

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 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

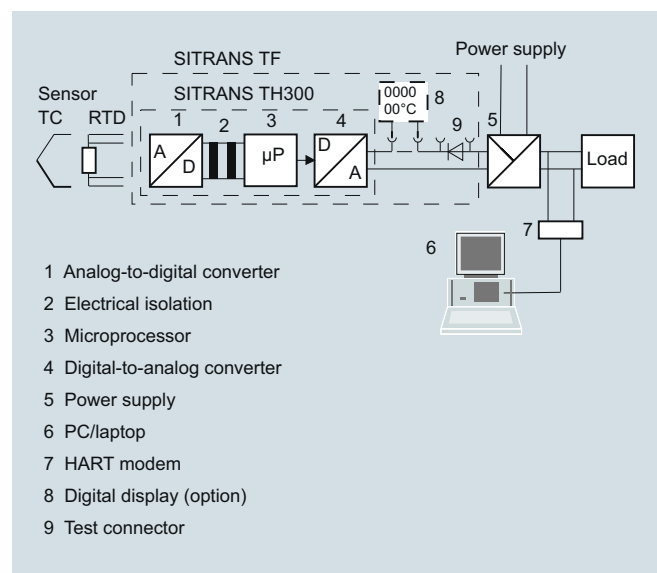
The sensor signal, whether resistance thermometer, thermocouple element or Ω or mV signal, is amplified and linearized. Sensor and output side are electrically isolated. An internal cold junction is integrated for measurements with thermocouple elements.

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

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Technical specifications

Input

Resistance thermometer

Measured variable	Temperature
Sensor type	
• to IEC 60751	Pt25 ... Pt1000
• to JIS C 1604; $\alpha=0.00392$ 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

Min. measured span

Characteristic curve

Thermocouples

Measured variable

Sensor type (thermocouples)

- Type B
- Type C
- Type D
- Type E
- Type J
- Type K
- Type L
- Type N
- Type R
- Type S
- Type T
- Type U

Units

Connection

- Normal connection
- Generation of average value
- Generation of difference

Response time

Open-circuit monitoring

Cold junction compensation

- Internal
- External
- External fixed

Measuring range

Min. measured span

Characteristic curve

mV sensor

Measured variable

Sensor type

Units

Response time

Open-circuit monitoring

Measuring range

Min. measured span

Overload capability of the input

Input resistance

Characteristic curve

parameterizable max. 0 ... 2200 Ω (see table "Digital measuring errors")

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

Resistance-linear or special characteristic

Temperature

Pt30Rh-Pt6Rh to DIN IEC 584
W5 %-Re acc. to ASTM 988
W3 %-Re acc. to ASTM 988
NiCr-CuNi to DIN IEC 584
Fe-CuNi to DIN IEC 584
NiCr-Ni to DIN IEC 584
Fe-CuNi to DIN 43710
NiCrSi-NiSi to DIN IEC 584
Pt13Rh-Pt to DIN IEC 584
Pt10Rh-Pt to DIN IEC 584
Cu-CuNi to DIN IEC 584
Cu-CuNi to DIN 43710

°C or °F

1 thermocouple (TC)

2 thermocouples (TC)

2 thermocouples (TC)
(TC 1 – TC 2 or TC 2 – TC 1)

≤ 250 ms for 1 sensor with open-circuit monitoring

Can be switched off

With integrated Pt100 resistance thermometer

With external Pt100 IEC 60751 (2-wire or 3-wire connection)

Cold junction temperature can be set as fixed value

parameterizable (see table "Digital measuring errors")

Min. 40 ... 100 °C (72 ... 180 °F) (see table "Digital measuring errors")

Temperature-linear or special characteristic

DC voltage

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

mV

≤ 250 ms for 1 sensor with open-circuit monitoring

Can be switched off

-10 ... +70 mV
-100 ... +1100 mV

2 mV or 20 mV

-1.5 ... +3.5 V DC

$\geq 1 \text{ M}\Omega$

Voltage-linear or special characteristic

Temperature Measurement

Transmitter for field mounting/field indicator

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Output Output signal Communication with SITRANS TH300		Auxiliary power Without digital display With digital display Electrically isolated • Test voltage Certificates and approvals Explosion protection ATEX • "Intrinsic safety" type of protection - EC type test certificate • "Operating equipment that is non-ignitable and has limited energy for zone 2" type of protection - EC type test certificate • "Flame-proof enclosure" type of protection - EC type test certificate Explosion protection to FM • Identification (XP, DIP, NI, S) Other certificates	
Digital display Digital display (optional) Display Digit height Display range Units Setting: Zero point, full-scale value and unit Load voltage		11 ... 35 V DC (30 V for Ex ib; 32 V for Ex ic and Ex nA) 13.1 ... 5 V DC (30 V for Ex ib; 32 V for Ex ic and Ex nA) Between input and output $U_{\text{eff}} = 1 \text{ kV}, 50 \text{ Hz}, 1 \text{ min}$ with digital display: II 2 (1) G EEx ia IIC T4 without digital display: II 2 (1) G EEx ia IIC T6 ZELM 11 ATEX 0471 X II 3G EEx nAL IIC T6/T4 ZELM 11 ATEX 0471 X II 2 G EEx d IIC T5/T6 II 1D Ex tD A20 IP65 T100 °C, T85 °C ZELM 11 ATEX 0472 X Certificate of Compliance 3017742 • XP/II/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/II/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 IECEx, GOST, INMETRO, NEPSI, KOSHA	
Measuring accuracy Digital measuring errors Reference conditions • Auxiliary power • Load • Ambient temperature • Warming-up time Error in the analog output (digital/analog converter) Error due to internal cold junction Influence of ambient temperature • Analog measuring error • Digital measuring errors - with resistance thermometers - with thermocouples Auxiliary power effect Effect of load impedance Long-term drift • In the first month • After one year • After 5 years		See table "Digital measuring errors" 24 V ± 1 % 500 Ω 23 °C (73.4 °F) > 5 min < 0.025 % of span < 0.5 °C (0.9 °F) 0.02 % of span/10 °C (18 °F) 0.06 °C (0.11 °F)/10 °C (18 °F) 0.6 °C (1.1 °F)/10 °C (18 °F) < 0.001 % of span/V < 0.002 % of span/100 Ω < 0.02 % of span < 0.3 % of span < 0.4 % of span	
Conditions of use <u>Ambient conditions</u> Storage temperature Condensation Electromagnetic compatibility Degree of protection to EN 60529		-40 ... +85 °C (-40 ... +185 °F) Permissible According to EN 61326 and NAMUR NE21 IP67	
Construction Weight Dimensions Enclosure material Electrical connection, sensor connection Mounting bracket (optional)		Approx. 1.5 kg (3.3 lb) without options See "Dimensional drawings" Die-cast aluminum, low in copper, GD-AlSi 12 or stainless steel, polyester-based lacquer, stainless steel rating plate Screw terminals, cable inlet via M20 x 1.5 or ½-14 NPT screwed gland Steel, galvanized and chrome-plated or stainless steel	
		Hardware and software requirements • For the parameterization software SIPROM T for SITRANS TF with TH200 - Personal computer - PC operating system • For the parameterization software SIMATIC PDM for SITRANS TH300 Communication Load for HART connection • Two-core shielded • Multi-core shielded Protocol 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	
		PC with CD-ROM drive and USB Windows 98, NT, 2000, XP, 7 and Win 8 See chapter 8 "Software", "SIMATIC PDM"	
		230 ... 1100 Ω ≤ 3.0 km (1.86 mi) ≤ 1.5 km (0.93 mi) HART protocol, version 5.9	

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Digital measuring errors

Resistance thermometer

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

Thermocouples

Input	Measuring range	Min. mea- sured 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. mea- sured 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).

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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.
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.	7 NG 3 1 3 - - - - -
Integrated transmitter SITRANS TH200, programmable - Without Ex protection - With Ex ia - With Ex nAL for zone 2 - Total device SITRANS TF Ex d¹⁾ - Total device SITRANS TF according to FM (XP, DIP, NI, S)¹⁾ SITRANS TH300, communication capability according to HART V 5.9 - Without Ex-protection - With Ex ia - With Ex nAL for zone 2 - Total device SITRANS TF Ex d¹⁾ - 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
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
Further designs Please add "-Z" to Article No. and specify Order code(s) and plain text.	Order code
Test protocol (5 measuring points)	C11
Functional safety SIL2	C20
Functional safety SIL2/3	C23
Explosion protection	
• Explosion protection Ex ia to INMETRO (Brazil) (only with 7NG313.-1....)	E25
• Explosion protection Ex d to INMETRO (Brazil) (only with 7NG313.-4....)	E26
• Explosion protection Ex nA to INMETRO (Brazil) (only with 7NG313.-2....)	E27
• Explosion protection Ex i to NEPSI (China) (only with 7NG313.-1....)	E55
• Explosion protection Ex d to NEPSI (China) (only with 7NG313.-4....)	E56
• Explosion protection Ex nA to NEPSI (China) (only with 7NG313.-2....)	E57
• Explosion protection Ex d to KOSHA (Korea) (only with 7NG313.-4....)	E70
• Two coats of lacquer on casing and cover (PU on epoxy)	G10
• Transient protection	J01
• Cable gland CAPRI 1/2 NPT ADE 4F, nickel-plated brass (CAPRI 848694 and 810634) included	D57
• Cable gland 1/2 NPT ADE 1F, cable diam. 6 ... 12 (CAPRI 818694 and 810534) included	D58
• Cable gland 1/2 NPT ADE 4F, stainless steel (CAPRI 848699 and 810634) included	D59
• Cable gland 1/2 NPT ADE 1F, cable diam. 4 ... 8.5 (CAPRI 818674 and 810534) included	D60

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	Y01 ²⁾
Measuring point no. (TAG), max. 8 characters	Y17 ³⁾
Meas. point descriptor, max. 16 characters	Y23 ⁴⁾
Meas. point message, max. 32 characters	Y24 ⁴⁾
Only inscription on measuring point label: specify in plain text: Measuring range	Y22 ⁴⁾
Pt100 (IEC) 2-wire, R _L = 0 Ω	U02 ⁵⁾
Pt100 (IEC) 3-wire	U03 ⁵⁾
Pt100 (IEC) 4-wire	U04 ⁵⁾
Thermocouple type B	U20 ⁵⁾⁶⁾
Thermocouple type C (W5)	U21 ⁵⁾⁶⁾
Thermocouple type D (W3)	U22 ⁵⁾⁶⁾
Thermocouple type E	U23 ⁵⁾⁶⁾
Thermocouple type J	U24 ⁵⁾⁶⁾
Thermocouple type K	U25 ⁵⁾⁶⁾
Thermocouple type L	U26 ⁵⁾⁶⁾
Thermocouple type N	U27 ⁵⁾⁶⁾
Thermocouple type R	U28 ⁵⁾⁶⁾
Thermocouple type S	U29 ⁵⁾⁶⁾
Thermocouple type T	U30 ⁵⁾⁶⁾
Thermocouple type U	U31 ⁵⁾⁶⁾
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	Y09 ⁷⁾
Fail-safe value 3.6 mA (instead of 22.8 mA)	U36 ³⁾
Supply units see Chapter "Supplementary Components".	

¹⁾ Without cable gland.

²⁾ For customer-specific programming for RTD and TC, the start value and the end value of the required measuring span must be specified here.

³⁾ For this selection, Y01 or Y09 must also be selected.

⁴⁾ 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.

⁵⁾ For this selection, Y01 must also be selected.

⁶⁾ Internal cold junction compensation is selected as the default for TC.

⁷⁾ 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.

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Transmitter for field mounting/field indicator

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Selection and Ordering data	Article No.
Accessories	
Modem for SITRANS TH100, TH200, TR200 and TF with TH200 incl. parameterization software T with USB interface	7NG3092-8KU
MiniDVD for temperature measuring instruments 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 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

► Available ex stock.

Supply units see Chapter "Supplementary Components".

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

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Selection and Ordering data	Article No.
SITRANS TF field indicator for 4 ... 20 mA signals, with documentation on MiniDVD	7NG3130 -
Click on the Article No. for the online configuration in the PIA Life Cycle Portal.	
Without Ex-protection	0 1
With Ex ia	1 1
With Ex nAL for zone 2	2 1
Total device SITRANS TF Ex d ¹⁾	4 1
Total device SITRANS TF according to FM (XP, DIP, NI, S) ¹⁾	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	
With	1
Mounting bracket and securing parts	
Without	0
Made of steel	1
Made of stainless steel	2
Further designs	Order code
Please add "-Z" to Article No. and specify Order code(s) and plain text.	
Test protocol (5 measuring points)	C11
Explosion protection	
• Explosion protection Ex ia to INMETRO (Brazil) (only with 7NG313.-1....)	E25
• Explosion protection Ex d to INMETRO (Brazil) (only with 7NG313.-4....)	E26
• Explosion protection Ex nA to INMETRO (Brazil) (only with 7NG313.-2....)	E27
• Explosion protection Ex i to NEPSI (China) (only with 7NG313.-1...)	E55
• Explosion protection Ex d to NEPSI (China) (only with 7NG313.-4....)	E56
• Explosion protection Ex nA to NEPSI (China) (only with 7NG313.-2....)	E57
• Explosion protection Ex d to KOSHA (Korea) (only with 7NG313.-4....)	E70
• Two coats of lacquer on casing and cover (PU on epoxy)	G10
• Transient protection	J01
• Cable gland CAPRI 1/2 NPT ADE 4F, nickel-plated brass (CAPRI 848694 and 810634) included	D57
• Cable gland 1/2 NPT ADE 1F, cable diam. 6 ... 12 (CAPRI 818694 and 810534) included	D58
• Cable gland 1/2 NPT ADE 4F, stainless steel (CAPRI 848699 and 810634) included	D59
• Cable gland 1/2 NPT ADE 1F, cable diam. 4 ... 8.5 (CAPRI 818674 and 810534) included	D60

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	Y01 ²⁾
Only inscription on TAG plate: specify in plain text: Measuring range	Y22 ³⁾
Only inscription on TAG plate: Measuring point descriptor, max. 16 characters	Y23 ³⁾
Only inscription on TAG plate: Measuring point message, max. 27 characters	Y24 ³⁾
Special differing customer-specific programming, specify in plain text	Y09 ⁴⁾
Supply units see Chapter "Supplementary Components".	
¹⁾ Without cable gland. ²⁾ For customer-specific programming for RTD and TC, the start value and the end value of the required measuring span must be specified here. ³⁾ If only Y22, Y23 or Y24 are ordered and the label <u>only</u> has to be on the tag plate, Y01 does not have to be specified. ⁴⁾ 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	
MiniDVD for temperature measuring instruments ▶ with documentation in German, English, French, Spanish, Italian and Portuguese, and parameterization software SIPROM T (included in delivery with SITRANS TF)	A5E00364512
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 indicator¹⁾	7MF4997-1BS
Connection board	A5E02226423

▶ Available ex stock.

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

Ordering example 1:

7NG3130-0AB10-Z Y01+Y23

Y01: -5...100 °C

Y23: TICA1234HEAT

Ordering example 2:

7NG3130-0AC10-Z Y01+Y23+Y24

Y01: 0 ... 20 BAR

Y23: PICA 1234 ABC

Y29: HEATING BOILER 67890

Factory setting (field indicator):

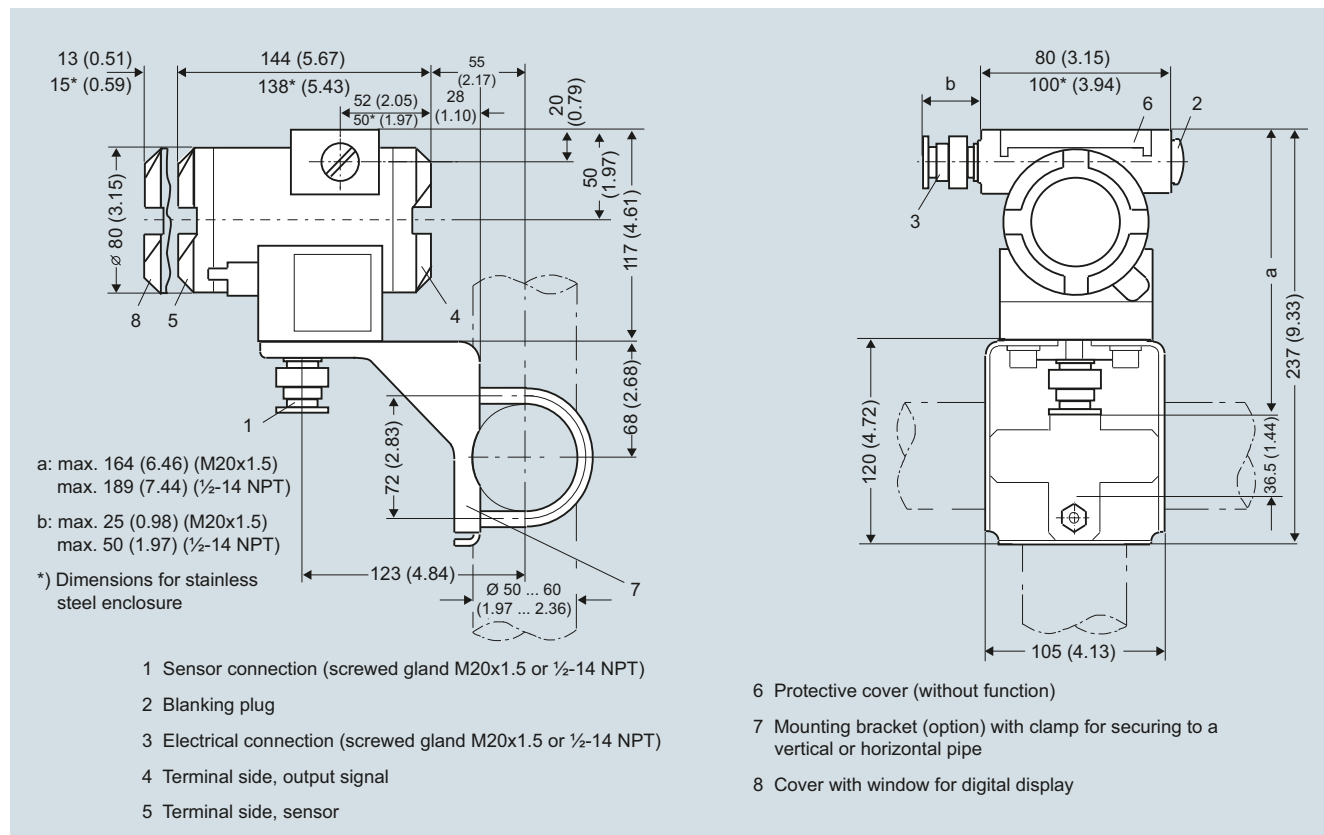
4 ... 20 mA

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)

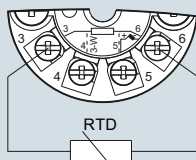
Temperature Measurement

Transmitter for field mounting/field indicator

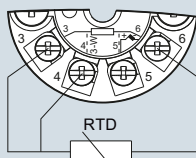
SITRANS TF - Transmitter, two-wire system and SITRANS TF - Field indicator for 4 to 20 mA

Schematics

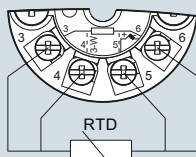
Resistance thermometer



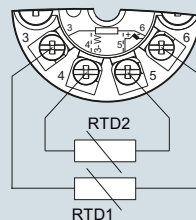
Two-wire system ¹⁾



Three-wire system



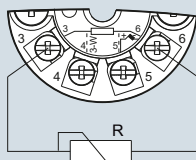
Four-wire system



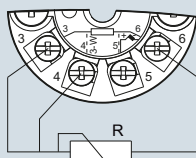
Generation of average value / difference ¹⁾

¹⁾ Programmable line resistance for the purpose of correction.

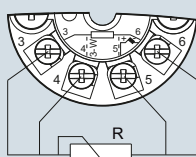
Resistance



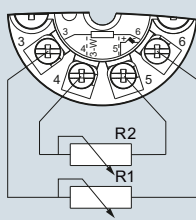
Two-wire system ¹⁾



Three-wire system

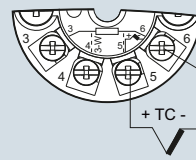


Four-wire system

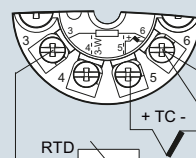


Generation of average value / difference ¹⁾

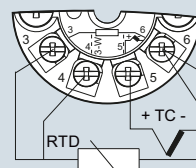
Thermocouple



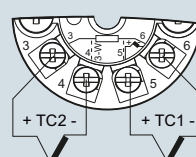
Cold junction compensation
Internal/fixed value



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

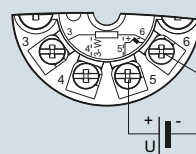


Cold junction compensation with
external Pt100 in three-wire system

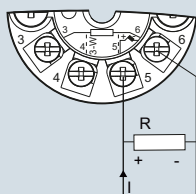


Generation of average value / difference
with internal cold junction compensation

Voltage measurement



Current measurement



SITRANS TF, sensor connection assignment

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 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

- 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

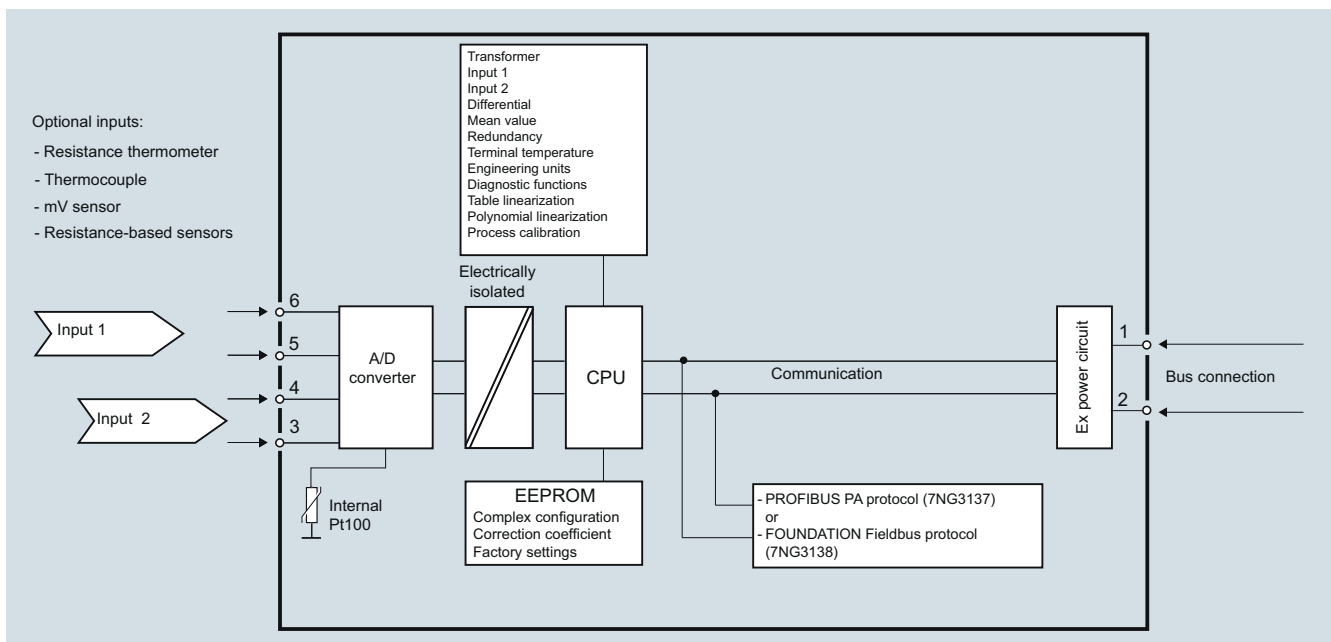
Transmitter with FOUNDATION fieldbus communication

- 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).



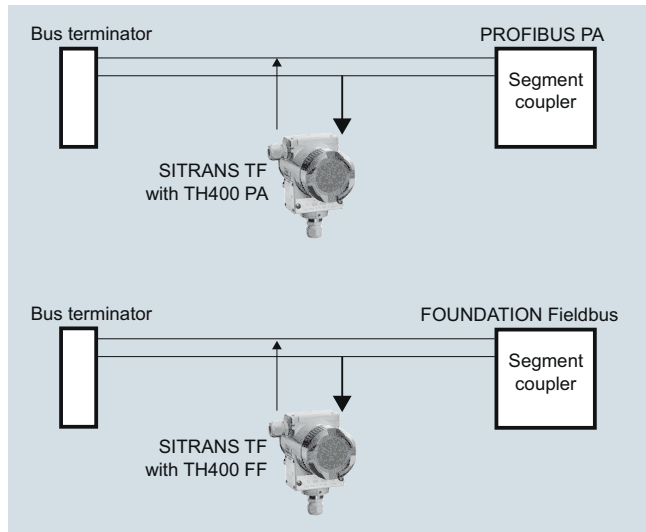
SITRANS TF with TH400, function diagram

Temperature Measurement

Transmitters for field mounting

SITRANS TF fieldbus transmitter

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 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-AISI 12 or stainless steel - Polyester-based lacquer for GD AISI 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 11 ATEX 0471 X
• Type of protection "intrinsic safety i" (version: 7NG313x-1xxxx)	II 2(1) G Ex ia IIC T4/T6
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 nA [nL] IIC T4/T6 II 3 G Ex nL IIC T4/T6
EC type test certificate	ZELM 11 ATEX 0472 X
• "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, 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.

Temperature transmitter in field enclosure

with fieldbus communication and electrical isolation, with documentation on MiniDVD

➤ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.

Integrated transmitter

SITRANS TH400 with PROFIBUS PA

- Without Ex protection
- With Ex ia (ATEX)
- With Ex nAL for zone 2 (ATEX)
- Total device SITRANS TF Ex d¹⁾
- Total device SITRANS TF according to FM (XP, DIP, NI, S)¹⁾

SITRANS TH400, with FOUNDATION fieldbus

- Without Ex protection
- With Ex ia (ATEX)
- With Ex nAL for zone 2 (ATEX)
- Total device SITRANS TF Ex d¹⁾
- Total device SITRANS TF according to FM (XP, DIP, NI, S)¹⁾

Enclosure

Die-cast aluminium

Stainless steel precision casting

Connections/cable inlet

Screwed glands M20x1.5

Screwed glands 1/2-14 NPT

Mounting bracket and fastening parts

None

Made of steel

Stainless steel

Further designs

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

Test report (5 measuring points)

Bus connection

- M12 plug (metal), without mating connector
- M12 plug (metal), with mating connector

Explosion protection

- 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....)
- 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

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

Meas. point no. (TAG), max. 32 characters

Meas. point descriptor, max. 32 characters

Meas. point message, max. 32 characters

Bus address, specify in plain text

Pt100 (IEC) 2-wire, R_L = 0 Ω

Pt100 (IEC) 3-wire

Pt100 (IEC) 4-wire

Thermocouple type B

Thermocouple type C (W5)

Thermocouple type D (W3)

Thermocouple type E

Thermocouple type J

Thermocouple type K

Thermocouple type L

Thermocouple type N

Thermocouple type R

Thermocouple type S

Thermocouple type T

Thermocouple type U

With TC: CJC: external (Pt100, 3-wire)

With TC: CJC: external with fixed value, specify in plain text

Special differing customer-specific programming, specify in plain text

¹⁾ Without cable gland

²⁾ Not available for explosion protection Ex d or XP.

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.

⁴⁾ 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.

⁵⁾ For this selection, Y01 or Y09 must also be selected.

⁶⁾ For this selection, Y01 must also be selected.

⁷⁾ Internal cold 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	
MiniDVD for temperature measuring instruments 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. 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	A5E02391790

▶ Available ex stock.

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:

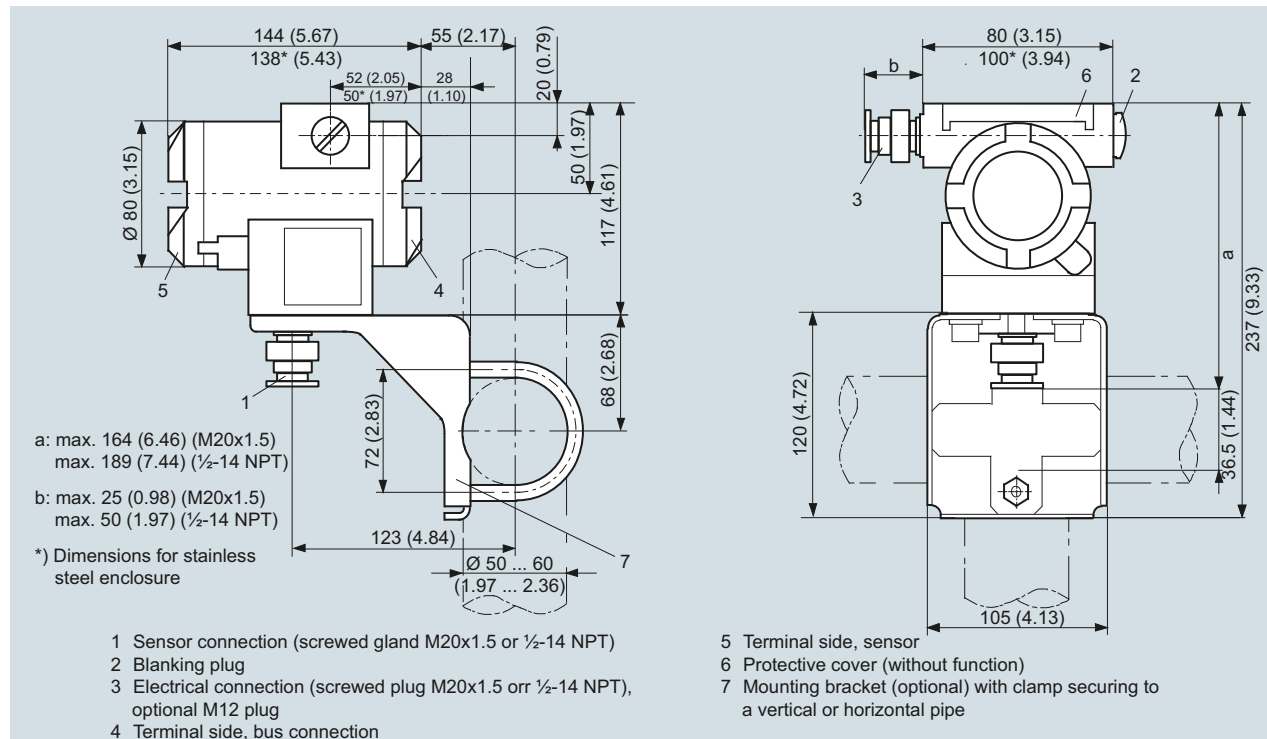
- for SITRANS TH400 PA:
 - Pt100 (IEC) with 3-wire circuit
 - Unit: °C
 - Failure mode: last valid value
 - Filter time: 0 s
 - PA address: 126
 - PROFIBUS Ident No.: manufacturer-specific
- for SITRANS TH400 FF:
 - Pt100 (IEC) with 3-wire circuit
 - Unit: °C
 - Failure mode: last valid value
 - Filter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

Temperature Measurement

Transmitters for field mounting

SITRANS TF fieldbus transmitter

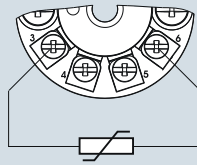
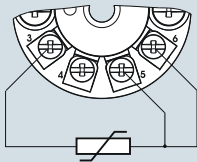
Dimensional drawings



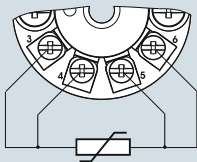
SITRANS TF with TH400, dimensions in mm (inches)

Schematics

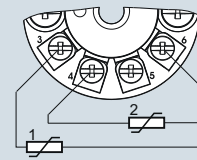
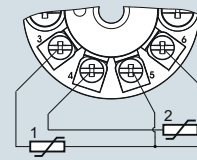
Resistance thermometer

Two-wire system ¹⁾

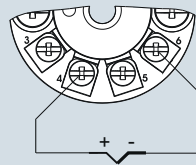
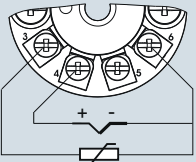
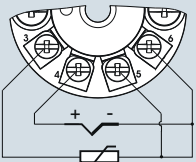
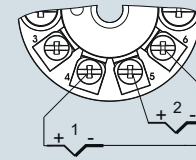
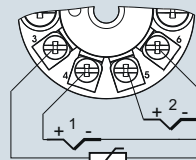
Three-wire system



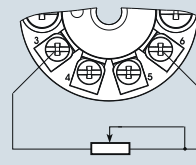
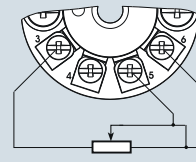
Four-wire system

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

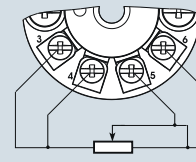
Thermocouple

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

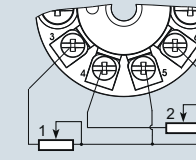
Resistance

Two-wire system ¹⁾

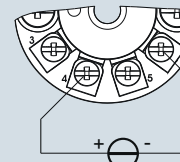
Three-wire system



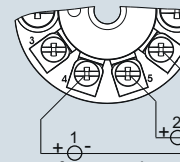
Four-wire system

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

Voltage measurement



One voltage source



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

¹⁾ Programmable line resistance for the purpose of correction.