

Temperature measurement

Temperature transmitters

Compact and head transmitters

SITRANS TH400, fieldbus transmitter

Overview



SITRANS TH400 fieldbus transmitters

Versions:

- For FOUNDATION fieldbus
- For PROFIBUS PA

The SITRANS TH400 Head transmitter is a small field bus transmitter for mounting in the connection head of form B. Extensive functionality enables the Head 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 meet the directive 2014/34/EU (ATEX) as well as the FM and CSA requirements.

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 or larger
- Polarity-neutral bus connection
- 24-bit analog-digital converter for high resolution
- Galvanic isolation
- Intrinsically-safe version for use in potentially explosive areas
- Special characteristic
- Sensor redundancy

With PROFIBUS PA communication

- Function blocks: 2 x analog

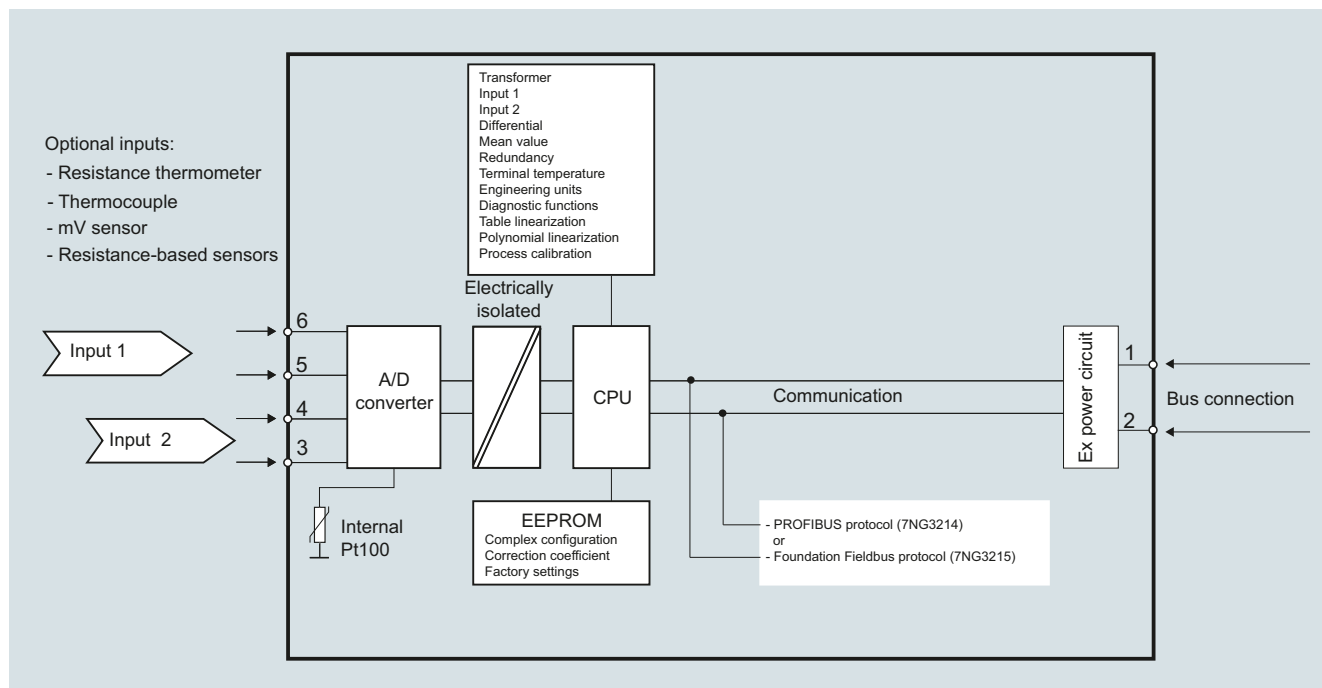
With FOUNDATION Fieldbus communication

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

Mode of operation

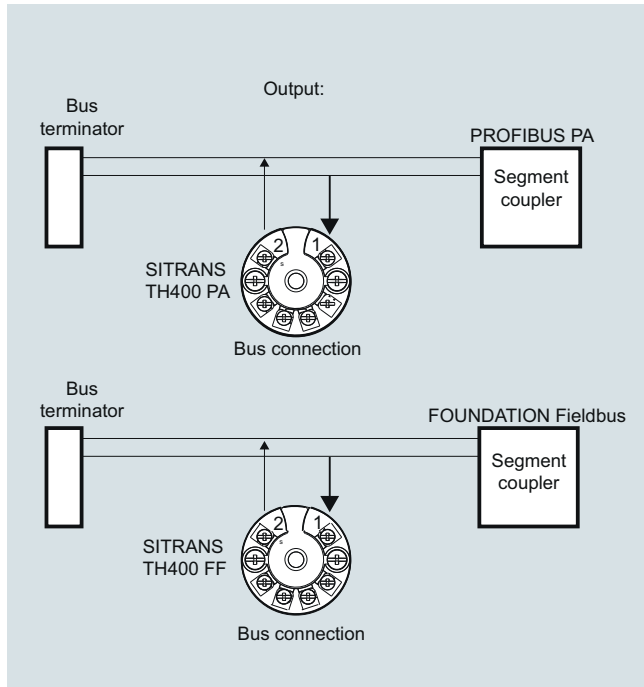
The following function diagram explains the mode of operation of the transmitter.

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

System communication



SITRANS TH400, communications interface

Technical specifications

Input

Analog-to-digital conversion

- Measurement rate < 50 ms
- Resolution 24-bit

Resistance thermometer

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

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

Ni25 ... Ni1000 acc. to DIN 43760

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

Cu10 ... Cu1000, $\alpha = 0.00427$

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

Line resistance per sensor cable Max. 50 Ω

Sensor current Nominal 0.2 mA

Sensor fault detection

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

Resistance-based sensor

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

According to IEC 584

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

According to DIN 43710

- Type L
- Type U

According to ASTM E988-90

- Type W3
- Type W5

External reference junction compensation

Sensor fault detection

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

mV sensor - voltage input

Measuring range -800 ... +800 mV

Input resistance 10 M Ω

Output

Filter time (programmable) 0 ... 60 s

Update time < 400 ms

Measuring accuracy

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

General values

Type of input

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

All

Basic values

Type of input

Basic accuracy	Temperature coefficient
$\leq \pm 0.1$ °C	$\leq \pm 0.002$ °C/°C
$\leq \pm 0.15$ °C	$\leq \pm 0.002$ °C/°C
$\leq \pm 1.3$ °C	$\leq \pm 0.02$ °C/°C
$\leq \pm 0.05$ Ω	$\leq \pm 0.002$ Ω /°C
$\leq \pm 10$ μ V	$\leq \pm 0.2$ % μ V/°C
$\leq \pm 0.5$ °C	$\leq \pm 0.01$ °C/°C
$\leq \pm 1$ °C	$\leq \pm 0.025$ °C/°C

Pt100 and Pt1000

Ni100

Cu10

Resistance-based sensor

Voltage source

Thermocouple, type: E, J, K, L, N, T, U

Thermocouple, type: B, R, S, W3, W5

Reference junction compensation

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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Rated conditions

Ambient conditions

Ambient temperature	-40 ... +85 °C (-40 ... +185 °F)
Storage temperature	-40 ... +85 °C (-40 ... +185 °F)
Relative humidity	≤ 98 %, with condensation
Insulation strength	
• Test voltage	500 V AC for 60 s
Mechanical testing	
• Vibrations (DIN class B) to	IEC 60068-2-6 and IEC 60068-2-64 4 g/2 ... 100 Hz

Electromagnetic compatibility

EMC noise voltage influence	< ± 0.1 % of span
Extended EMC noise immunity: NAMUR NE 21, criterion A, Burst	< ± 1 % of span
EMC 2014/30/EU Emission and Noise Immunity according to	EN 61326

Design

Material	Molded plastic
Weight	55 g (0.12 lb)
Dimensions	See Dimensional drawings
Cross-section of cables	Max. 2.5 mm ² (AWG 13)
Degree of protection	
• Transmitter enclosure	IP40
• Terminal	IP00

Auxiliary power

Supply voltage	
• Standard, Ex "nA", Ex "nL", NI	9.0 ... 32 V DC
• ATEX, FM, UL and CSA	9.0 ... 30 V DC
• In FISCO/FNICO installations	9.0 ... 17.5 V DC
Power consumption	< 11 mA
Max. increase in power consumption in the event of a fault	< 7 mA

Certificates and approvals

Explosion protection ATEX	
EC type-examination certificate	KEMA 06 ATEX 0264
• "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-examination certificate	KEMA 06 ATEX 0263 X
• Type of protection for "equipment is non-arcing"	II 3 GD Ex nA[nL] IIC T4...T6 II 3 GD Ex nL IIC T4...T6 II 3 GD Ex nA[ic] IIC T4...T6 II 3 GD Ex ic IIC T4...T6
Explosion protection: FM for USA	
• FM approval	FM 3027985
• Degrees 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
• Degrees 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	EAC Ex(GOST), NEPSI, IECEx

Communication

Parameterization interface	
• PROFIBUS PA connection	
- Protocol	Profile 3.0
- Address (for delivery)	126
• FOUNDATION Fieldbus connection	
- Protocol	FF protocol
- Functionality	Basic or LAS
- Version	ITK 4.6
- Function blocks	2 x analog and 1 x PID

Factory setting

<u>only for SITRANS TH400 PA</u>	
Sensor	Pt100 (IEC 751)
Type of connection	3-wire connection
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 751)
Type of connection	3-wire connection
Unit	°C
Failure mode	Last valid value
Filter time	0 s
Node address	22

Selection and ordering data

	Article No.
Head transmitter SITRANS TH400 For installation in connection head, with electrical isolation, operating instructions must be ordered separately.	
Bus-compatible to PROFIBUS PA	
<ul style="list-style-type: none"> No explosion protection or Zone 2/Div 2 according to ATEX/FM/CSA/IECEX/NEPSI/IECEX/NEPSI 	7NG3214-0NN00
<ul style="list-style-type: none"> With explosion protection "Intrinsically safe according to ATEX/FM/CSA/IECEX/NEPSI" 	7NG3214-0AN00
Bus-compatible to FOUNDATION Fieldbus	
<ul style="list-style-type: none"> No explosion protection or Zone 2/Div 2 according to ATEX/FM/CSA/IECEX/NEPSI 	7NG3215-0NN00
<ul style="list-style-type: none"> With explosion protection "Intrinsically safe according to ATEX/FM/CSA/IECEX/NEPSI" 	7NG3215-0AN00
Options	Order code
Append suffix "-Z" to article no., add order code and plain text, if applicable.	
Test report (5 measuring points)	C11¹⁾
Customer-specific programming	
Measuring range to be set Specify in plain text (max. 5 digits): Y01: ... to ... °C, °F	Y01¹⁾
Measuring point number (TAG) max. 8 characters	Y17²⁾
Measuring point description, max. 16 characters	Y23²⁾
Measuring point message, max. 32 characters	Y24²⁾
Specify bus address in plain text	Y25²⁾
Pt100 (IEC) 2-wire, R _L = 0 W	U02³⁾
Pt100 (IEC) 3-wire	U03³⁾
Pt100 (IEC) 4-wire	U04³⁾
Type B thermocouple	U20³⁾⁴⁾
Type C thermocouple (W5)	U21³⁾⁴⁾
Type D thermocouple (W3)	U22³⁾⁴⁾
Type E thermocouple	U23³⁾⁴⁾
Type J thermocouple	U24³⁾⁴⁾
Type K thermocouple	U25³⁾⁴⁾
Type L thermocouple	U26³⁾⁴⁾
Type N thermocouple	U27³⁾⁴⁾
Type R thermocouple	U28³⁾⁴⁾
Type S thermocouple	U29³⁾⁴⁾
Type T thermocouple	U30³⁾⁴⁾
Type U thermocouple	U31³⁾⁴⁾
For TC: Cold junction compensation: external (Pt100, 3-wire)	U41
For TC: Cold junction compensation: external with fixed value: specify in plain text	Y50
Enter special deviating customer-specific setting in plain text	Y09⁵⁾

- 1) For customer-specific programming for RTD and TC, the start value and the end value of the required measuring span must be specified here.
- 2) For this selection, Y01 or Y09 must also be selected.
- 3) For this selection, Y01 must also be selected.
- 4) Internal reference junction compensation is selected as the default for TC.
- 5) For customer-specific programming for mV and ohm, the start value and the end value of the required measuring span and the unit must be entered here.

Accessories

	Article No.
Additional accessories for assembly, connection and transmitter configuration, see page 2/251.	
SIMATIC PDM operating software	See Catalog F101 section 8
DIN rail adapters for head transmitters (Quantity delivered: 5 units)	7NG3092-8KA
Connecting cable 4-wire, 200 mm (7.87 inch), for sensor connections when using head transmitters in the high hinged cover (set with 5 units) for additional PA components,	7NG3092-8KC See Catalog IK PI

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

Y01: 0...500 °C

Y17: TICA8HEAT

Y25: 33

Factory setting:

- For SITRANS TH400 PA:
 - Pt100 (IEC 751); 3-wire connection
 - 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); 3-wire connection
 - Unit: °C
 - Failure mode: Last valid value
 - Filter time: 0 s
 - Node address: 22

Temperature measurement

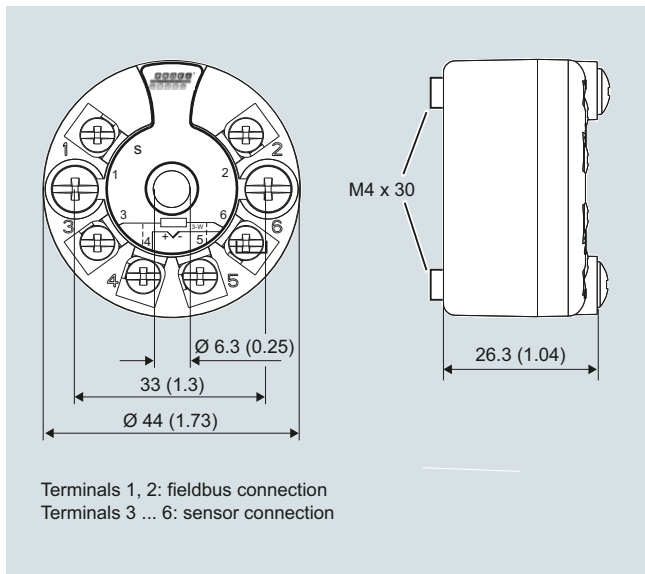
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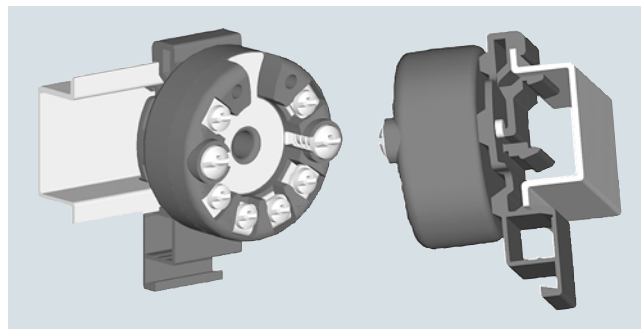
Dimensional drawings

2

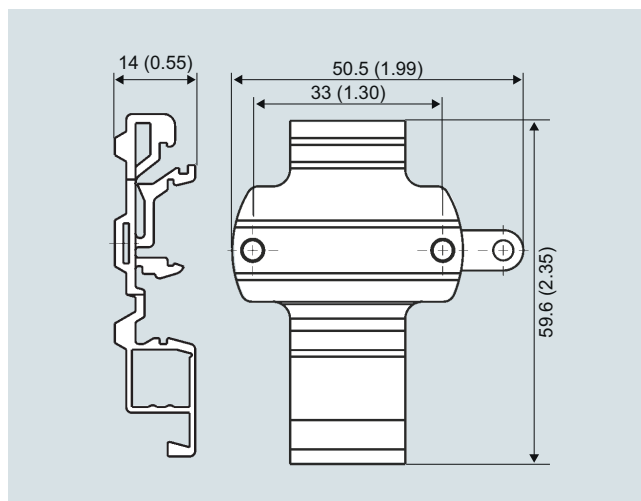


SITRANS TH400 dimensions in mm (inches) and connection diagram

Mounting on DIN rail



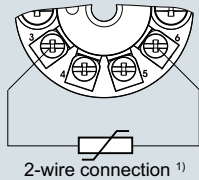
SITRANS TH400, mounting of transmitter on DIN rail



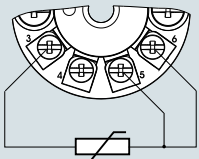
DIN rail adapter, dimensions in mm (inch)

Circuit diagrams

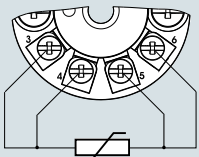
Resistance thermometer



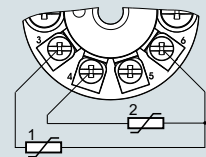
2-wire connection ¹⁾



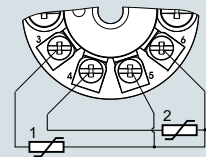
3-wire connection



4-wire connection



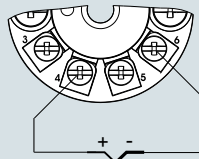
Mean-value/differential or redundancy generation
 2 x 2-wire connection ¹⁾



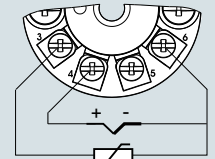
Mean-value/differential or redundancy generation
 1 sensor in 2-wire connection ¹⁾
 1 sensor in 3-wire connection

¹⁾ Programmable line resistance for the purpose of correction.

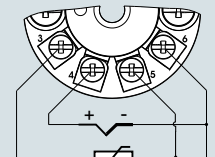
Thermocouple



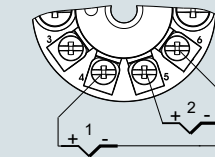
Internal cold junction compensation



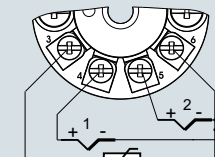
Cold junction compensation with external Pt100 in 2-wire connection ¹⁾



Cold junction compensation with external Pt100 in 3-wire connection

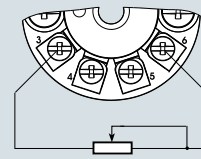


Mean value, differential or redundancy generation with internal cold junction compensation

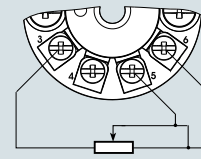


Mean value, differential or redundancy generation and cold junction compensation with internal Pt100 in 2-wire connection ¹⁾

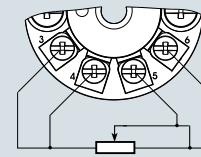
Resistance



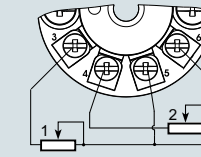
2-wire connection ¹⁾



3-wire connection

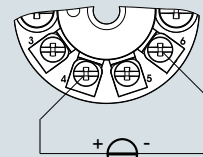


4-wire connection

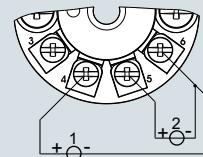


Mean value, differential or redundancy generation
 1 resistor in 2-wire connection ¹⁾
 1 resistor in 3-wire connection

Voltage measurement



One voltage source



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