

Temperature Measurement

Transmitter for field mounting/field indicator

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

Overview



Our field devices for heavy industrial use

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

The temperature transmitter SITRANS TF works where others feel uncomfortable.

Benefits

- Universal use
 - as transmitter for resistance thermometer, 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 IP66/67/68
- 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. For that reasons 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

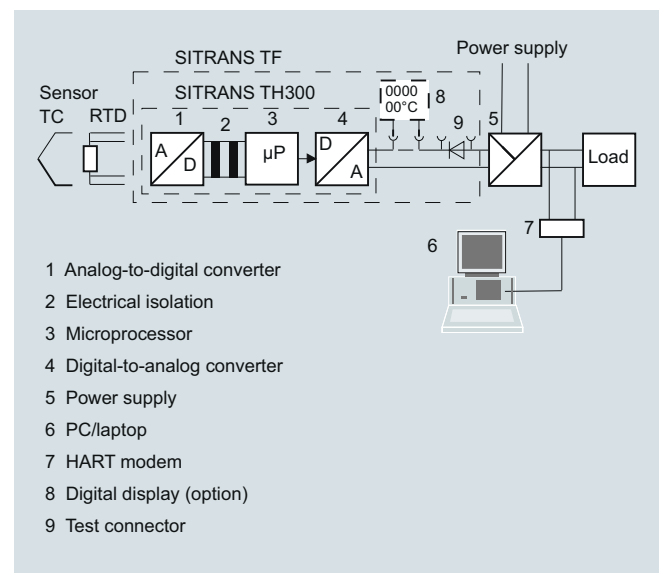
The sensor signal, whether resistance thermometer, thermocouple element or Ω or mV signal, is amplified and linearized. Sensor and output side are electrically isolated. An internal cold junction is integrated for measurements with thermocouple elements.

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

Temperature Measurement

Transmitter for field mounting/field indicator

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

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 $\leq 100 \Omega$ (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	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 $\leq 100 \Omega$ (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Can be switched off
Short-circuit monitoring	Can be switched off (value is adjustable)

Measuring range	parameterizable max. 0 ... 2200 Ω (see table "Digital measuring errors")
Min. measured span	5 ... 25 Ω (see Table "Digital measuring errors")
Characteristic curve	Resistance-linear or special characteristic
<u>Thermocouples</u>	
Measured variable	Temperature
Sensor type (thermocouples)	
• Type B	Pt30Rh-Pt6Rh to DIN IEC 584
• Type C	W5 %-Re 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
<u>mV sensor</u>	
Measured variable	DC voltage
Sensor type	DC voltage source (DC voltage source possible over an externally connected resistor)
Units	mV
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Can be switched off
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 M Ω
Characteristic curve	Voltage-linear or special characteristic

Temperature Measurement

Transmitter for field mounting/field indicator

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

Output		Auxiliary power	
Output signal	4 ... 20 mA, 2-wire	Without digital display	11 ... 35 V DC (30 V for Ex ib; 32 V for Ex ic and Ex nA)
Communication with SITRANS TH300	acc. to HART Rev. 5.9	With digital display	13.1 ... 5 V DC (30 V for Ex ib; 32 V for Ex ic and Ex nA)
Digital display		Electrically isolated	Between input and output
Digital display (optional)	In current loop	• Test voltage	$U_{\text{eff}} = 1 \text{ kV}$, 50 Hz, 1 min
Display	Max. 5 digits	Certificates and approvals	
Digit height	9 mm (0.35 inch)	Explosion protection ATEX	
Display range	-99 999 ... + 99 999	• "Intrinsic safety" type of protection	with digital display: II 2 (1) G Ex ib [ia Ga] IIC T4 Gb II 2 G Ex ib IIC T4 Gb II 1D Ex ia IIIC T100 °C Da
Units	any (max. 5 char.)		without digital display: II 2 (1) G Ex ib [ia Ga] IIC T6 Gb II 2 G Ex ib IIC T6 Gb II 1D Ex ia IIIC T100 °C Da
Setting: Zero point, full-scale value and unit	with 3 buttons		ZELM 11 ATEX 0471 X
Load voltage	2.1 V		II 3 G Ex ic IIC T6/T4 Gc II 3 G Ex nA IIC T6/T4 Gc II 3 G Ex nA [ic] IIC T6/T4 Gc
Measuring accuracy		- EC type test certificate	ZELM 11 ATEX 0471 X
Digital measuring errors	See table "Digital measuring errors"	• "Operating equipment that is non-ignitable and has limited energy for zone 2" type of protection	II 2 G Ex d IIC T6/T5 Gb II 2 D Ex tb IIIC T100 °C Db
Reference conditions		- EC type test certificate	ZELM 11 ATEX 0472 X
• Auxiliary power	24 V ± 1 %	• "Flame-proof enclosure" type of protection	Certificate of Compliance 3017742
• Load	500 Ω	- EC type test certificate	• XP/II/1/BCD/T5 Ta = 85 °C (185 °F), T6 Ta = 60 °C (140 °F), Type 4X
• Ambient temperature	23 °C (73.4 °F)		• DIP/II, III/1/EFG/T5 Ta = 85 °C (185 °F), T6 Ta = 60 °C (140 °F), Type 4X
• Warming-up time	> 5 min		• NI/II/2/ABCD/T5 Ta = 85 °C (185 °F), T6 Ta = 60 °C (140 °F), Type 4X
Error in the analog output (digital/analog converter)	< 0.025 % of span		• S/II, III/2/FG/T5 Ta = 85 °C (185 °F), T6 Ta = 60 °C (140 °F), Type 4X
Error due to internal cold junction	< 0.5 °C (0.9 °F)	Explosion protection to FM	
Influence of ambient temperature		• Identification (XP, DIP, NI, S)	
• Analog measuring error	0.02 % of span/10 °C (18 °F)		IECEx, EAC Ex(GOST), INMETRO, NEPSI, KOSHA
• 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		Hardware and software requirements	
<u>Ambient conditions</u>		• For the parameterization software SIPROM T for SITRANS TF with TH200	
Storage temperature	-40 ... +85 °C (-40 ... +185 °F)	- Personal computer	PC with CD-ROM drive and USB
Condensation	Permissible	- PC operating system	Windows 98, NT, 2000, XP, 7 and Win 8
Electromagnetic compatibility	According to EN 61326 and NAMUR NE21	• For the parameterization software SIMATIC PDM for SITRANS TH300	See chapter 8 "Software", "SIMATIC PDM"
Degree of protection to EN 60529	IP66/67/68		
Construction		Communication	
Weight	Approx. 1.5 kg (3.3 lb) without options	Load for HART connection	230 ... 1100 Ω
Dimensions	See "Dimensional drawings"	• Two-core shielded	≤ 3.0 km (1.86 mi)
Enclosure material	Die-cast aluminum, low in copper, GD-AlSi 12 or stainless steel, polyester-based lacquer, stainless steel rating plate	• Multi-core shielded	≤ 1.5 km (0.93 mi)
Electrical connection, sensor connection	Screw terminals, cable inlet via M20 x 1.5 or ½-14 NPT screwed gland	Protocol	HART protocol, version 5.9
Mounting bracket (optional)	Steel, galvanized and chrome-plated or stainless steel	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	

Temperature Measurement

Transmitter for field mounting/field indicator

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

Digital measuring errors

Resistance thermometer

Input	Measuring range °C / (°F)	Min. mea- sured span		Digital accuracy	
		°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 Ω	Min. mea- sured span Ω	Digital accuracy Ω
Resistance	0 ... 2200	25	0.25

Thermocouples

Input	Measuring range °C / (°F)	Min. mea- sured span		Digital accuracy	
		°C	(°F)	°C	(°F)
Type B	100 ... 1820 (212 ... 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	-200 ... +1200 (-328 ... +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 100 to 300 °C (212 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 mV	Min. mea- sured span mV	Digital accuracy μV
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).

Temperature Measurement

Transmitter for field mounting/field indicator

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

Selection and Ordering data	Article No.	Further designs	Order code
Temperature transmitter in field housing Two-wire system 4 ... 20 mA, with electrical isolation, with documentation on MiniDVD ↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.	7NG313	Please add "-Z" to Article No. and specify Order code(s) and plain text.	
Integrated transmitter SITRANS TH200, programmable <ul style="list-style-type: none"> Without Ex protection With Ex ia (ATEX + IECEx) With Ex nAL for zone 2 (ATEX + IECEx) Total device SITRANS TF Ex d (ATEX + IECEx)¹⁾ Total device SITRANS TF according to FM (XP, DIP, NI, S)¹⁾ SITRANS TH300, communication capability according to HART V 5.9 <ul style="list-style-type: none"> Without Ex-protection With Ex ia (ATEX + IECEx) With Ex nAL for zone 2 (ATEX + IECEx) Total device SITRANS TF Ex d (ATEX + IECEx)¹⁾ Total device SITRANS TF according to FM (XP, DIP, NI, S)¹⁾ 	5 0 5 1 5 2 5 4 5 5 6 0 6 1 6 2 6 4 6 5	Test protocol (5 measuring points) Functional safety SIL2 Functional safety SIL2/3 Explosion protection <ul style="list-style-type: none"> Explosion protection Ex ia to INMETRO (Brazil) (only with 7NG313.-1....) Explosion protection Ex d to INMETRO (Brazil) (only with 7NG313.-4....) Explosion protection Ex nA to INMETRO (Brazil) (only with 7NG313.-2....) Explosion protection Ex i to NEPSI (China) (only with 7NG313.-1....) Explosion protection Ex d to NEPSI (China) (only with 7NG313.-4....) Explosion protection Ex nA to NEPSI (China) (only with 7NG313.-2....) Explosion protection Ex d to KOSHA (Korea) (only with 7NG313.-4....) Explosion protection Ex i according to EAC (Russia/Belarus/Kazakhstan) (only for 7NG313.-1....) Explosion protection Ex d according to EAC (Russia/Belarus/Kazakhstan) (only for 7NG313.-4....) Explosion protection Ex nA according to EAC (Russia/Belarus/Kazakhstan) (only for 7NG313.-2....) 	C11 C20 C23 E25 ²⁾ E26 ²⁾ E27 ²⁾ E55 ²⁾ E56 ²⁾ E57 ²⁾ E70 ²⁾ E81 ²⁾ E82 ²⁾ E83 ²⁾
Enclosure Die-cast aluminium Stainless steel precision casting			A E
Connections/cable inlet Screwed glands M20x1.5 Screwed glands ½-14 NPT			B C
Digital indicator Without With			0 1
Mounting bracket and securing parts Without Made of steel Made of stainless steel			0 1 2
		Marine approvals <ul style="list-style-type: none"> Det Norske Veritas Germanischer Lloyd (DNV GL) Bureau Veritas (BV) Lloyd's Register of Shipping (LR) American Bureau of Shipping (ABS) Two coats of lacquer on casing and cover (PU on epoxy) Transient protection Cable gland CAPRI 1/2 NPT ADE 4F, nickel-plated brass (CAPRI 848694 and 810634) included Cable gland 1/2 NPT ADE 1F, cable diam. 6 ... 12 (CAPRI 818694 and 810534) included Cable gland 1/2 NPT ADE 4F, stainless steel (CAPRI 848699 and 810634) included Cable gland 1/2 NPT ADE 1F, cable diam. 4 ... 8.5 (CAPRI 818674 and 810534) included	D01 D02 D04 D05 G10 J01 D57 D58 D59 D60

Temperature Measurement

Transmitter for field mounting/field indicator

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

Selection and Ordering data	Order code
Customer-specific programming Add "-Z" to Article No. and specify Order code(s)	
Measuring range to be set Specify in plain text (max. 5 digits): Y01: ... to ... °C, °F	Y01³⁾
Measuring point no. (TAG), max. 8 characters	Y17⁴⁾
Meas. point descriptor, max. 16 characters	Y23⁵⁾
Meas. point message, max. 32 characters	Y24⁵⁾
Only inscription on measuring point label: specify in plain text: Measuring range	Y22⁵⁾
Pt100 (IEC) 2-wire, $R_L = 0 \Omega$	U02⁶⁾
Pt100 (IEC) 3-wire	U03⁶⁾
Pt100 (IEC) 4-wire	U04⁶⁾
Thermocouple type B	U20⁶⁾⁷⁾
Thermocouple type C (W5)	U21⁶⁾⁷⁾
Thermocouple type D (W3)	U22⁶⁾⁷⁾
Thermocouple type E	U23⁶⁾⁷⁾
Thermocouple type J	U24⁶⁾⁷⁾
Thermocouple type K	U25⁶⁾⁷⁾
Thermocouple type L	U26⁶⁾⁷⁾
Thermocouple type N	U27⁶⁾⁷⁾
Thermocouple type R	U28⁶⁾⁷⁾
Thermocouple type S	U29⁶⁾⁷⁾
Thermocouple type T	U30⁶⁾⁷⁾
Thermocouple type U	U31⁶⁾⁷⁾
With TC: CJC external (Pt100, 3-wire)	U41
With TC: CJC external with fixed value, specify in plain text	Y50
Special differing customer-specific programming, specify in plain text	Y09⁸⁾
Fail-safe value 3.6 mA (instead of 22.8 mA)	U34⁴⁾

Supply units see Chapter "Supplementary Components".

- 1) Without cable gland.
- 2) Option does not include ATEX/IECEx approval, only country-specific approval.
- 3) For customer-specific programming for RTD and TC, the start value and the end value of the required measuring span must be specified here. For specification on TAG plate, please select Y22.
- 4) For this selection, Y01 or Y09 must also be selected. For specification on TAG plate, please select Y23.
- 5) If only Y22, Y23 or Y24 are ordered and the label only has to be on the tag plate, Y01 does not have to be specified.
- 6) For this selection, Y01 must also be selected.
- 7) Internal reference junction compensation is selected as the default for TC.
- 8) For customer-specific programming, for example mV and ohm, the start value and the end value of the required measuring span and the unit must be entered here.

Selection and Ordering data	Article No.
Accessories Further accessories for assembly, connection and transmitter configuration, see page 2/238.	
Modem for SITRANS TH100, TH200, TR200 and TF with TH200 incl. parameterization software T with USB interface	7NG3092-8KN
HART modem With USB interface	7MF4997-1DB
SIMATIC PDM parameterization software also for SITRANS TH300	see chapter 8
Mounting bracket and securing parts Made of steel for 7NG313.-.B.. Made of steel for 7NG313.-.C.. Made of stainless steel for 7NG313.-.B.. Made of stainless steel for 7NG313.-.C..	7MF4997-1AC 7MF4997-1AB 7MF4997-1AJ 7MF4997-1AH
Digital indicator¹⁾	7MF4997-1BS
Connection board	A5E02226423

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

Ordering example 1:

7NG3135-0AB11-Z Y01+Y23+U03
Y01: -10 ... +100 °C
Y23: TICA1234HEAT

Ordering example 2:

7NG3136-0AC11-Z Y01+Y23+Y24+U25
Y01: -10 ... +100 °C
Y23: TICA 1234 ABC
Y24: HEATING BOILER 56789

Factory setting (transmitter):

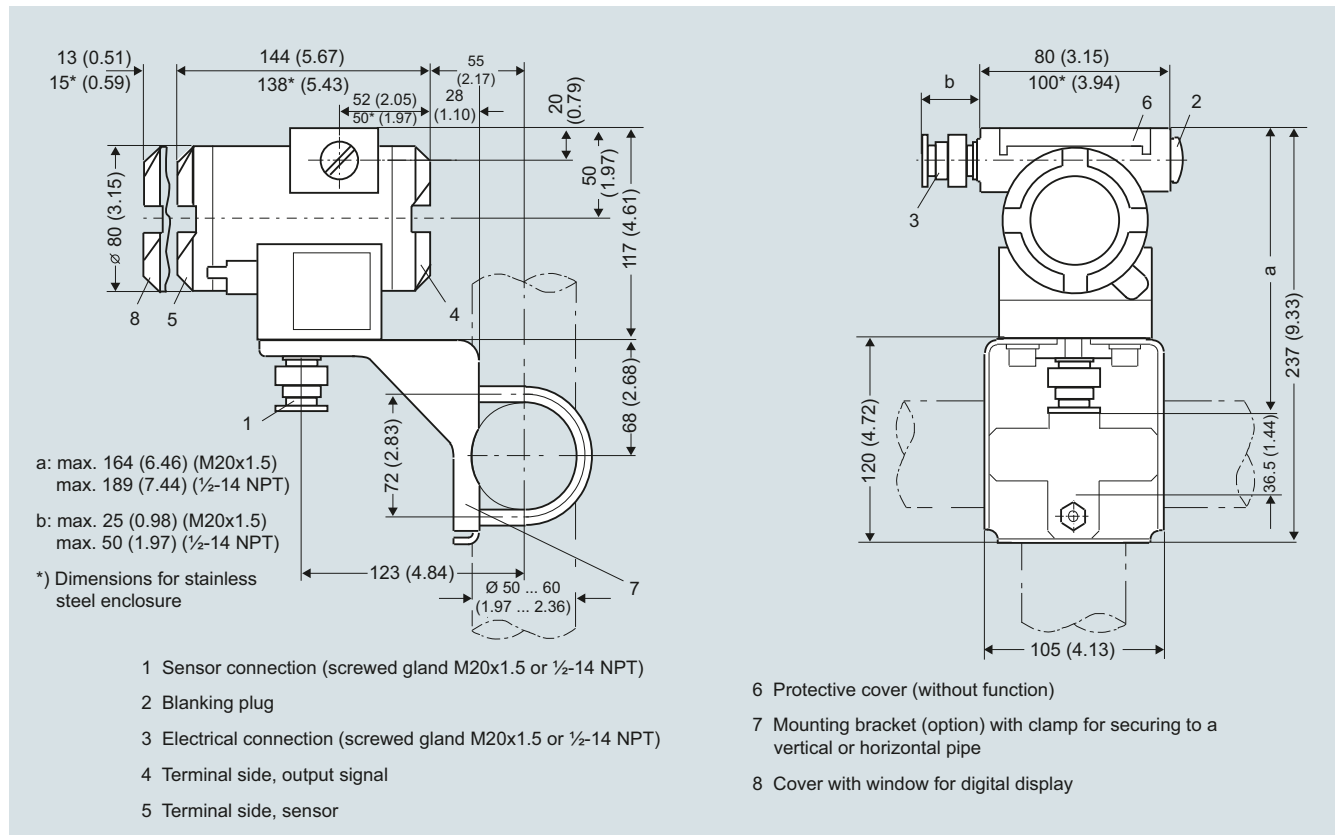
- Pt100 (IEC 751) with three-wire circuit
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

Temperature Measurement

Transmitter for field mounting/field indicator

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

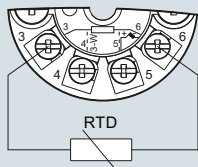
Dimensional drawings



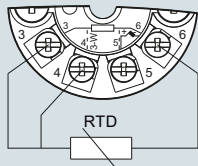
SITRANS TF, dimensions in mm (inches)

Schematics

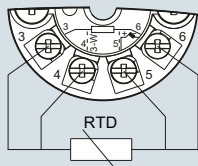
Resistance thermometer



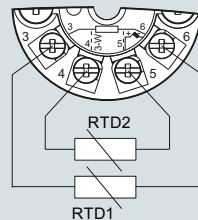
Two-wire system ¹⁾



Three-wire system



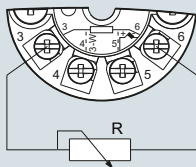
Four-wire system



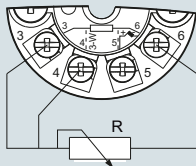
Generation of average value / difference ¹⁾

¹⁾ Programmable line resistance for the purpose of correction.

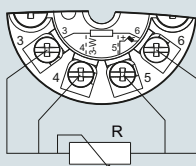
Resistance



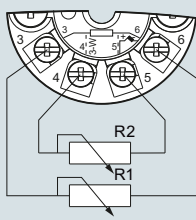
Two-wire system ¹⁾



Three-wire system

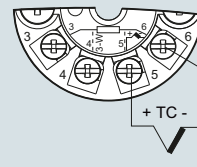


Four-wire system

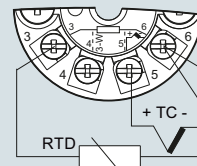


Generation of average value / difference ¹⁾

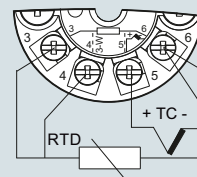
Thermocouple



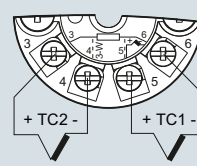
Cold junction compensation
Internal/fixed value



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

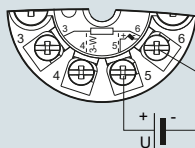


Cold junction compensation with
external Pt100 in three-wire system

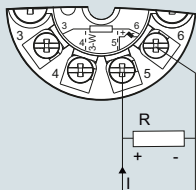


Generation of average value / difference
with internal cold junction compensation

Voltage measurement



Current measurement



SITRANS TF, sensor connection assignment

Temperature Measurement

Transmitters for field mounting

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 IP66/67/68
- 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. For that reason 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

- 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

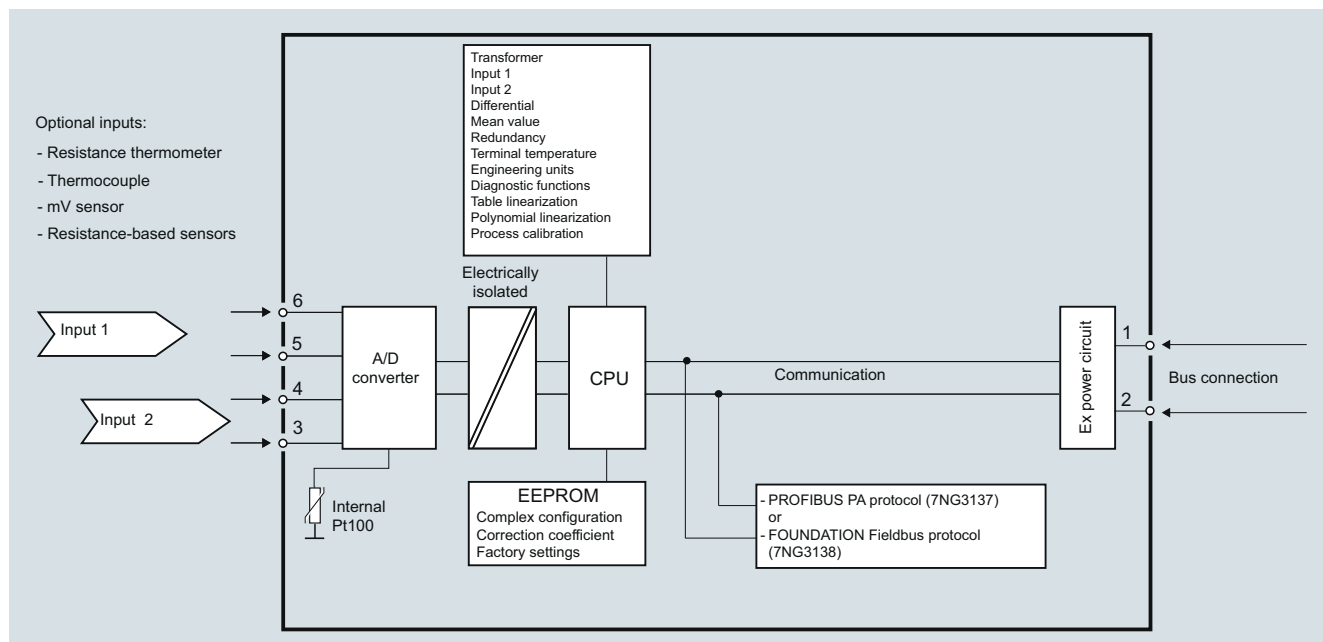
Transmitter with FOUNDATION fieldbus communication

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

Mode of operation

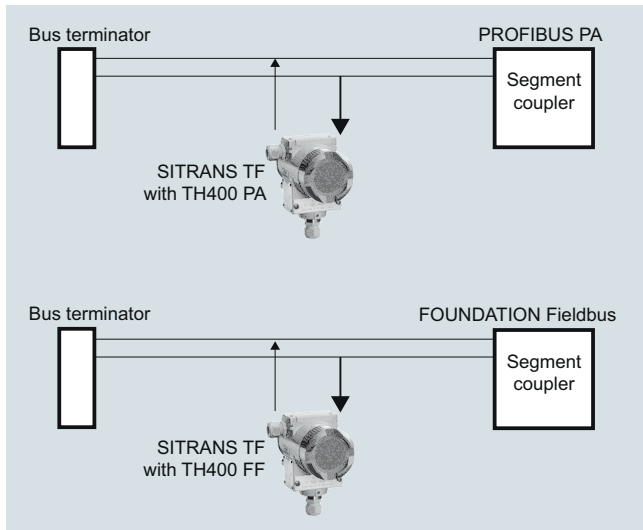
The following function diagram explains the mode of operation of the transmitter.

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, $\alpha = 0.00427$

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

Line resistance per sensor cable Max. 50 Ω

Sensor current Nominal 0.2 mA

Sensor fault detection

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

Resistance-based sensors

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

Sensor current Nominal 0.2 mA

Sensor fault detection

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

Thermocouple

to IEC 584

- Type B Measuring range 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 μ A

mV sensor - voltage input

Measuring range -800 ... +800 mV

Input resistance 10 M Ω

Output

Filter time (programmable) 0 ... 60 s

Update time < 400 ms

Measuring accuracy

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

General values

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

Basic values

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

Reference conditions

Warming-up time 30 s

Signal-to-noise ratio Min. 60 dB

Calibration condition 20 ... 28 °C (68 ... 82 °F)

Temperature Measurement

Transmitters for field mounting

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 2014/30/EU 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	<ul style="list-style-type: none"> Die-cast aluminum, low in copper, GD-AISI 12 or stainless steel Polyester-based lacquer for GD AISI 12 enclosure Stainless steel rating plate
Electrical connection, sensor connection	<ul style="list-style-type: none"> screw terminals Cable inlet via M20 x 1.5 or ½ -14 NPT screwed gland Bus connection with M12 device plug (optional)
Mounting bracket (optional)	Steel, galvanized and chrome-plated or stainless steel
Degree of protection	IP66/67 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 11 ATEX 0471 X
• Type of protection "intrinsic safety i" (version: 7NG313x-1xxxx)	II 2 (1) G Ex ib [ia Ga] IIC T6 Gb II 2 G Ex ib IIC T6 Gb II 1D Ex ia IIIC T100 °C Da
Conformity statement	ZELM 11 ATEX 0471 X
• "Operating equipment that is non-ignitable and has limited energy" type of protection (version: 7NG313x-2xxxx)	II 3 G Ex ic IIC T6/T4 Gc II 3 G Ex nA IIC T6/T4 Gc II 3 G Ex nA [ic] IIC T6/T4 Gc
EC type test certificate	ZELM 11 ATEX 0472 X
• "Flame-proof enclosure" type of protection (version: 7NG313x-4xxxx)	II 2 G Ex d IIC T6/T5 Gb II 2 D Ex tb IIIC T100 °C Db
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	EAC Ex(GOST), INMETRO, NEPSI, KOSHA

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

Temperature Measurement

Transmitters for field mounting

SITRANS TF fieldbus transmitter

Selection and Ordering data	Article No.	Further designs	Order code
Temperature transmitter in field enclosure with fieldbus communication and electrical isolation Click on the Article No. for the online configuration in the PIA Life Cycle Portal.	7NG313 - - - - 0	Please add "-Z" to Article No. and specify Order code(s) and plain text. Test report (5 measuring points)	C11
Integrated transmitter SITRANS TH400 with PROFIBUS PA <ul style="list-style-type: none"> Without Ex protection With Ex ia (ATEX) With Ex nAL for zone 2 (ATEX) Total device SITRANS TF Ex d (ATEX + IECEx)¹⁾ Total device SITRANS TF according to FM (XP, DIP, NI, S)¹⁾ SITRANS TH400, with FOUNDATION fieldbus <ul style="list-style-type: none"> Without Ex protection With Ex ia (ATEX) With Ex nAL for zone 2 (ATEX) Total device SITRANS TF Ex d (ATEX + IECEx)¹⁾ Total device SITRANS TF according to FM (XP, DIP, NI, S)¹⁾ 	7 0 7 1 7 2 7 4 7 5 8 0 8 1 8 2 8 4 8 5	Bus connection <ul style="list-style-type: none"> M12 device plug (metal), without mating connector M12 device plug (metal), with mating connector Explosion protection <ul style="list-style-type: none"> Explosion protection Ex ia to INMETRO (Brazil) (only with 7NG313.-1....) Explosion protection Ex d to INMETRO (Brazil) (only with 7NG313.-4....) Explosion protection Ex nA to INMETRO (Brazil) (only with 7NG313.-2....) Explosion protection Ex i to NEPSI (China) (only with 7NG313.-1...) Explosion protection Ex d to NEPSI (China) (only with 7NG313.-4....) Explosion protection Ex nA to NEPSI (China) (only with 7NG313.-2....) Explosion protection Ex d to KOSHA (Korea) (only with 7NG313.-4...) Explosion protection Ex i according to EAC (Russia/Belarus/Kazakhstan) (only for 7NG313.-1...) Explosion protection Ex d according to EAC (Russia/Belarus/Kazakhstan) (only for 7NG313.-4...) Explosion protection Ex nA according to EAC (Russia/Belarus/Kazakhstan) (only for 7NG313.-2...) Marine approvals <ul style="list-style-type: none"> Det Norske Veritas Germanischer Lloyd (DNV GL) Bureau Veritas (BV) Lloyd's Register of Shipping (LR) American Bureau of Shipping (ABS) Two coats of lacquer on casing and cover (PU on epoxy) Transient protection Cable gland CAPRI 1/2 NPT ADE 4F, nickel-plated brass (CAPRI 848694 and 810634) included Cable gland 1/2 NPT ADE 1F, cable diam. 6 ... 12 (CAPRI 818694 and 810534) included Cable gland 1/2 NPT ADE 4F, stainless steel (CAPRI 848699 and 810634) included Cable gland 1/2 NPT ADE 1F, cable diam. 4 ... 8.5 (CAPRI 818674 and 810534) included	M00²⁾ M01²⁾ E25³⁾ E26³⁾ E27³⁾ E55³⁾ E56³⁾ E57³⁾ E70³⁾ E81³⁾ E82³⁾ E83³⁾ D01 D02 D04 D05 G10 J01 D57 D58 D59 D60
Enclosure Die-cast aluminium Stainless steel precision casting	A E		
Connections/cable inlet Screwed glands M20x1.5 Screwed glands 1/2-14 NPT	B C		
Mounting bracket and fastening parts None Made of steel Stainless steel	0 1 2		

Temperature Measurement

Transmitters for field mounting

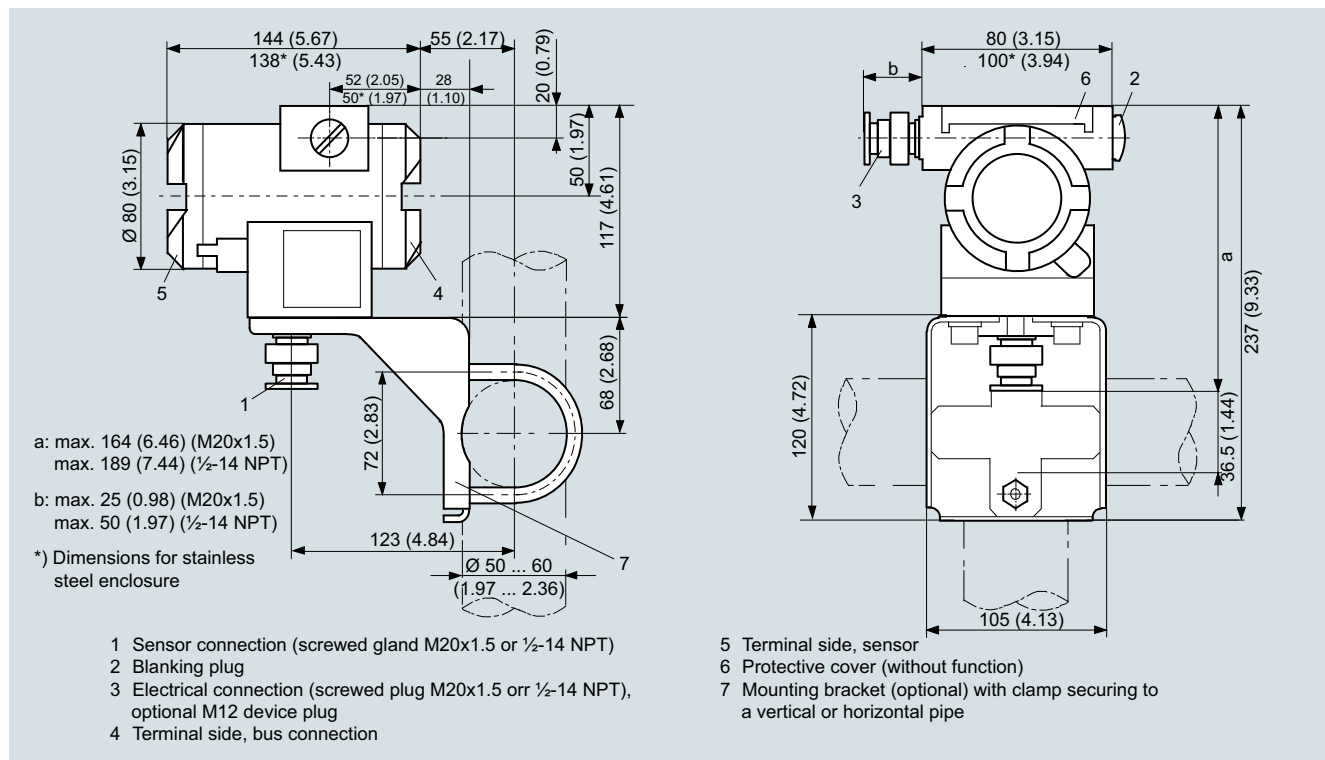
SITRANS TF fieldbus transmitter

Selection and Ordering data	Order code.
Customer-specific programming Add "-Z" to Article No. and specify Order code(s)	
Measuring range to be set Specify in plain text (max. 5 digits): Y01: ... to ... °C, °F	Y01⁴⁾
Meas. point no. (TAG), max. 8characters	Y15⁵⁾
Meas. point descriptor, max. 16 characters	Y23⁵⁾
Meas. point message, max. 32 characters	Y24⁶⁾
Bus address, specify in plain text	Y25⁵⁾
Pt100 (IEC) 2-wire, $R_L = 0 \Omega$	U02⁷⁾
Pt100 (IEC) 3-wire	U03⁷⁾
Pt100 (IEC) 4-wire	U04⁷⁾
Thermocouple type B	U20⁷⁾⁸⁾
Thermocouple type C (W5)	U21⁷⁾⁸⁾
Thermocouple type D (W3)	U22⁷⁾⁸⁾
Thermocouple type E	U23⁷⁾⁸⁾
Thermocouple type J	U24⁷⁾⁸⁾
Thermocouple type K	U25⁷⁾⁸⁾
Thermocouple type L	U26⁷⁾⁸⁾
Thermocouple type N	U27⁷⁾⁸⁾
Thermocouple type R	U28⁷⁾⁸⁾
Thermocouple type S	U29⁷⁾⁸⁾
Thermocouple type T	U30⁷⁾⁸⁾
Thermocouple type U	U31⁷⁾⁸⁾
With TC: CJC: external (Pt100, 3-wire)	U41
With TC: CJC: external with fixed value, specify in plain text	Y50
Special differing customer-specific programming, specify in plain text	Y09⁹⁾

- 1) Without cable gland
- 2) Not available for explosion protection Ex d or XP.
- 3) Option does not include ATEX/IECEx approval, only country-specific approval.
- 4) For customer-specific programming for RTD and TC, the start value and the end value of the required measuring span must be specified here.
- 5) If only Y15, Y23 or Y25 are ordered and the label only has to be on the tag plate, Y01 does not have to be specified.
- 6) For this selection, Y01 or Y09 must also be selected.
- 7) For this selection, Y01 must also be selected.
- 8) Internal cold junction compensation is selected as the default for TC
- 9) For customer-specific programming, for example mV and ohm, the start value and the end value of the required measuring span and the unit must be entered here

Selection and Ordering data	Article No.
Accessories Further accessories for assembly, connection and transmitter configuration, see page 2/238.	
SIMATIC PDM parameterization software also for SITRANS TF with TH400 PA	see Sec. 8
Mounting bracket and fastening parts Made of steel for 7NG313.-.B.. Made of steel for 7NG313.-.C.. Made of stainless steel for 7NG313.-.B.. Made of stainless steel for 7NG313.-.C..	7MF4997-1AC 7MF4997-1AB 7MF4997-1AJ 7MF4997-1AH
Connection board Ordering example 1: 7NG3137-0AB01-Z Y01+Y15+Y25+U03 Y01: -10 ... +100 °C Y15: TICA1234HEAT Y25: 33 Ordering example 2: 7NG3137-0AC01-Z Y01+Y15+Y25+U25 Y01: -10 ... +100 °C Y15: TICA 1234 ABC 5678 Y25: 35 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	A5E02391790

Dimensional drawings



SITRANS TF with TH400, dimensions in mm (inches)

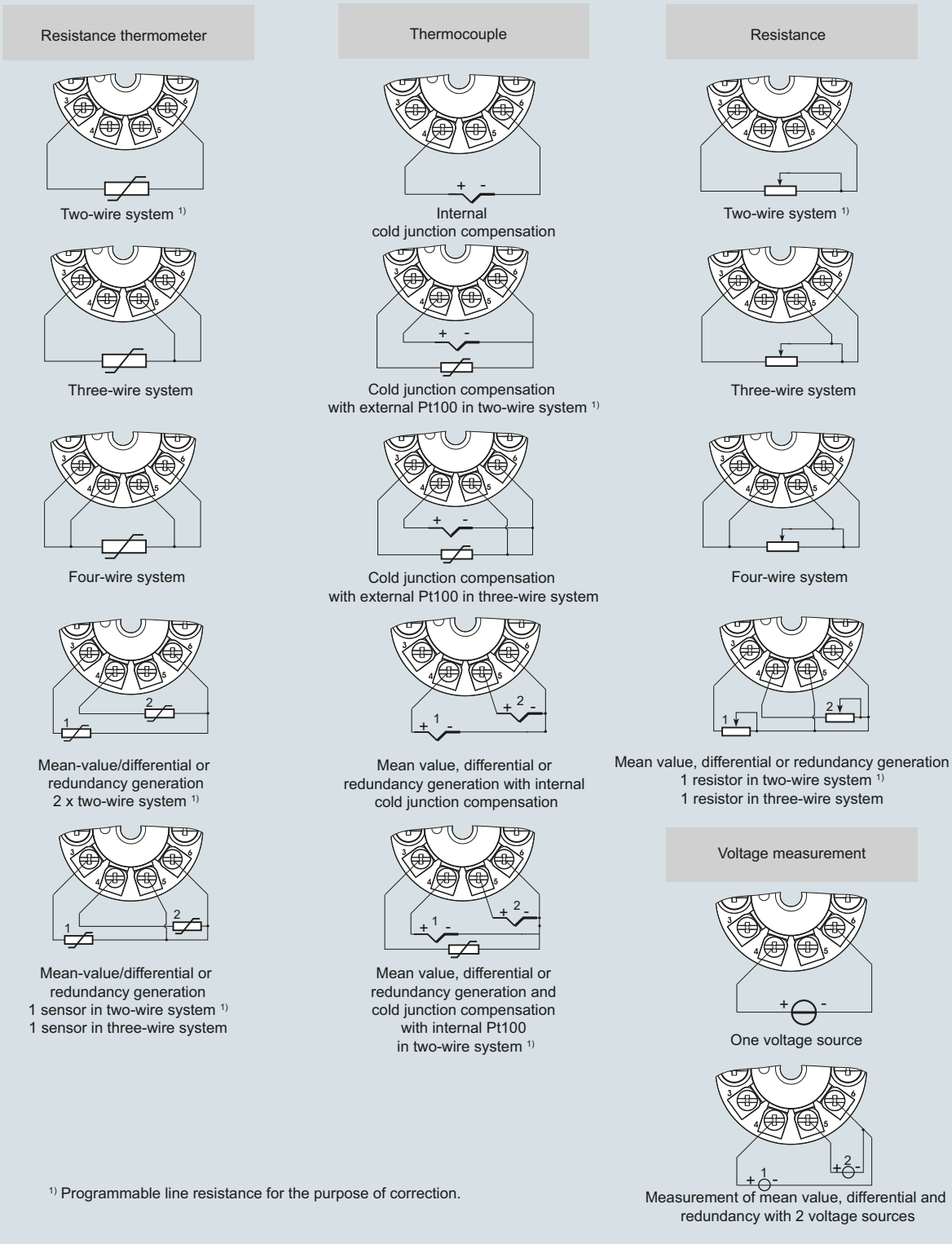
Temperature Measurement

Transmitters for field mounting

SITRANS TF fieldbus transmitter

Schematics

2



SITRANS TF with TH400, sensor connection assignment