

Temperature Measurement Transmitters for mounting in sensor head

SITRANS TH400
fieldbus transmitter

2

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

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

With PROFIBUS PA communication

- Function blocks: 2 x analog

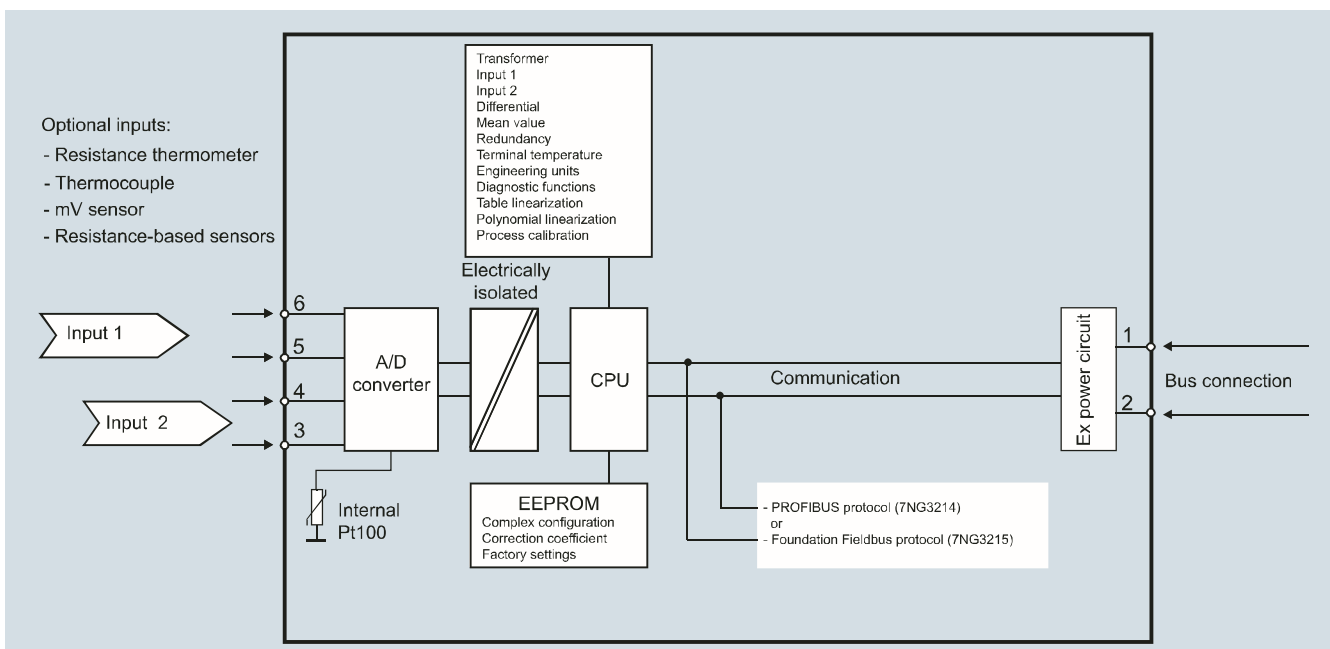
With FOUNDATION fieldbus communication

- 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).



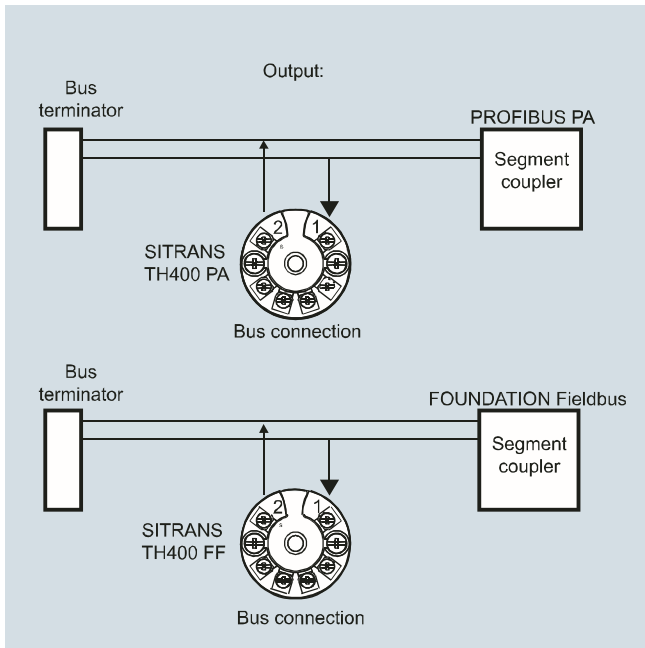
SITRANS TH400, function diagram

Temperature Measurement

Transmitters for mounting in sensor head

SITRANS TH400 fieldbus transmitter

System communication



SITRANS TH400, communication interface

Technical specifications

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

Thermocouple

to IEC 584

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

to DIN 43710

- Type L
- Type U

to ASTM E988-90

- Type W3
- Type W5

External cold junction compensation

Sensor fault detection

- Sensor break detection
- Sensor short-circuit detection
- Sensor current in the event of open-circuit monitoring

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

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fieldbus transmitter

2

Conditions of use <u>Ambient conditions</u> Permissible ambient temperature -40 ... +85 °C (-40 ... +185 °F) Permissible storage temperature -40 ... +85 °C (-40 ... +185 °F) Relative humidity ≤ 98 %, with condensation 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 <u>Electromagnetic compatibility</u> 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		Certificates and approvals Explosion protection ATEX EC type test certificate • "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 • Type of protection for "equipment is non-arcing" KEMA 06 ATEX 0263 X 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, PESO
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		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
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		Factory setting <u>only for SITRANS TH400 PA</u> 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 <u>only for SITRANS TH400 FF</u> 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 mounting in sensor head

SITRANS TH400 fieldbus transmitter

2

Selection and Ordering data	Article No.
Temperature transmitter SITRANS TH400 for installation in connection head, with electrical isolation, order instruction manual separately.	
<ul style="list-style-type: none"> Bus-compatible to PROFIBUS PA <ul style="list-style-type: none"> No explosion protection or Zone 2/Div 2 to ATEX/FM/CSA ▶ ◆ 7NG3214-0NN00 With explosion protection "Intrinsically safe to ATEX/FM/CSA" ▶ ◆ 7NG3214-0AN00 Bus-compatible to FOUNDATION Fieldbus <ul style="list-style-type: none"> No explosion protection or Zone 2/Div 2 to ATEX/FM/CSA ▶ ◆ 7NG3215-0NN00 With explosion protection "Intrinsically safe to ATEX/FM/CSA" ▶ ◆ 7NG3215-0AN00 	
Further designs	Order code
Please add "-Z" to Article No. and specify Order code(s) and plain text.	
With test protocol (5 measuring points)	C11
Customer-specific programming	
Add "-Z" to Article No. and specify Order code(s)	
Measuring range to be set Enter in plain text	Y01¹⁾
Measuring point no. (TAG), max. 32 characters	Y17
Measuring point descriptor, max. 32 characters	Y23
Measuring point message, max. 32 characters	Y24
Bus address, specify in plain text	Y25
Pt100 (IEC) 2-wire, $R_L = 0 \Omega$	U02
Pt100 (IEC) 3-wire	U03
Pt100 (IEC) 4-wire	U04
Thermocouple type B	U20
Thermocouple type C (W5)	U21
Thermocouple type D (W3)	U22
Thermocouple type E	U23
Thermocouple type J	U24
Thermocouple type K	U25
Thermocouple type L	U26
Thermocouple type N	U27
Thermocouple type R	U28
Thermocouple type S	U29
Thermocouple type T	U30
Thermocouple type U	U31
With TC: CJC internal	U40
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	Y09²⁾

Accessories	Article 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 Chapter 9
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
for additional PA components,	See Catalog IK PI

▶ Available ex stock.

◆ We can offer shorter delivery times for configurations designated with the Quick Ship Symbol ◆. For details see page 9/5 in the appendix.

1) Here, you enter the initial and final value of the desired measurement range for customer-specific programming for mV, Ω .2) If needed, here you can mention settings, which cannot be specified with existing order codes (e.g.: programming for mV, Ω).Ordering example 1:

7NG3214-0NN00-Z Y01+Y17+U03
 Y01: 0...100 C
 Y17: TICA1234HEAT

Ordering example 2:

7NG3214-0NN00-Z Y01+Y17+Y25+U25+U40
 Y01: 0...500 C
 Y17: TICA5678HEAT
 Y25: 33

Factory setting:

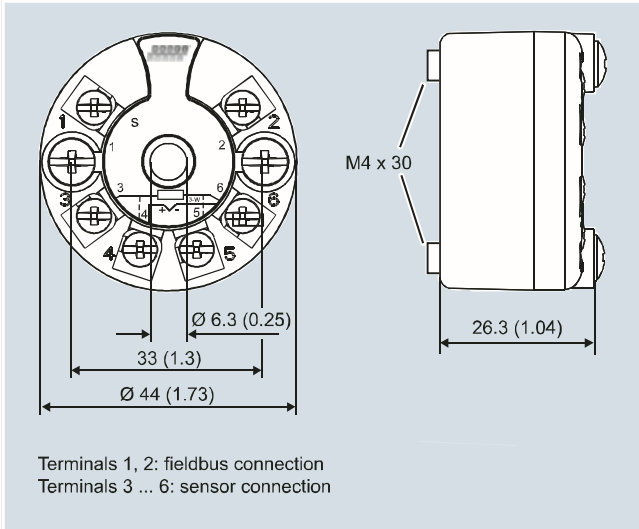
- For SITRANS TH400 PA:
 - Pt100 (IEC 751) with 3-wire circuit
 - Unit: °C
 - Failure mode: Last valid value
 - Filter time: 0 s
 - PA address: 126
 - PROFIBUS Ident No.: Manufacturer-specific
- For SITRANS TH400 FF:
 - Pt100 (IEC 751) with 3-wire circuit
 - Unit: °C
 - Failure mode: Last valid value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

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fieldbus transmitter

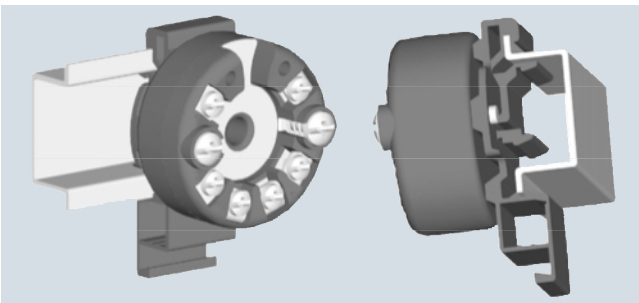
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Dimensional drawings

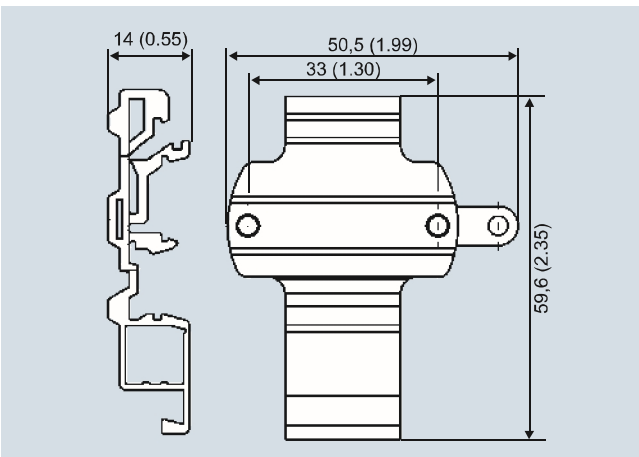


SITRANS TH400 dimensions in mm (inches) and connections

Mounting on DIN rail



SITRANS TH400, mounting of transmitter on DIN rail



DIN rail adaptor, dimensions in mm (inch)

Temperature Measurement

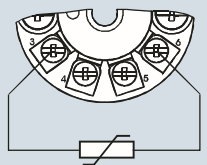
Transmitters for mounting in sensor head

SITRANS TH400
fieldbus transmitter

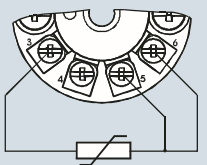
Schematics

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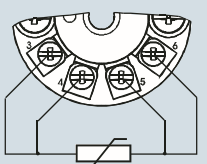
Resistance thermometer



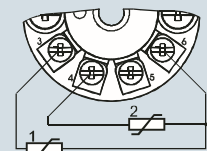
Two-wire system ¹⁾



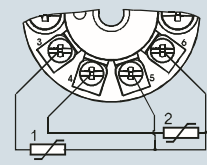
Three-wire system



Four-wire system



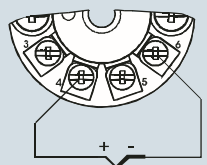
Mean-value/differential or redundancy generation
2 x two-wire system ¹⁾



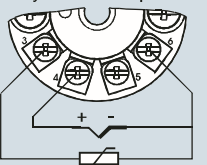
Mean-value/differential or redundancy generation
1 sensor in two-wire system ¹⁾
1 sensor in three-wire system

¹⁾ Programmable line resistance for the purpose of correction.

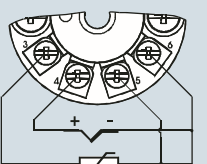
Thermocouple



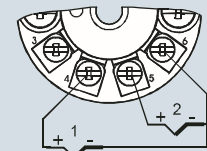
Internal cold junction compensation



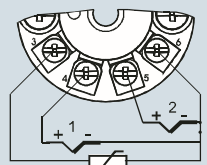
Cold junction compensation with external Pt100 in two-wire system ¹⁾



Cold junction compensation with external Pt100 in three-wire system

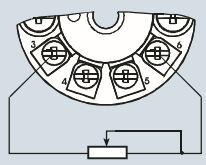


Mean value, differential or redundancy generation with internal cold junction compensation

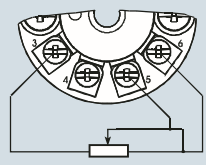


Mean value, differential or redundancy generation and cold junction compensation with internal Pt100 in two-wire system ¹⁾

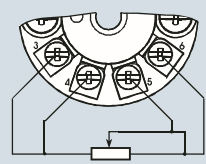
Resistance



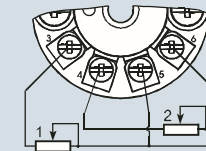
Two-wire system ¹⁾



Three-wire system

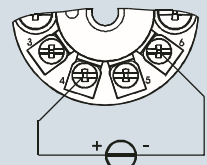


Four-wire system

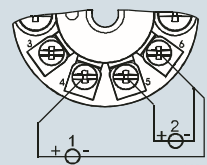


Mean value, differential or redundancy generation
1 resistor in two-wire system ¹⁾
1 resistor in three-wire system

Voltage measurement



One voltage source



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

SITRANS TH400, sensor connection assignment