensional drawing
Material	Molded plastic
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	PTB 05 ATEX 2049X
• "Intrinsic gas safety" type of protection	II 1 G Ex ia IIC T6/T4 Ga II (1) 2 G Ex ib [ia Ga] IIC T6/T4 Gb II (1) 3 G Ex ic [ia Ga] IIC T6/T4 Gc II 3 G Ex ic IIC T6/T4 Gc
• "Non-sparking" type of protection	II 3 G Ex nA IIC T6/T4 Gc II 3 G Ex nA[ic] IIC T6/T4 Gc
• "Intrinsic dust safety" type of protection	II 1 D Ex ia IIIC T115 °C Da
Explosion protection FM for USA **and** Canada ($_cFM_{US}$)	
• FM approval	PID 3024169
• Degree of protection	IS Cl I, II, III, Div 1, GP ABCDEFG T4/T5/T6 Cl I, ZN 0,1 AEx ia IIC T4/T5/T6 NI Cl I, II, III, Div 2, GP ABCDFG T4/T5/T6 Cl I, ZN 2, NI IIC T4/T5/T6
Other certificates	GOST
Software requirements for SIPROM T	
PC operating system	Windows ME, 2000 and XP; also Windows 95, 98 and 98SE, but only in connection with RS 232 modem.

Selection and Ordering data

		Order No.
SITRANS TH100 temperature transmitters for Pt100 for installation in 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" type of protection and for zone 2		
- to ATEX	▶ C)	**7NG3211-0AN00**
- to FM ($_cFM_{US}$)	▶ C)	**7NG3211-0BN00**
Further designs		Order code
Add "-Z" to Order No. and specify Order code(s)		
Customer-specific operating data		**Y01**[1)]
Test report (5 measuring points)		**C11**
Accessories		Order No.
Modem for SITRANS TH100, TH200 and TR200 incl. SIPROM T parameterization software With USB connection	▶	**7NG3092-8KU**
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**
Connecting cable 4-wire, 150 mm, for sensor connections when using head transmitters in the high hinged cover (set with 5 units)		**7NG3092-8KC**

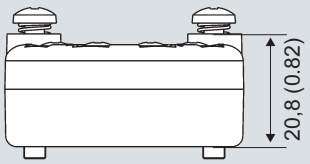
▶ Available ex stock.

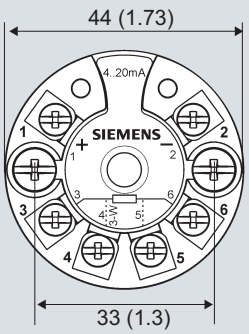
[1)] Y01: Quote all details that deviate from the factory settings (see below).
C) Subject to export regulations AL: N, ECCN: EAR99.
Supply units see Chap. 8 "Supplementary Components".

Factory setting:
- Pt100 (IEC 751) with 3-wire circuit
- Measuring range: 0 … 100 °C (32 … 212 °C)
- Error signal in the event of sensor breakage: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

SITRANS TH100
two-wire system (Pt100)

Dimensional drawings



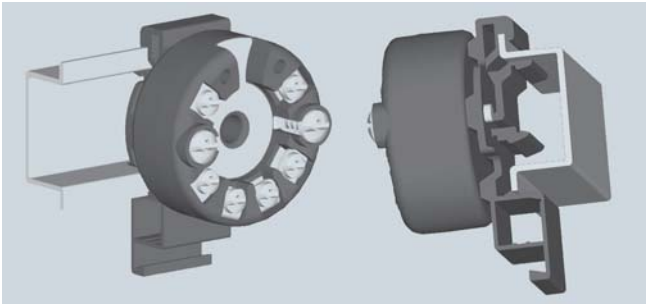


Internal diameter
Center hole 6.3 (0.25)

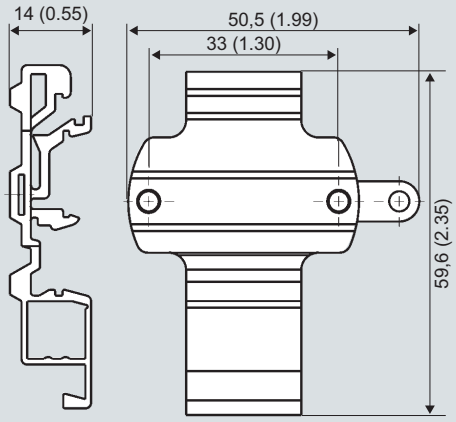
Mounting screw
M4x25

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

SITRANS TH100, dimensions in mm (inch)

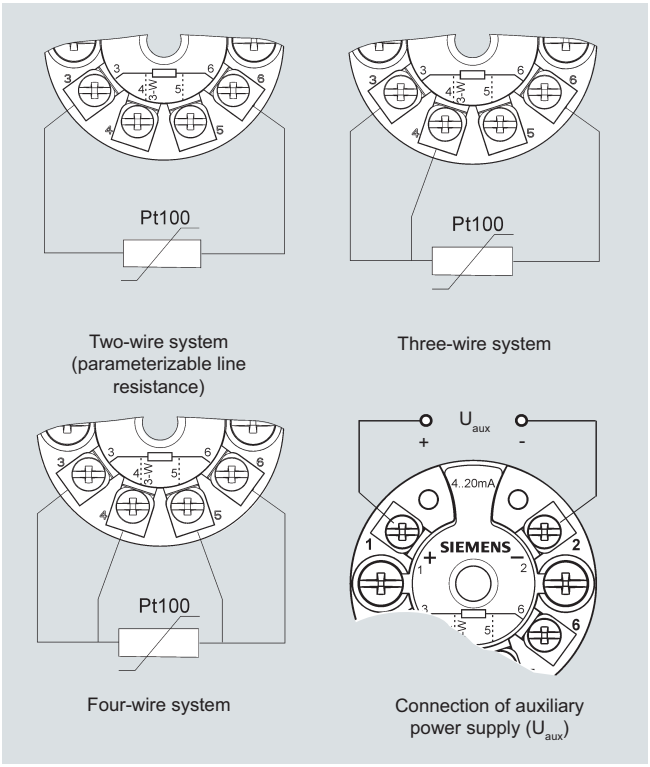


SITRANS TH100, mounting of transmitter on DIN rail



DIN rail adaptor, dimensions in mm (inch)

Schematics



SITRANS TH100, sensor connection assignment

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
- SIL2 (with order code C20), SIL2/3 (with C23)
- 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 (2, 3 or 4-wire system)
- Thermocouples
- 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.

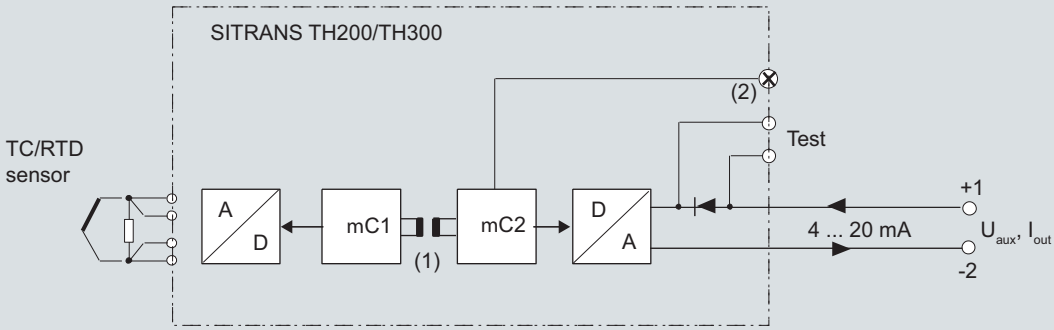
Transmitters of the "intrinsically safe" type of protection can be installed within potentially explosive atmospheres. The devices comply with the Directive 94/9/EC (ATEX), as well as FM and CSA regulations.

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.



Input		Output			
A/D	Analog-digital converter	µC2	Microcontroller, primary circuit	(1)	Electrically isolated
Sensors	Resistance thermometer, thermocouple, resistance-based sensor, mV sensor	D/A	Digital-analog converter	(2)	LED
		U_{aux}	Auxiliary power supply		
µC1	Microcontroller, secondary circuit	I_{out}	Output current		

SITRANS TH200 function diagram

SITRANS TH200
two-wire system, universal

Technical specifications

Input	
Resistance thermometer	
Measured variable	Temperature
Sensor type	
• to IEC 60751	Pt25 … Pt1000
• To JIS C 1604; a = 0.00392 K^{-1}	Pt25 … Pt1000
• to IEC 60751	Ni25 … Ni1000
• Special type	over special characteristic (max. 30 points)
Sensor factor	0.25 ... 10 (adaptation of the basic type, e.g. Pt100 to version Pt25 ... 1000)
Units	°C or °F
Connection	
• Standard connection	1 resistance thermometer (RTD) in 2-wire, 3-wire or 4-wire system
• Generation of average value	2 identical resistance thermometers in 2-wire system for generation of average temperature
• Generation of difference	2 identical resistance thermometers (RTD) in 2-wire system (RTD 1 – RTD 2 or RTD 2 – RTD 1)
Interface	
• Two-wire system	Parameterizable line resistance ≤ 100 Ω (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Always active (cannot be disabled)
Short-circuit monitoring	can be switched on/off (default value: ON)
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 ≤ 100 Ω (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Always active (cannot be disabled)
Short-circuit monitoring	can be switched on/off (default value: OFF)
Measuring range	parameterizable max. 0 ... 2200 Ω (see table "Digital measuring errors")
Min. measured span	5 Ω ... 25 Ω (see Table "Digital measuring errors")
Characteristic curve	Resistance-linear or special characteristic
Thermocouples	
Measured variable	Temperature
Sensor type (thermocouples)	
• Type B	Pt30Rh-Pt6Rh to DIN IEC 584
• Type C	W5 %-Re acc. to ASTM 988
• Type D	W3 %-Re acc. 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
Measuring range	Parameterizable (see table "Digital measuring errors")
Min. measured span	Min. 40 ... 100 °C (72 ... 180 °F) (see table "Digital measuring errors")
Characteristic curve	Temperature-linear or special characteristic
mV sensor	
Measured variable	DC voltage
Sensor type	DC voltage source (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

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	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: 3.80 mA ... 20.5 mA)
Error signal (e.g. following sensor fault) (conforming to NE43)	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	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)
Influence of ambient temperature	
• Analog measuring error	0.02 % of span/10°C (18 °F)
• Digital measuring errors	
- with resistance thermometers	0.06 °C (0.11 °F)/10°C (18 °F)
- with thermocouples	0.6 °C (1.1 °F)/10°C (18 °F)
Auxiliary power 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 span
• After one year	• < 0.2 % of span
• After 5 years	• < 0.3 % of span
Conditions of use	
Ambient conditions	
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

Certificates and approvals	
Explosion protection ATEX	
EC type test certificate	PTB 05 ATEX 2040X
• "Intrinsic safety" type of protection	II 1 G Ex ia IIC T6/T4 II 2 (1) G Ex ia/ib IIC T6/T4 II 3(1) G Ex ia/ic IIC T6/T4 II 1D Ex iaD 20 T115 °C
• "Operating equipment that is non-ignitable and has limited energy" type of protection	II 3 G Ex nL IIC T6/T4 II 3 G Ex nA IIC T6/T4
Explosion protection: FM for USA	
• FM approval	FM 3024169
• Degree of protection	IS / CI I, II, III / Div 1 / GP ABCDEFG T6, T5, T4 CI I / ZN 0 / AEx ia IIC T6, T5, T4 NI / CI I / Div 2 / GP ABCDFG T6, T5, T4 NI / CI I / ZN 2 / IIC T6, T5, T4
Explosion protection to FM for Canada ($_cFM_{US}$)	
• FM approval	FM 3024169C
• Degree of protection	IS / CI I, II, III / Div 1/ GP ABCDEFG T6, T5, T4 NI / CI I / DIV 2 / GP ABCD T6, T5, T4 NIFW / CI I, II, III / DIV 2 / GP ABCDFG T6, T5, T4 DIP / CI II, III / Div 2 / GP FG T6, T5, T4 CI I / ZN 0 / Ex ia IIC T6, T5, T4 CI I / ZN 2 / Ex nA nL IIC T6, T5, T4
Other certificates	GOST
Software requirements for SIPROM T	
PC operating system	Windows ME, 2000 and XP; also Windows 95, 98 and 98 SE, but only in connection with RS 232 modem.

Factory setting:

- Pt100 (IEC 751) with 3-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 TH200
two-wire system, universal

Digital measuring errors

Resistance thermometer

Input	Measuring range	Min. measured span		Digital accuracy	
	°C / (°F)	°C	(°F)	°C	(°F)
to IEC 60751					
Pt25	-200 ... +850 (-328 ... +1562)	10	(18)	0,3	(0.54)
Pt50	-200 ... +850 (-328 ... +1562)	10	(18)	0,15	(0.27)
Pt100 ... Pt200	-200 ... +850 (-328 ... +1562)	10	(18)	0,1	(0.18)
Pt500	-200 ... +850 (-328 ... +1562)	10	(18)	0,15	(0.27)
Pt1000	-200 ... +350 (-328 ... +662)	10	(18)	0,15	(0.27)
to JIS C1604-81					
Pt25	-200 ... +649 (-328 ... +1200)	10	(18)	0,3	(0.54)
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. measured span	Digital accuracy
	Ω	Ω	Ω
Resistance	0 ... 390	5	0,05
Resistance	0 ... 2200	25	0,25

Thermocouples

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 0.025 % of the set span (digital-analog error).

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

Selection and Ordering data		Order No.
Temperature transmitter SITRANS TH200		
for installation in connection head, type B (DIN 43729), two-wire system, 4 ... 20 mA, programmable, with electrical isolation		
• Without explosion protection	▶ C)	**7NG3211-1NN00**
• With explosion protection		
- to ATEX	▶ C)	**7NG3211-1AN00**
- to FM ($_cFM_{US}$)	▶ C)	**7NG3211-1BN00**
Further designs		Order code
Add "-Z" to Order No. and specify Order code(s)		
Customer-specific setting of operating data (specify operating data in plain text)		**Y01**[1)]
with test protocol (5 measuring points)		**C11**
Functional safety SIL2		**C20**
Functional safety SIL2/3		**C23**
Accessories		Order No.
Modem for SITRANS TH100, TH200 and TR200 incl. SIPROM T parameterization software With USB connection	▶	**7NG3092-8KU**
CD for measuring instruments for temperature With documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software	▶	**A5E00364512**
DIN rail adapters for head transmitters (Quantity delivered: 5 units)	▶	**7NG3092-8KA**
Connecting cable 4-wire, 150 mm, for sensor connections when using head transmitters in the high hinged cover (set with 5 units)		**7NG3092-8KC**

▶ Available ex stock.

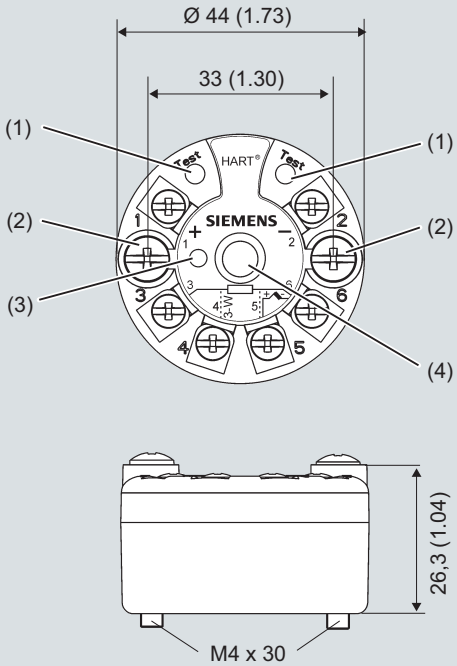
[1)] Y01: Quote all details that deviate from the factory settings (see below).
C) Subject to export regulations AL: N, ECCN: EAR99.
Supply units see Chap. 8 "Supplementary Components".

Factory setting:

- Pt100 (IEC 751) with 3-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

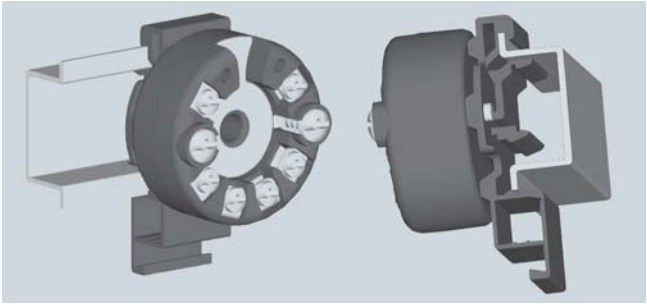
SITRANS TH200
two-wire system, universal

Dimensional drawings

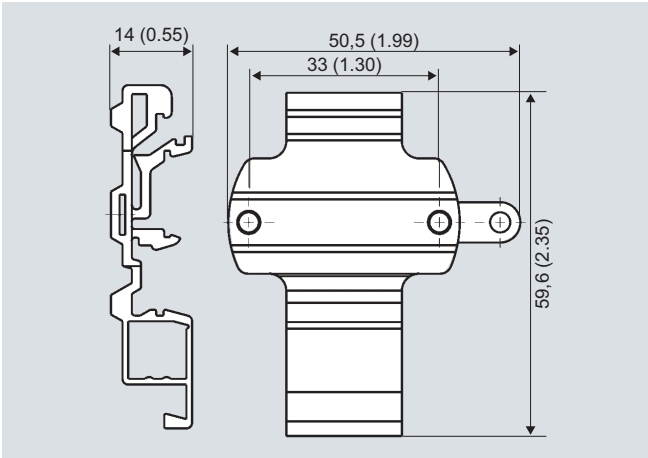


1(+) and 2(-)	Auxiliary power supply U_{aux}, output current I_{Out}
3, 4, 5 and 6	Pt100 sensor (for connections, see Sensor connection assignment)
Test (+), Test (-)	Measurement of the output current with a multimeter
(1)	Test terminal
(2)	Mounting screw M4x30
(3)	LED for operation indication
(4)	Internal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

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



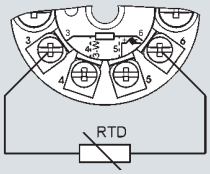
SITRANS TH200, mounting of transmitter on DIN rail



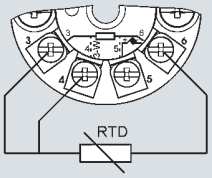
DIN rail adapter, dimensions in mm (inch)

Schematics

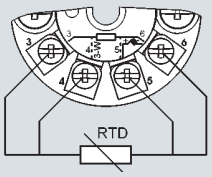
Resistance thermometer



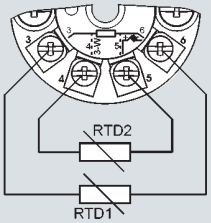
Two-wire system [1)]



Three-wire system

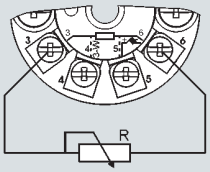


Four-wire system

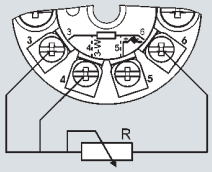


Generation of average value / difference [1)]

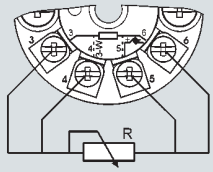
Resistance



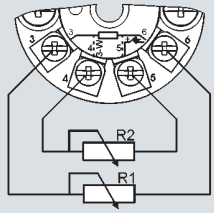
Two-wire system [1)]



Three-wire system

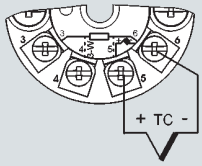


Four-wire system

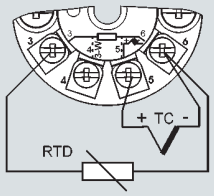


Generation of average value / difference [1)]

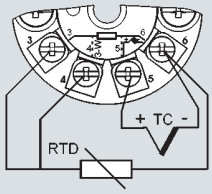
Thermocouple



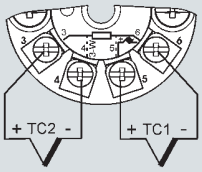
Cold junction compensation
Internal/fixed value



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



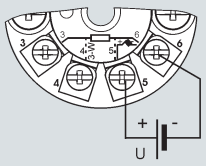
Cold junction compensation with external Pt100 in three-wire system



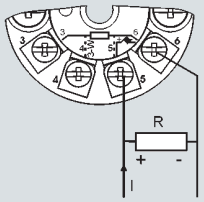
Generation of average value / difference with internal cold junction compensation

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

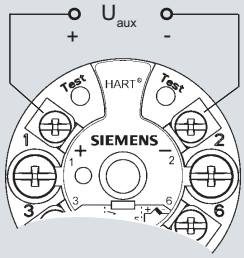
Voltage measurement



Current measurement



Connection of auxiliary power supply (U_{aux})



SITRANS TH200, sensor connection assignment

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
- SIL2 (with order code C20), SIL2/3 (with C23)
- 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 (2, 3 or 4-wire system)
- Thermocouples
- 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.

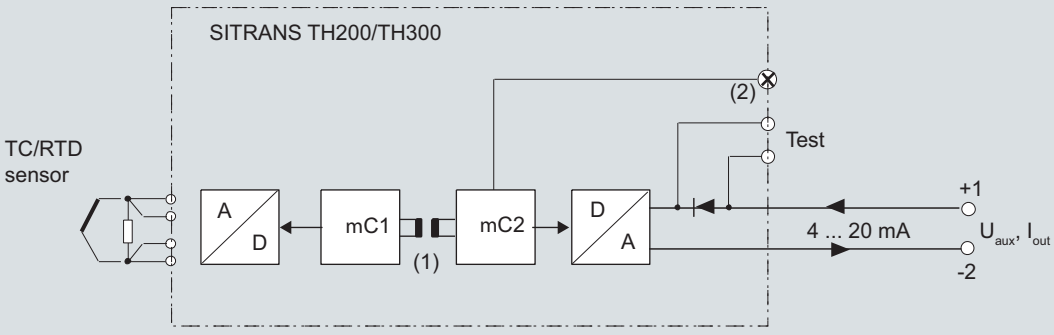
Transmitters of the "intrinsically safe" type of protection can be installed within potentially explosive atmospheres. The devices comply with the Directive 94/9/EC (ATEX), as well as FM and CSA regulations.

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.



Input		Output		(1)	Electrically isolated
A/D	Analog-digital converter	µC2	Microcontroller, primary circuit	(2)	LED
Sensors	Resistance thermometer, thermocouple, resistance-based sensor, mV sensor	D/A	Digital-analog converter		
		U_{aux}	Auxiliary power supply		
µC1	Microcontroller, secondary circuit	I_{out}	Output current		

SITRANS TH 300 function diagram

Technical specifications

Input	
Resistance thermometer	
Measured variable	Temperature
Sensor type	
• to IEC 60751	Pt25 … Pt1000
• To JIS C 1604; a = 0.00392 K^{-1}	Pt25 … Pt1000
• to IEC 60751	Ni25 … Ni1000
• Special type	over special characteristic (max. 30 points)
Sensor factor	0.25 ... 10 (adaptation of the basic type, e.g. Pt100 to version Pt25 ... 1000)
Units	°C or °F
Connection	
• Standard connection	1 resistance thermometer (RTD) in 2-wire, 3-wire or 4-wire system
• Generation of average value	2 identical resistance thermometers in 2-wire system for generation of average temperature
• Generation of difference	2 identical resistance thermometers (RTD) in 2-wire system (RTD 1 – RTD 2 or RTD 2 – RTD 1)
Interface	
• Two-wire system	Parameterizable line resistance ≤ 100 Ω (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Always active (cannot be disabled)
Short-circuit monitoring	can be switched on/off (default value: ON)
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 ≤ 100 Ω (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Always active (cannot be disabled)
Short-circuit monitoring	can be switched on/off (default value: OFF)
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
Thermocouples	
Measured variable	Temperature
Sensor type (thermocouples)	
• Type B	Pt30Rh-Pt6Rh to DIN IEC 584
• Type C	W5 %-Re acc. to ASTM 988
• Type D	W3 %-Re acc. 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
Measuring range	parameterizable (see table "Digital measuring errors")
Min. measured span	Min. 40 ... 100 °C (72 ... 180 °F) (see table "Digital measuring errors")
Characteristic curve	Temperature-linear or special characteristic
mV sensor	
Measured variable	DC voltage
Sensor type	DC voltage source (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

SITRANS TH300
two-wire system, universal, HART

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 with communication acc. to HART Rev. 5.9
Auxiliary power	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: 3.80 mA ... 20.5 mA)
Error signal (e.g. following sensor fault) (conforming to NE43)	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	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)
Influence of ambient temperature	
• Analog measuring error	0.02 % of span/10°C (18 °F)
• Digital measuring errors	
- with resistance thermometers	0.06 °C (0.11 °F)/10°C (18 °F)
- with thermocouples	0.6 °C (1.1 °F)/10°C (18 °F)
Auxiliary power 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 span
• After one year	< 0.2 % of span
• After 5 years	< 0.3 % of span
Conditions of use	
Ambient conditions	
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
Certificates and approvals	
Explosion protection ATEX	
EC type test certificate	PTB 05 ATEX 2040X
• "Intrinsic safety" type of protection	II 1 G Ex ia IIC T6/T4 II 2 (1) G Ex ia/ib IIC T6/T4 II 3(1) G Ex ia/ic IIC T6/T4 II 1D Ex iaD 20 T115 °C
• "Operating equipment that is non-ignitable and has limited energy" type of protection	II 3 G Ex nL IIC T6/T4 II 3 G Ex nA IIC T6/T4
Explosion protection: FM for USA	
• FM approval	FM 3024169
• Degree of protection	IS / Cl I, II, III / Div 1 / GP ABCDEFG T6, T5, T4 Cl I / ZN 0 / AEx ia IIC T6, T5, T4 NI / Cl I / Div 2 / GP ABCDFG T6, T5, T4 NI / Cl I / ZN 2 / IIC T6, T5, T4
Explosion protection to FM for Canada ($_cFM_{US}$)	
• FM approval	FM 3024169C
• Degree of protection	IS / Cl I, II, III / Div 1/ GP ABCDEFG T6, T5, T4 NI / Cl I / DIV 2 / GP ABCD T6, T5, T4 NIFW / Cl I, II, III / DIV 2 / GP ABCDFG T6, T5, T4 DIP / Cl II, III / Div 2 / GP FG T6, T5, T4 Cl I / ZN 0 / Ex ia IIC T6, T5, T4 Cl I / ZN 2 / Ex nA nL IIC T6, T5, T4
Other certificates	GOST

Factory setting:

- Pt100 (IEC 751) with 3-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)
to IEC 60751					
Pt25	-200 ... +850 (-328 ... +1562)	10	(18)	0,3	(0.54)
Pt50	-200 ... +850 (-328 ... +1562)	10	(18)	0,15	(0.27)
Pt100 ... Pt200	-200 ... +850 (-328 ... +1562)	10	(18)	0,1	(0.18)
Pt500	-200 ... +850 (-328 ... +1562)	10	(18)	0,15	(0.27)
Pt1000	-200 ... +350 (-328 ... +662)	10	(18)	0,15	(0.27)
to JIS C1604-81					
Pt25	-200 ... +649 (-328 ... +1200)	10	(18)	0,3	(0.54)
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)

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

Thermocouples

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 (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 0.025 % 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 TH300
two-wire system, universal, HART

Selection and Ordering data		Order No.
Temperature transmitter SITRANS TH300		
for installation in connection head, type B (DIN 43729), two-wire system 4 ... 20 mA, communication capable to HART, with galvanic isolation		
• Without explosion protection	▶ C)	**7NG3212-0NN00**
• With explosion protection		
- to ATEX	▶ C)	**7NG3212-0AN00**
- to FM ($_{C}FM_{US}$)	▶ C)	**7NG3212-0BN00**
Further designs		Order code
Add "-Z" to Order No. and specify Order code(s)		
Customer-specific setting of operating data (specify operating data in plain text)		**Y01**[1)]
with test protocol (5 measuring points)		**C11**
Functional safety SIL2		**C20**
Functional safety SIL2/3		**C23**
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	▶ D)	**7MF4997-1DA**
• With USB connection	▶ D)	**7MF4997-1DB**
SIMATIC PDM operating software		**See Section 9**
(Quantity delivered: 5 units)		**7NG3092-8KA**
Connecting cable		**7NG3092-8KC**
4-wire, 150 mm, for sensor connections when using head transmitters in the high hinged cover (set with 5 units)		

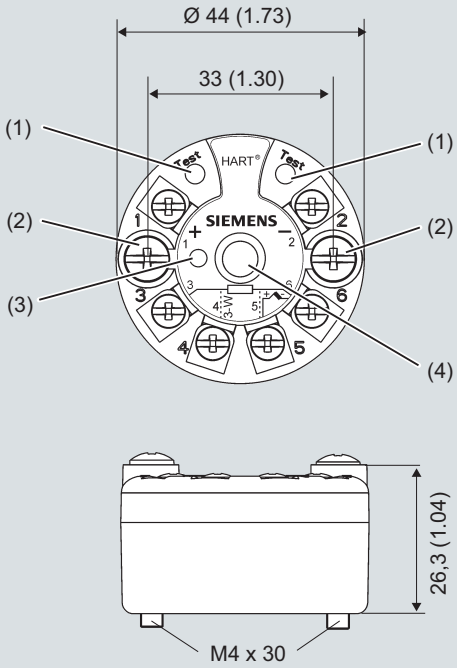
▶ Available ex stock.

[1)] Y01: Quote all details that deviate from the factory settings (see below).
C) Subject to export regulations AL: N, ECCN: EAR99.
D) Subject to export regulations AL: N, ECCN: EAR99H.
Supply units see Chap. 8 "Supplementary Components".

Factory setting:

- Pt100 (IEC 751) with 3-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

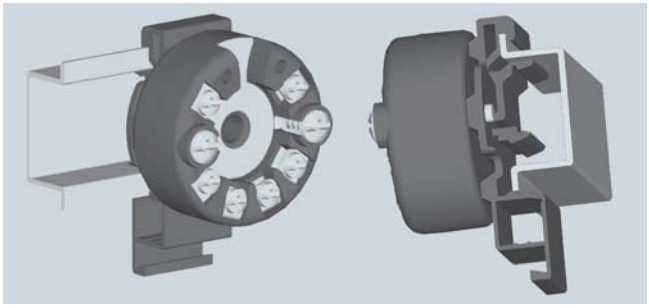
Dimensional drawings



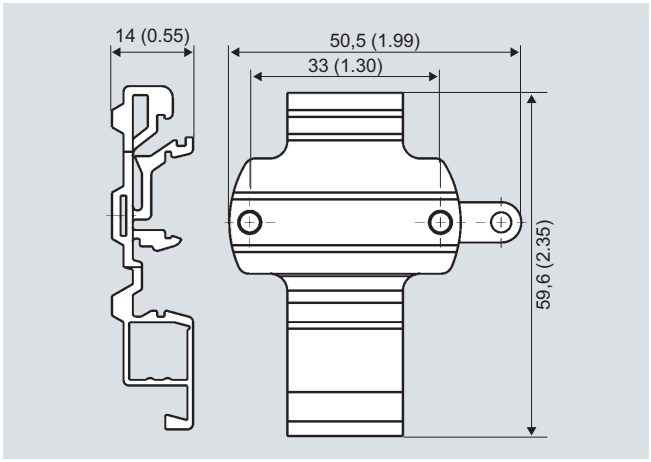
1(+) and 2(-)	Auxiliary power supply U_{aux}, output current I_{Out}
3, 4, 5 and 6	Pt100 sensor (for connections, see Sensor connection assignment)
Test (+), Test (-)	Measurement of the output current with a multimeter
(1)	Test terminal
(2)	Mounting screw M4x30
(3)	LED for operation indication
(4)	Internal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

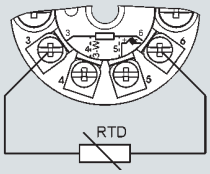


DIN rail adapter, dimensions in mm (inch)

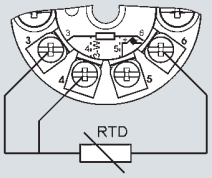
SITRANS TH300
two-wire system, universal, HART

Schematics

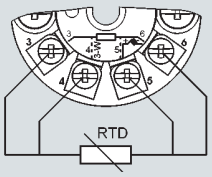
Resistance thermometer



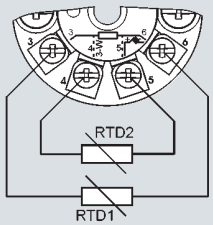
Two-wire system [1)]



Three-wire system

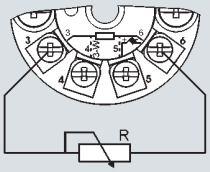


Four-wire system

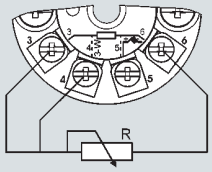


Generation of average value / difference [1)]

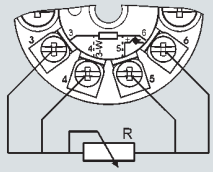
Resistance



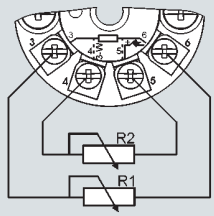
Two-wire system [1)]



Three-wire system

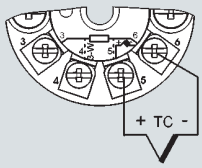


Four-wire system

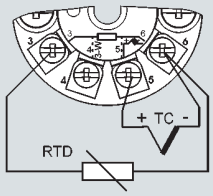


Generation of average value / difference [1)]

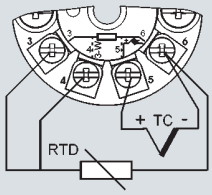
Thermocouple



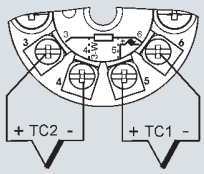
Cold junction compensation
Internal/fixed value



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



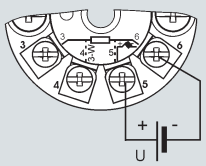
Cold junction compensation with external Pt100 in three-wire system



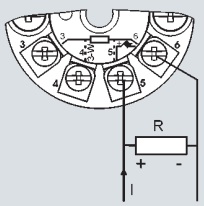
Generation of average value / difference with internal cold junction compensation

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

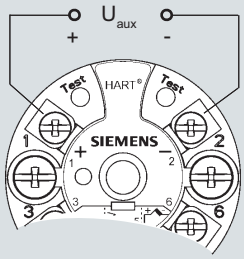
Voltage measurement



Current measurement



Connection of auxiliary power supply (U_{aux})



SITRANS TH200/TH300, sensor connection assignment

Overview

SITRANS TH400 fieldbus transmitters

Versions:

- For FOUNDATION fieldbus
- 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 the context of 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 thermal elements
- Differential, mean-value or redundant temperature measurement with resistance thermometers or thermal elements
- Linear resistance and bipolar millivolt measurements
- Differential, mean-value or redundant resistance and bipolar millivolt measurements

Function

Features

General

- 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 redundance

with PROFIBUS PA communication

- Function blocks: 2 x analog

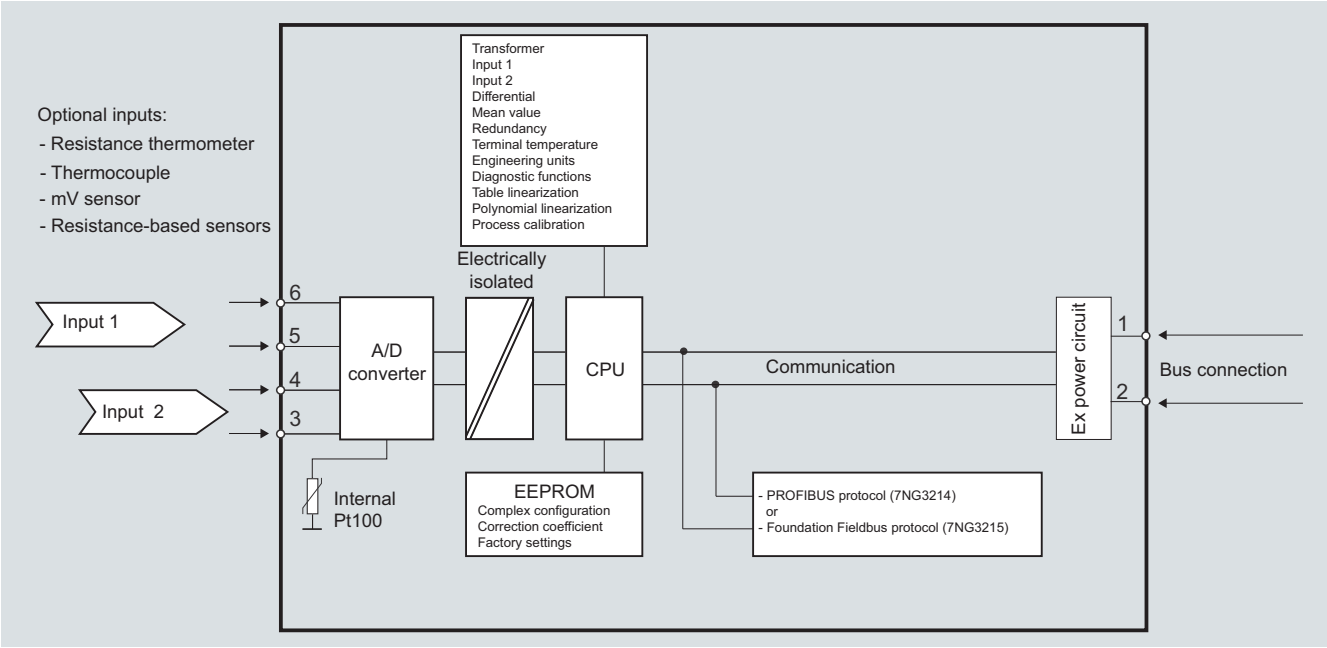
with FOUNDATION fieldbus communication

- 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.

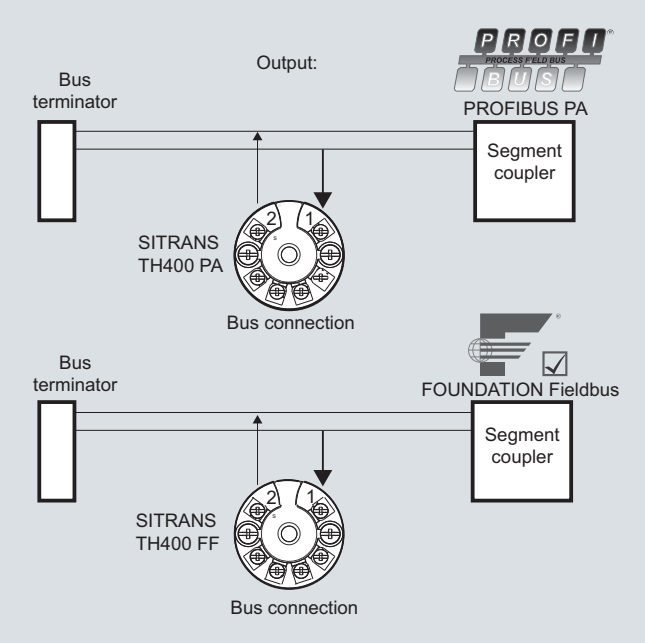
The only difference between the two versions of the SITRANS TH400 (7NG3214-... and 7NG3215-...) is the type of fieldbus protocol used (PROFIBUS PA or FOUNDATION fieldbus).



SITRANS TH400, function diagram

SITRANS TH400 fieldbus transmitters

System communication



SITRANS TH400, communication interface

Technical specifications

Input	
Analog-to-digital conversion	
• Measurement rate	< 50 ms
• Resolution	24-bit
Resistance thermometer	
Pt25 ... Pt1000 to IEC 60751/JIS C 1604	
• Measuring range	-200 ... +850 °C (-328 ... +1562 °F)
Ni25 ... Ni1000 to DIN 43760	
• Measuring range	-60 ... +250 °C (-76 ... +482 °F)
Cu10 ... Cu1000, α = 0.00427	
• Measuring range	-50 ... +200 °C (-58 ... +392 °F)
Line resistance per sensor cable	Max. 50 Ω
Sensor current	Nominal 0.2 mA
Sensor fault detection	
• Sensor break detection	Yes
• Sensor short-circuit detection	Yes, < 15 Ω
Resistance-based sensors	
Measuring range	0 Ω ... 10 kΩ
Line resistance per sensor cable	Max. 50 Ω
Sensor current	Nominal 0.2 mA
Sensor fault detection	
• Sensor break detection	Yes
• Sensor short-circuit detection	Yes, < 15 Ω

Thermocouple	
to IEC 584	Measuring range
• Type B	400 .. +1820 °C (752 ... 3308 °F)
• Type E	-100 ... +1000 °C (-148 ... +1832 °F)
• Type J	-100 ... +1000 °C (-148 ... +1832 °F)
• Type K	-100 ... +1200 °C (-148 ... +2192 °F)
• Type N	-180 ... +1300 °C (-292 ... +2372 °F)
• Type R	-50 ... +1760 °C (-58 ... +3200 °F)
• Type S	-50 ... +1760 °C (-58 ... +3200 °F)
• Type T	-200 ... +400 °C (-328 ... +752 °F)
to DIN 43710	
• Type L	-200 ... +900 °C (-328 ... +1652 °F)
• Type U	-200 ... +600 °C (-328 ... +1112 °F)
to ASTM E988-90	
• Type W3	0 ... 2300 °C (32 ... +4172 °F)
• Type W5	0 ... 2300 °C (32 ... +4172 °F)
External cold junction compensation	-40 ... +135 °C (-40 ... +275 °F)
Sensor fault detection	
• Sensor break detection	Yes
• Sensor short-circuit detection	Yes, < 3 mV
• Sensor current in the event of open-circuit monitoring	4 µA
mV sensor - voltage input	
Measuring range	-800 ... +800 mV
Input resistance	10 MΩ
Output	
Filter time (programmable)	0 ... 60 s
Update time	< 400 ms
Measuring accuracy	
Accuracy is defined as the higher value of general values and basic values.	

General values

Type of input	Absolute accuracy	Temperature coefficient
All	≤ ± 0.05 % of the measured value	≤ ± 0.002 % of the measured value/°C

Basic values

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

Conditions of use	
Ambient conditions	
Permissible ambient temperature	-40 ... +85 °C (-40 ... +185 °F)
Permissible storage temperature	-40 ... +85 °C (-40 ... +185 °F)
Relative humidity	≤ 98 %, with condensation
Insulation resistance	
• Test voltage	500 V AC for 60 s
Mechanical testing	
• Vibrations (DIN class B) to	IEC 60068-2-6 and IEC 60068-2-64 4 g/2 ... 100 Hz
Electromagnetic compatibility	
EMC noise voltage influence	< ± 0.1 % of span
Extended EMC noise immunity: NAMUR NE 21, criterion A, Burst	< ± 1 % of span
EMC 2004/108/EC Emission and Noise Immunity to	EN 61326
Construction	
Material	Molded plastic
Weight	55 g (0.12 lb)
Dimensions	See Dimensional drawings
Cross-section of cables	Max. 2.5 mm^2 (AWG 13)
Degree of protection	
• Transmitter enclosure	IP40
• Terminal	IP00
Auxiliary power	
Power supply	
• Standard, Ex "nA", Ex "nL", NI	9.0 ... 32 V DC
• ATEX, FM, UL and CSA	9.0 ... 30 V DC
• In FISCO/FNICO installations	9.0 ... 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	KEMA 06 ATEX 0264 X
• "Intrinsic safety" type of protection	II 1 G Ex ia IIC T4...T6 II 2(1) G Ex ib[ia] IIC T4...T6 II 1 D Ex iaD
EC type test certificate	KEMA 06 ATEX 0263 X
• Type of protection for "equipment is non-arcing"	II 3 GD Ex nA[nL] IIC T4...T6 II 3 GD Ex nL IIC T4...T6 II 3 GD Ex nA[ic] IIC T4...T6 II 3 GD Ex ic IIC T4...T6
Explosion protection: FM for USA	
• FM approval	FM 3027985
• Degree of protection	• IS Class I, Div 1, Groups A, B, C, D T4/T5/T6, FISCO • IS Class I, Zone 0, AEx ia, IIC T4/T5/T6, FISCO • NI Class I, Div 2, Groups A, B, C, D T4/T5/T6, FNICO
Explosion protection CSA for Canada	
• CSA approval	CSA 1861385
• Degree of protection	• IS Class I, Div 1, Groups A, B, C, D T4/T5/T6 • Ex ia IIC T4/T5/T6 and Ex ib [ia] IIC T4/T5/T6 • NI Class I, Div 2, Groups A, B, C, D T4/T5/T6 • Ex nA II T4/T5/T6
Other certificates	GOST
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	
only for SITRANS TH400 PA	
Sensor	Pt100 (IEC)
Type of connection	3-wire circuit
Unit	°C
Failure mode	Last valid value
Filter time	0 s
PA address	126
PROFIBUS Ident No.	Manufacturer-specific
only 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 TH400 fieldbus transmitters

Selection and Ordering data

		Order No.
Temperature transmitter SITRANS TH400		
for installation in connection head, with electrical isolation, order instruction manual separately.		
• Bus-compatible to PROFIBUS PA		
- No explosion protection or Zone 2/Div 2 to ATEX/FM/CSA	► C)	**7NG3214-0NN00**
- with explosion protection "Intrinsically safe to ATEX/FM/CSA"	► C)	**7NG3214-0AN00**
• Bus-compatible to FOUNDATION Fieldbus		
- No explosion protection or Zone 2/Div 2 to ATEX/FM/CSA	► C)	**7NG3215-0NN00**
- with explosion protection "Intrinsically safe to ATEX/FM/CSA"	► C)	**7NG3215-0AN00**
Further designs		Order code
Please add "**-Z**" to Order No. and specify Order code(s) and plain text.		
Customer-specific setting of operating data (specify operating data in plain text)		**Y01**[1]
with test protocol (5 measuring points)		**C11**[2]
Accessories		Order No.
CD for measuring instruments for temperature	►	**A5E00364512**
With documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software		
SIMATIC PDM operating software		**See Section 9**
DIN rail adapters for head transmitters		**7NG3092-8KA**
(Quantity delivered: 5 units)		
Connecting cable		**7NG3092-8KC**
4-wire, 150 mm, for sensor connections when using head transmitters in the high hinged cover (set with 5 units)		
for additional PA components,		**See Catalog IK PI**

► Available ex stock.

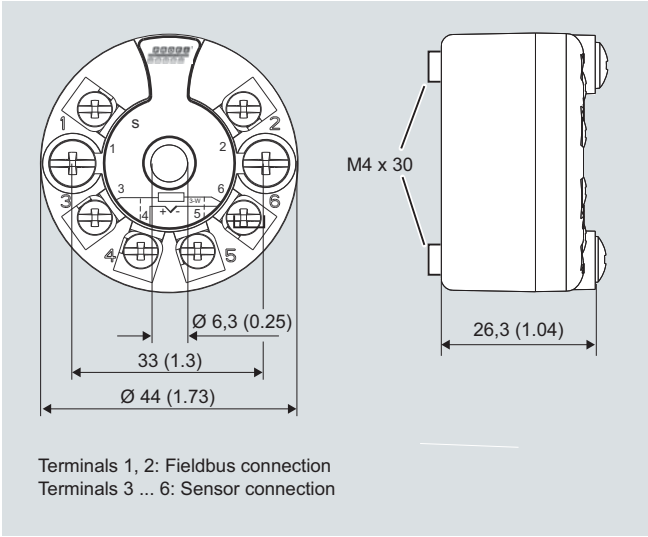
1) Y01: Quote all details that deviate from the factory setting (see below).
2) Can only be ordered together with Y01 (it is essential to specify the measuring range).

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

Factory setting:

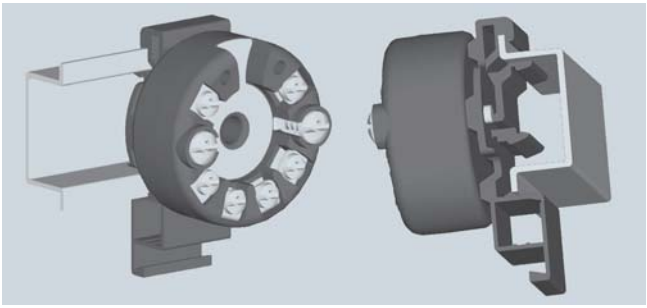
- For SITRANS TH400 PA:
  - Pt100 (IEC 751) with 3-wire circuit
  - Unit: °C
  - Failure mode: Last valid value
  - Filter time: 0 s
  - PA address: 126
  - PROFIBUS Ident No.: Manufacturer-specific
- For SITRANS TH400 FF:
  - Pt100 (IEC 751) with 3-wire circuit
  - Unit: °C
  - Failure mode: Last valid value
  - Filter time: 0 s
  - Node address: 22

Dimensional drawings

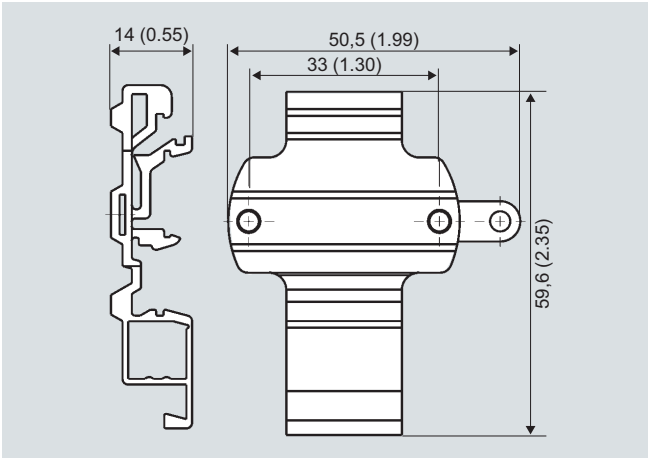


SITRANS TH400 dimensions in mm (inches) and connections

Mounting on DIN rail



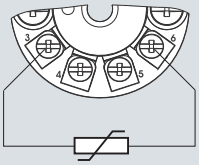
SITRANS TH400, mounting of transmitter on DIN rail



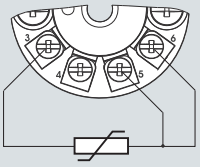
DIN rail adaptor, dimensions in mm (inch)

Schematics

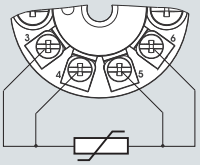
Resistance thermometer



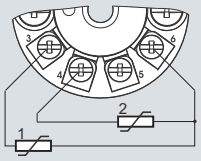
Two-wire system [1)]



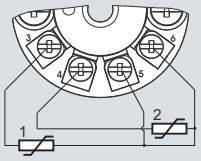
Three-wire system



Four-wire system

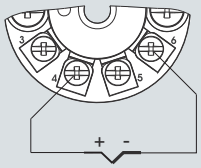


Mean-value/differential or redundancy generation
2 x two-wire system [1)]

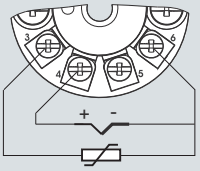


Mean-value/differential or redundancy generation
1 sensor in two-wire system [1)]
1 sensor in three-wire system

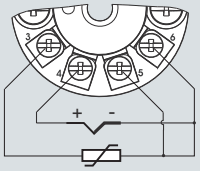
Thermocouple



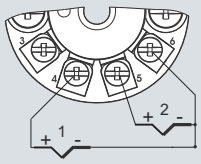
Internal
cold junction compensation



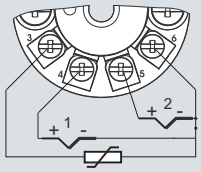
Cold junction compensation
with external Pt100 in two-wire system [1)]



Cold junction compensation
with external Pt100 in three-wire system

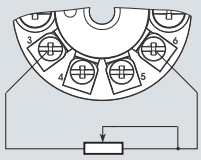


Mean value, differential or redundancy generation with internal cold junction compensation

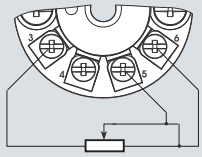


Mean value, differential or redundancy generation and cold junction compensation
with internal Pt100
in two-wire system [1)]

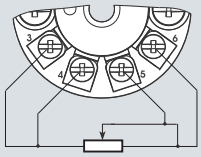
Resistance



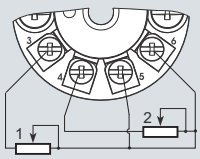
Two-wire system [1)]



Three-wire system

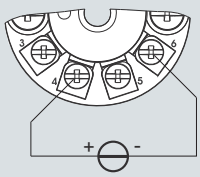


Four-wire system

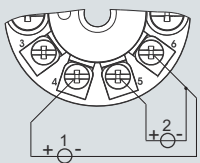


Mean value, differential or redundancy generation
1 resistor in two-wire system [1)]
1 resistor in three-wire system

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 TH400, sensor connection assignment

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
- SIL2 (with order code C20), SIL2/3 (with C23)

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 (2, 3 or 4-wire system)
- Thermocouples
- 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.

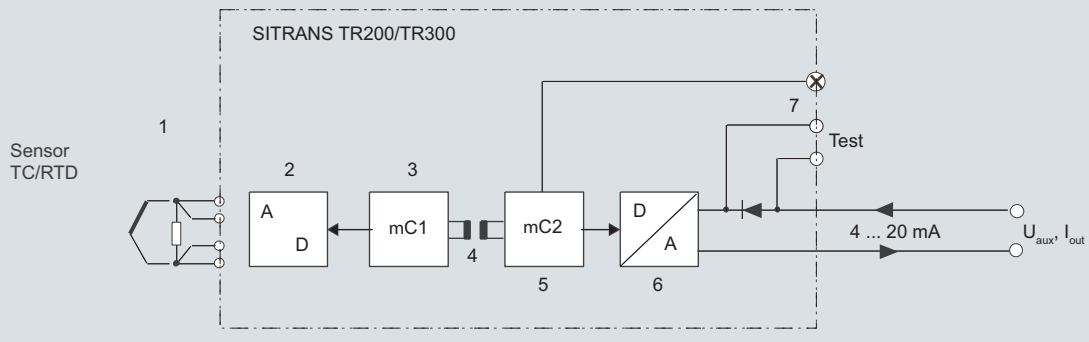
Transmitters of the "intrinsically safe" type of protection can be installed within potentially explosive atmospheres. The devices comply with the Directive 94/9/EC (ATEX).

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.



1 Sensor such as resistance thermometer, thermocouple, resistance-based, sensor, mV sensor
2 Analog-digital converter
3 Microcontroller, secondary circuit
4 Electrical isolation
5 Microcontroller, primary circuit
6 Digital-analog converter
7 LED

U_{aux} Auxiliary power supply
I_{out} Output current
Test Test terminals for temporary connection of an amperemeter

SITRANS TR200 function diagram

Technical specifications

Input	
Resistance thermometer	
Measured variable	Temperature
Sensor type	
• to IEC 60751	Pt25 … 1000
• to JIS C 1604; a=0.00392 K^{-1}	Pt25 … 1000
• to IEC 60751	Ni25 … 1000
• Special type	over special characteristic (max. 30 points)
Sensor factor	0.25 ... 10 (adaptation of the basic type, e.g. Pt100 to version Pt25 ... 1000)
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 resistance thermometers in 2-wire system for generation of average temperature
• Generation of difference	2 resistance thermometers (RTD) in 2-wire system (RTD 1 – RTD 2 or RTD 2 – RTD 1)
Interface	
• Two-wire system	Parameterizable line resistance ≤ 100 Ω (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time T_{63}	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Always active (cannot be disabled)
Short-circuit monitoring	can be switched on/off (default value: ON)
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 ≤ 100 Ω (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time T_{63}	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Always active (cannot be disabled)
Short-circuit monitoring	can be switched on/off (default value: OFF)
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
Thermocouples	
Measured variable	Temperature
Sensor type (thermocouples)	
• Type B	Pt30Rh-Pt6Rh to DIN IEC 584
• Type C	W5 %-Re acc. to ASTM 988
• Type D	W3 %-Re acc. 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 T_{63}	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Can be switched off
Cold junction compensation	
• Internal	With integrated Pt100 resistance thermometer
• External	With external Pt100 IEC 60571 (2-wire or 3-wire connection)
• External fixed	Cold junction temperature can be set as fixed value
Measuring range	parameterizable (see table "Digital measuring errors")
Min. measured span	Min. 40 ... 100 °C (72 ... 180 °F) (see table "Digital measuring errors")
Characteristic curve	Temperature-linear or special characteristic
mV sensor	
Measured variable	DC voltage
Sensor type	DC voltage source (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
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

SITRANS TR200
two-wire system, universal

Output	
Output signal	4 ... 20 mA, 2-wire
Auxiliary power	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 ... 20.5 mA)
Error signal (e.g. following sensor fault) (conforming to NE43)	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 2.12 kV DC ($1.5\ kV_{eff}$ AC)
Measuring accuracy	
Digital measuring errors	See Table "Digital measuring errors"
Reference conditions	
• Auxiliary power	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)
Influence of ambient temperature	
• Analog measuring error	0.02 % of span/10 °C (18 °F)
• Digital measuring errors	
- With resistance thermometer	0.06 °C (0.11 °F)/10 °C (18 °F)
- with thermocouples	0.6 °C (1.1 °F)/10 °C (18 °F)
Auxiliary power 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 span in the first month
• After one year	< 0.2 % of span after one year
• After 5 years	< 0.3 % of span after 5 years
Conditions of use	
Ambient conditions	
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	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	PTB 07 ATEX 2032X
• "Intrinsic safety" type of protection	II 2(1) G Ex ia/ib IIC T6/T4 II 3(1) G Ex ia/ic IIC T6/T4 II 3 G Ex ic IIC T6/T4 II 2(1) D Ex iaD/ibD 20/21 T115 °C
• Type of protection, "equipment is non-arcing"	II 3 G Ex nA IIC T6/T4
Other approvals	GOST
Software requirements for SIPROM T	
PC operating system	Windows ME, 2000 and XP; also Windows 95, 98 and 98 SE, but only in connection with RS 232 modem.

Factory setting:

- Pt100 (IEC 751) with 3-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

Digital measuring errors

Resistance thermometer

Input	Measuring range	Min. measured span		Digital accuracy	
	°C/(°F)	°C	(°F)	°C	(°F)
to IEC 60751					
Pt25	-200 ... +850 (-328 ... +1562)	10	(18)	0.3	(0.54)
Pt50	-200 ... +850 (-328 ... +1562)	10	(18)	0.15	(0.27)
Pt100 ... Pt200	-200 ... +850 (-328 ... +1562)	10	(18)	0.1	(0.18)
Pt500	-200 ... +850 (-328 ... +1562)	10	(18)	0.15	(0.27)
Pt1000	-200 ... +350 (-328 ... +662)	10	(18)	0.15	(0.27)
to JIS C1604-81					
Pt25	-200 ... +649 (-328 ... +1200)	10	(18)	0.3	(0.54)
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)

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

Thermocouples

Input	Measuring range	Min. measured span		Digital accuracy	
	°C/(°F)	°C	(°F)	°C	(°F)
Type B	0 ... 1820 (32 ... 3308)	100	(180)	2[1]	(3.6)[1]
Type C (W5)	0 ... 2300 (32 ... 4172)	100	(180)	2	(3.6)
Type D (W3)	0 ... 2300 (32 ... 4172)	100	(180)	1[2]	(1.8)[2]
Type E	-200 ... +1000 (-328 ... +1832)	50	(90)	1	(1.8)
Type J	-210 ... +1200 (-346 ... +2192)	50	(90)	1	(1.8)
Type K	-230 ... +1370 (-382 ... +2498)	50	(90)	1	(1.8)
Type L	-200 ... +900 (-328 ... +1652)	50	(90)	1	(1.8)
Type N	-200 ... +1300 (-328 ... +2372)	50	(90)	1	(1.8)
Type R	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.6)
Type S	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.6)
Type T	-200 ... +400 (-328 ... +752)	40	(72)	1	(1.8)
Type U	-200 ... +600 (-328 ... +1112)	50	(90)	2	(3.6)

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 0.025 % 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	▶ D)	**7NG3032-0JN00**
• with explosion protection to ATEX	▶ D)	**7NG3032-1JN00**
Further designs		Order code
Please add "**-Z**" to Order No. with and specify Order codes(s).		
Customer-specific setting of operating data (specify operating data in plain text)		**Y01[1]**
with test protocol (5 measuring points)		**C11**
Functional safety SIL2		**C20**
Functional safety SIL2/3		**C23**
Accessories		Order No.
Modem for SITRANS TH100, TH200 and TR200 incl. SIPROM T parameterization software		
With USB connection	▶	**7NG3092-8KU**
CD for measuring instruments for temperature	▶	**A5E00364512**
With documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software		

▶ Available ex stock.

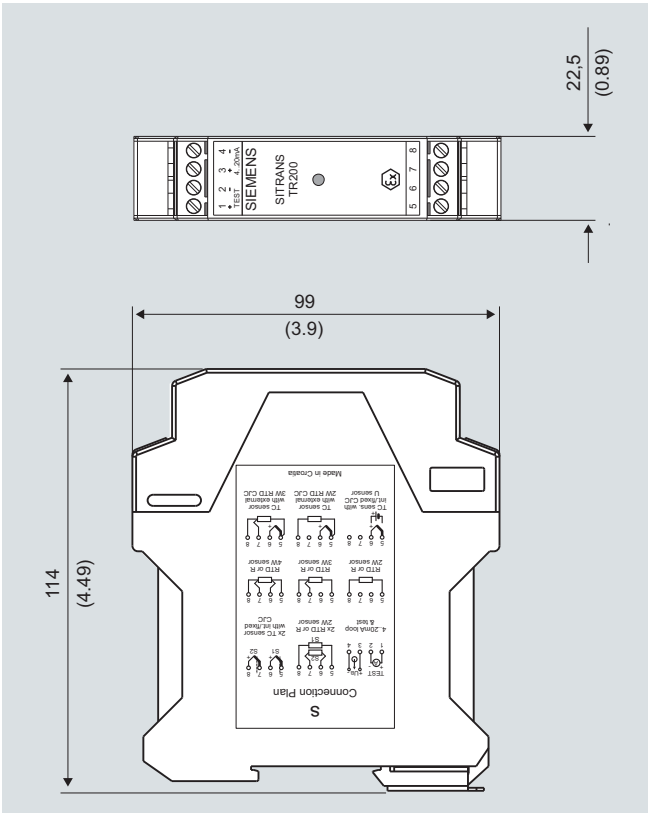
1) Y01: Quote all details that deviate from the factory setting (see below).
D) Subject to export regulations AL: N, ECCN: EAR99H.
Supply units see Chap. 8 "Supplementary Components".

Factory setting:

- Pt100 (IEC 751) with 3-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

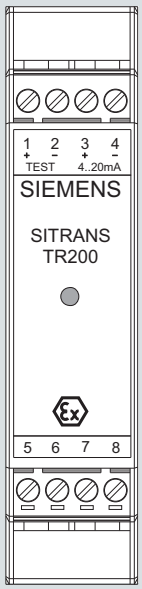
SITRANS TR200
two-wire system, universal

Dimensional drawings



SITRANS TR200, dimensions in mm (inch)

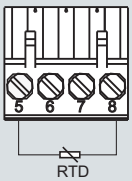
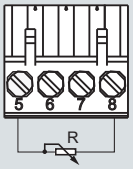
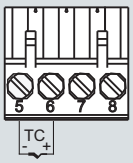
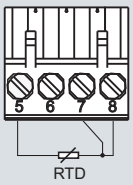
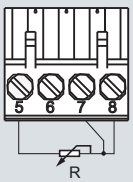
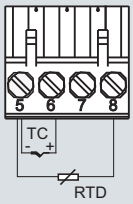
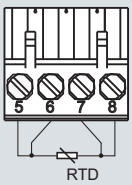
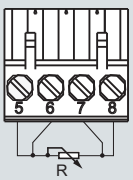
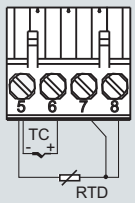
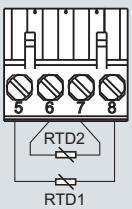
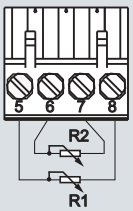
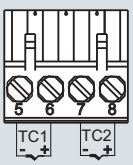
Schematics



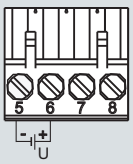
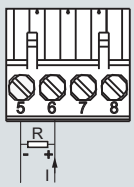
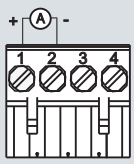
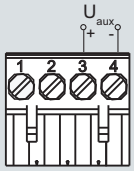
Asssignments

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

SITRANS TR200, pin assignment

Resistance thermometer	Resistance	Thermocouple
 Two-wire system [1]	 Two-wire system [1]	 Cold junction compensation Internal/fixed value
 Three-wire system	 Three-wire system	 Cold junction compensation with external Pt100 in two-wire system [1]
 Four-wire system	 Four-wire system	 Cold junction compensation with external Pt100 in three-wire system
 Generation of average value/difference [1]	 Generation of average value/difference [1]	 Generation of average value / difference with internal cold junction compensation

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

Voltage measurement	Current measurement	Test terminals	Power supply/ 4 ... 20 mA (U_{aux})
			

SITRANS TR200, sensor connection assignment

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
- SIL2 (with order code C20), SIL2/3 (with C23)

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 (2, 3 or 4-wire system)
- Thermocouples
- 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.

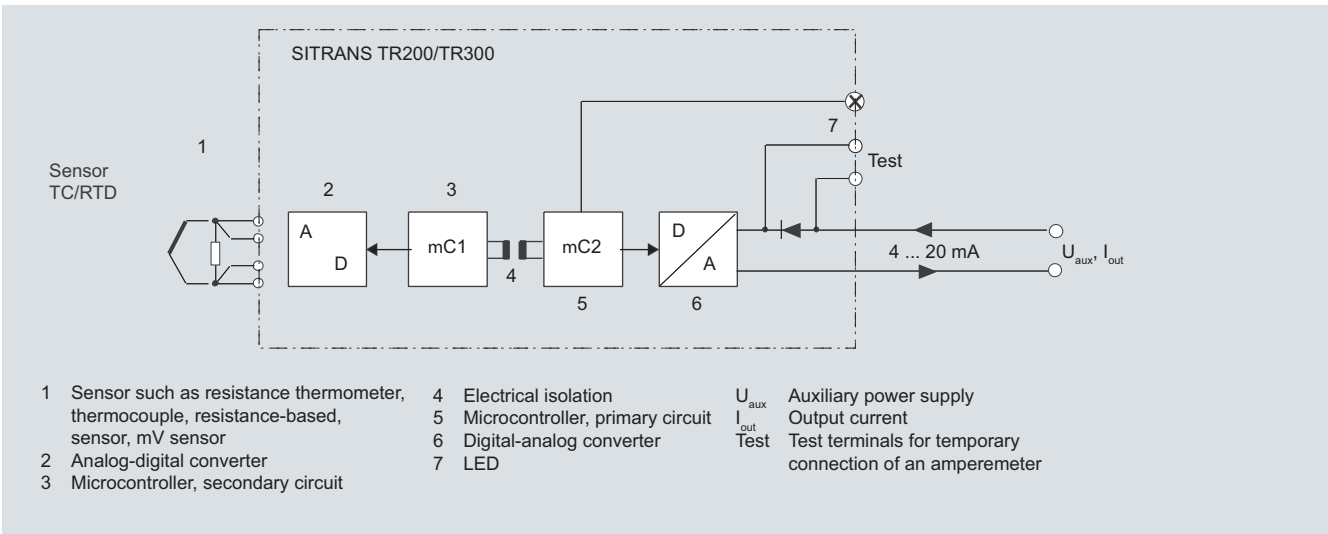
Transmitters of the "intrinsically safe" type of protection can be installed within potentially explosive atmospheres. The devices comply with the Directive 94/9/EC (ATEX).

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.



1 Sensor such as resistance thermometer, thermocouple, resistance-based, sensor, mV sensor
2 Analog-digital converter
3 Microcontroller, secondary circuit
4 Electrical isolation
5 Microcontroller, primary circuit
6 Digital-analog converter
7 LED

U_{aux} Auxiliary power supply
I_{out} Output current
Test Test terminals for temporary connection of an amperemeter

SITRANS TR300 function diagram

Technical specifications

Input	
Resistance thermometer	
Measured variable	Temperature
Sensor type	
• to IEC 60751	Pt25 … Pt1000
• to JIS C 1604; a=0.00392 K^{-1}	Pt25 … Pt1000
• to IEC 60751	Ni25 … Pt1000
• Special type	over special characteristic (max. 30 points)
Sensor factor	0.25 ... 10 (adaptation of the basic type, e.g. Pt100 to version Pt25 ... 1000)
Units	°C or °F
Connection	
• Standard connection	1 resistance thermometer (RTD) in 2-wire, 3-wire or 4-wire system
• Generation of average value	2 identical resistance thermometers in 2-wire system for generation of average temperature
• Generation of difference	2 identical resistance thermometers (RTD) in 2-wire system (RTD 1 – RTD 2 or RTD 2 – RTD 1)
Interface	
• Two-wire system	Parameterizable line resistance ≤ 100 Ω (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time T_{63}	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Always active (cannot be disabled)
Short-circuit monitoring	can be switched on/off (default value: ON)
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	W
Connection	
• Normal connection	1 resistance-based sensor (R) in 2-wire, 3-wire or 4-wire system
• Generation of average value	2 resistance-based sensors in 2-wire system for generation of average value
• Generation of difference	2 resistance thermometers in 2-wire system (R1 – R2 or R2 – R1)
Interface	
• Two-wire system	Parameterizable line resistance ≤ 100 Ω (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time T_{63}	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Always active (cannot be disabled)
Short-circuit monitoring	can be switched on/off (default value: OFF)
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
Thermocouples	
Measured variable	Temperature
Sensor type (thermocouples)	
• Type B	Pt30Rh-Pt6Rh to DIN IEC 584
• Type C	W5 %-Re acc. to ASTM 988
• Type D	W3 %-Re acc. 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 T_{63}	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Can be switched off
Cold junction compensation	
• Internal	With integrated Pt100 resistance thermometer
• External	With external Pt100 IEC 60571 (2-wire or 3-wire connection)
• External fixed	Cold junction temperature can be set as fixed value
Measuring range	parameterizable (see table "Digital measuring errors")
Min. measured span	Min. 40 ... 100 °C (72 ... 180 °F) (see table "Digital measuring errors")
Characteristic curve	Temperature-linear or special characteristic
mV sensor	
Measured variable	DC voltage
Sensor type	DC voltage source (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

SITRANS TR300
two-wire system, universal, HART

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 with communication acc. to HART Rev. 5.9
Auxiliary power	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 ... 20.5 mA)
Error signal (e.g. following sensor fault) (conforming to NE43)	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
Electrical isolation	Input against output (1 kV_{eff})
Measuring accuracy	
Digital measuring errors	see table "Digital measuring errors"
Reference conditions	
• Auxiliary power	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)
Auxiliary power 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 span in the first month
• After one year	< 0.2 % of span after one year
• After 5 years	< 0.3 % of span after 5 years
Conditions of use	
Ambient conditions	
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	Plastic, electronic module potted
Weight	122 g
Dimensions	See "Dimensional drawings"
Cross-section of cables	Max. 2.5 mm² (AWG 13)
Degree of protection to IEC 60529	
• Enclosure	IP20

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

Factory setting:

- Pt100 (IEC 751) with 3-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

Digital measuring errors

Resistance thermometer

Input	Measuring range	Min. measured span		Digital accuracy	
	°C / (°F)	°C	(°F)	°C	(°F)
to IEC 60751					
Pt25	-200 ... +850 (-328 ... +1562)	10	(18)	0.3	(0.54)
Pt50	-200 ... +850 (-328 ... +1562)	10	(18)	0.15	(0.27)
Pt100 ... Pt200	-200 ... +850 (-328 ... +1562)	10	(18)	0.1	(0.18)
Pt500	-200 ... +850 (-328 ... +1562)	10	(18)	0.15	(0.27)
Pt1000	-200 ... +350 (-328 ... +662)	10	(18)	0.15	(0.27)
to JIS C1604-81					
Pt25	-200 ... +649 (-328 ... +1200)	10	(18)	0.3	(0.54)
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)

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

Thermocouples

Input	Measuring range	Min. measured span		Digital accuracy	
	°C / (°F)	°C	(°F)	°C	(°F)
Type B	0 ... 1820 (32 ... 3308)	100	(180)	2[1]	(3.6)[1]
Type C (W5)	0 ... 2300 (32 ... 4172)	100	(180)	2	(3.6)
Type D (W3)	0 ... 2300 (32 ... 4172)	100	(180)	1[2]	(1.8)[2]
Type E	-200 ... +1000 (-328 ... +1832)	50	(90)	1	(1.8)
Type J	-210 ... +1200 (-346 ... +2192)	50	(90)	1	(1.8)
Type K	-230 ... +1370 (-382 ... +2498)	50	(90)	1	(1.8)
Type L	-200 ... +900 (-328 ... +1652)	50	(90)	1	(1.8)
Type N	-200 ... +1300 (-328 ... +2372)	50	(90)	1	(1.8)
Type R	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.6)
Type S	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.6)
Type T	-200 ... +400 (-328 ... +752)	40	(72)	1	(1.8)
Type U	-200 ... +600 (-328 ... +1112)	50	(90)	2	(3.6)

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 0,025 % 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).

Transmitters for rail mounting

SITRANS TR300
two-wire system, universal, HART

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 documentation on CD		
• Without explosion protection	▶ D)	**7NG3033-0JN00**
• with explosion protection to ATEX	▶ D)	**7NG3033-1JN00**
Further designs		Order code
Please add "**-Z**" to Order No. with and specify Order codes(s).		
Customer-specific setting of operating data (specify operating data in plain text)		**Y01**[1]
with test protocol (5 measuring points)		**C11**
Functional safety SIL2		**C20**
Functional safety SIL2/3		**C23**
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	▶ D)	**7MF4997-1DA**
• With USB connection	▶ D)	**7MF4997-1DB**
Simatic PDM operating software		**See Section 9**

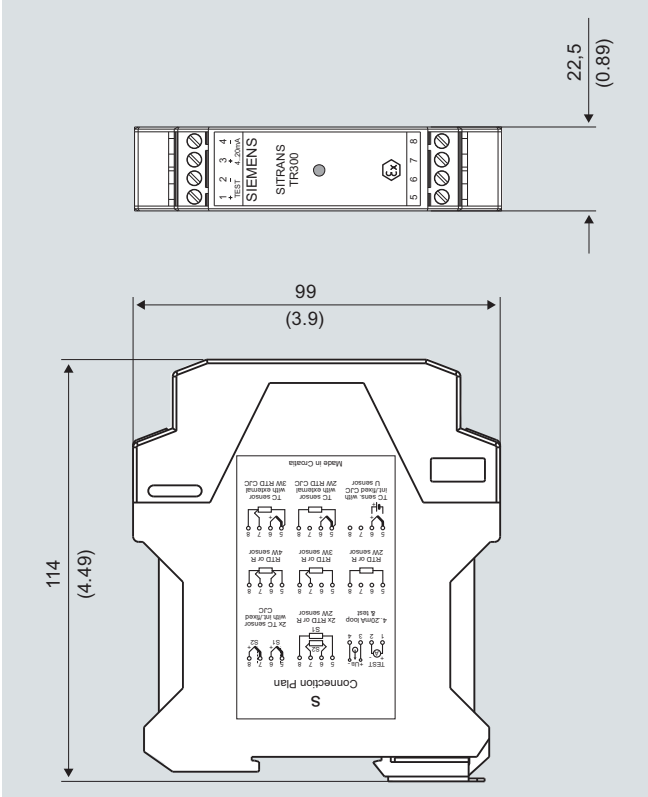
▶ Available ex stock

[1] Y01: Quote all details that deviate from the factory settings (see below).
D) Subject to export regulations AL: N, ECCN: EAR99H.
Supply units see Chap. 8 "Supplementary Components".

Factory setting:

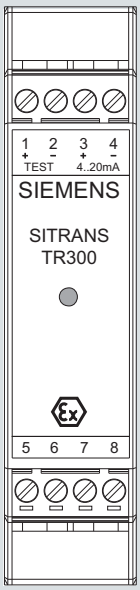
- Pt100 (IEC 751) with 3-wire circuit
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Error signal in the event of sensor breakage: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

Dimensional drawings



SITRANS TR300, dimensions in mm (inch)

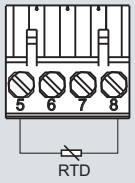
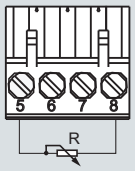
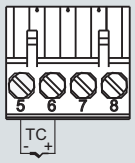
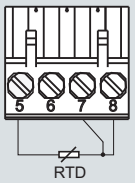
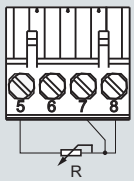
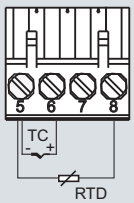
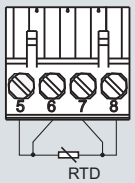
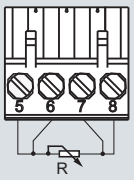
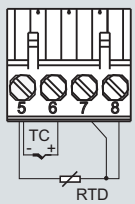
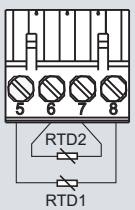
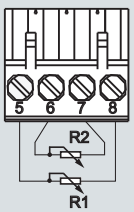
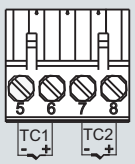
Schematics



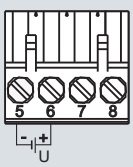
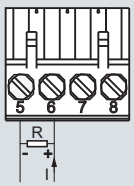
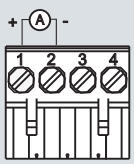
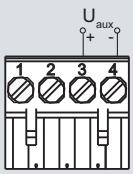
Assignments

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

Resistance thermometer	Resistance	Thermocouple
 Two-wire system [1]	 Two-wire system [1]	 Cold junction compensation Internal/fixed value
 Three-wire system	 Three-wire system	 Cold junction compensation with external Pt100 in two-wire system [1]
 Four-wire system	 Four-wire system	 Cold junction compensation with external Pt100 in three-wire system
 Generation of average value/difference [1]	 Generation of average value/difference [1]	 Generation of average value / difference with internal cold junction compensation

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

Voltage measurement	Current measurement	Test terminals	Power supply/ 4 ... 20 mA (U_{aux})
			

SITRANS TR300, sensor connection assignment

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 thermometer
- Thermocouples
- 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.

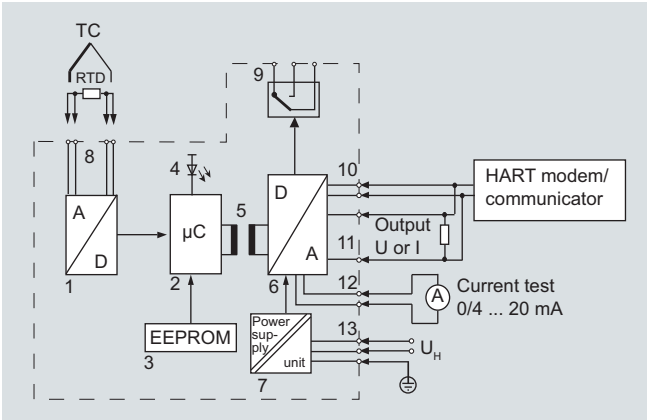
All SITRANS TW control room devices are available in a non-intrinsically safe version as well as in an intrinsically safe version for use with the most stringent requirements.

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 [EEx ia] or [EEx 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
- SIL1

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).

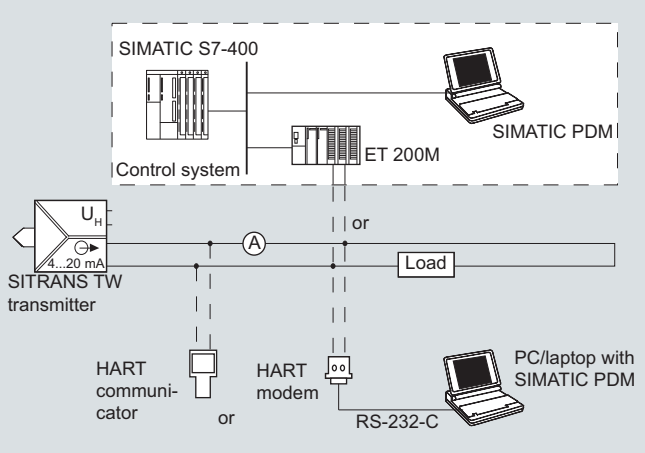
Diagnosis and simulation functions

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.

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
Measuring range	Parameterizable
Measuring span	min. 25 °C (45 °F) x 1/scaling factor
Sensor type	
• Acc. to IEC 751	Pt100 (IEC 751)
• Acc. to JIS C 1604-81	Pt100 (JIS C1604-81)
• to DIN 43760	Ni100 (DIN 43760)
• Special type ($R_{RTD} \leq 500\ \Omega$)	Multiples or parts of the defined characteristic values can be parameterized (e.g. Pt500, Ni120)
Characteristic curve	Temperature-linear, resistance-linear or customer-specific
Type of connection	• Normal connection • Sum or parallel connection • Mean-value or differential connection
Interface	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 sensor, potentiometer	
Measured variable	Actual resistance
Measuring range	Parameterizable
Measuring span	min. 10 Ω
Characteristic curve	Resistance-linear or customer-specific
Type of connection	• Normal connection • Differential connection • Mean-value connection
Interface	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)

Transmitters for rail mounting

SITRANS TW
four-wire system, universal, HART

Thermocouples	
Measured variable	Temperature
Measuring range	Parameterizable
Measuring span	min. 50 °C (90 °F) x 1/scaling factor
Measuring range limits	Depend. on type of thermocouple element
Thermocouple element	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)
Characteristic curve	Temperature-linear, voltage-linear or customer-specific
Type of connection	• Normal connection
	• Averaging connection
	• Mean-value connection
	• Differential connection
Cold junction compensation	None, internal measurement, external measurement or predefined fixed value
Sensor breakage monitoring	Function can be switched off
mV sensors	
Measured variable	DC voltage
Measuring range	Parameterizable
Measuring span	min. 4 mV
Input range	-120 ... +1000mV
Characteristic curve	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
Measuring range	Parameterizable
Characteristic curve	Voltage-linear or customer-specific
Input range/min. span	
• Devices with 7NG3242-xxxx**1** or 7NG3242-xxxx**0** with U/I plug	-1.2 ... + 10 V/0.04 V
• Devices with 7NG3242-xxxx**2**	-12 ... +100 V/0.4 V
• Devices with 7NG3242-xxxx**3**	-120 ... +140 V/4.0 V
Sensor breakage monitoring	Not possible

µA-, mA sources	
Measured variable	DC voltage
Measuring range	Parameterizable
Characteristic curve	Current-linear or customer- specific
Input range/min. span	
• Devices with 7NG3242-xxxx**4**	-12 ... +100 µA/0.4 µA
• Devices with 7NG3242-xxxx**5**	-120 ... +1000 µA/4 µA
• Devices with 7NG3242-xxxx**6**	-1.2 ... +10 mA/0.04 mA
• Devices with 7NG3242-xxxx**7** or 7NG3242-xxxx**0** with U/I plug	-12 ... +100 mA/0.4 mA
• Devices with 7NG3242-xxxx**8**	-120 ... +1000 mA/4 mA
Sensor breakage monitoring	Not possible
Output	
Output signal	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 (conforming to NE43)	-0.5 ... +23.0 mA, continuously adjustable
• Load	≤ 650 Ω
• No-load 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 current	≤ 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	By operation indicator, relay output or HART interface
Operation indicator	Flashing signal
• Limit violation	Flashing frequency 5 Hz
• Sensor fault monitoring	Flashing frequency 1 Hz
Relay outputs	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	≤ 2.5 A DC
Sensor fault monitoring	Signalling of sensor or line breakage and sensor short-circuit
Limit monitoring	
• Operating delay	0 ... 10 s
• Monitoring functions of limit module	• 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

Auxiliary power	
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
Electrically isolated	
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_{rms} between any two terminals must not exceed 300 V
Measuring accuracy	
Accuracy	
• Error in the internal cold junction	≤ 3 °C ± 0.1 °C / 10 °C (≤ 5.4 °F ± 0.18 °F / 18 °F)
• Error of external cold junction terminal 7NG3092-8AV	≤ 0.5 °C ± 0.1 °C / 10 °C (≤ 0.9 °F ± 0.18 °F / 18 °F)
• Digital output	See "Digital error"
• Analog output I_{AN} or U_{AN}	≤ 0.05 % of the span plus digital error
Influencing effects (referred to the digital output)	Compared to the max. span:
• Temperature drift	≤ 0.08 % / 10 °C (≤ 0.08 % /18 °F) ≤ 0.2 % in the range -10 ... +60 °C (14 ... 140 °F)
• Long-term drift	≤ 0.1 % / year
Influencing effects referred to the analog output I_{AN} or U_{AN}	Compared to the span:
• Temperature drift	≤ 0.08 % / 10°C (≤ 0.08 % / 18 °F) ≤ 0.2 % in the range -10 ... +60 °C (14 ... 140 °F)
• Power supply	≤ 0.05 % / 10 V
• Load with current output	≤ 0.05 % on change from 50 Ω to 650 Ω
• Load with voltage output	≤ 0.1 % on change in the load current from 0 mA to 10 mA
• Long-term drift (start-of-scale value, span)	≤ 0.03 % / month
Response time (T_{63} without electrical damping)	≤ 0.2 s
Electromagnetic compatibility	According to EN 61 326 and NAMUR NE21

Certificates and approvals	
ATEX	To DIN EN 50014: 1997, EN 50020: 1994
Intrinsic safety to EN 50 020	
• for 7NG3242-x**A**xxx	II (1) G D [EEx ia/ib] IIB
• for 7NG3242-x**B**xxx	II (1) G D [EEx ia/ib] IIC
EC type-examination certificate	TÜV (German Technical Inspectorate) 01 ATEX 1675
Other certificates	GOST
Conditions of use	
Installation conditions	
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)
Ambient conditions	
Permissible ambient temperature	-25 ... +70 °C (-13 ... +158 °F)
Permissible storage temperature	-40 ... +85 °C (-40 ... +185 °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 DIN rail (1.38 inch) (EN 50022) or 32-mm G-type rail (1.26 inch) (EN 50035)
Electrical connection / process connection	Screw plug connectors, max. 2.5 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 TW
four-wire system, universal, HART

Digital error

Resistance thermometer

Input	Measuring range	Max. permissible line resistance	Digital error
	°C / (°F)	Ω	°C / (°F)
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	Measuring 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

Thermocouples

Input	Measuring 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 ... +2501)	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

Ordering examples

Desired transmitter	Parameter: Standard	Parameter: Special	Ordering design
Example 1:			7NG3242-1AA00 (stock item)
SITRANS TW, transmitter in four-wire system			
• with explosion protection ATEX			
• 230 V AC/DC power supply			
• current output			
• without sensor fault/limit monitor			
- Sensor PT100, three-wire circuit	X		
- Measuring range 0 ... 150 °C	X		
- Temperature-linear characteristic	X		
- Filter time 1 s	X		
- Output 4 ... 20 mA, line filter 50 Hz	X		
- Output driven to full-scale in event of like breakage	X		
Example 2:			7NG3242-0BB10-Z Y01 + S76 + A05 + Y30 + H10 Y01: see Order code Y30: MA=0; ME= 950; D=C
SITRANS TW, transmitter in four-wire system			
• without explosion protection			
• 24 V AC/DC power supply			
• Voltage output			
• Sensor fault/limit monitor			
- Rating plate in English		S76	
- Sensor NiCr/Ni, type K		A05	
- Cold junction internal	X		
- Measuring range 0 ... 950 °C		Y30	
- Temperature-linear characteristic	X		
- Filter time 1 s	X		
- Output 0 ... 10 V, line filter 50 Hz		H10	
- Output driven to full-scale in event of like breakage	X		
- Limit monitoring switched off	X		
Example 3:			7NG3242-0BA01-Z Y01 + A40 + Y32 + G07 + H11 + J03 Y01: see Order code Y32: MA=0; ME= 5; D=V
SITRANS TW, transmitter in four-wire system			
• without explosion protection			
• 24 V AC/DC power supply			
• Current output			
• without sensor fault/limit monitor			
- Voltage input, measuring range -1.2 V ... +10 V		A40	
- Measuring range 0 ... 5 V		Y32	
- Source-proportional characteristic	X		
- Filter time 10 s		G07	
- Output 0 ... 20 mA, line filter 60 Hz		H11	
- No monitoring for sensor fault	(X)	J03	

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.

Transmitters for rail mounting

SITRANS TW
four-wire system, universal, HART

Selection and Ordering data		Order No.
SITRANS TW universal transmitter for rail mounting, in four-wire system (order instruction manual separately)	►	**7NG3242-**
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:		
- -1.2 ... +10 V DC		**1**
- -12 ... +100 V DC (not Ex version)		**2**
- -120 ... +140 V DC (not Ex version)		**3**
• Current input (µA, mA sources) [1] Measuring range:		
- -12 ... +100 µA DC		**4**
- -120 ... +1000 µA DC		**5**
- -1.2 ... +10 mA DC		**6**
- -12 ... +100 mA DC		**7**
- -120 ... +1000 mA DC		**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	► D)	**7MF4997-1DA**
• with USB interface	► D)	**7MF4997-1DB**

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

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 ■■ | ■■■ | + | ■■■ | + | ■■■ | + | ■■■ | + | ■■■

Sensor

Thermocouples Type	Temperature range		**Connection**			**Cold junction compensation**			**Measuring ranges**	
B: Pt30 %Rh/Pt6 %Rh	0 ... 1820 °C	A00	Standard		B01	None	C00		-30 ... +60 °C	E00
C:W5 %Re	0 ... 2300 °C	A01	Sum n [1]	n = 2	B02	Internal	C10		-20 ... +20 °C	E01
D:W3 %Re	0 ... 2300 °C	A02		...	...	Fixed val. 0 °C	C20		0 ... 40 °C	E02
E:NiCr/CuNi	-200 ... +1000 °C	A03		n = 10	B10	20 °C	C22		0 ... 60 °C	E03
J:Fe/CuNi (IEC)	-210 ... +1200 °C	A04	Difference [2]	Diff1	B31	50 °C	C25		0 ... 80 °C	E04
K:NiCr/Ni	-200 ... +1372 °C	A05		Diff2	B32	60 °C	C26		0 ... 100 °C	E05
L: Fe/CuNi (DIN)	-200 ... +900 °C	A06	Mean-val. [2]	MW	B41	70 °C	C27		0 ... 120 °C	E06
N:NiCrSi/NiSi	-200 ... +1300 °C	A07				Special value [7]	Y10		0 ... 150 °C	E07
R:Pt13 %Rh/Pt	-50 ... +1760 °C	A08				External meas. (through Pt100 DIN IEC 751) [7]	Y11		0 ... 200 °C	E08
S:Pt10 %Rh/Pt	-50 ... +1760 °C	A09							0 ... 250 °C	E09
T:Cu/CuNi (IEC)	-200 ... +400 °C	A10							0 ... 300 °C	E10
U:Cu/CuNi (DIN)	-200 ... +600 °C	A11							0 ... 350 °C	E11
									0 ... 400 °C	E12
Resistance thermometer (or max. permissible line resistance see „Technical specifications“)			**Connection**			**Connection**		**Line resistance [3]**		0 ... 450 °C	E13
										0 ... 500 °C	E14
										0 ... 600 °C	E15
Pt100 (DIN IEC)	-200 ... +850 °C	A20	Standard		B01	2-wire-system	C32	0 Ω	D00	0 ... 700 °C	E16
Pt100 (JIS)	-200 ... +649 °C	A21	Sum n [4]	n = 2	B02	3-wire-system	C33	10 Ω	D10	0 ... 800 °C	E17
Ni100 (DIN)	-60 ... +250 °C	A22		...	...	4-wire-system	C34	20 Ω	D20	0 ... 900 °C	E18
				n = 10	B10			50 Ω	D50	0 ... 1000 °C	E19
			Parallel n [5]	n = 0.1	B21			Special val. [7]	Y20	0 ... 1200 °C	E20
				n= 0.2	B22					0 ... 1400 °C	E21
				n= 0.5	B25					0 ... 1600 °C	E22
			Special value [6] [7]		Y00					0 ... 1800 °C	E23
			Difference [2]	Diff1	B51					50 ... 100 °C	E24
				Diff2	B52					50 ... 150 °C	E25
			Mean-val. [2]	MW	B61					100 ... 200 °C	E26
										100 ... 300 °C	E27
										100 ... 400 °C	E28
										200 ... 300 °C	E29
										200 ... 400 °C	E30
										200 ... 500 °C	E31
										300 ... 600 °C	E32
										500 ... 1000 °C	E33
										600 ... 1200 °C	E34
										800 ... 1600 °C	E35
										Special range [7]	Y30

Resistance-based sensors, potentiometers		**Connection**			**Connection**		**Line resistance [3]**		**Measuring ranges**	
(or max. permissible line resistance see „Technical specifications“)	A30	Standard		B01	2-wire-system	C32	0 Ω	D00	0 ... 100 Ω	E40
		Difference [2]	Diff1	B51	3-wire-system	C33	10 Ω	D10	0 ... 200 Ω	E41
			Diff2	B52	4-wire-system	C34	20 Ω	D20	0 ... 500 Ω	E42
		Mean val.[2]	MW	B61			50 Ω	D50	0 ... 1000 Ω	E43
							Special val. [7]	Y20	0 ... 2500 Ω	E44
									0 ... 5000 Ω [8]	E45
									0 ... 6000 Ω [8]	E46
									Special range [7]	Y31

mV, V and µA, mA sensors [9]	A40	**Meas. range with Order No. 7NG 3242 - ■■■■**	**-Z Y01**	
		0	-120 ... +1000 mV	E50
		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]	Y32

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

SITRANS TW
four-wire system, universal, HART

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

Type	Temperature range	
B: Pt30 %Rh/	0 ... 1820 °C	A00
C:W5 %Re	0 ... 2300 °C	A01
D:W3 %Re	0 ... 2300 °C	A02
E:NiCr/CuNi	-200 ... +1000 °C	A03
J:Fe/CuNi (IEC)	-210 ... +1200 °C	A04
K:NiCr/Ni	-200 ... +1372 °C	A05
L: Fe/CuNi (DIN)	-200 ... +900 °C	A06
N:NiCrSi/NiSi	-200 ... +1300 °C	A07
R:Pt13 %Rh/Pt	-50 ... +1760 °C	A08
S:Pt10 %Rh/Pt	-50 ... +1760 °C	A09
T:Cu/CuNi (IEC)	-200 ... +400 °C	A10
U:Cu/CuNi (DIN)	-200 ... +600 °C	A11

Voltage measurement

Temperature-linear	F00
Voltage-linear	F10

Filter time[1]

0 s	G00
0.1 s	G01
0.2 s	G02
0.5 s	G03
1 s	G04
2 s	G05
5 s	G06
10 s	G07
20 s	G08
50 s	G09
100 s	G10
Special time[5]	Y50

Output signal and line filter[2]

4 ... 20 mA/ 2 ... 10 V	
with line filter:	
50 Hz	H00
60 Hz	H01
10 Hz[4]	H02
0 ... 20 mA/ 0 ... 10 V	
with line filter:	
50 Hz	H10
60 Hz	H11
10 Hz	H12

Failure signal

with line breakage/fault:	
to full scale	J00
to start of scale	J01
hold last value	J02
no monitoring	J03
Safety value[5]	Y60

Limit monitor[3]

Limit monitoring ineffective (but sensor fault signalling with closed-circuit operation)	K00
Effective[5]	Y70

Resistance thermometer
(max. permissible line resistances see „Technical specifications“)

Pt100 (DIN IEC)	-200 ... +850 °C	A20
Pt100 (JIS)	-200 ... +649 °C	A21
Ni100 (DIN)	-60 ... +250 °C	A22

Voltage measurement

Temperature-linear	F00
Resistance-linear	F20

Filter time[1]: same as for thermocouple elements

Output signal and line filter[2]: same as for thermocouple elements

Failure signal

with line breakage/fault:	
to full scale	J00
to start of scale	J01
hold last value	J02
no monitoring	J03
Safety value[5]	Y60
with line breakage or short-circuit/fault:	
to full scale	J10
to start of scale	J11
hold last value	J12
no monitoring	J13
Safety value[5]	Y61

Limit monitor[3]: same as for thermocouple elements

Resistance-based sensors, potentiometers
(max. permissible line resistances see „Technical specifications“) A30

Voltage measurement

Resistance-linear	F20

Filter time[1]: same as for thermocouple elements

Output signal and line filter[2]: same as for thermocouple elements

Failure signal

with line breakage/fault:	
to full scale	J00
to start of scale	J01
hold last value	J02
no monitoring	J03
Safety value[5]	Y60

Limit monitor[3]: same as for thermocouple elements

mV, V and µA, mA sources A40

Voltage measurement

Source proportional	F30

Filter time[1]: same as for thermocouple elements

Output signal and line filter[2]: same as for thermocouple elements

Limit monitor[3]: same as for thermocouple elements

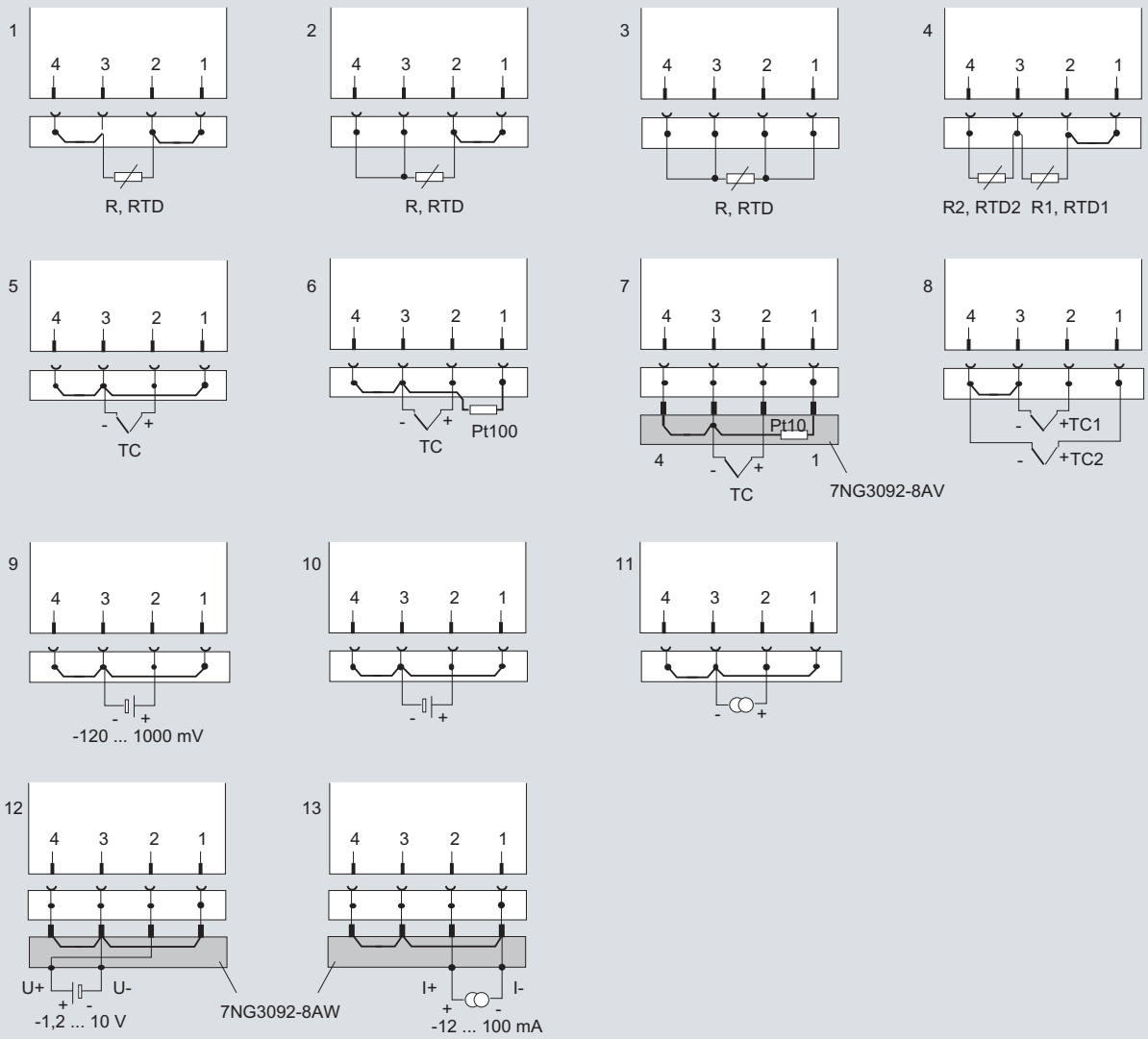
1) Software filter to smooth the result
2) Filter to suppress line disturbances on the measured signal.
3) If signalling relay present
4) for special appliciations
5) Operating data: see „Special operating data“

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=□□□□.□□	Temperature TV of the fixed cold junction
	D=□	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=□□□□.□□	Start-of-scale value MA and full-scale value ME for thermocouples and resistance thermometers
		(Range of values depending on type of sensor)
	D=□	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=□□□□.□□	Start-of-scale value MA and full-scale value ME for mV, V, µA and mA sources
		Range of values depending on type of sensor: -120.00 to 1,000.00
	D=□□	Dimension (mV entered as MV, V as V, µA 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=□□□□.□□	Lower limit value (dimension as defined by measuring range)
	OG=□□□□.□□	Upper limit value (dimension as defined by measuring range)
	H=□□□□.□□	Hysteresis (dimension as defined by measuring range)
	K=□	Switch on/off combination of limit function and sensor fault detection; J=on; N=off (standard: J)
	A=□	Type of relay output: A=open-circuit operation; R=closed-circuit operation (standard: R)
	T=□□.□	Switching delay T of relay output in s
		Range of values: 0.0 to 10.0 (standard: 0.0)

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 internalcold 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 7NG3092-8AW (7NG3242-xxxx0)

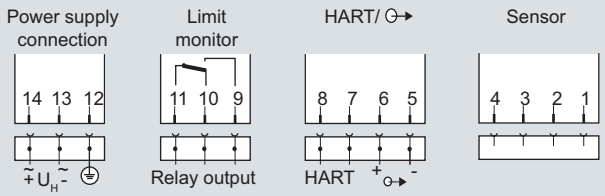
13 Current measurement -12 to 100 mA with U/I plug 7NG3092-8AW (7NG3242-xxxx0)

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	½ · (Channel 1 + Channel 2)

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



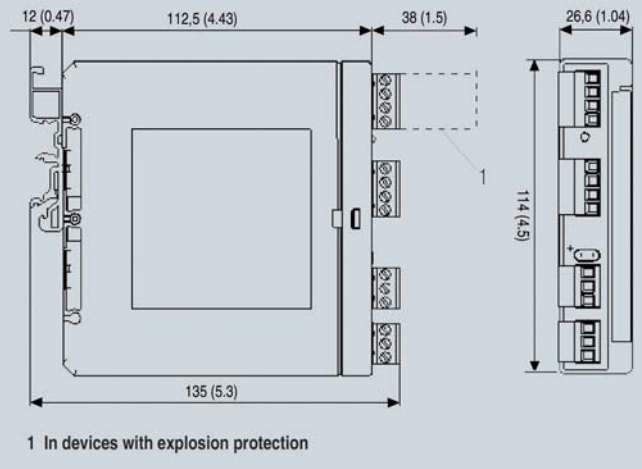
1 to 4	Signal input (see "Sensor input connections" for possible types of connection)
5, 6	Analog output (U or I output parameterizable using plug-in jumpers)
7, 8	Connection with HART communication for local parameterization
9 to 11	Output for sensor fault/limit monitor as relay contact (see below for possible parameterization)
12	PE connection
13, 14	Power supply input (protected against reverse polarity)

Connection diagram for power supply, input and outputs

Relay outputs

	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 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 WirelessHART 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. Alternatively the device can be commissioned comfortably by means of the local push-buttons w/o any additional handset devices.

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.

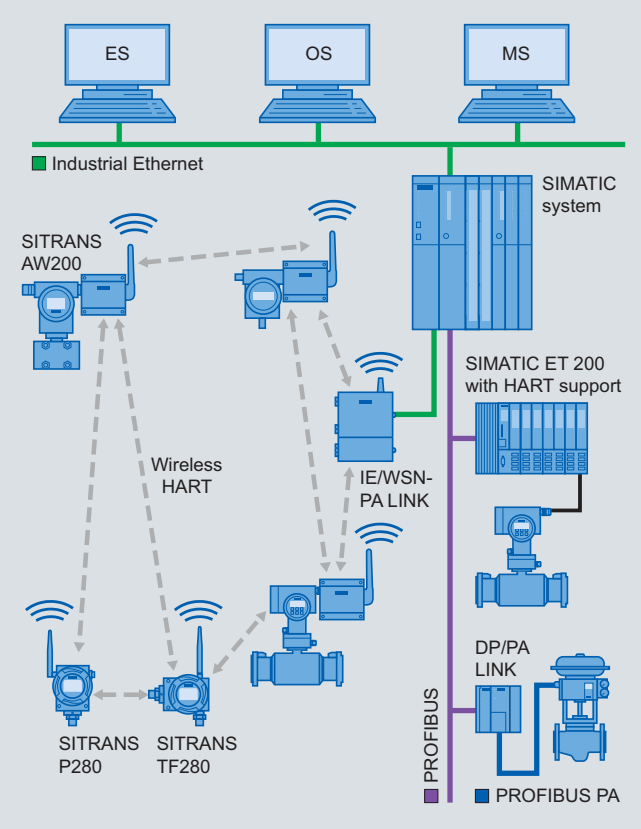
Detailed information on IE/WSN-PA LINK can be found in the FI 01 catalogue Sec. 9 or www.siemens.com/wirelesshart.

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. Siemens WirelessHART devices operate with optimum coexistence to SCALANCE W family products.



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.

The data in the following table refer to the transmitter only excluding a connected sensor, except as noted otherwise.

Input	
Sensor	
• Sensor type	Pt100 as per IEC 751/DIN EN 60751[1)]
• 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[2)]	
Accuracy	< 0.04 % of the measured value
Long-term drift	< 0.035 % of the measuring range in first year
Ambient temperature effect	max. 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

SITRANS TF280 WirelessHART

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

1) Pre-mounted Pt100: Class A (maximum MES: 0.15 + 0.002*|t| °C)

2) Calculation for errors:
Probable total error = $\sqrt{(MES^2 + AET^2 + LTD^2 + ATE^2)}$
Max. error = MES + AET + LTD + ATE
|t|: Absolut value of measured temperature
MES: Measurement error of sensor
AET: Accuracy error transmitter
LTD: Long term drift
ATE: Ambient temperature drift

Selection and Ordering data		Order No.
SITRANS TF280 WirelessHART Temperature transmitter (Required battery not included with delivery, see accessories)	▶ D)	**7MP1110-0A ■■■-0■■0**
Connections/cable entry		
Cable gland M20x1.5[1] 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		Order code
Please add "-Z" to Order No. and specify Order code(s) and plain text.		
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	▶ D)	**7MP1990-0AA00**
Mounting bracket, steel		**7MF4997-1AC**
Mounting bracket, stainless steel	▶	**7MF4997-1AJ**
Cover, die-cast aluminum, without window	▶ F)	**7MF4997-1BB**
Cover, die-cast aluminum, with window	F)	**7MF4997-1BE**
Thread adapter M20x1.5 (male thread) on ½-14 NP (female thread)	▶	**7MP1990-0BA00**
Thread adapter M20x1.5 (male thread) on G½B (female thread)	▶	**7MP1990-0BB00**
IE/WSN-PA Link		**see Sec. 9**
HART modem with RS232 interface	▶ D)	**7MF4997-1DA**
HART modem with USB interface	▶	**7MF4997-1DB**
SIMATIC PDM		**see Sec. 9**

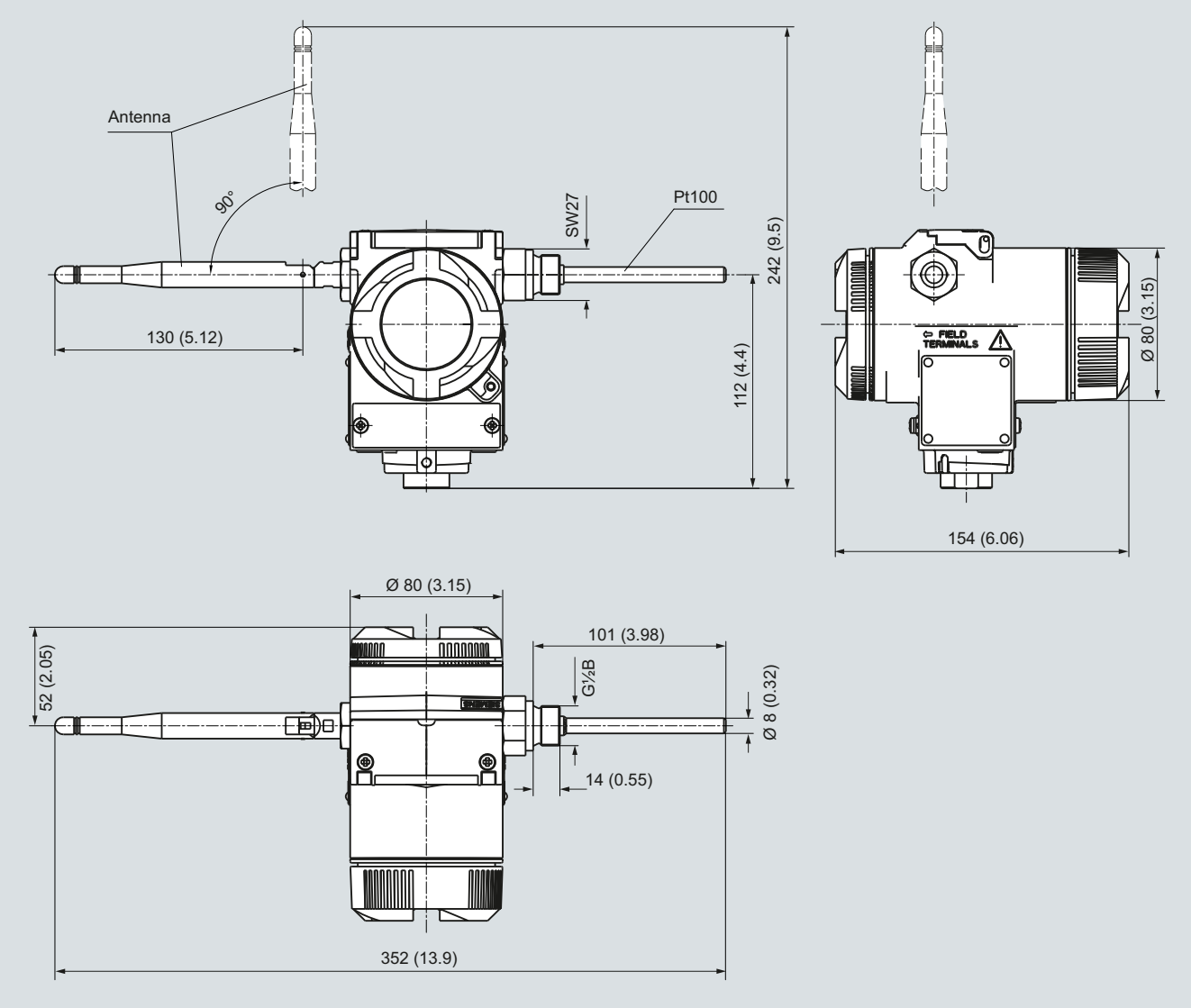
▶ Available ex stock

1) Please order sensor separately.

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

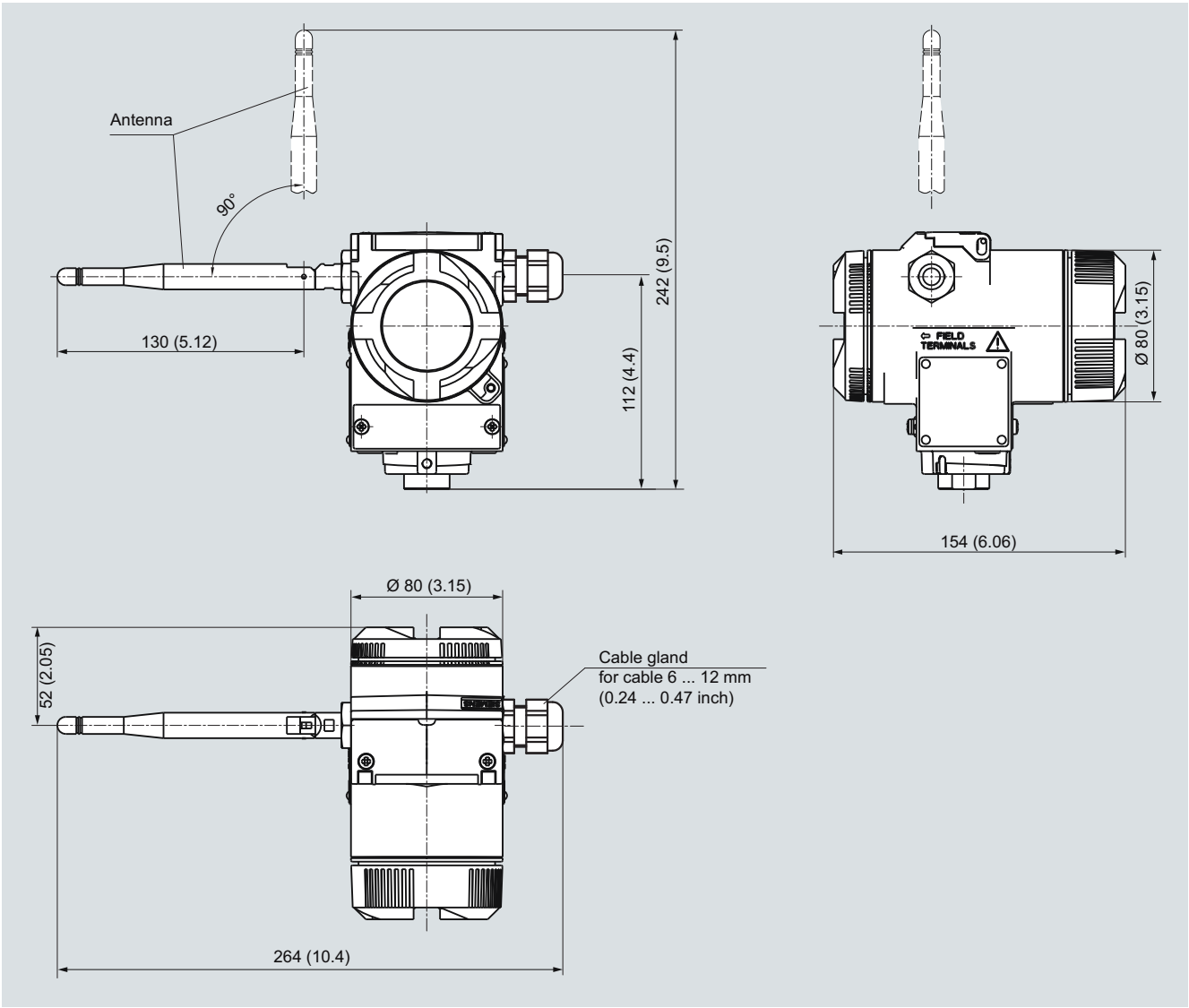
F) Subject to export regulations AL:9I999, ECCN: N.

Dimensional drawings



SITRANS TF280 WirelessHART temperature transmitter with Pt100, dimensions in mm (inch).
Please see the dimensional drawing of the mounting bracket on page 2/146.

SITRANS TF280 WirelessHART



SITRANS TF280 WirelessHART temperature transmitter, dimensions in mm (inch)
Please see the dimensional drawing of the mounting bracket on page 2/146.

Overview

Our field devices for heavy industrial use

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

The temperature transmitter SITRANS TF works where others feel uncomfortable.

Benefits

- Universal use
  - as transmitter for resistance thermometer, thermocouple element, 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
- Degree 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 hard to access,
  - 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 protections, for Europe and USA.
- SIL2 (with order code C20), SIL2/3 (with C23)

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 almost completely 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 TK. 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

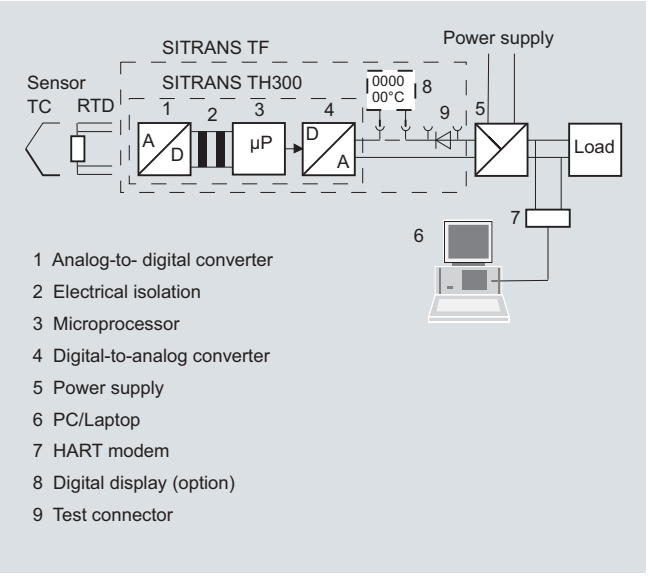
The sensor signal, whether resistance thermometer, thermocouple element or Ω or mV signal, is amplified and linearized. Sensor and output side are electrically isolated. An internal cold junction is integrated for measurements with thermocouple elements.

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 version 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.



Mode of operation: SITRANS TF with integrated transmitter and digital display

Technical specifications

Input	
Resistance thermometer	
Measured variable	Temperature
Sensor type	
• to IEC 60751	Pt25 … Pt1000
• to JIS C 1604; a=0.00392 K-1	Pt25 … Pt1000
• to IEC 60751	Ni25 … Ni1000
Units	°C and °F
Connection	
• Normal connection	1 resistance thermometer (RTD) in 2-wire, 3-wire or 4-wire system
• Generation of average value	Series or parallel connection of several resistance thermometers in a two-wire system for the generation of average temperatures or for adaptation to other device types
• Generation of difference	2 resistance thermometers (RTD) in 2-wire system (RTD 1 – RTD 2 or RTD 2 – RTD 1)
Interface	
• Two-wire system	Parameterizable line resistance ≤ 100 Ω (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Always active (cannot be disabled)
Short-circuit monitoring	can be switched on/off (default value: ON)
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-based sensor in 2-wire system (R 1 – R 2 or R 2 – R 1)
Interface	
• Two-wire system	Parameterizable line resistance ≤ 100 Ω (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Can be switched off
Short-circuit monitoring	Can be switched off (value is adjustable)
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
Thermocouples	
Measured variable	Temperature
Sensor type (thermocouples)	
• Type B	Pt30Rh-Pt6Rh to DIN IEC 584
• Type C	W5 %-Re acc. to ASTM 988
• Type D	W3 %-Re acc. 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	
• Normal 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 60751 (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. 40 ... 100 °C (72 ... 180 °F) (see table "Digital measuring errors")
Characteristic curve	Temperature-linear or special characteristic
mV sensor	
Measured variable	DC voltage
Sensor type	DC voltage source (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
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
Communication with SITRANS TH300	acc. 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	-99 999 ... + 99 999
Units	any (max. 5 char.)
Setting: Zero point, full-scale value and unit	with 3 buttons
Load voltage	2.1 V
Measuring accuracy	
Digital measuring errors	See table "Digital measuring errors"
Reference conditions	
• Auxiliary power	24 V ± 1 %
• Load	500 Ω
• Ambient 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)
Influence of ambient temperature	
• Analog measuring error	0.02 % of span/10 °C (18 °F)
• Digital measuring errors	
- with resistance thermometers	0.06 °C (0.11 °F)/10°C (18 °F)
- with thermocouples	0.6 °C (1.1 °F)/10°C (18 °F)
Auxiliary power 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 span
• After one year	< 0.3 % of span
• After 5 years	< 0.4 % of span
Conditions of use	
Ambient conditions	
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
Construction	
Weight	Approx. 1.5 kg (3.3 lb) without options
Dimensions	See "Dimensional drawings"
Enclosure material	Die-cast aluminum, low in copper, GD-AlSi 12 or stainless steel, polyester-based lacquer, stainless steel rating plate
Electrical connection, sensor connection	Screw terminals, cable inlet via M20 x 1.5 or ½-14 NPT screwed gland
Mounting bracket (optional)	Steel, galvanized and chrome-plated or stainless steel

Auxiliary power	
Without digital display	11 to 35 V DC (30 V with Ex)
With digital display	13.1 to 35 V DC (30 V with Ex)
Electrically isolated	Between input and output
• Test voltage	U_{eff} = 1 kV, 50 Hz, 1 min
Certificates and approvals	
Explosion protection ATEX	
• "Intrinsic safety" type of protection	with digital display: II 2 (1) G EEx ia IIC T4 without digital display: II 2 (1) G EEx ia IIC T6
- EC type test certificate	ZELM 99 ATEX 0007
• "Operating equipment that is non-ignitable and has limited energy for zone 2" type of protection	II 3G EEx nAL IIC T6/T4
- EC type test certificate	ZELM 99 ATEX 0007
• "Flame-proof enclosure" type of protection	II 2 G EEx d IIC T5/T6 II 1D Ex tD A20 IP65 T100 °C, T85 °C
- EC type test certificate	CESI 99 ATEX 079
Explosion protection to FM	Certificate of Compliance 3017742
• Identification (XP, DIP, NI, S)	• XP/I/1/BCD/T5 Ta = 85 °C (185 °F), T6 Ta = 50 °C (112 °F), Type 4X • DIP/II, III/1/EFG/T5 Ta = 85 °C (185 °F), T6 Ta = 50 °C (112 °F), Type 4X • NI/I/2/ABCD/T5 Ta = 85 °C (185 °F), T6 Ta = 50 °C (112 °F) , Type 4X • S/II, III/2/FG/T5 Ta = 85 °C (185 °F), T6 Ta = 50 °C (112 °F), Type 4X
Other certificates	GOST
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 5.9

Factory setting (transmitter):

- Pt100 (IEC 751) with 3-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 TF - Transmitter, two-wire system and SITRANS TF - Field indicator for 4 to 20 mA

Digital measuring errors

Resistance thermometer

Input	Measuring range	Min. measured span		Digital accuracy	
	°C / (°F)	°C)	(°F)	°C	(°F)
to IEC 60751					
Pt25	-200 ... +850 (-328 ... +1562)	10	(18)	0.3	(0.54)
Pt50	-200 ... +850 (-328 ... +1562)	10	(18)	0.15	(0.27)
Pt100 ... Pt200	-200 ... +850 (-328 ... +1562)	10	(18)	0.1	(0.18)
Pt500	-200 ... +850 (-328 ... +1562)	10	(18)	0.15	(0.27)
Pt1000	-200 ... +350 (-328 ... +662)	10	(18)	0.15	(0.27)
to JIS C1604-81					
Pt25	-200 ... +649 (-328 ... +1200)	10	(18)	0.3	(0.54)
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)

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

Thermocouples

Input	Measuring range	Min. measured span		Digital accuracy	
	°C / (°F)	°C	(°F)	°C	(°F)
Type B	0 ... 1820 (32 ... 3308)	100	(180)	2 [1]	(3.6) [1]
Type C (W5)	0 ... 2300 (32 ... 4172)	100	(180)	1 [2]	(1.8) [2]
Type D (W3)	0 ... 2300 (32 ... 4172)	100	(180)	1[2]	(1.8)[2]
Type E	-200 ... +1000 (-328 ... +1832)	50	(90)	1	(1.8)
Type J	-210 ... +1200 (-346 ... +2192)	50	(90)	1	(1.8)
Type K	-200 ... +1370 (-328 ... +2498)	50	(90)	1	(1.8)
Type L	-200 ... +900 (-328 ... +1652)	50	(90)	1	(1.8)
Type N	-200 ... +1300 (-328 ... +2372)	50	(90)	1	(1.8)
Type R	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.6)
Type S	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.6)
Type T	-20 ... +400 (-328 ... +752)	40	(72)	1	(1.8)
Type U	-200 ... +600 (-328 ... +1112)	50	(90)	2	(3.6)

[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 span	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 0.025 % 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.

		Order No.
Temperature transmitter in field housing Two-wire system 4 ... 20 mA, with electrical isolation, with documentation on CD-ROM		**7NG313 - ■■■■**
Integrated transmitter		
• SITRANS TH200, programmable		
- without Ex protection	D)	**5 0**
- with EEx ia	D)	**5 1**
- with EEx nAL for zone 2	D)	**5 2**
- total device SITRANS TF EEx d[1]	D)	**5 4**
- total device SITRANS TF according to FM (XP, DIP, NI, S)[1]	D)	**5 5**
• SITRANS TH300, communication capability according to HART V 5.9		
- without Ex-protection	D)	**6 0**
- with EEx ia	D)	**6 1**
- with EEx nAL for zone 2	D)	**6 2**
- total device SITRANS TF EEx d[1]	D)	**6 4**
- total device SITRANS TF according to FM (XP, DIP, NI, S)[1]	D)	**6 5**
SITRANS TF field indicator for 4 ... 20 mA signals, with documentation on CD-ROM		**7NG313 - ■■■■**
• 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		**Y01**[2]
Inscription on measuring-point label (TAG plate)		
• measuring range (max. 27 characters)		**Y22**[3]
• meas. point description (max. 16 char.)		**Y23**[3]
• measuring point text (max. 27 char.)		**Y24**[3]
Test protocol (5 measuring points)		**C11**[4]
Functional safety SIL2		**C20**[5]
Functional safety SIL2/3		**C23**[5]
Explosion protection		
Explosion protection EEx ia to INMERTO (Brazil) (only with 7NG313.-1....)		**E25**
Explosion protection EEx d to INMERTO (Brazil) (only with 7NG313.-4....)		**E26**

Supply units see Chap. 8 "Supplementary Components".

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.

		Order No.
Accessories		
Modem for SITRANS TH100, TH200 and TR200 incl. parameterization software T		
• with USB interface	▶	**7NG3092-8KU**
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**
HART modem		
• with RS 232 interface	▶ D)	**7MF4997-1DA**
• with USB interface	▶ D)	**7MF4997-1DB**
SIMATIC PDM parameterization software also for SITRANS TH300		**see chap. 9**
Mounting bracket and securing parts		
• made of steel for 7NG313.-..B..		**7MF4997-1AC**
• made of steel for 7NG313.-..C..		**7MF4997-1AB**
• made of stainless steel for 7NG313.-..B..	▶	**7MF4997-1AJ**
• made of stainless steel for 7NG313.-..C..		**7MF4997-1AH**
Digital indicator[1]		**7MF4997-1BS**
Connection board		**A5E02226423**

▶ Available ex stock.
Supply units see Chap. 8 "Supplementary Components".

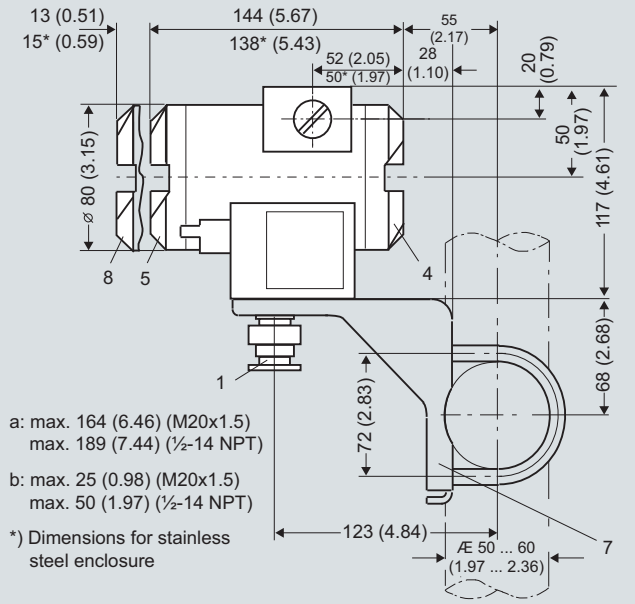
1) It is not possible to upgrade devices with Ex protection

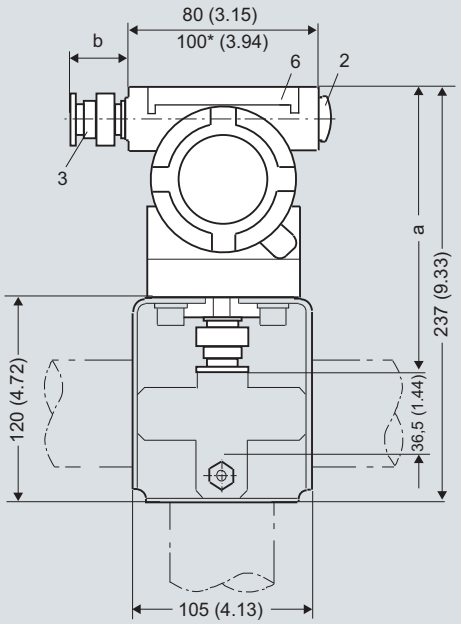
D) Subject to export regulations AL: N, ECCN: EAR99H.

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

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)

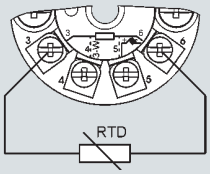
7 Mounting bracket (option) with clamp for securing to a vertical or horizontal pipe

8 Cover with window for digital display

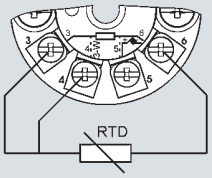
SITRANS TF, dimensions in mm (inches)

Schematics

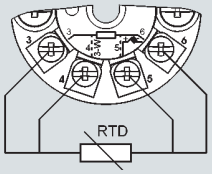
Resistance thermometer



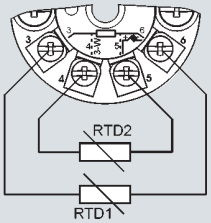
Two-wire system [1)]



Three-wire system

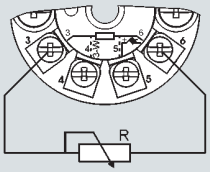


Four-wire system

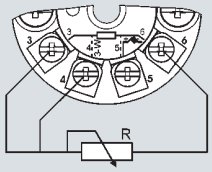


Generation of average value / difference [1)]

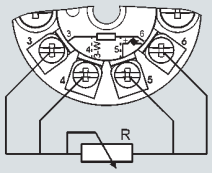
Resistance



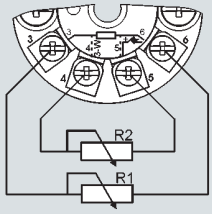
Two-wire system [1)]



Three-wire system

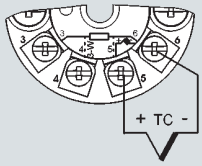


Four-wire system

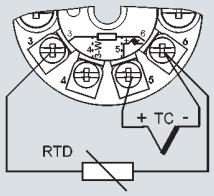


Generation of average value / difference [1)]

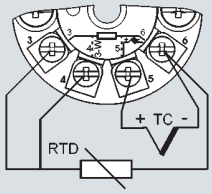
Thermocouple



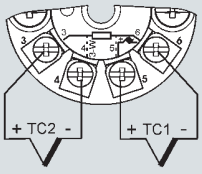
Cold junction compensation
Internal/fixed value



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



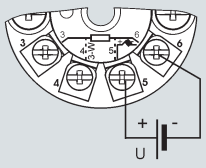
Cold junction compensation with external Pt100 in three-wire system



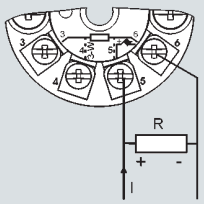
Generation of average value / difference with internal cold junction compensation

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

Voltage measurement



Current measurement



Sensor connection assignment

SITRANS TF
fieldbus transmitter

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 hard to access,
  - 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 almost completely 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

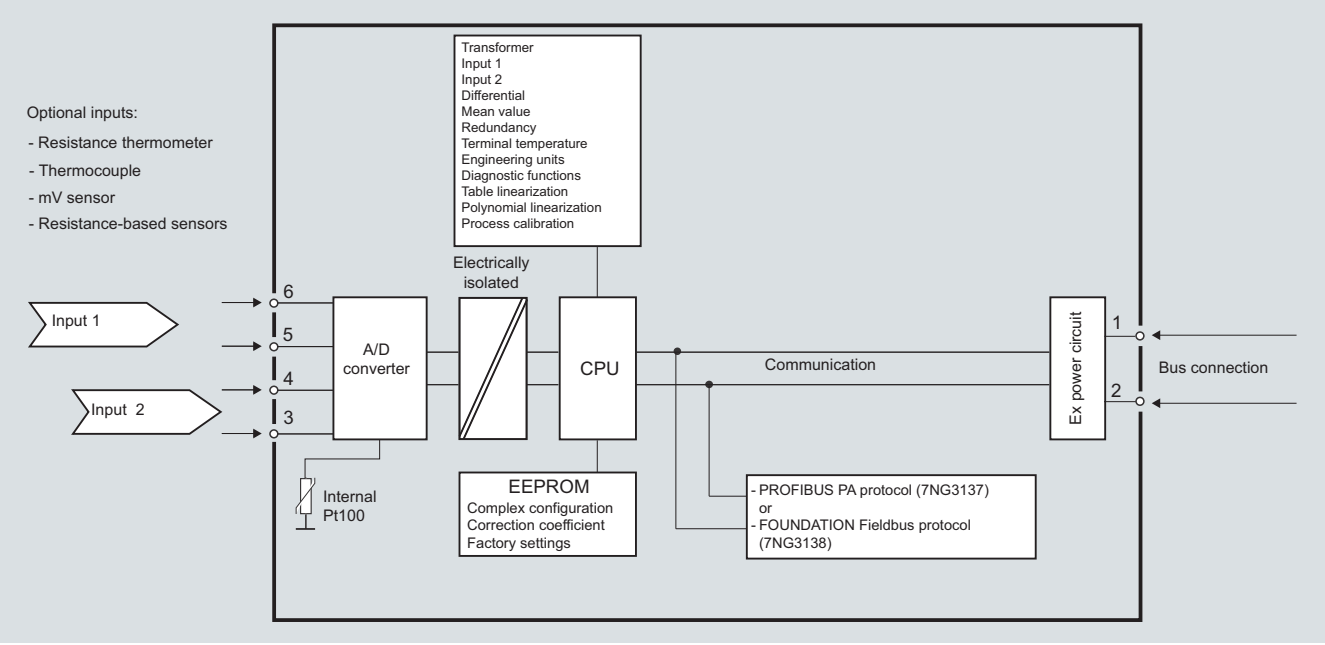
Transmitter with FOUNDATION fieldbus communication

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

Mode of operation

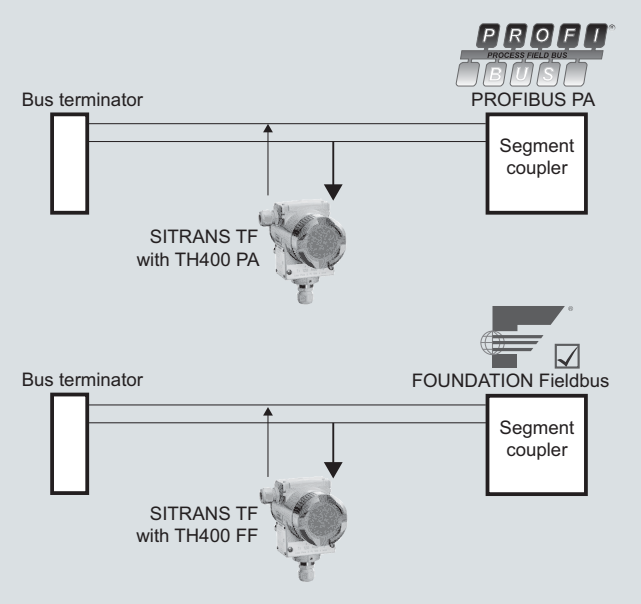
The following function diagram explains the mode of operation of the transmitter.

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

System communication



SITRANS TF with TH400, communication interface

Technical specifications

Input	
Analog/digital conversion	
• Measurement rate	< 50 ms
• Resolution	24-bit
Resistance thermometer	
Pt25 ... 1000 to IEC 60751/JIS C 1604	
• Measuring range	-200 ... +850 °C (-328 ... +1562 °F)
Ni25 ... 1000 to DIN 43760	
• Measuring range	-60 ... +250 °C (-76 ... +482 °F)
Cu10 ... 1000, α = 0.00427	
• Measuring range	-50 ... +200 °C (-58 ... +392 °F)
Line resistance per sensor cable	Max. 50 Ω
Sensor current	Nominal 0.2 mA
Sensor fault detection	
• Sensor break detection	Yes
• Sensor short-circuit detection	Yes, < 15 Ω
Resistance-based sensors	
Measuring range	0 ... 10 kΩ
Line resistance per sensor cable	Max. 50 Ω
Sensor current	Nominal 0.2 mA
Sensor fault detection	
• Sensor break detection	Yes
• Sensor short-circuit detection	Yes, < 15 Ω
Thermocouple	
to IEC 584	Measuring range
• Type B	400 ... 1820 °C (752 ... 3308 °F)
• Type E	-100 ... +1000 °C (-148 ... +1832 °F)
• Type J	-100 ... +1000 °C (-148 ... +1832 °F)
• Type K	-100 ... +1200 °C (-148 ... +2192 °F)
• Type N	-180 ... +1300 °C (-292 ... +2372 °F)
• Type R	-50 ... +1760 °C (-58 ... +3200 °F)
• Type S	-50 ... +1760 °C (-58 ... +3200 °F)
• Type T	-200 ... +400 °C (-328 ... +752 °F)
to DIN 43710	
• Type L	-200 ... +900 °C (-328 ... +1652 °F)
• Type U	-200 ... +600 °C (-328 ... +1112 °F)
to ASTM E988-90	
• Type W3	0 ... 2300 °C (32 ... 4172 °F)
• Type W5	0 ... 2300 °C (32 ... 4172 °F)
External cold junction compensation	-40 ... +135 °C (-40 ... +275 °F)
Sensor fault detection	
• Sensor break detection	Yes
• Sensor short-circuit detection	Yes, < 3 mV
• Sensor current in the event of open-circuit monitoring	4 µA
mV sensor - voltage input	
Measuring range	-800 ... +800 mV
Input resistance	10 MΩ
Output	
Filter time (programmable)	0 ... 60 s
Update time	< 400 ms

Measuring accuracy

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

General values

Type of input	Absolute accuracy	Temperature coefficient
All	≤ ± 0.05 % of the measured value	≤ ± 0.002 % of the measured value/°C

Basic values

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

Conditions of use	
Ambient conditions	
Permissible ambient temperature	-40 ... +85 °C (-40 ... +185 °F)
Permissible storage temperature	-40 ... +85 °C (-40 ... +185 °F)
Relative humidity	≤ 98 %, with condensation
Insulation resistance	
• Test voltage	500 V AC for 60 s
• Continuous operation	50 V AC/75 V DC
Electromagnetic compatibility	
NAMUR	NE21
EMC 2004/108/EC Emission and Noise Immunity	EN 61326-1, EN 61326-2-5
Construction	
Weight	Approx. 1.5 kg (3.3 lb) without options
Dimensions	See "Dimensional drawings"
Enclosure materials	• Die-cast aluminum, low in copper, GD-AlSi 12 or stainless steel • Polyester-based lacquer for GD AlSi 12 enclosure • Stainless steel rating plate
Electrical connection, sensor connection	• screw terminals • Cable inlet via M20 x 1.5 or ½ -14 NPT screwed gland • Bus connection with M12 plug (optional)
Mounting bracket (optional)	Steel, galvanized and chrome-plated or stainless steel
Degree of protection	IP67 to EN 60529
Auxiliary power	
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 II 1D Ex tD A20 IP65 T100 °C, T85 °C
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
Other certificates	GOST

Communication	
Parameterization interface	
• PROFIBUS PA connection	
- Protocol	A&D profile, Version 3.0
- Protocol	EN 50170 Volume 2
- Address (for delivery)	126
- Function blocks	2 x analog
• FOUNDATION fieldbus connection	
- Protocol	FF protocol
- Protocol	FF design specifications
- Functionality	Basic or LAS
- Version	ITK 4.6
- Function blocks	2 x analog and 1 x PID
Factory setting	
for SITRANS TH400 PA	
Sensor	Pt100 (IEC)
Type of connection	3-wire circuit
Unit	°C
Failure mode	Last valid value
Filter time	0 s
PA address	126
PROFIBUS Ident No.	Manufacturer-specific
for SITRANS TH400 FF	
Sensor	Pt100 (IEC)
Type of connection	3-wire circuit
Unit	°C
Failure mode	Last valid value
Filter time	0 s
Node address	22

Selection and Ordering data	Order No.
Temperature transmitter in field enclosure with fieldbus communication and electrical isolation, with documentation on CD	**7NG313 ■ - ■■■ 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 gland s ½-14 NPT	**C**
Mounting bracket and fastening parts	
• none	**0**
• made of steel	**1**
• stainless steel	**2**
Further designs Please add "**-Z**" to Order No. and specify Order code(s) and plain text.	Order code
Customer-specific operating data	**Y01**[2]
Inscription on measuring point label (TAG plate)	
• Measuring point number/TAG (max. 32 char.)	**Y15**[3]
• Measuring point description (max. 32 char.)	**Y23**[3]
• Bus address	**Y25**[3]
Test report (5 measuring points)	**C11**[4]
Bus connection	
• M12 plug (metal), without mating connector	**M00**[5]
• M12 plug (metal), with mating connector	**M01**[5]
Explosion protection	
Explosion protection EEx ia to INMERTO (Brazil) (only with 7NG313.-1....)	**E25**
Explosion protection EEx d to INMERTO (Brazil) (only with 7NG313.-4....)	**E26**

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.

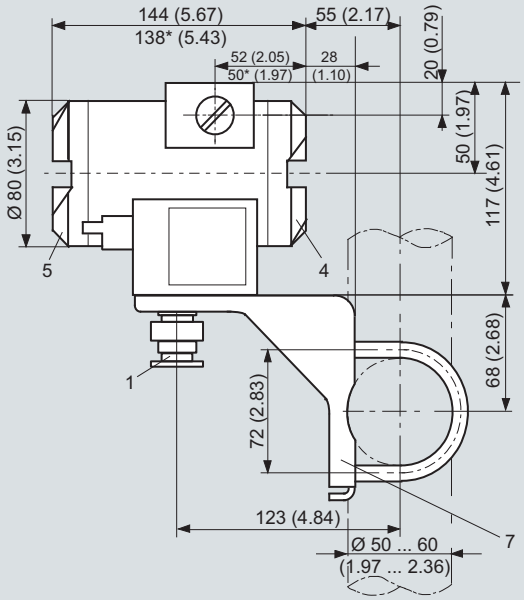
Selection and Ordering data	Order No.
Accessories	
CD for measuring instruments for temperature ▶ with documentation in German, English, French, Spanish, Italian and Portuguese, and parameterization software SIPROM T (included in delivery with SITRANS TF)	**A5E00364512**
SIMATIC PDM parameterization 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.

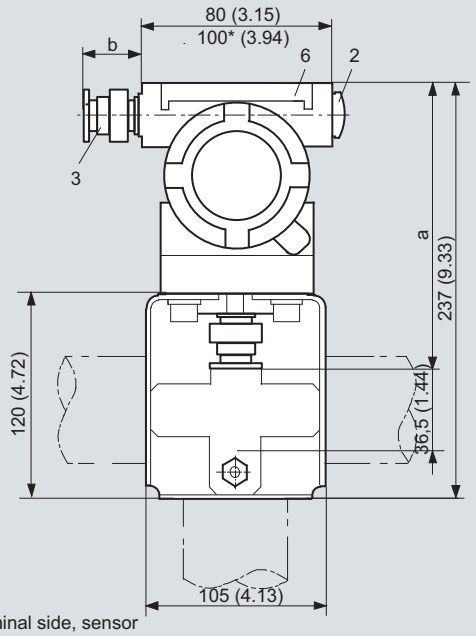
Factory setting:

- 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

Dimensional drawings



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

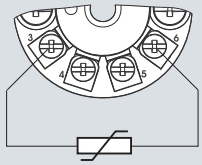


5 Terminal side, sensor
6 Protective cover (without function)
7 Mounting bracket (optional) with clamp securing to a vertical or horizontal pipe

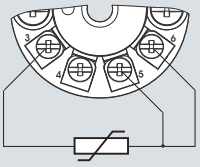
SITRANS TF with TH400, dimensions in mm (inches)

Schematics

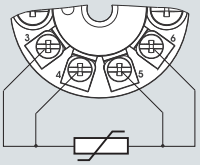
Resistance thermometer



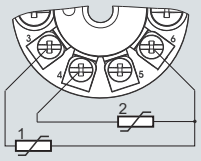
Two-wire system [1)]



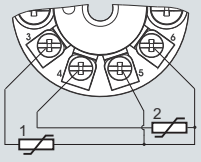
Three-wire system



Four-wire system

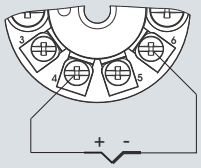


Mean-value/differential or redundancy generation
2 x two-wire system [1)]

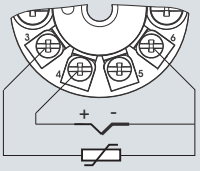


Mean-value/differential or redundancy generation
1 sensor in two-wire system [1)]
1 sensor in three-wire system

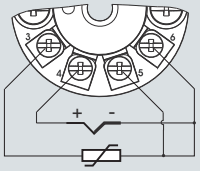
Thermocouple



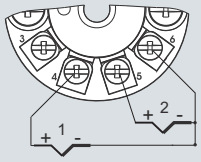
Internal
cold junction compensation



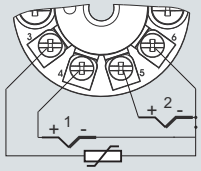
Cold junction compensation
with external Pt100 in two-wire system [1)]



Cold junction compensation
with external Pt100 in three-wire system

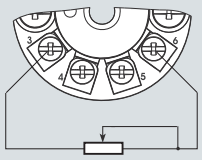


Mean value, differential or redundancy generation with internal cold junction compensation

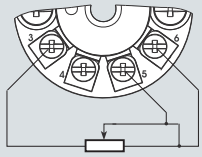


Mean value, differential or redundancy generation and cold junction compensation with internal Pt100 in two-wire system [1)]

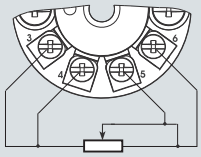
Resistance



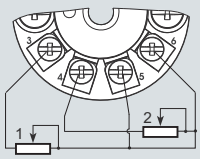
Two-wire system [1)]



Three-wire system

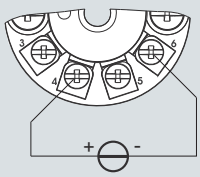


Four-wire system

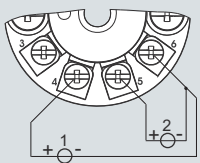


Mean value, differential or redundancy generation
1 resistor in two-wire system [1)]
1 resistor in three-wire system

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 TF with TH400, sensor connection assignment

Technical description

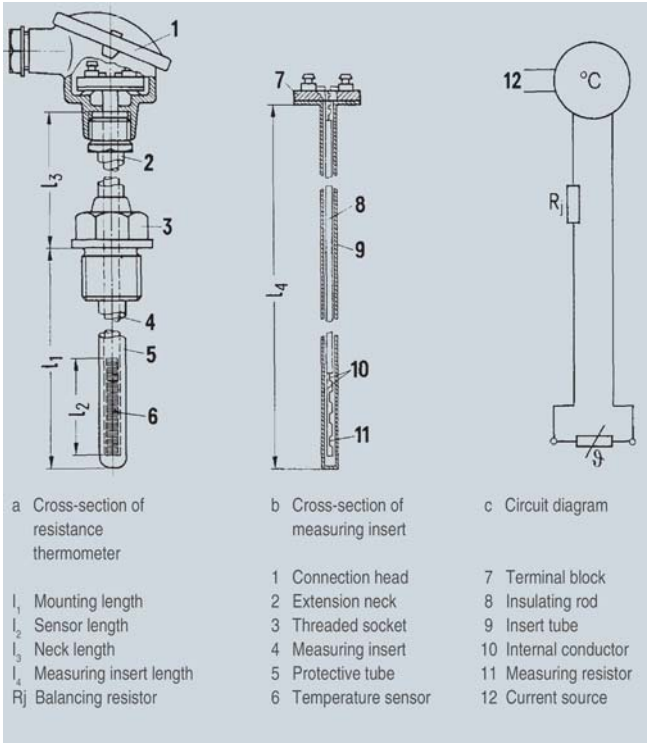
Design

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 0.2 Ω, 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 Ω ± 0.12 Ω . 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.

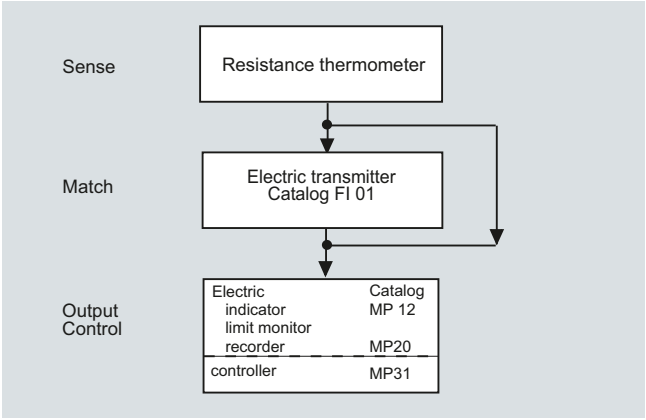
Installation examples with the suitable protective tube materials can be found under "Technical data" in the table "Installation examples and material of protective tubes".

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.

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.	Protective tube material	
	°C (°F)	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 X 6 CrNiMoTi 17 122	1.4541 1.4571
B. Paper mills			
In paper pulp (cylindrical paper mills, handmade paper, refiner)	60 (140)	X 6 CrNiMoTi 17 122	1.4571
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 Black, green and white lye tanks	In vat 180 (356) otherwise 80 (176)	X 6 CrNiTi 18 10 or X 6 CrNiMoTi Ti 17 122	1.4541 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.	Protective tube material	
	°C (°F)	name	No.
D. Dye works			
Jigger, automatic yarn skein dying machine	110 (230)	X 6 CrNiMoTi 17 122	1.4571
E. Food and drink industries			
1. Breweries			
Brewing water	80 (176)	Bronze Sn Bz 6 or X 6 CrNiTi 18 10	2.1020
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
3. Cereals production			
Salt removal in whey	20 (68)	X 6 CrNiTi 18 10	1.4541
4. Malt houses			
Steeping water	100 (212)	Bronze Sn Bz 6	2.1020
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.

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

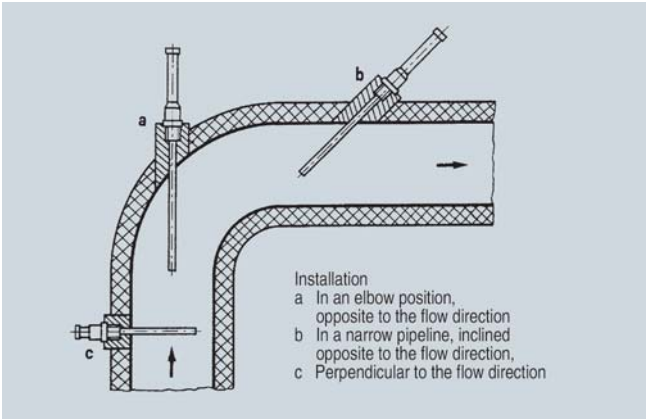
The resistance thermometers are divided into two classes according to their error limits:

Class	Error limits in °C
A	0,15 + 0,002 $\|t\|$ [1]
B	0,3 + 0,005 $\|t\|$

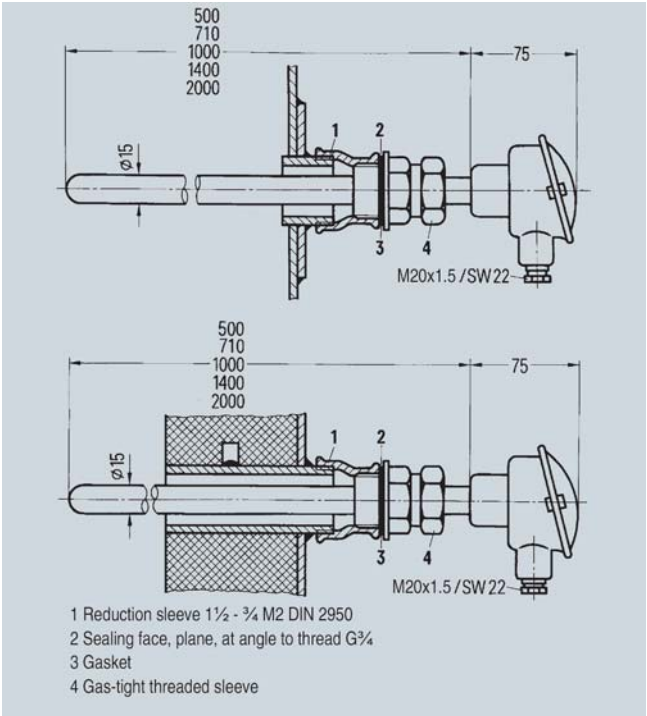
[1] $\|t\|$ is the numerical value of the temperature in °C without consideration of the sign

Integration

Protective tubes in a pipeline

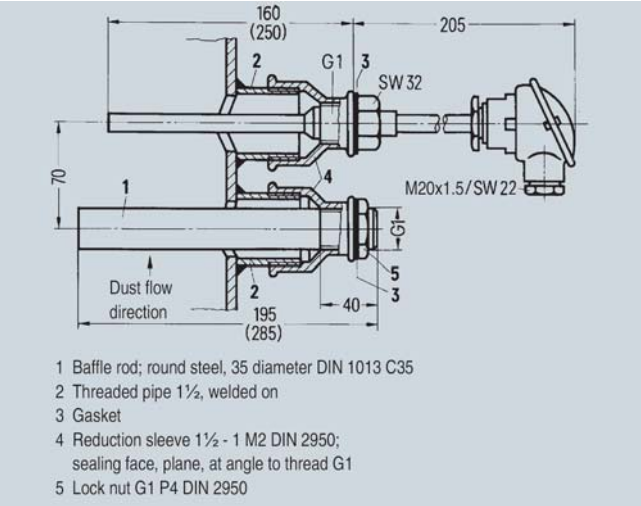


Flue gas resistance thermometer



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

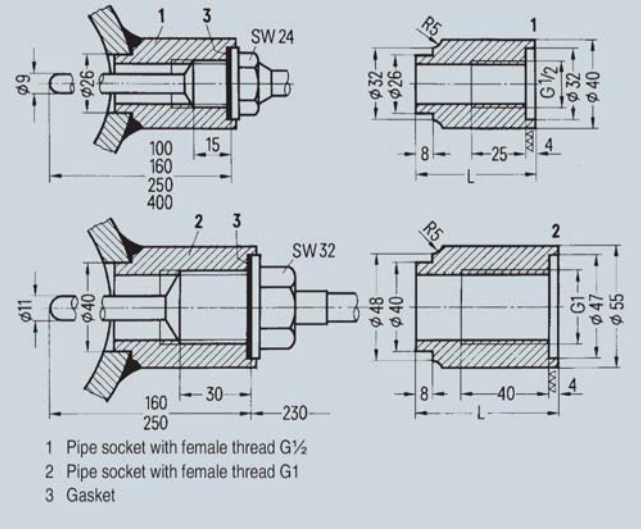
Screw-in resistance thermometer



1 Baffle rod; round steel, 35 diameter DIN 1013 C35
2 Threaded pipe 1½, welded on
3 Gasket
4 Reduction sleeve 1½ - 1 M2 DIN 2950; sealing face, plane, at angle to thread G1
5 Lock nut G1 P4 DIN 2950

In a pulverized coal line, with baffle rod

Screw-in protective tubes, mounted

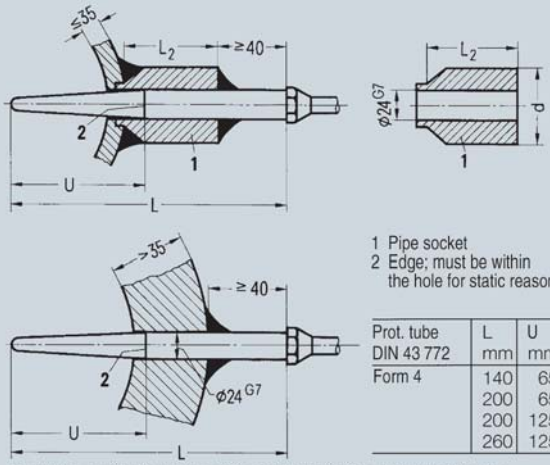


1 Pipe socket with female thread G½
2 Pipe socket with female thread G1
3 Gasket

At top for low-pressure, with screw socket G½; at bottom for high-pressure, with screw socket G1

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



1 Pipe socket
2 Edge; must be within the hole for static reason

Prot. tube DIN 43 772	L mm	U mm	L_2 mm
Form 4	140	65	40
	200	65	65
	200	125	40
	260	125	65

It must be possible to weld the pipe coupling, pipeline and protective tube.
Materials according to data provided by pipeline or vessel manufacturer.

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

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)	**Y11**[1)]
SIL2 application (only in combination with TH200 and TH300)	**Y01: SIL2, C20 + Txx**

[1)] For TH400 FF available soon

Questionnaire for temperature sensors (resistance thermometers and thermocouples)

General information

Customer: .....

Address: .....

Contact partner: .....

Purchasing dept.: ..... Tel.: .....

Sales dept.: ..... Tel.: .....

Process dept.: ..... Tel.: .....

Inquiry: .....

Quotation: .....

Place and date: .....

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: .....
   .....

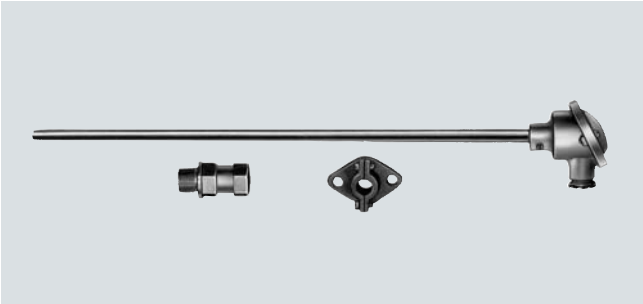
5. Tests: .....
   .....

6. Accessories: .....
   .....

7. Supplementary requirements: .....
   .....

Flue gas resistance thermometers with connection head

Overview



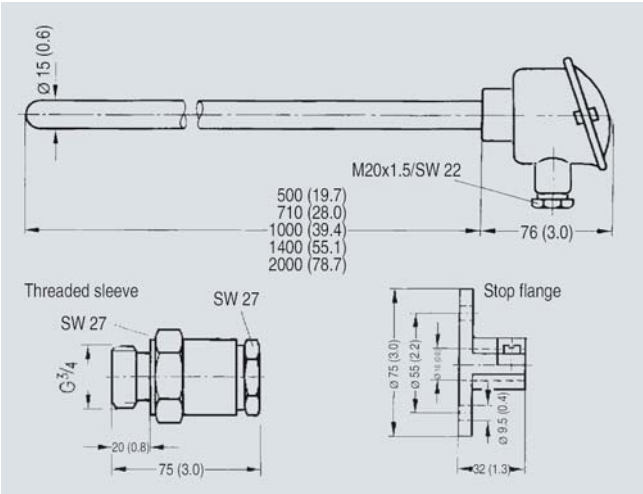
The flue gas resistance thermometer with connection head is suitable for the temperature range from -50 to +600 °C (-58 to +1112 °F) and can also be supplied with a built-in temperature transmitter.

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

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)	**7MC1000-1BA2**
• 710 (28.0)	1.1 (2.43)	**7MC1000-2BA2**
• 1000 (39.4)	1.5 (3.31)	**7MC1000-3BA2**
• 1400 (55.1)	1.9 (4.19)	**7MC1000-4BA2**
• 2000 (78.7)	2.7 (5.95)	**7MC1000-5BA2**
Connection head, form B, made of cast light alloy, with 1 cable inlet and		
• screw cover		**1**
• standard hinged cover		**4**
• high hinged cover		**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.		**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). If optional head transmitters are integrated, please note that all calibration points are located in the set measuring range. If the points are located outside the standard measuring range, a Y11 addition is always required.		**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)		
• G¾ internal thread with gasket		**7MC2998-5DA**
• G½ internal thread with gasket		**7MC2998-5DC**

To order a temperature transmitter installed in the connection head and transmitters for SIL applications, see "Temperature transmitters for mounting in the connection head" (page 3/74).

Individual parts: Measuring inserts, see "Accessories".

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

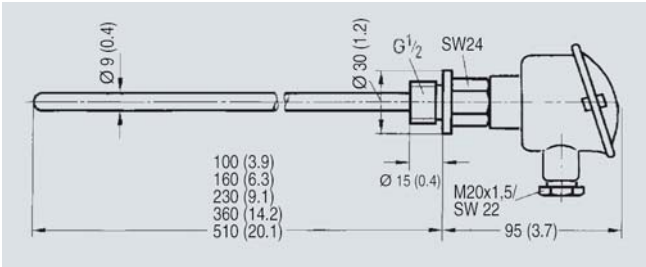
Overview

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	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 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):	Order No.
• 100 (3.9)	0.6 (1.32)	7MC1006-1DA1
• 160 (6.3)	0.7 (1.54)	7MC1006-2DA1
• 230 (9.1)	0.8 (1.76)	7MC1006-3DA1
• 360 (14.2)	0.9 (1.98)	7MC1006-4DA1
• 510 (20.1)	1.0 (2.20)	7MC1006-5DA1

Two Pt100 measuring resistors

Mounting length U_1/ mm (inch):	Weight/ kg (lb):	Order No.
• 100 (3.9)	0.6 (1.32)	7MC1006-1DB1
• 160 (6.3)	0.71 (1.57)	7MC1006-2DB1
• 230 (9.1)	0.81 (1.79)	7MC1006-3DB1
• 360 (14.2)	0.91 (2.01)	7MC1006-4DB1
• 510 (20.1)	1.01 (2.23)	7MC1006-5DB1

Measuring insert with explosion protection

One Pt100 measuring resistor

Mounting length U_1/ mm (inch):	Weight/ kg (lb):	Order No.
• 100 (3.9)	0.6 (1.32)	7MC1006-1DE1
• 160 (6.3)	0.7 (1.54)	7MC1006-2DE1
• 230 (9.1)	0.8 (1.76)	7MC1006-3DE1
• 360 (14.2)	0.9 (1.98)	7MC1006-4DE1
• 510 (20.1)	1.0 (2.20)	7MC1006-5DE1

Two Pt100 measuring resistors

Mounting length U_1/ mm (inch):	Weight/ kg (lb):	Order No.
• 100 (3.9)	0.6 (1.32)	7MC1006-1DF1
• 160 (6.3)	0.71 (1.57)	7MC1006-2DF1
• 230 (9.1)	0.81 (1.79)	7MC1006-3DF1
• 360 (14.2)	0.91 (2.01)	7MC1006-4DF1
• 510 (20.1)	1.01 (2.23)	7MC1006-5DF1

Connection head, form B,

	Order No.
• made of cast light alloy, with 1 cable inlet and	
- screw cover	1
- standard hinged cover	4
- high hinged cover	6
• made of stainless steel, with 1 cable inlet and screw cover	7

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

Selection and Ordering data	Order No.
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). If optional head transmitters are integrated, please note that all calibration points are located in the set measuring range. If the points are located outside the standard measuring range, a Y11 addition is always required.	**Y33**

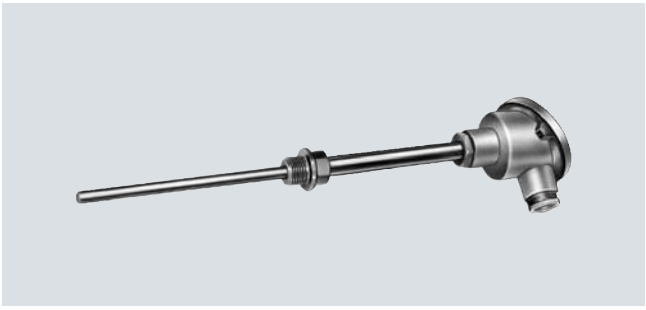
► Available ex stock

To order a temperature transmitter installed in the connection head and transmitters for SIL applications, see "Temperature transmitters for mounting in the connection head" (page 3/74).

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

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

Overview

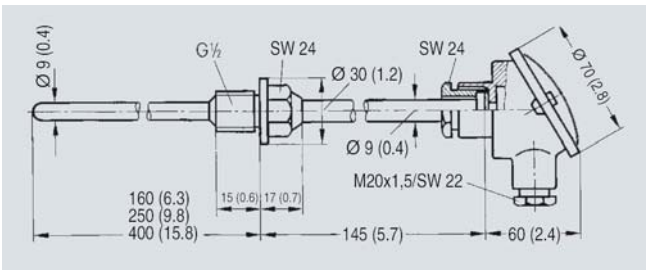


The low-pressure screw-in resistance thermometer with connection head and neck tube is suitable for the temperature range from -50 to +600 °C (-58 to +1112 °F) and can also be supplied with a built-in temperature transmitter.

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)	7MC1007-5DA1
• 250 (9.84)	0.9 (1.98)	7MC1007-6DA1
• 400 (15.7)	1.0 (2.20)	7MC1007-7DA1

Two Pt100 measuring resistors

Mounting length U_1/ mm (inch):	Weight/ kg (lb):	
• 160 (6.3)	0.9 (1.98)	7MC1007-5DB1
• 250 (9.84)	1.0 (2.20)	7MC1007-6DB1
• 400 (15.7)	1.1 (2.43)	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)	7MC1007-5DE1
• 250 (9.84)	0.9 (1.98)	7MC1007-6DE1
• 400 (15.7)	1.0 (2.20)	7MC1007-7DE1

Two Pt100 measuring resistors

Mounting length U_1/ mm (inch):	Weight/ kg (lb):	
• 160 (6.3)	0.9 (1.98)	7MC1007-5DF1
• 250 (9.84)	1.0 (2.20)	7MC1007-6DF1
• 400 (15.7)	1.1 (2.43)	7MC1007-7DF1

Connection head, form B,

• made of cast light alloy, with 1 cable inlet and	
- screw cover	1
- standard hinged cover	4
- high hinged cover	6
• made of stainless steel, with 1 cable inlet and screw cover	7

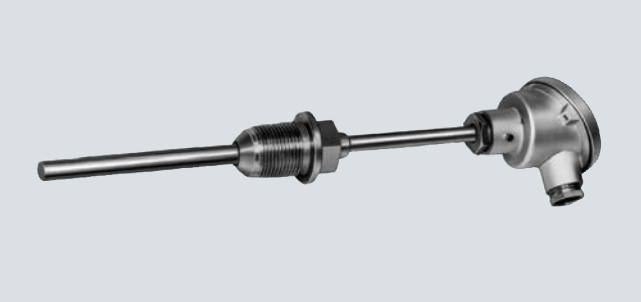
Further designs Please add "**-Z**" to Order No. and specify Order code(s) and plain text.	Order code
• Different design (mounting length, protective tube material etc.), specify in plain text.	**Y01**
• TAG plate made of stainless steel specify TAG No. in plain text	**Y15**
• Calibration carried out at one point, specify desired temperature in plain text (order equivalent number of times for several calibration points). If optional head transmitters are integrated, please note that all calibration points are located in the set measuring range. If the points are located outside the standard measuring range, a Y11 addition is always required.	**Y33**

To order a temperature transmitter installed in the connection head and transmitters for SIL applications, see "Temperature transmitters for mounting in the connection head" (page 3/74).

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

High-pressure screw-in resistance thermometers

Overview

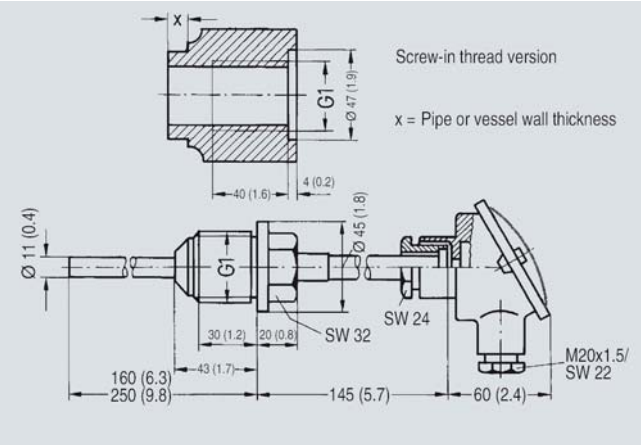


The high-pressure screw-in resistance thermometer with connection head and neck tube is suitable for the temperature range from -50 to +600 °C (-58 to +1112 °F) and can also be supplied with a built-in temperature transmitter.

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 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

Dimensional drawings



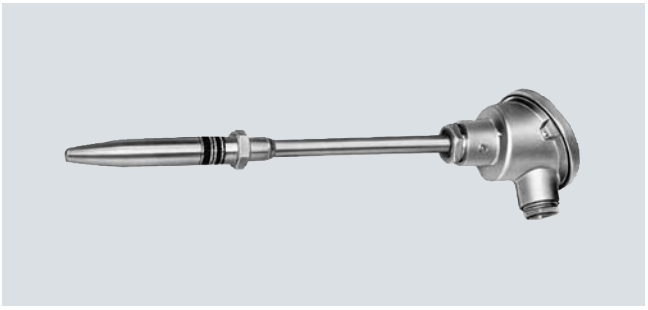
High-pressure screw-in resistance thermometer with neck tube, dimensions in mm (inches)

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)	**7MC1008-6DA1** ■
• 250 (9.84)	0.93 (2.05)	**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)	**7MC1008-6DB1** ■
• 250 (9.84)	0.94 (2.07)	**7MC1008-7DB1** ■
Connection head, form B,		
• made of cast light alloy, with 1 cable inlet and		
- screw cover		**1**
- standard hinged cover		**4**
- high hinged cover		**6**
• made of stainless steel, with 1 cable inlet and screw cover		**7**
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). If optional head transmitters are integrated, please note that all calibration points are located in the set measuring range. If the points are located outside the standard measuring range, a Y11 addition is always required.		**Y33**

To order a temperature transmitter installed in the connection head and transmitters for SIL applications, see "Temperature transmitters for mounting in the connection head" (page 3/74).

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

Overview

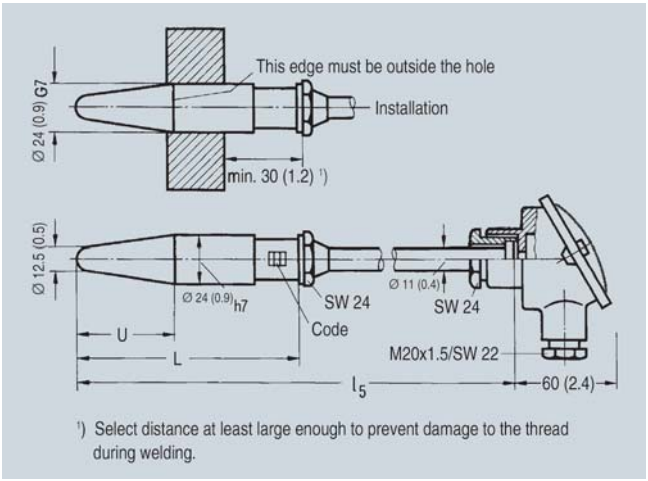


The high-pressure welding type resistance thermometer with connection head and neck tube is suitable for the temperature range from -50 to 540 or 550 °C (-58 to 1004 or 1022 °F) and can also be supplied with a built-in temperature transmitter.

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 m/s (1.31 ft/s)	$t_{0.5}$ = 25 s, $t_{0.9}$ = 80 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	7MC1010-■GA2■
- max. 550 °C (1022 °F), protective tube X 6 CrNiMoTi 17 122, mat. No. 1.4571	7MC1010-■FA2■
• Measuring insert with explosion protection	
- max. 550 °C (1022 °F), protective tube X 6 CrNiMoTi 17 122, mat. No. 1.4571	7MC1010-■FE2■

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	7MC1010-■GB2■
- max. 550 °C (1022 °F), protective tube X 6 CrNiMoTi 17 122, mat. No. 1.4571	7MC1010-■FB2■
• Measuring insert with explosion protection	
- max. 550 °C (1022 °F), protective tube X 6 CrNiMoTi 17 122, mat. No. 1.4571	7MC1010-■FF2■

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)	
65 (2.6)	140 (5.5)	305 (12.0)	0.78 (1.7)/ 0.79 (1.7)	1
		365 (14.4)	0.82 (1.8)/ 0.83 (1.8)	2
		395 (15.6)	0.85 (1.9)/ 0.86 (1.9)	3
	200 (7.9)	365 (14.4)	0.95 (2.1)/ 0.96 (2.1)	4
		395 (15.6)	0.98 (2.2)/ 1.00 (2.2)	5
125 (4.9)	200 (7.9)	365 (14.4)	0.95 (2.1)/ 0.96 (2.1)	6
		395 (15.6)	0.98 (2.2)/ 1.00 (2.2	7
	260 (10.2)	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	1
- standard hinged cover	4
- high hinged cover	6
• made of stainless steel, with 1 cable bushing and screw cover	7

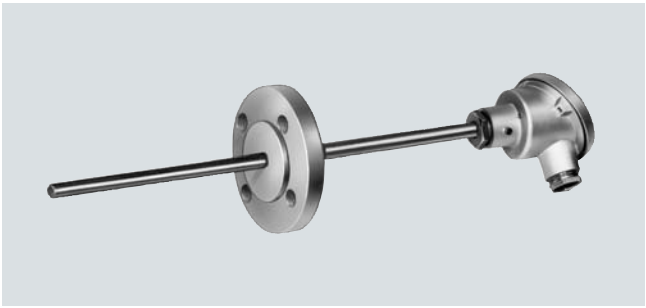
High-pressure welding-type resistance thermometers

Selection and Ordering data	Order No.
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). If optional head transmitters are integrated, please note that all calibration points are located in the set measuring range. If the points are located outside the standard measuring range, a Y11 addition is always required.	**Y33**

To order a temperature transmitter installed in the connection head and transmitters for SIL applications, see "Temperature transmitters for mounting in the connection head" (page 3/74).

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

Overview

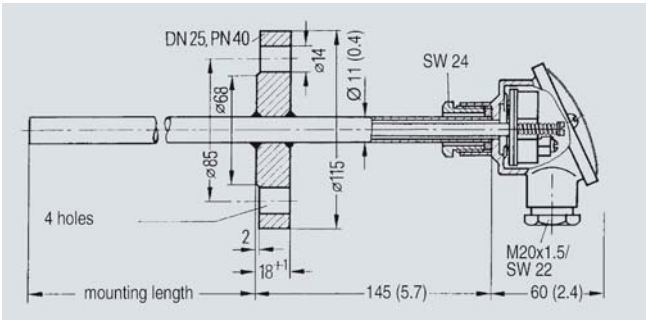


The flange-type resistance thermometer with connection head can be installed in tanks and pipelines; it is suitable for a temperature range from -50 to +600 °C (-58 to +1112 °F) and can also be supplied with a built-in temperature transmitter.

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-typeresistance 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)	**7MC1017-1FA1** ■
• 250 (9.84)	1.5 (3.31)	**7MC1017-2FA1** ■
Two Pt100 measuring resistors		
Mounting length/ mm (inch):	Weight/ kg (lb):	
• 160 (6.3)	1.6 (3.53)	**7MC1017-1FB1** ■
• 250 (9.84)	1.6 (3.53)	**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)	**7MC1017-1FE1** ■
• 250 (9.84)	1.5 (3.31)	**7MC1017-2FE1** ■
Two Pt100 measuring resistors		
Mounting length/ mm (inch):	Weight/ kg (lb):	
• 160 (6.3)	1.6 (3.53)	**7MC1017-1FF1** ■
• 250 (9.84)	1.6 (3.53)	**7MC1017-2FF1** ■
Connection head, form B		
• made of cast light alloy, with 1 cable inlet and		
- screw cover		**1**
- standard hinged cover		**4**
▶ - high hinged cover		**6**
• made of stainless steel, with 1 cable inlet and screw cover		**7**
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). If optional head transmitters are integrated, please note that all calibration points are located in the set measuring range. If the points are located outside the standard measuring range, a Y11 addition is always required.		**Y33**

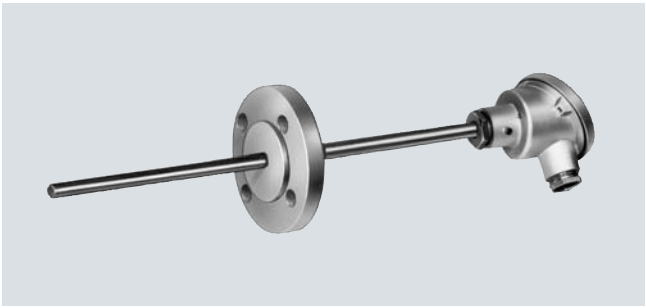
▶ Available ex stock

To order a temperature transmitter installed in the connection head and transmitters for SIL applications, see "Temperature transmitters for mounting in the connection head" (page 3/74).

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

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

Overview

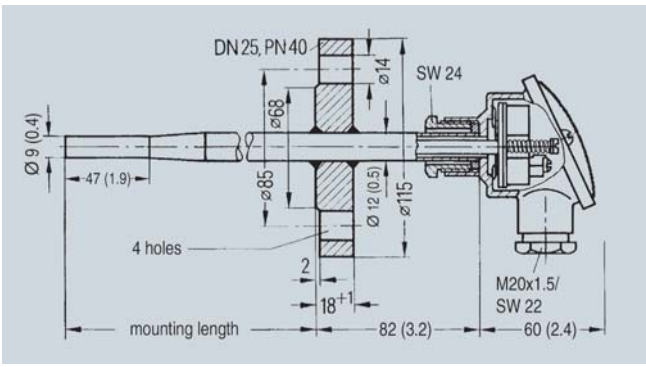


The flange-type resistance thermometer with connection head with reduced response time can be installed in tanks and pipelines; it is suitable for a temperature range from -50 to +600 °C (-58 to +1112 °F). The sensor is also available with a built-in temperature transmitter.

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)	7MC1041-1AA0
• 285 (11.2) / 1.5 (3.31)	7MC1041-2AA0
• 345 (13.6) / 1.5 (3.31)	7MC1041-3AA0
Two Pt100 measuring resistors	
Mounting length/ mm (inch): / Weight/ kg (lb):	
• 225 (8.9) / 1.6 (3.53)	7MC1041-1AB0
• 285 (11.2) / 1.6 (3.53)	7MC1041-2AB0
• 345 (13.6) / 1.6 (3.53)	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)	7MC1041-1EA0
• 285 (11.2) / 1.5 (3.31)	7MC1041-2EA0
• 345 (13.6) / 1.5 (3.31)	7MC1041-3EA0
Two Pt100 measuring resistors	
Mounting length/ mm (inch): / Weight/ kg (lb):	
• 225 (8.9) / 1.6 (3.53)	7MC1041-1EB0
• 285 (11.2) / 1.6 (3.53)	7MC1041-2EB0
• 345 (13.6) / 1.6 (3.53)	7MC1041-3EB0
Connection head, form B	
• made of cast light alloy, with 1 cable inlet and	
- screw cover	1
- standard hinged cover	4
- high hinged cover	6
• made of stainless steel, with 1 cable inlet and screw cover	7
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). If optional head transmitters are integrated, please note that all calibration points are located in the set measuring range. If the points are located outside the standard measuring range, a Y11 addition is always required.	Y33

To order a temperature transmitter installed in the connection head and transmitters for SIL applications, see "Temperature transmitters for mounting in the connection head" (page 3/74).

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

Resistant thermometers for damp rooms

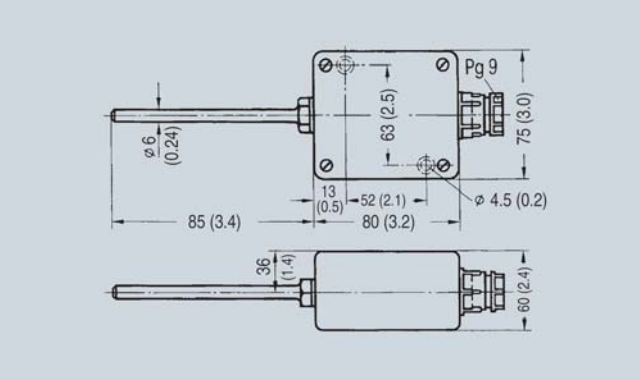
Overview

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)	▶ **7MC1027-1AA**
• with two Pt100 measuring resistors 0.1 kg (0.22 kg)	**7MC1027-1AB**
Further designs	Order code
Please add "**-Z**" to Order No. and specify Order code(s) and plain text.	
• 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). If optional head transmitters are integrated, please note that all calibration points are located in the set measuring range. If the points are located outside the standard measuring range, a Y11 addition is always required.	**Y33**

▶ Available ex stock

To order a temperature transmitter installed in the connection head and transmitters for SIL applications, see "Temperature transmitters for mounting in the connection head" (page 3/74).

Note:

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

Accessories
Measuring inserts, not explosion protected

Design

Components (design to DIN 43762)

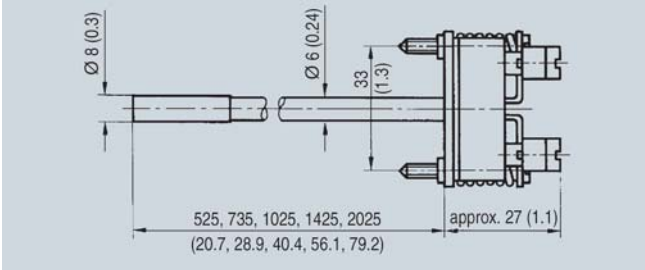
- Measuring insert with resistor,
- insert tube with retaining plate,
- terminal block with clamping springs and 2 or 3 internal conductors of Cu-Ni sheathed wire for each Pt100 measuring resistor.

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

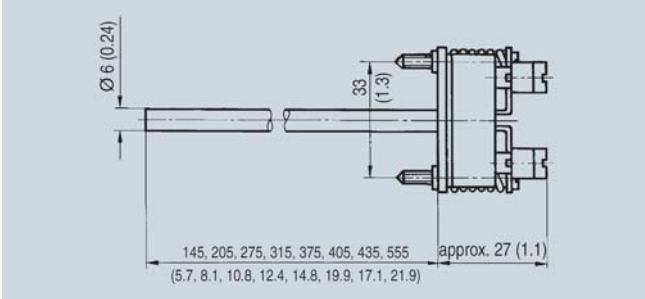
The measuring inserts have a filling of Al_2O_3 powder which surrounds the measuring resistor and the internal conductors and results in a high vibration resistance (for temperatures up to 600 °C (1112 °F). The winding is embedded in a ceramic body.

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):	Order No.
• 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	Order No.
	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)	**7MC1910-1JA**
• 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**

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	Order No.
	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.

Supplement the order no. with "-Z", add order code Y01 and specify plain text:
Y01: Different design (mounting length, protective tube material etc. specify in plain text).

Accessories
Measuring inserts, explosion protected

Overview

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.

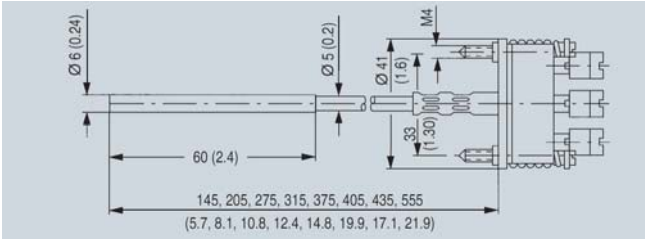
Design

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.

Technical specifications

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

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	Order No.
	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	Screw-in thermometer 7MC1010	Flange-type thermometer 7MC1017	Flange-type thermometer 7MC1041	Weight	Order No.
	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.

Supplement the order no. with "-Z", add order code Y01 and specify plain text:
Y01: Different design (mounting length, protective tube material etc. specify in plain text).

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)

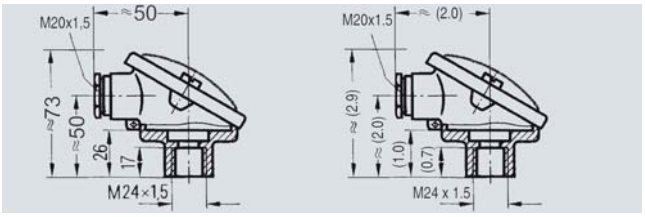
Neck tube

Neck tube for high-pressure screw-in resistance thermometer

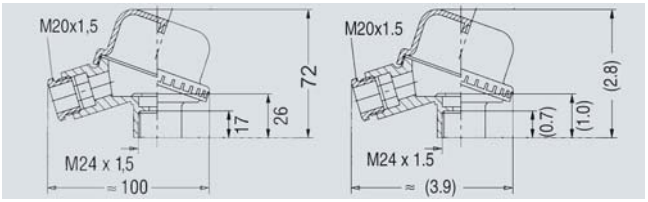
- Made of stainless steel, mat. No. 1.4571
- With threads at both ends
- For measuring insert tube with 6 mm (0.24 inch) OD

Dimensional drawings

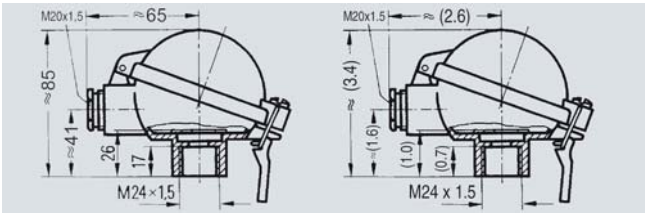
Connection heads for low and high-pressure resistance thermometers, flue gas and flange-type resistance thermometers



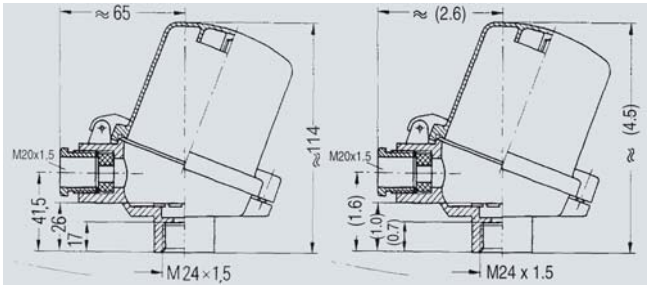
Connection head, form B, degree of protection IP54, made of cast light alloy, with screw cover, dimensions in mm (inches)



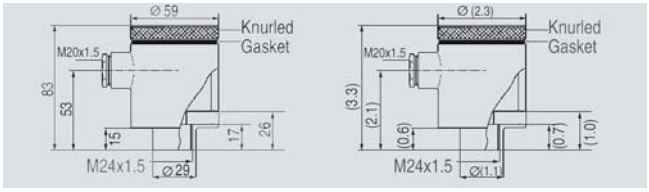
Connection head, form B, degree of protection IP54, made of plastic, with screw cover, dimensions in mm (inches)



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)

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

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)	**7MC1906-1AA**
• 165 (6.50)	305/365 (12.01/14.37)	140/200 (5.51/7.87)	0.15 (0.33)	**7MC1906-2AA**
• 195 (7.68)	395 (15.55)	200 (7.87)	0.18 (0.40)	**7MC1906-3AA**
• 225 (8.86)	365 (14.37)	140 (5.51)	0.20 (0.44)	**7MC1906-4AA**
• 255 (10.04)	395 (15.55)	140 (5.51)	0.22 (0.49)	**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**

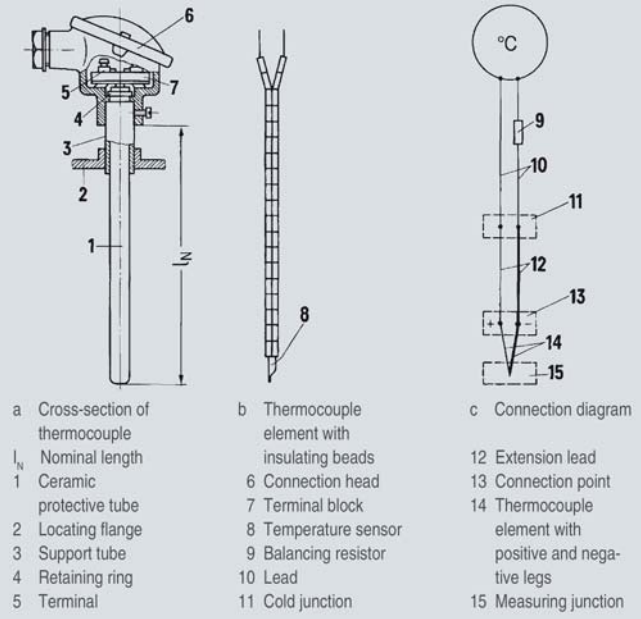
Connection heads with a drilled hole of 15.5 mm diameter (0.61 inch) instead of the female thread M24 x 1.5 on request.

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:



a Cross-section of thermocouple
l_N Nominal length
1 Ceramic protective tube
2 Locating flange
3 Support tube
4 Retaining ring
5 Terminal

b Thermocouple element with insulating beads
6 Connection head
7 Terminal block
8 Temperature sensor
9 Balancing resistor
10 Lead
11 Cold junction

c Connection diagram
12 Extension lead
13 Connection point
14 Thermocouple element with positive and negative legs
15 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 conjunction) 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 isee 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 thermo-couples.

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 process 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".

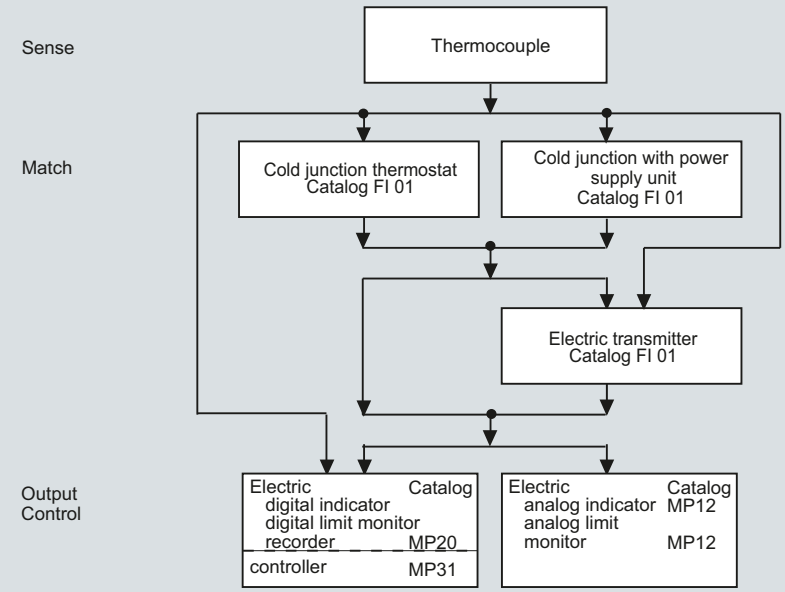
Owing to the different operating conditions, no guarantee can be given for protective fittings. The manufacturer is responsible for damages and measuring errors caused by wrong installation in compliance with the General Terms of Delivery if the instruments have been installed by the manufacturer and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

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
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 carbide Inside: KER 710
Melt (for short periods)	1600 (2912)	Pt 10% Rh/Pt	Immersion-type thermocouple element of special design
4. Soaking pit			
Furnace chamber	1350 (2462)	Pt 10% Rh/Pt	Outside: Silicon carbide Inside: KER 710
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 recuperator	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 carbide 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 recuperator	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 recuperator	700 (1292)	Ni Cr/Ni	As above

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

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 porce-lain
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 peri-ods: 500 ... 1000 (932 ... 1832)	Fe/Cu Ni	Special design on request (to be manu-factured on site according to specifi-cations)
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 t hermocouple 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

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)	**Y11**[1)]
SIL2 application (only in combination with TH200 and TH300)	**Y01: SIL2, C20 + Txx**

[1)] For TH400 FF available soon.

Questionnaire for temperature sensors (resistance thermometers and thermocouples)

General information

Customer: .....

Address: .....

Contact partner: .....

Purchasing dept.: ..... Tel.: .....

Sales dept.: ..... Tel.: .....

Process dept.: ..... Tel.: .....

Inquiry: .....

Quotation: .....

Place and date: .....

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: .....
   .....

Straight thermocouples to DIN 43733, with connection head

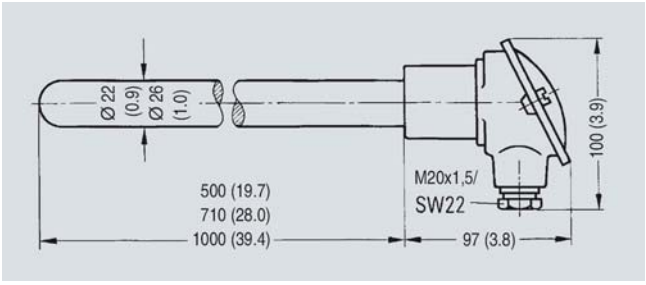
Overview

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

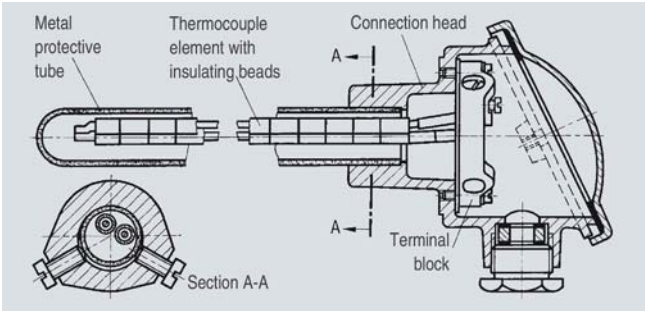
Thermocouples	Ni Cr/Ni type K
• Number	1 or 2
• Leg diameter	2 ... 3 mm (0.08 ... 0.12 inch)
• Insulation of legs	Insulating beads
Protective tube	Metal
Connection head	Form A, DIN 43729; made of cast light alloy, with one cable bushing

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) — 7MC2000-1DC0
- 710 (28.0) — 7MC2000-2DC0
- 1000 (39.4) — 7MC2000-3DC0

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) — 7MC2000-1DD0
- 710 (28.0) — 7MC2000-2DD0
- 1000 (39.4) — 7MC2000-3DD0

to 1100 °C (2012 °F)
X 18 CrN28, 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) — 7MC2000-1EC0
- 710 (28.0) — 7MC2000-2EC0
- 1000 (39.4) — 7MC2000-3EC0

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) — 7MC2000-1ED0
- 710 (28.0) — 7MC2000-2ED0
- 1000 (39.4) — 7MC2000-3ED0

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) — 7MC2000-1FC0
- 710 (28.0) — 7MC2000-2FC0
- 1000 (39.4) — 7MC2000-3FC0

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) — 7MC2000-1FD0
- 710 (28.0) — 7MC2000-2FD0
- 1000 (39.4) — 7MC2000-3FD0

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) — 7MC2000-1HC0
- 710 (28.0) — 7MC2000-2HC0
- 1000 (39.4) — 7MC2000-3HC0

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) — 7MC2000-1HD0
- 710 (28.0) — 7MC2000-2HD0
- 1000 (39.4) — 7MC2000-3HD0

Connection head, form A,
- made of cast light alloy, with 1 cable inlet and
  - screw cover — 1
  - high hinged cover — 6

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
• 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). If optional head transmitters are integrated, please note that all calibration points are located in the set measuring range. If the points are located outside the standard measuring range, a Y11 addition is always required.	**Y33**

To order a temperature transmitter installed in the connection head, see "Temperature transmitters for installation in the connection head" (page 3/95).

Installation of a transmitter is only possible here in the versions with a high hinged cover (7MC2000-....6).
Sensor type setting essential for the function. By default, the transmitter is supplied with the factory settings for configuration by the customer. The factory settings of sensor type, measuring range, etc. can be ordered using option Y11.

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		
∅ 22 mm x 2 mm (∅ 0.87 inch x 0.08 inch), 0.55 ... 1.10 kg (1.21 ... 2.42 lb), dished		
Nominal length in mm (inch):	Protective tube length in mm (inch):	
• 500 (19.7)	520 (20.5)	**7MC2900-1DA**
• 710 (28.0)	730 (28.7)	**7MC2900-2DA**
• 1000 (39.4)	1020 (40.2)	**7MC2900-3DA**
X 10 CrAl 24, material No. 1.4749		
∅ 26 mm x 4 mm (∅ 1.02 inch x 0.16 inch), 1.25 ... 2.20 kg (2.76 ... 4.85 lb), dished		
Nominal length in mm (inch):	Protective tube length in mm (inch):	
• 500 (19.7)	520 (20.5)	**7MC2900-1EC**
• 710 (28.0)	730 (28.7)	**7MC2900-2EC**
• 1000 (39.4)	1020 (40.2)	**7MC2900-3EC**
X 15 CrNiSi 25 20, material No. 1.4841		
∅ 22 mm x 2 mm (∅ 0.87 inch x 0.08 inch), 1.05 kg (2.31 lb), dished		
Nominal length in mm (inch):	Protective tube length in mm (inch):	
• 1000 (39.4)	1020 (40.2)	**7MC2900-3FA**
CrAl 205 (Megapyr), material No. 1.4767		
∅ 22 mm x 2 mm (∅ 0.87 inch x 0.05 inch), 0.55 ... 1.10 kg (1.21 ... 2.42 lb)		
Nominal length in mm (inch):	Protective tube length in mm (inch):	
• 500 (19.7)	520 (20.5)	**7MC2900-1HA**
• 710 (28.0)	730 (28.7)	**7MC2900-2HA**
• 1000 (39.4)	1020 (40.2)	**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 *L1* in mm (inch):	Thermocouple length *L2* in mm (inch):	
• 500 (19.7)	540 (21.3)	**7MC2903-1CA**
• 710 (28.0)	750 (29.5)	**7MC2903-2CA**
• 1000 (39.4)	1040 (40.9)	**7MC2903-3CA**

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))

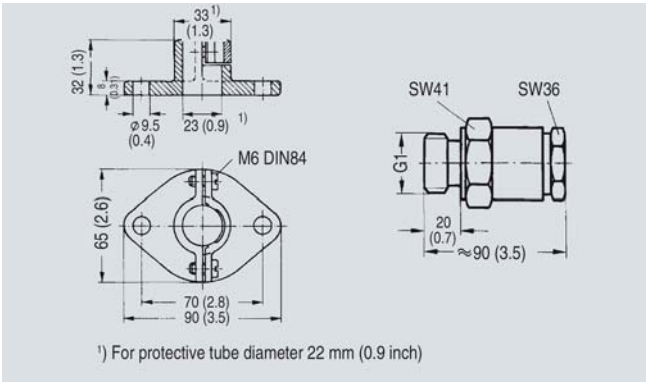
Selection and Ordering data	Order No.
Connection head, form A, (without terminal block and terminals) 1 Cable inlet, degree of protection IP53, 0.35 kg (0.77 lb)	
Cast light alloy fastener, unscrewable for protective tube diameter in mm (inch) (bore = protective tube diam. +0.5 mm) (0.02 inch): • 22 (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): • 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	
• for protective tube outer diameters 22 mm (0.87 inch); 0.35 kg (0.77 lb)	**7MC2998-2CB**
• for protective tube outer diameters 26 mm (1.02 inch); 0.32 kg (0.71 lb)	**7MC2998-2CC**
Threaded sleeve Gas-tight up to 1 bar (14.5 psi), adjustable, materiall No. 1.0718, with gasket; 0.40 kg (0.88 lb)	
• for protective tube outer diameters 22 mm (0.87 inch), **G1**	**7MC2998-2DB**
• for protective tube outer diameters 26 mm (1.02 inch), **G1**	**7MC2998-2DC**

Dimensional drawings



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

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

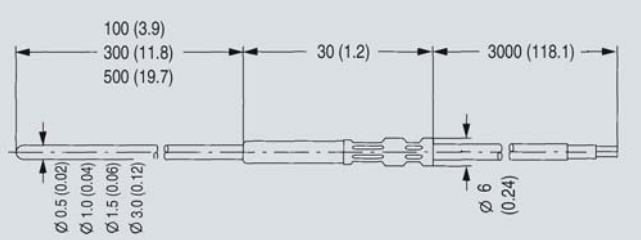
Thermocouple	Ni Cr/Ni, type K, one off
Jacket	
• Form	Outer diameter 0.5, 1.0, 1.5 or 3 mm (0.02, 0.04, 0.06 or 0.12 inch)
• Minimum bending radius	fivefold outer diameter
• Material	Inconel; NiCr 15 Fe, mat. No. 2.4816

Extension lead

- Number of conductors: 2
- Conductor cross-section: 0.22 mm^2 (0.00034 $inch^2$)
- Length: 3 m (9.84 ft)

Type	Max. temperature °C (°F)	Conductor material	Insulation single	Insulation 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

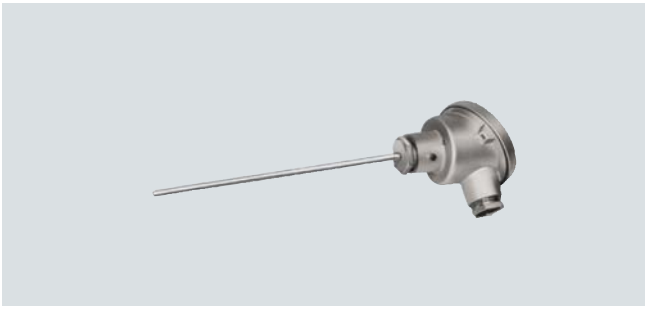


Jacket thermocouple with extension lead, dimensions in mm (inches)

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)	**7MC2027-1AA20**
• 300 (11.8)	**7MC2027-2AA20**
• 500 (19.7)	**7MC2027-3AA20**
Extension lead type L2KK	
Nominal length in mm (inch):	
• 100 (3.94)	**7MC2027-1BA20**
• 300 (11.8)	**7MC2027-2BA20**
• 500 (19.7)	**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)	**7MC2027-1AA30**
• 300 (11.8)	**7MC2027-2AA30**
• 500 (19.7)	**7MC2027-3AA30**
Extension lead type L2KK	
Nominal length in mm (inch):	
• 100 (3.94)	**7MC2027-1BA30**
• 300 (11.8)	**7MC2027-2BA30**
• 500 (19.7)	**7MC2027-3BA30**
Jacket outer diameter 3.0 mm (0.12 inch)	
Extension lead type L2SS	
Nominal length in mm (inch):	
• 100 (3.94)	**7MC2027-1AA40**
• 300 (11.8)	**7MC2027-2AA40**
• 500 (19.7)	**7MC2027-3AA40**
Extension lead type L2KK	
Nominal length in mm (inch):	
• 100 (3.94)	**7MC2027-1BA40**
• 300 (11.8)	**7MC2027-2BA40**
• 500 (19.7)	**7MC2027-3BA40**
Extension lead type L2TGD	
Nominal length in mm (inch):	
• 100 (3.94)	**7MC2027-1CA40**
• 300 (11.8)	**7MC2027-2CA40**
• 500 (19.7)	**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.	**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**

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

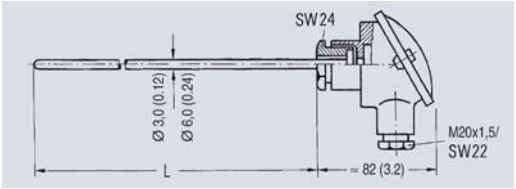
Thermocouple	Fe/Cu Ni, Fe-CuNi or Ni Cr/Ni
Jacket	Measuring junction insulated from base of jacket
• Material	X 6 CrNiTi 18 10, mat. No. 1.4541 Inconel
• Temperature	Up to 800 °C (1472 °F) Up to 1100 °C (2012 °F)
Connection head	Form B to DIN 43729
• Material	Cast light alloy
• Temperature	-30 ... +100 °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: ≥ 1000 MΩ/m at 20 °C (≥ 305 MΩ/ft at 68 °F)
- Minimum bending radius: 5 x outer diameter of jacket
- Leak resistance of measuring junction: Tested at 40 bar (580 psi)

Thermocouple	Jacket		No. of thermocouples	Thermocouple 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)	**7MC2021-2CE-Z**
• 6.0 (0.24)	**7MC2021-4CE-Z**
2 thermocouples Jacket outer diameter/mm (inch):	
• 3.0 (0.12)	**7MC2021-2CF-Z**
• 6.0 (0.24)	**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)	**7MC2021-2CA-Z**
• 6.0 (0.24)	**7MC2021-4CA-Z**
2 thermocouples Jacket outer diameter/mm (inch):	
• 3.0 (0.12)	**7MC2021-2CB-Z**
• 6.0 (0.24)	**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)	**7MC2021-2LC-Z**
• 6.0 (0.24)	**7MC2021-4LC-Z**
2 thermocouples Jacket outer diameter/mm (inch):	
• 3.0 (0.12)	**7MC2021-2LD-Z**
• 6.0 (0.24)	**7MC2021-4LD-Z**
Further designs Please specify Order code(s) and plain text.	Order code
• Length L in m (ft)	
- 0.25 (0.82)	**A01**
- 1 (3.28)	**A02**
- 5 (16.4)	**A03**
- 10 (32.8)	**A04**
• 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). If optional head transmitters are integrated, please note that all calibration points are located in the set measuring range. If the points are located outside the standard measuring range, a Y11 addition is always required.	**Y33**

To order a temp. transmitter installed in the connection head, see "Temp. transm. for installation in the connection head" (page 3/95).

Sensor type setting essential for the function. By default, the transmitter is supplied with the factory settings for configuration by the customer. The factory settings of sensor type, measuring range, etc. can be ordered using option Y11.

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**

Jacket thermocouples with socket

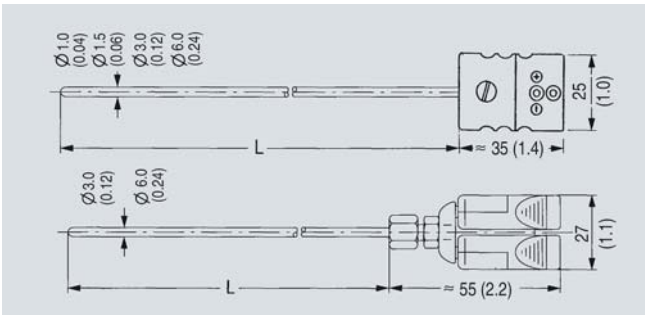
Overview

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):	Length *L*/m (ft):	
• 3.0 (0.12)	0.3 (0.98)	**7MC2028-1AC31**
• 3.0 (0.12)	0.5 (1.64)	**7MC2028-2AC31**
2 thermocouples		
Jacket outer dia./ mm (inch):	Length *L*/m (ft):	
• 3.0 (0.12)	0.3 (0.98)	**7MC2028-1AD31**
• 3.0 (0.12)	0.5 (1.64)	**7MC2028-2AD31**
• 6.0 (0.24)	0.3 (0.98)	**7MC2028-1AD41**
• 6.0 (0.24)	0.5 (1.64)	**7MC2028-2AD41**
Jacket material No. 2.4816		
Temperature of medium 1000 °C (1832 °F)		
1 thermocouple		
Jacket outer diameter/mm (inch):	Length *L*/m (ft):	
• 1.0 (0.04)	0.3 (0.98)	**7MC2028-1AC12**
• 1.0 (0.04)	0.5 (1.64)	**7MC2028-2AC12**
Jacket material No. 2.4816		
Temperature of medium 1100 °C (2012 °F)		
1 thermocouple		
Jacket outer dia./ mm (inch):	Length *L*/m (ft):	
• 1.5 (0.06)	0.3 (0.98)	**7MC2028-1AC22**
• 1.5 (0.06)	0.5 (1.64)	**7MC2028-2AC22**
• 3.0 (0.12)	0.3 (0.98)	**7MC2028-1AC32**
• 3.0 (0.12)	0.5 (1.64)	**7MC2028-2AC32**
• 6.0 (0.24)	0.3 (0.98)	**7MC2028-1AC42**
• 6.0 (0.24)	0.5 (1.64)	**7MC2028-2AC42**
2 thermocouples		
Jacket outer dia./ mm (inch):	Length *L*/m (ft):	
• 3.0 (0.12)	0.3 (0.98)	**7MC2028-1AD32**
• 3.0 (0.12)	0.5 (1.64)	**7MC2028-2AD32**
• 6.0 (0.24)	0.3 (0.98)	**7MC2028-1AD42**
• 6.0 (0.24)	0.5 (1.64)	**7MC2028-2AD42**
Further designs		Order code
Please add "-**Z**" to Order No. and specify Order code(s) and plain text.		
• 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). If optional head transmitters are integrated, please note that all calibration points are located in the set measuring range. If the points are located outside the standard measuring range, a Y11 addition is always required.		**Y33**

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

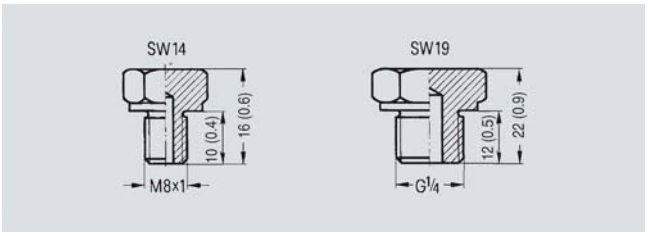
(Please order coupling plug separately (see "Individual parts"))

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 mm² (2 x 0.00034 inch²) 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 mm² (2 x 0.00034 inch²) 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 mm² (2 x 0.00034 inch²) 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 mm² (2 x 0.00034 inch²) 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)	**A01**
- 1 (3.28)	**A02**
- 5 (16.4)	**A03**
- 10 (32.8)	**A04**

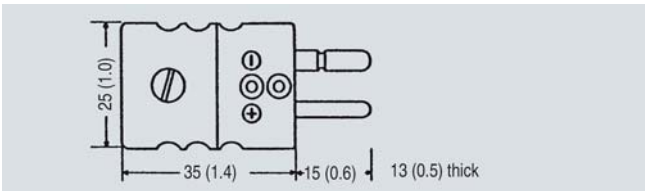
Other individual parts

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

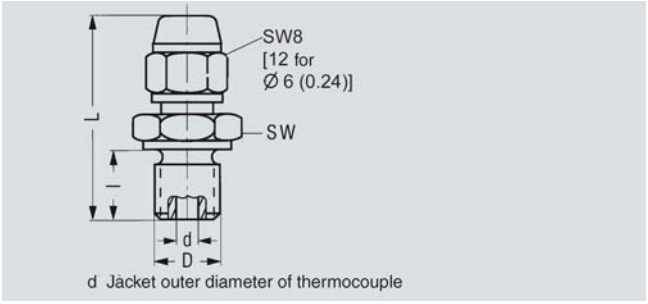
Dimensional drawings



Screw nipple with M8 x 1 thread (left) or G¼ (right), dimensions in mm (inches)



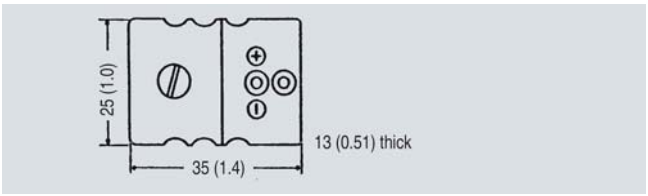
Coupling plug, dimensions in mm (inches)



d Jäcket outer diameter of thermocouple

d mm (inch)	D	l mm (inch)	L mm (inch)	SW
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)	G¼	10 (0.4)	48 (1.9)	19

Compression joint with M8 x 1 or G¼ thread dimensions in mm (inches)



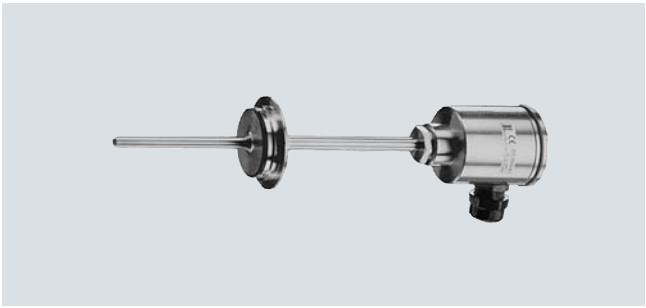
Coupling socket, dimensions in mm (inches)

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)	**7MC2922-1EA**
• with G¼ thread, for all jacket outer diameters listed in the catalog, 0.02 kg (0.04 lb)	**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)	**7MC2922-3AA**
- jacket outer diameter 3.0 mm (0.12 inch)	**7MC2922-3BA**
• Thread G¼; 0.04 kg (0.08 lb)	
- jacket outer diameter 6 mm (0.24 inch)	**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**

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: • 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	• 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 (5.9×10^{-5} inch)
• Hygiene	Surface roughness Ra < 0.8 µm (3.1×10^{-5} inch)
• Welded seam	< 1.5 µm (5.9×10^{-5} inch)

Selection and Ordering data

Order No. 7MC8005-□□□□0-□□□0 Order code □□□

Pt100 resistance thermometer for food, pharmaceuticals and biotechnology

Connection head

- Form B, cast light alloy, screw cover, IP54, cable gland — 1
- Form B, plastic, screw cover, IP54, cable gland — 2
- Form BUZ, cast light alloy, screw cover, IP65, cable gland — 3
- Form BUZH, cast light alloy, high hinged cover, IP 65, cable gland — 4
- Form B, stainless steel, standard, IP67, cable gland — 5
- Special version: (add Order code and plain text) — 9 — H1Y

Process connection, material 1.4404/316L

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

ISO 2852	DIN 32676	Tri-Clamp	Outer diameter D	
–	–	½"/ ¾"	25.0 mm	CA
DN 25/ 33.7/38	DN 25/32/40	1", 1½"	50.5 mm	CB
DN 40/51	DN 50	2"	64.0 mm	CC
DN 63.5	–	2½"	77.5 mm	CD
DN 88.9	DN 80	–	106.0 mm	CE

- Varivent connection (Tuchenhagen)
  - D = 50 mm (1.97 inch), for Varivent housing DN 25 and DN 1" — KU
  - D = 68 mm (2.68 inch), for Varivent housing DN 40 ... 125 and 1½" ... 6" — KV
- NEUMO/BioControl with O-Ring
  - Size 25 — BA
  - Size 50 — BB
  - Size 65 — BC

Sanitary nozzle

- DN 25 with hexagon union nut G 1¼", 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 — J1Y

Protective tube	Measuring insert		
Ø F1=6 mm (0.24 inch)	Ø 3/3.2 mm, (0.12/0.13 inch) miner. insul.	1	
Ø F1=9 mm (0.35 inch)	Ø 6 mm (0.24 inch)	2	
Ø F1=9 mm (0.35 inch)	Ø 6 mm (0.24 inch) miner. insul.	3	
Ø F1=9 mm (0.35 inch) tapered tip F3=5 Ø x 20 mm (0.2 x 0.79 inch)	Ø 3/3.2 mm, (0.12/0.12 inch) miner. insul.	4	
Special version: (add Order code and plain text)		9	L1Y

Selection and Ordering data

Order No. 7MC8005-□□□□0-□□□0 Order code □□□

Pt100 resistance thermometer for food, pharmaceuticals and biotechnology

Neck tube length M

- 80 mm (3.15 inch) — 1
- 145 mm (5.71 inch) — 2
- Special version: (add Order code and plain text) — 9 — N1Y

Mounting length U1

- 15 mm (0.59 inch) — B
- 35 mm (1.38 inch) — C
- 50 mm (1.97 inch) — D
- 100 mm (3.94 inch) — E
- 160 mm (6.30 inch) — F
- 250 mm (9.84 inch) — G
- 400 mm (15.75 inch) — H
- 4 inch — J
- 6 inch — K
- 9 inch — L
- Special version: (add Order code and plain text) — Z — P1Y

Sensor

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

- 1 x Pt100, class A, three-wire — F
- 2 x Pt100, class A, three-wire — G
- 1 x Pt100, class A, four-wire — H
- Special version: (add Order code and plain text) — Z — Q1Y

Further designs

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

Order code

- Process connection completely electropolished — P01
- Hygiene version (R_a < 0.8 µm (3.1 x 10^{-5} inch)) — H01
- Certificates
  - Roughness depth measurement R_a certified by factory certificate to EN 10204-3.1B — C18
  - Material certificate to EN 10204-3.1 — C19
- Specify special version in plain text — Y01
- TAG plate made of stainless steel specify TAG No. in plain text — Y15
- Test report (at 0, 50 and 100%) specify measuring range in plain text If optional head transmitters are integrated, please note that all calibration points are located in the set measuring range. If the points are located outside the standard measuring range, a Y11 addition is always required. — Y33

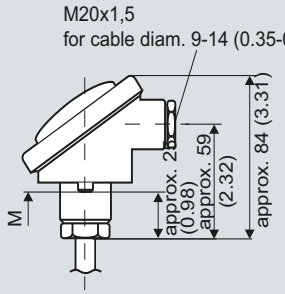
To order a temperature transmitter installed in the connection head, see "Temperature transmitters for mounting in the connection head" (page 3/74).

3

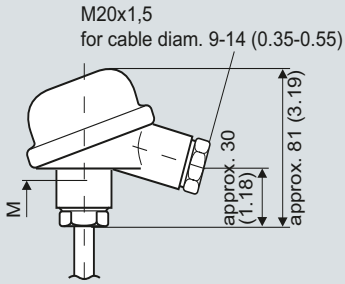
Dimensional drawings

Connection heads

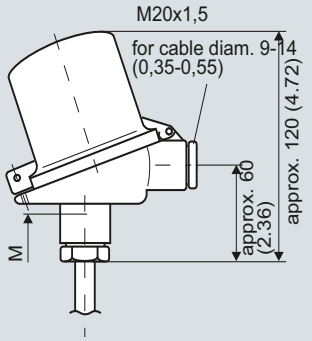
Form B, cover with 2 slotted screws, Mat. Aluminium, IP 54



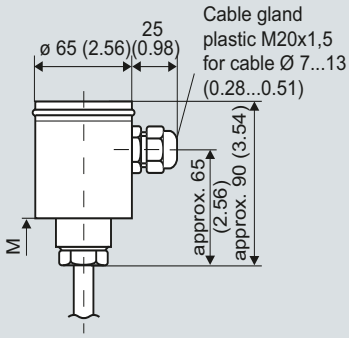
Form B, screw cover plastic, IP 54 (BK)



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



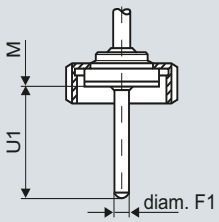
Form B, standard, screw cover, stainless steel 1.4301, IP 67



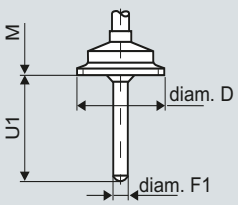
Neck tube length M up to sealing face

Process connections

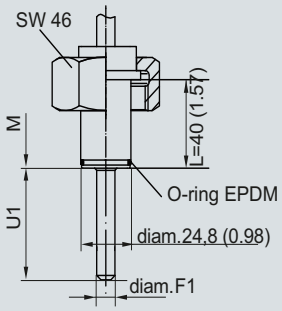
Tapered nipple with slotted nut DIN 11 851 or aseptic to DIN 11 864 DN 25 to 50 (1" to 2½")



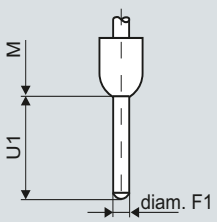
Clamp connection to DIN 32 676 or ISO 2852, TRI-clamp DN 8 to 80 (1" to 3")



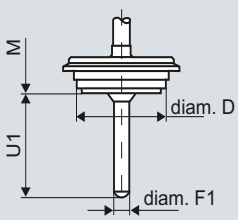
Sanitary nozzle DN25 with hexagon union nut



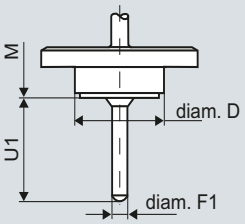
Spherical welding-type sleeve Sphere 30 x 40 mm (1.18 x 1.57 in)



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"

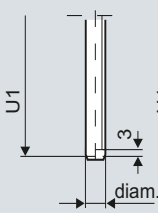


Neuma BioControl
Size 25 D-30.5 diam.
Size 50 D-50 diam.
Size 65 D-68 diam.

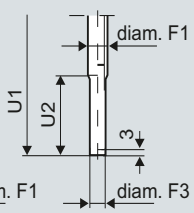


Thermowell based on DIN 43 772

Form 2

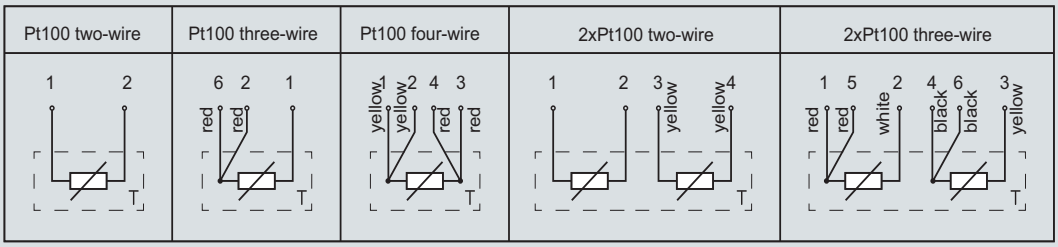


Similiar to form 3 tapered tip



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

Schematics



Connection diagram

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

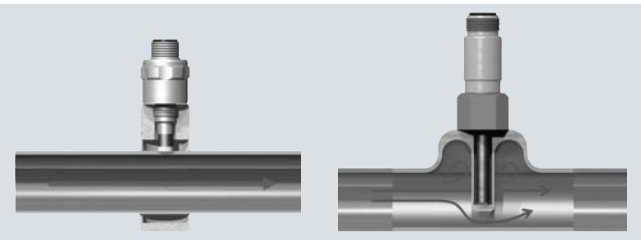
Benefits

- 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, particulary for sterilization processes.

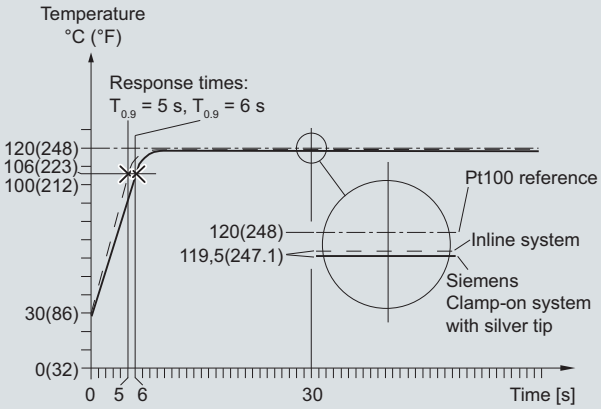
It completely replaces the commonly used inline measurement system, without having any of the inherent disadvantages: opening of pipelines during assembly, high costs for assembly and qualification of welded connections, flow and hygienic problems.



Siemens clamp-on

Conventional inline measurement

Measurement technology is comparable with inline measurements.



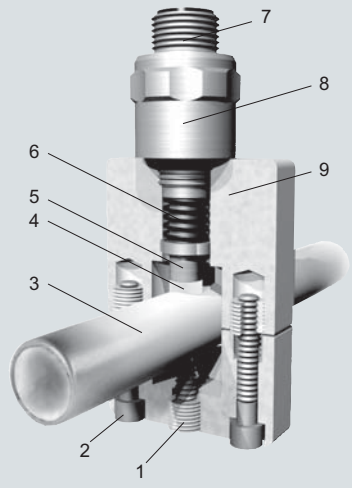
Sample application showing pipeline 13 x 1.5 mm (0.51 x 0.06 inch) made of stainless steel using heat-conductive-compound.

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.



1 Vibration-locking-screw
2 Mounting screws
3 Process pipeline
4 Temperature sensor
5 Thermal decoupling
6 Spring load
7 Electrical connection M12
8 Replaceable measuring insert
9 Heat insulated pipe collar

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.

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 ... +160 °C (-4 ... +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 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	• 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	• 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"	• 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	$U_i \leq 30$ V, $P_i \leq 200$ mW C_i and L_i are negligibly small.

3

Resistance thermometers with clamp-on system

Selection and Ordering data		Order no.	Order code
Pipe collar Pt100 thermometer		**7MC8016-0**	**0**
Type of connection			
Connector M12 x 1			**A**
Connection head form B, stainless steel			**B**
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)			**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)	90 x 85 x 20 (3.54 x 3.35 x 0.79)		**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**

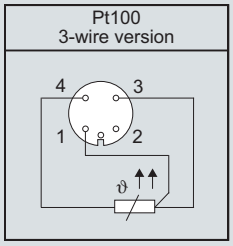
Selection and Ordering data	Ord. code
Further designs	
Add "-Z" to Order No. and specify Order Code.	
Transmitter (only connection type available: connection head)	
TH100	**T10**
TH100 Ex	**T11**
TH200	**T20**
TH200 Ex	**T21**
TH300	**T30**
TH300 Ex	**T31**
TH400 PA	**T40**
TH400 PA Ex	**T41**
TH400 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**
If optional head transmitters are integrated, please note that all calibration points are located in the set measuring range. If the points are located outside the standard measuring range, a Y11 addition is always required.	

[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")

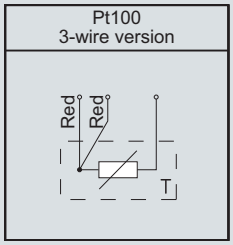
Selection and Ordering data		Order No.
Accessories		
Modem for SITRANS TH100 and TH200 incl. parameterization software SIPROM T		
• With USB connection		**7NG3092-8KU**
• With RS 232 connection	C)	**7NG3092-8KM**
HART modem		
• With RS 232 connection	D)	**7MF4997-1DA**
• With USB connection	D)	**7MF4997-1DB**
SIMATIC PDM operating software, see "Communication and Software"		
CD for measuring instruments for temperature wiht documentation in German, English, French, Spanisch, Italian, Portuguese and SIPROM T parameterization software		**A5E00364512**

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".

Schematics

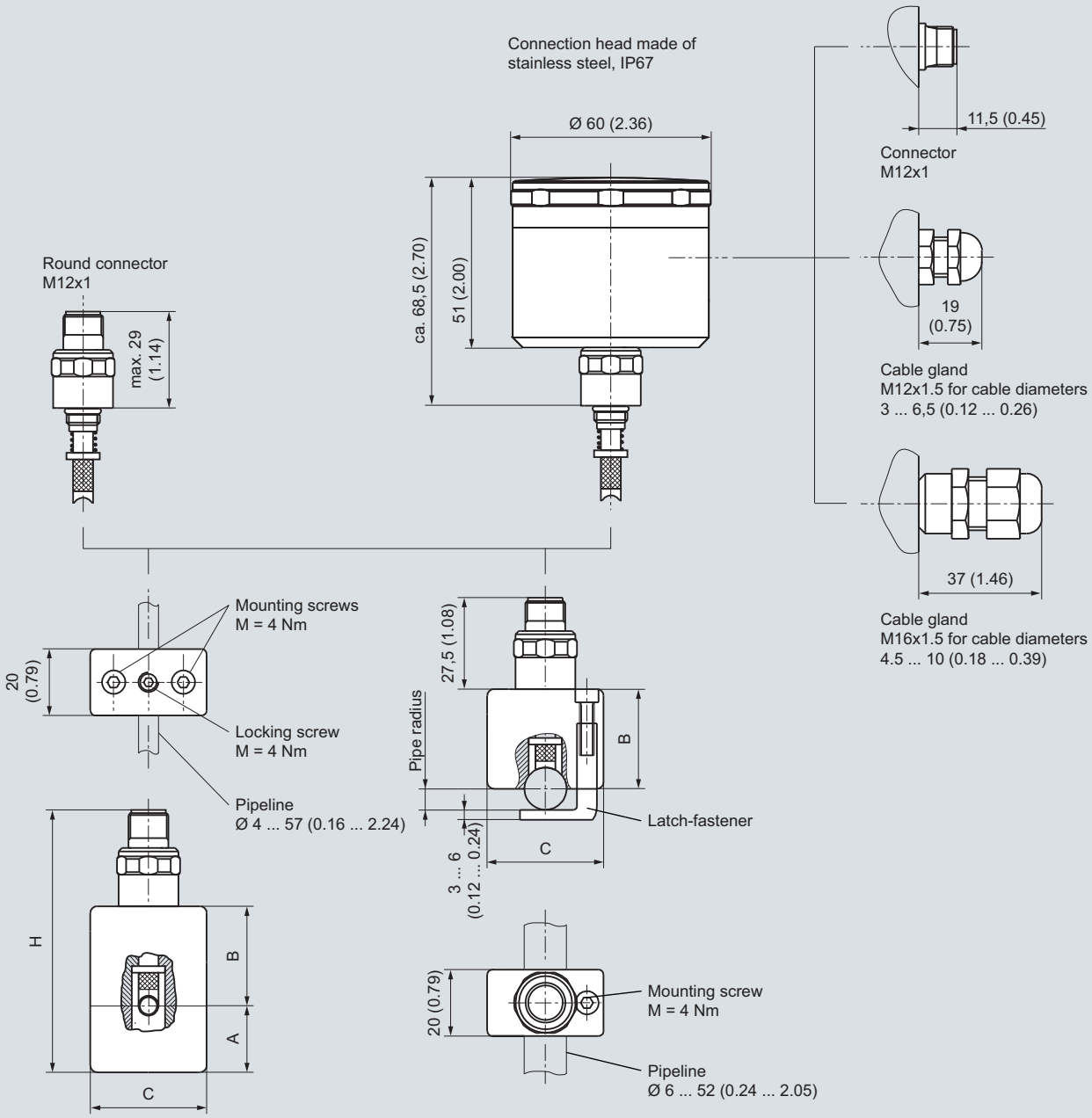


Connection diagram for round connector M12 x 1, 4-pole



Connection diagram for connection head or cable gland

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)