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

Overview

	Type	Description	Page	Software for parameterization
SITRANS TS temperature sensors				
	**SITRANS TS500** Temperature Sensor Assemblies Include thermowell, sensor, head and transmitters	• Integrated temperature assemblies • Include thermowell, sensor, head and transmitter in single model number. • Various options include configuration, calibration and certificates.	2/6	-

	Application	Mounting of transmitter with Ex protection		Page	Software for parameterization
		Transmitter	Sensor		
Compact and head transmitters					
	**SITRANS TH100 Slim** For temperature measurement in combination with Pt100 compact resistance thermometers	-	-	2/24	SIPROM T
	**SITRANS TH100** • 4 to 20 mA • Transmitters for Pt100	Zone 2, zone 1, zone 0, zone 21, zone 20, DIV 1, DIV 2	Zone 2, zone 1, zone 0, zone 21, zone 20, DIV 1, DIV 2	2/27	SIPROM T
	**SITRANS TH200** Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.1 V • 4 to 20 mA • Universal	Zone 2, zone 1, zone 0, zone 21, zone 20, DIV 1, DIV 2	Zone 2, zone 1, zone 0, zone 21, zone 20, DIV 1, DIV 2	2/31	SIPROM T
	**SITRANS TH300** Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.1 V • 4 to 20 mA • Universal • HART	Zone 2, zone 1, zone 0, zone 21, zone 20, DIV 1, DIV 2	Zone 2, zone 1, zone 0, zone 21, zone 20, DIV 1, DIV 2	2/38	SIMATIC PDM
	**SITRANS TH400** Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages • Fieldbus transmitters • PROFIBUS PA • FOUNDATION fieldbus	Zone 2, zone 1, zone 0, zone 21, zone 20, DIV 1, DIV 2	Zone 2, zone 1, zone 0, zone 21, zone 20, DIV 1, DIV 2	2/45	SIMATIC PDM for TH 400 with PROFIBUS PA

	Application	Mounting of transmitter with Ex protection		Page	Software for parameterization
		Transmitter	Sensor		
	**SITRANS TH320** 2-wire head transmitter with and without HART communications interface. With 1 input for connection to resistance thermometers, linear resistors, potentiometers, thermocouples, and DC voltages up to 1.7 V • 4 to 20 mA • HART 7 • Universal • SIL2/3 according to IEC 61508	Zone 2, zone 1, zone 0, zone 21, zone 20, M1, DIV 1, DIV 2	Zone 2, zone 1, zone 0, zone 21, zone 20, M1, DIV 1, DIV 2	2/51	SIMATIC PDM
	**SITRANS TH420** Transmitters with 2 inputs for connection to resistance thermometers, linear resistors, potentiometers, thermocouples and DC voltages up to 1.7 V • Drift detection function • HART 7 • Universal • SIL2/3 according to IEC 61508 • High input availability	Zone 2, zone 1, zone 0, zone 21, zone 20, M1, DIV 1, DIV 2	Zone 2, zone 1, zone 0, zone 21, zone 20, M1, DIV 1, DIV 2	2/60	SIMATIC PDM
Rail transmitters					
	**SITRANS TR200** • 4 to 20 mA • Universal	Zone 2, zone 1, zone 0, zone 21	Zone 2, zone 1, zone 0, zone 21, zone 20	2/70	SIPROM T
	**SITRANS TR300** • 4 to 20 mA • Universal • HART	Zone 2, zone 1, zone 0, zone 21	Zone 2, zone 1, zone 0, zone 21, zone 20	2/77	SIMATIC PDM
	**SITRANS TR320** 2-wire rail transmitter with and without HART communications interface. With 1 input for connection to resistance thermometers, linear resistors, potentiometers, thermocouples, and DC voltages up to 1.7 V • 4 to 20 mA • HART 7 • Universal • SIL2/3 according to IEC 61508	Zone 2, zone 1, zone 0, zone 21, zone 20, M1, DIV 1, DIV 2	Zone 2, zone 1, zone 0, zone 21, zone 20, M1, DIV 1, DIV 2	2/84	SIMATIC PDM
	**SITRANS TR420** Transmitters with 2 inputs for connection to resistance thermometers, linear resistors, potentiometers, thermocouples and DC voltages up to 1.7 V • Drift detection function • HART 7 • Universal • SIL2/3 according to IEC 61508 • High input availability	Zone 2, zone 1, zone 0, zone 21, zone 20, M1, DIV 1, DIV 2	Zone 2, zone 1, zone 0, zone 21, zone 20, M1, DIV 1, DIV 2	2/93	SIMATIC PDM

2

	Application	Mounting of transmitter with Ex protection		Page	Software for parameterization
		Transmitter	Sensor		
Field transmitters					
	**SITRANS TF** Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.1 V • In field enclosure for heavy industrial use • 4 to 20 mA • HART 5 • Universal	Zone 2, zone 1; zone 21, DIV 1, DIV 2	Zone 2, zone 1, zone 0	2/103	Depending on the installed TH200/TH300 transmitter
	**SITRANS TF** Fieldbus transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 0.8 V • In field enclosure for heavy industrial use • PROFIBUS PA • FOUNDATION fieldbus	Zone 2, zone 1; zone 21, DIV 1, DIV 2	Zone 2 zone 1, zone 0	2/112	SIMATIC PDM for PROFIBUS PA
	**SITRANS TF320** NEW Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.7 V • In field enclosure for heavy industrial use • 4 to 20 mA • HART 7 • Universal • SIL2/3 according to IEC 61508	Zone 2, Zone 1, Zone 21, DIV 1, DIV 2	Zone 2, Zone 1, Zone 21, DIV 1, DIV 2	2/119	Local operation with buttons. SIMATIC PDM local with HART modem or SIPROM T (depending on SITRANS TH320 type used)
	**SITRANS TF420** NEW Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.7 V • In field enclosure for heavy industrial use • HART 7 • Universal • SIL2/3 according to IEC 61508 • High input availability	Zone 2, Zone 1, Zone 21, DIV 1, DIV 2	Zone 2, Zone 1, Zone 21, DIV 1, DIV 2	2/132	Local operation with buttons. SIMATIC PDM locally with HART modem.
Field indicator for 4 to 20 mA signals					
	**SITRANS TF** Field indicator for 4 to 20 mA signals Display of units can be user-defined	Zone 2, zone 1, zone 21, DIV 1, DIV 2	-	2/103	-

	Application	Mounting of transmitter with Ex protection		Page	Software for parameterization
		Transmitter	Sensor		
Fiber-optic temperature measurement					
	**SITRANS TO500** Multipoint temperature transmitter for measuring temperatures and temperature profiles with fiber-optic multipoint measuring lances.		Zone 0, Zone 20	2/147	Via Ethernet with the supplied parameter assignment software
	**SITRANS TO multipoint measuring lance** For measuring temperatures and temperature profiles using fiber-optic Fiber Bragg Grating (FBG).			2/150	

Supplied product documentation on DVD and safety instructions

The scope of delivery of the Siemens products for process instrumentation includes a multilingual instruction sheet with **safety instructions** as well as a uniform **mini DVD – Process Instrumentation and Weighing Systems**.

This DVD contains the most important manuals and certificates for the Siemens process instrumentation and weighing technology portfolio. The delivery may also contain product-specific or order-specific printed materials.

For additional information, refer to the Annex on page 10/3.

Overview

Temperature sensors of the SITRANS TS500 product family are used to measure temperatures in industrial equipment.

Benefits

The modular design makes it possible to customize the temperature sensor for most applications, while still being able to use many standardized individual components.

SITRANS TS500 Temperature sensors as a modular system

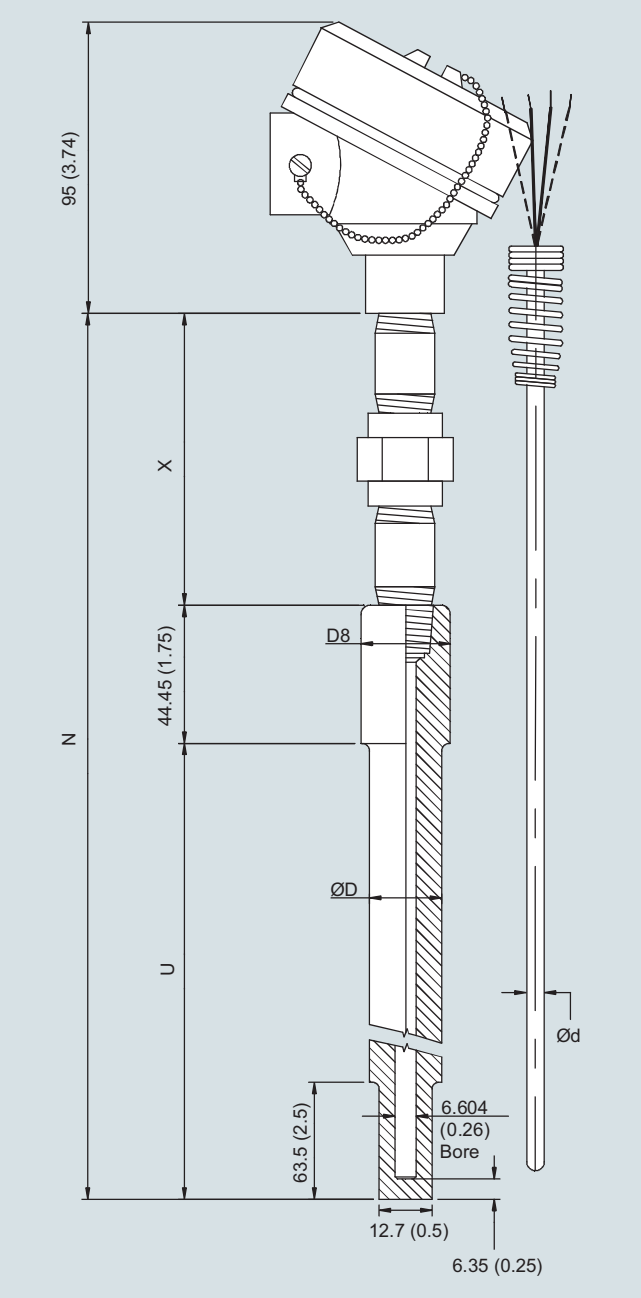
Due to their modular design, temperature sensors of the SITRANS TS500 series are well suited to a large number of applications.

The replaceable measuring insert makes it possible to conduct maintenance work even during ongoing operations. These devices are used particularly frequently in vessels and pipelines of the following industries:

- Power plants
- Chemical industry
- Petrochemical industry
- General process engineering
- Water, waste water

Design

SITRANS TS500 7MC65xx



SITRANS TS500, type SWR, socket reduced well, dimensions in mm (inch)

The temperature sensors of the SITRANS TS500 series are available in four different designs:

- General Purpose without Thermowell
- Threaded Thermowell
- Flanged Thermowell
- Socket Thermowell

Function

A complete measuring point consists of a measuring insert which contains the basic sensors, the protective fitting and an optional transmitter.

The basic sensors are:

- Resistance thermometers:
  Temperature measurement is based on the temperature dependency of the installed measuring resistor.
- Thermocouples:
  Temperature measurement is based on the Seebeck effect. A thermocouple which subjected to a temperature drop produces thermoelectric voltage that can be measured.

Transmitters:

The optional Siemens transmitters assume the following functions:

- Optimum measurement processing
- Strengthening of weak sensor signals directly on site
- Transmits standardized signals
- Protects against electromagnetic interferences
- Support enhanced diagnosis options

The resistance thermometer is intended for installation in containers and pipelines.

- Modular design consisting of thermowell, measuring insert, connection head and optional transmitter.
- Transmitter can be integrated (4 to 20 mA, PROFIBUS PA or FOUNDATION Fieldbus)

Configuration

Components: Process connections

Flanges

The different properties of the flanges are as follows:

- Standard series EN 1092, ASME 16.5,..
- Nominal pressure
- Nominal diameter
- Sealing face

This information is stamped into the flange, as well as the material code and batch number for "3.1 Material".

Components: Thermowell

Thermowells fulfill two basic functions:

- They protect the measuring insert from aggressive media
- They make it possible to replace units during ongoing operations

This catalog is limited to the standard versions. Special versions are available on request.

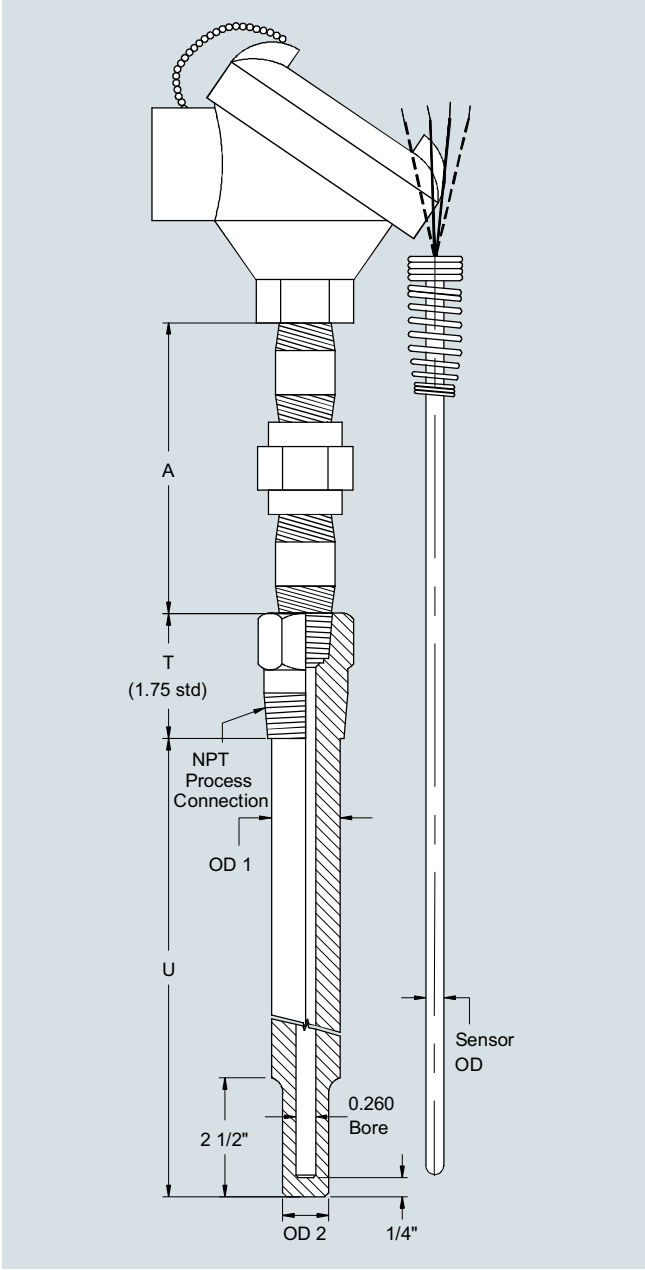
- Barstock thermowells
  Where process loads are too high, or where thermowells with welded seams are not allowed, deep hole drilled barstock thermowells are used.

Components: Extension (neck tube)

The extension is the section from the lower edge of the connection head to the fixed point of the process connection or thermowell. There is a variety of terms for this components, e.g. neck tube. For this reason the term extension has been selected as a standardized term for the different designs. Function is the deciding factor:

- Thermal decoupling of connection head from process temperature
- Installation of connection head over existing insulation
- Simple standardization of measuring inserts: In general, the length of the extension may be freely selected. However, when using standardized insertion lengths ensures that measuring inserts are quickly available can be used.
- The extension takes the spring load of the sensor.
- Depending on the design, the extension can also be used to achieve an alignment of the connection head.

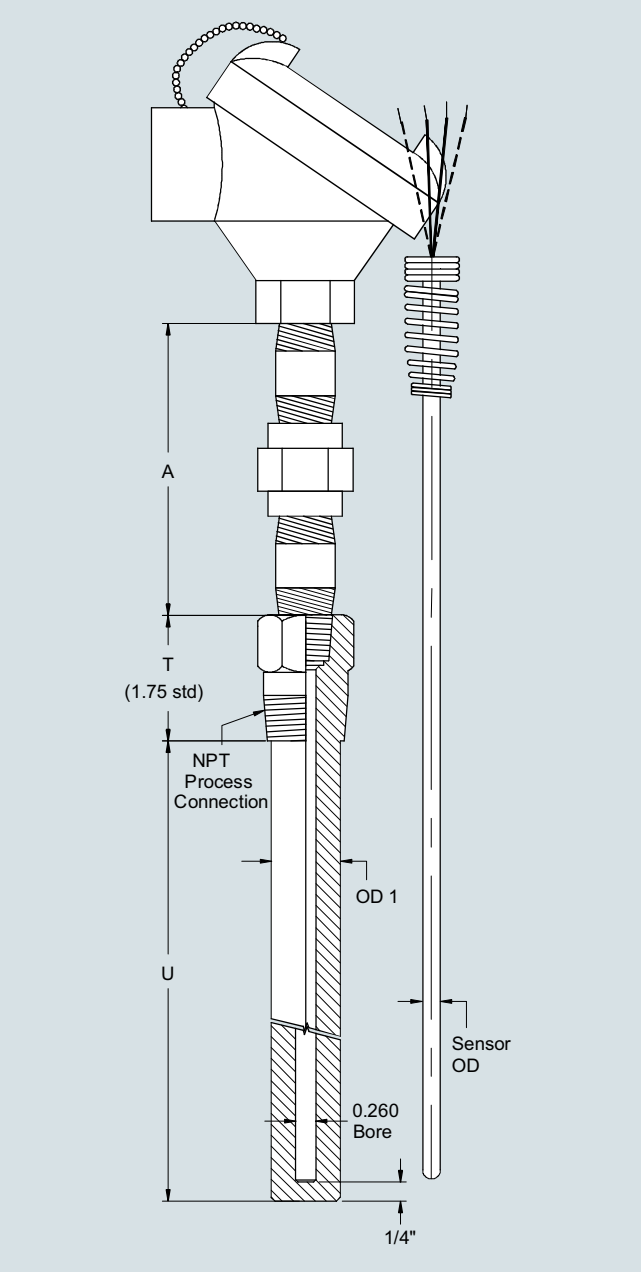
Step down threaded well assemblies



Process NPT	OD1	OD2
½"	0.68"	5/8"
¾"	7/8"	5/8"
1"	1 1/16"	5/8"
1 ¼"	1 1/8"	¾"
1 ½"	1 1/8"	¾"

Dimensions in inch

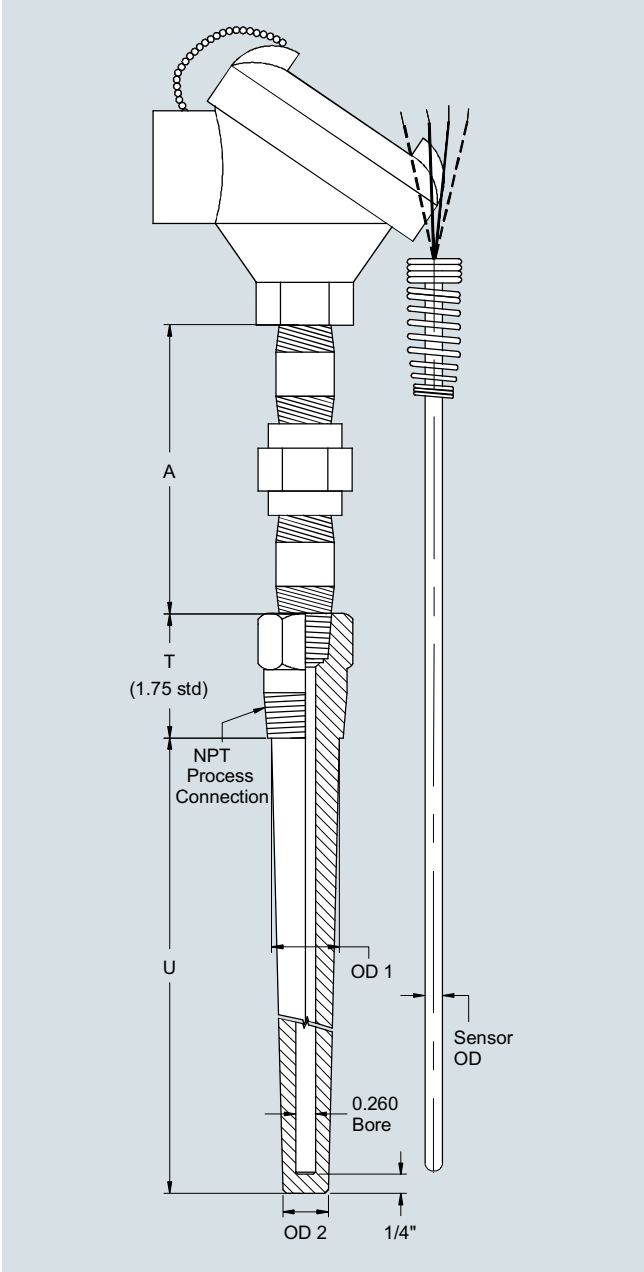
Straight threaded well assemblies



Process NPT	OD1
½"	0.68"
¾"	¾"
1"	7/8"
1 ¼"	1 1/8"
1 ½"	1 1/8"

Dimensions in inch

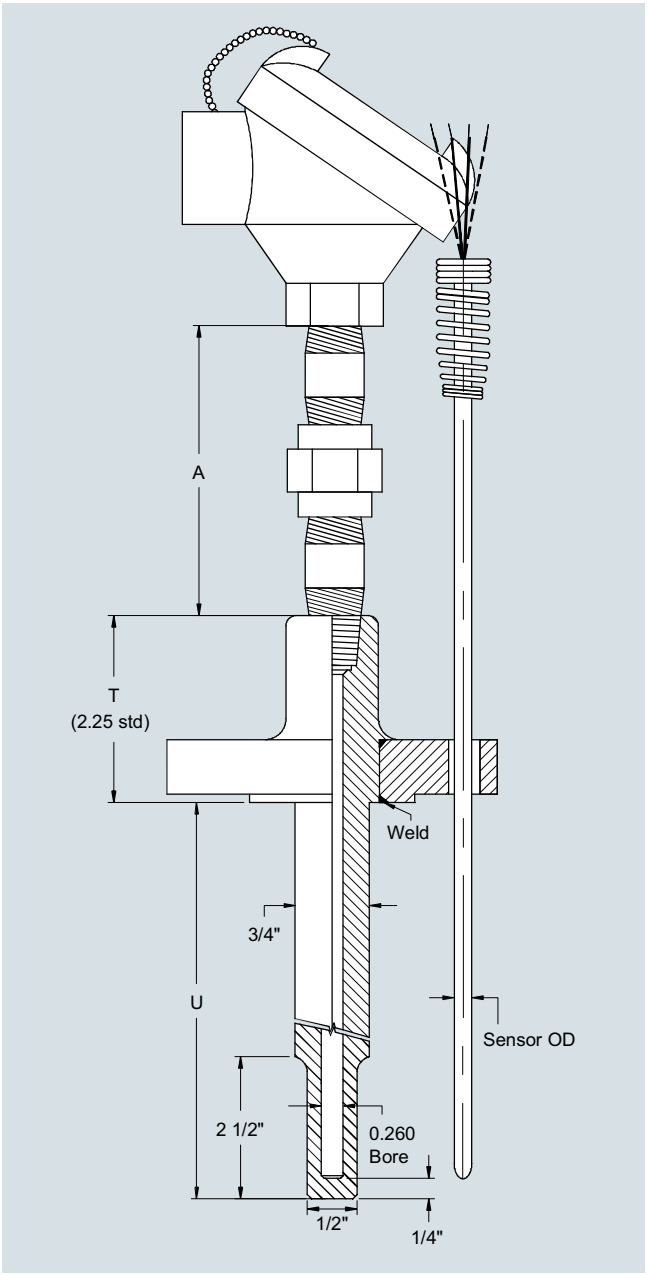
Tapered threaded well assemblies



Process NPT	OD1	OD2
½"	0.68"	5/8"
¾"	7/8"	5/8"
1"	1 1/16"	5/8"
1 ¼"	1 1/8"	¾"
1 ½"	1 1/8"	¾"

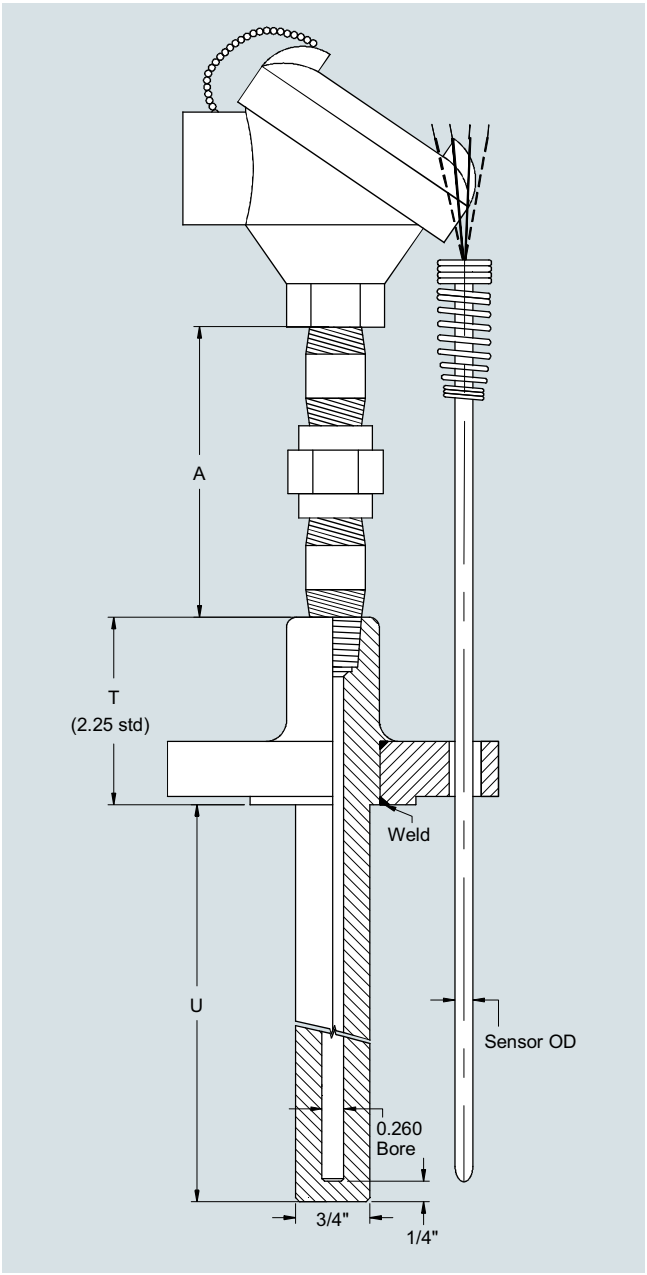
Dimensions in inch

Step down flanged well assemblies



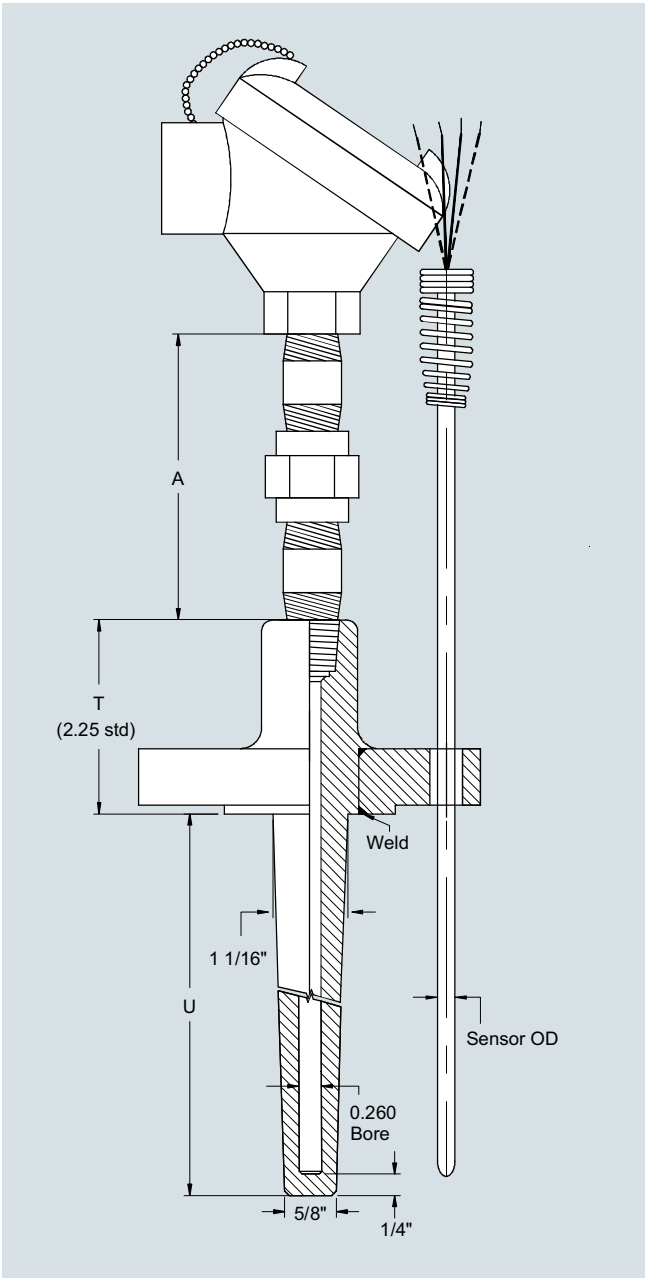
Dimensions in inch

Straight flanged well assemblies



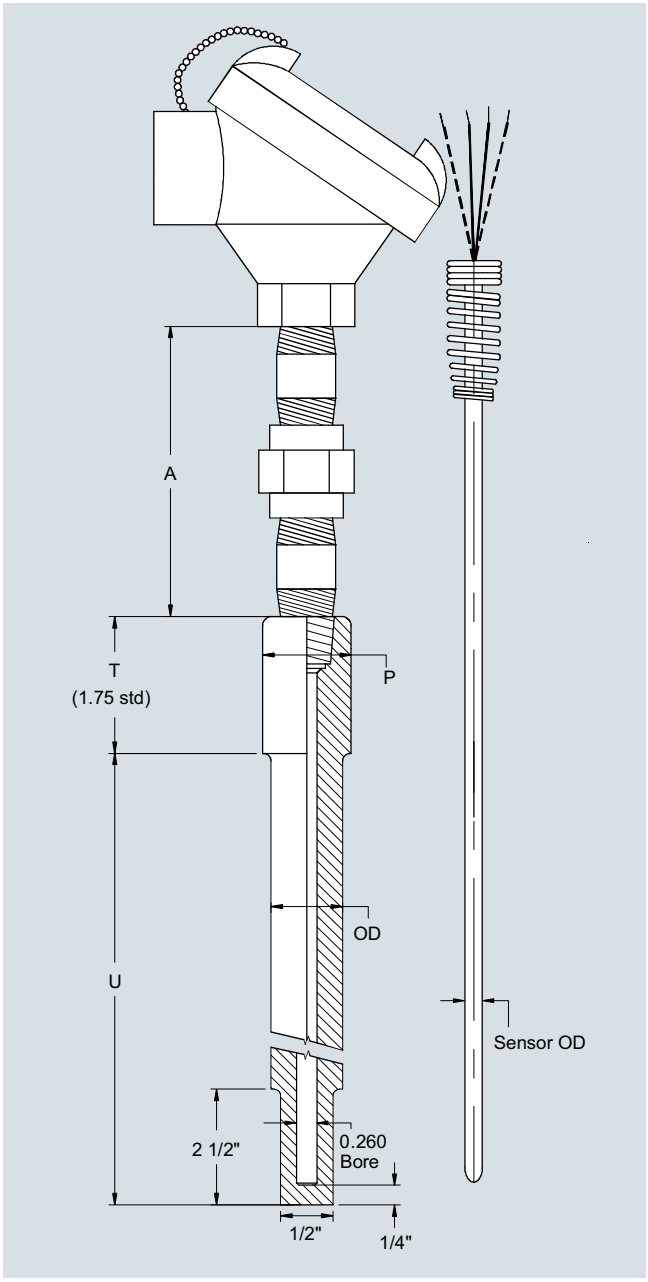
Dimensions in inch

Tapered flanged well assemblies



Dimensions in inch

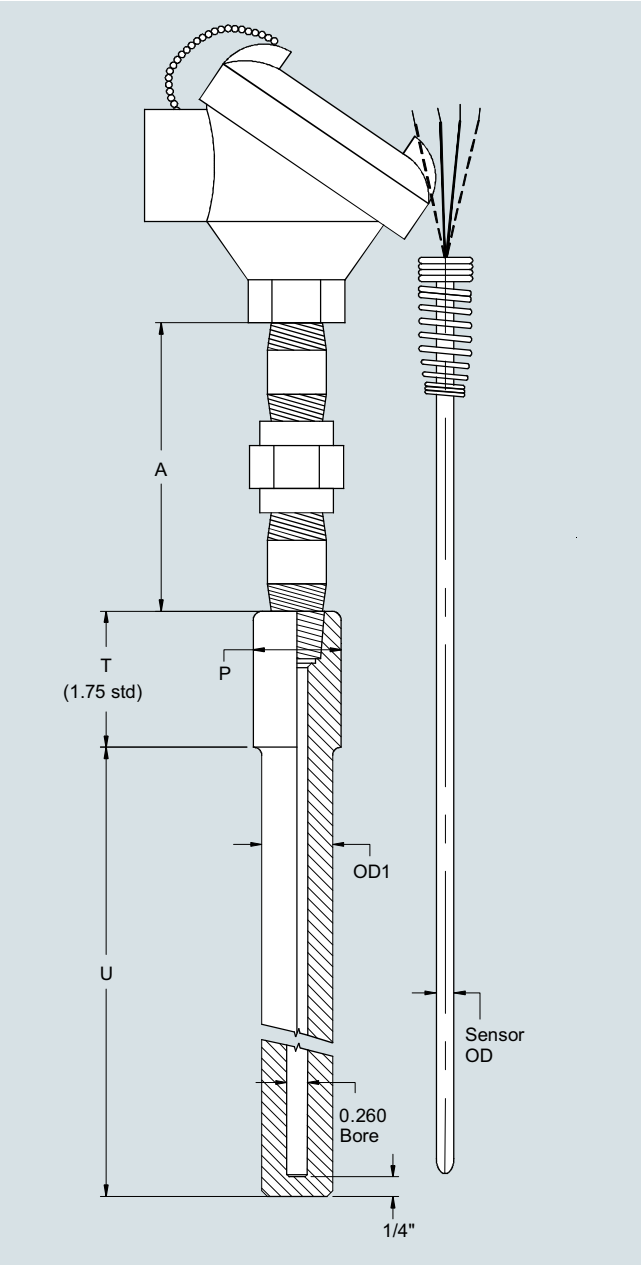
Step down socket well assemblies



Dimensions in inch

2

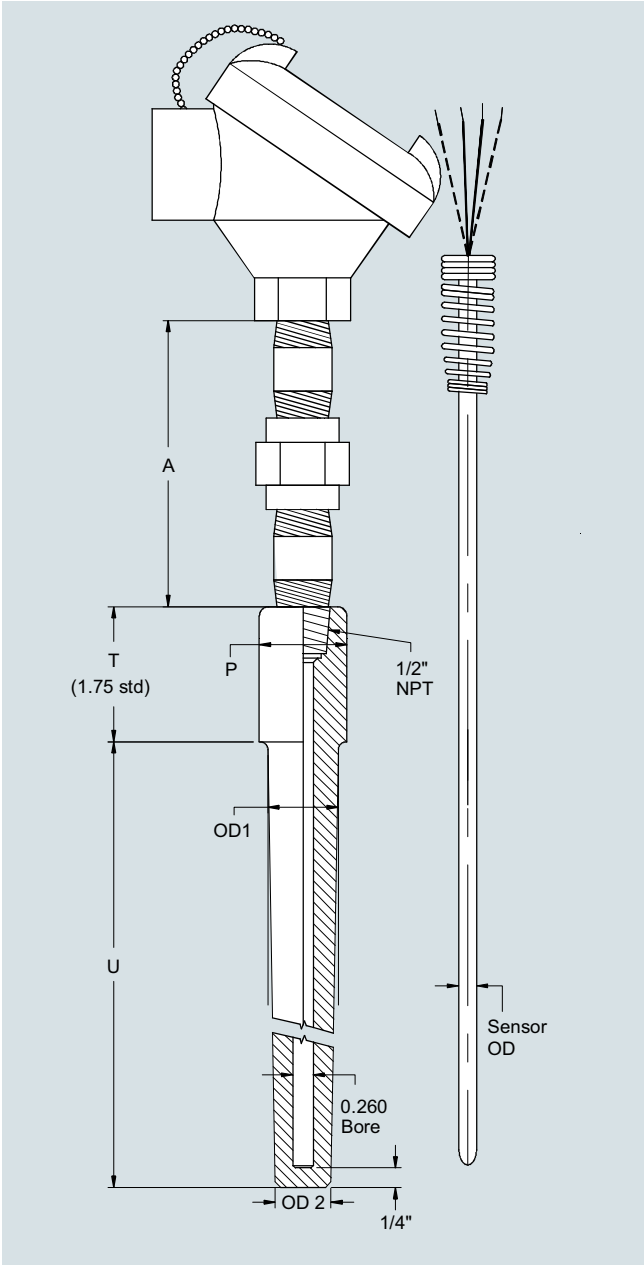
Straight socket well assemblies



Process NPT	OD1
½"	0.68"
¾"	¾"
1"	7/8"
1 ¼"	1 1/8"
1 ½"	1 1/8"

Dimensions in inch

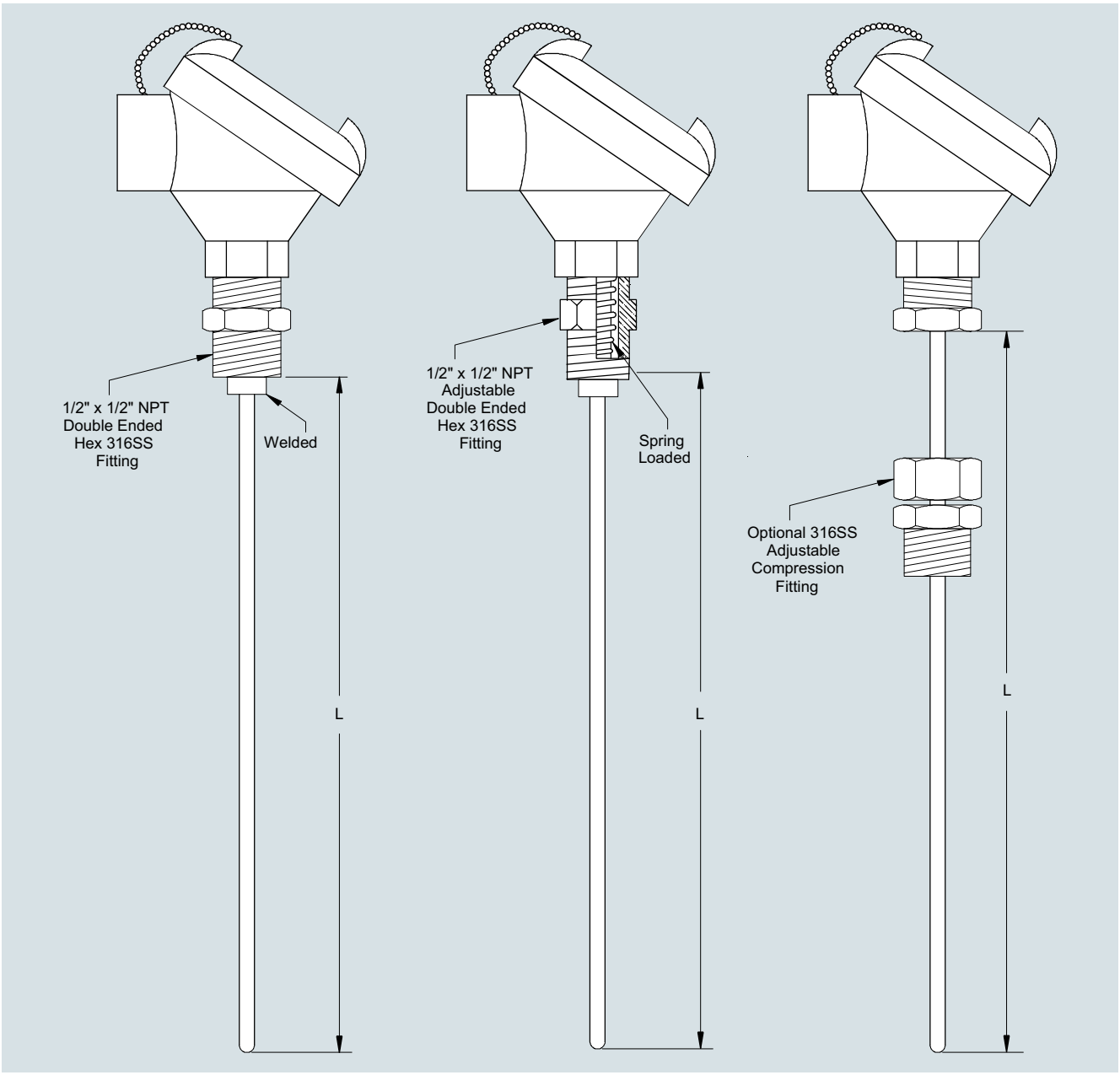
Tapered socket well assemblies



Process NPT	OD1	OD2
½"	0.68"	5/8"
¾"	7/8"	5/8"
1"	1 1/16"	5/8"
1 ¼"	1 1/8"	¾"
1 ½"	1 1/8"	¾"

Dimensions in inch

General purpose sensors



Dimensions in inch

Components: Connection head

Connection head

The connection head protects the wiring connections. The connection head features sufficient room for mounting a terminal block or transmitter.

Different connection heads are used depending on the application and preference.

Components: Measuring insert

Measuring inserts feature a large spring range. These measuring inserts are ideal for use with NPT threads with the typical loose tolerances. In this configuration, the extension function is partially or fully integrated (nipple-union-nipple). Moreover it is also possible to directly attach field devices, e.g. SITRANS TF.

Components: Transmitters

SITRANS TH head transmitters process the weak non-linear sensor signals and transmit a stable and temperature-linear standard signal, thereby minimizing sensor signal disruptions.

The transmitters constantly monitor the temperature sensors and transmit diagnostic data to superordinate systems.

Because of the low energy feed of the SITRANS TH head transmitters, self-heating of the temperature sensors can be maintained at minimal levels.

The electrical isolation and integrated cold junction ensure that temperature sensors with thermocouples provide reliable measurements at a low cost.

SITRANS TH product family

For detailed technical data on the SITRANS TH transmitters, please refer to the catalog FI 01.

- TH100 - the basic device
  - Output 4 to 20mA
  - for Pt100
  - can be configured using simple software
- TH200 - the universal device
  - Output 4 to 20mA
  - Resistance thermometer, thermocouples
  - can be configured using simple software
- TH300 - HART universal
  - Output 4 to 20 mA/HART
  - Resistance thermometer, thermocouples
  - HART conforming
  - Diagnostic functions
- TH400 - Fieldbus PA and FF
  - Output PROFIBUS PA or FOUNDATION Fieldbus
  - Resistance thermometer, thermocouples
  - Diagnostic functions; for detailed technical description of the SITRANS TH transmitter please refer to the related chapter of this catalog.

Measuring technology: Sensor elements

The diverse application spectrum for industrial temperature measuring technology requires different sensor technologies.

Resistance thermometer

Sensor elements made of other basic materials with different nominal resistances or different underlying standards are available on request. Resistance thermometers can be classified as follows:

- Basic design:
  The sensor element is built with thin layer technology. The resistance material is applied in the form of a thin layer on a ceramic carrier material.
- Versions featuring increased vibration-resistance:
  In addition to the basic design, the vibration resistance is improved through extra measures.
- Versions with expanded measuring range:
  Elements in wire-wound design. The wire winding is embedded in a ceramic body.

Thermocouples

Other thermocouples based on other thermo couples or underlying standards are available upon request.

The most common base metal thermocouples include:

- Type K (NiCr-Ni) more stable than type J, but drifts in upper range.
- Type J (Fe-CuNi) narrow application band

Measuring technology: Measuring range

The measuring range describes the temperature limits within which the thermometer can be used in a way that is meaningful for measurement purposes. Depending on the loads present, the thermowell materials and the desired accuracy levels, the actual application range for the thermometer may be smaller.

Resistance thermometer [°C (°F)]	
Basic version and increased vibration resistance	-50 ... +400 (-58 ... +752)
Expanded measuring range	-196 ... +600 (-320.8 ... +1112)

Thermocouple [°C (°F)]	
Type K	-40 ... +1000 (-40 ... +1132)
Type J	-40 ... +750 (-40 ... +1382)

Measuring technology: Measuring accuracy

Resistance thermometer

The tolerance classes of the resistance thermometers correspond with IEC 751/EN 60751:

Tolerance	Δt
Basic accuracy, Class B	±(0.30 °C +0.0050|t[°C]|) ±(0.54 °F +0.0050|t [°F]-32|)
Increased accuracy, Class A	±(0.15 °C +0.0020|t[°C]|) (±(0.27 °F +0.0020|t [°F]-32|))
High degree of accuracy, Class A+ (1/3 B)	±(0.10 °C +0.0017|t[°C]|) (±(0.18 °F +0.0017|t [°F]-32|))

The following tables provide an overview of the scope of these tolerances. If you exceed the specified limits with a resistance thermometer, the values of the next lower accuracy class apply:

Resistance thermometer Basic version [°C (°F)]	
Tolerance	**Range**
Basic accuracy, Class B	-50 ... +400 (-58 ... +752)
Increased accuracy, Class A	-30 ... +300 (-22 ... +572)
High degree of accuracy Class A+ (1/3 B)	0 ... 150 (32 ... 302)

Resistance thermometer Increased vibration-resistance [°C (°F)]	
Tolerance	**Range**
Basic accuracy, Class B	-50 ... +400 (-58 ... +752)
Increased accuracy, Class A	-30 ... +300 (-22 ... +572)
High degree of accuracy Class A+ (1/3 B)	0 ... 150 (32 ... 302)

Resistance thermometer Expanded measuring range [°C (°F)]	
Tolerance	**Range**
Basic accuracy, Class B	-196 ... +600 (-321 ... +1112)
Increased accuracy, Class A	-100 ... +450 (-148 ... +842)

Thermocouples

The tolerance classes of the thermocouples correspond with IEC 584/EN 60584:

Catalog versions

Type	Basic accuracy, Class 2	Increased accuracy, Class 1
K	-40 °C ... +333 °C ±2.5 °C (-40 °F ... +631 °F ±4.5 °F) 333 °C ... 1000 °C ±0.0075x|t[°C]| (631 °F ... 1832 °F ±0.0075x|t[°F]-32|)	-40 °C ... +375 °C ±1.5 °C (-40 °F ... +707 °F ±2.7 °F) 375 °C ... 1000 °C ±0.004x|t[°C]| (707 °F ... 1832 °F ±0.004x|t[°F]-32|)
J	-40 °C ... +333 °C ±2.5 °C (-40 °F ... +631 °F ±4.5 °F) 333 °C ... 750 °C ±0.0075x|t[°C]| (631 °F ... 1382 °F ±0.0075x|t[°F]-32|)	-40 °C ... +375 °C ±1.5 °C (-40 °F ... +707 °F ±2.7 °F) 375 °C ... 750 °C ±0.004x|t[°C]| (707 °F ... 1382 °F ±0.004x|t[°F]-32|)

Other thermocouples, ignoble

Type	Basic accuracy, Class 2	Increased accuracy, Class 1
T	-40 °C ... 133 °C ±1 °C (-40 °F ... +271 °F ±1.8 °F) 133 °C ... 350 °C ±0.0075x|t[°C]| (271 °F ... 662 °F ±0.0075x|t[°F]-32|)	-40 °C ... +125 °C ±0.5 °C (-40 °F ... +257 °F ±0.9 °F) 125 °C ... 350 °C ±0.004x|t[°C]| (257 °F ... 662 °F ±0.004x|t[°F]-32|)
E	-40 °C ... +333 °C ±2.5 °C (-40 °F ... +631 °F ±4.5 °F) 333 °C ... 900 °C ±0.0075x|t[°C]| (631 °F ... 1652 °F ±0.0075x|t[°F]-32|)	-40 °C ... +375 °C ±1.5 °C (-40 °F ... +707 °F ±2.7 °F) 375 °C ... 800 °C ±0.004x|t[°C]| (707 °F ... 1472 °F ±0.004x|t[°F]-32|)

Other thermocouples. noble

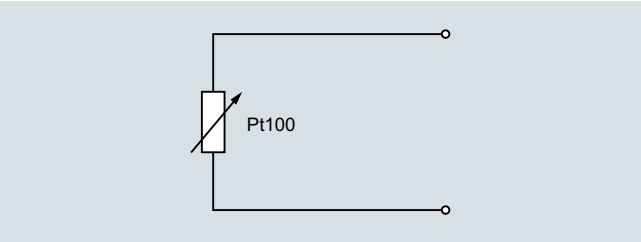
Type	Basic accuracy, Class 2	Increased accuracy. Class 1
R and S	0 °C ... 600 °C±1.5 °C (32 °F ... 1112 °F±2.7 °F) 600 °C ... 1600 °C±0.0025 x |t| (1112 °F ... 2912 °F±0.0025 x |t|)	0 °C ... 1100 °C±1 °C (32 °F ... 2012 °F±1.8 °F) 1100 °C ... 1600 °C±[1 + 0.003 (t - 1100)] °C (2112 °F ... 2912 °F±[1.8 + 0.003 (t - 212)] °F)
B	600 °C ... 1700 °C±0.0025 x |t| (1112 °F ... 3092 °F±0.0025 x |t|)	

Measuring technology: Connection types

In the case of resistance thermometers, the type of sensor connection directly affects the level of accuracy:

Two-wire system

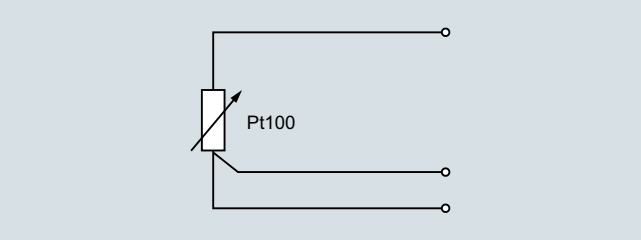
The resistance of sensor lines are included in the measurement result as an error. Adjustments are recommended in this case.



Pt100 Two-wire system

Three-wire system

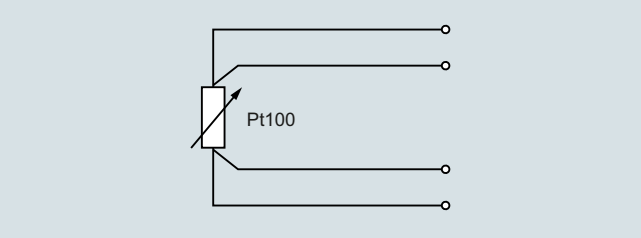
Line resistance is not included in the measurement result. Requirements: all terminal and line resistances (corrosion) are at the same level, and terminals are at the same temperature level.



Pt100 Three-wire system

Four-wire system

Line resistance is not included in the measurement result. This type of connection is the most secure and most accurate.



Pt100 Four-wire system

Siemens measuring inserts can be used to implement all types of connections for 1 x Pt100 devices. In the case of 2 x Pt100 versions, two- and three-wire systems are also possible. For measurement-related reasons, we always recommend a 1 x four-wire or 2 x 3-wire connection.

Thermowell calculation

Properly applied load diagrams will provide a sufficient degree of safety for the most common thermowell configurations.

However, there are cases in which operating conditions deviate too greatly from standard parameters. In this case, a customized thermowell calculation may be required.

Another reason for doing this calculation is the fact that flowing media can create turbulence at the tip of the thermowell under certain conditions. The thermowell will then vibrate and may even be destroyed if not configured correctly. This is the most frequent cause of thermowell bailure.

SIEMENS offers the two recognized methods for calculating the thermowell:

- DIN/Dittrich method
- ASME/Murdock method
  This method also takes into account turbulence formation on a mathematical level.

Both methods provide a high degree of safety with regard to thermowell configuration, however, they do not provide a guarantee against breakdowns.

Materials

Material descriptions/Standards comparison				**Max. temperature [°C (°F)] (unloaded)**	**Properties**	**Applications**
Mat. No.:	AISI/Trade name:	EN 10028-2:	Description			
1.4404 or 1.4435	AISI 316 L	X2CrNiMo17-12-2	Austenitic stainless steel	600 (1112)	Good acid resistance, resistant against grain boundary corrosion	Chemical industry, waste treatment, paper and cellulose industry, food industry
2.4816	Inconel 600	NiCr15Fe	Nickel-Chrome alloy	1150 (2102)	Resistant at high temperatures, resistant against chlorine-induced cold crack corrosion	Chemical industry, petrochemical industry, food industry
1.4876	Incoloy 800	X10NiCrAlTi32-21	Austenitic heat-resistant stainless steel	1100 (2012)	Excellent resistance against oxidation and carbonization at high temperatures, good corrosion resistance	O&G industry, waste gas treatment, power plants (steam boiler, heat exchanger), applications using aggressive fluids
2.4819	Hastelloy C 276	NiMo16Cr15W	Nickel-Chrome-Molybdenum alloy	1100 (2012)	Resistant at high temperatures, in oxidizing and reducing atmosphere, resistant against pitting and crevice corrosion, good corrosion resistance after welding	Chemicals industry, paper and cellulose industry, waste treatment, waste incinerators, emissions controls, shipbuilding and offshore industry
2.4360	Monel 400	NiCu30Fe	Nickel-Copper alloy	500 (932)	Excellent corrosion resistance, particularly against chlorine-induced cold crack corrosion	Chemical industry, offshore industry, nuclear technology, petrochemical industry

Where cost-intensive materials are used with flange thermowells, cost savings can be achieved by using a so-called flanged wheel. A thin disc of the material which comes into contact with media is applied prior to the flange (ordinary stainless steel).

Vibration resistance of measuring insert, cable sensor

Similar to the thermowell, inner (Karman vortices) and outer (plant) vibrations also affect the measuring insert. For this reason, a special assembly of measurement elements is required. Other than a few exceptions for cable and compact thermometers, Siemens only produces sensors based on a mineral-insulated cable. Together with precautions taken when installing the measuring element, the Siemens basic version already exceeds EN 60751 by more than a factor of 3. Pursuant to the measurement methods of this standard, the following values are obtained (tip-tip):

- 10 g: Basic version and expanded measuring range
- 60 g: Increased vibration-resistance and thermocouple

Electrical stability

Insulation resistance

The insulation resistance between each measuring circuit and the fitting is tested at a voltage of 500 V DC at room temperature.

$R_{iso} \geq 100\ M\Omega$

Due to the property of the mineral-insulated cable, the insulation resistance decreases as temperature increases. Because of the special production method, it is, however, possible to achieve very good values even at high temperatures.

Line resistance

When connected to two-wire systems, the line resistance is included in the measurement result. The following rule of thumb can be used:

- ∅ Measuring insert 6 mm (0.24 in) 2.8 Ω/m or 44.78 (44.78)

For this reason a connection to three- or four-wire systems is highly recommended.

Selection and Ordering data

2

Selection and Ordering data	Article No.	Ord. Code
SITRANS TS500 ↗	**7MC650**	
Threaded sensor assembly (no thermowell)	**-**	**- 0**
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.		
Sheath Material		
316L Stainless Steel	**2**	
310 Stainless Steel	**4**	
Alloy 600	**7**	
Form		
Adjustable Compression Fitting	**2**	
Fixed Welded	**3**	
Spring-Loaded	**4**	
Process Connection Size		
½" NPT	**J**	
Insertion length (U-Length)		
1"	**P 0**	
1.5"	**P 1**	
2"	**P 2**	
2.5"	**P 3**	
3"	**P 4**	
3.5"	**P 5**	
4"	**P 6**	
4.5"	**P 7**	
5"	**P 8**	
5.5"	**Q 0**	
6"	**Q 1**	
6.5"	**Q 2**	
7"	**Q 3**	
7.5"	**Q 4**	
8"	**Q 5**	
8.5"	**Q 6**	
9"	**Q 7**	
9.5"	**Q 8**	
10"	**R 0**	
10.5"	**R 1**	
11"	**R 2**	
11.5"	**R 3**	
12"	**R 4**	
12.5"	**R 5**	
13"	**R 6**	
13.5"	**R 7**	
14"	**R 8**	
14.5"	**S 0**	
15"	**S 1**	
15,5"	**S 2**	
16"	**S 3**	
16.5"	**S 4**	
17"	**S 5**	
17.5"	**S 6**	
18"	**S 7**	
18.5"	**S 8**	
19"	**T 0**	
19.5"	**T 1**	
20"	**T 2**	
20.5"	**T 3**	
21"	**T 4**	
21.5"	**T 5**	
22"	**T 6**	
22.5"	**T 7**	
23"	**T 8**	
23.5"	**U 0**	
24"	**U 1**	
Other, specify U length	**Z 0**	**K 1 Y**
Sensor Diameter		
¼"	**7**	

Selection and Ordering data	Article No.	Ord. Code
SITRANS TS500	**7MC650**	
Threaded sensor assembly (no thermowell)	**-**	**- 0**
Connection Head		
Cast Aluminum	**J**	
Cast Stainless Steel	**S**	
Flip-Top Aluminum	**B**	
Explosion Proof Aluminum (FM [XP]/CSA/ATEX [Ex d])	**G**	
Explosion Proof SS	**U**	
Without Head (for TF/display, use option A80-A83)	**N**	
Other	**Z**	**P 1 Y**
Sensor Type		
RTD		
Standard RTDs are 3-wire, 100 Ohm Platinum, 500 F		
Class B	**A 1**	
Class A	**A 2**	
Class AA (4-wire)	**A 3**	
Class B Dual	**A 5**	
Class A Dual	**A 6**	
High Vibration RTD (900 F) - Class B	**B 1**	
RTD high temp (900 F) - Class B	**C 1**	
Thermocouple		
Standard thermocouples are ungrounded		
Type J	**J 1**	
Type J dual	**J 5**	
Type K	**K 1**	
Type K dual	**K 5**	
Type T	**T 1**	
Type T dual	**T 5**	
Type E	**E 1**	
Type E dual	**E 5**	
Other	**Z 0**	**Q 1 Y**

Selection and Ordering data	Order Code
Options Add "**-Z**" to Article No. and add options, separate extensions with "+".	
Explosion protection	
ATEX Intrinsic safety "ia", "ic"	**E01**
ATEX Flameproof enclosure "d"	**E02**
ATEX Non sparking "n"	**E03**
cFMus intrinsic safety	**E11**
cFMus explosion proof	**E13**
Transmitter mounted in head Measuring range to be set must be specified with plain text data "Y01".	
SITRANS TH100 No Approvals	**T10**
SITRANS TH100 ATEX (Ex ia, Ex n)	**T11**
SITRANS TH100 FM (IS)	**T13**
SITRANS TH200 No Approvals	**T20**
SITRANS TH200 ATEX (Ex ia, Ex n)	**T21**
SITRANS TH200 FM (IS)	**T23**
SITRANS TH300 No Approvals	**T30**
SITRANS TH300 ATEX (Ex ia, Ex n)	**T31**
SITRANS TH300 FM (IS)	**T33**
SITRANS TH400 PA No Approvals	**T40**
SITRANS TH400 PA FM (IS), ATEX (Ex ia, Ex n)	**T41**
SITRANS TH400 FF No Approvals	**T45**
SITRANS TH400 FF FM (IS), ATEX (Ex ia, Ex n)	**T46**
Transmitter with display - SITRANS TF	
With SITRANS TH200 (SIPROM T communication)	
General Purpose [7NG3135-0AC10]	**A81**
XP FM/CSA (XP) [7NG3135-5AC10]	**A82**
With SITRANS TH300 (HART Communication)	
General Purpose [7NG3136-0AC10]	**A83**
XP FM/CSA (XP) [7NG3136-5AC10]	**A84**
Other temperature transmitter (TF280, TF PA, etc)	
Mounting of transmitter - Ordered separately	**A80**
Transmitter Configuration	
Specify measuring range in plain text	**Y01**
Specify HART-address (max. 8 characters) in plain text	**Y17**
Tag Number (max. 16 characters) - TF only	**Y23**
Tag Description (max. 27 characters) - TF only	**Y24**
Specify bus address in plain text	**Y25**
Fail-safe value 3.6 mA (instead of 22.8 mA)	**U36**
Certificates	
Material certificate for wetted parts	**C12**
Cert SIL 2	**C20**
Cert SIL 2/3	**C23**
Factory calibration - sensor only	**Y33**
Factory cal - matched pair	**C15**
Factory cal - sensor/transmitter assembly	**Y35**
Sensor options	
Grounded T/C (std = ungrounded)	**G31**
4-wire RTD (std = 3-wire)	**R04**
Further options	
SS tag plate - wired to sensor assembly (connection head only)	**Y15**
Special option (define in plain text: "Y99:…")	**Y99**

Selection and Ordering data

2

Selection and Ordering data

	Article No.	Ord. Code
SITRANS TS500 ↗ **Barstock Thermowell Assembly**	**7MC652** -	
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.		
Well Material		
316 SS	**2**	
Special Version (Y99 required)	**8**	
Thermowell Process Connection Type & Size		
Threaded Thermowell		
½" NPT	**1 J**	
¾" NPT	**1 K**	
1" NPT	**1 L**	
Flanged Thermowell		
1.0" 150# RF	**2 E**	
1.0" 300# RF	**2 F**	
1.5" 150# RF	**2 G**	
1.5" 300# RF	**2 H**	
2.0" 150# RF	**2 J**	
2.0" 300# RF	**2 K**	
3.0" 150# RF	**2 P**	
3.0" 300# RF	**2 Q**	
Socket Weld Thermowell		
¾" Socket Weld	**0 K**	
1" Socket Weld	**0 L**	
Other design		
Customer-specified connection (Specify in plain text)	**9 X**	**H 1 Y**
Thermowell Form		
Straight	**S**	
Tapered	**T**	
Step-Down (Reduced)	**U**	
Other, Specify themowell form, U-length and T-Length	**Z 8 8**	**K 1 Y**
Insertion length (U-Length), with standard T-length (1.75")		
2"	**1 2**	
2.5"	**1 3**	
3"	**1 4**	
3.5"	**1 5**	
4"	**1 6**	
4.5"	**1 7**	
5"	**2 0**	
5.5"	**2 1**	
6"	**2 2**	
6.5"	**2 3**	
7"	**2 4**	
7.5"	**2 5**	
8"	**2 6**	
8.5"	**2 7**	
9"	**3 0**	
9.5"	**3 1**	
10"	**3 2**	
10.5"	**3 3**	
11"	**3 4**	
11.5"	**3 5**	
12"	**3 6**	
12.5"	**3 7**	
13"	**4 0**	
13.5"	**4 1**	
14"	**4 2**	
14.5"	**4 3**	
15"	**4 4**	
15,5"	**4 5**	
16"	**4 6**	
16.5"	**4 7**	
17"	**5 0**	
17.5"	**5 1**	
18"	**5 2**	
18.5"	**5 3**	
19"	**5 4**	
19.5"	**5 5**	
20"	**5 6**	
20.5"	**5 7**	
21"	**6 0**	
21.5"	**6 1**	
22"	**6 2**	
22.5"	**6 3**	
23"	**6 4**	
23.5"	**6 5**	
24"	**6 6**	
24,5"	**6 7**	
Other, specify U length	**Z 8 8**	**K 1 Y**

Selection and Ordering data

	Article No.	Ord. Code
SITRANS TS500 **Barstock Thermowell Assembly**	**7MC652** -	
Extension (A-length)		
None	**0**	
3" Hex nipple-union-nipple, SS (HUNS)	**7**	
3" Nipple, SS (NS)	**9**	**N 0 G**
3" Nipple-union-nipple, galv. steel (NUN)	**9**	**N 0 M**
3" Nipple-union-nipple, SS (NUNS)	**9**	**N 0 N**
6" Nipple-union-nipple, galv. steel (NUN)	**9**	**N 9 M**
6" Nipple-union-nipple, SS (NUNS)	**9**	**N 9 N**
6" Hex nipple-union-nipple, SS (HUNS)	**9**	**N 9 H**
Other	**9**	**N 8 Y**
Connection Head		
Cast Aluminum	**J**	
Cast Stainless Steel	**S**	
Flip-Top Aluminum	**B**	
Explosion Proof Aluminum (FM [XP]/CSA/ATEX [Ex d])	**G**	
Explosion Proof SS	**U**	
Without Head (for TF/display, use option A80)	**N**	
Other	**Z**	**P 1 Y**
Sensor Type		
RTD		
Standard RTDs are 3-wire, 100 Ohm Platinum, 500 F		
Class B	**A 1**	
Class A	**A 2**	
Class AA (4-wire)	**A 3**	
Class B Dual	**A 5**	
Class A Dual	**A 6**	
High Vibration RTD (900 F) - Class B	**B 1**	
RTD high temp (900 F) - Class B	**C 1**	
Thermocouple		
Standard thermocouples are ungrounded		
Type J	**J 1**	
Type J dual	**J 5**	
Type K	**K 1**	
Type K dual	**K 5**	
Type T	**T 1**	
Type T dual	**T 5**	
Type E	**E 1**	
Type E dual	**E 5**	
Other Sensor		
Other, Specify type (Q1Y = …)	**Z 0**	**Q 1 Y**
No Sensor		
For well-only configurations	**N 0**	

Selection and Ordering data	Order Code
Options	
Add "**-Z**" to Article No. and add options, separate extensions with "+".	
Transmitter mounted in head Measuring range to be set must be specified with plain text data "Y01".	
SITRANS TH100 No Approvals	**T10**
SITRANS TH100 ATEX (Ex ia, Ex n)	**T11**
SITRANS TH100 FM (IS)	**T13**
SITRANS TH200 No Approvals	**T20**
SITRANS TH200 ATEX (Ex ia, Ex n)	**T21**
SITRANS TH200 FM (IS)	**T23**
SITRANS TH300 No Approvals	**T30**
SITRANS TH300 ATEX (Ex ia, Ex n)	**T31**
SITRANS TH300 FM (IS)	**T33**
SITRANS TH400 PA No Approvals	**T40**
SITRANS TH400 PA FM (IS), ATEX (Ex ia, Ex n)	**T41**
SITRANS TH400 FF No Approvals	**T45**
SITRANS TH400 FF FM (IS), ATEX (Ex ia, Ex n)	**T46**
Transmitter with display - SITRANS TF	
With SITRANS TH200 (SIPROM T communication)	
General Purpose [7NG3135-0AC10]	**A81**
XP FM/CSA (XP) [7NG3135-5AC10]	**A82**
With SITRANS TH300 (HART Communication)	
General Purpose [7NG3136-0AC10]	**A83**
XP FM/CSA (XP) [7NG3136-5AC10]	**A84**
Other temperature transmitter (TF280, TF PA, etc)	
Mounting of transmitter - Ordered separately	**A80**
Transmitter Configuration	
Specify measuring range in plain text	**Y01**
Specify HART-address (max. 8 characters) in plain text	**Y17**
Specify measuring point description (max. 16 characters) in plain text	**Y23**
Specify measuring point text (max. 32 characters) in plain text	**Y24**
Specify bus address in plain text	**Y25**
Fail-safe value 3.6 mA (instead of 22.8 mA)	**U36**
Certificates	
Material certificate for wetted parts	**C12**
Cert SIL 2	**C20**
Cert SIL 2/3	**C23**
Hydrostatic pressure test	**C31**
Thermowell NACE cert	**C50**
Oxygen-cleaned (ISO 9001 grease-free for oxygen service)	**C51**
Inspection certificate Thermowell calculation according ASME PTC 19.3 (Murdock)	**C37**
Factory calibration - sensor only	**Y33**
Factory cal - matched pair	**C15**
Factory cal - sensor/transmitter assembly	**Y35**

Selection and Ordering data	Order Code
Full Penetration Welding for Flanged Process Connections	
Full penetration weld	**G02**
X-ray test certificate for full penetration weld	**C41**
Ultrasonic test certificate for full penetration weld	**C44**
Sensor options	
Grounded T/C (std = ungrounded)	**G31**
4-wire RTD (std = 3-wire)	**R04**
Further options	
SS tag plate	**Y15**
Special option (define in plain text: "Y99:…")	**Y99**

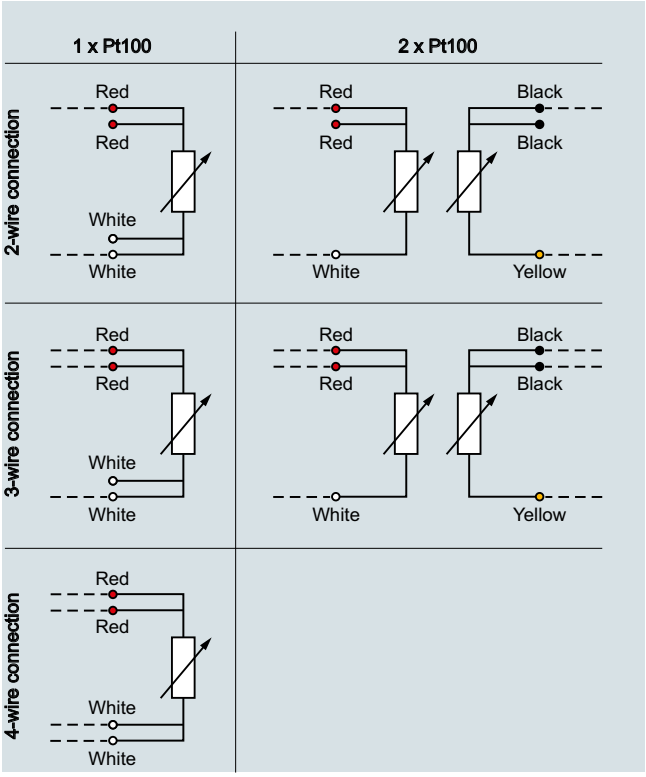
2

Schematics

Resistance thermometer

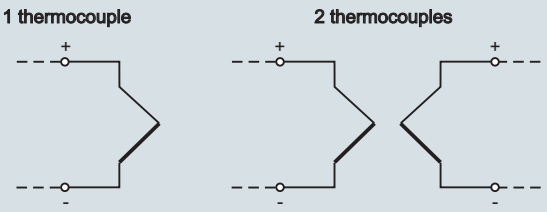
SITRANS TSinsert measuring inserts are designed as a four-wire system for single Pt100 if not mentioned differently. This makes it possible to implement all of the aforementioned connection types.

Double Pt100 measuring inserts (for 6 mm OD only) are designed as a three-wire system.



Schematics 1 x Pt100-2W up to 2 x Pt100-4W

Thermocouples



Type	+	-
J	White	Red
K	Yellow	Red
N	Orange	Red
E	Purple	Red
T	Blue	Red

Circuit diagram for thermocouple

Where thermocouples are used, the use of head transmitters offers particular advantages: The cold junction is already integrated into the universal transmitter. There is no need for expensive thermo or extension cable. This also removes a number of possible error sources. The weak millivolt signal of the thermocouple is already converted into a stable and temperature-linear DC or bus signal on site. This drastically reduces the effects of electromagnetic factors on the measurement result.

If a head transmitter is not installed, the sensor feed line consists either of the appropriate thermo or extension leads. The thermo line is made from the thermo material of the relevant thermocouple, while the extension lead uses a cost-effective substitute material. The extension cable behaves similar to a thermo line at an electrical level, within a limited temperature range of up to 200°C.

A wide spectrum of color coding is available for thermocouples on an international level. This must be taken into account during the electrical connecting.

Country	International/ Germany			North America			UK/ Czech Republic		
Standard	Not intrinsically safe[1]			Extension lead[2]			BS 1843		
	Jacket	+	-	Jacket	+	-	Jacket	+	-
N	PN	PN	WH	OG	OG	RD	OG	OG	BU
K	GN	GN	WH	YE	YE	RD	RD	BR	BU
J	BK	BK	WH	BK	WH	RD	BK	YE	BU
T	BR	BR	WH	BU	BU	RD	BU	WH	BU
E	VT	VT	WH	VT	VT	RD	BR	BR	BU
R+S	OG	OG	WH		BK	RD	GN	WH	BU
B	GY	GY	WH	GY	GY	RD	-	-	-

[1] With an intrinsically safe line as per IEC 584-3, the sheath is always blue.
[2] For thermo lines as per ANSI MC96, the sheath is always blue.

Country	Netherlands			Japan			France		
Standard	DIN 43714			ISC 1610-198			NF C42-323		
	Jacket	+	-	Jacket	+	-	Jacket	+	-
N	GN	RD	GN	BU	RD	WH	VT	VT	YE
K	BU	RD	BU	YE	RD	WH	BK	BK	YE
J	BR	RD	BR	BR	RD	WH	BU	BU	YE
T	BK	RD	BK	VT	RD	WH	OG	OG	YE
E	WH	RD	WH	BK	RD	WH	GN	GN	YE
R+S	GY	RD	GY	GY	RD	WH	-	-	-
B	GN	RD	GN	BU	RD	WH	VT	VT	YE

Abbreviation for colors				
BK: black	BR: brown	BU: blue	GD: gold	GN: green
GY: gray	OG: orange	PN: pink	RD: red	SR: silver
TQ: turquoise	VT: violet	WH: white	YE: yellow	

Transmitters

In addition, our transmitters also allow for a large number of other possible connections (e.g. difference, average, two sensors). More information can be obtained at:
http://www.usa.siemens.com/temperature

SITRANS TH100 Slim (Pt100)

Overview

SITRANS TH100 Slim is particularly suited for the production of compact thermometers with integrated transmitter.

Its cylindrical stainless steel enclosure is simply welded to the basic body of the compact thermometer.

Its compact design makes the SITRANS TH100 Slim the ideal solution for manufacturers from a wide variety of industries.

For the parameterization, the SIPROM T software is used in combination with the modem for SITRANS TH100/TH200.

Benefits

- Transmitter in 2-wire system with M12 device plug for mounting on compact thermometer.
- Solution for easy and space-saving temperature measurements in a variety of industries.
- Programmable; as a result, the sensor connection, measuring range and much more are programmable.

Application

The SITRANS TH100 Slim transmitter can be used in combination with Pt100 compact resistance thermometers for temperature measurement in all industries. Thanks to its compact design, it can be mounted to all kinds of designs.

The output signal is a load-independent direct current of 4 to 20 mA which is proportional to the temperature.

Parameterization is implemented over the PC using the parameterization software SIPROM T and the modem for SITRANS TH100/TH200. If you already have a "Modem for SITRANS TK" (article number 7NG3190-6KB), you can continue to use this for parameterization of the SITRANS TH100.

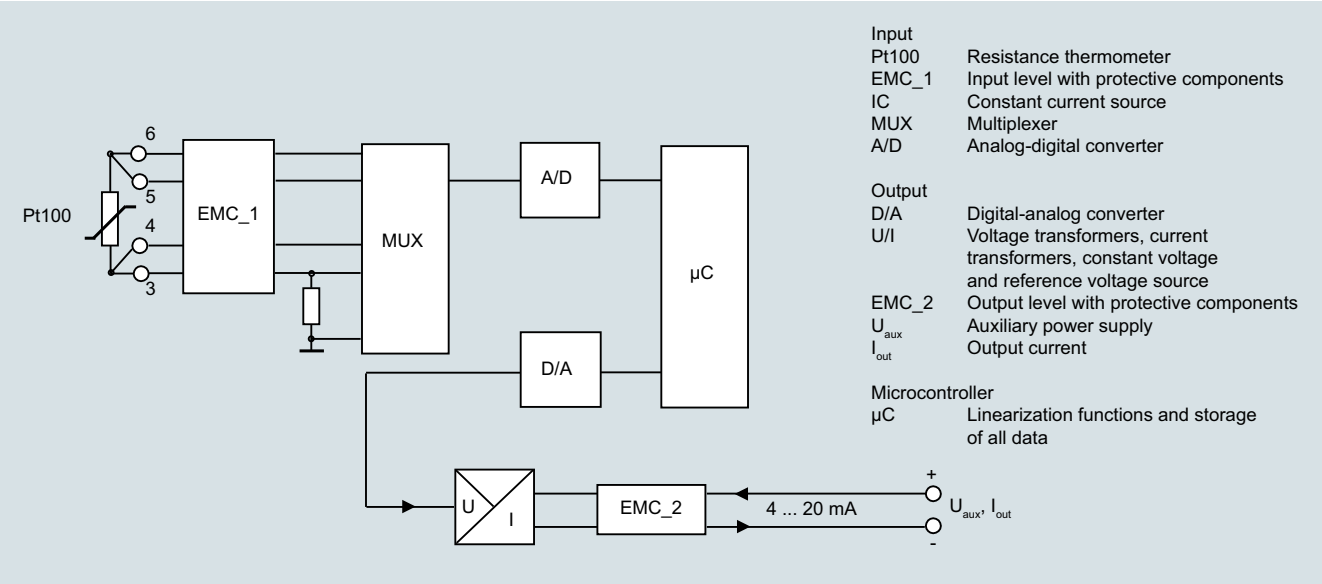
Function

Mode of operation

The measured signal supplied by a Pt100 resistance thermometer (2, 3 or 4-wire connection) is amplified in the input stage. The voltage, which is proportional to the input variable, is then converted into digital signals by a multiplexer in an analog-to-digital converter. They are converted in the microcontroller in accordance with the sensor characteristic and additional parameters (measuring range, damping, ambient temperature, etc.).

The signal prepared in this way is converted in an analog-to-digital converter into a load-independent direct current of 4 to 20 mA.

An EMC filter protects the input and output circuits against electromagnetic interferences.



SITRANS TH100 Slim, function block diagram

Technical specifications

Input	
Resistance thermometer	
Measured variable	Temperature
Input type	Pt100 according to IEC 60751
Characteristic curve	Temperature-linear
Type of connection	2, 3, 4-wire connection
Resolution	14 bit
Measuring accuracy	< 0.25 °C (0.45 °F)
Repeatability	< 0.1 °C (0.18 °F)
Measuring current	Approx. 0.4 mA
Measuring cycle	< 0.7 s
Measuring range	-60 ... +160 °C (-76 ... +320 °F)
Measuring span	25 ... 220 °C (45 ... 396 °F)
Unit	°C or °F
Offset	Programmable: -100 ... +100 °C (-180 ... +180 °F)
Wire resistance	Max. 20 Ω (total from feeder and return conductor)
Noise rejection	50 and 60 Hz
Output	
Output signal	4 ... 20 mA, 2-wire
Auxiliary power	8.5 ... 36 V DC (30 V for Ex)
Max. load	$(U_{aux} - 8.5\ V)/0.023\ A$
Overrange	3.6 ... 23 mA, infinitely adjustable (factory setting: 3.84 ... 20.5 mA)
Error signal (in the event of sensor breakage)	3.6 ... 23 mA, infinitely adjustable (factory setting: 3.6 mA or 22.8 mA)
Damping time	0 ... 30 s
Protection	Against reverse polarity
Resolution	12 bit
Accuracy at 23 °C (73.4 °F)	< 0.1% of measuring span
Temperature effect	< 0.13 %/10 °C (0.13 %/18 °F)
Effect of auxiliary power	< 0.02 % of span/V
Effect of load impedance	< 0.055 % of max. span/100 Ω
Long-term drift	• < 0.025% of the max. span in the first month • < 0.035% of the max. span after one year • < 0.05% of the max. span after 5 years
Ambient conditions	
Ambient temperature range	-40 ... +85 °C (-40 ... +185 °F)
Storage temperature range	-40 ... +85 °C (-40 ... +185 °F)
Relative humidity	98 %, with condensation
Electromagnetic compatibility	According to EN 61326 and NAMUR NE21
Design	
Weight	42 g
Dimensions	See dimensional drawing
Material	316L stainless steel
Degree of protection according to IEC 60529	
• Enclosure	IP67

Software requirements for SIPROM T	
PC operating system	Windows ME, 2000 and XP; also Windows 95, 98 and 98SE, but only in connection with RS232 modem

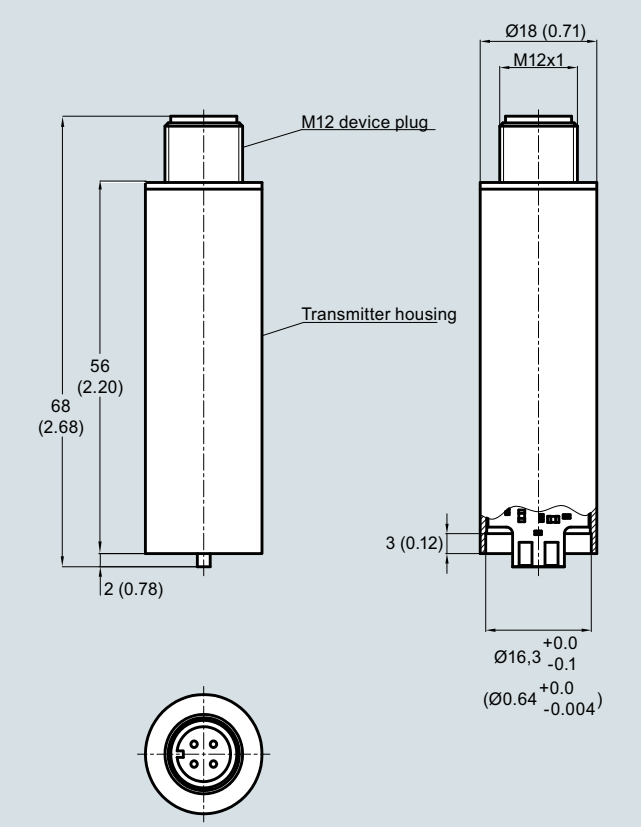
Factory setting:

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

Selection and ordering data

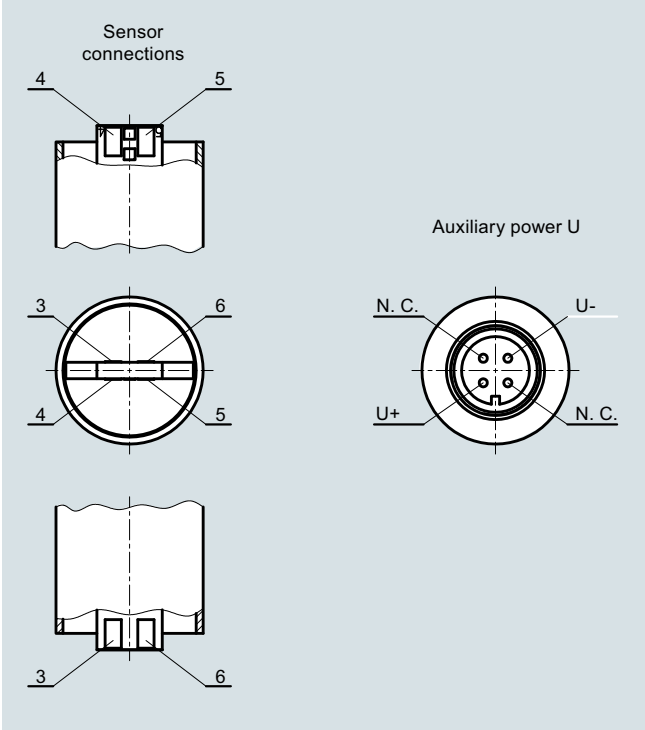
	Article No.
SITRANS TH100 Slim temperature transmitters for Pt100 For welding to compact thermometers 2-wire system, 4 ... 20 mA, programmable, without galvanic isolation	
• Without explosion protection	**7NG3150-0NN00**
Accessories	
Modem	
Modem with USB interface and SIPROM T software	**7NG3092-8KN**

Dimensional drawings

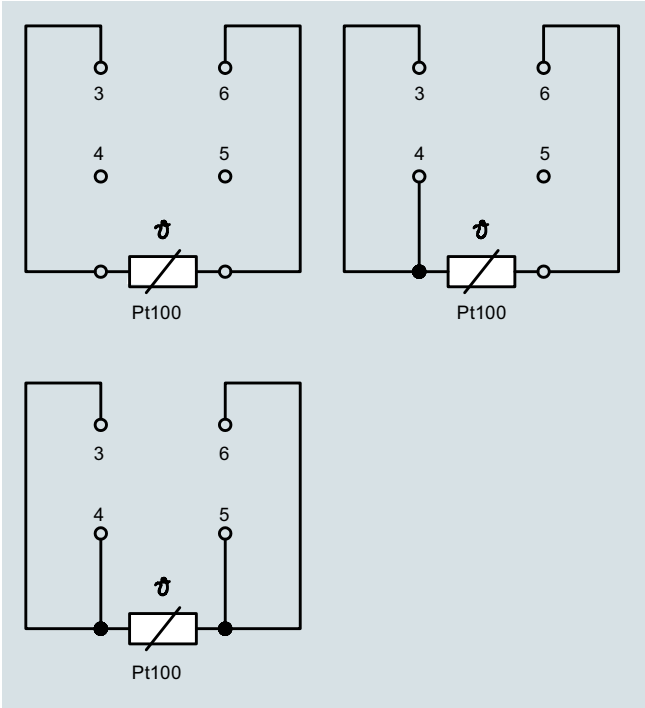


SITRANS TH100 Slim, dimensions in mm (inch)

Circuit diagrams



SITRANS TH100 Slim, auxiliary power and sensor connection



SITRANS TH100 Slim, sensor connection assignment

Overview

The SITRANS TH100, which represents an economical alternative by dispensing with galvanic isolation and universal sensor connection, is ideally suited for Pt100 measurements.

For the parameterization, the SIPROM T software is used in combination with the modem for SITRANS TH100/TH200.

Its compact design makes the SITRANS TH100 suitable for retrofitting measuring points or replacing analog transmitters.

The transmitter is available in a non-Ex version and in a version suitable for use in hazardous areas.

Benefits

- Transmitter with 2-wire system
- Mounting in connection head, type B or larger or on DIN rail
- Programmable; as a result, the sensor connection, measuring range and much more are programmable
- Intrinsically safe version for use in hazardous areas

Application

The SITRANS TH100 transmitter can be used for temperature measurement with Pt100 resistance thermometers in all industries. Its compact size means that it can be installed in connection heads of type B or larger.

The output signal is a load-independent direct current of 4 to 20 mA which is proportional to the temperature.

Parameterization is implemented over the PC using the parameterization software SIPROM T and the modem for SITRANS TH100/TH200. If you already have a "Modem for SITRANS TK" (article number 7NG3190-6KB), you can continue to use this for parameterization of the SITRANS TH100.

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.

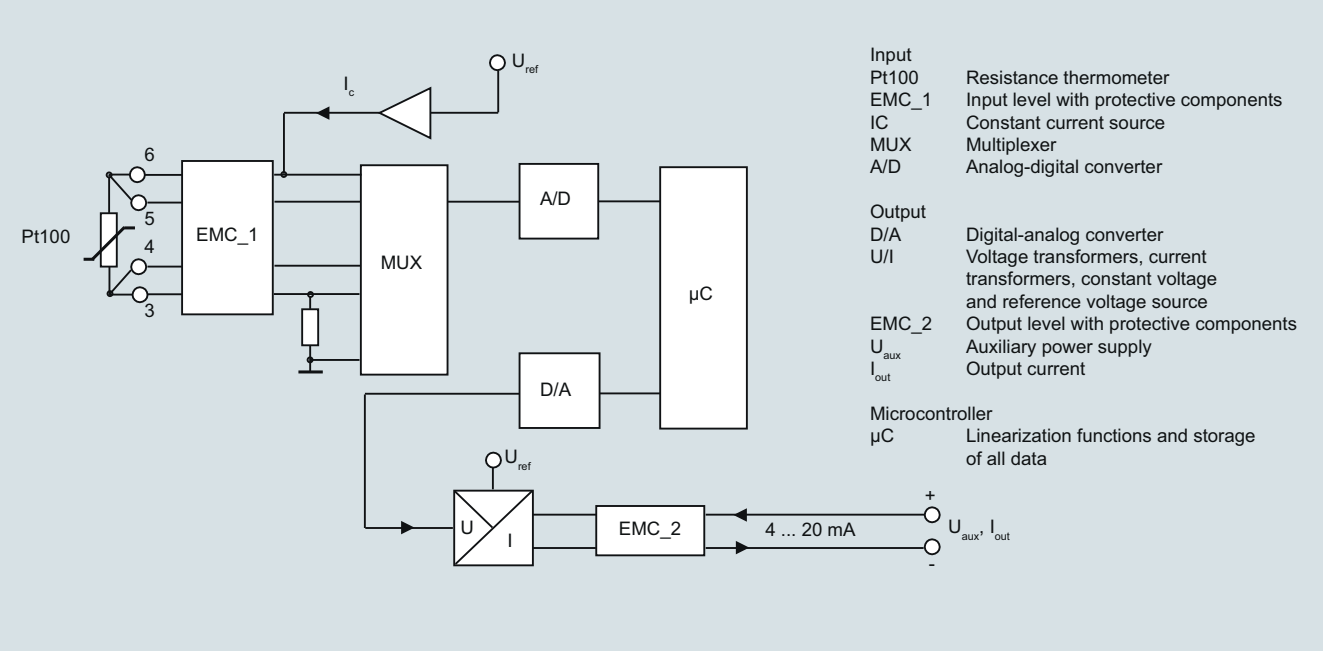
Function

Mode of operation

The measured signal supplied by a Pt100 resistance thermometer (2, 3 or 4-wire connection) is amplified in the input stage. The voltage, which is proportional to the input variable, is then converted into digital signals by a multiplexer in an analog-to-digital converter. They are converted in the microcontroller in accordance with the sensor characteristic and further parameters (measuring range, damping, ambient temperature, etc.).

The signal prepared in this way is converted in an analog-to-digital converter into a load-independent direct current of 4 to 20 mA.

An EMC filter protects the input and output circuits against electromagnetic interferences.



SITRANS TH100, function block diagram

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Technical specifications

Input	
Resistance thermometer	
Measured variable	Temperature
Input type	Pt100 according to IEC 60751
Characteristic curve	Temperature-linear
Type of connection	2, 3, 4-wire connection
Resolution	14 bit
Measuring accuracy	
• Span <250 °C (450 °F)	< 0.25 °C (0.45 °F)
• Span >250 °C (450 °F)	< 0.1% of measuring span
Repeatability	< 0.1 °C (0.18 °F)
Measuring current	approx. 0.4 mA
Measuring cycle	< 0.7 s
Measuring range	-200 ... +850 °C (-328 ... +1562 °F)
Measuring span	25 ... 1050 °C (77 ... 1922 °F)
Unit	°C or °F
Offset	Programmable: -100 ... +100 °C (-180 ... +180 °F)
Wire resistance	Max. 20 Ω (total from feeder and return conductor)
Noise rejection	50 and 60 Hz
Output	
Output signal	4 ... 20 mA, 2-wire
Auxiliary power	8.5 ... 36 V DC (30 V with Ex ia and ib; 32 V with Ex nL/ic; 35 V with Ex nA)
Max. load	$(U_{aux} - 8.5\ V)/0.023\ A$
Overrange	3.6 ... 23 mA, infinitely adjustable (default range: 3.84 ... 20.5 mA)
Error signal (following sensor fault) (conforming to NE43)	3.6 ... 23 mA, infinitely adjustable (default range: 3.6 mA or 22.8 mA)
Damping time	0…30 s (default value: 0 s)
Protection	Against reverse polarity
Resolution	12 bit
Accuracy at 23 °C (73.4 °F)	< 0.1% of measuring span
Temperature effect	< 0.1 %/10 °C (0.1 %/18 °F)
Effect of auxiliary power	< 0.01 % of span/V
Effect of load impedance	< 0.025 % of max. span/100 Ω
Long-term drift	• < 0.025% of the max. span in the first month • < 0.035% of the max. span after one year • < 0.05% of the max. span after 5 years
Ambient conditions	
Ambient temperature	-40 ... +85 °C (-40 ... +185 °F)
Storage temperature	-40 ... +85 °C (-40 ... +185 °F)
Relative humidity	< 98 %, with condensation
Electromagnetic compatibility	According to EN 61326 and NAMUR NE21
Design	
Weight	50 g
Dimensions	See dimensional drawing
Material	Molded plastic
Cross-section of cables	Max. 2.5 mm^2 (AWG 13)
Degree of protection according to IEC 60529	
• Enclosure	IP40
• Terminals	IP00

Certificates and approvals	
Explosion protection ATEX	
EC type-examination certificate	PTB 05 ATEX 2049X
• "Intrinsic gas safety" type of protection	II 1 G Ex ia IIC T6/T4 II (1) 2 G Ex ib [ia Ga] IIC T6/T4 Gb II (1) 3 G Ex ic [ia Ga] IIC T6/T4 Gc II 3 G Ex ic IIC T6/T4 Gc
• "Non-sparking" type of protection	II 3 G Ex nA IIC T6/T4 Gc II 3 G Ex nA [ic] IIC T6/T4 Gc
• "Intrinsic dust safety" type of protection	II 1 D Ex ia IIIC T115 °C Da
Explosion protection: FM for USA	
• FM approval	FM 3024169
• Degrees of protection	IS / Cl I, II, III / Div 1 / GP ABCDEFG T6, T5, T4 Cl I / ZN 0 / AEx ia IIC T6, T5, T4 NI / Cl I / Div 2 / GP ABCDFG T6, T5, T4 NI / Cl I / ZN 2 / IIC T6, T5, T4
Explosion protection to FM for Canada ($_cFM_{US}$)	
• FM approval	FM 3024169C
• Degrees of protection	IS / Cl I, II, III / Div 1/ GP ABCDEFG T6, T5, T4 NI / Cl I / DIV 2 / GP ABCD T6, T5, T4 NIFW / Cl I, II, III / DIV 2 / GP ABCDFG T6, T5, T4 DIP / Cl II, III / Div 2 / GP FG T6, T5, T4 Cl I / ZN 0 / Ex ia IIC T6, T5, T4 Cl I / ZN 2 / Ex nA nL IIC T6, T5, T4
Other certificates	EAC Ex(GOST), NEPSI
Software requirements for SIPROM T	
PC operating system	Windows ME, 2000, XP, Win 7 and Win 8; in connection with RS 232 modem, also Windows 95, 98 and 98SE

Factory setting:
- Pt100 (IEC 751) in the 3-wire connection
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current in the event of sensor breakage: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

Selection and ordering data

	Article No.
SITRANS TH100 Head transmitter for Pt100 For installation in connection head type B, 2-wire system 4 ... 20 mA, programmable, without galvanic isolation	
Without explosion protection	**7NG3211-0NN00**
With explosion protection "Intrinsic safety" type of protection and for zone 2	
• According to ATEX	**7NG3211-0AN00**
• According to FM ($_{C}FM_{US}$)	**7NG3211-0BN00**

Options	Order code
Append suffix "**-Z**" to article no., add order code and plain text, if applicable.	
Test report (5 measuring points)	**C11**
Customer-specific programming	
Measuring range to be set Specify in plain text (max. 5 digits): Y01:... to ... °C, °F	**Y01**[1]
Measuring point number (TAG) max. 8 characters	**Y17**[2]
Measuring point description, max. 16 characters	**Y23**[2]
Pt100 (IEC) 2-wire, R_L = 0 Ω	**U02**[3]
Pt100 (IEC) 3-wire	**U03**[3]
Pt100 (IEC) 4-wire	**U04**[3]
Enter special deviating customer-specific setting in plain text	**Y09**[4]
Fault current 3.6 mA (instead of 22.8 mA)	**U36**[2]

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) 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 2/154.	
Modem Modem with USB interface and SIPROM T software	**7NG3092-8KN**
Mounting rail adapter for head transmitter (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)	**7NG3092-8KC**

For supply units, see Catalog FI01 section "Supplementary components"

Ordering example:

7NG3211-0NN00-Z Y01+Y23+U03

Y01: -10 ... +100 °C

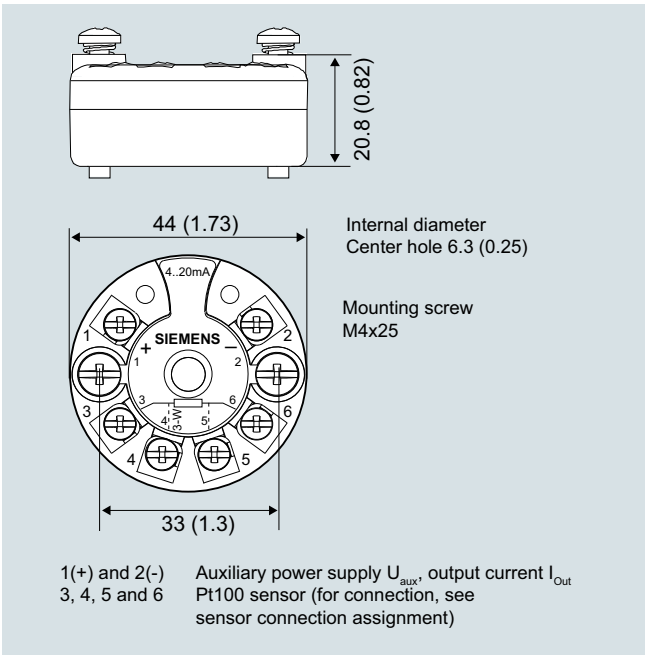
Y23: TICA1234HEAT

Factory setting:

- Pt100 (IEC 751) in the 3-wire connection
- Measuring range: 0 … 100 °C (32 … 212 °C)
- Fault current in the event of sensor breakage: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

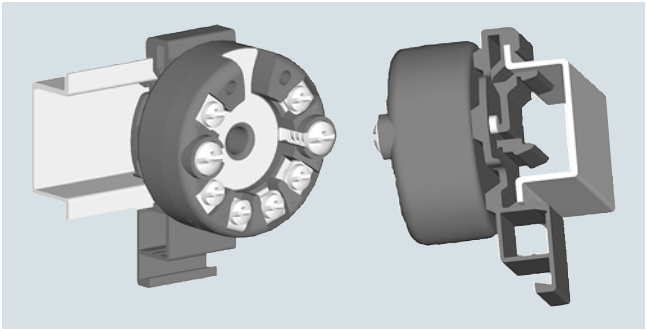
SITRANS TH100 (4 to 20 mA, Pt100)

Dimensional drawings

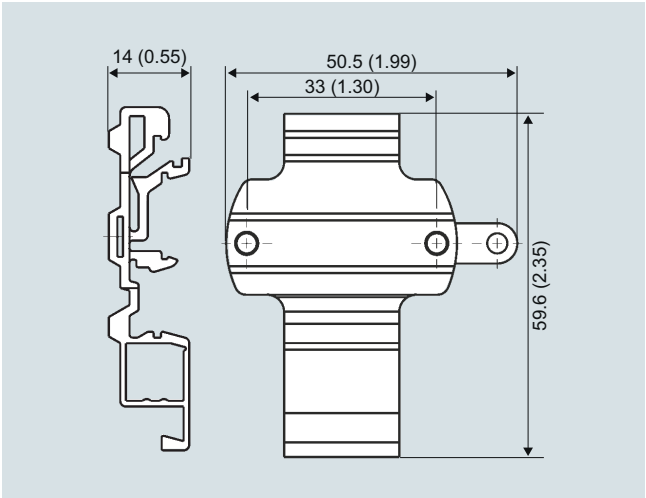


SITRANS TH100, dimensions in mm (inch)

Mounting on DIN rail

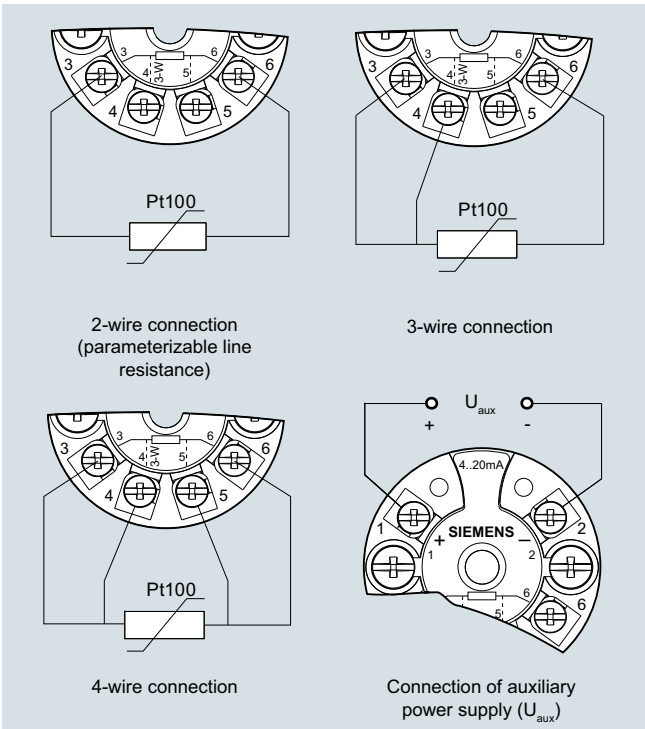


SITRANS TH100, mounting of transmitter on DIN rail



DIN rail adapter, dimensions in mm (inch)

Circuit diagrams



SITRANS TH100, sensor connection assignment

Overview

Ultra flexible - with the universal SITRANS TH200 transmitter

- 2-wire device for 4 to 20 mA
- Mounting in the connection head of the temperature sensor
- Universal input for virtually any type of temperature sensor
- Configurable over PC

Benefits

- Compact design
- Flexible mounting and center hole allow you to select your preferred type of installation
- Galvanic isolation
- Test sockets for multimeters
- Diagnostics LED (green/red)
- Sensor monitoring
  open circuits and short-circuits
- Self-monitoring
- Configuration status stored in EEPROM
- SIL2 (with order note C20), SIL2/3 (with C23)
- Expanded diagnostic functions, such as slave pointer, operating hours counter, etc.
- Special characteristic
- Electromagnetic compatibility to EN 61326 and NE21

Application

SITRANS TH200 transmitters can be used in all industrial sectors. Its compact size means that it can be installed in connection heads of type B or larger. The following sensors/signal sources can be connected over their universal input module:

- Resistance thermometer (2, 3, 4-wire connection)
- Thermocouples
- Resistance-based sensors and DC voltage sources

The output signal is a direct current from 4 to 20 mA in accordance with the sensor characteristic.

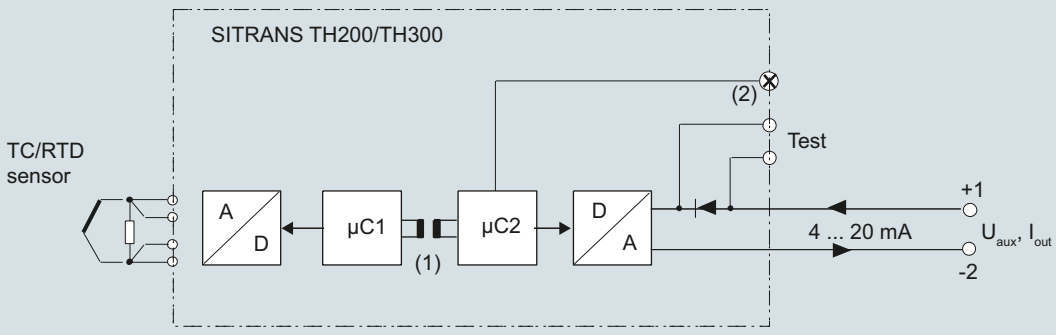
Transmitters of the "intrinsically safe" type of protection can be installed within potentially explosive atmospheres. The devices meet the directive 2014/34/EU (ATEX) as well as the FM and CSA requirements.

Function

The SITRANS TH200 is configured over a PC. A USB or RS 232 modem is linked to the output terminals for this purpose. The configuration data can now be edited using the SIPROM T software tool. The configuration data are then permanently stored in the non-volatile memory (EEPROM).

Once the sensors and power supply have been correctly connected, the transmitter outputs a temperature-linear output signal and the diagnostics LED displays a green light. In the case of a sensor break, the LED flashes red, an internal device fault is indicated by a steady red light.

The test socket can be used to connect an ammeter at any time for monitoring purposes and plausibility checks. The output current can be read without any interruption, or even without opening the current loop.



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

SITRANS TH200 function diagram

2

Technical specifications

Input	
Resistance thermometer	
Measured variable	Temperature
Sensor type	
• According to IEC 60751	Pt25 … Pt1000
• Acc. to JIS C 1604; a = 0.00392 K^{-1}	Pt25 … Pt1000
• According to IEC 60751	Ni25 … Ni1000
• Special type	Via special characteristic (max. 30 points)
Sensor factor	0.25 ... 10 (adaptation of the basic type, e.g. Pt100 to version Pt25 ... 1000)
Units	°C or °F
Connection	
• Standard connection	1 resistance thermometer (RTD) in 2-wire, 3-wire or 4-wire connection
• Averaging	2 identical resistance thermometers in 2-wire connection for generation of average temperature
• Differentiation	2 identical resistance thermometers (RTD) in 2-wire connection (RTD 1 – RTD 2 or RTD 2 – RTD 1)
Connection	
• 2-wire connection	Line resistance can be configured ≤100 Ω (loop resistance)
• 3-wire connection	No trim necessary
• 4-wire connection	No trim necessary
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Always active (cannot be switched off)
Short-circuit monitoring	Can be switched on/off (default value: ON)
Measuring range	Assignable (see "Digital measuring error" table)
Min. measuring span	10 °C (18 °F)
Characteristic curve	Temperature-linear or special characteristic
Resistance-based sensor	
Measured variable	Actual resistance
Sensor type	Resistance-based, potentiometers
Units	Ω
Connection	
• Standard connection	1 resistance-based sensor (R) in 2-wire, 3-wire or 4-wire connection
• Averaging	2 resistance-based sensors in 2-wire connection for averaging
• Differentiation	2 resistance thermometers in 2-wire connection (R1 – R2 or R2 – R1)
Connection	
• 2-wire connection	Line resistance can be configured ≤100 Ω (loop resistance)
• 3-wire connection	No trim necessary
• 4-wire connection	No trim necessary
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Always active (cannot be switched off)
Short-circuit monitoring	Can be switched on/off (default value: OFF)
Measuring range	Assignable max. 0 ... 2200 Ω (see "Digital measuring error" table)
Min. measuring span	5 Ω ... 25 Ω (see "Digital measuring error" table)
Characteristic curve	Resistance-linear or special characteristic

Thermocouples	
Measured variable	Temperature
Sensor type (thermocouples)	
• Type B	Pt30Rh-Pt6Rh acc. to IEC 584
• Type C	W5%-Re acc. to ASTM 988
• Type D	W3%-Re acc. to ASTM 988
• Type E	NiCr-CuNi acc. to IEC 584
• Type J	Fe-CuNi acc. to IEC 584
• Type K	NiCr-Ni acc. to IEC 584
• Type L	Fe-CuNi acc. to DIN 43710
• Type N	NiCrSi-NiSi acc. to IEC 584
• Type R	Pt13Rh-Pt acc. to IEC 584
• Type S	Pt10Rh-Pt acc. to IEC 584
• Type T	Cu-CuNi acc. to IEC 584
• Type U	Cu-CuNi acc. to DIN 43710
Units	°C or °F
Connection	
• Standard connection	1 thermocouple (TC)
• Averaging	2 thermocouples (TC)
• Differentiation	2 thermocouples (TC) (TC1 – TC2 or TC2 – TC1)
Response time	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Can be switched off
Reference junction compensation	
• Internal	With integrated Pt100 resistance thermometer
• External	With external Pt100 IEC 60751 (2-wire or 3-wire connection)
• External fixed	Reference junction temperature can be set as fixed value
Measuring range	Assignable (see "Digital measuring error" table)
Min. measuring span	Min. 40 ... 100 °C (72 ... 180 °F) (see "Digital measuring error" table)
Characteristic curve	Temperature-linear or special characteristic
mV sensor	
Measured variable	DC voltage
Sensor type	DC voltage source (DC voltage source possible over an externally connected resistor)
Units	mV
Response time	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Can be switched off
Measuring range	-10 ... +70 mV -100 … +1100 mV
Min. measuring span	2 mV or 20 mV
Overload capability of the input	-1.5 ... +3.5 V DC
Input resistance	≥ 1 MΩ
Characteristic curve	Voltage-linear or special characteristic

Output	
Output signal	4 ... 20 mA, 2-wire
Auxiliary power	11 ... 35 V DC (to 30 V with Ex ia and ib; to 32 V with Ex nA/nL/ic)
Max. load	(U_{aux} – 11 V)/0.023 A
Overrange	3.6 ... 23 mA, infinitely adjustable (default range: 3.80 mA ... 20.5 mA)
Error signal (e.g. following sensor fault) (conforming to NE43)	3.6 ... 23 mA, infinitely adjustable (default value: 22.8 mA)
Sample cycle	0.25 s nominal
Damping	Software filter 1st order 0 ... 30 s (parameterizable)
Protection	Against reverse polarity
Galvanic isolation	Input against output 2.12 kV DC (1.5 kV_{rms} AC)
Measuring accuracy	
Digital measuring error	See "Digital measuring error" table
Reference conditions	
• Auxiliary power	24 V ± 1 %
• Load	500 Ω
• Ambient temperature	23 °C
• Warming-up time	> 5 min
Error in the analog output (digital/analog converter)	< 0.025 % of measuring span
Error due to internal reference junction	< 0.5 °C (0.9 °F)
Effect of ambient temperature	
• Analog measuring error	0.02 % of meas. span/10 °C (18 °F)
• Digital measuring error	
- 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 meas. span/V
Effect of load impedance	< 0.002 % of meas. span/100 Ω
Long-term drift	
• In the first month	• < 0.02 % of measuring span
• After one year	• < 0.2 % of measuring span
• After 5 years	• < 0.3 % of measuring span
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
Electromagnetic compatibility	acc. to EN 61326 and NE21
Design	
Material	Molded plastic
Weight	50 g (0.11 lb)
Dimensions	See "Dimensional drawings"
Cross-section of cables	Max. 2.5 mm^2 (AWG 13)
Degree of protection according to IEC 60529	
• Enclosure	IP40
• Terminals	IP00

Certificates and approvals	
Explosion protection ATEX	
EC type-examination certificate	PTB 05 ATEX 2040X
• "Intrinsic safety" type of protection	II 1 G Ex ia IIC T6/T4 II 2 (1) G Ex ia/ib IIC T6/T4 II 3(1) G Ex ia/ic IIC T6/T4 II 1D Ex iaD 20 T115 °C
• "Non-sparking and energy-limited equipment" type of protection	II 3 G Ex nL IIC T6/T4 II 3 G Ex nA IIC T6/T4
Explosion protection: FM for USA	
• FM approval	FM 3024169
• Degrees of protection	IS / Cl I, II, III / Div 1 / GP ABCDEFG T6, T5, T4 Cl I / ZN 0 / AEx ia IIC T6, T5, T4 NI / Cl I / Div 2 / GP ABCDFG T6, T5, T4 NI / Cl I / ZN 2 / IIC T6, T5, T4
Explosion protection to FM for Canada ($_cFM_{US}$)	
• FM approval	FM 3024169C
• Degrees of protection	IS / Cl I, II, III / Div 1/ GP ABCDEFG T6, T5, T4 NI / Cl I / DIV 2 / GP ABCD T6, T5, T4 NIFW / Cl I, II, III / DIV 2 / GP ABCDFG T6, T5, T4 DIP / Cl II, III / Div 2 / GP FG T6, T5, T4 Cl I / ZN 0 / Ex ia IIC T6, T5, T4 Cl I / ZN 2 / Ex nA nL IIC T6, T5, T4
Other certificates	EAC Ex(GOST), NEPSI, IEC, EXPO-LABS
Software requirements for SIPROM T	
PC operating system	Windows ME, 2000, XP, Win 7 and Win 8; in connection with RS 232 modem, also Windows 95, 98 and 98SE

Factory setting:

- Pt100 (IEC 751) in the 3-wire connection
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

SITRANS TH200 (4 to 20 mA, universal)

Digital measuring error

Resistance thermometer

Input	Measuring range	Minimum measuring span		Digital accuracy	
	°C (°F)	°C	(°F)	°C	(°F)
According 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)
According 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 sensor

Input	Measuring range	Minimum measuring span	Digital accuracy
	Ω	Ω	Ω
Resistance	0 ... 390	5	0.05
Resistance	0 ... 2200	25	0.25

Thermocouples

Input	Measuring range	Minimum measuring span		Digital accuracy	
	°C (°F)	°C	(°F)	°C	(°F)
Type B	100 ... 1820 (212 ... 3308)	100	(180)	2[1)]	(3.60)[1)]
Type C (W5)	0 ... 2300 (32 ... 4172)	100	(180)	2	(3.60)
Type D (W3)	0 ... 2300 (32 ... 4172)	100	(180)	1[2)]	(1.80)[2)]
Type E	-200 ... +1000 (-328 ... +1832)	50	(90)	1	(1.80)
Type J	-200 ... +1200 (-328 ... +2192)	50	(90)	1	(1.80)
Type K	-200 ... +1370 (-328 ... +2498)	50	(90)	1	(1.80)
Type L	-200 ... +900 (-328 ... +1652)	50	(90)	1	(1.80)
Type N	-200 ... +1300 (-328 ... +2372)	50	(90)	1	(1.80)
Type R	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.60)
Type S	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.60)
Type T	-200 ... +400 (-328 ... +752)	40	(72)	1	(1.80)
Type U	-200 ... +600 (-328 ... +1112)	50	(90)	2	(3.60)

[1)] The digital accuracy in the range 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 range	Minimum measuring 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 reference junction errors in the case of thermocouple measurements).

Selection and ordering data

	Article No.
Head transmitter SITRANS TH200 For installation in connection head type B, 2-wire system 4 ... 20 mA, programmable, with galvanic isolation	
Without explosion protection	**7NG3211-1NN00**
With explosion protection	
• According to ATEX	**7NG3211-1AN00**
• According to FM ($_{C}FM_{US}$)	**7NG3211-1BN00**

Options	**Order code**
Append suffix "**-Z**" to article no., add order code and plain text, if applicable.	
Test report (5 measuring points)	**C11**
Functional safety SIL2	**C20**
Functional safety SIL2/3	**C23**
Customer-specific programming	
Measuring range to be set Specify in plain text (max. 5 digits): Y01:... to ... °C, °F	**Y01**[1]
Measuring point number (TAG) max. 8 characters	**Y17**[2]
Measuring point description, max. 16 characters	**Y23**[2]
Measuring point message, max. 32 characters	**Y24**[2]
Pt100 (IEC) 2-wire, R_L = 0 Ω	**U02**[3]
Pt100 (IEC) 3-wire	**U03**[3]
Pt100 (IEC) 4-wire	**U04**[3]
Type B thermocouple	**U20**[3][4]
Type C thermocouple (W5)	**U21**[3][4]
Type D thermocouple (W3)	**U22**[3][4]
Type E thermocouple	**U23**[3][4]
Type J thermocouple	**U24**[3][4]
Type K thermocouple	**U25**[3][4]
Type L thermocouple	**U26**[3][4]
Type N thermocouple	**U27**[3][4]
Type R thermocouple	**U28**[3][4]
Type S thermocouple	**U29**[3][4]
Type T thermocouple	**U30**[3][4]
Type U thermocouple	**U31**[3][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	**Y09**[5]
Fault current 3.6 mA (instead of 22.8 mA)	**U36**[2]
Cable extension Transmitter with installed cable extension 200 mm (7.87 inch), for Pt100 in 4-wire connection	**W01**

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) nternal 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 2/154.	
Modem Modem with USB interface and SIPROM T software	**7NG3092-8KN**
Mounting rail adapter for head transmitter (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)	**7NG3092-8KC**

For supply units, see Catalog FI01 section "Supplementary components"

Ordering example 1:

7NG3211-1NN00-Z Y01+Y17+U03

Y01: -10 ... +100 °C

Y17: TICA123

Ordering example 2:

7NG3211-1NN00-Z Y01+Y23+ U25

Y01: -10 ... +100 °C

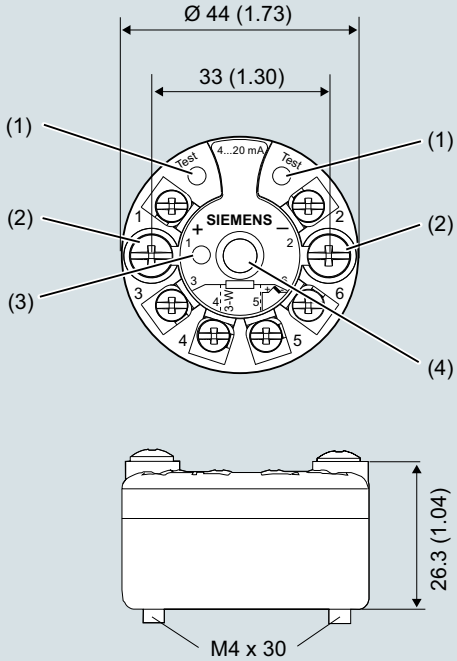
Y23: TICA1234HEAT

Factory setting:

- Pt100 (IEC 751); 3-wire connection
- Measuring range: 0 … 100 °C (32 … 212 °F)
- Fault current: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

2

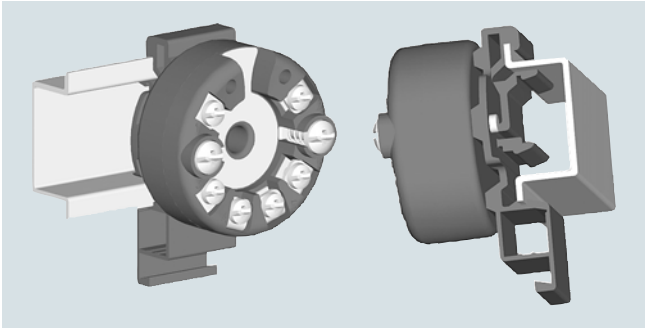
Dimensional drawings



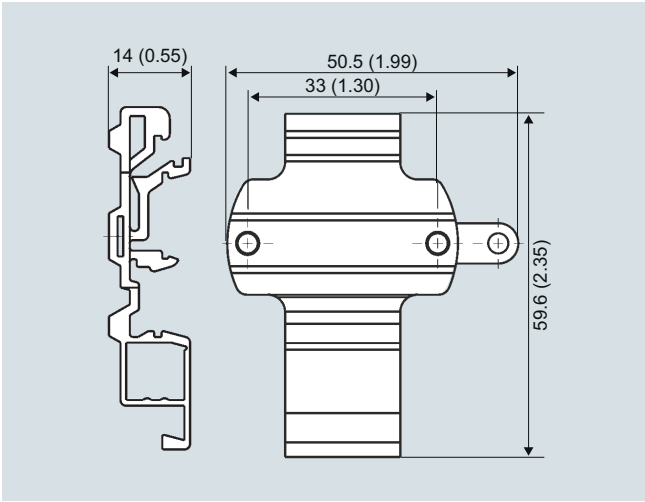
1(+) and 2(-)	Auxiliary power supply U_{aux}, output current I_{Out}
3, 4, 5 and 6	Pt100 sensor (for connections, see sensor connection assignment)
Test (+), Test (-)	Measurement of the output current with a multimeter
(1)	Test terminal
(2)	Mounting screw M4x30
(3)	LED for operation indication
(4)	Internal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

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

Mounting on DIN rail



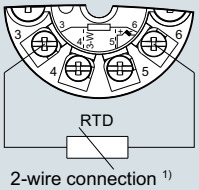
SITRANS TH200, mounting of transmitter on DIN rail



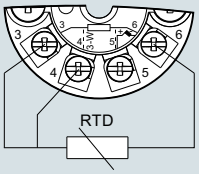
DIN rail adapter, dimensions in mm (inch)

Circuit diagrams

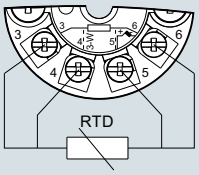
Resistance thermometer



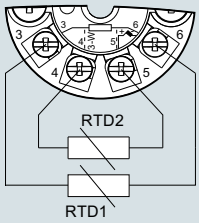
2-wire connection [1)]



3-wire connection

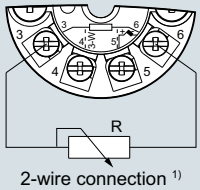


4-wire connection

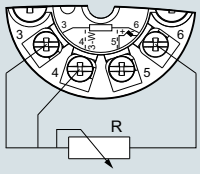


Generation of average value / difference [1)]

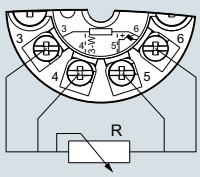
Resistance



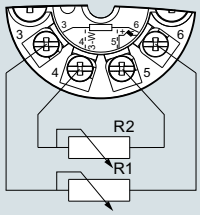
2-wire connection [1)]



3-wire connection

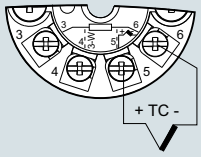


4-wire connection

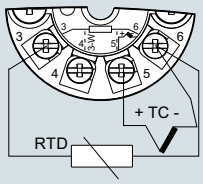


Generation of average value / difference [1)]

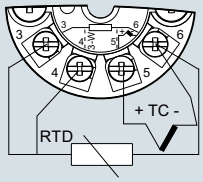
Thermocouple



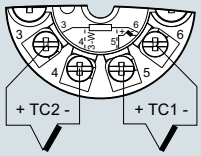
Cold junction compensation
Internal/fixed value



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



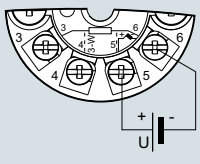
Cold junction compensation with external Pt100 in 3-wire connection



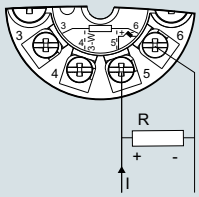
Generation of average value / difference with internal cold junction compensation

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

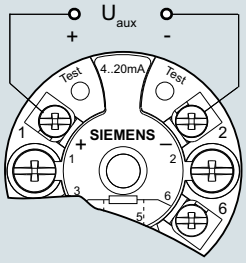
Voltage measurement



Current measurement



Connection of auxiliary power supply (U_{aux})



SITRANS TH200, sensor connection assignment

SITRANS TH300 (4 to 20 mA, HART, universal)

Overview

Robust and durable HART - the universal SITRANS TH300 transmitter

- 2-wire device for 4 to 20 mA, HART
- Mounting in the connection head of the temperature sensor
- Universal input for virtually any type of temperature sensor
- Configurable over HART

Benefits

- Compact design
- Flexible mounting and center hole allow you to select your preferred type of installation
- Galvanic isolation
- Test sockets for multimeters
- Diagnostics LED (green/red)
- Sensor monitoring
  open circuits and short-circuits
- Self-monitoring
- Configuration status stored in EEPROM
- SIL2 (with order note C20), SIL2/3 (with C23)
- Expanded diagnostic functions, such as slave pointer, operating hours counter, etc.
- Special characteristic
- Electromagnetic compatibility to EN 61326 and NE21

Application

SITRANS TH300 transmitters can be used in all industrial sectors. Its compact size means that it can be installed in connection heads of type B or larger. The following sensors/signal sources can be connected over their universal input module:

- Resistance thermometer (2, 3, 4-wire connection)
- Thermocouples
- Resistance-based sensors and DC voltage sources

The output signal is a load-independent direct current of 4 to 20 mA corresponding to the sensor characteristic overlaid by the digital HART signal.

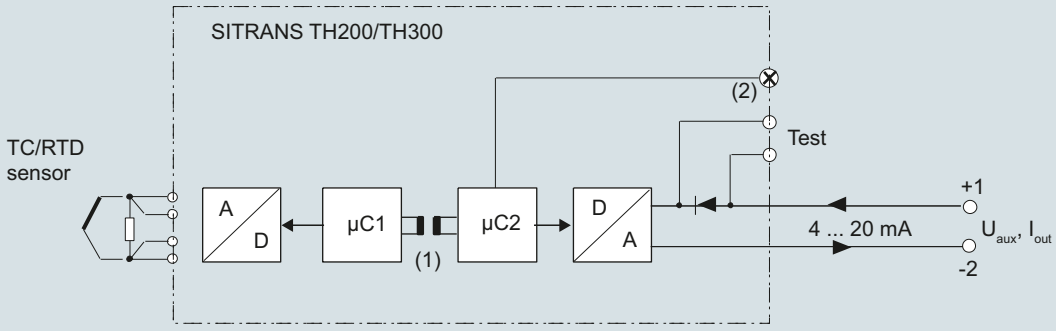
Transmitters of the "intrinsically safe" type of protection can be installed within potentially explosive atmospheres. The devices meet the directive 2014/34/EU (ATEX) as well as the FM and CSA requirements.

Function

The SITRANS TH300 is configured over HART. This can be done using a handheld communicator or even more conveniently with a HART modem and the SIMATIC PDM parameterization software. The configuration data are then permanently stored in the non-volatile memory (EEPROM).

Once the sensors and power supply have been correctly connected, the transmitter outputs a temperature-linear output signal and the diagnostics LED displays a green light. In the case of a sensor break, the LED flashes red, an internal device fault is indicated by a steady red light.

The test socket can be used to connect an ammeter at any time for monitoring purposes and plausibility checks. The output current can be read without any interruption, or even without opening the current loop.



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

SITRANS TH 300 function diagram

Technical specifications

Input	
Resistance thermometer	
Measured variable	Temperature
Sensor type	
• According to IEC 60751	Pt25 … Pt1000
• Acc. to JIS C 1604; a = 0.00392 K^{-1}	Pt25 … Pt1000
• According to IEC 60751	Ni25 … Ni1000
• Special type	Via special characteristic (max. 30 points)
Sensor factor	0.25 ... 10 (adaptation of the basic type, e.g. Pt100 to version Pt25 ... 1000)
Units	°C or °F
Connection	
• Standard connection	1 resistance thermometer (RTD) in 2-wire, 3-wire or 4-wire connection
• Averaging	2 identical resistance thermometers in 2-wire connection for generation of average temperature
• Differentiation	2 identical resistance thermometers (RTD) in 2-wire connection (RTD 1 – RTD 2 or RTD 2 – RTD 1)
Connection	
• 2-wire connection	Line resistance can be configured ≤100 Ω (loop resistance)
• 3-wire connection	No trim necessary
• 4-wire connection	No trim necessary
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Always active (cannot be switched off)
Short-circuit monitoring	Can be switched on/off (default value: ON)
Measuring range	Assignable (see "Digital measuring error" table)
Min. measuring span	10 °C (18 °F)
Characteristic curve	Temperature-linear or special characteristic
Resistance-based sensor	
Measured variable	Actual resistance
Sensor type	Resistance-based, potentiometers
Units	Ω
Connection	
• Standard connection	1 resistance-based sensor (R) in 2-wire, 3-wire or 4-wire connection
• Averaging	2 resistance-based sensors in 2-wire connection for averaging
• Differentiation	2 resistance thermometers in 2-wire connection (R1 – R2 or R2 – R1)
Connection	
• 2-wire connection	Line resistance can be configured ≤100 Ω (loop resistance)
• 3-wire connection	No trim necessary
• 4-wire connection	No trim necessary
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Always active (cannot be switched off)
Short-circuit monitoring	Can be switched on/off (default value: OFF)
Measuring range	Assignable max. 0 ... 2200 Ω (see "Digital measuring error" table)
Min. measuring span	5 ... 25 Ω (see "Digital measuring error" table)
Characteristic curve	Resistance-linear or special characteristic

Thermocouples	
Measured variable	Temperature
Sensor type (thermocouples)	
• Type B	Pt30Rh-Pt6Rh acc. to IEC 584
• Type C	W5%-Re acc. to ASTM 988
• Type D	W3%-Re acc. to ASTM 988
• Type E	NiCr-CuNi acc. to IEC 584
• Type J	Fe-CuNi acc. to IEC 584
• Type K	NiCr-Ni acc. to IEC 584
• Type L	Fe-CuNi acc. to DIN 43710
• Type N	NiCrSi-NiSi acc. to IEC 584
• Type R	Pt13Rh-Pt acc. to IEC 584
• Type S	Pt10Rh-Pt acc. to IEC 584
• Type T	Cu-CuNi acc. to IEC 584
• Type U	Cu-CuNi acc. to DIN 43710
Units	°C or °F
Connection	
• Standard connection	1 thermocouple (TC)
• Averaging	2 thermocouples (TC)
• Differentiation	2 thermocouples (TC) (TC1 – TC2 or TC2 – TC1)
Response time	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Can be switched off
Reference junction compensation	
• Internal	With integrated Pt100 resistance thermometer
• External	With external Pt100 IEC 60751 (2-wire or 3-wire connection)
• External fixed	Reference junction temperature can be set as fixed value
Measuring range	Assignable (see "Digital measuring error" table)
Min. measuring span	Min. 40 ... 100 °C (72 ... 180 °F) (see "Digital measuring error" table)
Characteristic curve	Temperature-linear or special characteristic
mV sensor	
Measured variable	DC voltage
Sensor type	DC voltage source (DC voltage source possible over an externally connected resistor)
Units	mV
Response time	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Can be switched off
Measuring range	-10 ... +70 mV -100 … +1100 mV
Min. measuring span	2 mV or 20 mV
Overload capability of the input	-1.5 ... +3.5 V DC
Input resistance	≥ 1 MΩ
Characteristic curve	Voltage-linear or special characteristic

SITRANS TH300 (4 to 20 mA, HART, universal)

Output	
Output signal	4 ... 20 mA, 2-wire with communication acc. to HART Rev. 5.9
Auxiliary power	11 ... 35 V DC (to 30 V with Ex ia and ib; to 32 V with Ex nA/nL/ic)
Max. load	$(U_{aux} - 11\ V)/0.023\ A$
Overrange	3.6 ... 23 mA, infinitely adjustable (default range: 3.80 mA ... 20.5 mA)
Error signal (e.g. following sensor fault) (conforming to NE43)	3.6 ... 23 mA, infinitely adjustable (default value: 22.8 mA)
Sample cycle	0.25 s nominal
Damping	Software filter 1st order 0 ... 30 s (parameterizable)
Protection	Against reverse polarity
Galvanic isolation	Input against output 2.12 kV DC ($1.5\ kV_{rms}$ AC)
Measuring accuracy	
Digital measuring error	See "Digital measuring error" table
Reference conditions	
• Auxiliary power	24 V ± 1 %
• Load	500 Ω
• Ambient temperature	23 °C
• Warming-up time	> 5 min
Error in the analog output (digital/analog converter)	< 0.025 % of measuring span
Error due to internal reference junction	< 0.5 °C (0.9 °F)
Effect of ambient temperature	
• Analog measuring error	0.02 % of meas. span/10 °C (18 °F)
• Digital measuring error	
- 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 meas. span/V
Effect of load impedance	< 0.002 % of meas. span/100 Ω
Long-term drift	
• In the first month	< 0.02 % of measuring span
• After one year	< 0.2 % of measuring span
• After 5 years	< 0.3 % of measuring span
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
Electromagnetic compatibility	According to EN 61326 and NE21
Design	
Material	Molded plastic
Weight	50 g (0.11 lb)
Dimensions	See "Dimensional drawings"
Cross-section of cables	Max. 2.5 mm^2 (AWG 13)
Degree of protection according to IEC 60529	
• Enclosure	IP40
• Terminals	IP00

Certificates and approvals	
Explosion protection ATEX	
EC type-examination certificate	PTB 05 ATEX 2040X
• "Intrinsic safety" type of protection	II 1 G Ex ia IIC T6/T4 II 2 (1) G Ex ia/ib IIC T6/T4 II 3(1) G Ex ia/ic IIC T6/T4 II 1D Ex iaD 20 T115 °C
• "Non-sparking and energy-limited equipment" type of protection	II 3 G Ex nL IIC T6/T4 II 3 G Ex nA IIC T6/T4
Explosion protection: FM for USA	
• FM approval	FM 3024169
• Degrees of protection	IS / Cl I, II, III / Div 1 / GP ABCDEFG T6, T5, T4 Cl I / ZN 0 / AEx ia IIC T6, T5, T4 NI / Cl I / Div 2 / GP ABCDFG T6, T5, T4 NI / Cl I / ZN 2 / IIC T6, T5, T4
Explosion protection to FM for Canada ($_cFM_{US}$)	
• FM approval	FM 3024169C
• Degrees of protection	IS / Cl I, II, III / Div 1/ GP ABCDEFG T6, T5, T4 NI / Cl I / DIV 2 / GP ABCD T6, T5, T4 NIFW / Cl I, II, III / DIV 2 / GP ABCDFG T6, T5, T4 DIP / Cl II, III / Div 2 / GP FG T6, T5, T4 Cl I / ZN 0 / Ex ia IIC T6, T5, T4 Cl I / ZN 2 / Ex nA nL IIC T6, T5, T4
Other certificates	EAC Ex(GOST), NEPSI, IEC, EXPOLABS

Factory setting:

- Pt100 (IEC 751) in the 3-wire connection
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

Digital measuring error

Resistance thermometer

Input	Measuring range	Minimum measuring span		Digital accuracy	
	°C (°F)	°C	(°F)	°C	(°F)
According 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)
According 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 sensor

Input	Measuring range	Minimum measuring span	Digital accuracy
	Ω	Ω	Ω
Resistance	0 ... 390	5	0.05
Resistance	0 ... 2200	25	0.25

Thermocouples

Input	Measuring range	Minimum measuring span		Digital accuracy	
	°C (°F)	°C	(°F)	°C	(°F)
Type B	100 ... 1820 (212 ... 3308)	100	(180)	2[1]	(3.60)[1]
Type C (W5)	0 ... 2300 (32 ... 4172)	100	(180)	2	(3.60)
Type D (W3)	0 ... 2300 (32 ... 4172)	100	(180)	1[2]	(1.80)[2]
Type E	-200 ... +1000 (-328 ... +1832)	50	(90)	1	(1.80)
Type J	-200 ... +1200 (-328 ... +2192)	50	(90)	1	(1.80)
Type K	-200 ... +1370 (-328 ... +2498)	50	(90)	1	(1.80)
Type L	-200 ... +900 (-328 ... +1652)	50	(90)	1	(1.80)
Type N	-200 ... +1300 (-328 ... +2372)	50	(90)	1	(1.80)
Type R	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.60)
Type S	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.60)
Type T	-200 ... +400 (-328 ... +752)	40	(72)	1	(1.80)
Type U	-200 ... +600 (-328 ... +1112)	50	(90)	2	(3.60)

[1] The digital accuracy in the range 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 range	Minimum measuring 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 reference junction errors in the case of thermocouple measurements).

SITRANS TH300 (4 to 20 mA, HART, universal)

Selection and ordering data

	Article No.
SITRANS TH300 head transmitter For installation in connection head type B, 2-wire system 4 ... 20 mA, communication-capable according to HART, with galvanic isolation	
Without explosion protection	**7NG3212-0NN00**
With explosion protection	
• According to ATEX	**7NG3212-0AN00**
• According to FM ($_{C}FM_{US}$)	**7NG3212-0BN00**

Options	Order code
Append suffix "**-Z**" to article no., add order code and plain text, if applicable.	
Test report (5 measuring points)	**C11**
Functional safety SIL2	**C20**
Functional safety SIL2/3	**C23**
Customer-specific programming	
Measuring range to be set Specify in plain text (max. 5 digits): Y01: ... to ... °C, °F	**Y01**[1]
Measuring point number (TAG) max. 8 characters	**Y17**[2]
Measuring point description, max. 16 characters	**Y23**[2]
Measuring point message, max. 32 characters	**Y24**[2]
Pt100 (IEC) 2-wire, R_L = 0 Ω	**U02**[3]
Pt100 (IEC) 3-wire	**U03**[3]
Pt100 (IEC) 4-wire	**U04**[3]
Type B thermocouple	**U20**[3][4]
Type C thermocouple (W5)	**U21**[3][4]
Type D thermocouple (W3)	**U22**[3][4]
Type E thermocouple	**U23**[3][4]
Type J thermocouple	**U24**[3][4]
Type K thermocouple	**U25**[3][4]
Type L thermocouple	**U26**[3][4]
Type N thermocouple	**U27**[3][4]
Type R thermocouple	**U28**[3][4]
Type S thermocouple	**U29**[3][4]
Type T thermocouple	**U30**[3][4]
Type U thermocouple	**U31**[3][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	**Y09**[5]
Fault current 3.6 mA (instead of 22.8 mA)	**U36**[2]
Cable extension Transmitter with installed cable extension 200 mm (7.87 inch), for Pt100 in 4-wire connection	**W01**

[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 2/154.	
Modem	
Modem with USB interface	**7MF4997-1DB**
SIMATIC PDM operating software	See Catalog FI01 section 8
Mounting rail adapter for head transmitter (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)	**7NG3092-8KC**

For supply units, see Catalog FI01 section "Supplementary components"

Ordering example 1:

7NG3212-0NN00-Z Y01+Y17+U03
Y01: -10 ... +100 °C
Y17: TICA123

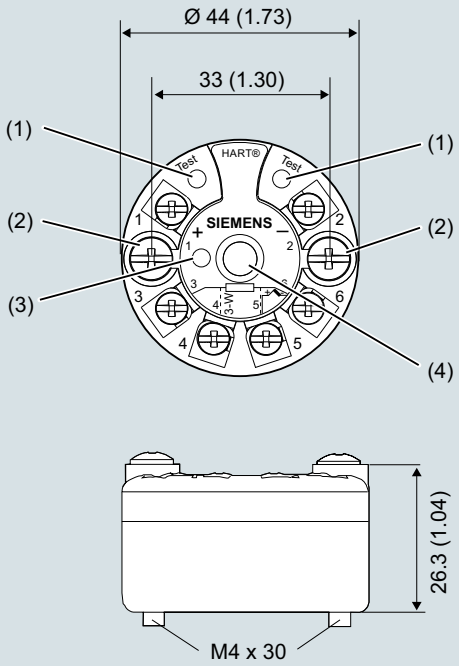
Ordering example 2:

7NG3212-0NN00-Z Y01+Y23+ U25
Y01: -10 ... +100 °C
Y23: TICA1234HEAT

Factory setting:

- Pt100 (IEC 751); 3-wire connection
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

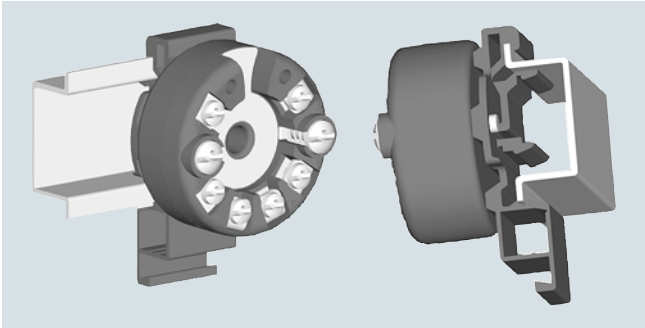
Dimensional drawings



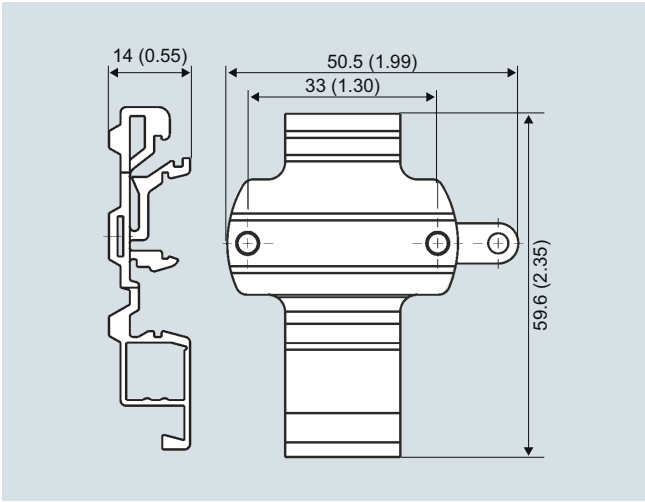
1(+) and 2(-)	Auxiliary power supply U_{aux}, output current I_{Out}
3, 4, 5 and 6	Pt100 sensor (for connections, see sensor connection assignment)
Test (+), Test (-)	Measurement of the output current with a multimeter
(1)	Test terminal
(2)	Mounting screw M4x30
(3)	LED for operation indication
(4)	Internal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

SITRANS TH300, dimensions and pin assignment, dimensions in mm (inch)

Mounting on DIN rail



SITRANS TH300, mounting of transmitter on DIN rail

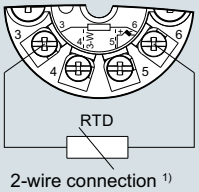


DIN rail adapter, dimensions in mm (inch)

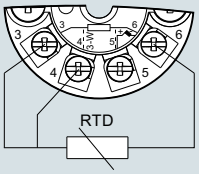
2

Circuit diagrams

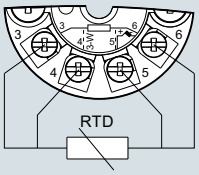
Resistance thermometer



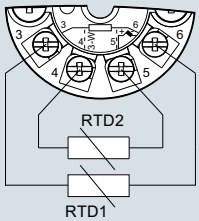
2-wire connection [1)]



3-wire connection

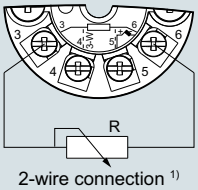


4-wire connection

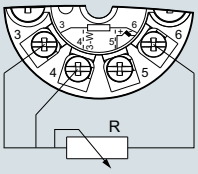


Generation of average value / difference [1)]

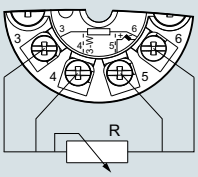
Resistance



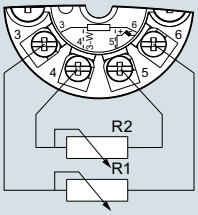
2-wire connection [1)]



3-wire connection

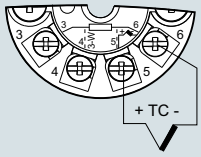


4-wire connection

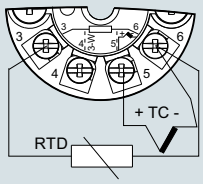


Generation of average value / difference [1)]

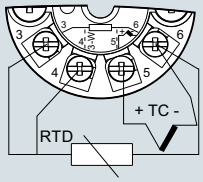
Thermocouple



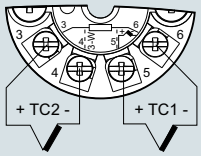
Cold junction compensation
Internal/fixed value



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



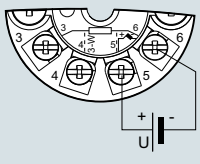
Cold junction compensation with external Pt100 in 3-wire connection



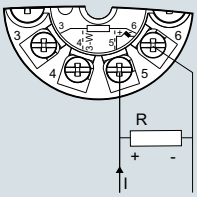
Generation of average value / difference with internal cold junction compensation

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

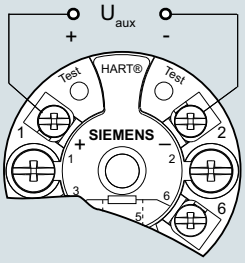
Voltage measurement



Current measurement



Connection of auxiliary power supply (U_{aux})



SITRANS TH300, sensor connection assignment

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 redundance

With PROFIBUS PA communication

- Function blocks: 2 x analog

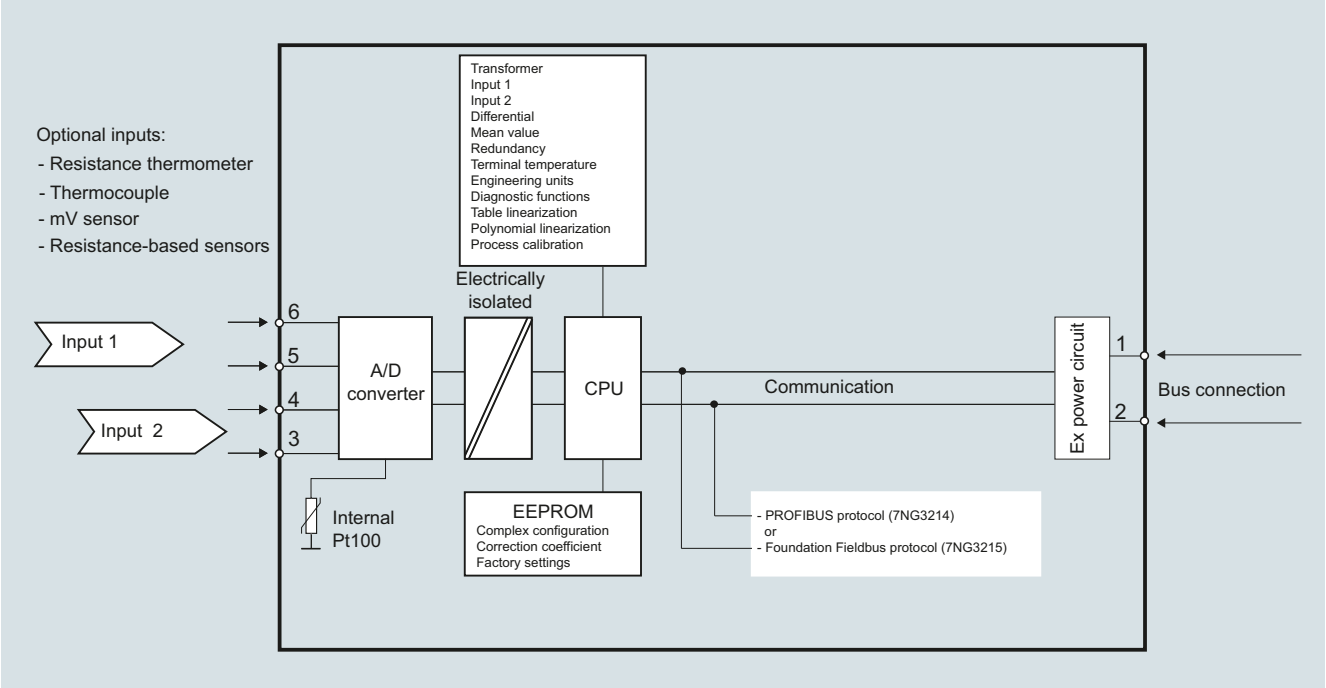
With FOUNDATION Fieldbus communication

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

Mode of operation

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

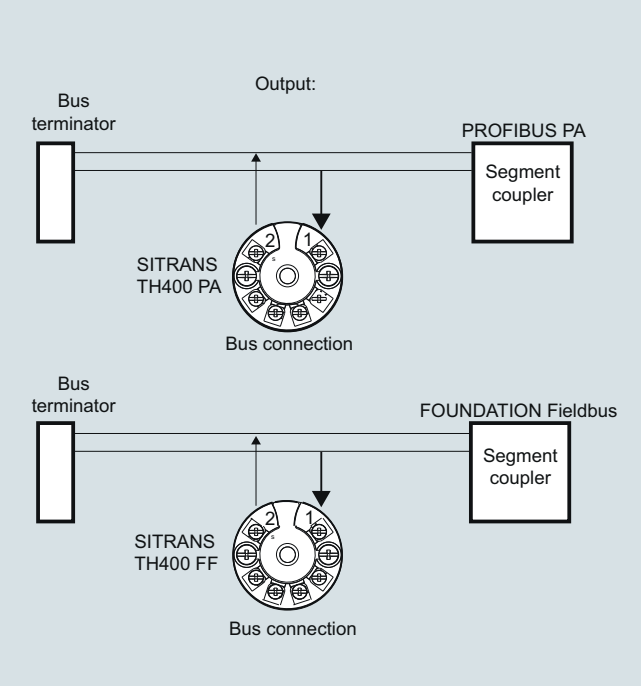
The only difference between the two versions of the SITRANS TH400 (7NG3214-... and 7NG3215-...) is the type of fieldbus protocol used (PROFIBUS PA or FOUNDATION Fieldbus).



SITRANS TH400, function diagram

SITRANS TH400, fieldbus transmitter

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

Measuring accuracy

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

General values

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

Basic values

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

Reference conditions	
Warming-up time	30 s
Signal-to-noise ratio	Min. 60 dB
Calibration condition	20 ... 28 °C (68 ... 82 °F)

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

2

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	
• No explosion protection or Zone 2/Div 2 according to ATEX/FM/CSA/IECEX/NEPSI/IECEX/NEPSI	**7NG3214-0NN00**
• With explosion protection "Intrinsically safe according to ATEX/FM/CSA/IECEX/NEPSI"	**7NG3214-0AN00**
Bus-compatible to FOUNDATION Fieldbus	
• No explosion protection or Zone 2/Div 2 according to ATEX/FM/CSA/IECEX/NEPSI	**7NG3215-0NN00**
• 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)	**C11**[1]
Customer-specific programming	
Measuring range to be set Specify in plain text (max. 5 digits): Y01: ... to ... °C, °F	**Y01**[1]
Measuring point number (TAG) max. 8 characters	**Y17**[2]
Measuring point description, max. 16 characters	**Y23**[2]
Measuring point message, max. 32 characters	**Y24**[2]
Specify bus address in plain text	**Y25**[2]
Pt100 (IEC) 2-wire, R_L = 0 W	**U02**[3]
Pt100 (IEC) 3-wire	**U03**[3]
Pt100 (IEC) 4-wire	**U04**[3]
Type B thermocouple	**U20**[3)4)]
Type C thermocouple (W5)	**U21**[3)4)]
Type D thermocouple (W3)	**U22**[3)4)]
Type E thermocouple	**U23**[3)4)]
Type J thermocouple	**U24**[3)4)]
Type K thermocouple	**U25**[3)4)]
Type L thermocouple	**U26**[3)4)]
Type N thermocouple	**U27**[3)4)]
Type R thermocouple	**U28**[3)4)]
Type S thermocouple	**U29**[3)4)]
Type T thermocouple	**U30**[3)4)]
Type U thermocouple	**U31**[3)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	**Y09**[5]

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) nternal 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 2/154.	
SIMATIC PDM operating software	See Catalog FI01 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)	**7NG3092-8KC**
for additional PA components,	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

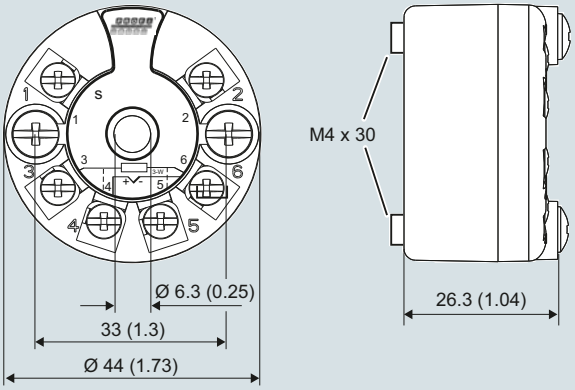
Y17: TICA8HEAT

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

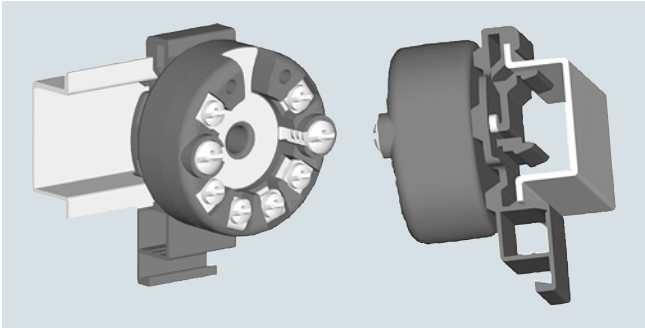
Dimensional drawings



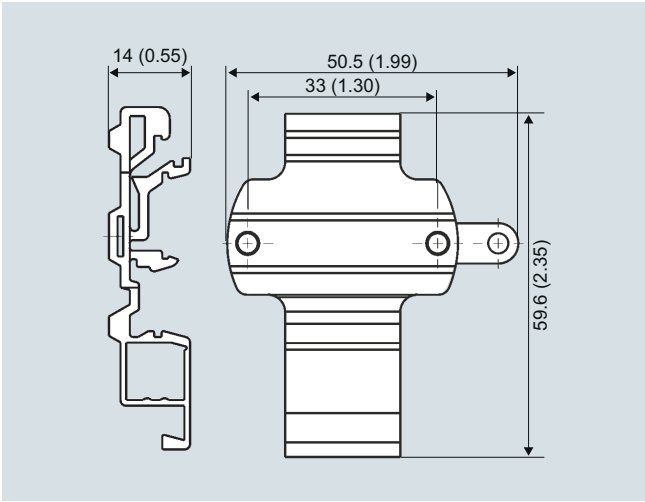
Terminals 1, 2: fieldbus connection
Terminals 3 ... 6: sensor connection

SITRANS TH400 dimensions in mm (inches) and connection diagram

Mounting on DIN rail



SITRANS TH400, mounting of transmitter on DIN rail

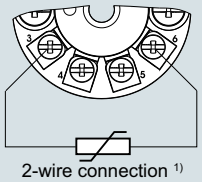


DIN rail adapter, dimensions in mm (inch)

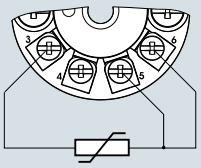
2

Circuit diagrams

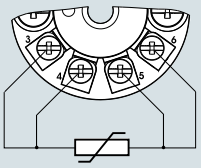
Resistance thermometer



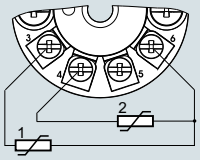
2-wire connection [1)]



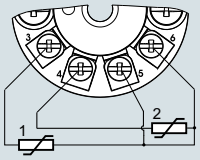
3-wire connection



4-wire connection

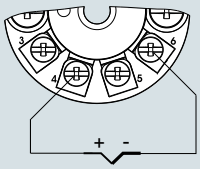


Mean-value/differential or redundancy generation
2 x 2-wire connection [1)]

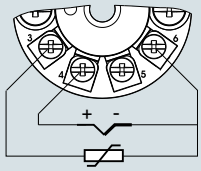


Mean-value/differential or redundancy generation
1 sensor in 2-wire connection [1)]
1 sensor in 3-wire connection

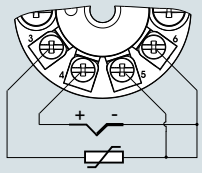
Thermocouple



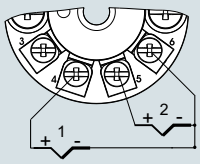
Internal
cold junction compensation



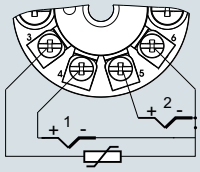
Cold junction compensation
with external Pt100 in 2-wire connection [1)]



Cold junction compensation
with external Pt100 in 3-wire connection

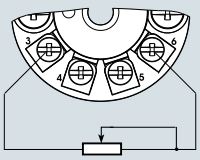


Mean value, differential or redundancy generation with internal cold junction compensation

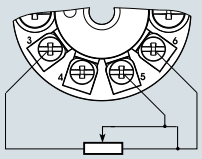


Mean value, differential or redundancy generation and cold junction compensation
with internal Pt100
in 2-wire connection [1)]

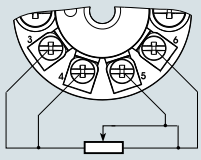
Resistance



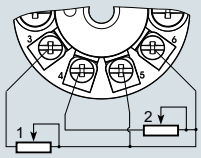
2-wire connection [1)]



3-wire connection

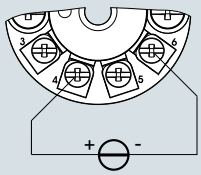


4-wire connection

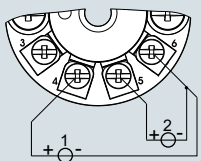


Mean value, differential or redundancy generation
1 resistor in 2-wire connection [1)]
1 resistor in 3-wire connection

Voltage measurement



One voltage source



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

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

SITRANS TH400, sensor connection assignment

Overview

- 2-wire head transmitter with and without HART communications interface
- Mounting in the connection head of the temperature sensor
- Universal input for virtually any type of temperature sensor
- Can be configured via PC, HART 7 or optional local operation

Benefits

- Compact design
- Flexible mounting and center hole allow you to select your preferred type of installation
- Galvanic isolation
- Test terminals for ammeter
- Diagnostics LED (green/red)
- Input monitoring
  Wire break and short-circuit
- Self-monitoring
- Configuration status stored in EEPROM
- SIL2/3 (with order note C20)
- Expanded diagnostic functions, such as slave pointer, operating hours counter, etc.
- Special characteristic
- Electromagnetic compatibility according to DIN EN 61326 and NE21

Application

SITRANS TH320 transmitters can be used in all sectors. Its compact size means that it can be installed in connection heads of type B or larger. The following sensors/signal sources can be connected over their universal input module:

- Resistance thermometer (2-wire, 3-wire, 4-wire connection)
- Thermocouples
- Linear resistance, potentiometer and DC voltage sources

With HART communications interface:

- The output signal is a load-independent direct current from 4 to 20 mA in accordance with the input characteristic, superimposed by the digital HART signal.

Transmitters of the "intrinsically safe or Zone 2 increased safety" type of protection can be installed in hazardous areas. The device meets the requirements of the EU Directive 2014/34/EU (ATEX), the FM and CSA regulations as well as other national approvals.

2

Function

Without HART communications interface

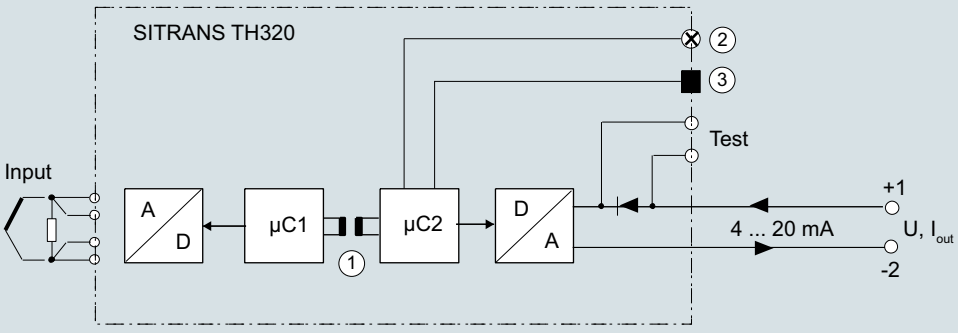
For the SITRANS TH320 without HART functionality, parameters are assigned with the PC. A special modem and the software tool SIPROM T are available for this purpose.

With HART communications interface

- The SITRANS TH320 is configured via HART. The configuration can be carried out using a handheld communicator or, more conveniently, with a HART modem and the SIMATIC PDM configuration software. The configuration data is then permanently stored in the non-volatile memory (EEPROM).

After correct connection of input and supply voltage, the transmitter outputs a temperature-linear output signal and the diagnostics LED is green. In case of external errors, e.g. sensor short circuit or interruption, the LED flashes red; an internal error is indicated by a permanent red light.

An ammeter can be connected at any time for checking and plausibility via the test terminals. The output current can be read without any interruption, or even without opening the current loop.



Input		Output	
A/D	Analog-digital converter	µC2	Microcontroller, primary circuit
µC1	Microcontroller, secondary circuit	D/A	Digital-analog converter
		U	Supply Voltage
		I_{out}	Output current
①	Galvanic isolation	②	LED
		③	Extension port

SITRANS TH320 function block diagram

Technical specifications

General	
Supply voltage[1) 2)]	
• Without explosion protection (non-Ex)	7.5 ... 48 V DC
• with explosion protection (Ex i)	7.5 ... 30 V DC
Additional minimum supply voltage when using test terminals	0.8 V
Maximum power loss	≤ 850 mW
Minimum load resistance at supply voltage > 37 V	(V_{supply} - 37 V)/23 mA
Insulation voltage, test/operation	
• Without explosion protection (non-Ex)	2.5 kV AC/55 V AC
• with explosion protection (Ex i)	2.5 kV AC/42 V AC
Polarity protection	All inputs and outputs
Write protection	Open circuits or software
Warming-up time	< 5 min
Starting time	< 2.75 s
Programming	HART
Signal-to-noise ratio	> 60 dB
Long-term stability	Better than: • ± 0.05% of measuring span/year • ± 0.18% of measuring span/5 years
Response time	4 ... 20 mA: ≤ 55 ms HART: ≤ 75 ms (typically 70 ms)
Programmable damping	0 ... 60 s
Signal dynamic	
• Input	24 bit
• Output	18 bit
Influence of change in supply voltage	< 0.005% of measuring span/V DC
Input	
Resistance thermometer (RTD)	
Input type	
• Pt10 ... 10000	• IEC 60751 • JIS C 1604-8 • GOST 6651_2009 • Callendar-Van Dusen
• Ni10 ... 10000	• DIN 43760-1987 • GOST 6651-2009/OIML R84:2003
• Cu5 ... 1000	• Edison Copper Winding No. 15 • GOST 6651-2009/OIML R84:2003
Type of connection	2-wire, 3-wire or 4-wire
Line resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the line resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8)	Max. 30 nF
• All other input types	Max. 50 nF
Fault detection, programmable	None, short-circuited, defective, short-circuited or defective
	Note When the low limit for the configured input type is below the constant detection limit for short-circuited inputs, the detection of short circuits is disabled regardless of the configuration of the fault detection.
Detection limit for short-circuited input	15 Ω
Fault detection time (RTD)	≤ 75 ms (typically 70 ms)
Fault detection time (for 3-wire and 4-wire)	≤ 2 000 ms

Thermocouples (TC)	
Input type	
• B	IEC 60584-1
• E	IEC 60584-1
• J	IEC 60584-1
• K	IEC 60584-1
• L	DIN 43710
• Lr	GOST 3044-84
• N	IEC 60584-1
• R	IEC 60584-1
• S	IEC 60584-1
• T	IEC 60584-1
• U	DIN 43710
• W3	ASTM E988-96
• W5	ASTM E988-96
• LR	GOST 3044-84
Cold junction compensation (CJC)	Constant, internal or external over Pt100 or Ni100 RTD
• Temperature range internal CJC	-50 ... +100 °C (-58 ... +212 °F)
• Connection external CJC	2-wire or 3-wire
• External CJC, line resistance per wire (for 3-wire and 4-wire connections)	50 Ω
• Effect of the line resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
• Input current external CJC	< 0.15 mA
• Temperature range external CJC	-50 ... +135 °C (-58 ... +275 °F)
• Cable, wire-wire capacity	Max. 50 nF
• Total line resistance	Max. 10 kΩ
• Fault detection, programmable	None, short-circuited, defective, short-circuited or defective
	Note The short-circuited fault detection only applies to the CJC input.
• Fault detection time (TC)	≤ 75 ms (typically 70 ms)
• Fault detection time, external CJC (for 3-wire and 4-wire)	≤ 2 000 ms
Linear resistance	
Input range	0 ... 100 kΩ
Minimum measuring span	25 Ω
Type of connection	2-wire, 3-wire or 4-wire
Line resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the line resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• R > 400 Ω	Max. 30 nF
• R ≤ 400 Ω	Max. 50 nF
Fault detection, programmable	None, defective
Potentiometers	
Input range	10 ... 100 kΩ
Minimum measuring span	25 Ω
Type of connection	3-wire or 4-wire
Line resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the line resistance (with 4-wire and 5-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• R > 400 Ω	Max. 30 nF
• R ≤ 400 Ω	Max. 50 nF

SITRANS TH320 (HART, universal)

Fault detection, programmable	None, short-circuited, defective, short-circuited or defective
	Note When the configured potentiometer size is below the constant detection limit for short-circuited inputs, the detection of short circuits is disabled regardless of the configuration of the fault detection.
Detection limit for short-circuited input	15 Ω
Fault detection time, wiper arm (no short-circuit detection)	≤ 75 ms (typically 70 ms)
Fault detection time, element	≤ 2 000 ms
Fault detection time (for 4-wire and 5-wire)	≤ 2 000 ms
Voltage input	
Measuring range	
• Unipolar	-100 ... 1700 mV
• Bipolar	-800 ... +800 mV
Minimum measuring span	2.5 mV
Input resistance	10 MΩ
Cable, wire-wire capacity	
• Input range: -100 ... 1700 mV	Max. 30 nF
• Input range: -20 ... 100 mV	Max. 50 nF
Fault detection, programmable	None, defective
Fault detection time	≤ 75 ms (typically 70 ms)
Output and HART communication	
Normal range, programmable	3.8 ... 20.5 mA/20.5 ... 3.8 mA
Extended range (output limits), programmable	3.5 ... 23 mA/23 ... 3.5 mA
Programmable input/output limits	
• Fault current	Enable/disable
• Fault current setting	3.5 ... 23 mA
Update time	10 ms
Load (with current output)	≤ (V_{Supply} - 7.5)/0.023 Ω
Load stability	< 0.01% of meas. span/100 Ω (measuring span = currently selected range)
Input fault detection, programmable (detection of input short circuits is ignored with TC and voltage inputs)	3.5 ... 23 mA
NAMUR NE43 Upscale	> 21 mA
NAMUR NE43 Downscale	< 3.6 mA
HART protocol versions	HART 7
Measuring accuracy	
Input accuracy	See "Input accuracy" table
Output accuracy	See "Output accuracy" table
Rated conditions	
Ambient temperature	-50 ... +85 °C (-58 ... +185 °F)
Ambient temperature for devices with functional safety	-40 ... +80 °C (-40 ... +176 °F)
Storage temperature	-50 ... +85 °C (-58 ... +185 °F)
Reference temperature for sensor calibration	24 °C ±1.0 °C (75.2 °F ±1.8 °F)
Relative humidity	< 99% (no condensation)
Degree of protection	
• Transmitter enclosure	IP68
• Terminals	IP00

Design	
Weight	50 g (0.11 lb)
Maximum core cross-section	1 x 1.5 mm² (stranded wire)
Tightening torque for clamping screws	0.4 Nm
Vibrations	IEC 60068-2-6
• 2 ... 25 Hz	± 1.6 mm (0.07 inch)
• 25 ... 100 Hz	± 4 g
Certificates and approvals	
Explosion protection ATEX/IECEx and others	
Certificates[3]	DEKRA 17ATEX0116 X IECEx DEK 17.0054X A5E43700604A-2018X
"Intrinsic safety ia/ib" type of protection	For use in Zone 0, 1, 2, 20, 21, 22
• ATEX	II 1 G Ex ia IIC T6 ... T4 Ga II 2(1) G Ex ib [ia Ga] IIC T6 ... T4 Gb II 1 D Ex ia IIIC Da I M1 Ex ia I Ma
• IECEx and others	Ex ia IIC T6 ... T4 Ga Ex ib [ia Ga] IIC T6 ... T4 Gb Ex ia IIIC Da Ex ia I Ma
"Intrinsic safety ic" type of protection	For use in Zones 2 and 22
• ATEX	II 2 G Ex ic IIC T6…T4 Gc II 2 D Ex ic IIIC Dc
• IECEx and others	Ex ic IIC T6 ... T4 Gc Ex ic IIIC Dc
"Non-sparking/increased safety nA/ec" type of protection	For use in Zones 2 and 22
• ATEX	II 2 G Ex nA IIC T6…T4 Gc II 2 G Ex ec IIC T6…T4 Gc
• IECEx and others	Ex nA IIC T6 ... T4 Gc Ex ec IIC T6 ... T4 Gc
Explosion protection CSA/FM for Canada and USA	
Certificates	CSA 1861385 FM18CA0024 FM18US0046
"Intrinsic safety ia" type of protection	IS, CL I, Div 1, GP ABCD, T6 ... T4 Ex ia IIC T6 … T4 Ga AEx ia IIC T6 … T4 Ga or: Ex ib [ia Ga] IIC T6…T4 Gb AEx ib [ia Ga] IIC T6…T4 Gb
"Non incendive field wiring NIFW" type of protection	NIFW, CL I, Div 2, GP ABCD T6 ... T4
"Non incendive NI" type of protection	NI, CL I, Div 2, GP ABCD T6...T4 Ex nA IIC T6 ... T4 Gc AEx nA IIC T6 ... T4 Gc

[1] Note that the minimum supply voltage must correspond to the value measured at the terminals of the SITRANS TH320.
All external voltage drops must be taken into consideration.

[2] Protect the device from overvoltage with the help of a suitable power supply or suitable overvoltage protection equipment.

[3] Additional available certificates are listed on the Internet at http://www.siemens.com/processinstrumentation/certificates

Measuring ranges/Minimum measuring span

RTD

Input type	Standard	Measuring range in °C (°F)	α_0 in $°C^{-1}$ ($°F^{-1}$)	Minimum measuring span in °C (°F)
Pt10 ... 10000	IEC 60751	-200 ... +850 (-328 ... +1 562)	0.003851 (0.002139)	10 (50)
	JIS C 1604-8	-200 ... +649 (-328 ... +1 200)	0.003916 (0.002176)	10 (50)
	GOST 6651_2009	-200 ... +850 (-328 ... +1 562)	0.003910 (0.002172)	10 (50)
	Callendar-Van Dusen	-200 ... +850 (-328 ... +1 562)	-	10 (50)
Ni10 ... 10000	DIN 43760-1987	-60 ... +250 (-76 ... +482)	0.006180 (0.003433)	10 (50)
	GOST 6651-2009/OIML R84:2003	-60 ... +180 (-76 ... +356)	0.006170 (0.003428)	10 (50)
Cu5 ... 1000	Edison Copper Winding No. 15	-200 ... +260 (-328 ... +500)	0.004270 (0.002372)	100 (212)
	GOST 6651-2009/OIML R84:2003	-180 ... +200 (-292 ... +392)	0.004280 (0.002378)	100 (212)
	GOST 6651-94	-50 ... +200 (-58 ... +392)	0.004260 (0.002367)	100 (212)

TC

Input type	Standard	Measuring range in °C (°F)	Minimum measuring span in °C (°F)
B	IEC 60584-1	0 (85) ... 1 820 (32 (185) ... 3 308)	100 (212)
E	IEC 60584-1	-200 ... +1 000 (-392 ... +1 832)	50 (122)
J	IEC 60584-1	-100 ... +1 200 (-212 ... +2 192)	50 (122)
K	IEC 60584-1	-180 ... +1 372 (-356 ... +2 502)	50 (122)
L	DIN 43710	-200 ... +900 (-392 ... +1 652)	50 (122)
Lr	GOST 3044-84	-200 ... +800 (-392 ... +1 472)	50 (122)
N	IEC 60584-1	-180 ... +1 300 (-356 ... +2 372)	50 (122)
R	IEC 60584-1	-50 ... +1 760 (-122 ... +3 200)	100 (212)
S	IEC 60584-1	-50 ... +1 760 (-122 ... +3 200)	100 (212)
T	IEC 60584-1	-200 ... +400 (-392 ... +752)	50 (122)
U	DIN 43710	-200 ... +600 (-392 ... +1 112)	50 (122)
W3	ASTM E988-96	0 ... 2 300 (32 ... 4 172)	100 (212)
W5	ASTM E988-96	0 ... 2 300 (32 ... 4 172)	100 (212)
LR	GOST 3044-84	-200 ... +800 (-392 ... +1472)	50 (122)

Input accuracy

Basic values

Input type	Basic accuracy	Temperature coefficient[1)]
RTD		
Pt10	≤ ±0.8 °C (1.44 °F)	≤ ±0.020 °C/°C (°F/°F)
Pt20	≤ ±0.4 °C (0.72 °F)	≤ ±0.010 °C/°C (°F/°F)
Pt50	≤ ±0.16 °C (0.288 °F)	≤ ±0.004 °C/°C (°F/°F)
Pt100	≤ ±0.04 °C (0.072 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt200	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt500	$T_{max.}$ < 180 °C (356 °F) = ≤ ±0.08 °C (0.144 °F) $T_{max.}$ > 180 °C (356 °F) = ≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt1000	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt2000	$T_{max.}$ < 300 °C (572 °F) = ≤ ±0.08 °C (0.144 °F) $T_{max.}$ > 300 °C (572 °F) = ≤ ±0.4 °C (0.72 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt10000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Ni10	≤ ±1.6 °C (2.88 °F)	≤ ±0.020 °C/°C (°F/°F)
Ni20	≤ ±0.8 °C (1.44 °F)	≤ ±0.010 °C/°C (°F/°F)
Ni50	≤ ±0.32 °C (0.576 °F)	≤ ±0.004 °C/°C (°F/°F)
Ni100	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni120	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni200	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni500	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni1000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)

SITRANS TH320 (HART, universal)

Input type	Basic accuracy	Temperature coefficient[1]
Ni2000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni10000	≤ ±0.32 °C (0.576 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Cu5	≤ ±1.6 °C (2.88 °F)	≤ ±0.040 °C/°C (°F/°F)
Cu10	≤ ±0.8 °C (1.44 °F)	≤ ±0.020 °C/°C (°F/°F)
Cu20	≤ ±0.4 °C (0.72 °F)	≤ ±0.010 °C/°C (°F/°F)
Cu50	≤ ±0.16 °C (0.288 °F)	≤ ±0.004 °C/°C (°F/°F)
Cu100	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu200	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu500	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu1000	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Linear resistance		
0 ... 400 Ω	≤ ±40 mΩ	≤ ±2 mΩ/°C (1.11 mΩ/°F)
0 ... 100 kΩ	≤ ±4 Ω	≤ ±0.2 Ω/°C (0.11 Ω/°F)
Potentiometers		
0 ... 100%	< 0.05%	< ± 0.005%
Voltage input		
mV: -20 ... 100 mV	≤ ±5 µV	≤ ±0.2 µV/°C (0.11 µV/°F)
mV: -100 ... 1700 mV	≤ ±0.1 mV	≤ ±36 µV/°C (20 µV/°F)
mV: ± 800 mV	≤ ±0.1 mV	≤ ±32 µV/°C (17.8 µV/°F)
TC		
E	≤ ±0.2 °C (0.36 °F)	≤ ±0.025 °C/°C (°F/°F)
J	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
K	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
L	≤ ±0.35 °C (0.63 °F)	≤ ±0.025 °C/°C (°F/°F)
N	≤ ±0.4 °C (0.72 °F)	≤ ±0.025 °C/°C (°F/°F)
T	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
U	< 0 °C (32 °F) ≤ ±0.8 °C (1.44 °F) ≥ 0 °C (32 °F) ≤ ±0.4 °C (0.72 °F)	≤ ±0.025 °C/°C (°F/°F)
Lr	≤ ±0.2 °C (0.36 °F)	≤ ±0.1 °C/°C (°F/°F)
R	< 200 °C (392 °F) ≤ ±0.5 °C (0.9 °F) ≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
S	< 200 °C (392 °F) ≤ ±0.5 °C (0.9 °F) ≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
W3	≤ ±0.6 °C (1.08 °F)	≤ ±0.1 °C/°C (°F/°F)
W5	≤ ±0.4 °C (0.72 °F)	≤ ±0.1 °C/°C (°F/°F)
B[2]	≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
B[3]	≤ ±3 °C (5.4 °F)	≤ ±0.1 °C/°C (°F/°F)
B[4]	≤ ±8 °C (14.4 °F)	≤ ±0.8 °C/°C (°F/°F)
B[5]	Not specified	Not specified
CJC (internal)	< ±0.5 °C (0.9 °F)	Included in basic accuracy
CJC (external)	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)

1) Temperature coefficients correspond to the specified values or 0.002% of the input span, depending on which value is greater.
2) Accuracy of the specification range > 400 °C (752 °F)
3) Accuracy of the specification range > 160 °C (320 °F) < 400 °C (752 °F)
4) Accuracy of the specification range > 85 °C (185 °F) < 160 °C (320 °F)
5) Accuracy of the specification range < 85 °C (185 °F)

Output accuracy

Output type	Basic accuracy	Temperature coefficient
Analog output	≤ ±1.6 µA (0.01% of the full output span)	≤ ±0.48 µA/K (≤ ±0.003% of the full output span/K)

Selection and ordering data

	Article No.
SITRANS TH320 head transmitter with 1 input ↗	**7NG031** ■ - ■■■■■ - 0■■
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.	
Communication	
With HART	**0**
2-wire, 4 ... 20 mA	**7**
Primary value output	
Input 1	**0**
Input 1, type	
RTD	
• Pt100 (IEC), 3-wire	**B**
• Pt100 (IEC), 4-wire	**C**
• Pt1000 (IEC), 3-wire	**D**
• Pt1000 (IEC), 4-wire	**E**
TC	
• Type B	**F**
• Type E	**G**
• Type J	**H**
• Type K	**J**
• Type L	**K**
• Type N	**L**
• Type R	**N**
• Type S	**P**
• Type T	**Q**
Potentiometer, 4-wire	**R**
Input 1, type customer-specific	
Define customer-specific input configurations in V options	**Y**
Input 2, type	
Without input 2	**A**
CJC configuration for TC	
Without CJC	**0**
Internal CJC	**1**
External CJC Pt100 (IEC), 3-wire	**3**
External CJC Ni100 (DIN), 3-wire	**6**
Materials not in contact with media	
Without	**0**
Type of protection	
General safety (non-Ex); CE, RCM, FM, KCC, EAC	**A**
Intrinsic safety (Ex i) / Non-incendive field wiring (NIFW) / Increased safety zone 2 (Ex ec) / Non incendive (NI) (ATEX, IECEx, EACEx, CSA, FM, NEPSI, Inmetro)	**N**
Electrical connection/cable entry	
Without	**A**
Local HMI	
Without display	**0**

Options	Order code
Append "**-Z**" to Article No., add order code and, if applicable, free text.	
Manufacturer declarations	
Quality inspection certificate, 5-point factory calibration (IEC 60770-2)	**C11**
Certificates for functional safety	
Functional safety SIL2/3 (IEC 61508)	**C20**
Device options	
PDF file with device settings	**D10**
Without labeling of the measuring range on the TAG plate	**D41**
Jumper plug set on device for write protection	**D81**
Jumper plug set on device for fault current > 21 mA (instead of < 3.6 mA) (only non-SIL)	**D82**
Input 1: TC	
Type C W5	**V01**
Type D W3	**V02**
Type U	**V03**
Type Lr	**V04**
Input 1: RTD	
Pt x (IEC), 3-wire, define RTD factor x in option Y21	**V61**
Pt x (IEC), 4-wire, define RTD factor x in option Y21	**V62**
Pt x (JIS C1604-81), 3-wire, define RTD factor x in option Y21	**V64**
Pt x (JIS C1604-81), 4-wire, define RTD factor x in option Y21	**V65**
Pt x (GOST 6651-2009), 3-wire, define RTD factor x in option Y21	**V67**
Pt x (GOST 6651-2009), 4-wire, define RTD factor x in option Y21	**V68**
Ni x (DIN 43760-87), 3-wire, define RTD factor x in option Y21	**V70**
Ni x (DIN 43760-87), 4-wire, define RTD factor x in option Y21	**V71**
Ni x (GOST 6651-2009), 3-wire, define RTD factor x in option Y21	**V73**
Ni x (GOST 6651-2009), 4-wire, define RTD factor x in option Y21	**V74**
Cu x (ECW-15), 2-wire, define line resistance value in option Y51 and RTD factor x in option Y21	**V75**
Cu x (ECW-15), 3-wire, define RTD factor x in option Y21	**V76**
Cu x (ECW-15), 4-wire, define RTD factor x in option Y21	**V77**
Cu x (GOST 6651-94), 2-wire, define line resistance value in option Y51 and RTD factor x in option Y21	**V78**
Cu x (GOST 6651-94), 3-wire, define RTD factor x in option Y21	**V79**
Cu x (GOST 6651-94), 4-wire, define RTD factor x in option Y21	**V80**
Cu x (GOST 6651-2009), 2-wire, define line resistance value in option Y51 and RTD factor x in option Y21	**V81**
Cu x (GOST 6651-2009), 3-wire, define RTD factor x in option Y21	**V82**
Cu x (GOST 6651-2009), 4-wire, define RTD factor x in option Y21	**V83**

SITRANS TH320 (HART, universal)

Options	Order code
Append "**-Z**" to Article No., add order code and, if applicable, free text.	
Device settings	
Measuring range setting temperature input: Start of scale value (max. 5 characters), full scale value (max. 5 characters), unit (°C, °F, °Ra, K)	**Y01**
Customer-specific programming in plain text (n-lines)	**Y09**
Long tag (device parameter, max. 32 characters), adhesive label	**Y15**
Measuring point description (device parameter, max. 32 characters), adhesive label	**Y16**
Input 1: RTD factor; e.g. factor "200" = Pt200, adhesive label	**Y21**

Accessories

	Article No.
Additional accessories for assembly, connection and transmitter configuration, see page 2/154.	
Modems	
Modem with USB interface	**7MF4997-1DB**
Modem with USB interface and SIPROM T software	**7NG3092-8KN**
SIMATIC PDM parameterization software	See Catalog FI 01 section 8
Mounting rail adapter for head transmitter (Quantity delivered: 5 units)	**7NG3092-8KA**
Connecting cable 4-wire, 200 mm (7.97 inch), for input connections when using head transmitters in the high hinged cover (set with 5 units)	**7NG3092-8KC**

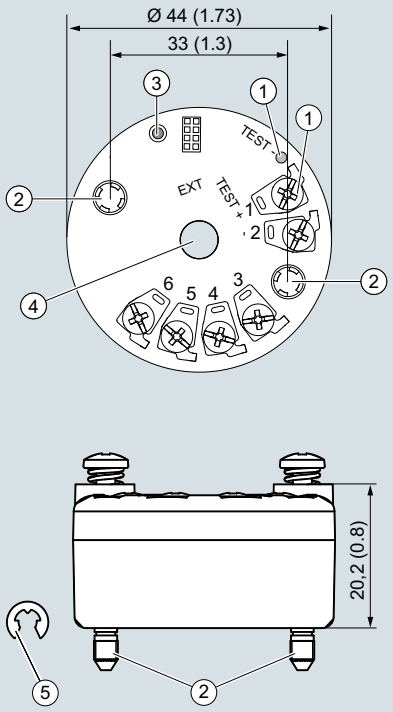
Ordering example

7NG0310-0BA00-0AA0-Z Y01
Y01: -10 ... +100 °C

Factory setting

- Pt100 (IEC 60751); 3-wire connection
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current
  - Device error: < 3.6 mA
  - Input circuit wire break: 22.8 mA
  - Input circuit short circuit: 22.4 mA
  - Input monitoring wire break and short-circuit
- No trimming of input and output (offset)
- Damping 0.0 s

Dimensional drawings



1 Test terminal
2 Mounting screw M4
3 LED
4 Internal diameter of center hole 6.3 (0.25)
5 Lock washer DIN 6799 - 3.2 A2

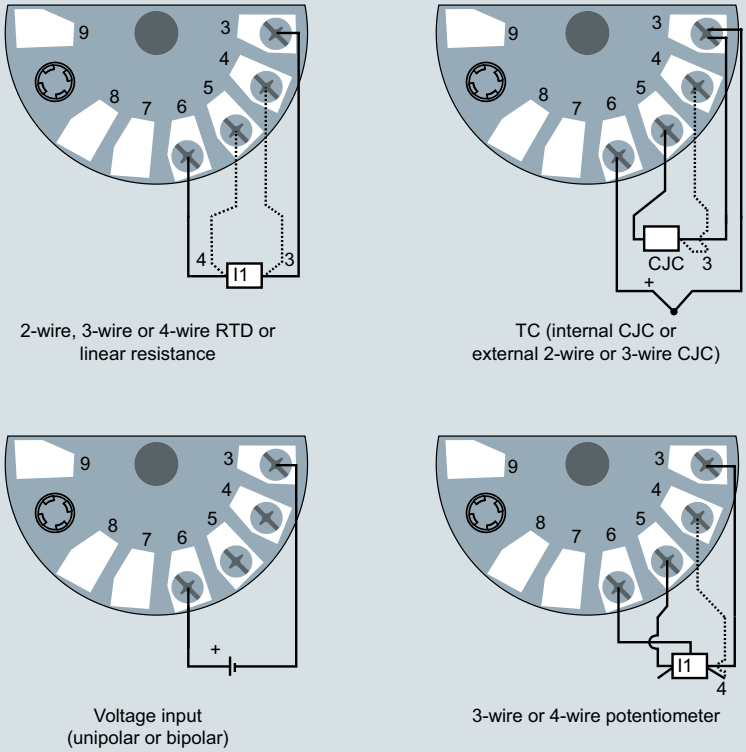
1(+) and 2(-)	Output terminals
3, 4, 5 and 6	Input terminals

SITRANS TH320, dimensions and pin assignment, dimensions in mm (inch)

Circuit diagrams

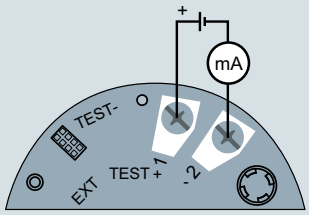
Connections

Input connection



SITRANS TH320, input connection assignment

Output connection



SITRANS TH320, output connection assignment

SITRANS TH420 (HART, universal)

Overview

- 2-wire head transmitter with HART communications interface
- Mounting in the connection head of the temperature sensor
- Universal input for virtually any type of temperature sensor
- Connection of two independent input circuits for redundant operation (high input availability)
- Input drift detection
- Configurable via HART 7

Benefits

- Compact design
- Connection of two independent input circuits for redundant operation (high input availability)
- Flexible mounting and center hole allow you to select your preferred type of installation
- Galvanic isolation
- Test terminals for ammeter
- Diagnostics LED (green/red)
- Input monitoring
  wire break, short circuit and drift
- Self-monitoring
- Configuration status stored in EEPROM
- SIL2/3 (with order note C20)
- Expanded diagnostic functions, such as slave pointer, operating hours counter, etc.
- Special characteristic
- Electromagnetic compatibility according to DIN EN 61326 and NE21

Application

The SITRANS TH420 transmitter with two inputs can be used in all sectors. Its compact size means that it can be installed in connection heads of type B or larger. Due to its universal input module, the following sensors and signal sources can be connected in redundant operation (high input availability):

- 2 resistance thermometers (2-wire, 3-wire, 4-wire connection)
- 2 thermocouples
- 2 linear resistors, potentiometer and DC voltage sources

The output signal is a load-independent direct current from 4 to 20 mA in accordance with the input characteristic, superimposed by the digital HART signal.

The dual input mode also supports drift detection of the inputs, whereby maintenance intervals can be more easily planned.

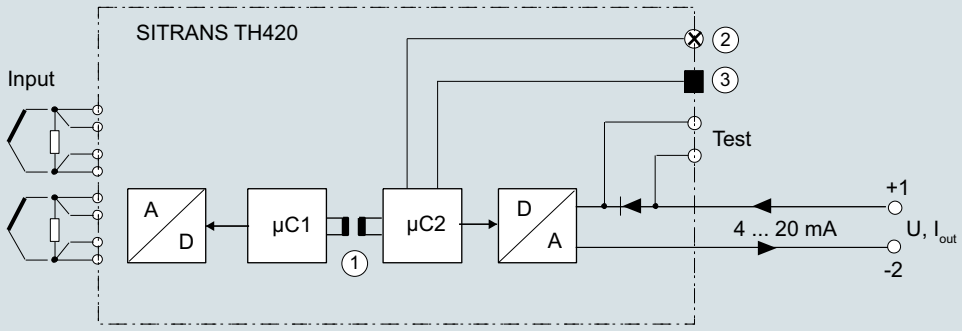
Transmitters of the "intrinsically safe or Zone 2 increased safety" type of protection can be installed in hazardous areas. The device meets the requirements of the EU Directive 2014/34/EU (ATEX), the FM and CSA regulations as well as other national approvals.

Function

The SITRANS TH420 is configured via HART. The configuration can be carried out using a handheld communicator or, more conveniently, with a HART modem and the SIMATIC PDM configuration software. The configuration data are then permanently stored in the non-volatile memory (EEPROM).

After correct connection of input and supply voltage, the transmitter outputs a temperature-linear output signal and the diagnostics LED is green. In case of external errors, e.g. sensor short circuit or interruption, the LED flashes red; an internal error is indicated by a permanent red light.

An ammeter can be connected at any time for checking and plausibility via the test terminals. The output current can be read without any interruption, or even without opening the current loop.



Input		Output	
A/D	Analog-digital converter	µC2	Microcontroller, primary circuit
µC1	Microcontroller, secondary circuit	D/A	Digital-analog converter
		U	Supply Voltage
		I_{out}	Output current
①	Galvanic isolation	②	LED
		③	Extension port

SITRANS TH420, function block diagram

2

Technical specifications

General	
Supply voltage[1) 2)]	
• Without explosion protection (non-Ex)	7.5 ... 48 V DC
• with explosion protection (Ex i)	7.5 ... 30 V DC
Additional minimum supply voltage when using test terminals	0.8 V
Maximum power loss	≤ 850 mW
Minimum load resistance at supply voltage > 37 V	(V_{supply} - 37 V)/23 mA
Insulation voltage, test/operation	
• Without explosion protection (non-Ex)	2.5 kV AC/55 V AC
• with explosion protection (Ex i)	2.5 kV AC/42 V AC
Polarity protection	All inputs and outputs
Write protection	Open circuits or software
Warming-up time	< 5 min
Starting time	< 2.75 s
Programming	HART
Signal-to-noise ratio	> 60 dB
Long-term stability	Better than: • ± 0.05% of measuring span/year • ± 0.18% of measuring span/5 years
Response time	≤ 75 ms (typically 70 ms)
Programmable damping	0 ... 60 s
Signal dynamic	
• Input	24 bit
• Output	18 bit
Influence of change in supply voltage	< 0.005% of measuring span/V DC
Input	
Resistance thermometer (RTD)	
Input type	
• Pt10 ... 10000	• IEC 60751 • JIS C 1604-8 • GOST 6651_2009 • Callendar-Van Dusen
• Ni10 ... 10000	• DIN 43760-1987 • GOST 6651-2009/OIML R84:2003
• Cu5 ... 1000	• Edison Copper Winding No. 15 • GOST 6651-2009/OIML R84:2003
Type of connection	2-wire, 3-wire or 4-wire
Line resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the line resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8)	Max. 30 nF
• All other input types	Max. 50 nF
Fault detection, programmable	None, short-circuited, defective, short-circuited or defective
	Note When the low limit for the configured input type is below the constant detection limit for short-circuited inputs, the detection of short circuits is disabled regardless of the configuration of the fault detection.
Detection limit for short-circuited input	15 Ω
Fault detection time (RTD)	≤ 75 ms (typically 70 ms)
Fault detection time (for 3-wire and 4-wire)	≤ 2 000 ms

Thermocouples (TC)	
Input type	
• B	IEC 60584-1
• E	IEC 60584-1
• J	IEC 60584-1
• K	IEC 60584-1
• L	DIN 43710
• Lr	GOST 3044-84
• N	IEC 60584-1
• R	IEC 60584-1
• S	IEC 60584-1
• T	IEC 60584-1
• U	DIN 43710
• W3	ASTM E988-96
• W5	ASTM E988-96
• LR	GOST 3044-84
Cold junction compensation (CJC)	Constant, internal or external over Pt100 or Ni100 RTD
• Temperature range internal CJC	-50 ... +100 °C (-58 ... +212 °F)
• Connection external CJC	2-wire, 3-wire or 4-wire
• External CJC, line resistance per wire (for 3-wire and 4-wire connections)	50 Ω
• Effect of the line resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
• Input current external CJC	< 0.15 mA
• Temperature range external CJC	-50 ... +135 °C (-58 ... +275 °F)
• Cable, wire-wire capacity	Max. 50 nF
• Total line resistance	Max. 10 kΩ
• Fault detection, programmable	None, short-circuited, defective, short-circuited or defective
	Note The short-circuited fault detection only applies to the CJC input.
• Fault detection time (TC)	≤ 75 ms (typically 70 ms)
• Fault detection time, external CJC (for 3-wire and 4-wire)	≤ 2 000 ms
Linear resistance	
Input range	0 ... 100 kΩ
Minimum measuring span	25 Ω
Type of connection	2-wire, 3-wire or 4-wire
Line resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the line resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• R > 400 Ω	Max. 30 nF
• R ≤ 400 Ω	Max. 50 nF
Fault detection, programmable	None, defective
Potentiometers	
Input range	10 ... 100 kΩ
Minimum measuring span	25 Ω
Type of connection	3-wire, 4-wire or 5-wire
Line resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the line resistance (with 4-wire and 5-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• R > 400 Ω	Max. 30 nF
• R ≤ 400 Ω	Max. 50 nF

Fault detection, programmable	None, short-circuited, defective, short-circuited or defective
	Note
	When the configured potentiometer size is below the constant detection limit for short-circuited inputs, the detection of short circuits is disabled regardless of the configuration of the fault detection.
Detection limit for short-circuited input	15 Ω
Fault detection time, wiper arm (no short-circuit detection)	≤ 75 ms (typically 70 ms)
Fault detection time, element	≤ 2 000 ms
Fault detection time (for 4-wire and 5-wire)	≤ 2 000 ms
Voltage input	
Measuring range	
• Unipolar	-100 ... 1700 mV
• Bipolar	-800 ... +800 mV
Minimum measuring span	2.5 mV
Input resistance	10 MΩ
Cable, wire-wire capacity	
• Input range: -100 ... 1700 mV	Max. 30 nF
• Input range: -20 ... 100 mV	Max. 50 nF
Fault detection, programmable	None, defective
Fault detection time	≤ 75 ms (typically 70 ms)
Output and HART communication	
Normal range, programmable	3.8 ... 20.5 mA/20.5 ... 3.8 mA
Extended range (output limits), programmable	3.5 ... 23 mA/23 ... 3.5 mA
Programmable input/output limits	
• Fault current	Enable/disable
• Fault current setting	3.5 ... 23 mA
Update time	10 ms
Load (with current output)	≤ (V_{Supply} - 7.5)/0.023 Ω
Load stability	< 0.01% of meas. span/100 Ω (measuring span = currently selected range)
Input fault detection, programmable (detection of input short circuits is ignored with TC and voltage inputs)	3.5 ... 23 mA
NAMUR NE43 Upscale	> 21 mA
NAMUR NE43 Downscale	< 3.6 mA
HART protocol versions	HART 7
Measuring accuracy	
Input accuracy	See "Input accuracy" table
Output accuracy	See "Output accuracy" table
Rated conditions	
Ambient temperature	-50 ... +85 °C (-58 ... +185 °F)
Ambient temperature for devices with functional safety	-40 ... +80 °C (-40 ... +176 °F)
Storage temperature	-50 ... +85 °C (-58 ... +185 °F)
Reference temperature for sensor calibration	24 °C ±1.0 °C (75.2 °F ±1.8 °F)
Relative humidity	< 99% (no condensation)
Degree of protection	
• Transmitter enclosure	IP68
• Terminals	IP00

Design	
Weight	50 g (0.11 lb)
Maximum core cross-section	1 x 1.5 mm² (stranded wire)
Tightening torque for clamping screws	0.4 Nm
Vibrations	IEC 60068-2-6
• 2 ... 25 Hz	± 1.6 mm (0.07 inch)
• 25 ... 100 Hz	± 4 g
Certificates and approvals	
Explosion protection ATEX/IECEx and others	
Certificates[3]	DEKRA 17ATEX0116 X IECEx DEK 17.0054X A5E43700604A-2018X
"Intrinsic safety ia/ib" type of protection	For use in Zone 0, 1, 2, 20, 21, 22
• ATEX	II 1 G Ex ia IIC T6 ... T4 Ga II 2(1) G Ex ib [ia Ga] IIC T6 ... T4 Gb II 1 D Ex ia IIIC Da I M1 Ex ia I Ma
• IECEx and others	Ex ia IIC T6 ... T4 Ga Ex ib [ia Ga] IIC T6 ... T4 Gb Ex ia IIIC Da Ex ia I Ma
"Intrinsic safety ic" type of protection	For use in Zones 2 and 22
• ATEX	II 2 G Ex ic IIC T6…T4 Gc II 2 D Ex ic IIIC Dc
• IECEx and others	Ex ic IIC T6 ... T4 Gc Ex ic IIIC Dc
"Non-sparking/increased safety nA/ec" type of protection	For use in Zones 2 and 22
• ATEX	II 2 G Ex nA IIC T6…T4 Gc II 2 G Ex ec IIC T6…T4 Gc
• IECEx and others	Ex nA IIC T6 ... T4 Gc Ex ec IIC T6 ... T4 Gc
Explosion protection CSA/FM for Canada and USA	
Certificates	CSA 1861385 FM18CA0024 FM18US0046
"Intrinsic safety ia" type of protection	IS, CL I, Div 1, GP ABCD, T6 ... T4 Ex ia IIC T6 … T4 Ga AEx ia IIC T6 … T4 Ga or: Ex ib [ia Ga] IIC T6…T4 Gb AEx ib [ia Ga] IIC T6…T4 Gb
"Non incendive field wiring NIFW" type of protection	NIFW, CL I, Div 2, GP ABCD T6 ... T4
"Non incendive NI" type of protection	NI, CL I, Div 2, GP ABCD T6...T4 Ex nA IIC T6 ... T4 Gc AEx nA IIC T6 ... T4 Gc

1) Note that the minimum supply voltage must correspond to the value measured at the terminals of the SITRANS TH420.
All external voltage drops must be taken into consideration.

2) Protect the device from overvoltage with the help of a suitable power supply or suitable overvoltage protection equipment.

3) Additional available certificates are listed on the Internet at http://www.siemens.com/processinstrumentation/certificates

SITRANS TH420 (HART, universal)

Measuring ranges/Minimum measuring span

RTD

Input type	Standard	Measuring range in °C (°F)	α_0 in $°C^{-1}$ ($°F^{-1}$)	Minimum measuring span in °C (°F)
Pt10 ... 10000	IEC 60751	-200 ... +850 (-328 ... +1 562)	0.003851 (0.002139)	10 (50)
	JIS C 1604-8	-200 ... +649 (-328 ... +1 200)	0.003916 (0.002176)	10 (50)
	GOST 6651_2009	-200 ... +850 (-328 ... +1 562)	0.003910 (0.002172)	10 (50)
	Callendar-Van Dusen	-200 ... +850 (-328 ... +1 562)	-	10 (50)
Ni10 ... 10000	DIN 43760-1987	-60 ... +250 (-76 ... +482)	0.006180 (0.003433)	10 (50)
	GOST 6651-2009/OIML R84:2003	-60 ... +180 (-76 ... +356)	0.006170 (0.003428)	10 (50)
Cu5 ... 1000	Edison Copper Winding No. 15	-200 ... +260 (-328 ... +500)	0.004270 (0.002372)	100 (212)
	GOST 6651-2009/OIML R84:2003	-180 ... +200 (-292 ... +392)	0.004280 (0.002378)	100 (212)
	GOST 6651-94	-50 ... +200 (-58 ... +392)	0.004260 (0.002367)	100 (212)

TC

Input type	Standard	Measuring range in °C (°F)	Minimum measuring span in °C (°F)
B	IEC 60584-1	0 (85) ... 1 820 (32 (185) ... 3 308)	100 (212)
E	IEC 60584-1	-200 ... +1 000 (-392 ... +1 832)	50 (122)
J	IEC 60584-1	-100 ... +1 200 (-212 ... +2 192)	50 (122)
K	IEC 60584-1	-180 ... +1 372 (-356 ... +2 502)	50 (122)
L	DIN 43710	-200 ... +900 (-392 ... +1 652)	50 (122)
Lr	GOST 3044-84	-200 ... +800 (-392 ... +1 472)	50 (122)
N	IEC 60584-1	-180 ... +1 300 (-356 ... +2 372)	50 (122)
R	IEC 60584-1	-50 ... +1 760 (-122 ... +3 200)	100 (212)
S	IEC 60584-1	-50 ... +1 760 (-122 ... +3 200)	100 (212)
T	IEC 60584-1	-200 ... +400 (-392 ... +752)	50 (122)
U	DIN 43710	-200 ... +600 (-392 ... +1 112)	50 (122)
W3	ASTM E988-96	0 ... 2 300 (32 ... 4 172)	100 (212)
W5	ASTM E988-96	0 ... 2 300 (32 ... 4 172)	100 (212)
LR	GOST 3044-84	-200 ... +800 (-392 ... +1472)	50 (122)

Input accuracy

Basic values

Input type	Basic accuracy	Temperature coefficient[1)]
RTD		
Pt10	≤ ±0.8 °C (1.44 °F)	≤ ±0.020 °C/°C (°F/°F)
Pt20	≤ ±0.4 °C (0.72 °F)	≤ ±0.010 °C/°C (°F/°F)
Pt50	≤ ±0.16 °C (0.288 °F)	≤ ±0.004 °C/°C (°F/°F)
Pt100	≤ ±0.04 °C (0.072 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt200	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt500	$T_{max.}$ < 180 °C (356 °F) = ≤ ±0.08 °C (0.144 °F) $T_{max.}$ > 180 °C (356 °F) = ≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt1000	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt2000	$T_{max.}$ < 300 °C (572 °F) = ≤ ±0.08 °C (0.144 °F) $T_{max.}$ > 300 °C (572 °F) = ≤ ±0.4 °C (0.72 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt10000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Ni10	≤ ±1.6 °C (2.88 °F)	≤ ±0.020 °C/°C (°F/°F)
Ni20	≤ ±0.8 °C (1.44 °F)	≤ ±0.010 °C/°C (°F/°F)
Ni50	≤ ±0.32 °C (0.576 °F)	≤ ±0.004 °C/°C (°F/°F)
Ni100	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni120	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni200	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni500	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni1000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)

Input type	Basic accuracy	Temperature coefficient[1]
Ni2000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni10000	≤ ±0.32 °C (0.576 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Cu5	≤ ±1.6 °C (2.88 °F)	≤ ±0.040 °C/°C (°F/°F)
Cu10	≤ ±0.8 °C (1.44 °F)	≤ ±0.020 °C/°C (°F/°F)
Cu20	≤ ±0.4 °C (0.72 °F)	≤ ±0.010 °C/°C (°F/°F)
Cu50	≤ ±0.16 °C (0.288 °F)	≤ ±0.004 °C/°C (°F/°F)
Cu100	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu200	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu500	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu1000	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Linear resistance		
0 ... 400 Ω	≤ ±40 mΩ	≤ ±2 mΩ/°C (1.11 mΩ/°F)
0 ... 100 kΩ	≤ ±4 Ω	≤ ±0.2 Ω/°C (0.11 Ω/°F)
Potentiometers		
0 ... 100%	< 0.05%	< ± 0.005%
Voltage input		
mV: -20 ... 100 mV	≤ ±5 µV	≤ ±0.2 µV/°C (0.11 µV/°F)
mV: -100 ... 1700 mV	≤ ±0.1 mV	≤ ±36 µV/°C (20 µV/°F)
mV: ± 800 mV	≤ ±0.1 mV	≤ ±32 µV/°C (17.8 µV/°F)
TC		
E	≤ ±0.2 °C (0.36 °F)	≤ ±0.025 °C/°C (°F/°F)
J	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
K	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
L	≤ ±0.35 °C (0.63 °F)	≤ ±0.025 °C/°C (°F/°F)
N	≤ ±0.4 °C (0.72 °F)	≤ ±0.025 °C/°C (°F/°F)
T	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
U	< 0 °C (32 °F) ≤ ±0.8 °C (1.44 °F) ≥ 0 °C (32 °F) ≤ ±0.4 °C (0.72 °F)	≤ ±0.025 °C/°C (°F/°F)
Lr	≤ ±0.2 °C (0.36 °F)	≤ ±0.1 °C/°C (°F/°F)
R	< 200 °C (392 °F) ≤ ±0.5 °C (0.9 °F) ≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
S	< 200 °C (392 °F) ≤ ±0.5 °C (0.9 °F) ≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
W3	≤ ±0.6 °C (1.08 °F)	≤ ±0.1 °C/°C (°F/°F)
W5	≤ ±0.4 °C (0.72 °F)	≤ ±0.1 °C/°C (°F/°F)
B[2]	≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
B[3]	≤ ±3 °C (5.4 °F)	≤ ±0.1 °C/°C (°F/°F)
B[4]	≤ ±8 °C (14.4 °F)	≤ ±0.8 °C/°C (°F/°F)
B[5]	Not specified	Not specified
CJC (internal)	< ±0.5 °C (0.9 °F)	Included in basic accuracy
CJC (external)	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)

1) Temperature coefficients correspond to the specified values or 0.002% of the input span, depending on which value is greater.
2) Accuracy of the specification range > 400 °C (752 °F)
3) Accuracy of the specification range > 160 °C (320 °F) < 400 °C (752 °F)
4) Accuracy of the specification range > 85 °C (185 °F) < 160 °C (320 °F)
5) Accuracy of the specification range < 85 °C (185 °F)

Output accuracy

Output type	Basic accuracy	Temperature coefficient
Average value measurement	Average of accuracy of input 1 and input 2	Average of temperature coefficient of input 1 and input 2
Differential measurement	Sum of accuracy of input 1 and input 2	Sum of temperature coefficient of input 1 and input 2
Analog output	≤ ±1.6 µA (0.01% of the full output span)	≤ ±0.48 µA/K (≤ ±0.003% of the full output span/K)

SITRANS TH420 (HART, universal)

Selection and ordering data

	Article No.	Order code
SITRANS TH420 **Head transmitter with 2 inputs** ↗	**7NG041**	- - - 0
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.		
Communication		
With HART	**0**	
Primary value output		
Input 1	**0**	
Input 1, input 2 as redundancy	**1**	
Input 2, input 1 as redundancy	**2**	
Average input 1 and input 2, both as redundancy	**3**	
Minimum input 1 and input 2, both as redundancy	**4**	
Maximum input 1 and input 2, both as redundancy	**5**	
Difference input 1 - input 2	**6**	
Difference input 2 - input 1	**7**	
Absolute difference	**8**	
Primary value output, customer-specific		
Minimum input 1 and input 2, without redundancy	**9**	**H 1 A**
Maximum input 1 and input 2, without redundancy	**9**	**H 1 B**
Average input 1 and input 2, without redundancy	**9**	**H 1 C**
Input 2	**9**	**H 1 D**
Input 1, type		
RTD		
• Pt100 (IEC), 3-wire	**B**	
• Pt100 (IEC), 4-wire	**C**	
• Pt1000 (IEC), 3-wire	**D**	
• Pt1000 (IEC), 4-wire	**E**	
TC		
• Type B	**F**	
• Type E	**G**	
• Type J	**H**	
• Type K	**J**	
• Type L	**K**	
• Type N	**L**	
• Type R	**N**	
• Type S	**P**	
• Type T	**Q**	
Potentiometer, 4-wire	**R**	
Input 1, type customer-specific		
Define customer-specific input configurations in V options	**Y**	

	Article No.	Order code
SITRANS TH420 **Head transmitter with 2 inputs**	**7NG041**	- - - - - 0
Input 2, type		
Without input 2	**A**	
RTD		
• Pt100 (IEC), 3-wire	**B**	
• Pt100 (IEC), 4-wire	**C**	
• Pt1000 (IEC), 3-wire	**D**	
• Pt1000 (IEC), 4-wire	**E**	
TC		
• Type B	**F**	
• Type E	**G**	
• Type J	**H**	
• Type K	**J**	
• Type L	**K**	
• Type N	**L**	
• Type R	**N**	
• Type S	**P**	
• Type T	**Q**	
Potentiometer, 4-wire	**R**	
Input 2, type customer-specific		
Define customer-specific input configurations in W options	**Y**	
CJC configuration for TC		
Input 1: no CJC; input 2: No CJC	**0**	
Input 1: internal CJC; input 2: internal CJC	**1**	
Input 1: external CJC; input 2: external CJC; define type in option Jxx	**2**	
Input 1: external CJC; define type in option Jxx; input 2: internal CJC	**3**	
Input 1: internal CJC; input 2: external CJC; define type in option Jxx	**4**	
Input 1: Internal CJC; Input 2: No CJC	**5**	
Input 1: External CJC (define type in option Jxx); input 2: No CJC	**6**	
Materials not in contact with media		
Without	**0**	
Type of protection		
General safety (non-Ex); CE, RCM, FM, KCC, EAC	**A**	
Intrinsic safety (Ex i) / Non-incendive field wiring (NIFW) / Increased safety zone 2 (Ex ec) / Non incendive (NI) (ATEX, IECEx, EACEx, CSA, FM, NEPSI, Inmetro)	**N**	
Electrical connection/cable entry		
Without	**A**	
Local HMI		
Without display	**0**	

Options	Order code
Append "**-Z**" to Article No., add order code and, if applicable, free text.	
Manufacturer declarations	
Quality inspection certificate, 5-point factory calibration (IEC 60770-2)	**C11**
Certificates for functional safety	
Functional safety SIL2/3 (IEC 61508)	**C20**
Device options	
PDF file with device settings	**D10**
Without labeling of the measuring range on the TAG plate	**D41**
Jumper plug set on device for write protection	**D81**
Jumper plug set on device for fault current > 21 mA (instead of < 3.6 mA) (only non-SIL)	**D82**
External CJC types	
Pt100, IEC 60751, 3-wire	**J02**
Pt100, IEC 60751, 4-wire	**J03**
Ni100, DIN 43760-87, 3-wire	**J05**
Ni100, DIN 43760-87, 4-wire	**J06**
Input 1: TC	
Type C W5	**V01**
Type D W3	**V02**
Type U	**V03**
Type Lr	**V04**
Input 1: Potentiometers	
Potentiometer, 5-wire	**V31**
Input 1: RTD	
Pt x (IEC), 3-wire, define RTD factor x in option Y21	**V61**
Pt x (IEC), 4-wire, define RTD factor x in option Y21	**V62**
Pt x (JIS C1604-81), 3-wire, define RTD factor x in option Y21	**V64**
Pt x (JIS C1604-81), 4-wire, define RTD factor x in option Y21	**V65**
Pt x (GOST 6651-2009), 3-wire, define RTD factor x in option Y21	**V67**
Pt x (GOST 6651-2009), 4-wire, define RTD factor x in option Y21	**V68**
Ni x (DIN 43760-87), 3-wire, define RTD factor x in option Y21	**V70**
Ni x (DIN 43760-87), 4-wire, define RTD factor x in option Y21	**V71**
Ni x (GOST 6651-2009), 3-wire, define RTD factor x in option Y21	**V73**
Ni x (GOST 6651-2009), 4-wire, define RTD factor x in option Y21	**V74**
Cu x (ECW-15), 3-wire, define RTD factor x in option Y21	**V76**
Cu x (ECW-15), 4-wire, define RTD factor x in option Y21	**V77**
Cu x (GOST 6651-94), 3-wire, define RTD factor x in option Y21	**V79**
Cu x (GOST 6651-94), 4-wire, define RTD factor x in option Y21	**V80**
Cu x (GOST 6651-2009), 3-wire, define RTD factor x in option Y21	**V82**
Cu x (GOST 6651-2009), 4-wire, define RTD factor x in option Y21	**V83**
Input 2: TC	
Type C W5	**W01**
Type D W3	**W02**
Type U	**W03**
Type Lr	**W04**

Options	Order code
Append "**-Z**" to Article No., add order code and, if applicable, free text.	
Device settings	
Measuring range setting temperature input: Start of scale value (max. 5 characters), full scale value (max. 5 characters), unit (°C, °F, °Ra, K)	**Y01**
Customer-specific programming in plain text (n-lines)	**Y09**
Input 1: RTD factor; e.g. factor "200" = Pt200, adhesive label	**Y21**
Long tag (device parameter, max. 32 characters), adhesive label	**Y15**
Measuring point description (device parameter, max. 32 characters), adhesive label	**Y16**
Input 1: RTD factor; e.g. factor "200" = Pt200, adhesive label	**Y21**

Accessories

	Article No.
Additional accessories for assembly, connection and transmitter configuration, see page 2/154.	
Modems	
Modem with USB interface	**7MF4997-1DB**
SIMATIC PDM parameterization software	See Catalog FI 01 section 8
Mounting rail adapter for head transmitter (Quantity delivered: 5 units)	**7NG3092-8KA**
Connecting cable 4-wire, 200 mm (7.87 inch), for input connections when using head transmitters in the high hinged cover (set with 5 units)	**7NG3092-8KC**

Ordering example

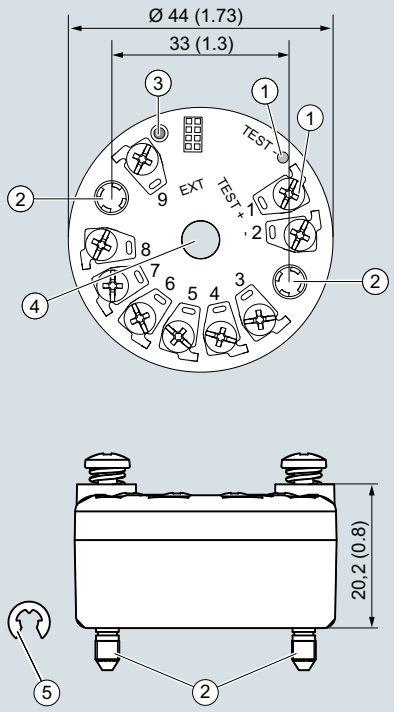
7NG0410-0BA00-0AA0-Z Y01

Y01: -10 ... +100 °C

Factory setting

- Input 1: Pt100 (IEC 751); 3-wire connection
- Input 2: not configured (inactive)
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current
  - Device error: < 3.6 mA
  - Input circuit wire break: 22.8 mA
  - Input circuit short circuit: 22.4 mA
  - Input circuit drift: 22 mA (active when input 2 is active)
  - Input monitoring wire break and short-circuit
- No trimming of input and output (offset)
- Damping 0.0 s

Dimensional drawings



(1) Test terminal
(2) Mounting screw M4
(3) LED
(4) Internal diameter of center hole 6.3 (0.25)
(5) Lock washer DIN 6799 - 3.2 A2

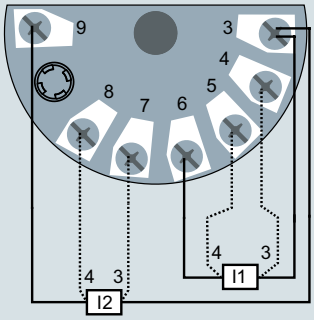
1(+) and 2(-)	Output terminals
3, 4, 5, 6, 7, 8 and 9	Input terminals

SITRANS TH420, dimensions and pin assignment, dimensions in mm (inch)

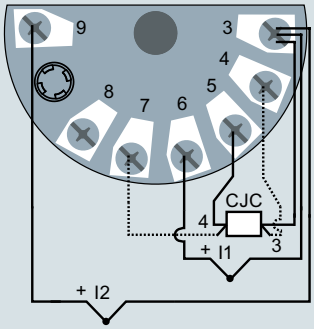
Circuit diagrams

Connections

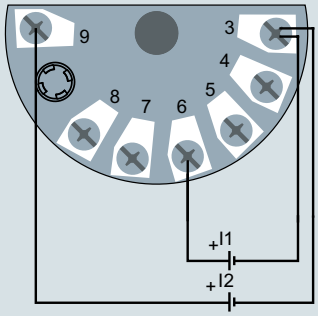
Input connection



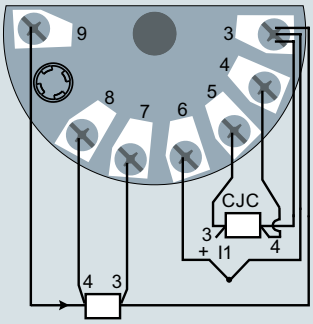
Input 1 and/or input 2:
2-wire, 3-wire or 4-wire RTD or
linear resistance



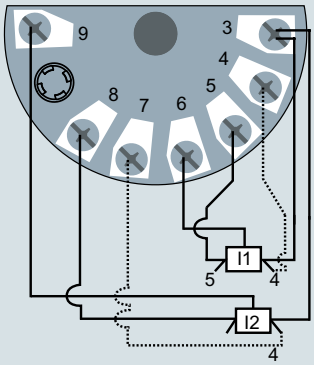
Input 1 and/or input 2:
TC (internal CJC or
external 2-wire, 3-wire or
4-wire CJC)



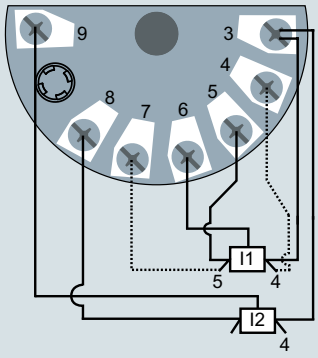
Input 1 and/or input 2:
Voltage input
(unipolar or bipolar)



Input 1: TC (internal CJC or
external 2-wire or 3-wire CJC)
Input 2: 2-wire, 3-wire or 4-wire RTD



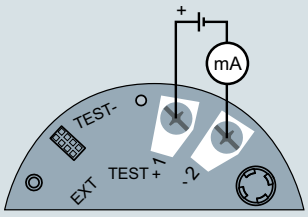
Input 1 and/or Input 2:
3-wire or 4-wire potentiometer



Input 1: 5-wire potentiometer
Input 2: 3-wire potentiometer

SITRANS TH420, input connection assignment

Output connection



SITRANS TH420, output connection assignment

SITRANS TR200 (4 to 20 mA, universal)

Overview

Keep flexible - with the universal SITRANS TR200 transmitter

- 2-wire device for 4 to 20 mA
- Enclosure for rail mounting
- Universal input for virtually any type of temperature sensor
- Configurable over PC

Benefits

- Compact design
- Galvanic isolation
- Test sockets for multimeters
- Diagnostics LED (green/red)
- Sensor monitoring
  open circuits and short-circuits
- Self-monitoring
- Configuration status stored in EEPROM
- Expanded diagnostic functions, such as slave pointer, operating hours counter, etc.
- Special characteristic
- Electromagnetic compatibility to EN 61326 and NE21
- SIL2 (with order note C20), SIL2/3 (with C23)

Application

SITRANS TR200 transmitters can be used in all industrial sectors. Their compact design enables simple mounting on standard DIN rails on-site in protective boxes or in control cabinets. The following sensors/signal sources can be connected over their universal input module:

- Resistance thermometer (2, 3, 4-wire connection)
- Thermocouples
- Resistance-based sensors and DC voltage sources

The output signal is a direct current from 4 to 20 mA in accordance with the sensor characteristic.

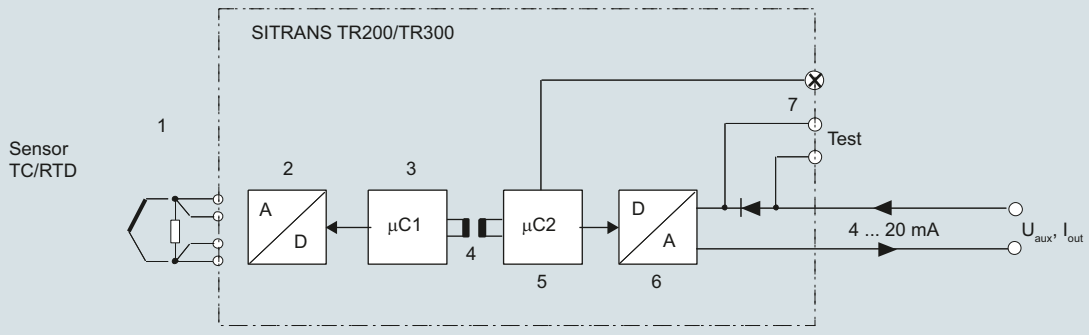
Transmitters of the "intrinsically safe" type of protection can be installed within potentially explosive atmospheres. The devices meet the directive 2014/34/EU (ATEX).

Function

The SITRANS TR200 is configured over a PC. For this purpose, the USB or RS 232 modem is connected to the output terminals. The configuration data can now be edited using the SIPROM T software tool. The configuration data are then permanently stored in the non-volatile memory (EEPROM).

Once the sensors and power supply have been correctly connected, the transmitter outputs a temperature-linear output signal and the diagnostics LED displays a green light. In the case of a sensor break, the LED flashes red, an internal device fault is indicated by a steady red light.

The test socket can be used to connect an ammeter at any time for monitoring purposes and plausibility checks. The output current can be read without any interruption, or even without opening the current loop.



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

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

SITRANS TR200 function diagram

Technical specifications

Input	
Resistance thermometer	
Measured variable	Temperature
Sensor type	
• According to IEC 60751	Pt25 … Pt1000
• Acc. to JIS C 1604; a=0.00392 K^{-1}	Pt25 … Pt1000
• According to IEC 60751	Ni25 … Ni1000
• Special type	Via special characteristic (max. 30 points)
Sensor factor	0.25 ... 10 (adaptation of the basic type, e.g. Pt100 to version Pt25 ... 1000)
Units	°C or °F
Connection	
• Standard connection	1 resistance thermometer (RTD) in 2-wire, 3-wire or 4-wire connection
• Averaging	2 resistance thermometers in 2-wire connection for generation of average temperature
• Differentiation	2 resistance thermometers (RTD) in 2-wire connection (RTD 1 – RTD 2 or RTD 2 – RTD 1)
Connection	
• 2-wire connection	Line resistance can be configured ≤100 Ω (loop resistance)
• 3-wire connection	No trim necessary
• 4-wire connection	No trim necessary
Sensor current	≤ 0.45 mA
Response time T_{63}	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Always active (cannot be switched off)
Short-circuit monitoring	Can be switched on/off (default value: ON)
Measuring range	Assignable (see "Digital measuring error" table)
Min. measuring span	10 °C (18 °F)
Characteristic curve	Temperature-linear or special characteristic
Resistance-based sensor	
Measured variable	Actual resistance
Sensor type	Resistance-based, potentiometers
Units	Ω
Connection	
• Standard connection	1 resistance-based sensor (R) in 2-wire, 3-wire or 4-wire connection
• Averaging	2 resistance-based sensors in 2-wire connection for averaging
• Differentiation	2 resistance thermometers in 2-wire connection (R1 – R2 or R2 – R1)
Connection	
• 2-wire connection	Line resistance can be configured ≤100 Ω (loop resistance)
• 3-wire connection	No trim necessary
• 4-wire connection	No trim necessary
Sensor current	≤ 0.45 mA
Response time T_{63}	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Always active (cannot be switched off)
Short-circuit monitoring	Can be switched on/off (default value: OFF)
Measuring range	Assignable max. 0 ... 2200 Ω (see "Digital measuring error" table)
Min. measuring span	5 ... 25 Ω (see "Digital measuring error" table)
Characteristic curve	Resistance-linear or special characteristic

Thermocouples	
Measured variable	Temperature
Sensor type (thermocouples)	
• Type B	Pt30Rh-Pt6Rh acc. to IEC 584
• Type C	W5%-Re acc. to ASTM 988
• Type D	W3%-Re acc. to ASTM 988
• Type E	NiCr-CuNi acc. to IEC 584
• Type J	Fe-CuNi acc. to IEC 584
• Type K	NiCr-Ni acc. to IEC 584
• Type L	Fe-CuNi acc. to DIN 43710
• Type N	NiCrSi-NiSi acc. to IEC 584
• Type R	Pt13Rh-Pt acc. to IEC 584
• Type S	Pt10Rh-Pt acc. to IEC 584
• Type T	Cu-CuNi acc. to IEC 584
• Type U	Cu-CuNi acc. to DIN 43710
Units	°C or °F
Connection	
• Standard connection	1 thermocouple (TC)
• Averaging	2 thermocouples (TC)
• Differentiation	2 thermocouples (TC) (TC1 – TC2 or TC2 – TC1)
Response time T_{63}	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Can be switched off
Reference junction compensation	
• Internal	With integrated Pt100 resistance thermometer
• External	With external Pt100 IEC 60751 (2-wire or 3-wire connection)
• External fixed	Reference junction temperature can be set as fixed value
Measuring range	Assignable (see "Digital measuring error" table)
Min. measuring span	Min. 40 ... 100 °C (72 ... 180 °F) (see "Digital measuring error" table)
Characteristic curve	Temperature-linear or special characteristic
mV sensor	
Measured variable	DC voltage
Sensor type	DC voltage source (DC voltage source possible over an externally connected resistor)
Units	mV
Response time T_{63}	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Can be switched off
Measuring range	Assignable max. -100 … 1100 mV
Min. measuring span	2 mV or 20 mV
Overload capability of the input	-1.5 ... +3.5 V DC
Input resistance	≥ 1 MΩ
Characteristic curve	Voltage-linear or special characteristic

SITRANS TR200 (4 to 20 mA, universal)

Output	
Output signal	4 ... 20 mA, 2-wire
Auxiliary power	11 ... 35 V DC (to 30 V with Ex i/ic; to 32 V with Ex nA)
Max. load	$(U_{aux} - 11\ V)/0.023\ A$
Overrange	3.6 ... 23 mA, infinitely adjustable (default range: 3.84 mA ... 20.5 mA)
Error signal (e.g. following sensor fault) (conforming to NE43)	3.6 ... 23 mA, infinitely adjustable (default value: 22.8 mA)
Sample cycle	0.25 s nominal
Damping	Software filter 1st order 0 ... 30 s (parameterizable)
Protection	Against reverse polarity
Galvanic isolation	Input against output 2.12 kV DC (1.5 kV_{rms} AC)
Measuring accuracy	
Digital measuring error	See "Digital measuring error" table
Reference conditions	
• Auxiliary power	24 V ± 1 %
• Load	500 Ω
• Ambient temperature	23 °C
• Warming-up time	> 5 min
Error in the analog output (digital/analog converter)	< 0.025 % of measuring span
Error due to internal reference junction	< 0.5 °C (0.9 °F)
Effect of ambient temperature	
• Analog measuring error	0.02 % of meas. span/10 °C (18 °F)
• Digital measuring error	
- With resistance thermometer	0.06 °C (0.11 °F)/10 °C (18 °F)
- With thermocouples	0.6 °C (1.1 °F)/10 °C (18 °F)
Auxiliary power effect	< 0.001 % of meas. span/V
Effect of load impedance	< 0.002 % of meas. span/100 Ω
Long-term drift	
• In the first month	< 0.02 % of measuring span
• After one year	< 0.2 % of measuring span
• After 5 years	< 0.3 % of measuring span
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
Electromagnetic compatibility	According to EN 61326 and NE21
Design	
Material	Plastic, electronic module potted
Weight	122 g
Dimensions	See "Dimensional drawings"
Cross-section of cables	Max. 2.5 mm^2 (AWG 13)
Degree of protection according to IEC 60529	
• Enclosure	IP20

Certificates and approvals	
Explosion protection ATEX	
EC type-examination certificate	PTB 07 ATEX 2032X
• "Intrinsic safety" type of protection	II 2(1) G Ex ia/ib IIC T6/T4 II 3(1) G Ex ia/ic IIC T6/T4 II 3 G Ex ic IIC T6/T4 II 2(1) D Ex iaD/ibD 20/21 T115 °C
• "Non-sparking equipment" type of protection	II 3 G Ex nA IIC T6/T4
Other certificates	NEPSI and EAC Ex
Software requirements for SIPROM T	
PC operating system	Windows ME, 2000, XP, Win 7 and Win 8; in connection with RS 232 modem, also Windows 95, 98 and 98SE

Factory setting:

- Pt100 (IEC 751); 3-wire connection
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

Digital measuring error

Resistance thermometer

Input	Measuring range	Minimum measuring span		Digital accuracy	
	°C (°F)	°C	(°F)	°C	(°F)
According 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)
According 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 sensor

Input	Measuring range	Minimum measuring span	Digital accuracy
	Ω	Ω	Ω
Resistance	0 ... 390	5	0.05
Resistance	0 ... 2200	25	0.25

Thermocouples

Input	Measuring range	Minimum measuring span		Digital accuracy	
	°C (°F)	°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	-200 ... +400 (-328 ... +752)	40	(72)	1	(1.8)
Type U	-200 ... +600 (-328 ... +1112)	50	(90)	2	(3.6)

[1] The digital accuracy in the range 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 range	Minimum measuring 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 measuring 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 reference junction errors in the case of thermocouple measurements).

Selection and ordering data

	Article No.
SITRANS TR200 rail transmitter Installation on mounting rail 2-wire system, 4 to 20 mA, programmable, with galvanic isolation	
• Without explosion protection	**7NG3032-0JN00**
• With explosion protection according to ATEX	**7NG3032-1JN00**

Options	**Order code**
Append suffix "**-Z**" to article no., add order code and plain text, if applicable.	
With test report (5 measuring points)	**C11**
Functional safety SIL2	**C20**
Functional safety SIL2/3	**C23**
Customer-specific programming	
Measuring range to be set Specify in plain text (max. 5 digits): Y01:... to ... °C, °F	**Y01**[1]
Measuring point number (TAG) max. 8 characters	**Y17**[2]
Measuring point description, max. 16 characters	**Y23**[2]
Measuring point message, max. 32 characters	**Y24**[2]
Text on front plate, max. 16 characters	**Y29**[2)3]
Pt100 (IEC) 2-wire, R_L = 0 W	**U02**[4]
Pt100 (IEC) 3-wire	**U03**[4]
Pt100 (IEC) 4-wire	**U04**[4]
Type B thermocouple	**U20**[4)5]
Type C thermocouple (W5)	**U21**[4)5]
Type D thermocouple (W3)	**U22**[4)5]
Type E thermocouple	**U23**[4)5]
Type J thermocouple	**U24**[4)5]
Type K thermocouple	**U25**[4)5]
Type L thermocouple	**U26**[4)5]
Type N thermocouple	**U27**[4)5]
Type R thermocouple	**U28**[1)4)5]
Type S thermocouple	**U29**[4)5]
Type T thermocouple	**U30**[4)5]
Type U thermocouple	**U31**[4)5]
For TC: Cold junction compensation: external (Pt100, 3-wire)	**U41**
For TC: Reference junction compensation: external with fixed value: specify in plain text	**Y50**
Enter special deviating customer-specific setting in plain text	**Y09**[6]
Fault current 3.6 mA (instead of 22.8 mA)	**U36**[2]

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) Text on front plate is not saved in the device.
4) For this selection, Y01 must also be selected.
5) Internal reference junction compensation is selected as the default for TC.
6) 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 2/154.	
Modem Modem with USB interface and SIPROM T software	**7NG3092-8KN**

For supply units, see Catalog FI01 section "Supplementary components"

Ordering example 1:

7NG3032-0JN00-Z Y01+Y17+Y29+U03
Y01: -10 ... +100 °C
Y17: TICA123
Y29: TICA123

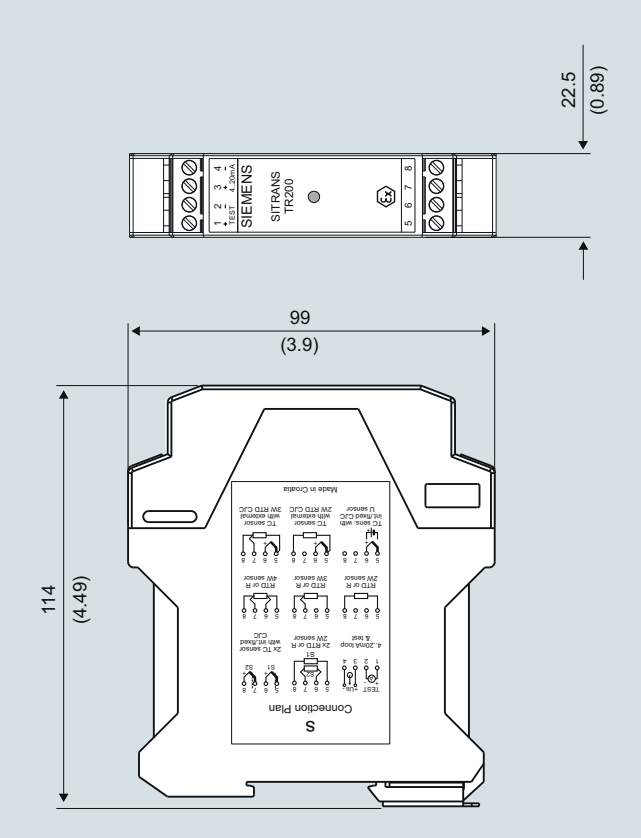
Ordering example 2:

7NG3032-0JN00-Z Y01+Y17+Y23+Y29+U25
Y01: -10 ... +100 °C
Y17: TICA123
Y23: TICA123HEAT
Y29: TICA123HEAT

Factory setting:

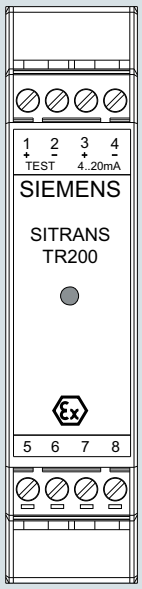
- Pt100 (IEC 751); 3-wire connection
- Measuring range: 0 … 100 °C (32 … 212 °F)
- Fault current: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

Dimensional drawings



SITRANS TR200, dimensions in mm (inch)

Circuit diagrams

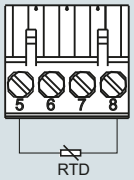
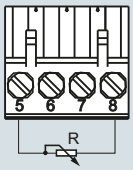
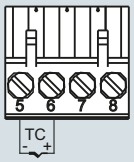
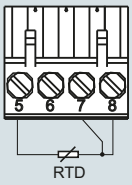
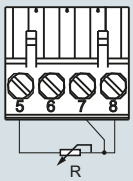
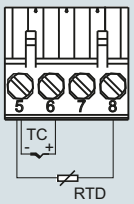
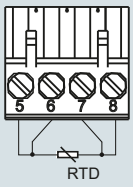
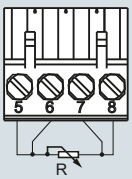
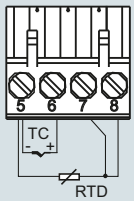
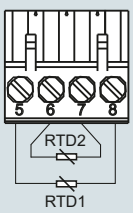
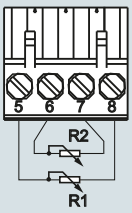
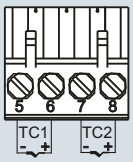


Connections

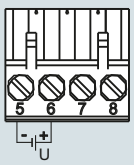
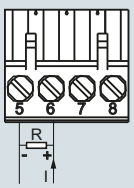
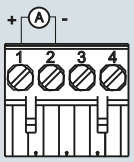
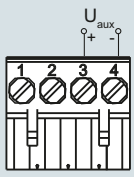
1 (+) and 2 (-)	Test terminals (test) for measurement of the output current with a multimeter
3 (+) and 4 (-)	Power supply U_{aux}, output current I_{out}
5, 6, 7 and 8	Sensor connection, see schematics

SITRANS TR200, connector assignment

SITRANS TR200 (4 to 20 mA, universal)

Resistance thermometer	Resistance	Thermocouple
 2-wire system [1]	 2-wire system [1]	 Cold junction compensation internal/fixed value
 3-wire system	 3-wire system	 Cold junction compensation with external Pt100 in 2-wire system [1]
 4-wire system	 4-wire system	 Cold junction compensation with external Pt100 in 3-wire system
 Generation of average value/difference [1]	 Generation of average value/difference [1]	 Generation of average value / difference with internal cold junction compensation

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

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

SITRANS TR200, sensor connection assignment

Overview

Robust and durable HART - the universal SITRANS TR300 transmitter

- 2-wire device for 4 to 20 mA, HART
- Device for rail mounting
- Universal input for virtually any type of temperature sensor
- Configurable over HART

Benefits

- Compact design
- Galvanic isolation
- Test sockets for multimeters
- Diagnostics LED (green/red)
- Sensor monitoring
  open circuits and short-circuits
- Self-monitoring
- Configuration status stored in EEPROM
- Expanded diagnostic functions, such as slave pointer, operating hours counter, etc.
- Special characteristic
- Electromagnetic compatibility to EN 61326 and NE21
- SIL2 (with order note C20), SIL2/3 (with C23)

Application

SITRANS TR300 transmitters can be used in all industrial sectors. Their compact design enables simple mounting on standard DIN rails on-site in protective boxes or in control cabinets. The following sensors/signal sources can be connected over their universal input module:

- Resistance thermometer (2, 3, 4-wire connection)
- Thermocouples
- Resistance-based sensors and DC voltage sources

The output signal is a direct current from 4 to 20 mA in accordance with the sensor characteristic, superimposed by the digital HART signal.

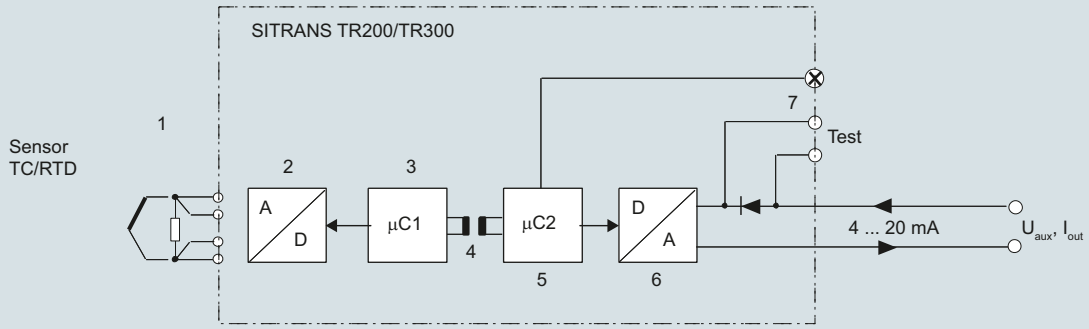
Transmitters of the "intrinsically safe" type of protection can be installed within potentially explosive atmospheres. The devices meet the directive 2014/34/EU (ATEX).

Function

The SITRANS TR300 is configured over HART. This can be done using a handheld communicator or even more conveniently with a HART modem and the SIMATIC PDM parameterization software. The configuration data are then permanently stored in the non-volatile memory (EEPROM).

Once the sensors and power supply have been correctly connected, the transmitter outputs a temperature-linear output signal and the diagnostics LED displays a green light. In the case of a sensor break, the LED flashes red, an internal device fault is indicated by a steady red light.

The test socket can be used to connect an ammeter at any time for monitoring purposes and plausibility checks. The output current can be read without any interruption, or even without opening the current loop.



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

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

SITRANS TR300 function diagram

SITRANS TR300 (4 to 20 mA, HART, universal)

Technical specifications

Input	
Resistance thermometer	
Measured variable	Temperature
Sensor type	
• According to IEC 60751	Pt25 … Pt1000
• Acc. to JIS C 1604; a=0.00392 K^{-1}	Pt25 … Pt1000
• According to IEC 60751	Ni25 … Ni1000
• Special type	Via special characteristic (max. 30 points)
Sensor factor	0.25 ... 10 (adaptation of the basic type, e.g. Pt100 to version Pt25 ... 1000)
Units	°C or °F
Connection	
• Standard connection	1 resistance thermometer (RTD) in 2-wire, 3-wire or 4-wire connection
• Averaging	2 identical resistance thermometers in 2-wire connection for generation of average temperature
• Differentiation	2 identical resistance thermometers (RTD) in 2-wire connection (RTD 1 – RTD 2 or RTD 2 – RTD 1)
Connection	
• 2-wire connection	Line resistance can be configured ≤100 Ω (loop resistance)
• 3-wire connection	No trim necessary
• 4-wire connection	No trim necessary
Sensor current	≤ 0.45 mA
Response time T_{63}	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Always active (cannot be switched off)
Short-circuit monitoring	Can be switched on/off (default value: ON)
Measuring range	Assignable (see "Digital measuring error" table)
Min. measuring span	10 °C (18 °F)
Characteristic curve	Temperature-linear or special characteristic
Resistance-based sensor	
Measured variable	Actual resistance
Sensor type	Resistance-based, potentiometers
Units	Ω
Connection	
• Standard connection	1 resistance-based sensor (R) in 2-wire, 3-wire or 4-wire connection
• Averaging	2 resistance-based sensors in 2-wire connection for averaging
• Differentiation	2 resistance thermometers in 2-wire connection (R1 – R2 or R2 – R1)
Connection	
• 2-wire connection	Line resistance can be configured ≤100 Ω (loop resistance)
• 3-wire connection	No trim necessary
• 4-wire connection	No trim necessary
Sensor current	≤ 0.45 mA
Response time T_{63}	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Always active (cannot be switched off)
Short-circuit monitoring	Can be switched on/off (default value: OFF)
Measuring range	Assignable max. 0 ... 2200 Ω (see "Digital measuring error" table)
Min. measuring span	5 ... 25 Ω (see "Digital measuring error" table)
Characteristic curve	Resistance-linear or special characteristic

Thermocouples	
Measured variable	Temperature
Sensor type (thermocouples)	
• Type B	Pt30Rh-Pt6Rh acc. to IEC 584
• Type C	W5%-Re acc. to ASTM 988
• Type D	W3%-Re acc. to ASTM 988
• Type E	NiCr-CuNi acc. to IEC 584
• Type J	Fe-CuNi acc. to IEC 584
• Type K	NiCr-Ni acc. to IEC 584
• Type L	Fe-CuNi acc. to DIN 43710
• Type N	NiCrSi-NiSi acc. to IEC 584
• Type R	Pt13Rh-Pt acc. to IEC 584
• Type S	Pt10Rh-Pt acc. to IEC 584
• Type T	Cu-CuNi acc. to IEC 584
• Type U	Cu-CuNi acc. to DIN 43710
Units	°C or °F
Connection	
• Standard connection	1 thermocouple (TC)
• Averaging	2 thermocouples (TC)
• Differentiation	2 thermocouples (TC) (TC1 – TC2 or TC2 – TC1)
Response time T_{63}	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Can be switched off
Reference junction compensation	
• Internal	With integrated Pt100 resistance thermometer
• External	With external Pt100 IEC 60751 (2-wire or 3-wire connection)
• External fixed	Reference junction temperature can be set as fixed value
Measuring range	Assignable (see "Digital measuring error" table)
Min. measuring span	Min. 40 ... 100 °C (72 ... 180 °F) (see "Digital measuring error" table)
Characteristic curve	Temperature-linear or special characteristic
mV sensor	
Measured variable	DC voltage
Sensor type	DC voltage source (DC voltage source possible over an externally connected resistor)
Units	mV
Response time T_{63}	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Can be switched off
Measuring range	Assignable max. -100 … 1100 mV
Min. measuring span	2 mV or 20 mV
Overload capability of the input	-1.5 ... +3.5 V DC
Input resistance	≥ 1 MΩ
Characteristic curve	Voltage-linear or special characteristic

Output	
Output signal	4 ... 20 mA, 2-wire with communication acc. to HART Rev. 5.9
Auxiliary power	11 ... 35 V DC (to 30 V with Ex i/ic; to 32 V with Ex nA)
Max. load	$(U_{aux} - 11\ V)/0.023\ A$
Overrange	3.6 ... 23 mA, infinitely adjustable (default range: 3.84 mA ... 20.5 mA)
Error signal (e.g. following sensor fault) (conforming to NE43)	3.6 ... 23 mA, infinitely adjustable (default value: 22.8 mA)
Sample cycle	0.25 s nominal
Damping	Software filter 1st order 0 ... 30 s (parameterizable)
Protection	Against reverse polarity
Galvanic isolation	Input against output 2.12 kV DC ($1.5\ kV_{rms}$ AC)
Measuring accuracy	
Digital measuring error	See "Digital measuring error" table
Reference conditions	
• Auxiliary power	24 V ± 1 %
• Load	500 Ω
• Ambient temperature	23 °C
• Warming-up time	> 5 min
Error in the analog output (digital/analog converter)	< 0.025 % of measuring span
Error due to internal reference junction	< 0.5 °C (0.9 °F)
Effect of ambient temperature	
• Analog measuring error of measuring span	< 0.02% of max. meas. span/10 °C (18 °F)
• Digital measuring error	0.06 °C (0.11 °F)/10 °C (18 °F)
- With resistance thermometers	0.6 °C (1.1 °F)/10°C (18 °F)
- With thermocouples	
Auxiliary power effect	< 0.001 % of meas. span/V
Effect of load impedance	< 0.002 % of meas. span/100 Ω
Long-term drift	
• In the first month	< 0.02 % of measuring span
• After one year	< 0.2 % of measuring span
• After 5 years	< 0.3 % of measuring span
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
Electromagnetic compatibility	According to EN 61326 and NE21
Design	
Material	Plastic, electronic module potted
Weight	122 g
Dimensions	See "Dimensional drawings"
Cross-section of cables	Max. 2.5 mm^2 (AWG 13)
Degree of protection according to IEC 60529	
• Enclosure	IP20
Certificates and approvals	
Explosion protection ATEX	
EC type-examination certificate	PTB 07 ATEX 2032X
• "Intrinsic safety" type of protection	II 2(1) G Ex ia/ib IIC T6/T4 II 3(1) G Ex ia/ic IIC T6/T4 II 3 G Ex ic IIC T6/T4 II 2(1) D Ex iaD/ibD 20/21 T115 °C
• "Non-sparking equipment" type of protection	II 3 G Ex nA IIC T6/T4
Other certificates	EAC Ex(GOST) and NEPSI

Factory setting:

- Pt100 (IEC 751); 3-wire connection
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

SITRANS TR300 (4 to 20 mA, HART, universal)

Digital measuring error

Resistance thermometer

Input	Measuring range	Minimum measuring span		Digital accuracy	
	°C (°F)	°C	(°F)	°C	(°F)
According 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)
According 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 sensor

Input	Measuring range	Minimum measuring span	Digital accuracy
	Ω	Ω	Ω
Resistance	0 ... 390	5	0.05
Resistance	0 ... 2200	25	0.25

Thermocouples

Input	Measuring range	Minimum measuring span		Digital accuracy	
	°C (°F)	°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	-200 ... +400 (-328 ... +752)	40	(72)	1	(1.8)
Type U	-200 ... +600 (-328 ... +1112)	50	(90)	2	(3.6)

[1)] The digital accuracy in the range 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 range	Minimum measuring 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 measuring 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 reference junction errors in the case of thermocouple measurements).

Selection and ordering data

	Article No.
SITRANS TR300 rail transmitter Installation on mounting rail 2-wire system, 4 … 20 mA, HART, with galvanic isolation	
• Without explosion protection	**7NG3033-0JN00**
• With explosion protection according to ATEX	**7NG3033-1JN00**

Options	Order code
Append suffix "**-Z**" to article no., add order code and plain text, if applicable.	
With test report (5 measuring points)	**C11**
Functional safety SIL2	**C20**
Functional safety SIL2/3	**C23**
Customer-specific programming	
Measuring range to be set Specify in plain text (max. 5 digits): Y01:... to ... °C, °F	**Y01**[1]
Measuring point number (TAG) max. 8 characters	**Y17**[2]
Measuring point description, max. 16 characters	**Y23**[2]
Measuring point message, max. 32 characters	**Y24**[2]
Text on front plate, max. 16 characters	**Y29**[2)3]
Pt100 (IEC) 2-wire, R_L = 0 Ω	**U02**[4]
Pt100 (IEC) 3-wire	**U03**[4]
Pt100 (IEC) 4-wire	**U04**[4]
Type B thermocouple	**U20**[4)5]
Type C thermocouple (W5)	**U21**[4)5]
Type D thermocouple (W3)	**U22**[4)5]
Type E thermocouple	**U23**[4)5]
Type J thermocouple	**U24**[4)5]
Type K thermocouple	**U25**[4)5]
Type L thermocouple	**U26**[4)5]
Type N thermocouple	**U27**[4)5]
Type R thermocouple	**U28**[4)5]
Type S thermocouple	**U29**[4)5]
Type T thermocouple	**U30**[4)5]
Type U thermocouple	**U31**[4)5]
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	**Y09**[6]
Fault current 3.6 mA (instead of 22.8 mA)	**U36**[2]

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) Text on front plate is not saved in the device.
4) For this selection, Y01 must also be selected.
5) Internal reference junction compensation is selected as the default for TC.
6) 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 2/154.	
Modem	
Modem with USB interface	**7MF4997-1DB**
SIMATIC PDM operating software	**See section 8**

For supply units, see Catalog FI01 section "Supplementary components"

Ordering example 1:

7NG3033-0JN00-Z Y01+Y17+Y29+U03
Y01: -10 ... +100 °C
Y17: TICA123
Y29: TICA123

Ordering example 2:

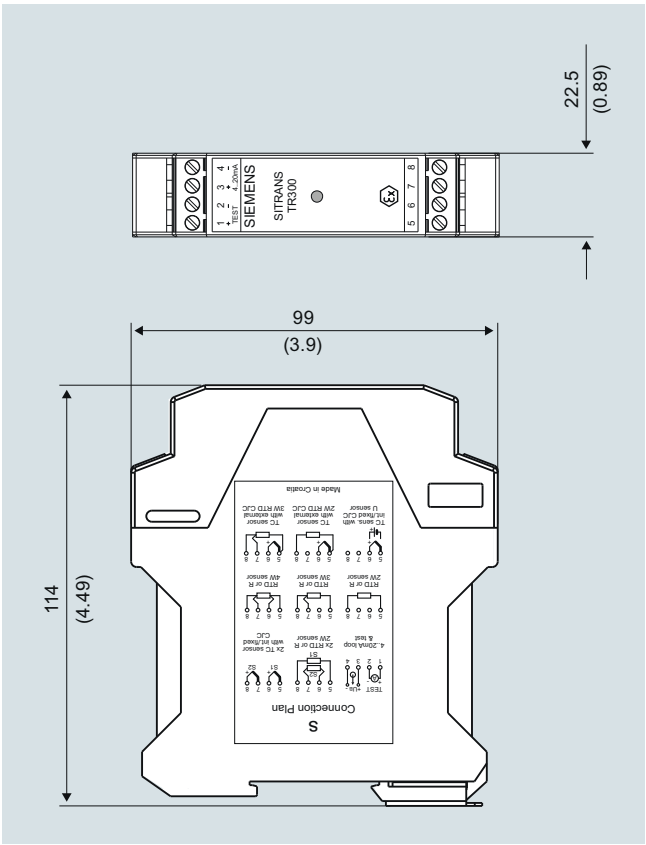
7NG3033-0JN00-Z Y01+Y17+Y23+Y29+U25
Y01: -10 ... +100 °C
Y17: TICA123
Y23: TICA123HEAT
Y29: TICA123HEAT

Factory setting:

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

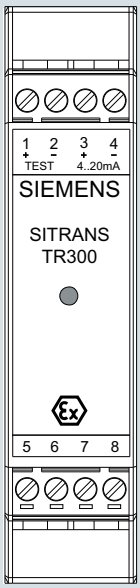
SITRANS TR300 (4 to 20 mA, HART, universal)

Dimensional drawings



SITRANS TR300, dimensions in mm (inch)

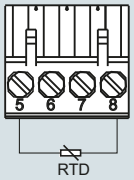
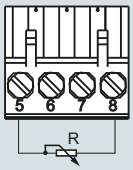
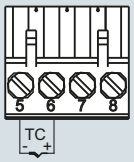
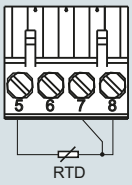
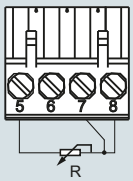
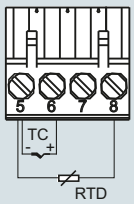
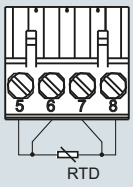
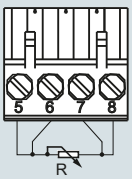
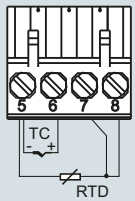
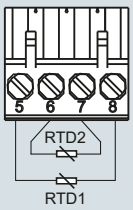
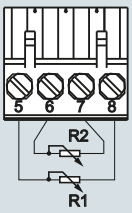
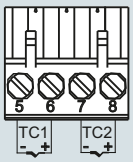
Circuit diagrams



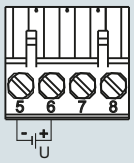
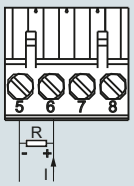
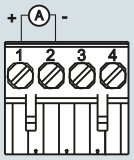
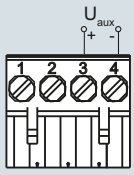
Connections

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

SITRANS TR300, connector assignment

Resistance thermometer	Resistance	Thermocouple
 2-wire system [1]	 2-wire system [1]	 Cold junction compensation internal/fixed value
 3-wire system	 3-wire system	 Cold junction compensation with external Pt100 in 2-wire system [1]
 4-wire system	 4-wire system	 Cold junction compensation with external Pt100 in 3-wire system
 Generation of average value/difference [1]	 Generation of average value/difference [1]	 Generation of average value / difference with internal cold junction compensation

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

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

SITRANS TR300, sensor connection assignment

SITRANS TR320 (HART, universal)

Overview

- 2-wire rail transmitter with and without HART communications interface
- Enclosure for rail mounting
- Universal input for virtually any type of temperature sensor
- Can be configured via PC, HART 7 or optional local operation

Benefits

- Compact design
- Galvanic isolation
- Test terminals for ammeter
- Diagnostics LED (green/red)
- Input monitoring
  Wire break and short-circuit
- Self-monitoring
- Configuration status stored in EEPROM
- Expanded diagnostic functions, such as slave pointer, operating hours counter, etc.
- Special characteristic
- Electromagnetic compatibility according to DIN EN 61326 and NE21
- SIL2/3 (with order note C20)

Application

SITRANS TR320 transmitters can be used in all sectors. Their compact design enables simple mounting on standard DIN rails on-site in protective boxes or in control cabinets. The following sensors/signal sources can be connected over their universal input module:

- Resistance thermometer (2-wire, 3-wire, 4-wire connection)
- Thermocouples
- Linear resistance, potentiometer and DC voltage sources

With HART communication interface:

- The output signal is a load-independent direct current from 4 to 20 mA in accordance with the input characteristic, superimposed by the digital HART signal.

Transmitters of the "intrinsically safe or Zone 2 increased safety" type of protection can be installed in hazardous areas. The device meets the requirements of the EU Directive 2014/34/EU (ATEX), the FM and CSA regulations as well as other national approvals.

Function

Without HART communications interface

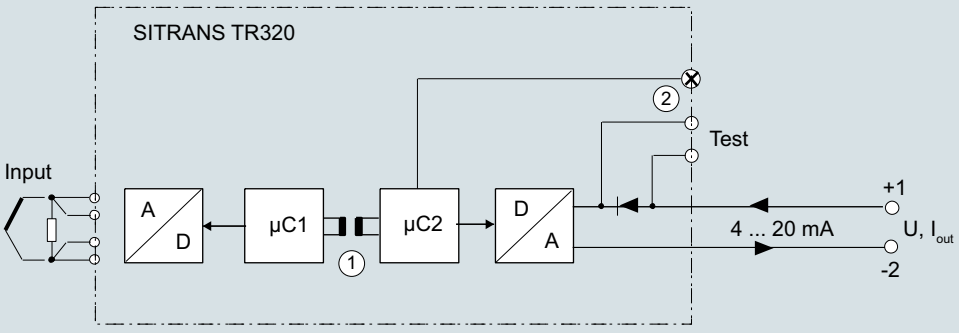
For the SITRANS TR320 without HART functionality, parameters are assigned with the PC. Available for this purpose are a special modem and the software tool SIPROM T.

With HART communications interface

- The SITRANS TR320 is configured via HART. The configuration can be carried out using a handheld communicator or, more conveniently, with a HART modem and the SIMATIC PDM configuration software. The configuration data are then permanently stored in the non-volatile memory (EEPROM).

After correct connection of input and supply voltage, the transmitter outputs a temperature-linear output signal and the diagnostics LED is green. In case of external errors, e.g. sensor short circuit or interruption, the LED flashes red; an internal error is indicated by a permanent red light.

An ammeter can be connected at any time for checking and plausibility via the test terminals. The output current can be read without any interruption, or even without opening the current loop.



Input		Output	
A/D	Analog-digital converter	µC2	Microcontroller, primary circuit
µC1	Microcontroller, secondary circuit	D/A	Digital-analog converter
		U	Supply Voltage
		I_{out}	Output current
①	Galvanic isolation	②	LED

SITRANS TR320 function block diagram

2

Technical specifications

General	
Supply voltage[1) 2)]	
• Without explosion protection (non-Ex)	7.5 ... 48 V DC
• with explosion protection (Ex i)	7.5 ... 30 V DC
Additional minimum supply voltage when using test terminals	0.8 V
Maximum power loss	≤ 850 mW
Minimum load resistance at supply voltage > 37 V	(V_{supply} - 37 V)/23 mA
Insulation voltage, test/operation	
• Without explosion protection (non-Ex)	2.5 kV AC/55 V AC
• with explosion protection (Ex i)	2.5 kV AC/42 V AC
Polarity protection	All inputs and outputs
Write protection	Open circuits or software
Warming-up time	< 5 min
Starting time	< 2.75 s
Programming	HART
Signal-to-noise ratio	> 60 dB
Long-term stability	Better than: • ± 0.05% of measuring span/year • ± 0.18% of measuring span/5 years
Response time	4 ... 20 mA: ≤ 55 ms HART: ≤ 75 ms (typically 70 ms)
Programmable damping	0 ... 60 s
Signal dynamic	
• Input	24 bit
• Output	18 bit
Influence of change in supply voltage	< 0.005% of measuring span/V DC
Input	
Resistance thermometer (RTD)	
Input type	
• Pt10 ... 10000	• IEC 60751 • JIS C 1604-8 • GOST 6651_2009 • Callendar-Van Dusen
• Ni10 ... 10000	• DIN 43760-1987 • GOST 6651-2009/OIML R84:2003
• Cu5 ... 1000	• Edison Copper Winding No. 15 • GOST 6651-2009/OIML R84:2003
Type of connection	2-wire, 3-wire or 4-wire
Line resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the line resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8)	Max. 30 nF
• All other input types	Max. 50 nF
Fault detection, programmable	None, short-circuited, defective, short-circuited or defective
	Note When the low limit for the configured input type is below the constant detection limit for short-circuited inputs, the detection of short circuits is disabled regardless of the configuration of the fault detection.
Detection limit for short-circuited input	15 Ω
Fault detection time (RTD)	≤ 75 ms (typically 70 ms)
Fault detection time (for 3-wire and 4-wire)	≤ 2 000 ms

Thermocouples (TC)	
Input type	
• B	IEC 60584-1
• E	IEC 60584-1
• J	IEC 60584-1
• K	IEC 60584-1
• L	DIN 43710
• Lr	GOST 3044-84
• N	IEC 60584-1
• R	IEC 60584-1
• S	IEC 60584-1
• T	IEC 60584-1
• U	DIN 43710
• W3	ASTM E988-96
• W5	ASTM E988-96
• LR	GOST 3044-84
Cold junction compensation (CJC)	Constant, internal or external over Pt100 or Ni100 RTD
• Temperature range internal CJC	-50 ... +100 °C (-58 ... +212 °F)
• Connection external CJC	2-wire or 3-wire
• External CJC, line resistance per wire (for 3-wire and 4-wire connections)	50 Ω
• Effect of the line resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
• Input current external CJC	< 0.15 mA
• Temperature range external CJC	-50 ... +135 °C (-58 ... +275 °F)
• Cable, wire-wire capacity	Max. 50 nF
• Total line resistance	Max. 10 kΩ
• Fault detection, programmable	None, short-circuited, defective, short-circuited or defective
	Note The short-circuited fault detection only applies to the CJC input.
• Fault detection time (TC)	≤ 75 ms (typically 70 ms)
• Fault detection time, external CJC (for 3-wire and 4-wire)	≤ 2 000 ms
Linear resistance	
Input range	0 ... 100 kΩ
Minimum measuring span	25 Ω
Type of connection	2-wire, 3-wire or 4-wire
Line resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the line resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• R > 400 Ω	Max. 30 nF
• R ≤ 400 Ω	Max. 50 nF
Fault detection, programmable	None, defective
Potentiometers	
Input range	10 ... 100 kΩ
Minimum measuring span	25 Ω
Type of connection	3-wire or 4-wire
Line resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the line resistance (with 4-wire and 5-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• R > 400 Ω	Max. 30 nF
• R ≤ 400 Ω	Max. 50 nF

Fault detection, programmable	None, short-circuited, defective, short-circuited or defective
	Note
	When the configured potentiometer size is below the constant detection limit for short-circuited inputs, the detection of short circuits is disabled regardless of the configuration of the fault detection.
Detection limit for short-circuited input	15 Ω
Fault detection time, wiper arm (no short-circuit detection)	≤ 75 ms (typically 70 ms)
Fault detection time, element	≤ 2 000 ms
Fault detection time (for 4-wire and 5-wire)	≤ 2 000 ms
Voltage input	
Measuring range	
• Unipolar	-100 ... 1700 mV
• Bipolar	-800 ... +800 mV
Minimum measuring span	2.5 mV
Input resistance	10 MΩ
Cable, wire-wire capacity	
• Input range: -100 ... 1700 mV	Max. 30 nF
• Input range: -20 ... 100 mV	Max. 50 nF
Fault detection, programmable	None, defective
Fault detection time	≤ 75 ms (typically 70 ms)
Output and HART communication	
Normal range, programmable	3.8 ... 20.5 mA/20.5 ... 3.8 mA
Extended range (output limits), programmable	3.5 ... 23 mA/23 ... 3.5 mA
Programmable input/output limits	
• Fault current	Enable/disable
• Fault current setting	3.5 ... 23 mA
Update time	10 ms
Load (with current output)	≤ (V_{Supply} - 7.5)/0.023 Ω
Load stability	< 0.01% of meas. span/100 Ω (measuring span = currently selected range)
Input fault detection, programmable (detection of input short circuits is ignored with TC and voltage inputs)	3.5 ... 23 mA
NAMUR NE43 Upscale	> 21 mA
NAMUR NE43 Downscale	< 3.6 mA
HART protocol versions	HART 7
Measuring accuracy	
Input accuracy	See "Input accuracy" table
Output accuracy	See "Output accuracy" table
Rated conditions	
Ambient temperature	-50 ... +85 °C (-58 ... +185 °F)
Ambient temperature for devices with functional safety	-40 ... +80 °C (-40 ... +176 °F)
Storage temperature	-50 ... +85 °C (-58 ... +185 °F)
Reference temperature for sensor calibration	24 °C ±1.0 °C (75.2 °F ±1.8 °F)
Relative humidity	< 99% (no condensation)
Degree of protection	
• Transmitter enclosure	IP20
• Terminals	IP20

Design	
Weight	122 g (0.27 lb)
Maximum core cross-section	2.5 mm² (AWG 13)
Tightening torque for clamping screws	0.5 ... 0.6 Nm
Vibrations	IEC 60068-2-6
• 2 ... 25 Hz	± 1.6 mm (0.07 inch)
• 25 ... 100 Hz	± 4 g
Certificates and approvals	
Explosion protection ATEX/IECEx and others	
Certificates[3)]	DEKRA 17ATEX0116 X IECEx DEK 17.0054X A5E43700604A-2018X
"Intrinsic safety ia/ib" type of protection	For use in Zone 0, 1, 2, 20, 21, 22
• ATEX	II 1 G Ex ia IIC T6 ... T4 Ga II 2(1) G Ex ib [ia Ga] IIC T6 ... T4 Gb II 1 D Ex ia IIIC Da I M1 Ex ia I Ma
• IECEx and others	Ex ia IIC T6 ... T4 Ga Ex ib [ia Ga] IIC T6 ... T4 Gb Ex ia IIIC Da Ex ia I Ma
"Intrinsic safety ic" type of protection	For use in Zones 2 and 22
• ATEX	II 2 G Ex ic IIC T6…T4 Gc II 2 D Ex ic IIIC Dc
• IECEx and others	Ex ic IIC T6 ... T4 Gc Ex ic IIIC Dc
"Non-sparking/increased safety nA/ec" type of protection	For use in Zones 2 and 22
• ATEX	II 2 G Ex nA IIC T6…T4 Gc II 2 G Ex ec IIC T6…T4 Gc
• IECEx and others	Ex nA IIC T6 ... T4 Gc Ex ec IIC T6 ... T4 Gc
Explosion protection CSA/FM for Canada and USA	
Certificates	CSA 1861385 FM18CA0024 FM18US0046
"Intrinsic safety ia" type of protection	IS, CL I, Div 1, GP ABCD, T6 ... T4 Ex ia IIC T6 … T4 Ga AEx ia IIC T6 … T4 Ga or: Ex ib [ia Ga] IIC T6…T4 Gb AEx ib [ia Ga] IIC T6…T4 Gb
"Non incendive field wiring NIFW" type of protection	NIFW, CL I, Div 2, GP ABCD T6 ... T4
"Non incendive NI" type of protection	NI, CL I, Div 2, GP ABCD T6...T4 Ex nA IIC T6 ... T4 Gc AEx nA IIC T6 ... T4 Gc

1) Note that the minimum supply voltage must correspond to the value measured at the terminals of the SITRANS TR320.
All external voltage drops must be taken into consideration.

2) Protect the device from overvoltage with the help of a suitable power supply or suitable overvoltage protection equipment.

3) Additional available certificates are listed on the Internet at http://www.siemens.com/processinstrumentation/certificates

SITRANS TR320 (HART, universal)

Measuring ranges/Minimum measuring span

RTD

Input type	Standard	Measuring range in °C (°F)	α_0 in $°C^{-1}$ ($°F^{-1}$)	Minimum measuring span in °C (°F)
Pt10 ... 10000	IEC 60751	-200 ... +850 (-328 ... +1 562)	0.003851 (0.002139)	10 (50)
	JIS C 1604-8	-200 ... +649 (-328 ... +1 200)	0.003916 (0.002176)	10 (50)
	GOST 6651_2009	-200 ... +850 (-328 ... +1 562)	0.003910 (0.002172)	10 (50)
	Callendar-Van Dusen	-200 ... +850 (-328 ... +1 562)	-	10 (50)
Ni10 ... 10000	DIN 43760-1987	-60 ... +250 (-76 ... +482)	0.006180 (0.003433)	10 (50)
	GOST 6651-2009/OIML R84:2003	-60 ... +180 (-76 ... +356)	0.006170 (0.003428)	10 (50)
Cu5 ... 1000	Edison Copper Winding No. 15	-200 ... +260 (-328 ... +500)	0.004270 (0.002372)	100 (212)
	GOST 6651-2009/OIML R84:2003	-180 ... +200 (-292 ... +392)	0.004280 (0.002378)	100 (212)
	GOST 6651-94	-50 ... +200 (-58 ... +392)	0.004260 (0.002367)	100 (212)

TC

Input type	Standard	Measuring range in °C (°F)	Minimum measuring span in °C (°F)
B	IEC 60584-1	0 (85) ... 1 820 (32 (185) ... 3 308)	100 (212)
E	IEC 60584-1	-200 ... +1 000 (-392 ... +1 832)	50 (122)
J	IEC 60584-1	-100 ... +1 200 (-212 ... +2 192)	50 (122)
K	IEC 60584-1	-180 ... +1 372 (-356 ... +2 502)	50 (122)
L	DIN 43710	-200 ... +900 (-392 ... +1 652)	50 (122)
Lr	GOST 3044-84	-200 ... +800 (-392 ... +1 472)	50 (122)
N	IEC 60584-1	-180 ... +1 300 (-356 ... +2 372)	50 (122)
R	IEC 60584-1	-50 ... +1 760 (-122 ... +3 200)	100 (212)
S	IEC 60584-1	-50 ... +1 760 (-122 ... +3 200)	100 (212)
T	IEC 60584-1	-200 ... +400 (-392 ... +752)	50 (122)
U	DIN 43710	-200 ... +600 (-392 ... +1 112)	50 (122)
W3	ASTM E988-96	0 ... 2 300 (32 ... 4 172)	100 (212)
W5	ASTM E988-96	0 ... 2 300 (32 ... 4 172)	100 (212)
LR	GOST 3044-84	-200 ... +800 (-392 ... +1472)	50 (122)

Input accuracy

Basic values

Input type	Basic accuracy	Temperature coefficient[1)]
RTD		
Pt10	≤ ±0.8 °C (1.44 °F)	≤ ±0.020 °C/°C (°F/°F)
Pt20	≤ ±0.4 °C (0.72 °F)	≤ ±0.010 °C/°C (°F/°F)
Pt50	≤ ±0.16 °C (0.288 °F)	≤ ±0.004 °C/°C (°F/°F)
Pt100	≤ ±0.04 °C (0.072 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt200	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt500	$T_{max.}$ < 180 °C (356 °F) = ≤ ±0.08 °C (0.144 °F) $T_{max.}$ > 180 °C (356 °F) = ≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt1000	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt2000	$T_{max.}$ < 300 °C (572 °F) = ≤ ±0.08 °C (0.144 °F) $T_{max.}$ > 300 °C (572 °F) = ≤ ±0.4 °C (0.72 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt10000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Ni10	≤ ±1.6 °C (2.88 °F)	≤ ±0.020 °C/°C (°F/°F)
Ni20	≤ ±0.8 °C (1.44 °F)	≤ ±0.010 °C/°C (°F/°F)
Ni50	≤ ±0.32 °C (0.576 °F)	≤ ±0.004 °C/°C (°F/°F)
Ni100	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni120	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni200	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni500	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni1000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)

Input type	Basic accuracy	Temperature coefficient[1]
Ni2000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni10000	≤ ±0.32 °C (0.576 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Cu5	≤ ±1.6 °C (2.88 °F)	≤ ±0.040 °C/°C (°F/°F)
Cu10	≤ ±0.8 °C (1.44 °F)	≤ ±0.020 °C/°C (°F/°F)
Cu20	≤ ±0.4 °C (0.72 °F)	≤ ±0.010 °C/°C (°F/°F)
Cu50	≤ ±0.16 °C (0.288 °F)	≤ ±0.004 °C/°C (°F/°F)
Cu100	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu200	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu500	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu1000	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Linear resistance		
0 ... 400 Ω	≤ ±40 mΩ	≤ ±2 mΩ/°C (1.11 mΩ/°F)
0 ... 100 kΩ	≤ ±4 Ω	≤ ±0.2 Ω/°C (0.11 Ω/°F)
Potentiometers		
0 ... 100%	< 0.05%	< ± 0.005%
Voltage input		
mV: -20 ... 100 mV	≤ ±5 µV	≤ ±0.2 µV/°C (0.11 µV/°F)
mV: -100 ... 1700 mV	≤ ±0.1 mV	≤ ±36 µV/°C (20 µV/°F)
mV: ± 800 mV	≤ ±0.1 mV	≤ ±32 µV/°C (17.8 µV/°F)
TC		
E	≤ ±0.2 °C (0.36 °F)	≤ ±0.025 °C/°C (°F/°F)
J	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
K	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
L	≤ ±0.35 °C (0.63 °F)	≤ ±0.025 °C/°C (°F/°F)
N	≤ ±0.4 °C (0.72 °F)	≤ ±0.025 °C/°C (°F/°F)
T	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
U	< 0 °C (32 °F) ≤ ±0.8 °C (1.44 °F) ≥ 0 °C (32 °F) ≤ ±0.4 °C (0.72 °F)	≤ ±0.025 °C/°C (°F/°F)
Lr	≤ ±0.2 °C (0.36 °F)	≤ ±0.1 °C/°C (°F/°F)
R	< 200 °C (392 °F) ≤ ±0.5 °C (0.9 °F) ≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
S	< 200 °C (392 °F) ≤ ±0.5 °C (0.9 °F) ≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
W3	≤ ±0.6 °C (1.08 °F)	≤ ±0.1 °C/°C (°F/°F)
W5	≤ ±0.4 °C (0.72 °F)	≤ ±0.1 °C/°C (°F/°F)
B[2]	≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
B[3]	≤ ±3 °C (5.4 °F)	≤ ±0.1 °C/°C (°F/°F)
B[4]	≤ ±8 °C (14.4 °F)	≤ ±0.8 °C/°C (°F/°F)
B[5]	Not specified	Not specified
CJC (internal)	< ±0.5 °C (0.9 °F)	Included in basic accuracy
CJC (external)	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)

1) Temperature coefficients correspond to the specified values or 0.002% of the input span, depending on which value is greater.
2) Accuracy of the specification range > 400 °C (752 °F)
3) Accuracy of the specification range > 160 °C (320 °F) < 400 °C (752 °F)
4) Accuracy of the specification range > 85 °C (185 °F) < 160 °C (320 °F)
5) Accuracy of the specification range < 85 °C (185 °F)

Output accuracy

Output type	Basic accuracy	Temperature coefficient
Analog output	≤ ±1.6 µA (0.01% of the full output span)	≤ ±0.48 µA/K (≤ ±0.003% of the full output span/K)

SITRANS TR320 (HART, universal)

Selection and ordering data

	Article No
SITRANS TR320 rail transmitter with 1 input ↗	**7NG032** - ■■■■■ - 0■■
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.	
Communication	
With HART	**0**
2-wire, 4 ... 20 mA	**7**
Primary value output	
Input 1	**0**
Input 1, type	
RTD	
• Pt100 (IEC), 3-wire	**B**
• Pt100 (IEC), 4-wire	**C**
• Pt1000 (IEC), 3-wire	**D**
• Pt1000 (IEC), 4-wire	**E**
TC	
• Type B	**F**
• Type E	**G**
• Type J	**H**
• Type K	**J**
• Type L	**K**
• Type N	**L**
• Type R	**N**
• Type S	**P**
• Type T	**Q**
Potentiometer, 4-wire	**R**
Input 1, type customer-specific	
Define customer-specific input configurations with V options	**Y**
Input 2, type	
Without input 2	**A**
CJC configuration for TC	
Without CJC	**0**
Internal CJC	**1**
External CJC Pt100 (IEC), 2-wire, define line resistance value in option Y53	**2**
External CJC Pt100 (IEC), 3-wire	**3**
External CJC Ni100 (DIN), 3-wire	**6**
Materials not in contact with media	
Without	**0**
Type of protection	
General safety (non-Ex); CE, RCM, FM, KCC, EAC	**A**
Intrinsic safety (Ex i) / Non-incendive field wiring (NIFW) / Increased safety zone 2 (Ex ec) / Non incendive (NI) (ATEX, IECEx, EACEx, CSA, FM, NEPSI, Inmetro)	**N**
Electrical connection/cable entry	
Without	**A**
Local HMI	
Without display	**0**

Options	Order code
Append "**-Z**" to Article No., add order code and, if applicable, free text.	
Manufacturer declarations	
Quality inspection certificate, 5-point factory calibration (IEC 60770-2)	**C11**
Certificates for functional safety	
Functional safety SIL2/3 (IEC 61508)	**C20**
Device options	
PDF file with device settings	**D10**
Without labeling of the measuring range on the TAG plate	**D41**
Jumper plug set on device for write protection	**D81**
Jumper plug set on device for fault current > 21 mA (instead of < 3.6 mA) (only non-SIL)	**D82**
Input 1: TC	
Type C W5	**V01**
Type D W3	**V02**
Type U	**V03**
Type Lr	**V04**
Input 1: RTD	
Pt x (IEC), 3-wire, define RTD factor x in option Y21	**V61**
Pt x (IEC), 4-wire, define RTD factor x in option Y21	**V62**
Pt x (JIS C1604-81), 3-wire, define RTD factor x in option Y21	**V64**
Pt x (JIS C1604-81), 4-wire, define RTD factor x in option Y21	**V65**
Pt x (GOST 6651-2009), 3-wire, define RTD factor x in option Y21	**V67**
Pt x (GOST 6651-2009), 4-wire, define RTD factor x in option Y21	**V68**
Ni x (DIN 43760-87), 3-wire, define RTD factor x in option Y21	**V70**
Ni x (DIN 43760-87), 4-wire, define RTD factor x in option Y21	**V71**
Ni x (GOST 6651-2009), 3-wire, define RTD factor x in option Y21	**V73**
Ni x (GOST 6651-2009), 4-wire, define RTD factor x in option Y21	**V74**
Cu x (ECW-15), 2-wire, define line resistance value in option Y51 and RTD factor x in option Y21	**V75**
Cu x (ECW-15), 3-wire, define RTD factor x in option Y21	**V76**
Cu x (ECW-15), 4-wire, define RTD factor x in option Y21	**V77**
Cu x (GOST 6651-94), 3-wire, define RTD factor x in option Y21	**V79**
Cu x (GOST 6651-94), 4-wire, define RTD factor x in option Y21	**V80**
Cu x (GOST 6651-2009), 3-wire, define RTD factor x in option Y21	**V82**
Cu x (GOST 6651-2009), 4-wire, define RTD factor x in option Y21	**V83**
Device settings	
Measuring range setting temperature input: Start of scale value (max. 5 characters), full scale value (max. 5 characters), unit (°C, °F, °Ra, K)	**Y01**
Customer-specific programming in plain text (n-lines)	**Y09**
Long tag (device parameter, max. 32 characters), adhesive label	**Y15**
Measuring point description (device parameter, max. 32 characters), adhesive label	**Y16**
Input 1: RTD factor; e.g. factor "200" = Pt200, adhesive label	**Y21**

Accessories

	Article No.
Additional accessories for assembly, connection and transmitter configuration, see page 2/154.	
Modems	
Modem with USB interface	**7MF4997-1DB**
Modem with USB interface and SIPROM T software	**7NG3092-8KN**
SIMATIC PDM parameterization software	See Catalog FI 01 section 8

Ordering example

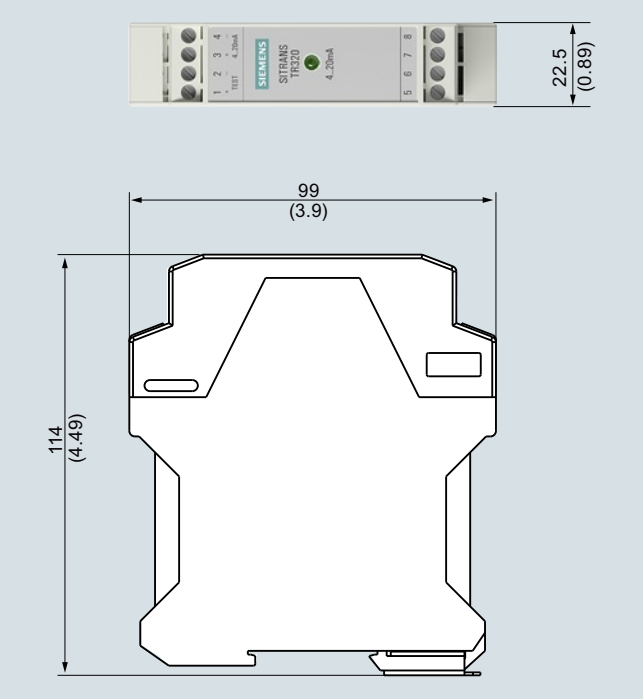
7NG0320-0BA00-0AA0-Z Y01

Y01: -10 ... +100 °C

Factory setting

- Pt100 (IEC 751); 3-wire connection
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current
  - Device error: < 3.6 mA
  - Input circuit wire break: 22.8 mA
  - Input circuit short circuit: 22.4 mA
  - Input monitoring wire break and short-circuit
- No trimming of input and output (offset)
- Damping 0.0 s

Dimensional drawings



SITRANS TR320, dimensions in mm (inch)

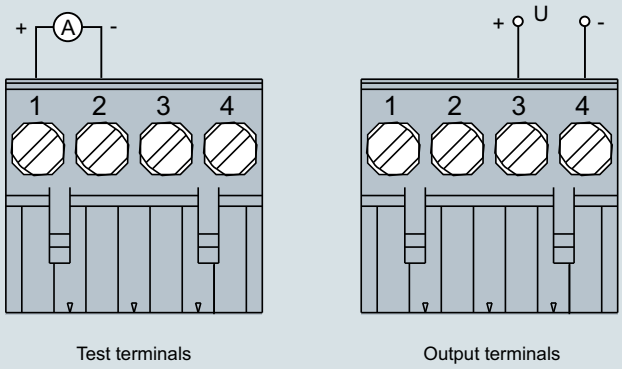
Circuit diagrams

Connections

1 (+) and 2 (-)	Test terminals for measurement of the output current with an amperemeter
3 (+) and 4 (-)	Output terminals
5, 6, 7 and 8	Input terminals

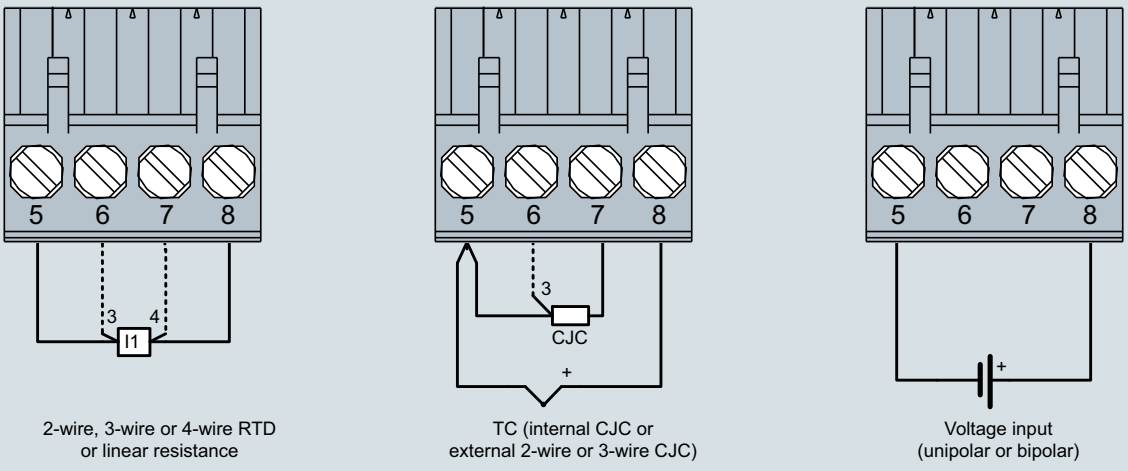
SITRANS TR320, connector assignment

Output and test connection



SITRANS TR320, output connection assignment

Input connection



SITRANS TR320, input connection assignment

Overview

- 2-wire rail transmitter with HART communications interface
- Device for rail mounting
- Universal input for virtually any type of temperature sensor
- Connection of two independent input circuits for redundant operation (high input availability)
- Input drift detection
- Configurable via HART 7

Benefits

- Compact design
- Connection of two independent input circuits for redundant operation (high input availability)
- Galvanic isolation
- Test terminals for ammeter
- Diagnostics LED (green/red)
- Input monitoring
  Wire break and short-circuit
- Self-monitoring
- Configuration status stored in EEPROM
- Expanded diagnostic functions, such as slave pointer, operating hours counter, etc.
- Special characteristic
- Electromagnetic compatibility according to DIN EN 61326 and NE21
- SIL2/3 (with order note C20)

Application

SITRANS TR420 transmitters with two inputs can be used in all sectors. Their compact design enables simple mounting on standard DIN rails on-site in protective boxes or in control cabinets. The following sensors/signal sources can be connected over their universal input module:

- 2 resistance thermometers (2-wire, 3-wire, 4-wire connection)
- 2 thermocouples
- 2 linear resistors, potentiometer and DC voltage sources

The output signal is a load-independent direct current from 4 to 20 mA in accordance with the input characteristic, superimposed by the digital HART signal.

The dual input mode also supports drift detection of the inputs, whereby maintenance intervals can be more easily planned.

Transmitters of the "intrinsically safe or Zone 2 increased safety" type of protection can be installed in hazardous areas. The device meets the requirements of the EU Directive 2014/34/EU (ATEX), the FM and CSA regulations as well as other national approvals.

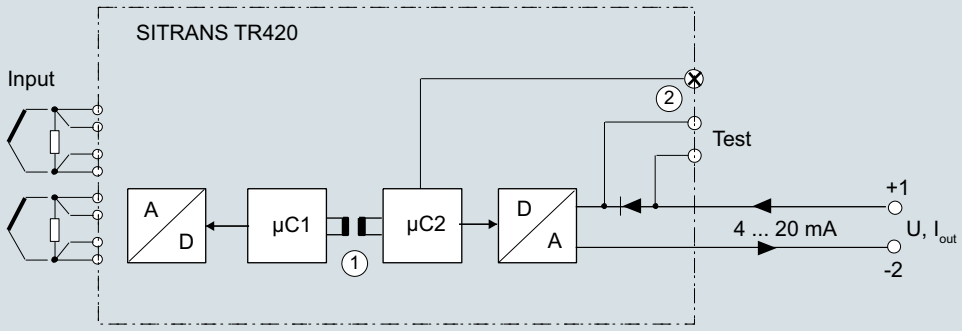
SITRANS TR420 (HART, universal)

Function

The SITRANS TR420 is configured via HART. The configuration can be carried out using a handheld communicator or, more conveniently, with a HART modem and the SIMATIC PDM configuration software. The configuration data are then permanently stored in the non-volatile memory (EEPROM).

After correct connection of input and supply voltage, the transmitter outputs a temperature-linear output signal and the diagnostics LED is green. In case of external errors, e.g. sensor short circuit or interruption, the LED flashes red; an internal error is indicated by a permanent red light.

An ammeter can be connected at any time for checking and plausibility via the test terminals. The output current can be read without any interruption, or even without opening the current loop.



Input		Output	
A/D	Analog-digital converter	µC2	Microcontroller, primary circuit
µC1	Microcontroller, secondary circuit	D/A	Digital-analog converter
		U	Supply Voltage
		I_{out}	Output current
①	Galvanic isolation	②	LED

SITRANS TR420, function block diagram

Technical specifications

General	
Supply voltage[1) 2)]	
• Without explosion protection (non-Ex)	7.5 ... 48 V DC
• with explosion protection (Ex i)	7.5 ... 30 V DC
Additional minimum supply voltage when using test terminals	0.8 V
Maximum power loss	≤ 850 mW
Minimum load resistance at supply voltage > 37 V	(V_{supply} - 37 V)/23 mA
Insulation voltage, test/operation	
• Without explosion protection (non-Ex)	2.5 kV AC/55 V AC
• with explosion protection (Ex i)	2.5 kV AC/42 V AC
Polarity protection	All inputs and outputs
Write protection	Open circuits or software
Warming-up time	< 5 min
Starting time	< 2.75 s
Programming	SIPROM T and HART
Signal-to-noise ratio	> 60 dB
Long-term stability	Better than: • ± 0.05% of measuring span/year • ± 0.18% of measuring span/5 years
Response time	≤ 75 ms (typically 70 ms)
Programmable damping	0 ... 60 s
Signal dynamic	
• Input	24 bit
• Output	18 bit
Influence of change in supply voltage	< 0.005% of measuring span/V DC
Input	
Resistance thermometer (RTD)	
Input type	
• Pt10 ... 10000	• IEC 60751 • JIS C 1604-8 • GOST 6651_2009 • Callendar-Van Dusen
• Ni10 ... 10000	• DIN 43760-1987 • GOST 6651-2009/OIML R84:2003
• Cu5 ... 1000	• Edison Copper Winding No. 15 • GOST 6651-2009/OIML R84:2003
Type of connection	2-wire, 3-wire or 4-wire
Line resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the line resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8)	Max. 30 nF
• All other input types	Max. 50 nF
Fault detection, programmable	None, short-circuited, defective, short-circuited or defective
	Note When the low limit for the configured input type is below the constant detection limit for short-circuited inputs, the detection of short circuits is disabled regardless of the configuration of the fault detection.
Detection limit for short-circuited input	15 Ω
Fault detection time (RTD)	≤ 75 ms (typically 70 ms)
Fault detection time (for 3-wire and 4-wire)	≤ 2 000 ms

Thermocouples (TC)	
Input type	
• B	IEC 60584-1
• E	IEC 60584-1
• J	IEC 60584-1
• K	IEC 60584-1
• L	DIN 43710
• Lr	GOST 3044-84
• N	IEC 60584-1
• R	IEC 60584-1
• S	IEC 60584-1
• T	IEC 60584-1
• U	DIN 43710
• W3	ASTM E988-96
• W5	ASTM E988-96
• LR	GOST 3044-84
Cold junction compensation (CJC)	Constant, internal or external over Pt100 or Ni100 RTD
• Temperature range internal CJC	-50 ... +100 °C (-58 ... +212 °F)
• Connection external CJC	2-wire, 3-wire or 4-wire
• External CJC, line resistance per wire (for 3-wire and 4-wire connections)	50 Ω
• Effect of the line resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
• Input current external CJC	< 0.15 mA
• Temperature range external CJC	-50 ... +135 °C (-58 ... +275 °F)
• Cable, wire-wire capacity	Max. 50 nF
• Total line resistance	Max. 10 kΩ
• Fault detection, programmable	None, short-circuited, defective, short-circuited or defective
	Note The short-circuited fault detection only applies to the CJC input.
• Fault detection time (TC)	≤ 75 ms (typically 70 ms)
• Fault detection time, external CJC (for 3-wire and 4-wire)	≤ 2 000 ms
Linear resistance	
Input range	0 ... 100 kΩ
Minimum measuring span	25 Ω
Type of connection	2-wire, 3-wire or 4-wire
Line resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the line resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• R > 400 Ω	Max. 30 nF
• R ≤ 400 Ω	Max. 50 nF
Fault detection, programmable	None, defective
Potentiometers	
Input range	10 ... 100 kΩ
Minimum measuring span	25 Ω
Type of connection	3-wire, 4-wire or 5-wire
Line resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the line resistance (with 4-wire and 5-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• R > 400 Ω	Max. 30 nF
• R ≤ 400 Ω	Max. 50 nF

SITRANS TR420 (HART, universal)

Fault detection, programmable	None, short-circuited, defective, short-circuited or defective
	Note When the configured potentiometer size is below the constant detection limit for short-circuited inputs, the detection of short circuits is disabled regardless of the configuration of the fault detection.
Detection limit for short-circuited input	15 Ω
Fault detection time, wiper arm (no short-circuit detection)	≤ 75 ms (typically 70 ms)
Fault detection time, element	≤ 2 000 ms
Fault detection time (for 4-wire and 5-wire)	≤ 2 000 ms
Voltage input	
Measuring range	
• Unipolar	-100 ... 1700 mV
• Bipolar	-800 ... +800 mV
Minimum measuring span	2.5 mV
Input resistance	10 MΩ
Cable, wire-wire capacity	
• Input range: -100 ... 1700 mV	Max. 30 nF
• Input range: -20 ... 100 mV	Max. 50 nF
Fault detection, programmable	None, defective
Fault detection time	≤ 75 ms (typically 70 ms)
Output and HART communication	
Normal range, programmable	3.8 ... 20.5 mA/20.5 ... 3.8 mA
Extended range (output limits), programmable	3.5 ... 23 mA/23 ... 3.5 mA
Programmable input/output limits	
• Fault current	Enable/disable
• Fault current setting	3.5 ... 23 mA
Update time	10 ms
Load (with current output)	≤ (V_{Supply} - 7.5)/0.023 Ω
Load stability	< 0.01% of meas. span/100 Ω (measuring span = currently selected range)
Input fault detection, programmable (detection of input short circuits is ignored with TC and voltage inputs)	3.5 ... 23 mA
NAMUR NE43 Upscale	> 21 mA
NAMUR NE43 Downscale	< 3.6 mA
HART protocol versions	HART 7
Measuring accuracy	
Input accuracy	See "Input accuracy" table
Output accuracy	See "Output accuracy" table
Rated conditions	
Ambient temperature	-50 ... +85 °C (-58 ... +185 °F)
Ambient temperature for devices with functional safety	-40 ... +80 °C (-40 ... +176 °F)
Storage temperature	-50 ... +85 °C (-58 ... +185 °F)
Reference temperature for sensor calibration	24 °C ±1.0 °C (75.2 °F ±1.8 °F)
Relative humidity	< 99% (no condensation)
Degree of protection	
• Transmitter enclosure	IP20
• Terminals	IP20

Design	
Weight	122 g (0.27 lb)
Maximum core cross-section	2.5 mm² (AWG 13)
Tightening torque for clamping screws	0.5 ... 0.6 Nm
Vibrations	IEC 60068-2-6
• 2 ... 25 Hz	± 1.6 mm (0.07 inch)
• 25 ... 100 Hz	± 4 g
Certificates and approvals	
Explosion protection ATEX/IECEx and others	
Certificates[3]	DEKRA 17ATEX0116 X IECEx DEK 17.0054X A5E43700604A-2018X
"Intrinsic safety ia/ib" type of protection	For use in Zone 0, 1, 2, 20, 21, 22
• ATEX	II 1 G Ex ia IIC T6 ... T4 Ga II 2(1) G Ex ib [ia Ga] IIC T6 ... T4 Gb II 1 D Ex ia IIIC Da I M1 Ex ia I Ma
• IECEx and others	Ex ia IIC T6 ... T4 Ga Ex ib [ia Ga] IIC T6 ... T4 Gb Ex ia IIIC Da Ex ia I Ma
"Intrinsic safety ic" type of protection	For use in Zones 2 and 22
• ATEX	II 2 G Ex ic IIC T6…T4 Gc II 2 D Ex ic IIIC Dc
• IECEx and others	Ex ic IIC T6 ... T4 Gc Ex ic IIIC Dc
"Non-sparking/increased safety nA/ec" type of protection	For use in Zones 2 and 22
• ATEX	II 2 G Ex nA IIC T6…T4 Gc II 2 G Ex ec IIC T6…T4 Gc
• IECEx and others	Ex nA IIC T6 ... T4 Gc Ex ec IIC T6 ... T4 Gc
Explosion protection CSA/FM for Canada and USA	
Certificates	CSA 1861385 FM18CA0024 FM18US0046
"Intrinsic safety ia" type of protection	IS, CL I, Div 1, GP ABCD, T6 ... T4 Ex ia IIC T6 … T4 Ga AEx ia IIC T6 … T4 Ga or: Ex ib [ia Ga] IIC T6…T4 Gb AEx ib [ia Ga] IIC T6…T4 Gb
"Non incendive field wiring NIFW" type of protection	NIFW, CL I, Div 2, GP ABCD T6 ... T4
"Non incendive NI" type of protection	NI, CL I, Div 2, GP ABCD T6...T4 Ex nA IIC T6 ... T4 Gc AEx nA IIC T6 ... T4 Gc

[1] Note that the minimum supply voltage must correspond to the value measured at the terminals of the SITRANS TR420.
All external voltage drops must be taken into consideration.

[2] Protect the device from overvoltage with the help of a suitable power supply or suitable overvoltage protection equipment.

[3] Additional available certificates are listed on the Internet at http://www.siemens.com/processinstrumentation/certificates

Measuring ranges/Minimum measuring span

RTD

Input type	Standard	Measuring range in °C (°F)	α_0 in $°C^{-1}$ ($°F^{-1}$)	Minimum measuring span in °C (°F)
Pt10 ... 10000	IEC 60751	-200 ... +850 (-328 ... +1 562)	0.003851 (0.002139)	10 (50)
	JIS C 1604-8	-200 ... +649 (-328 ... +1 200)	0.003916 (0.002176)	10 (50)
	GOST 6651_2009	-200 ... +850 (-328 ... +1 562)	0.003910 (0.002172)	10 (50)
	Callendar-Van Dusen	-200 ... +850 (-328 ... +1 562)	-	10 (50)
Ni10 ... 10000	DIN 43760-1987	-60 ... +250 (-76 ... +482)	0.006180 (0.003433)	10 (50)
	GOST 6651-2009/OIML R84:2003	-60 ... +180 (-76 ... +356)	0.006170 (0.003428)	10 (50)
Cu5 ... 1000	Edison Copper Winding No. 15	-200 ... +260 (-328 ... +500)	0.004270 (0.002372)	100 (212)
	GOST 6651-2009/OIML R84:2003	-180 ... +200 (-292 ... +392)	0.004280 (0.002378)	100 (212)
	GOST 6651-94	-50 ... +200 (-58 ... +392)	0.004260 (0.002367)	100 (212)

TC

Input type	Standard	Measuring range in °C (°F)	Minimum measuring span in °C (°F)
B	IEC 60584-1	0 (85) ... 1 820 (32 (185) ... 3 308)	100 (212)
E	IEC 60584-1	-200 ... +1 000 (-392 ... +1 832)	50 (122)
J	IEC 60584-1	-100 ... +1 200 (-212 ... +2 192)	50 (122)
K	IEC 60584-1	-180 ... +1 372 (-356 ... +2 502)	50 (122)
L	DIN 43710	-200 ... +900 (-392 ... +1 652)	50 (122)
Lr	GOST 3044-84	-200 ... +800 (-392 ... +1 472)	50 (122)
N	IEC 60584-1	-180 ... +1 300 (-356 ... +2 372)	50 (122)
R	IEC 60584-1	-50 ... +1 760 (-122 ... +3 200)	100 (212)
S	IEC 60584-1	-50 ... +1 760 (-122 ... +3 200)	100 (212)
T	IEC 60584-1	-200 ... +400 (-392 ... +752)	50 (122)
U	DIN 43710	-200 ... +600 (-392 ... +1 112)	50 (122)
W3	ASTM E988-96	0 ... 2 300 (32 ... 4 172)	100 (212)
W5	ASTM E988-96	0 ... 2 300 (32 ... 4 172)	100 (212)
LR	GOST 3044-84	-200 ... +800 (-392 ... +1472)	50 (122)

Input accuracy

Basic values

Input type	Basic accuracy	Temperature coefficient[1)]
RTD		
Pt10	≤ ±0.8 °C (1.44 °F)	≤ ±0.020 °C/°C (°F/°F)
Pt20	≤ ±0.4 °C (0.72 °F)	≤ ±0.010 °C/°C (°F/°F)
Pt50	≤ ±0.16 °C (0.288 °F)	≤ ±0.004 °C/°C (°F/°F)
Pt100	≤ ±0.04 °C (0.072 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt200	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt500	$T_{max.}$ < 180 °C (356 °F) = ≤ ±0.08 °C (0.144 °F) $T_{max.}$ > 180 °C (356 °F) = ≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt1000	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt2000	$T_{max.}$ < 300 °C (572 °F) = ≤ ±0.08 °C (0.144 °F) $T_{max.}$ > 300 °C (572 °F) = ≤ ±0.4 °C (0.72 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt10000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Ni10	≤ ±1.6 °C (2.88 °F)	≤ ±0.020 °C/°C (°F/°F)
Ni20	≤ ±0.8 °C (1.44 °F)	≤ ±0.010 °C/°C (°F/°F)
Ni50	≤ ±0.32 °C (0.576 °F)	≤ ±0.004 °C/°C (°F/°F)
Ni100	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni120	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni200	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni500	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni1000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)

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Input type	Basic accuracy	Temperature coefficient[1]
Ni2000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni10000	≤ ±0.32 °C (0.576 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Cu5	≤ ±1.6 °C (2.88 °F)	≤ ±0.040 °C/°C (°F/°F)
Cu10	≤ ±0.8 °C (1.44 °F)	≤ ±0.020 °C/°C (°F/°F)
Cu20	≤ ±0.4 °C (0.72 °F)	≤ ±0.010 °C/°C (°F/°F)
Cu50	≤ ±0.16 °C (0.288 °F)	≤ ±0.004 °C/°C (°F/°F)
Cu100	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu200	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu500	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu1000	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Linear resistance		
0 ... 400 Ω	≤ ±40 mΩ	≤ ±2 mΩ/°C (1.11 mΩ/°F)
0 ... 100 kΩ	≤ ±4 Ω	≤ ±0.2 Ω/°C (0.11 Ω/°F)
Potentiometers		
0 ... 100%	< 0.05%	< ± 0.005%
Voltage input		
mV: -20 ... 100 mV	≤ ±5 µV	≤ ±0.2 µV/°C (0.11 µV/°F)
mV: -100 ... 1700 mV	≤ ±0.1 mV	≤ ±36 µV/°C (20 µV/°F)
mV: ± 800 mV	≤ ±0.1 mV	≤ ±32 µV/°C (17.8 µV/°F)
TC		
E	≤ ±0.2 °C (0.36 °F)	≤ ±0.025 °C/°C (°F/°F)
J	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
K	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
L	≤ ±0.35 °C (0.63 °F)	≤ ±0.025 °C/°C (°F/°F)
N	≤ ±0.4 °C (0.72 °F)	≤ ±0.025 °C/°C (°F/°F)
T	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
U	< 0 °C (32 °F) ≤ ±0.8 °C (1.44 °F) ≥ 0 °C (32 °F) ≤ ±0.4 °C (0.72 °F)	≤ ±0.025 °C/°C (°F/°F)
Lr	≤ ±0.2 °C (0.36 °F)	≤ ±0.1 °C/°C (°F/°F)
R	< 200 °C (392 °F) ≤ ±0.5 °C (0.9 °F) ≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
S	< 200 °C (392 °F) ≤ ±0.5 °C (0.9 °F) ≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
W3	≤ ±0.6 °C (1.08 °F)	≤ ±0.1 °C/°C (°F/°F)
W5	≤ ±0.4 °C (0.72 °F)	≤ ±0.1 °C/°C (°F/°F)
B[2]	≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
B[3]	≤ ±3 °C (5.4 °F)	≤ ±0.1 °C/°C (°F/°F)
B[4]	≤ ±8 °C (14.4 °F)	≤ ±0.8 °C/°C (°F/°F)
B[5]	Not specified	Not specified
CJC (internal)	< ±0.5 °C (0.9 °F)	Included in basic accuracy
CJC (external)	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)

1) Temperature coefficients correspond to the specified values or 0.002% of the input span, depending on which value is greater.
2) Accuracy of the specification range > 400 °C (752 °F)
3) Accuracy of the specification range > 160 °C (320 °F) < 400 °C (752 °F)
4) Accuracy of the specification range > 85 °C (185 °F) < 160 °C (320 °F)
5) Accuracy of the specification range < 85 °C (185 °F)

Output accuracy

Output type	Basic accuracy	Temperature coefficient
Average value measurement	Average of accuracy of input 1 and input 2	Average of temperature coefficient of input 1 and input 2
Differential measurement	Sum of accuracy of input 1 and input 2	Sum of temperature coefficient of input 1 and input 2
Analog output	≤ ±1.6 µA (0.01% of the full output span)	≤ ±0.48 µA/K (≤ ±0.003% of the full output span/K)

Selection and ordering data

	Article No.	Order code
SITRANS TR420 rail transmitter with 2 inputs ↗	**7NG042** -	- 0
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.		
Communication		
With HART	**0**	
Primary value output		
Input 1	**0**	
Input 1, input 2 as redundancy	**1**	
Input 2, input 1 as redundancy	**2**	
Average input 1 and input 2, both as redundancy	**3**	
Minimum input 1 and input 2, both as redundancy	**4**	
Maximum input 1 and input 2, both as redundancy	**5**	
Difference input 1 - input 2	**6**	
Difference input 2 - input 1	**7**	
Absolute difference	**8**	
Primary value output, customer-specific		
Minimum input 1 and input 2, without redundancy	**9**	**H 1 A**
Maximum input 1 and input 2, without redundancy	**9**	**H 1 B**
Average input 1 and input 2, without redundancy	**9**	**H 1 C**
Input 2	**9**	**H 1 D**
Input 1, type		
RTD		
• Pt100 (IEC), 3-wire	**B**	
• Pt100 (IEC), 4-wire	**C**	
• Pt1000 (IEC), 3-wire	**D**	
• Pt1000 (IEC), 4-wire	**E**	
TC		
• Type B	**F**	
• Type E	**G**	
• Type J	**H**	
• Type K	**J**	
• Type L	**K**	
• Type N	**L**	
• Type R	**N**	
• Type S	**P**	
• Type T	**Q**	
Potentiometer, 4-wire	**R**	
Input 1, type customer-specific		
Define customer-specific input configurations in V options	**Y**	

	Article No.	Order code
SITRANS TR420 rail transmitter with 2 inputs	**7NG042** -	- 0
Input 2, type		
Without input 2	**A**	
RTD		
• Pt100 (IEC), 3-wire	**B**	
• Pt100 (IEC), 4-wire	**C**	
• Pt1000 (IEC), 3-wire	**D**	
• Pt1000 (IEC), 4-wire	**E**	
TC		
• Type B	**F**	
• Type E	**G**	
• Type J	**H**	
• Type K	**J**	
• Type L	**K**	
• Type N	**L**	
• Type R	**N**	
• Type S	**P**	
• Type T	**Q**	
Potentiometer, 4-wire	**R**	
Input 2, type customer-specific		
Define customer-specific input configurations in W options	**Y**	
CJC configuration for TC		
Input 1: no CJC; input 2: No CJC	**0**	
Input 1: internal CJC; input 2: internal CJC	**1**	
Input 1: external CJC; input 2: external CJC; define type in option Jxx	**2**	
Input 1: external CJC; define type in option Jxx; input 2: internal CJC	**3**	
Input 1: internal CJC; input 2: external CJC; define type in option Jxx	**4**	
Input 1: Internal CJC; Input 2: No CJC	**5**	
Input 1: External CJC (define type in option Jxx); input 2: No CJC	**6**	
Materials not in contact with media		
Without	**0**	
Type of protection		
General safety (non-Ex); CE, RCM, FM, KCC, EAC	**A**	
Intrinsic safety (Ex i) / Non-incendive field wiring (NIFW) / Increased safety zone 2 (Ex ec) / Non incendive (NI) (ATEX, IECEx, EACEx, CSA, FM, NEPSI, Inmetro)	**N**	
Electrical connection/ cable entry		
Without	**A**	
Local HMI		
Without display	**0**	

SITRANS TR420 (HART, universal)

Options	Order code
Append "**-Z**" to Article No., add order code and, if applicable, free text.	
Manufacturer declarations	
Quality inspection certificate, 5-point factory calibration (IEC 60770-2)	**C11**
Certificates for functional safety	
Functional safety SIL2/3 (IEC 61508)	**C20**
Device options	
PDF file with device settings	**D10**
Without labeling of the measuring range on the TAG plate	**D41**
Jumper plug set on device for write protection	**D81**
Jumper plug set on device for fault current > 21 mA (instead of < 3.6 mA) (only non-SIL)	**D82**
External CJC types	
Pt100, IEC 60751, 3-wire	**J02**
Pt100, IEC 60751, 4-wire	**J03**
Ni100, DIN 43760-87, 3-wire	**J05**
Ni100, DIN 43760-87, 4-wire	**J06**
Input 1: TC	
Type C W5	**V01**
Type D W3	**V02**
Type U	**V03**
Type Lr	**V04**
Input 1: Potentiometers	
Potentiometer, 5-wire	**V31**
Input 1: RTD	
Pt x (IEC), 3-wire, define RTD factor x in option Y21	**V61**
Pt x (IEC), 4-wire, define RTD factor x in option Y21	**V62**
Pt x (JIS C1604-81), 3-wire, define RTD factor x in option Y21	**V64**
Pt x (JIS C1604-81), 4-wire, define RTD factor x in option Y21	**V65**
Pt x (GOST 6651-2009), 3-wire, define RTD factor x in option Y21	**V67**
Pt x (GOST 6651-2009), 4-wire, define RTD factor x in option Y21	**V68**
Ni x (DIN 43760-87), 3-wire, define RTD factor x in option Y21	**V70**
Ni x (DIN 43760-87), 4-wire, define RTD factor x in option Y21	**V71**
Ni x (GOST 6651-2009), 3-wire, define RTD factor x in option Y21	**V73**
Ni x (GOST 6651-2009), 4-wire, define RTD factor x in option Y21	**V74**
Cu x (ECW-15), 3-wire, define RTD factor x in option Y21	**V76**
Cu x (ECW-15), 4-wire, define RTD factor x in option Y21	**V77**
Cu x (GOST 6651-94), 3-wire, define RTD factor x in option Y21	**V79**
Cu x (GOST 6651-94), 4-wire, define RTD factor x in option Y21	**V80**
Cu x (GOST 6651-2009), 3-wire, define RTD factor x in option Y21	**V82**
Cu x (GOST 6651-2009), 4-wire, define RTD factor x in option Y21	**V83**
Input 2: TC	
Type C W5	**W01**
Type D W3	**W02**
Type U	**W03**
Type Lr	**W04**

Options	Order code
Append "**-Z**" to Article No., add order code and, if applicable, free text.	
Device settings	
Measuring range setting temperature input: Start of scale value (max. 5 characters), full scale value (max. 5 characters), unit (°C, °F, °Ra, K)	**Y01**
Customer-specific programming in plain text (n-lines)	**Y09**
Long tag (device parameter, max. 32 characters), adhesive label	**Y15**
Measuring point description (device parameter, max. 32 characters), adhesive label	**Y16**
Input 1: RTD factor; e.g. factor "200" = Pt200, adhesive label	**Y21**

Accessories

	Article No.
Additional accessories for assembly, connection and transmitter configuration, see page 2/154.	
Modem	
Modem with USB interface	**7MF4997-1DB**
SIMATIC PDM parameterization software	See Catalog FI 01 section 8

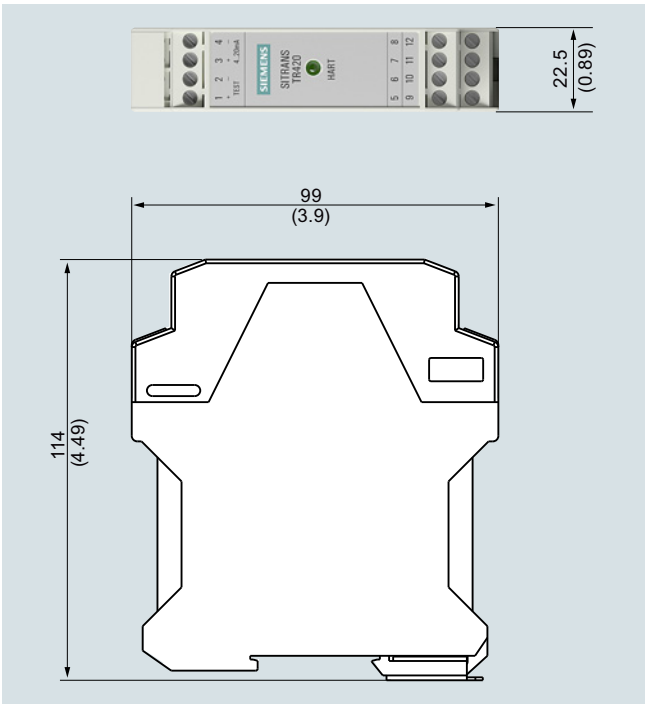
Ordering example

7NG0420-0BA00-0AA0-Z Y01
Y01: -10 ... +100 °C

Factory setting

- Input 1: Pt100 (IEC 751); 3-wire connection
- Input 2: not configured (inactive)
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current
  - Device error: < 3.6 mA
  - Input circuit wire break: 22.8 mA
  - Input circuit short circuit: 22.4 mA
  - Input circuit drift: 22 mA (active when input 2 is active)
  - Input monitoring wire break and short-circuit
- No trimming of input and output (offset)
- Damping 0.0 s

Dimension drawings



SITRANS TR420, dimensions in mm (inch)

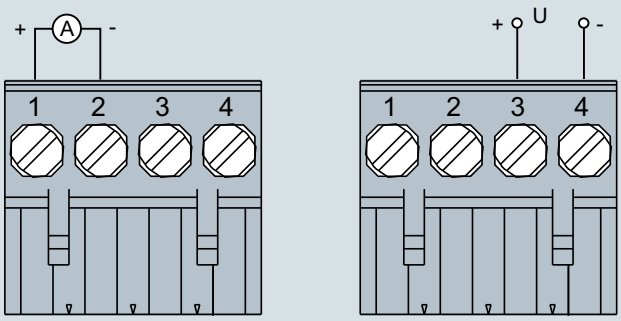
Circuit diagrams

Connections

1 (+) and 2 (-)	Test terminals for measurement of the output current with an amperemeter
3 (+) and 4 (-)	Output terminals
5, 6, 7 and 8	Input 1 terminals
9, 10, 11 and 12	Input 2 terminals

SITRANS TR420, connector assignment

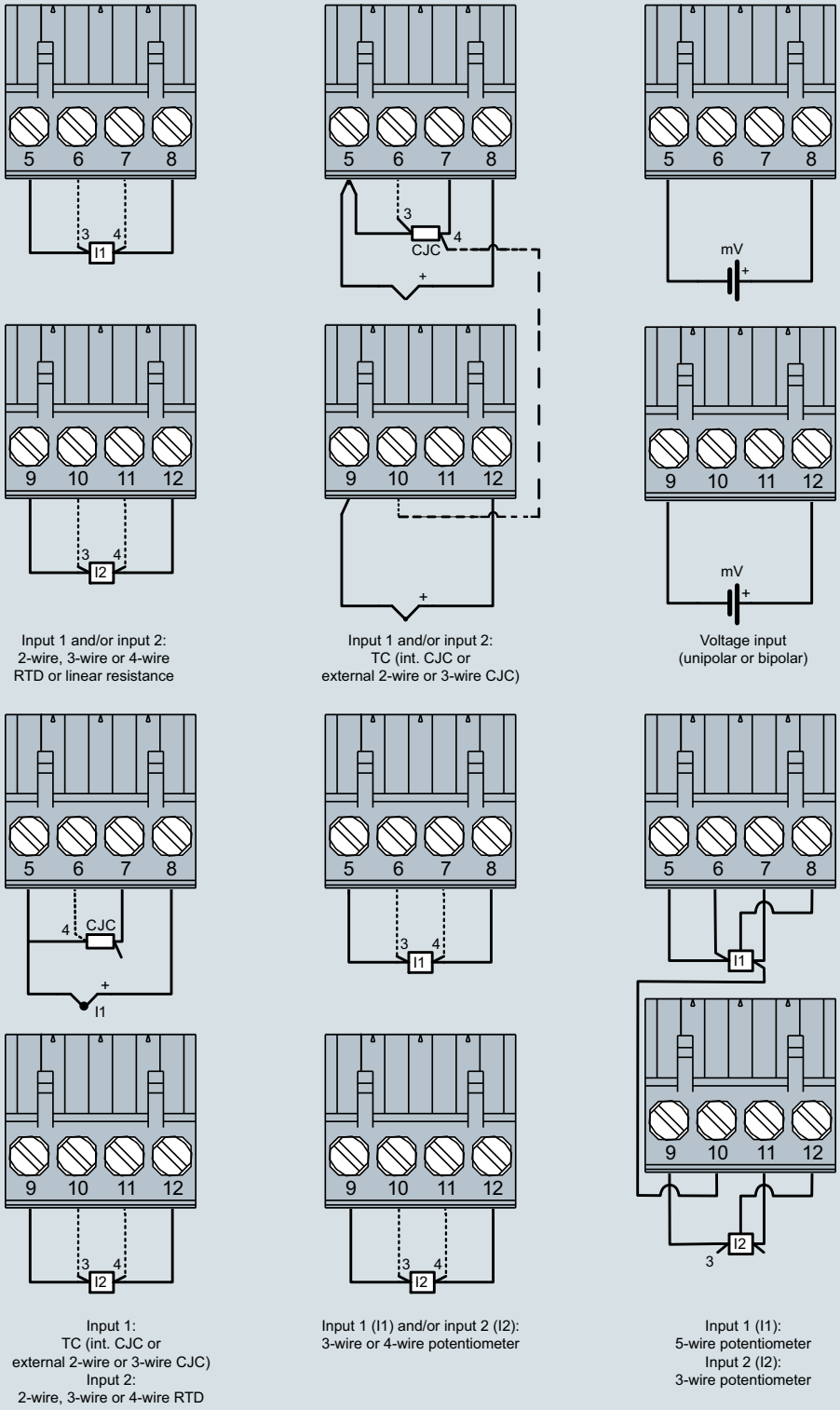
Output and test connection



SITRANS TR420, output connection assignment

SITRANS TR420 (HART, universal)

Input connection



SITRANS TR420, input connection assignment

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 aluminum or stainless steel
- IP66/67/68 degree of protection
- Test terminals for direct read-out of the output signal without breaking the current loop
- Can be mounted elsewhere if the measuring point
  - is difficult to access
  - has high temperatures
  - experiences vibrations due to the process cell
  - is to avoid long neck pipes and thermowells
- Can be mounted directly on American-design sensors
- Wide range of approvals for use in potentially explosive atmospheres. Types of protection "Intrinsically safe, non-sparking and flameproof", for Europe and the USA.
- SIL2 (with order note 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 substances. 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.

For the SITRANS TF with integrated programmable SITRANS TH200, parameters are assigned with the PC. 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

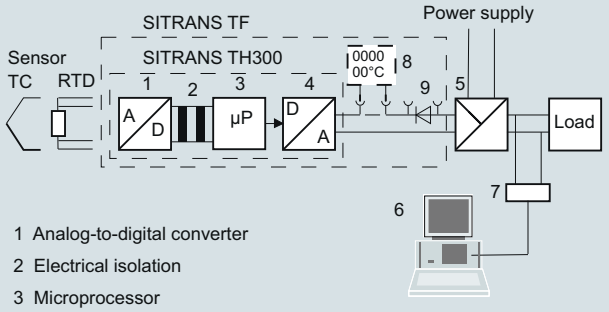
The sensor signal, whether resistance thermometer, thermocouple element or Ω or mV signal, is amplified and linearized. Sensor and output side are electrically isolated. An internal cold junction is integrated for measurements with thermocouples.

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 in any unit, e.g. pressure, flow rate, level or temperature.



1 Analog-to-digital converter
2 Electrical isolation
3 Microprocessor
4 Digital-to-analog converter
5 Power supply
6 PC/laptop
7 HART modem
8 Digital display (option)
9 Test connector

Mode of operation of SITRANS TF with integrated SITRANS TH300 and digital display

Technical specifications

Input	
Resistance thermometer	
Measured variable	Temperature
Input type	
• According to IEC 60751	Pt25 … Pt1000
• Acc. to JIS C 1604; a=0.00392 K-1	Pt25 … Pt1000
• According to IEC 60751	Ni25 … Ni1000
Units	°C and °F
Connection	
• Standard connection	1 resistance thermometer (RTD) in 2-wire, 3-wire or 4-wire connection
• Averaging	Series or parallel connection of several resistance thermometers in the 2-wire connection for the generation of average temperatures or for adaptation to other device types
• Differentiation	2 resistance thermometers (RTD) in 2-wire connection (RTD 1 – RTD 2 or RTD 2 – RTD 1)
Connection	
• 2-wire connection	Line resistance can be configured ≤100 Ω (loop resistance)
• 3-wire connection	No trim necessary
• 4-wire connection	No trim necessary
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Always active (cannot be switched off)
Short-circuit monitoring	Can be switched on/off (default value: ON)
Measuring range	Assignable (see "Digital measuring error" table)
Min. measuring span	10 °C (18 °F)
Characteristic curve	Temperature-linear or special characteristic
Resistance-based sensor	
Measured variable	Actual resistance
Sensor type	Resistance-based, potentiometers
Units	Ω
Connection	
• Standard connection	1 resistance-based sensor (R) in 2-wire, 3-wire or 4-wire connection
• Averaging	2 resistance-based sensors in 2-wire connection for averaging
• Differentiation	2 resistance-based sensors in 2-wire connection (R 1 – R 2 or R 2 – R 1)
Connection	
• 2-wire connection	Line resistance can be configured ≤100 Ω (loop resistance)
• 3-wire connection	No trim necessary
• 4-wire connection	No trim necessary
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Can be switched off
Short-circuit monitoring	Can be switched off (value is adjustable)
Measuring range	Assignable max. 0 ... 2200 Ω (see "Digital measuring error" table)
Min. measuring span	5 ... 25 Ω (see "Digital measuring error" table)
Characteristic curve	Resistance-linear or special characteristic

Thermocouples	
Measured variable	Temperature
Sensor type (thermocouples)	
• Type B	Pt30Rh-Pt6Rh acc. to IEC 584
• Type C	W5%-Re acc. to ASTM 988
• Type D	W3%-Re acc. to ASTM 988
• Type E	NiCr-CuNi acc. to IEC 584
• Type J	Fe-CuNi acc. to IEC 584
• Type K	NiCr-Ni acc. to IEC 584
• Type L	Fe-CuNi acc. to DIN 43710
• Type N	NiCrSi-NiSi acc. to IEC 584
• Type R	Pt13Rh-Pt acc. to IEC 584
• Type S	Pt10Rh-Pt acc. to IEC 584
• Type T	Cu-CuNi acc. to IEC 584
• Type U	Cu-CuNi acc. to DIN 43710
Units	°C or °F
Connection	
• Standard connection	1 thermocouple (TC)
• Averaging	2 thermocouples (TC)
• Differentiation	2 thermocouples (TC) (TC 1 – TC 2 or TC 2 – TC 1)
Response time	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Can be switched off
Reference junction compensation	
• Internal	With integrated Pt100 resistance thermometer
• External	With external Pt100 IEC 60751 (2-wire or 3-wire connection)
• External fixed	Reference junction temperature can be set as fixed value
Measuring range	Assignable (see "Digital measuring error" table)
Min. measuring span	Min. 40 ... 100 °C (72 ... 180 °F) (see "Digital measuring error" table)
Characteristic curve	Temperature-linear or special characteristic
mV sensor	
Measured variable	DC voltage
Sensor type	DC voltage source (DC voltage source possible over an externally connected resistor)
Units	mV
Response time	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Can be switched off
Measuring range	-10 ... +70 mV -100 ... +1100 mV
Min. measuring span	2 mV or 20 mV
Overload capability of the input	-1.5 ... +3.5 V DC
Input resistance	≥ 1 MΩ
Characteristic curve	Voltage-linear or special characteristic

SITRANS TF - Transmitter, 2-wire system / SITRANS TF - Field indicator for 4 to 20 mA

Output	
Output signal	4 ... 20 mA, 2-wire
Communication with SITRANS TH300	According to HART Rev. 5.9
Digital display	
Digital display (optional)	In current loop
Display	Max. 5 digits
Digit height	9 mm (0.35")
Display range	-99 999 ... +99 999
Units	Any (max. 5 char.)
Setting: Zero point, full-scale value and unit	Using 3 buttons
Load voltage	2.1 V
Measuring accuracy	
Digital measuring error	See "Digital measuring error" table
Reference conditions	
• Auxiliary power	24 V ± 1 %
• Load	500 Ω
• Ambient temperature	23 °C (73.4 °F)
• Warming-up time	> 5 min
Error in the analog output (digital/analog converter)	< 0.025 % of measuring span
Error due to internal reference junction	< 0.5 °C (0.9 °F)
Effect of ambient temperature	
• Analog measuring error • Digital measuring error	0.02 % of meas. span/10 °C (18 °F)
• 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 meas. span/V
Effect of load impedance	< 0.002 % of meas. span/100 Ω
Long-term drift	
• In the first month	< 0.02 % of measuring span
• After one year	< 0.2 % of measuring span
• After 5 years	< 0.3 % of measuring span
Rated conditions	
Ambient conditions	
Ambient temperature	-40 ... +85 °C (-40 ... +185 °F)
Condensation	Permissible
Electromagnetic compatibility	According to EN 61326 and NAMUR NE21
Degree of protection acc. to EN 60529	IP66/67/68
Design	
Weight	Approx. 1.5 kg (3.3 lb) without options
Dimensions	See "Dimensional drawings"
Enclosure material	Die-cast aluminum, low in copper, GD-AlSi 12 or stainless steel, polyester-based lacquer, stainless steel rating plate
Electrical connection, sensor connection	Screw terminals, cable inlet via M20 x 1.5 or ½-14 NPT screwed gland
Mounting bracket (optional)	Steel, galvanized and chrome-plated or stainless steel
Auxiliary power	
Without digital display	11 ... 35 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)
With digital display	13.1 ... 35 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)
Galvanic isolation	Between input and output
• Test voltage	U_{eff} = 1 kV, 50 Hz, 1 min

Certificates and approvals	
Explosion protection ATEX	
• "Intrinsic safety" type of protection	With digital display: II 2 (1) G Ex ib [ia Ga] IIC T4 Gb II 2 G Ex ib IIC T4 Gb II 1D Ex ia IIIC T100 °C Da 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
• EC type-examination certificate	ZELM 11 ATEX 0471 X
• "Non-sparking and energy-limited equipment for Zone 2" type of protection	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-examination certificate	ZELM 11 ATEX 0471 X
• "Flameproof enclosure" type of protection	II 2 G Ex d IIC T6/T5 Gb II 2 D Ex tb IIIC T100 °C Db
• EC type-examination certificate	ZELM 11 ATEX 0472 X
Explosion protection acc. to FM	Certificate of Compliance 3017742
• Identification (XP, DIP, NI, S)	• XP/I/1/BCD/T5 Ta = 85 °C (185 °F), T6 Ta = 60 °C (140 °F), Type 4X • DIP/II, III/1/EFG/T5 Ta = 85 °C (185 °F), T6 Ta = 60 °C (140 °F), Type 4X • NI/I/2/ABCD/T5 Ta = 85 °C (185 °F), T6 Ta = 60 °C (140 °F), Type 4X • S/II, III/2/FG/T5 Ta = 85 °C (185 °F), T6 Ta = 60 °C (140 °F), Type 4X
Other certificates	IECEx, EAC Ex(GOST), INMETRO, NEPSI, KOSHA
Hardware and software requirements	
• For the SIPROM T parameterization software for SITRANS TF with TH200	
• Personal computer	PC with CD-ROM drive and USB interface
• PC operating system	Windows 98, NT, 2000, XP, 7 and Win 8
• For the SIMATIC PDM parameterization software for SITRANS TH300	See section 8 "Digitalization and communication", "SIMATIC PDM"
Communication	
Load for HART connection	230 ... 1100 Ω
• Two-core shielded	≤ 3.0 km (1.86 mi)
• Multi-core shielded	≤ 1.5 km (0.93 mi)
Protocol	HART protocol, version 5.9

Factory setting of the transmitter:

- Pt100 (IEC 751); 3-wire connection
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

Digital measuring error

Resistance thermometer

Input	Measuring range	Minimum measuring span		Digital accuracy	
	°C (°F)	°C	(°F)	°C	(°F)
According 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)
According 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 sensor

Input	Measuring range	Minimum measuring span	Digital accuracy
	Ω	Ω	Ω
Resistance	0 ... 390	5	0.05
Resistance	0 ... 2200	25	0.25

Thermocouples

Input	Measuring range	Minimum measuring span		Digital accuracy	
	°C (°F)	°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 range	Minimum measuring 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 measuring 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 reference junction errors in the case of thermocouple measurements).

Selection and ordering data

	Article No.
Temperature transmitter in field enclosure ↗ 2-wire system 4 ... 20 mA, with electrical isolation	**7NG313** ■ - ■ ■ ■ ■ ■
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.	
Built-in transmitter	
SITRANS TH200, programmable	
• Without Ex protection	**5 0**
• With Ex ia (ATEX + IECEx)	**5 1**
• With Ex nAL for Zone 2 (ATEX + IECEx)	**5 2**
• Total device SITRANS TF Ex d (ATEX + IECEx)[1]	**5 4**
• Total device SITRANS TF according to FM (XP, DIP, NI, S)[1]	**5 5**
SITRANS TH300, communication-capable according to HART V 5.9	
• Without Ex protection	**6 0**
• With Ex ia (ATEX + IECEx)	**6 1**
• With Ex nAL for Zone 2 (ATEX + IECEx)	**6 2**
• Total device SITRANS TF Ex d (ATEX + IECEx)[1]	**6 4**
• Total device SITRANS TF according to FM (XP, DIP, NI, S)[1]	**6 5**
Enclosure	
Die-cast aluminum	**A**
Stainless steel precision casting	**E**
Connections/cable inlet	
Screwed glands M20x1.5	**B**
½-14 NPT glands	**C**
Digital indicator	
Without	**0**
With	**1**
Mounting bracket and fastening parts	
Without	**0**
Made of steel	**1**
Made of stainless steel	**2**

[1] Without cable gland.

Options	Order code
Append suffix "**-Z**" to article no., add order code and plain text, if applicable.	
Test report (5 measuring points)	**C11**
Functional safety SIL2	**C20**
Functional safety SIL2/3	**C23**
Explosion protection	
• Explosion protection Ex ia according to INMETRO (Brazil) (only for 7NG313.-1...)	**E25**[1]
• Explosion protection Ex d according to INMETRO (Brazil) (only for 7NG313.-4...)	**E26**[1]
• Explosion protection Ex nA according to INMETRO (Brazil) (only for 7NG313.-2...)	**E27**[1]
• Explosion protection Ex i according to NEPSI (China) (only for 7NG313.-1...)	**E55**[1]
• Explosion protection Ex d according to NEPSI (China) (only for 7NG313.-4...)	**E56**[1]
• Explosion protection Ex nA according to NEPSI (China) (only for 7NG313.-2...)	**E57**[1]
• Explosion protection Ex d according to KOSHA (Korea) (only for 7NG313.-4...)	**E70**[1]
• Explosion protection Ex i according to EAC (Russia/Belarus/Kazahstan) (only for 7NG313.-1...)	**E81**[1]
• Explosion protection Ex d according to EAC (Russia/Belarus/Kazahstan) (only for 7NG313.-4...)	**E82**[1]
• Explosion protection Ex nA according to EAC (Russia/Belarus/Kazakhstan) (only for 7NG313.-2...)	**E83**[1]
Marine approvals	
• Det Norske Veritas Germanischer Lloyd (DNV GL)	**D01**
• Bureau Veritas (BV)	**D02**
• Lloyd's Register of Shipping (LR)	**D04**
• American Bureau of Shipping (ABS)	**D05**
Two-layer coating of enclosure and cover (PU on epoxy)	**G10**
Transient protection	**J01**
Cable gland CAPRI ½ NPT ADE 4F, nickel-plated brass (CAPRI 848694 and 810634) included	**D57**
Cable gland ½ NPT ADE 1F, cable diameter 6 ... 12 (CAPRI 818694 and 810534) included	**D58**
Cable gland ½ NPT ADE 4F, Stainless steel (CAPRI 848699 and 810634) included	**D59**
Cable gland ½ NPT ADE 1F, cable diameter 4 ... 8.5 (CAPRI 818674 and 810534) included	**D60**

SITRANS TF - Transmitter, 2-wire system / SITRANS TF - Field indicator for 4 to 20 mA

Options	Order code
Append suffix "**-Z**" to article no., add order code and plain text, if applicable.	
Customer-specific programming	
Measuring range to be set Specify in plain text (max. 5 digits): Y01:... to ... °C, °F	**Y01**[2]
Measuring point number (TAG) max. 8 characters	**Y17**[3]
Measuring point description, max. 16 characters	**Y23**[4]
Measuring point description, max. 32 characters	**Y24**[4]
Labeling of measuring point plate only, 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]
Type B thermocouple	**U20**[5][6]
Type C thermocouple (W5)	**U21**[5][6]
Type D thermocouple (W3) [5][6]	**U22**[5][6]
Type E thermocouple	**U23**[5][6]
Type J thermocouple	**U24**[5][6]
Type K thermocouple	**U25**[5][6]
Type L thermocouple	**U26**[5][6]
Type N thermocouple	**U27**[5][6]
Type R thermocouple	**U28**[5][6]
Type S thermocouple	**U29**[5][6]
Type T thermocouple	**U30**[5][6]
Type U thermocouple	**U31**[5][6]
For TC: Cold junction compensation: external (Pt100, 3-wire)	**U41**
For TC: Reference junction compensation: external with fixed value: specify in plain text	**Y50**
Enter special deviating customer-specific setting in plain text	**Y09**[7]
Fault current 3.6 mA (instead of 22.8 mA)	**U36**[3]

1) [1] Option does not include ATEX/IECEx approval, only country-specific approval.

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. For specification on TAG plate, please select Y22.

3) For this selection, Y01 or Y09 must also be selected. For specification on TAG plate, please select Y23.

4) If only Y22, Y23 or Y24 is ordered and if the labeling is only noted on the measuring point plate, do not specify Y01.

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

6) Internal reference 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.

Accessories

	Article No.
Additional accessories for assembly, connection and transmitter configuration, see page 2/154.	
Modems	
Modem with USB interface	**7MF4997-1DB**
Modem with USB interface and SIPROM T software	**7NG3092-8KN**
SIMATIC PDM parameterization software Also for SITRANS TH300	**See section 8**
Mounting bracket and fastening parts	
Made of steel for 7NG313.-..B..	**7MF4997-1AC**
Made of steel for 7NG313.-..C..	**7MF4997-1AB**
Made of stainless steel for 7NG313.-..B..	**7MF4997-1AJ**
Made of stainless steel for 7NG313.-..C..	**7MF4997-1AH**
Made of stainless steel 316L for 7NG313.-..B..	**7MF4997-1AQ**
Made of stainless steel 316L for 7NG313.-..C..	**7MF4997-1AP**
Digital display[1]	**7MF4997-1BS**
Connection board	**A5E02226423**

For supply units, see Catalog FI 01 section "Supplementary components".

1) Retrofitting not possible with Ex devices.

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 of the transmitter

- Pt100 (IEC 751); 3-wire connection
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

SITRANS TF - Transmitter, 2-wire system / SITRANS TF - Field indicator for 4 to 4 mA

	Article No.
SITRANS TF field indicator For 4 ... 20 mA signals ↗	**7NG3130 -** ■ ■ ■ ■ ■
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.	
Without Ex protection	**0** **1**
With Ex ia (ATEX + IECEx)	**1** **1**
With Ex nAL for Zone 2 (ATEX + IECEx)	**2** **1**
Total device SITRANS TF Ex d (ATEX + IECEx)[1]	**4** **1**
Total device SITRANS TF according to FM (XP, DIP, NI, S)[1]	**5** **1**
Enclosure	
Die-cast aluminum	**A**
Stainless steel precision casting	**E**
Connections/cable inlet	
Screwed glands M20x1.5	**B**
½-14 NPT glands	**C**
Digital indicator	
With	**1**
Mounting bracket and fastening parts	
Without	**0**
Made of steel	**1**
Made of stainless steel	**2**

1) Without cable gland

Options	Order code
Append suffix "**-Z**" to article no., add order code and plain text, if applicable.	
Test report (5 measuring points)	**C11**
Explosion protection	
• Explosion protection Ex ia according to INMETRO (Brazil) (only for 7NG313.-1...)	**E25**[1]
• Explosion protection Ex d according to INMETRO (Brazil) (only for 7NG313.-4...)	**E26**[1]
• Explosion protection Ex nA according to INMETRO (Brazil) (only for 7NG313.-2...)	**E27**[1]
• Explosion protection Ex i according to NEPSI (China) (only for 7NG313.-1...)	**E55**[1]
• Explosion protection Ex d according to NEPSI (China) (only for 7NG313.-4...)	**E56**[1]
• Explosion protection Ex nA according to NEPSI (China) (only for 7NG313.-2...)	**E57**[1]
• Explosion protection Ex d according to KOSHA (Korea) (only for 7NG313.-4...)	**E70**[1]
• Explosion protection Ex i according to EAC (Russia/Belarus/Kazahstan) (only for 7NG313.-1...)	**E81**[1]
• Explosion protection Ex d according to EAC (Russia/Belarus/Kazahstan) (only for 7NG313.-4...)	**E82**[1]
• Explosion protection Ex nA according to EAC (Russia/Belarus/Kazakhstan) (only for 7NG313.-2...)	**E83**[1]
Marine approvals	
• Det Norske Veritas Germanischer Lloyd (DNV GL)	**D01**
• Bureau Veritas (BV)	**D02**
• Lloyd's Register of Shipping (LR)	**D04**
• American Bureau of Shipping (ABS)	**D05**
Two-layer coating of enclosure and cover (PU on epoxy)	**G10**
Transient protection	**J01**
Cable gland CAPRI ½ NPT ADE 4F, nickel-plated brass (CAPRI 848694 and 810634) included	**D57**
Cable gland ½ NPT ADE 1F, cable diameter 6 ... 12 (CAPRI 818694 and 810534) included	**D58**

Options	Order code
Append suffix "**-Z**" to article no., add order code and plain text, if applicable.	
Cable gland ½ NPT ADE 4F, Stainless steel (CAPRI 848699 and 810634) included	**D59**
Cable gland ½ NPT ADE 1F, cable diameter 4 ... 8.5 (CAPRI 818674 and 810534) included	**D60**
Customer-specific programming	
Measuring range to be set Specify in plain text (max. 5 digits): Y01:... to ... °C, °F	**Y01**[2]
Labeling of measuring point plate only, specify in plain text: Measuring range	**Y22**[3]
Measuring point description, max. 16 characters	**Y23**[3]
Measuring point description, max. 32 characters	**Y24**[3]
Enter special deviating customer-specific setting in plain text	**Y09**[4]

1) Option does not include ATEX/IECEx approval, only country-specific approval.

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 is ordered and if the labeling is only noted on the measuring point plate, do not specify Y01.

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.

5) Retrofitting not possible with Ex devices.

Accessories

	Article No.
Additional accessories for assembly, connection and transmitter configuration, see page 2/154.	
Mounting bracket and fastening parts	
Made of steel for 7NG313.-..B..	**7MF4997-1AC**
Made of steel for 7NG313.-..C..	**7MF4997-1AB**
Made of stainless steel for 7NG313.-..B..	**7MF4997-1AJ**
Made of stainless steel for 7NG313.-..C..	**7MF4997-1AH**
Made of stainless steel 316L for 7NG313.-..B..	**7MF4997-1AQ**
Made of stainless steel 316L for 7NG313.-..C..	**7MF4997-1AP**
Digital display[1]	**7MF4997-1BS**
Connection board For supply units, see Catalog FI 01 section "Supplementary components".	**A5E02226423**

Ordering example 1

7NG3130-0AB10-Z Y01+Y23
Y01: -5 ... 100 °C
Y23: TICA1234HEAT

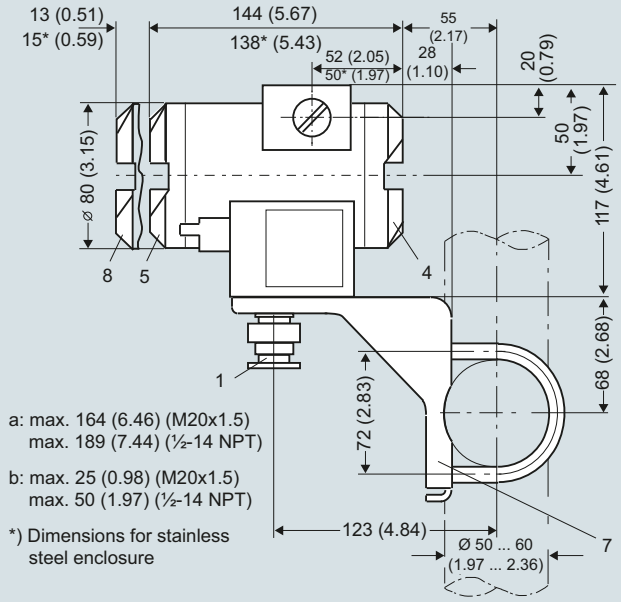
Ordering example 2

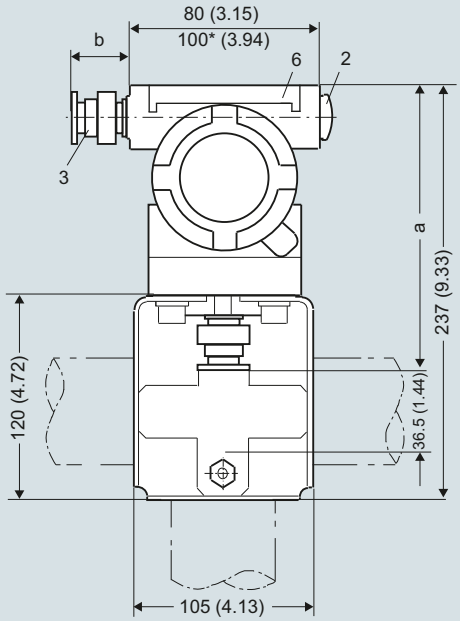
7NG3130-0AC11-Z Y01+Y23+Y24
Y01: 0 ... 20 BAR
Y23: PICA 1234 ABC
Y24: HEATING BOILER 67890

Factory setting of the display

4 ... 20 m

Dimensional drawings





1 Sensor connection (screwed gland M20x1.5 or ½-14 NPT)

2 Blanking plug

3 Electrical connection (screwed gland M20x1.5 or ½-14 NPT)

4 Terminal side, output signal

5 Terminal side, sensor

6 Protective cover (without function)

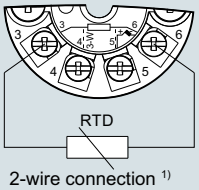
7 Mounting bracket (option) with clamp for securing to a vertical or horizontal pipe

8 Cover with window for digital display

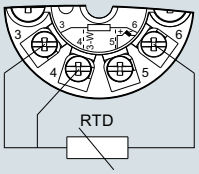
SITRANS TF, dimensions in mm (inches)

Circuit diagrams

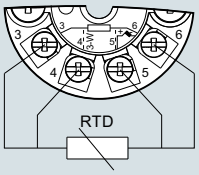
Resistance thermometer



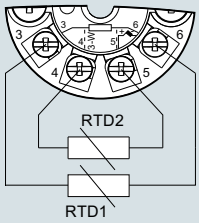
2-wire connection [1)]



3-wire connection

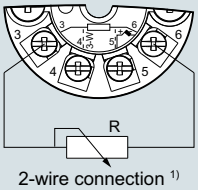


4-wire connection

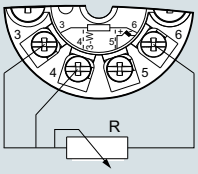


Generation of average value / difference [1)]

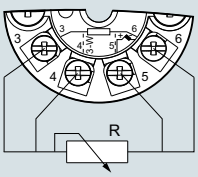
Resistance



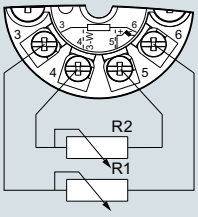
2-wire connection [1)]



3-wire connection

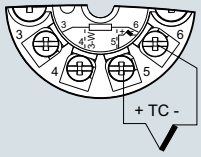


4-wire connection

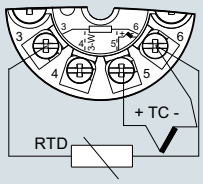


Generation of average value / difference [1)]

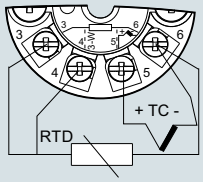
Thermocouple



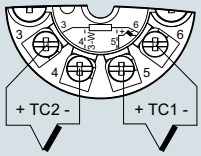
Cold junction compensation
Internal/fixed value



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



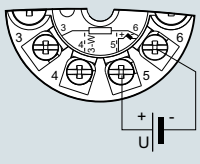
Cold junction compensation with external Pt100 in 3-wire connection



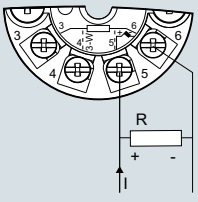
Generation of average value / difference with internal cold junction compensation

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

Voltage measurement



Current measurement



SITRANS TF, sensor connection assignment

SITRANS TF - Fieldbus transmitter

Overview

Our field devices for heavy industrial use

- FOUNDATION fieldbus
- PROFIBUS PA

The SITRANS TF temperature transmitter works where others can't cope.

Benefits

- For universal use as a transmitter for resistance thermometers, thermocouple elements, Ω or mV signals
- Rugged two-chamber enclosure in die-cast aluminum or stainless steel
- IP66/67/68 degree of protection
- Can be mounted elsewhere if the measuring point
  - is difficult to access
  - has high temperatures
  - experiences vibrations due to the process cell
  - is to avoid long neck pipes and thermowells
- 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 substances. The inner workings offer high measuring accuracy, universal input and a wide range of diagnostic options.

Function

Features

General

- Polarity-neutral bus connection
- 24-bit analog-digital converter for high resolution
- Galvanic isolation
- Version for use in hazardous areas
- Special characteristic
- Sensor redundancy

Transmitter with PROFIBUS PA communication

- Function blocks: 2 x analog

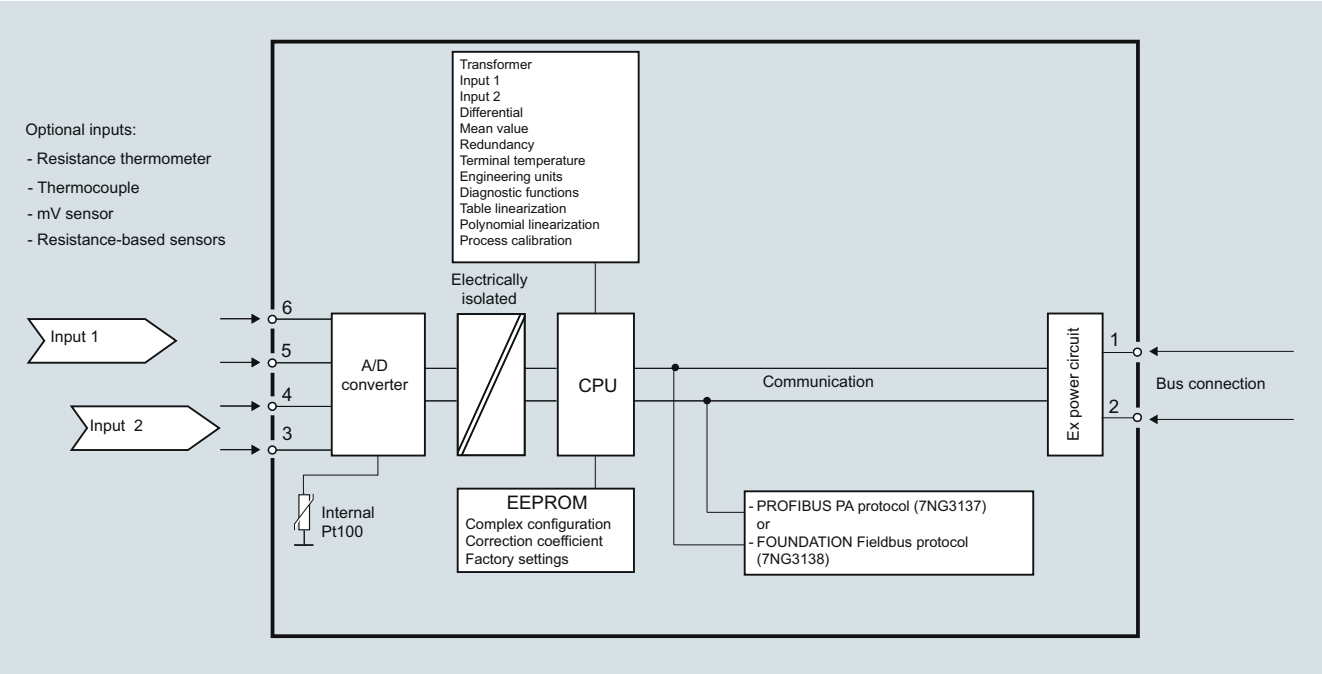
Transmitter with FOUNDATION fieldbus communication

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

Mode of operation

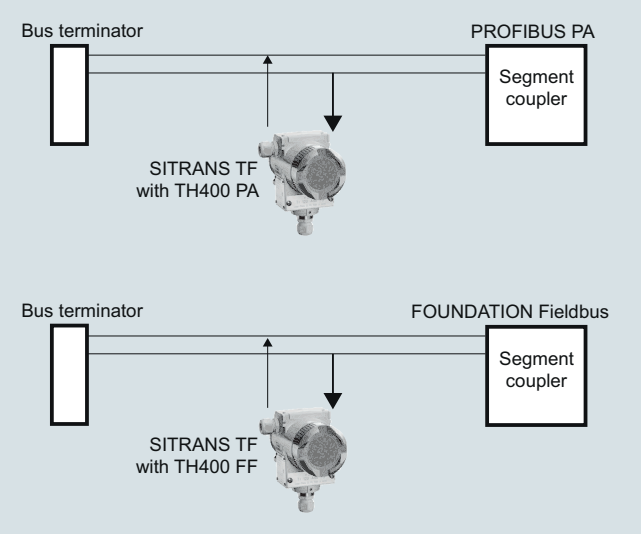
The following function diagram explains the mode of operation of the transmitter.

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

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

General values

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

Basic values

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

Reference conditions	
Warming-up time	30 s
Signal-to-noise ratio	Min. 60 dB

SITRANS TF - Fieldbus transmitter

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
• 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
Design	
Weight	Approx. 1.5 kg (3.3 lb) without options
Dimensions	See "Dimensional drawings"
Enclosure materials	• Die-cast aluminum, low in copper, GD-AlSi 12 or stainless steel • Polyester-based lacquer for GD AlSi 12 enclosure • Stainless steel rating plate
Electrical connection, sensor connection	• Screw terminals • Cable inlet via M20 x 1.5 or ½-14 NPT screwed gland • Bus connection with M12 device plug (optional)
Mounting bracket (optional)	Steel, galvanized and chrome-plated or stainless steel
Degree of protection	IP66/67/68 according to EN 60529
Auxiliary power	
Supply voltage	
• 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-examination certificate	ZELM 11 ATEX 0471 X
• "Intrinsic safety" type of protection (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
• "Non-sparking and energy-limited equipment" 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-examination 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 standard	EN 50170 Volume 2
- Address (for delivery)	126
- Function blocks	2 x analog
• FOUNDATION Fieldbus connection	
- Protocol	FF protocol
- Protocol standard	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 connection
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 connection
Unit	°C
Failure mode	Last valid value
Filter time	0 s
Node address	22

Selection and ordering data

	Article No.						
Temperature transmitter in field enclosure ↗ With fieldbus communication and electrical isolation	**7NG313**	■	-	■	■	**0**	■
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.							
Built-in transmitter							
SITRANS TH400 with PROFIBUS PA							
• Without Ex protection		**7**		**0**			
• With Ex ia (ATEX)		**7**		**1**			
• With Ex nAL for Zone 2 (ATEX)		**7**		**2**			
• Total device SITRANS TF Ex d (ATEX + IECEx)[1]		**7**		**4**			
• Total device SITRANS TF according to FM (XP, DIP, NI, S)[1]		**7**		**5**			
SITRANS TH400, with FOUNDATION Fieldbus							
• Without Ex protection		**8**		**0**			
• With Ex ia (ATEX)		**8**		**1**			
• With Ex nAL for Zone 2 (ATEX)		**8**		**2**			
• Total device SITRANS TF Ex d (ATEX + IECEx)[1]		**8**		**4**			
• Total device SITRANS TF according to FM (XP, DIP, NI, S)[1]		**8**		**5**			
Enclosure							
Die-cast aluminum					**A**		
Stainless steel precision casting					**E**		
Connections/cable inlet							
Screwed glands M20x1.5						**B**	
½-14 NPT glands						**C**	
Mounting bracket and fastening parts							
Without							**0**
Made of steel							**1**
Made of stainless steel							**2**

[1] Without cable gland

Options	Order code
Append suffix "**-Z**" to article no., add order code and plain text, if applicable.	
Test report (5 measuring points)	**C11**
Bus connection	
• M12 device plug (metal) without mating connector	**M00**[1]
• M12 device plug (metal) with mating connector	**M01**[1]
Explosion protection	
• Explosion protection Ex ia according to INMETRO (Brazil) (only for 7NG313.-1...)	**E25**[2]
• Explosion protection Ex d according to INMETRO (Brazil) (only for 7NG313.-4...)	**E26**[2]
• Explosion protection Ex nA according to INMETRO (Brazil) (only for 7NG313.-2...)	**E27**[2]
• Explosion protection Ex i according to NEPSI (China) (only for 7NG313.-1...)	**E55**[2]
• Explosion protection Ex d according to NEPSI (China) (only for 7NG313.-4...)	**E56**[2]
• Explosion protection Ex nA according to NEPSI (China) (only for 7NG313.-2...)	**E57**[2]
• Explosion protection Ex d according to KOSHA (Korea) (only for 7NG313.-4...)	**E70**[2]
• Explosion protection Ex i according to EAC (Russia/Belarus/Kazahstan) (only for 7NG313.-1...)	**E81**[2]
• Explosion protection Ex d according to EAC (Russia/Belarus/Kazahstan) (only for 7NG313.-4...)	**E82**[2]
• Explosion protection Ex nA according to EAC (Russia/Belarus/Kazakhstan) (only for 7NG313.-2...)	**E83**[2]
Marine approvals	
• Det Norske Veritas Germanischer Lloyd (DNV GL)	**D01**
• Bureau Veritas (BV)	**D02**
• Lloyd's Register of Shipping (LR)	**D04**
• American Bureau of Shipping (ABS)	**D05**
Two-layer coating of enclosure and cover (PU on epoxy)	**G10**
Transient protection	**J01**
Cable gland CAPRI ½ NPT ADE 4F, nickel-plated brass (CAPRI 848694 and 810634) included	**D57**
Cable gland ½ NPT ADE 1F, cable diameter 6 ... 12 (CAPRI 818694 and 810534) included	**D58**
Cable gland ½ NPT ADE 4F, Stainless steel (CAPRI 848699 and 810634) included	**D59**
Cable gland ½ NPT ADE 1F, cable diameter 4 ... 8.5 (CAPRI 818674 and 810534) included	**D60**

SITRANS TF - Fieldbus transmitter

Options	Order code
Append suffix "**-Z**" to article no., add order code and plain text, if applicable.	
Customer-specific programming	
Measuring range to be set Specify in plain text (max. 5 digits): Y01:... to ... °C, °F	**Y01**[3]
Measuring point number (TAG) max. 8 characters	**Y15**[4]
Measuring point description, max. 16 characters	**Y23**[4]
Measuring point description, max. 32 characters	**Y24**[5]
Specify bus address in plain text	**Y25**[4]
Pt100 (IEC) 2-wire, R_L = 0 Ω	**U02**[6]
Pt100 (IEC) 3-wire	**U03**[6]
Pt100 (IEC) 4-wire	**U04**[6]
Type B thermocouple	**U20**[6][7]
Type C thermocouple (W5)	**U21**[6][7]
Type D thermocouple (W3)	**U22**[6][7]
Type E thermocouple	**U23**[6][7]
Type J thermocouple	**U24**[6][7]
Type K thermocouple	**U25**[6][7]
Type L thermocouple	**U26**[6][7]
Type N thermocouple	**U27**[6][7]
Type R thermocouple	**U28**[6][7]
Type S thermocouple	**U29**[6][7]
Type T thermocouple	**U30**[6][7]
Type U thermocouple	**U31**[6][7]
For TC: Cold junction compensation: external (Pt100, 3-wire)	**U41**
For TC: Reference junction compensation: external with fixed value: specify in plain text	**Y50**
Enter special deviating customer-specific setting in plain text	**Y09**[8]

1) Not possible with explosion protection Ex d or XP.

2) Option does not include ATEX/IECEx approval, only country-specific approval. For specification on TAG plate, please select Y22.

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 Y23.

4) If only Y15, Y23 or Y25 is ordered and if the labeling is only noted on the measuring point plate, do not specify Y01.

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

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.

Accessories

	Article No.
Additional accessories for assembly, connection and transmitter configuration, see page 2/154.	
SIMATIC PDM parameterization software Also for SITRANS TH300	**See section 8**
Mounting bracket and fastening parts	
Made of steel for 7NG313.-..B..	**7MF4997-1AC**
Made of steel for 7NG313.-..C..	**7MF4997-1AB**
Made of stainless steel for 7NG313.-..B..	**7MF4997-1AJ**
Made of stainless steel for 7NG313.-..C..	**7MF4997-1AH**
Made of stainless steel 316L for 7NG313.-..B..	**7MF4997-1AQ**
Made of stainless steel 316L for 7NG313.-..C..	**7MF4997-1AP**
Connection board	**A5E02226423**

For supply units, see Catalog FI 01 section "Supplementary components".

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

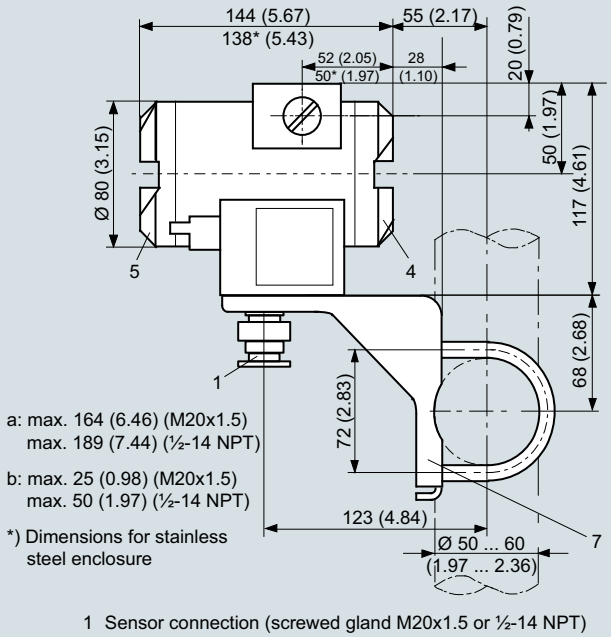
For SITRANS TH400 PA:

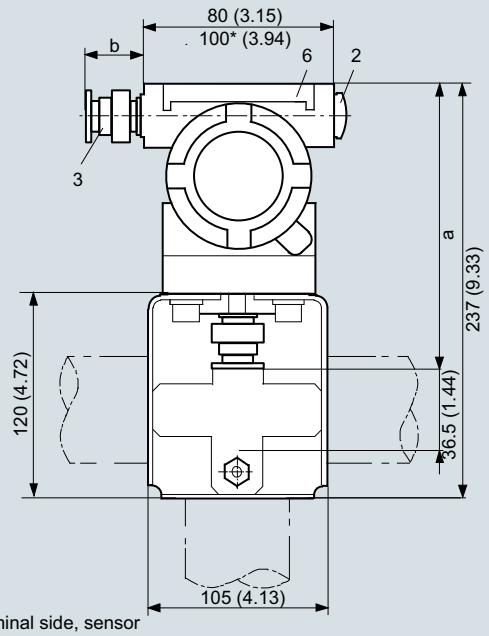
- Pt100 (IEC); 3-wire connection
- Unit: °C
- Failure mode: Last valid value
- Filter time: 0 s - PA address: 126
- PROFIBUS Ident No.: Manufacturer-specific

For SITRANS TH400 FF:

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

Dimensional drawings





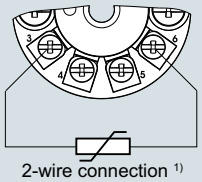
1 Sensor connection (screwed gland M20x1.5 or ½-14 NPT)
2 Blanking plug
3 Electrical connection (screwed plug M20x1.5 orr ½-14 NPT), optional M12 device plug
4 Terminal side, bus connection
5 Terminal side, sensor
6 Protective cover (without function)
7 Mounting bracket (optional) with clamp securing to a vertical or horizontal pipe

SITRANS TF with TH400, dimensions in mm (inches)

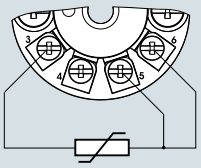
2

Circuit diagrams

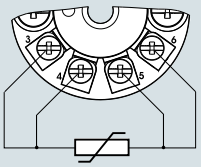
Resistance thermometer



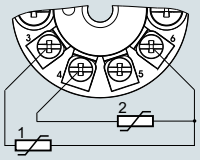
2-wire connection [1)]



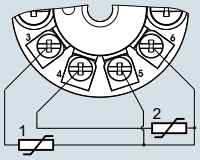
3-wire connection



4-wire connection

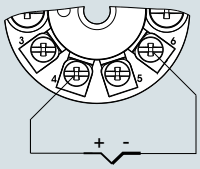


Mean-value/differential or redundancy generation
2 x 2-wire connection [1)]

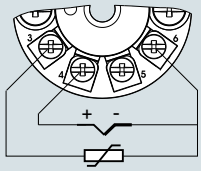


Mean-value/differential or redundancy generation
1 sensor in 2-wire connection [1)]
1 sensor in 3-wire connection

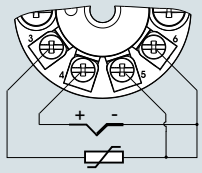
Thermocouple



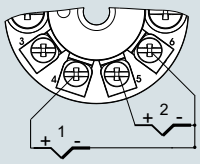
Internal
cold junction compensation



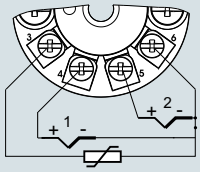
Cold junction compensation
with external Pt100 in 2-wire connection [1)]



Cold junction compensation
with external Pt100 in 3-wire connection

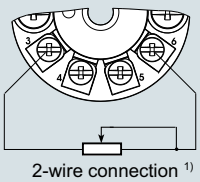


Mean value, differential or redundancy generation with internal cold junction compensation

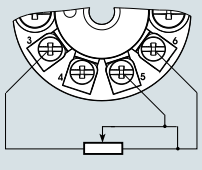


Mean value, differential or redundancy generation and cold junction compensation with internal Pt100
in 2-wire connection [1)]

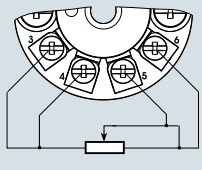
Resistance



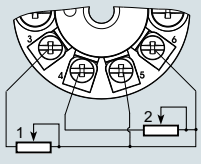
2-wire connection [1)]



3-wire connection

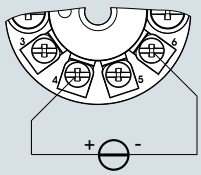


4-wire connection

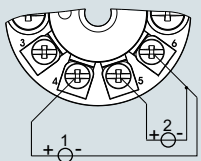


Mean value, differential or redundancy generation
1 resistor in 2-wire connection [1)]
1 resistor in 3-wire connection

Voltage measurement



One voltage source



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

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

SITRANS TF with TH400, sensor connection assignment

Overview

SITRANS TF320 in dual chamber enclosure

SITRANS TF320 in single chamber enclosure

- 2-wire temperature transmitter with and without HART communication interface
- Universal input for virtually any type of temperature sensor
- Can be configured via PC, HART 7 or optional local operation

Benefits

- Universally applicable as a temperature transmitter with galvanic isolation for:
  - Resistance thermometer (2-wire, 3-wire, 4-wire connection)
  - Thermocouples
  - Linear resistances, potentiometer and DC voltage sources
- Local operation of the temperature transmitter via display (single chamber enclosure) or control keys accessible from outside (dual chamber enclosure)
- Rugged single or dual chamber enclosure made of die-cast aluminum or stainless steel 316L
- Electronic compartment isolated (watertight) from terminal compartment in dual chamber enclosure
- Degree of protection IP66/67/68 (1.5 m/2 h)
- Electromagnetic compatibility according to DIN EN 61326 and NE21
- Test terminals for direct read-out of the output signal without breaking the current loop
- Remote installation option:
  - Measuring point is difficult to access
  - Measuring point is subjected to high temperatures
  - Measuring point is subjected to vibration through plant
  - Long neck pipes and thermowells must be avoided
- Mounted directly on sensors
- Temperature transmitters of the "intrinsically safe protection type, increased safety for zone 2, flameproof and dust-protected" type of protection can be installed in hazardous areas. The transmitter meets the requirements of the EU Directive 2014/34/EU (ATEX), the FM and CSA regulations as well as other national approvals, e.g. EACEx, NEPSI, KCs, Inmetro.
- SIL2/3 (with order note C20)

Application

SITRANS TF320 can be used everywhere where temperatures need to be measured under particularly adverse conditions and where a user-friendly 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 substances. The inner workings offer high measuring accuracy, universal input and a wide range of diagnostic options.

2

Function

Configuration

The communication capability over the HART protocol V 7 permits parameterization using a PC or HART communicator (handheld communicator). The SIMATIC PDM makes it easy.

For the SITRANS TF320 without HART functionality, parameters are assigned with the PC. A special modem and the software tool SIPROM T are available for this purpose.

The optional local operation on the device gives you the possibility to configure the device's most important functions very quickly.

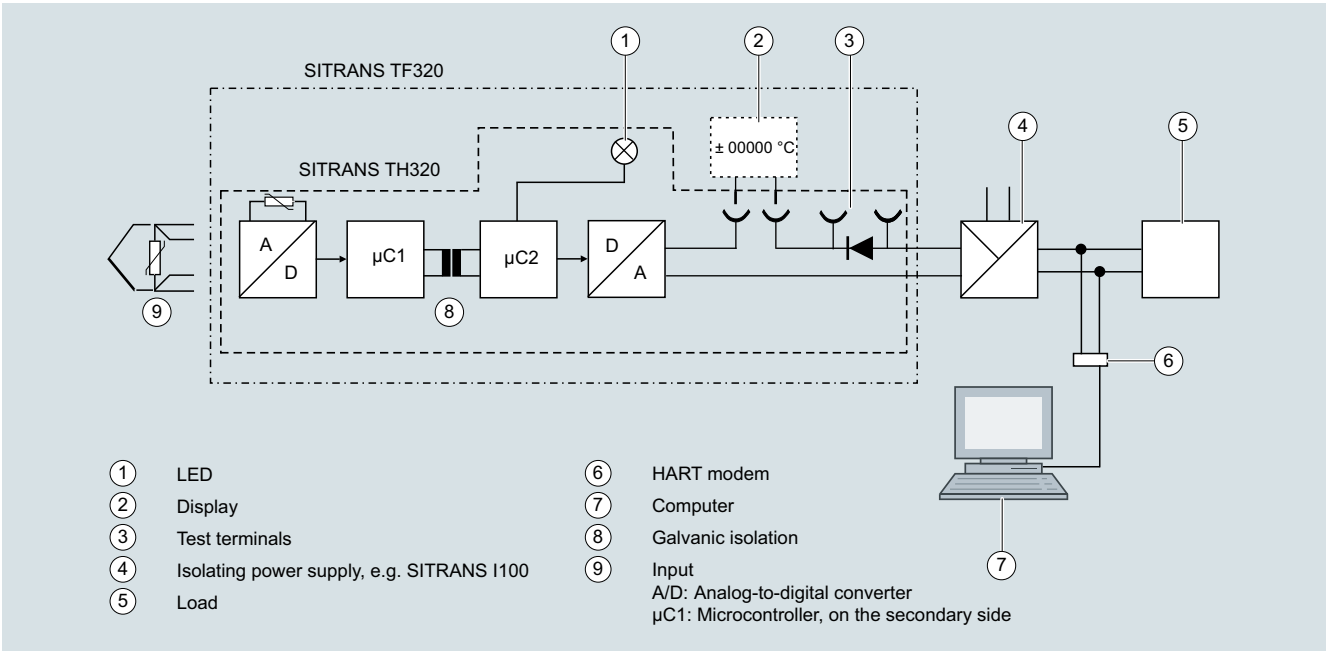
Principle of operation

SITRANS TF320 as temperature transmitter

The input signal, whether resistance thermometer (RTD), thermocouple (TC), Ω or mV signal, is amplified and linearized. Input and output side are galvanically isolated. An internal cold junction is integrated for measurements with thermocouples.

The device outputs a temperature-linear direct current from 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 TF320 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.



Function block diagram SITRANS TF320 with integrated SITRANS TH320

Technical specifications

General	
Supply voltage[1) 2)]	
• Without explosion protection (non-Ex)	10.5 ... 48 V DC
• with explosion protection (Ex i)	10.5 ... 30 V DC
Additional minimum supply voltage when using test terminals	0.8 V
Maximum power loss	≤ 850 mW
Minimum load resistance at supply voltage > 37 V	(V_{supply} - 37 V)/23 mA
Insulation voltage, test/operation	
• Without explosion protection (non-Ex)	2.5 kV AC/55 V AC
• with explosion protection (Ex i)	2.5 kV AC/42 V AC
Polarity protection	All inputs and outputs
Write protection	Wire jumper (transmitter), switch (on display) or software
Warm-up time	< 5 min
Starting time	< 2.75 s
Programming	SIPROM T and HART
Signal-to-noise ratio	> 60 dB
Long-term stability	Better than: • ± 0.05% of measuring span/year • ± 0.18% of measuring span/5 years
Response time	4 ... 20 mA: ≤ 55 ms HART: ≤ 75 ms (typically 70 ms)
Programmable damping	0 ... 60 s
Signal dynamic	
• Input	24 bit
• Output	18 bit
Influence of change in supply voltage	< 0.005% of measuring span/V DC
Input	
Resistance thermometer (RTD)	
Input type	
• Pt10 ... 10000	• IEC 60751 • JIS C 1604-8 • GOST 6651_2009 • Callendar-Van Dusen
• Ni10 ... 10000	• DIN 43760-1987 • GOST 6651-2009/OIML R84:2003
• Cu5 ... 1000	• Edison Copper Winding No. 15 • GOST 6651-2009/OIML R84:2003
Type of connection	2-wire, 3-wire or 4-wire
Line resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the line resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8)	Max. 30 nF
• All other input types	Max. 50 nF
Fault detection, programmable	None, short-circuited, defective, short-circuited or defective
	Note When the low limit for the configured input type is below the constant detection limit for short-circuited inputs, the detection of short circuits is disabled regardless of the configuration of the fault detection.
Detection limit for short-circuited input	15 Ω
Fault detection time (RTD)	≤ 75 ms (typically 70 ms)
Fault detection time (for 3-wire and 4-wire)	≤ 2 000 ms
Thermocouples (TC)	
Input type	
• B	IEC 60584-1
• E	IEC 60584-1
• J	IEC 60584-1
• K	IEC 60584-1
• L	DIN 43710
• Lr	GOST 3044-84
• N	IEC 60584-1
• R	IEC 60584-1
• S	IEC 60584-1
• T	IEC 60584-1
• U	DIN 43710
• W3	ASTM E988-96
• W5	ASTM E988-96
• LR	GOST 3044-84
Cold junction compensation (CJC)	Constant, internal or external over Pt100 or Ni100 RTD
• Temperature range internal CJC	-50 ... +100 °C (-58 ... +212 °F)
• Connection external CJC	2-wire or 3-wire
• External CJC, line resistance per wire (for 3-wire and 4-wire connections)	50 Ω
• Effect of the line resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
• Input current external CJC	< 0.15 mA
• Temperature range external CJC	-50 ... +135 °C (-58 ... +275 °F)
• Cable, wire-wire capacity	Max. 50 nF
• Total line resistance	Max. 10 kΩ
• Fault detection, programmable	None, short-circuited, defective, short-circuited or defective
	Note The short-circuited fault detection only applies to the CJC input.
• Fault detection time (TC)	≤ 75 ms (typically 70 ms)
• Fault detection time, external CJC (for 3-wire and 4-wire)	≤ 2 000 ms
Linear resistance	
Input range	0 ... 100 kΩ
Minimum measuring span	25 Ω
Type of connection	2-wire, 3-wire or 4-wire
Line resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the line resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• R > 400 Ω	Max. 30 nF
• R ≤ 400 Ω	Max. 50 nF
Fault detection, programmable	None, defective

SITRANS TF320 (HART, universal)

Potentiometers	
Input range	10 Ω ... 100 kΩ
Minimum measuring span	25 Ω
Type of connection	2-wire, 3-wire or 4-wire
Line resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the line resistance (with 4-wire and 5-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• R > 400 Ω	Max. 30 nF
• R ≤ 400 Ω	Max. 50 nF
Fault detection, programmable	None, short-circuited, defective, short-circuited or defective
	Note When the configured potentiometer size is below the constant detection limit for short-circuited inputs, the detection of short circuits is disabled regardless of the configuration of the fault detection.
Detection limit for short-circuited input	15 Ω
Fault detection time, wiper arm (no short-circuit detection)	≤ 75 ms (typically 70 ms)
Fault detection time, element	≤ 2 000 ms
Fault detection time (for 4-wire and 5-wire)	≤ 2 000 ms
Supply voltage	
Measuring range	
• Unipolar	-100 ... 1700 mV
• Bipolar	-800 ... +800 mV
Minimum measuring span	2.5 mV
Input resistance	10 MΩ
Cable, wire-wire capacity	
• Input range: -100 ... 1700 mV	Max. 30 nF
• Input range: -20 ... 100 mV	Max. 50 nF
Fault detection, programmable	None, defective
Fault detection time	≤ 75 ms (typically 70 ms)
Output and HART communication	
Normal range, programmable	3.8 ... 20.5 mA/20.5 ... 3.8 mA
Extended range (output limits), programmable	3.5 ... 23 mA/23 ... 3.5 mA
Programmable input/output limits	
• Fault current	Enable/disable
• Fault current setting	3.5 ... 23 mA
Update time	10 ms
Load (with current output)	≤ (V_{Supply} - 10.5)/0.023 Ω
Load stability	< 0.01% of measuring span/100 Ω (measuring span = currently selected range)
Input fault detection, programmable (detection of input short circuits is ignored with TC and voltage inputs)	3.5 ... 23 mA
NAMUR NE43 Upscale	> 21 mA
NAMUR NE43 Downscale	< 3.6 mA
HART protocol versions	HART 7
Measuring accuracy	
Input accuracy	See "Input accuracy" table
Output accuracy	See "Output accuracy" table

Rated conditions	
Ambient temperature	
• Without local operation in single chamber enclosure	-50 ... +85 °C (-58 ... +185 °F)
• With local operation	-40 ... +85 °C (-40 ... +185 °F)
• For transmitters with functional safety	-40 ... +80 °C (-40 ... +176 °F)
Storage temperature	-50 ... +85 °C (-58 ... +185 °F)
Reference temperature for sensor calibration	24 °C ±1.0 °C (75.2 °F ±1.8 °F)
Relative humidity	< 99% (no condensation)
Degree of protection	
• Temperature transmitter enclosure	IP66/IP67/IP68
• Terminals	IP00
Mechanical construction	
Weight	
• Single chamber enclosure	0.85 kg (1.87 lb)
• Dual chamber enclosure	• Aluminum: 1.3 kg (2.87 lb) • Stainless steel: 3.3 kg (7.28 lb)
Maximum core cross-section	
• Single chamber enclosure	1.5 mm² (AWG 16)
• Dual chamber enclosure	2.5 mm² (AWG 14)
Tightening torque for clamping screws	0.5 ... 0.6 Nm
Vibrations	IEC 60068-2-6
• 2 ... 25 Hz	± 1.6 mm (0.07 inch)
• 25 ... 100 Hz	± 4 g
Certificates and approvals	
Explosion protection ATEX/IECEx and others	
Certificates[3)]	IECEx DEK 19.0069X DEKRA 19ATEX0106 X (Category 1) DEKRA 19ATEX0107 X (Category 3)
"Intrinsic safety ia/ib" type of protection	For use in Zone 0, 1, 2
• ATEX	II 1 G Ex ia IIC T6 ... T4 Ga II 2(1) G Ex ib [ia Ga] IIC T6 ... T4 Gb
• IECEx and others	Ex ia IIC T6 ... T4 Ga Ex ib [ia Ga] IIC T6 ... T4 Gb
• EACEx	Ex ia IIC T6 ... T4 Ga Ex ib [ia Ga] IIC T6 ... T4 Gb
"Intrinsic safety ic" type of protection	For use in Zones 2
• ATEX	II 2 G Ex ic IIC T6…T4 Gc
• IECEx and others	Ex ic IIC T6 ... T4 Gc
• EACEx	2Ex ic IIC T6…T4 Gc X
"Non-sparking/increased safety nA/ec" type of protection	For use in Zones 2
• ATEX	II 2 G Ex nA IIC T6…T4 Gc II 2 G Ex ec IIC T6…T4 Gc
• IECEx and others	Ex nA IIC T6 ... T4 Gc Ex ec IIC T6 ... T4 Gc
• EACEx	2Ex nA IIC T6…T4 Gc
• "Flameproof enclosure db" type of protection	For use in Zone 1
• ATEX	II 2 G Ex db IIC T6…T4 Gb
• IECEx and others	Ex db IIC T6 ... T4 Gb
• EACEx	1Ex d IIC T6…T4 Gb X
• "Protection by enclosure tb" type of protection	For use in Zone 21
• ATEX	II 2 D Ex tb IIC T100°C Db
• IECEx and others	Ex tb IIC T100°C Db
• EACEx	Ex tb IIC T100°C Db X

Explosion protection CSA/FM for Canada and USA	
Certificates	FMxxCAxxxx FMxxUSxxxx
"Intrinsic safety ia" type of protection	IS, CL I, Div 1, GP ABCD, T6 ... T4 Ex ia IIC T6 … T4 Ga AEx ia IIC T6 … T4 Ga or: Ex ib [ia Ga] IIC T6…T4 Gb AEx ib [ia Ga] IIC T6…T4 Gb
"Non incendive field wiring NIFW" type of protection	NIFW, CL I, Div 2, GP ABCD T6 ... T4
"Non incendive NI" type of protection	NI, CL I, Div 2, GP ABCD T6...T4 Ex nA IIC T6 ... T4 Gc AEx nA IIC T6 ... T4 Gc
"Explosion-proof XP" type of protection	XP/ CL I / DIV1 / GP ABCD / T6....T4 CL I / Zn1 / AEx/Ex d IIC T6...T4 Gb
"Dust-protected DIP" type of protection	DIP/ CL II, III / DIV 1 / GP EFG / T6...T4 Zn21 / AEx/Ex tb IIIC T100°C Gb

1) Note that the minimum supply voltage must correspond to the value measured at the terminals of the SITRANS TF320.
All external voltage drops must be taken into consideration.

2) Protect the device from overvoltage with the help of a suitable power supply or suitable overvoltage protection equipment.

3) Additional available certificates are listed on the Internet at
http://www.siemens.com/processinstrumentation/certificates

Measuring ranges/Minimum measuring span

RTD

Input type	Standard	Measuring range in °C (°F)	α_0 in $°C^{-1}$ ($°F^{-1}$)	Minimum measuring span in °C (°F)
Pt10 ... 10000	IEC 60751	-200 ... +850 (-328 ... +1 562)	0.003851 (0.002139)	10 (50)
	JIS C 1604-8	-200 ... +649 (-328 ... +1 200)	0.003916 (0.002176)	10 (50)
	GOST 6651_2009	-200 ... +850 (-328 ... +1 562)	0.003910 (0.002172)	10 (50)
	Callendar-Van Dusen	-200 ... +850 (-328 ... +1 562)	-	10 (50)
Ni10 ... 10000	DIN 43760-1987	-60 ... +250 (-76 ... +482)	0.006180 (0.003433)	10 (50)
	GOST 6651-2009/OIML R84:2003	-60 ... +180 (-76 ... +356)	0.006170 (0.003428)	10 (50)
Cu5 ... 1000	Edison Copper Winding No. 15	-200 ... +260 (-328 ... +500)	0.004270 (0.002372)	100 (212)
	GOST 6651-2009/OIML R84:2003	-180 ... +200 (-292 ... +392)	0.004280 (0.002378)	100 (212)
	GOST 6651-94	-50 ... +200 (-58 ... +392)	0.004260 (0.002367)	100 (212)

TC

Input type	Standard	Measuring range in °C (°F)	Minimum measuring span in °C (°F)
B	IEC 60584-1	0 (85) ... 1 820 (32 (185) ... 3 308)	100 (212)
E	IEC 60584-1	-200 ... +1 000 (-392 ... +1 832)	50 (122)
J	IEC 60584-1	-100 ... +1 200 (-212 ... +2 192)	50 (122)
K	IEC 60584-1	-180 ... +1 372 (-356 ... +2 502)	50 (122)
L	DIN 43710	-200 ... +900 (-392 ... +1 652)	50 (122)
Lr	GOST 3044-84	-200 ... +800 (-392 ... +1 472)	50 (122)
N	IEC 60584-1	-180 ... +1 300 (-356 ... +2 372)	50 (122)
R	IEC 60584-1	-50 ... +1 760 (-122 ... +3 200)	100 (212)
S	IEC 60584-1	-50 ... +1 760 (-122 ... +3 200)	100 (212)
T	IEC 60584-1	-200 ... +400 (-392 ... +752)	50 (122)
U	DIN 43710	-200 ... +600 (-392 ... +1 112)	50 (122)
W3	ASTM E988-96	0 ... 2 300 (32 ... 4 172)	100 (212)
W5	ASTM E988-96	0 ... 2 300 (32 ... 4 172)	100 (212)
LR	GOST 3044-84	-200 ... +800 (-392 ... +1472)	50 (122)

SITRANS TF320 (HART, universal)

Input accuracy

Basic values

Input type	Basic accuracy	Temperature coefficient[1)]
RTD		
Pt10	≤ ±0.8 °C (1.44 °F)	≤ ±0.020 °C/°C (°F/°F)
Pt20	≤ ±0.4 °C (0.72 °F)	≤ ±0.010 °C/°C (°F/°F)
Pt50	≤ ±0.16 °C (0.288 °F)	≤ ±0.004 °C/°C (°F/°F)
Pt100	≤ ±0.04 °C (0.072 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt200	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt500	$T_{max.}$ < 180 °C (356 °F) = ≤ ±0.08 °C (0.144 °F) $T_{max.}$ > 180 °C (356 °F) = ≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt1000	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt2000	$T_{max.}$ < 300 °C (572 °F) = ≤ ±0.08 °C (0.144 °F) $T_{max.}$ > 300 °C (572 °F) = ≤ ±0.4 °C (0.72 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt10000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Ni10	≤ ±1.6 °C (2.88 °F)	≤ ±0.020 °C/°C (°F/°F)
Ni20	≤ ±0.8 °C (1.44 °F)	≤ ±0.010 °C/°C (°F/°F)
Ni50	≤ ±0.32 °C (0.576 °F)	≤ ±0.004 °C/°C (°F/°F)
Ni100	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni120	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni200	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni500	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni1000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni2000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni10000	≤ ±0.32 °C (0.576 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Cu5	≤ ±1.6 °C (2.88 °F)	≤ ±0.040 °C/°C (°F/°F)
Cu10	≤ ±0.8 °C (1.44 °F)	≤ ±0.020 °C/°C (°F/°F)
Cu20	≤ ±0.4 °C (0.72 °F)	≤ ±0.010 °C/°C (°F/°F)
Cu50	≤ ±0.16 °C (0.288 °F)	≤ ±0.004 °C/°C (°F/°F)
Cu100	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu200	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu500	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu1000	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Linear resistance		
0 ... 400 Ω	≤ ±40 mΩ	≤ ±2 mΩ/°C (1.11 mΩ/°F)
0 ... 100 kΩ	≤ ±4 Ω	≤ ±0.2 Ω/°C (0.11 Ω/°F)
Potentiometers		
0 ... 100%	< 0.05%	< ± 0.005%
Supply voltage		
mV: -20 ... 100 mV	≤ ±5 µV	≤ ±0.2 µV/°C (0.11 µV/°F)
mV: -100 ... 1700 mV	≤ ±0.1 mV	≤ ±36 µV/°C (20 µV/°F)
mV: ± 800 mV	≤ ±0.1 mV	≤ ±32 µV/°C (17.8 µV/°F)
TC		
E	≤ ±0.2 °C (0.36 °F)	≤ ±0.025 °C/°C (°F/°F)
J	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
K	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
L	≤ ±0.35 °C (0.63 °F)	≤ ±0.025 °C/°C (°F/°F)
N	≤ ±0.4 °C (0.72 °F)	≤ ±0.025 °C/°C (°F/°F)
T	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
U	< 0 °C (32 °F) ≤ ±0.8 °C (1.44 °F) ≥ 0 °C (32 °F) ≤ ±0.4 °C (0.72 °F)	≤ ±0.025 °C/°C (°F/°F)
Lr	≤ ±0.2 °C (0.36 °F)	≤ ±0.1 °C/°C (°F/°F)
R	< 200 °C (392 °F) ≤ ±0.5 °C (0.9 °F) ≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
S	< 200 °C (392 °F) ≤ ±0.5 °C (0.9 °F) ≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)

Input type	Basic accuracy	Temperature coefficient[1]
W3	≤ ±0.6 °C (1.08 °F)	≤ ±0.1 °C/°C (°F/°F)
W5	≤ ±0.4 °C (0.72 °F)	≤ ±0.1 °C/°C (°F/°F)
B[2]	≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
B[3]	≤ ±3 °C (5.4 °F)	≤ ±0.1 °C/°C (°F/°F)
B[4]	≤ ±8 °C (14.4 °F)	≤ ±0.8 °C/°C (°F/°F)
B[5]	Not specified	Not specified
CJC (internal)	< ±0.5 °C (0.9 °F)	Included in basic accuracy
CJC (external)	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)

1) Temperature coefficients correspond to the specified values or 0.002% of the input span, depending on which value is greater.

2) Accuracy of the specification range > 400 °C (752 °F)

3) Accuracy of the specification range > 160 °C (320 °F) < 400 °C (752 °F)

4) Accuracy of the specification range > 85 °C (185 °F) < 160 °C (320 °F)

5) Accuracy of the specification range < 85 °C (185 °F)

Output accuracy

Output type	Basic accuracy	Temperature coefficient
Analog output	≤ ±1.6 µA (0.01% of the full output span)	≤ ±0.48 µA/K (≤ ±0.003% of the full output span/K)

SITRANS TF320 (HART, universal)

Selection and ordering data

Single chamber enclosure

	Article No.
SITRANS TF320 Temperature transmitter with single chamber enclosure for wall or pipe mounting, one configurable input and a galvanically isolated 2-wire output. ↗	**7NG034** ■ - ■■■■■ - 0■■■
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.	
Communication	
With HART (4 ... 20 mA)	**0**
Without HART (4 ... 20 mA)	**7**
Primary value output	
Input 1	**0**
Input 1, type	
RTD	
• Pt100 (IEC 60751), 3-wire	**B**
• Pt100 (IEC 60751), 4-wire	**C**
• Pt1000 (IEC 60751), 3-wire	**D**
• Pt1000 (IEC 60751), 4-wire	**E**
TC	
• Type B	**F**
• Type E	**G**
• Type J	**H**
• Type K	**J**
• Type L	**K**
• Type N	**L**
• Type R	**N**
• Type S	**P**
• Type T	**Q**
Potentiometer, 4-wire	**R**
Input 2, type	
Without input 2	**A**
CJC configuration for TC	
None CJC	**0**
Internal CJC	**1**
External CJC RTD Pt100 (IEC 60751), 3-wire	**3**
External CJC RTD Ni100 (DIN 43760-87), 3-wire	**6**
Material of non-wetted parts	
Die-cast aluminum enclosure	**1**
Type of protection (Ex)	
General purpose	**A**
Intrinsic safety (Ex i) / Non-incendive field wiring (NIFW)	**B**
Flameproof enclosure (Ex d) / Explosion proof (XP)	**C**
Dust ignition protection by enclosure zone 21/22 (Ex t) / Dust ignition proof (DIP) / Increased safety zone 2 (Ex ec) / Non-incendive (NI)	**L**
Flameproof enclosure (Ex d) / Intrinsic safety (Ex i) / Dust ignition protection by enclosure zone 21/22 (Ex t) / Increased safety zone 2 (Ex ec)	**S**
Electrical connection/cable entries	
2x M20 x 1.5	**F**
2x ½'' NPT	**M**
Local operation	
Without local operation	**0**
Local operation (closed lid)	**1**
Local operation (lid with glass window)	**2**

Options	Order Code
Append "**-Z**" to Article No., add order code and, if applicable, free text.	
Cable gland included	
Plastic	**A00**
Metal	**A01**
Stainless steel	**A02**
Stainless steel 316L/1.4404	**A03**
CMP, for XP devices	**A10**
CAPRI ADE 4F, CuZn, cable inner diameter 7 ... 12 mm, cable outer diameter 10 ... 16 mm	**A11**
CAPRI ADE 4F, stainless steel, cable inner diameter 7 ... 12 mm, cable outer diameter 10 ... 16 mm	**A12**
Mounting cable glands/plugs	
Cable gland mounted	**A97**
Device plug for output, mounted right	**A98**
Device options	
Degree of protection IP66 / IP68 (not for device plugs M12 and Han)	**D30**
General approval without Ex approval	
Worldwide (CE, RCM) except EAC, FM, KCC	**E00**
Explosion protection certificates	
ATEX (Europe) and IECEx (world)	**E47**
Mounting system (only single chamber enclosures)	
Pipe mounting kit for single chamber enclosure, stainless steel 316L	**H06**
Wall mounting kit for single chamber enclosure, stainless steel 316L	**H07**

Selection and ordering data

Dual chamber enclosure

	Article No.
SITRANS TF320 Temperature transmitter with dual chamber enclosure for wall or pipe mounting, one configurable input and a galvanically isolated 2-wire output. ↗	**7NG035** - - 0
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.	
Communication	
With HART (4 ... 20 mA)	**0**
Without HART (4 ... 20 mA)	**7**
Primary value output	
Input 1	**0**
Input 1, type	
RTD	
• Pt100 (IEC 60751), 3-wire	**B**
• Pt100 (IEC 60751), 4-wire	**C**
• Pt1000 (IEC 60751), 3-wire	**D**
• Pt1000 (IEC 60751), 4-wire	**E**
TC	
• Type B	**F**
• Type E	**G**
• Type J	**H**
• Type K	**J**
• Type L	**K**
• Type N	**L**
• Type R	**N**
• Type S	**P**
• Type T	**Q**
Potentiometer, 4-wire	**R**
Input 2, type	
Without input 2	**A**
CJC configuration for TC	
Without CJC	**0**
Internal CJC	**1**
External CJC RTD Pt100 (IEC 60751), 3-wire	**3**
External CJC RTD Ni100 (DIN 43760-87), 3-wire	**6**
Material of non-wetted parts	
Die-cast aluminum enclosure	**1**
Enclosure made of stainless steel precision casting CF3M/1.4409 (similar to 316L)	**2**
Type of protection (Ex)	
General purpose	**A**
Intrinsic safety (Ex i) / Non-incendive field wiring (NIFW)	**B**
Flameproof enclosure (Ex d) / Explosion proof (XP)	**C**
Dust ignition protection by enclosure zone 21/22 (Ex t) / Dust ignition proof (DIP) / Increased safety zone 2 (Ex ec) / Non-incendive (NI)	**L**
Flameproof enclosure (Ex d) / Intrinsic safety (Ex i) / Dust ignition protection by enclosure zone 21/22 (Ex t) / Increased safety zone 2 (Ex ec)	**S**
Electrical connection/cable entries	
2x M20 x 1.5	**F**
2x ½'' NPT	**M**
Local operation	
Without local operation	**0**
Local operation (closed lid)	**1**
Local operation (lid with glass window)	**2**

Options	Order Code
Append "**-Z**" to Article No., add order code and, if applicable, free text.	
Cable gland included	
Plastic	**A00**
Metal	**A01**
Stainless steel	**A02**
Stainless steel 316L/1.4404	**A03**
CMP, for XP devices	**A10**
CAPRI ADE 4F, CuZn, cable inner diameter 7 ... 12 mm, cable outer diameter 10 ... 16 mm	**A11**
CAPRI ADE 4F, stainless steel, cable inner diameter 7 ... 12 mm, cable outer diameter 10 ... 16 mm	**A12**
Mounting cable glands/plugs	
Cable gland mounted	**A97**
Device plug for output, mounted right	**A98**
Device options	
Double layer coating (epoxy resin and polyurethane) 120 µm of enclosure and lid	**D20**
Degree of protection IP66 / IP68 (not for device plugs M12 and Han)	**D30**
Stainless steel Ex plate 1.4404/316L	**D42**
General approval without Ex approval	
Worldwide (CE, RCM) except EAC, FM, KCC	**E00**
Explosion protection certificates	
ATEX (Europe) and IECEx (world)	**E47**
Mounting brackets (only dual chamber enclosure)	
Wall/pipe mounting bracket for dual chamber enclosure, steel	**H01**
Wall/pipe mounting bracket for dual chamber enclosure, stainless steel 304	**H02**
Wall/pipe mounting bracket for dual chamber enclosure, stainless steel 316L	**H03**

SITRANS TF320 (HART, universal)

Accessories

	Article No.
Additional accessories for assembly, connection and transmitter configuration, see page 2/154.	
Modems	
Modem with USB interface and SIPROM T software	**7NG3092-8KN**
HART modem with USB interface	**7MF4997-1DB**
Thread adapter	
Thread adapter M20x1.5 (male thread) to ½-14 NPT (female thread)	**7MP1990-0BA00**
Thread adapter M20x1.5 (male thread) to G½ (female thread)	**7MP1990-0BB00**
Local operation	
Local operation for temperature transmitter in dual chamber enclosure	**7MF7902-1AD**
Mounting system for local operation 7MF7902-1AD in single chamber enclosure	**7MF7902-1AS**
Mounting brackets (only dual chamber enclosure)	
Wall/pipe mounting bracket for dual chamber enclosure, steel, 5/16-24UNF	**7MF7900-1AB**
Wall/pipe mounting bracket for dual chamber enclosure, steel, M8	**7MF7900-1AC**
Wall/pipe mounting bracket for dual chamber enclosure, stainless steel 316L, 5/16-24UNF	**7MF7900-1AH**
Wall/pipe mounting bracket for dual chamber enclosure, stainless steel 316L, M8	**7MF7900-1AJ**
Mounting system (only single chamber enclosures)	
Pipe mounting kit for single chamber enclosure, stainless steel 316L	**7MF7900-1AK**
Wall mounting kit for single chamber enclosure, stainless steel 316L	**7MF7900-1AL**
Cable gland	
Cable gland, gray, non-Ex, M20	**7MF7906-1AB**
Cable gland, gray, non-Ex, NPT	**7MF7906-1BB**
Cable gland, metal, non-Ex, NPT	**7MF7906-1BD**
Cable gland, metal, non-Ex, M20	**7MF7906-1AD**
Cable gland, metal, Ex-d, NPT	**7MF7906-1BE**
Cable gland, metal, Ex-d, M20	**7MF7906-1AE**
Cable gland, 316L, non-Ex, NPT	**7MF7906-1BH**
Cable gland, 316L, non-Ex, M20	**7MF7906-1AH**
Cable gland, 316L, Ex-d, NPT	**7MF7906-1BJ**
Cable gland, 316L, Ex-d, M20	**7MF7906-1AJ**
Cable gland, E1FX Tri-Star ½-14 NPT, CMP	**7MF7906-1NE**
Cable gland, ½ NPT Capri ADE 4F cpl., CuZn	**7MF7906-1PE**
Cable gland, ½ NPT Capri ADE 4F cpl., stainless steel	**7MF7906-1PJ**

	Article No.
Plug and cable socket	
Plug Han 7D, plastic, straight	**7MF7906-2AB**
Plug Han 7D, plastic, angled	**7MF7906-2AC**
Plug Han 7D, metal, straight, blue	**7MF7906-2AQ**
Plug Han 7D, metal, straight, grey	**7MF7906-2AN**
Plug Han 7D, metal, angled, blue	**7MF7906-2AR**
Plug Han 7D, metal, angled, grey	**7MF7906-2AP**
Plug Han 8D, plastic, straight	**7MF7906-2EB**
Plug Han 8D, plastic, angled	**7MF7906-2EC**
Plug Han 8D, metal, straight, blue	**7MF7906-2EQ**
Plug Han 8D, metal, straight, grey	**7MF7906-2EN**
Plug Han 8D, metal, angled, blue	**7MF7906-2ER**
Plug Han 8D, metal, angled, grey	**7MF7906-2EP**
Cable socket, plastic, for plug Han 7D	**7MF7906-2BB**
Cable socket, plastic, for plug Han 8D	**7MF7906-2FB**
Cable socket, metal, for Han 7D blue	**7MF7906-2BQ**
Cable socket, metal, for Han 8D blue	**7MF7906-2FQ**
Cable socket, metal, for Han 7D grey	**7MF7906-2BN**
Cable socket, metal, for Han 8D grey	**7MF7906-2FN**
Plug M12 with cable socket, stainless steel	**7MF7906-3AB**
Overvoltage protection	
Overvoltage protection up to 20 kV, M20	**7MF7906-3AC**
Overvoltage protection up to 20 kV, NPT	**7MF7906-3AD**
Lid	
Closed lid aluminum, painted 2x, without glass window, with seal NBR	**7MF7901-1BB**
Closed lid aluminum, painted 2x, without glass window, with seal FVMQ	**7MF7901-1BC**
Lid aluminum 2x coated, with glass window, with seal NBR	**7MF7901-1BG**
Lid aluminum 2x coated, with glass window, with seal FVMQ	**7MF7901-1BH**
Closed lid stainless steel precision casting, without glass window, with seal NBR	**7MF7901-2AB**
Closed lid stainless steel precision casting, without glass window, with seal FVMQ	**7MF7901-2AC**
Lid stainless steel precision casting, with glass window, with seal NBR	**7MF7901-2AG**
Lid stainless steel precision casting, with glass window, with seal FVMQ	**7MF7901-2AH**

Ordering example

SITRANS TF320 (single chamber enclosure)

7NG0340-0BA01-0AF2-Z Y01+Y17+P10

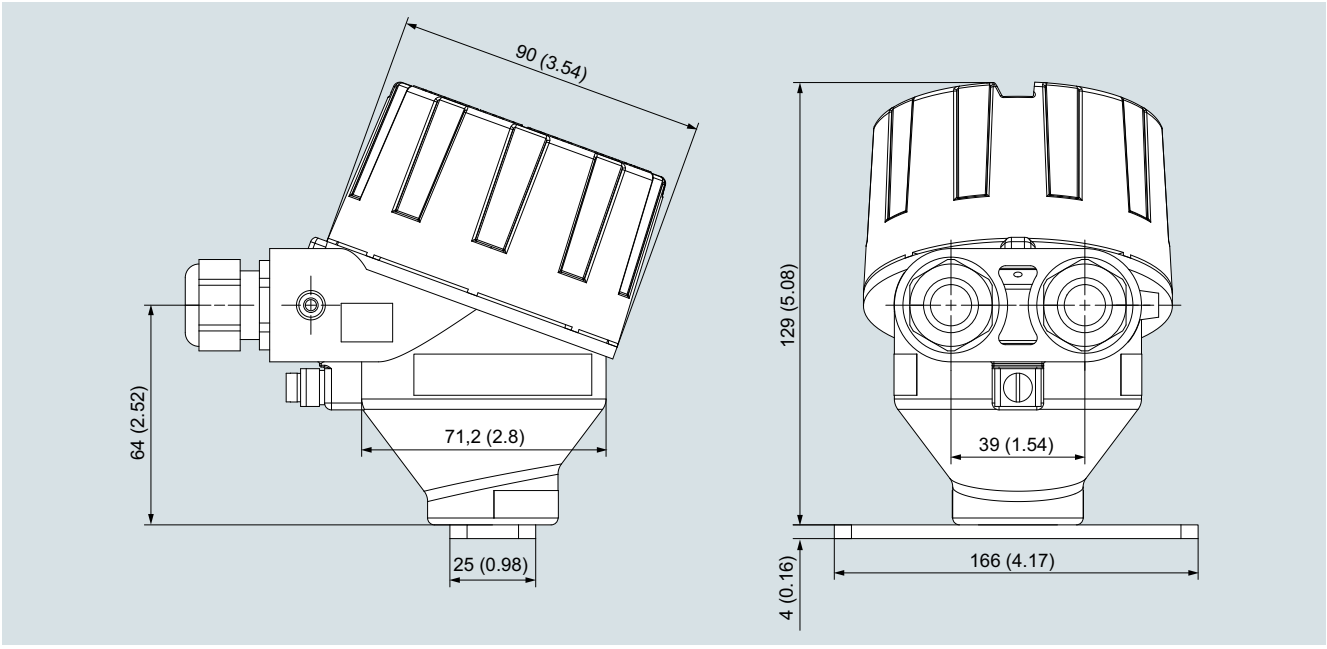
Y01: -10 ... +100 °C

Y17: TICA123

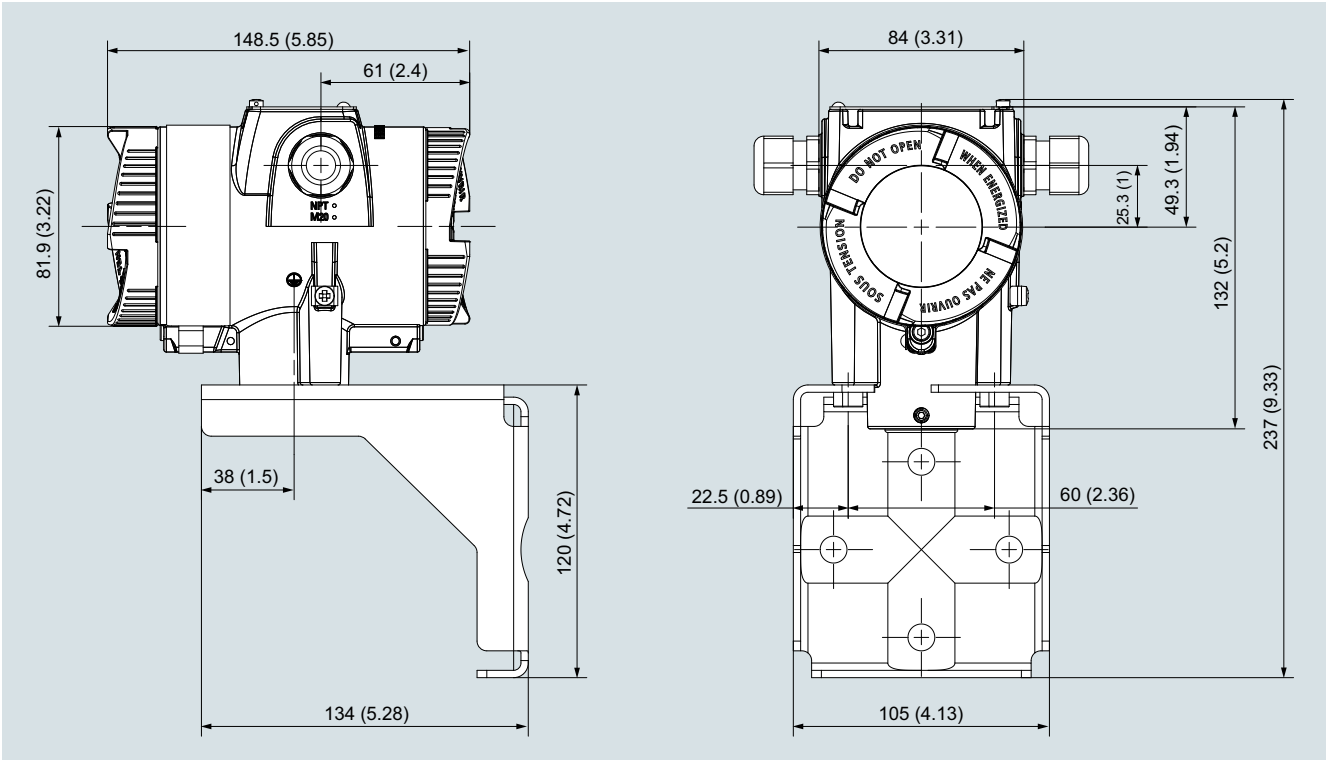
Factory setting

- Pt100 (IEC 60751) in 3-wire connection
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current
  - Input circuit wire break: 22.8 mA
  - Input circuit short circuit: 22.4 mA
  - Input monitoring wire break and short-circuit
- No trimming of input and output (offset)
- Damping 0.0 s

Dimensional drawings



SITRANS TF320, single chamber enclosure, dimensions in mm (inch)



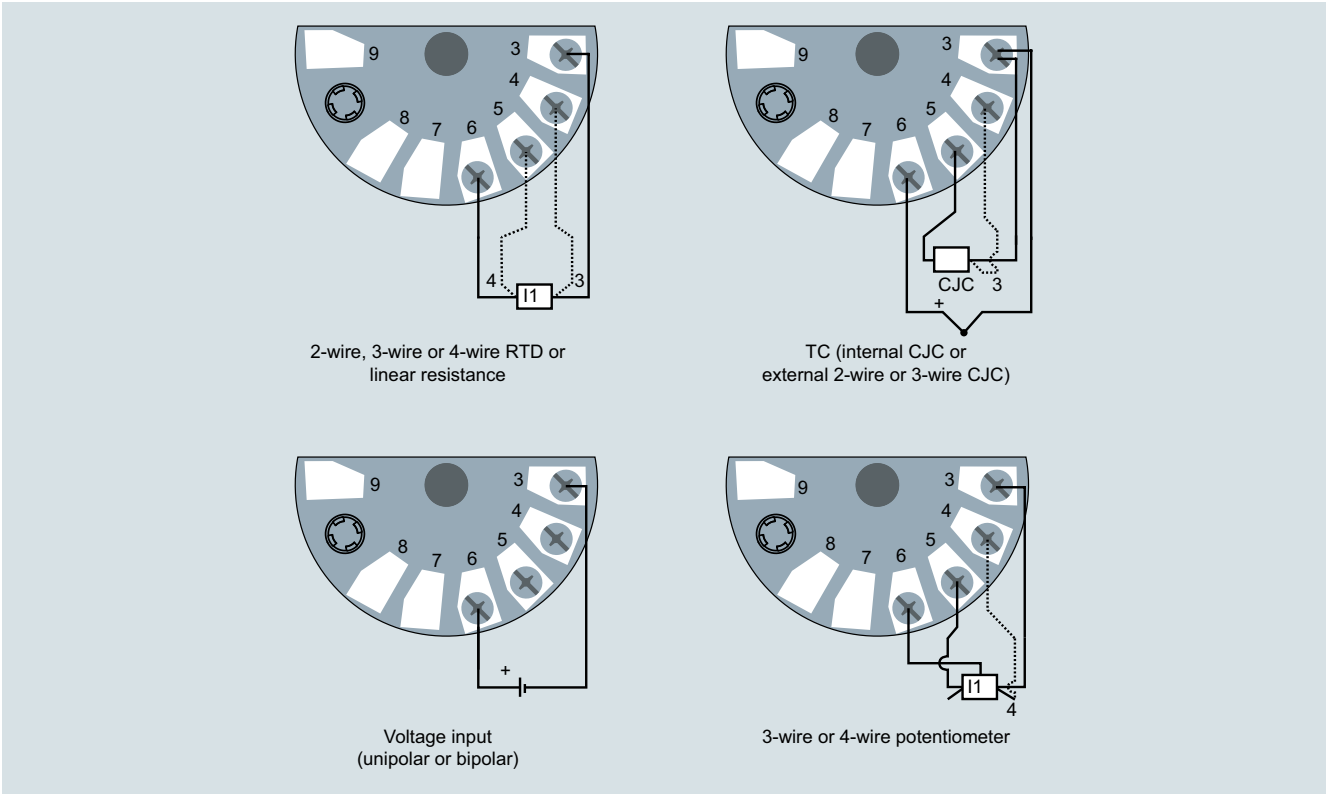
SITRANS TF320, dual chamber enclosure, dimensions in mm (inch)

2

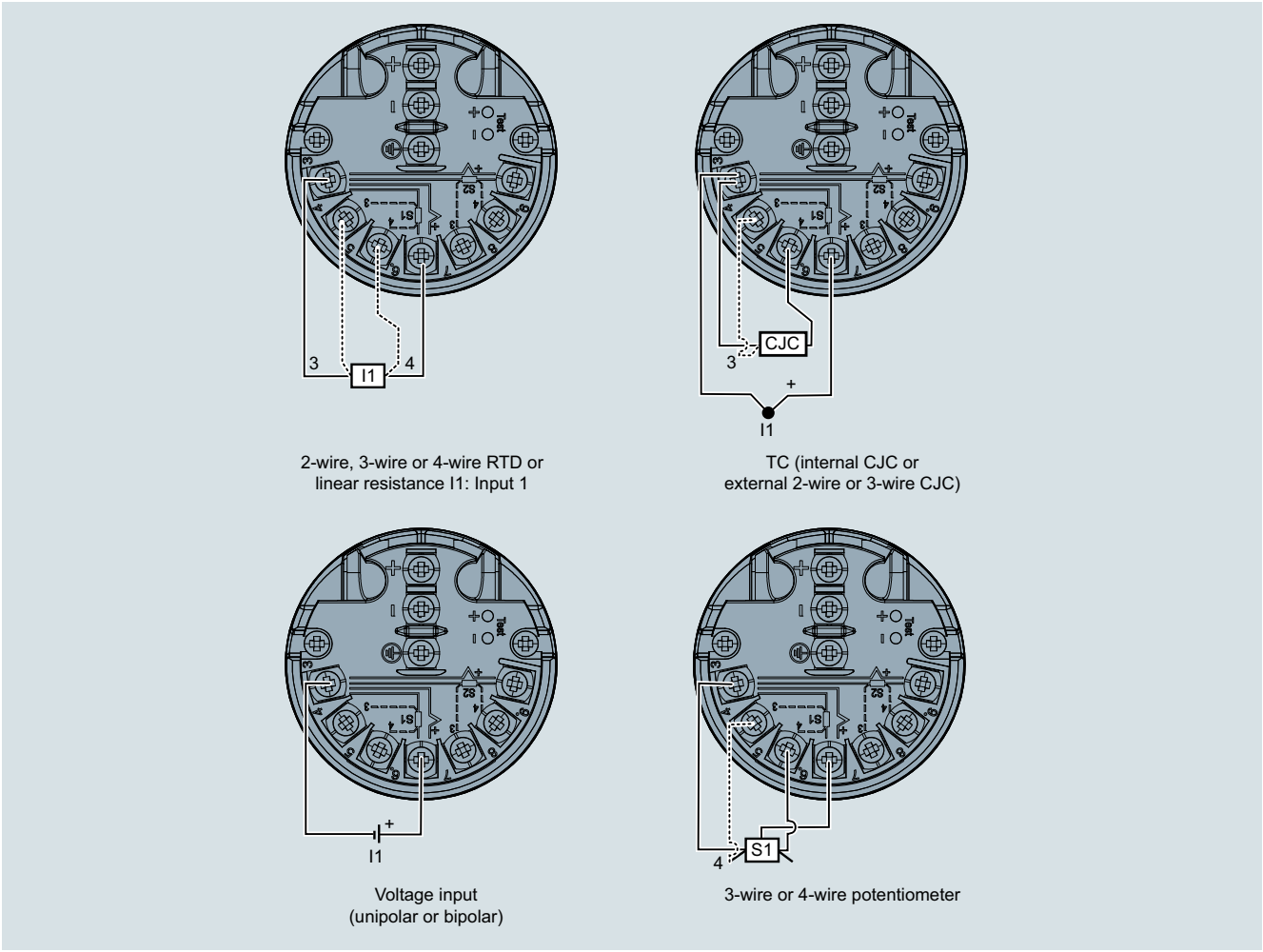
Circuit diagrams

Connections

Input connection

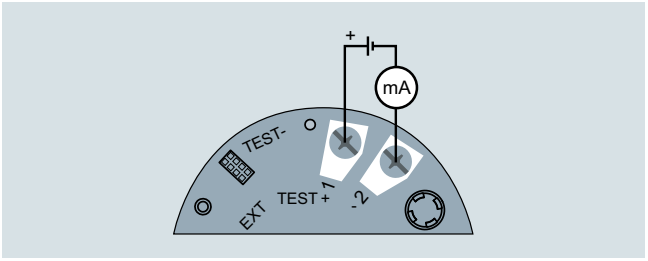


SITRANS TF320 in single chamber enclosure (7NG034*), input connection assignment



SITRANS TF320 in dual chamber enclosure (7NG035*), input connection assignment

Output connection



SITRANS TF320 in single chamber enclosure (7NG034*), output connection assignment

SITRANS TF420 (HART, universal)

Overview

SITRANS TF420 in dual chamber enclosure

SITRANS TF420 in single chamber enclosure

- 2-wire temperature transmitter with HART communication interface
- Universal input for virtually any type of temperature sensor
- Connection of two independent input circuits for redundant operation (high input availability)
- Input drift detection
- Can be configured via PC, HART 7 or optional local operation

Benefits

- Universally applicable as a temperature transmitter with galvanic isolation for:
  - Resistance thermometer (2-wire, 3-wire, 4-wire connection)
  - Thermocouples
  - Linear resistances, potentiometer and DC voltage sources
- Local operation of the temperature transmitter via display (single chamber enclosure) or control keys accessible from outside (dual chamber enclosure)
- Rugged single or dual chamber enclosure made of die-cast aluminum or stainless steel 316/316L
- Electronic compartment isolated (watertight) from terminal compartment in dual chamber enclosure
- Degree of protection IP66/67/68 (1.5 m/2 h)
- Electromagnetic compatibility according to DIN EN 61326 and NE21
- Test terminals for direct read-out of the output signal without breaking the current loop
- Remote installation option:
  - Measuring point is difficult to access
  - Measuring point is subjected to high temperatures
  - Measuring point is subjected to vibration through plant
  - Long neck pipes and thermowells must be avoided
- Mounted directly on sensors
- Temperature transmitters of the "intrinsically safe protection type, increased safety for zone 2, flameproof and dust-protected" type of protection can be installed in hazardous areas. The transmitter meets the requirements of the EU Directive 2014/34/EU (ATEX), the FM and CSA regulations as well as other national approvals, e.g. EACEx, NEPSI, KCs, Inmetro.
- SIL2/3 (with order note C20)

Application

SITRANS TF420 with its two sensor inputs can be used everywhere where temperatures need to be measured without interruption under particularly adverse conditions and 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 substances. 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 7 permits parameterization using a PC or HART communicator (handheld communicator). The SIMATIC PDM makes it easy.

The optional local operation on the device gives you the possibility to configure the device's most important functions very quickly.

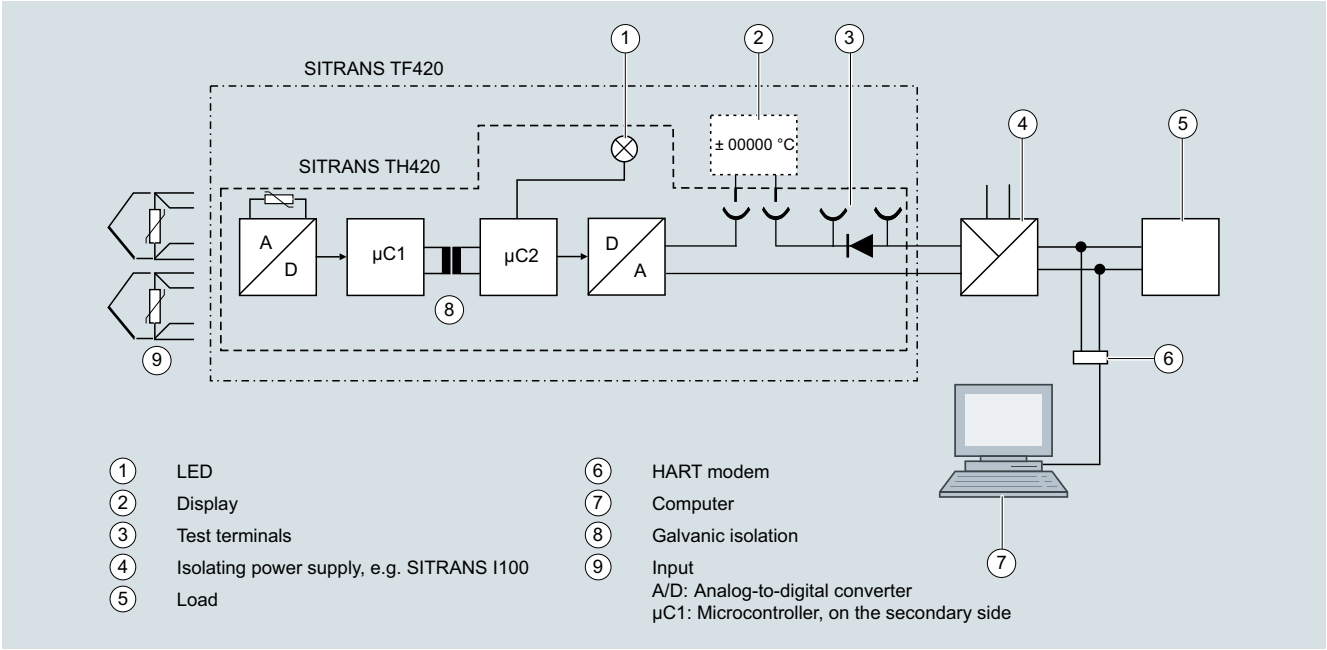
Principle of operation

SITRANS TF420 as temperature transmitter

Two sensor signals, whether resistance thermometers (RTD), thermocouples (TC), Ω or mV signals, are amplified and linearized. Input and output side are galvanically isolated. An internal cold junction is integrated for measurements with thermocouples.

The device outputs a temperature-linear direct current from 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 TF420 automatically detects when a sensor should be interrupted or is indicating a short-circuit. If the back-up functionality has been selected in the primary value display, the SITRANS TF420 automatically switches to the 2nd input without interrupting the measured value; e.g. primary value input 1 with input 2 as backup. The practical test terminals allow direct measurement of 4 to 20 mA signals over an ammeter without interrupting the output current loop.



Function block diagram SITRANS TF420 with integrated SITRANS TH420

2

Technical specifications

General	
Supply voltage[1) 2)]	
• Without explosion protection (non-Ex)	10.5 ... 48 V DC
• with explosion protection (Ex i)	10.5 ... 30 V DC
Additional minimum supply voltage when using test terminals	0.8 V
Maximum power loss	≤ 850 mW
Minimum load resistance at supply voltage > 37 V	(V_{supply} - 37 V)/23 mA
Insulation voltage, test/operation	
• Without explosion protection (non-Ex)	2.5 kV AC/55 V AC
• with explosion protection (Ex i)	2.5 kV AC/42 V AC
Polarity protection	All inputs and outputs
Write protection	Wire jumper (transmitter), switch (on display) or software
Warm-up time	< 5 min
Starting time	< 2.75 s
Programming	HART
Signal-to-noise ratio	> 60 dB
Long-term stability	Better than: • ± 0.05% of measuring span/year • ± 0.18% of measuring span/5 years
Response time	4 ... 20 mA: ≤ 55 ms HART: ≤ 75 ms (typically 70 ms)
Programmable damping	0 ... 60 s
Signal dynamic	
• Input	24 bit
• Output	18 bit
Influence of change in supply voltage	< 0.005% of measuring span/V DC
Input	
Resistance thermometer (RTD)	
Input type	
• Pt10 ... 10000	• IEC 60751 • JIS C 1604-8 • GOST 6651_2009 • Callendar-Van Dusen
• Ni10 ... 10000	• DIN 43760-1987 • GOST 6651-2009/OIML R84:2003
• Cu5 ... 1000	• Edison Copper Winding No. 15 • GOST 6651-2009/OIML R84:2003
Type of connection	2-wire, 3-wire or 4-wire
Line resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the line resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8)	Max. 30 nF
• All other input types	Max. 50 nF
Fault detection, programmable	None, short-circuited, defective, short-circuited or defective
	Note When the low limit for the configured input type is below the constant detection limit for short-circuited inputs, the detection of short circuits is disabled regardless of the configuration of the fault detection.
Detection limit for short-circuited input	15 Ω
Fault detection time (RTD)	≤ 75 ms (typically 70 ms)
Fault detection time (for 3-wire and 4-wire)	≤ 2 000 ms
Thermocouples (TC)	
Input type	
• B	IEC 60584-1
• E	IEC 60584-1
• J	IEC 60584-1
• K	IEC 60584-1
• L	DIN 43710
• Lr	GOST 3044-84
• N	IEC 60584-1
• R	IEC 60584-1
• S	IEC 60584-1
• T	IEC 60584-1
• U	DIN 43710
• W3	ASTM E988-96
• W5	ASTM E988-96
• LR	GOST 3044-84
Cold junction compensation (CJC)	Constant, internal or external over Pt100 or Ni100 RTD
• Temperature range internal CJC	-50 ... +100 °C (-58 ... +212 °F)
• Connection external CJC	2-wire or 3-wire
• External CJC, line resistance per wire (for 3-wire and 4-wire connections)	50 Ω
• Effect of the line resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
• Input current external CJC	< 0.15 mA
• Temperature range external CJC	-50 ... +135 °C (-58 ... +275 °F)
• Cable, wire-wire capacity	Max. 50 nF
• Total line resistance	Max. 10 kΩ
• Fault detection, programmable	None, short-circuited, defective, short-circuited or defective
	Note The short-circuited fault detection only applies to the CJC input.
• Fault detection time (TC)	≤ 75 ms (typically 70 ms)
• Fault detection time, external CJC (for 3-wire and 4-wire)	≤ 2 000 ms
Linear resistance	
Input range	10 Ω ... 100 kΩ
Minimum measuring span	25 Ω
Type of connection	2-wire, 3-wire or 4-wire
Line resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the line resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• R > 400 Ω	Max. 30 nF
• R ≤ 400 Ω	Max. 50 nF
Fault detection, programmable	None, defective

Potentiometers	
Input range	0 ... 100 kΩ
Minimum measuring span	25 Ω
Type of connection	2-wire, 3-wire or 4-wire
Line resistance per wire	Max. 50 Ω
Input current	< 0.15 mA
Effect of the line resistance (with 4-wire and 5-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	
• R > 400 Ω	Max. 30 nF
• R ≤ 400 Ω	Max. 50 nF
Fault detection, programmable	None, short-circuited, defective, short-circuited or defective
	Note When the configured potentiometer size is below the constant detection limit for short-circuited inputs, the detection of short circuits is disabled regardless of the configuration of the fault detection.
Detection limit for short-circuited input	15 Ω
Fault detection time, wiper arm (no short-circuit detection)	≤ 75 ms (typically 70 ms)
Fault detection time, element	≤ 2 000 ms
Fault detection time (for 4-wire and 5-wire)	≤ 2 000 ms
Supply voltage	
Measuring range	
• Unipolar	-100 ... 1700 mV
• Bipolar	-800 ... +800 mV
Minimum measuring span	2.5 mV
Input resistance	10 MΩ
Cable, wire-wire capacity	
• Input range: -100 ... 1700 mV	Max. 30 nF
• Input range: -20 ... 100 mV	Max. 50 nF
Fault detection, programmable	None, defective
Fault detection time	≤ 75 ms (typically 70 ms)
Output and HART communication	
Normal range, programmable	3.8 ... 20.5 mA/20.5 ... 3.8 mA
Extended range (output limits), programmable	3.5 ... 23 mA/23 ... 3.5 mA
Programmable input/output limits	
• Fault current	Enable/disable
• Fault current setting	3.5 ... 23 mA
Update time	10 ms
Load (with current output)	≤ (V_{Supply} - 10.5)/0.023 Ω
Load stability	< 0.01% of measuring span/100 Ω (measuring span = currently selected range)
Input fault detection, programmable (detection of input short circuits is ignored with TC and voltage inputs)	3.5 ... 23 mA
NAMUR NE43 Upscale	> 21 mA
NAMUR NE43 Downscale	< 3.6 mA
HART protocol versions	HART 7
Measuring accuracy	
Input accuracy	See "Input accuracy" table
Output accuracy	See "Output accuracy" table

Rated conditions	
Ambient temperature	
• Without local operation in single chamber enclosure	-50 ... +85 °C (-58 ... +185 °F)
• With local operation	-40 ... +85 °C (-40 ... +185 °F)
• For transmitters with functional safety	-40 ... +80 °C (-40 ... +176 °F)
Storage temperature	-50 ... +85 °C (-58 ... +185 °F)
Reference temperature for sensor calibration	24 °C ±1.0 °C (75.2 °F ±1.8 °F)
Relative humidity	< 99% (no condensation)
Degree of protection	
• Temperature transmitter enclosure	IP66/IP67/IP68
• Terminals	IP00
Mechanical construction	
Weight	
• Single chamber enclosure	0.85 kg (1.87 lb)
• Dual chamber enclosure	• Aluminum: 1.3 kg (2.87 lb) • Stainless steel: 3.3 kg (7.28 lb)
Maximum core cross-section	
• Single chamber enclosure	1.5 mm² (AWG 16)
• Dual chamber enclosure	2.5 mm² (AWG 14)
Tightening torque for clamping screws	0.5 ... 0.6 Nm
Vibrations	IEC 60068-2-6
• 2 ... 25 Hz	± 1.6 mm (0.07 inch)
• 25 ... 100 Hz	± 4 g
Certificates and approvals	
Explosion protection ATEX/IECEx and others	
Certificates[3)]	IECEx DEK 19.0069X DEKRA 19ATEX0106 X (Category 1) DEKRA 19ATEX0107 X (Category 3)
"Intrinsic safety ia/ib" type of protection	For use in Zone 0, 1, 2
• ATEX	II 1 G Ex ia IIC T6 ... T4 Ga II 2(1) G Ex ib [ia Ga] IIC T6 ... T4 Gb
• IECEx and others	Ex ia IIC T6 ... T4 Ga Ex ib [ia Ga] IIC T6 ... T4 Gb
• EACEx	Ex ia IIC T6 ... T4 Ga Ex ib [ia Ga] IIC T6 ... T4 Gb
"Intrinsic safety ic" type of protection	For use in Zones 2
• ATEX	II 2 G Ex ic IIC T6…T4 Gc
• IECEx and others	Ex ic IIC T6 ... T4 Gc
• EACEx	2Ex ic IIC T6…T4 Gc X
"Non-sparking/increased safety nA/ec" type of protection	For use in Zones 2
• ATEX	II 2 G Ex nA IIC T6…T4 Gc II 2 G Ex ec IIC T6…T4 Gc
• IECEx and others	Ex nA IIC T6 ... T4 Gc Ex ec IIC T6 ... T4 Gc
• EACEx	2Ex nA IIC T6…T4 Gc
• "Flameproof enclosure db" type of protection	For use in Zone 1
• ATEX	II 2 G Ex db IIC T6…T4 Gb
• IECEx and others	Ex db IIC T6 ... T4 Gb
• EACEx	1Ex d IIC T6…T4 Gb X
• "Protection by enclosure tb" type of protection	For use in Zone 21
• ATEX	II 2 D Ex tb IIC T100°C Db
• IECEx and others	Ex tb IIC T100°C Db
• EACEx	Ex tb IIC T100°C Db X

Explosion protection CSA/FM for Canada and USA	
Certificates	FMxxCAxxxx FMxxUSxxxx
"Intrinsic safety ia" type of protection	IS, CL I, Div 1, GP ABCD, T6 ... T4 Ex ia IIC T6 … T4 Ga AEx ia IIC T6 … T4 Ga or: Ex ib [ia Ga] IIC T6…T4 Gb AEx ib [ia Ga] IIC T6…T4 Gb
"Non incendive field wiring NIFW" type of protection	NIFW, CL I, Div 2, GP ABCD T6 ... T4
"Non incendive NI" type of protection	NI, CL I, Div 2, GP ABCD T6...T4 Ex nA IIC T6 ... T4 Gc AEx nA IIC T6 ... T4 Gc
"Explosion-proof XP" type of protection	XP/ CL I / DIV1 / GP ABCD / T6....T4 CL I / Zn1 / AEx/Ex d IIC T6...T4 Gb
"Dust-protected DIP" type of protection	DIP/ CL II, III / DIV 1 / GP EFG / T6...T4 Zn21 / AEx/Ex tb IIIC T100°C Gb

1) Note that the minimum supply voltage must correspond to the value measured at the terminals of the SITRANS TF420.
All external voltage drops must be taken into consideration.

2) Protect the device from overvoltage with the help of a suitable power supply or suitable overvoltage protection equipment.

3) Additional available certificates are listed on the Internet at
http://www.siemens.com/processinstrumentation/certificates

Measuring ranges/Minimum measuring span

RTD

Input type	Standard	Measuring range in °C (°F)	α_0 in $°C^{-1}$ ($°F^{-1}$)	Minimum measuring span in °C (°F)
Pt10 ... 10000	IEC 60751	-200 ... +850 (-328 ... +1 562)	0.003851 (0.002139)	10 (50)
	JIS C 1604-8	-200 ... +649 (-328 ... +1 200)	0.003916 (0.002176)	10 (50)
	GOST 6651_2009	-200 ... +850 (-328 ... +1 562)	0.003910 (0.002172)	10 (50)
	Callendar-Van Dusen	-200 ... +850 (-328 ... +1 562)	-	10 (50)
Ni10 ... 10000	DIN 43760-1987	-60 ... +250 (-76 ... +482)	0.006180 (0.003433)	10 (50)
	GOST 6651-2009/OIML R84:2003	-60 ... +180 (-76 ... +356)	0.006170 (0.003428)	10 (50)
Cu5 ... 1000	Edison Copper Winding No. 15	-200 ... +260 (-328 ... +500)	0.004270 (0.002372)	100 (212)
	GOST 6651-2009/OIML R84:2003	-180 ... +200 (-292 ... +392)	0.004280 (0.002378)	100 (212)
	GOST 6651-94	-50 ... +200 (-58 ... +392)	0.004260 (0.002367)	100 (212)

TC

Input type	Standard	Measuring range in °C (°F)	Minimum measuring span in °C (°F)
B	IEC 60584-1	0 (85) ... 1 820 (32 (185) ... 3 308)	100 (212)
E	IEC 60584-1	-200 ... +1 000 (-392 ... +1 832)	50 (122)
J	IEC 60584-1	-100 ... +1 200 (-212 ... +2 192)	50 (122)
K	IEC 60584-1	-180 ... +1 372 (-356 ... +2 502)	50 (122)
L	DIN 43710	-200 ... +900 (-392 ... +1 652)	50 (122)
Lr	GOST 3044-84	-200 ... +800 (-392 ... +1 472)	50 (122)
N	IEC 60584-1	-180 ... +1 300 (-356 ... +2 372)	50 (122)
R	IEC 60584-1	-50 ... +1 760 (-122 ... +3 200)	100 (212)
S	IEC 60584-1	-50 ... +1 760 (-122 ... +3 200)	100 (212)
T	IEC 60584-1	-200 ... +400 (-392 ... +752)	50 (122)
U	DIN 43710	-200 ... +600 (-392 ... +1 112)	50 (122)
W3	ASTM E988-96	0 ... 2 300 (32 ... 4 172)	100 (212)
W5	ASTM E988-96	0 ... 2 300 (32 ... 4 172)	100 (212)
LR	GOST 3044-84	-200 ... +800 (-392 ... +1472)	50 (122)

Input accuracy

Basic values

Input type	Basic accuracy	Temperature coefficient[1)]
RTD		
Pt10	≤ ±0.8 °C (1.44 °F)	≤ ±0.020 °C/°C (°F/°F)
Pt20	≤ ±0.4 °C (0.72 °F)	≤ ±0.010 °C/°C (°F/°F)
Pt50	≤ ±0.16 °C (0.288 °F)	≤ ±0.004 °C/°C (°F/°F)
Pt100	≤ ±0.04 °C (0.072 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt200	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt500	$T_{max.}$ < 180 °C (356 °F) = ≤ ±0.08 °C (0.144 °F) $T_{max.}$ > 180 °C (356 °F) = ≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt1000	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt2000	$T_{max.}$ < 300 °C (572 °F) = ≤ ±0.08 °C (0.144 °F) $T_{max.}$ > 300 °C (572 °F) = ≤ ±0.4 °C (0.72 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt10000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Ni10	≤ ±1.6 °C (2.88 °F)	≤ ±0.020 °C/°C (°F/°F)
Ni20	≤ ±0.8 °C (1.44 °F)	≤ ±0.010 °C/°C (°F/°F)
Ni50	≤ ±0.32 °C (0.576 °F)	≤ ±0.004 °C/°C (°F/°F)
Ni100	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni120	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni200	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni500	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni1000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni2000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni10000	≤ ±0.32 °C (0.576 °F)	≤ ±0.002 °C/°C (°F/°F)
Ni x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Cu5	≤ ±1.6 °C (2.88 °F)	≤ ±0.040 °C/°C (°F/°F)
Cu10	≤ ±0.8 °C (1.44 °F)	≤ ±0.020 °C/°C (°F/°F)
Cu20	≤ ±0.4 °C (0.72 °F)	≤ ±0.010 °C/°C (°F/°F)
Cu50	≤ ±0.16 °C (0.288 °F)	≤ ±0.004 °C/°C (°F/°F)
Cu100	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu200	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu500	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu1000	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Cu x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Linear resistance		
0 ... 400 Ω	≤ ±40 mΩ	≤ ±2 mΩ/°C (1.11 mΩ/°F)
0 ... 100 kΩ	≤ ±4 Ω	≤ ±0.2 Ω/°C (0.11 Ω/°F)
Potentiometers		
0 ... 100%	< 0.05%	< ± 0.005%
Supply voltage		
mV: -20 ... 100 mV	≤ ±5 µV	≤ ±0.2 µV/°C (0.11 µV/°F)
mV: -100 ... 1700 mV	≤ ±0.1 mV	≤ ±36 µV/°C (20 µV/°F)
mV: ± 800 mV	≤ ±0.1 mV	≤ ±32 µV/°C (17.8 µV/°F)
TC		
E	≤ ±0.2 °C (0.36 °F)	≤ ±0.025 °C/°C (°F/°F)
J	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
K	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
L	≤ ±0.35 °C (0.63 °F)	≤ ±0.025 °C/°C (°F/°F)
N	≤ ±0.4 °C (0.72 °F)	≤ ±0.025 °C/°C (°F/°F)
T	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
U	< 0 °C (32 °F) ≤ ±0.8 °C (1.44 °F) ≥ 0 °C (32 °F) ≤ ±0.4 °C (0.72 °F)	≤ ±0.025 °C/°C (°F/°F)
Lr	≤ ±0.2 °C (0.36 °F)	≤ ±0.1 °C/°C (°F/°F)
R	< 200 °C (392 °F) ≤ ±0.5 °C (0.9 °F) ≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
S	< 200 °C (392 °F) ≤ ±0.5 °C (0.9 °F) ≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)

SITRANS TF420 (HART, universal)

Input type	Basic accuracy	Temperature coefficient[1]
W3	≤ ±0.6 °C (1.08 °F)	≤ ±0.1 °C/°C (°F/°F)
W5	≤ ±0.4 °C (0.72 °F)	≤ ±0.1 °C/°C (°F/°F)
B[2]	≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
B[3]	≤ ±3 °C (5.4 °F)	≤ ±0.1 °C/°C (°F/°F)
B[4]	≤ ±8 °C (14.4 °F)	≤ ±0.8 °C/°C (°F/°F)
B[5]	Not specified	Not specified
CJC (internal)	< ±0.5 °C (0.9 °F)	Included in basic accuracy
CJC (external)	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)

1) Temperature coefficients correspond to the specified values or 0.002% of the input span, depending on which value is greater.

2) Accuracy of the specification range > 400 °C (752 °F)

3) Accuracy of the specification range > 160 °C (320 °F) < 400 °C (752 °F)

4) Accuracy of the specification range > 85 °C (185 °F) < 160 °C (320 °F)

5) Accuracy of the specification range < 85 °C (185 °F)

Output accuracy

Output type	Basic accuracy	Temperature coefficient
Average value measurement	Average of accuracy of input 1 and input 2	Average of temperature coefficient of input 1 and input 2
Differential measurement	Sum of accuracy of input 1 and input 2	Sum of temperature coefficient of input 1 and input 2
Analog output	≤ ±1.6 µA (0.01% of the full output span)	≤ ±0.48 µA/K (≤ ±0.003% of the full output span/K)

Selection and ordering data

Single chamber enclosure

	Article No.
SITRANS TF420 Temperature transmitter with single chamber enclosure for wall or pipe mounting, two separately configurable inputs and a galvanically isolated 2-wire output. ↗	**7NG044** - - 0
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.	
Communication	
With HART (4 ... 20 mA)	0
Primary value output	
Input 1	0
Input 1, input 2 as redundancy (hot backup)	1
Input 2, input 1 as redundancy (hot backup)	2
Average input 1 and input 2, both as redundancy (hot backup)	3
Minimum input 1 and input 2, both as redundancy (hot backup)	4
Maximum input 1 and input 2, both as redundancy (hot backup)	5
Difference input 1 - input 2	6
Difference input 2 - input 1	7
Absolute difference	8
Input 1, type	
RTD	
• Pt100 (IEC 60751), 3-wire	B
• Pt100 (IEC 60751), 4-wire	C
• Pt1000 (IEC 60751), 3-wire	D
• Pt1000 (IEC 60751), 4-wire	E
TC	
• Type B	F
• Type E	G
• Type J	H
• Type K	J
• Type L	K
• Type N	L
• Type R	N
• Type S	P
• Type T	Q
Potentiometer, 4-wire	R
RTD	
• Pt100 (IEC 60751), 3-wire	B
• Pt100 (IEC 60751), 4-wire	C
• Pt1000 (IEC 60751), 3-wire	D
• Pt1000 (IEC 60751), 4-wire	E
TC	
• Type B	F
• Type E	G
• Type J	H
• Type K	J
• Type L	K
• Type N	L
• Type R	N
• Type S	P
• Type T	Q
Potentiometer, 4-wire	R

	Article No.
SITRANS TF420 Temperature transmitter with single chamber enclosure for wall or pipe mounting, two separately configurable inputs and a galvanically isolated 2-wire output.	**7NG044** - - 0
CJC configuration for TC	
Input 1: None CJC; Input 2: No CJC	0
Input 1: Internal CJC; Input 2: Internal CJC	1
Input 1: External CJC; input 2: External CJC; define type in option Jxx	2
Input 1: External CJC; define type in option Jxx; input 2: Internal CJC	3
Input 1: Internal CJC; Input 2: External CJC; define type in option Jxx	4
Input 1: Internal CJC; Input 2: No CJC	5
Input 1: External CJC (define type in option Jxx); input 2: No CJC	6
Material of non-wetted parts	
Die-cast aluminum enclosure	1
Type of protection (Ex)	
General purpose	A
Intrinsic safety (Ex i) / Non-incendive field wiring (NIFW)	B
Flameproof enclosure (Ex d) / Explosion proof (XP)	C
Dust ignition protection by enclosure zone 21/22 (Ex t) / Dust ignition proof (DIP) / Increased safety zone 2 (Ex ec) / Non-incendive (NI)	L
Flameproof enclosure (Ex d) / Intrinsic safety (Ex i) / Dust ignition protection by enclosure zone 21/22 (Ex t) / Increased safety zone 2 (Ex ec)	S
Electrical connection/cable entries	
2x M20 x 1.5	F
2x ½" NPT	M
Local operation	
Without local operation	0
Local operation (closed lid)	1
Local operation (lid with glass window)	2

SITRANS TF420 (HART, universal)

Options	Order Code
Append "**-Z**" to Article No., add order code and, if applicable, free text.	
Cable gland included	
Plastic	**A00**
Metal	**A01**
Stainless steel	**A02**
Stainless steel 316L/1.4404	**A03**
CMP, for XP devices	**A10**
CAPRI ADE 4F, CuZn, cable inner diameter 7 ... 12 mm, cable outer diameter 10 ... 16 mm	**A11**
CAPRI ADE 4F, stainless steel, cable inner diameter 7 ... 12 mm, cable outer diameter 10 ... 16 mm	**A12**
Mounting cable glands/plugs	
Cable gland mounted	**A97**
Device plug for output, mounted right	**A98**
Device options	
Degree of protection IP66 / IP68 (not for device plugs M12 and Han)	**D30**
General approval without Ex approval	
Worldwide (CE, RCM) except EAC, FM, KCC	**E00**
Explosion protection certificates	
ATEX (Europe) and IECEx (world)	**E47**
Mounting system (only single chamber enclosures)	
Pipe mounting kit for single chamber enclosure, stainless steel 316L	**H06**
Wall mounting kit for single chamber enclosure, stainless steel 316L	**H07**

Selection and ordering data

Dual chamber enclosure

	Article No.
SITRANS TF420 Temperature transmitter with dual chamber enclosure for wall or pipe mounting, two separately configurable inputs and a galvanically isolated 2-wire output. ↗	**7NG045** - ■■■■■ - 0 ■■■
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.	
Communication	
With HART (4 ... 20 mA)	**0**
Primary value output	
Input 1	**0**
Input 1, input 2 as redundancy (hot backup)	**1**
Input 2, input 1 as redundancy (hot backup)	**2**
Average input 1 and input 2, both as redundancy (hot backup)	**3**
Minimum input 1 and input 2, both as redundancy (hot backup)	**4**
Maximum input 1 and input 2, both as redundancy (hot backup)	**5**
Difference input 1 - input 2	**6**
Difference input 2 - input 1	**7**
Absolute difference	**8**
Input 1, type	
RTD	
• Pt100 (IEC 60751), 3-wire	**B**
• Pt100 (IEC 60751), 4-wire	**C**
• Pt1000 (IEC 60751), 3-wire	**D**
• Pt1000 (IEC 60751), 4-wire	**E**
TC	
• Type B	**F**
• Type E	**G**
• Type J	**H**
• Type K	**J**
• Type L	**K**
• Type N	**L**
• Type R	**N**
• Type S	**P**
• Type T	**Q**
Potentiometer, 4-wire	**R**
Input 2, type	
Without input 2	**A**
RTD	
• Pt100 (IEC 60751), 3-wire	**B**
• Pt100 (IEC 60751), 4-wire	**C**
• Pt1000 (IEC 60751), 3-wire	**D**
• Pt1000 (IEC 60751), 4-wire	**E**
TC	
• Type B	**F**
• Type E	**G**
• Type J	**H**
• Type K	**J**
• Type L	**K**
• Type N	**L**
• Type R	**N**
• Type S	**P**
• Type T	**Q**
Potentiometer, 4-wire	**R**

	Article No.
SITRANS TF420 Temperature transmitter with dual chamber enclosure for wall or pipe mounting, two separately configurable inputs and a galvanically isolated 2-wire output.	**7NG045** ■ - ■■■■■ - 0 ■■■
CJC configuration for TC	
Input 1: None CJC; Input 2: No CJC	**0**
Input 1: Internal CJC; Input 2: Internal CJC	**1**
Input 1: External CJC; input 2: External CJC; define type in option Jxx	**2**
Input 1: External CJC; define type in option Jxx; input 2: Internal CJC	**3**
Input 1: Internal CJC; Input 2: External CJC; define type in option Jxx	**4**
Input 1: Internal CJC; Input 2: No CJC	**5**
Input 1: External CJC (define type in option Jxx); input 2: No CJC	**6**
Material of non-wetted parts	
Die-cast aluminum enclosure	**1**
Enclosure made of stainless steel precision casting CF3M/1.4409 (similar to 316L)	**2**
Type of protection (Ex)	
General purpose (non-Ex)	**A**
Intrinsic safety (Ex i) / Non-incendive field wiring (NIFW)	**B**
Flameproof enclosure (Ex d) / Explosion proof (XP)	**C**
Dust ignition protection by enclosure zone 21/22 (Ex t) / Dust ignition proof (DIP) / Increased safety zone 2 (Ex ec) / Non-incendive (NI)	**L**
Flameproof enclosure (Ex d) / Intrinsic safety (Ex i) / Dust ignition protection by enclosure zone 21/22 (Ex t) / Increased safety zone 2 (Ex ec)	**S**
Electrical connection/cable entries	
2x M20 x 1.5	**F**
2x ½" NPT	**M**
Local operation	
Without local operation	**0**
Local operation (closed lid)	**1**
Local operation (lid with glass window)	**2**

SITRANS TF420 (HART, universal)

Options	Order Code
Append "**-Z**" to Article No., add order code and, if applicable, free text.	
Cable gland included	
Plastic	**A00**
Metal	**A01**
Stainless steel	**A02**
Stainless steel 316L/1.4404	**A03**
CMP, for XP devices	**A10**
CAPRI ADE 4F, CuZn, cable inner diameter 7 ... 12 mm, cable outer diameter 10 ... 16 mm	**A11**
CAPRI ADE 4F, stainless steel, cable inner diameter 7 ... 12 mm, cable outer diameter 10 ... 16 mm	**A12**
Cable gland accessories	
Dual hole insert included	**A20**
Mounting cable glands/plugs	
Cable gland mounted	**A97**
Device plug for output, mounted right	**A98**
Device options	
Double layer coating (epoxy resin and polyurethane) 120 µm of enclosure and lid	**D20**
Degree of protection IP66 / IP68 (not for device plugs M12 and Han)	**D30**
Stainless steel Ex plate 1.4404/316L	**D42**
General approval without Ex approval	
Worldwide (CE, RCM) except EAC, FM, KCC	**E00**
Explosion protection certificates	
ATEX (Europe) and IECEx (world)	**E47**
Mounting brackets (only dual chamber enclosure)	
Wall/pipe mounting bracket for dual chamber enclosure, steel	**H01**
Wall/pipe mounting bracket for dual chamber enclosure, stainless steel 304	**H02**
Wall/pipe mounting bracket for dual chamber enclosure, stainless steel 316L	**H03**

Accessories

	Article No.
Additional accessories for assembly, connection and transmitter configuration, see page 2/154.	
Modems	
Modem with USB interface and SIPROM T software	**7NG3092-8KN**
HART modem with USB interface	**7MF4997-1DB**
Thread adapter	
Thread adapter M20x1.5 (male thread) to ½-14 NPT (female thread)	**7MP1990-0BA00**
Thread adapter M20x1.5 (male thread) to G½ (female thread)	**7MP1990-0BB00**
Local operation	
Local operation for temperature transmitter in dual chamber enclosure	**7MF7902-1AD**
Mounting system for local operation 7MF7902-1AD in single chamber enclosure	**7MF7902-1AS**
Mounting brackets (only dual chamber enclosure)	
Wall/pipe mounting bracket for dual chamber enclosure, steel, 5/16-24UNF	**7MF7900-1AB**
Wall/pipe mounting bracket for dual chamber enclosure, steel, M8	**7MF7900-1AC**
Wall/pipe mounting bracket for dual chamber enclosure, stainless steel 316L, 5/16-24UNF	**7MF7900-1AH**
Wall/pipe mounting bracket for dual chamber enclosure, stainless steel 316L, M8	**7MF7900-1AJ**
Mounting system (only single chamber enclosures)	
Pipe mounting kit for single chamber enclosure, stainless steel 316L	**7MF7900-1AK**
Wall mounting kit for single chamber enclosure, stainless steel 316L	**7MF7900-1AL**
Cable gland	
Cable gland, gray, non-Ex, M20	**7MF7906-1AB**
Cable gland, gray, non-Ex, NPT	**7MF7906-1BB**
Cable gland, metal, non-Ex, NPT	**7MF7906-1BD**
Cable gland, metal, non-Ex, M20	**7MF7906-1AD**
Cable gland, metal, Ex-d, NPT	**7MF7906-1BE**
Cable gland, metal, Ex-d, M20	**7MF7906-1AE**
Cable gland, 316L, non-Ex, NPT	**7MF7906-1BH**
Cable gland, 316L, non-Ex, M20	**7MF7906-1AH**
Cable gland, 316L, Ex-d, NPT	**7MF7906-1BJ**
Cable gland, 316L, Ex-d, M20	**7MF7906-1AJ**
Cable gland, E1FX Tri-Star 1/2-14NPT, CMP	**7MF7906-1NE**
Cable gland, ½ NPT Capri ADE 4F cpl., CuZn	**7MF7906-1PE**
Cable gland, ½ NPT Capri ADE 4F cpl., stainless steel	**7MF7906-1PJ**
Dual hole gasket for 2 cables in cable gland	**7MF7906-1WN**

	Article No.
Plug and cable socket	
Plug Han 7D, plastic, straight	**7MF7906-2AB**
Plug Han 7D, plastic, angled	**7MF7906-2AC**
Plug Han 7D, metal, straight, blue	**7MF7906-2AQ**
Plug Han 7D, metal, straight, grey	**7MF7906-2AN**
Plug Han 7D, metal, angled, blue	**7MF7906-2AR**
Plug Han 7D, metal, angled, grey	**7MF7906-2AP**
Plug Han 8D, plastic, straight	**7MF7906-2EB**
Plug Han 8D, plastic, angled	**7MF7906-2EC**
Plug Han 8D, metal, straight, blue	**7MF7906-2EQ**
Plug Han 8D, metal, straight, grey	**7MF7906-2EN**
Plug Han 8D, metal, angled, blue	**7MF7906-2ER**
Plug Han 8D, metal, angled, grey	**7MF7906-2EP**
Cable socket, plastic, for plug Han 7D	**7MF7906-2BB**
Cable socket, plastic, for plug Han 8D	**7MF7906-2FB**
Cable socket, metal, for Han 7D blue	**7MF7906-2BQ**
Cable socket, metal, for Han 8D blue	**7MF7906-2FQ**
Cable socket, metal, for Han 7D grey	**7MF7906-2BN**
Cable socket, metal, for Han 8D grey	**7MF7906-2FN**
Plug M12 with cable socket, stainless steel	**7MF7906-3AB**
Overvoltage protection	
Overvoltage protection up to 20 kV, M20	**7MF7906-3AC**
Overvoltage protection up to 20 kV, NPT	**7MF7906-3AD**
Lid	
Closed lid aluminum, painted 2x, without glass window, with seal NBR	**7MF7901-1BB**
Closed lid aluminum, painted 2x, without glass window, with seal FVMQ	**7MF7901-1BC**
Lid aluminum 2x coated, with glass window, with seal NBR	**7MF7901-1BG**
Lid aluminum 2x coated, with glass window, with seal FVMQ	**7MF7901-1BH**
Closed lid stainless steel precision casting, without glass window, with seal NBR	**7MF7901-2AB**
Closed lid stainless steel precision casting, without glass window, with seal FVMQ	**7MF7901-2AC**
Lid stainless steel precision casting, with glass window, with seal NBR	**7MF7901-2AG**
Lid stainless steel precision casting, with glass window, with seal FVMQ	**7MF7901-2AH**

Ordering example

SITRANS TF420 (single chamber enclosure)

7NG0450-0BA02-0AF2-Z Y01+Y17+P10

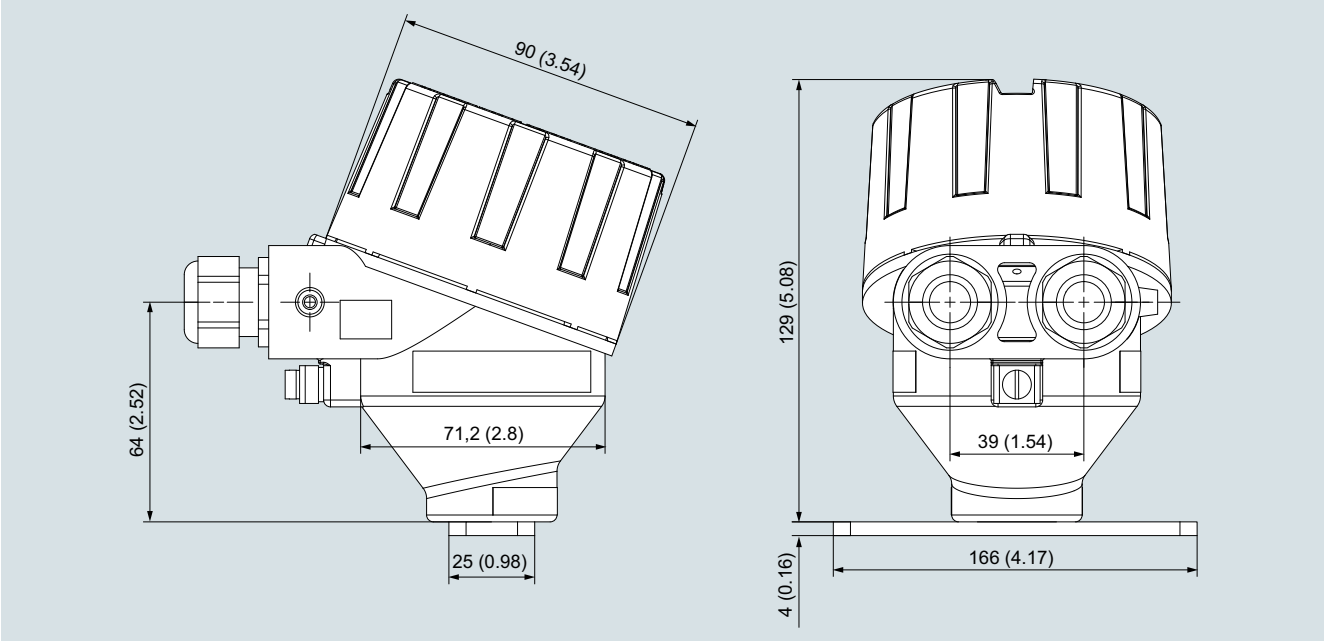
Y01: -10 ... +100 °C (32 ... 212 °F)

Y17: TICA123

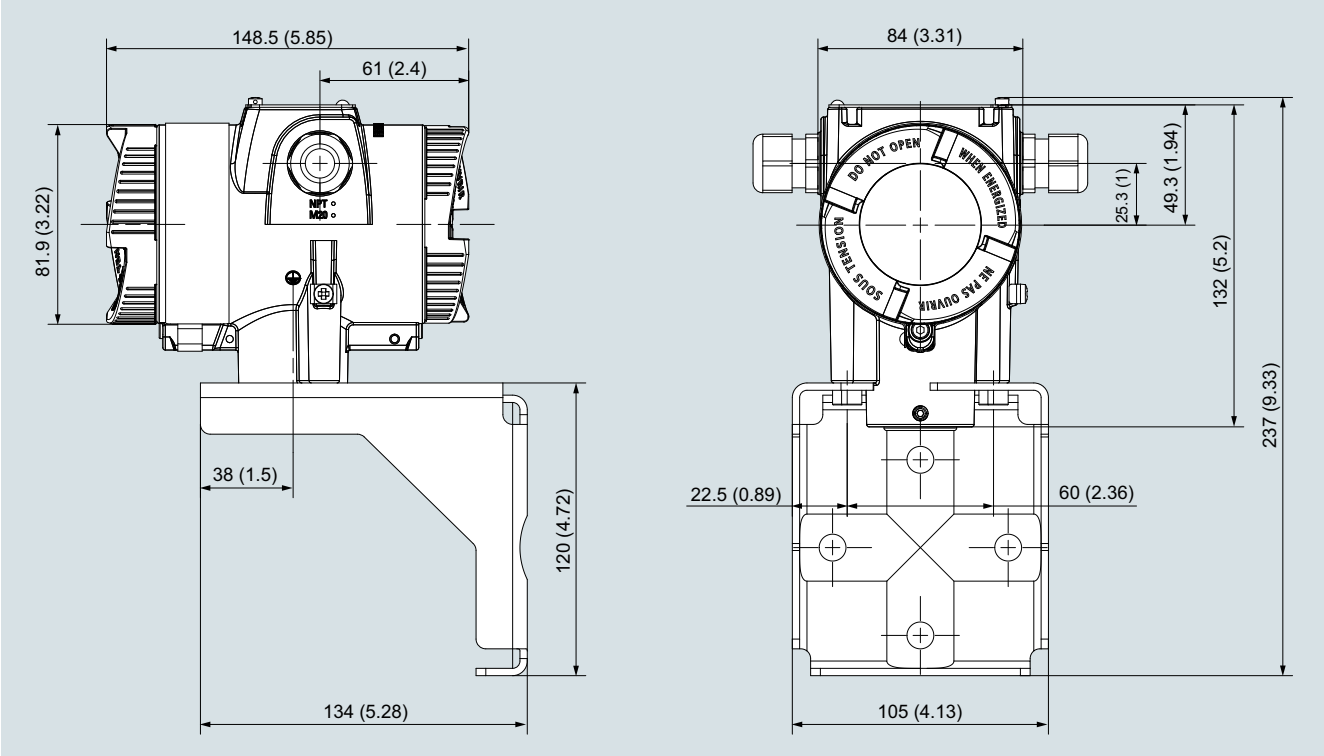
Factory setting

- Input 1: Pt100 (IEC 751); 3-wire connection
- Input 2: not configured (inactive)
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current
  - Input circuit wire break: 22.8 mA
  - Input circuit short circuit: 22.4 mA
  - Input circuit drift: 22 mA (active when input 2 is active)
  - Input monitoring wire break and short-circuit
- No trimming of input and output (offset)
- Damping 0.0 s

Dimensional drawings



SITRANS TF420, single chamber enclosure, dimensions in mm (inch)

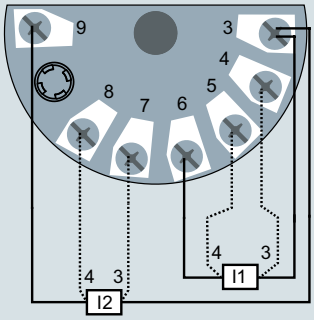


SITRANS TF420, dual chamber enclosure, dimensions in mm (inch)

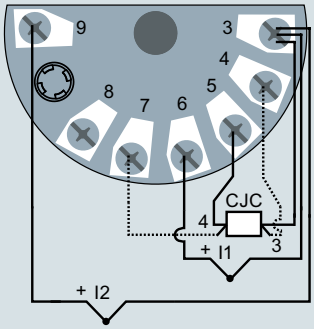
Circuit diagrams

Connections

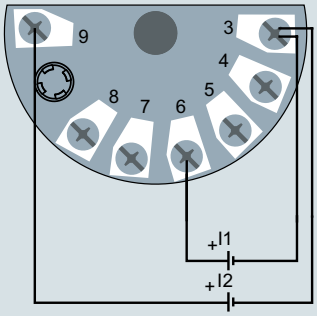
Input connection



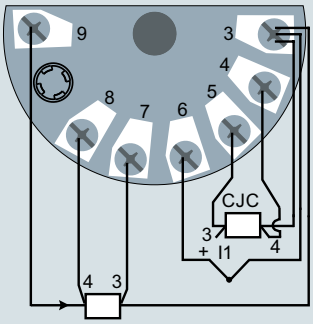
Input 1 and/or input 2:
2-wire, 3-wire or 4-wire RTD or
linear resistance



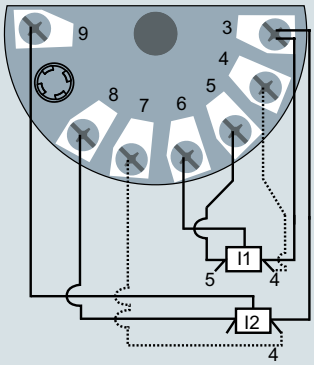
Input 1 and/or input 2:
TC (internal CJC or
external 2-wire, 3-wire or
4-wire CJC)



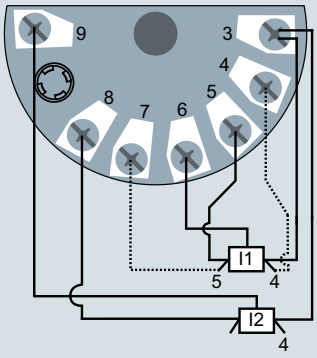
Input 1 and/or input 2:
Voltage input
(unipolar or bipolar)



Input 1: TC (internal CJC or
external 2-wire or 3-wire CJC)
Input 2: 2-wire, 3-wire or 4-wire RTD

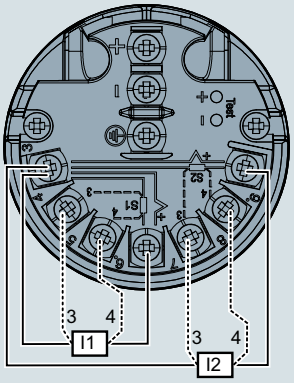


Input 1 and/or Input 2:
3-wire or 4-wire potentiometer

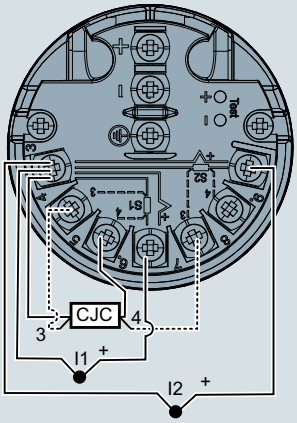


Input 1: 5-wire potentiometer
Input 2: 3-wire potentiometer

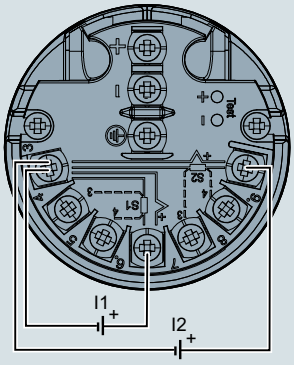
SITRANS TF420 in single chamber enclosure (7NG044*), input connection assignment



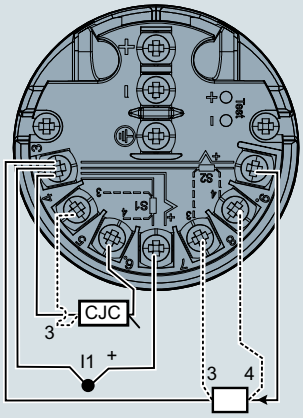
Input 1 (I1) and/or input 2 (I2):
2-wire, 3-wire or 4-wire RTD or
linear resistance



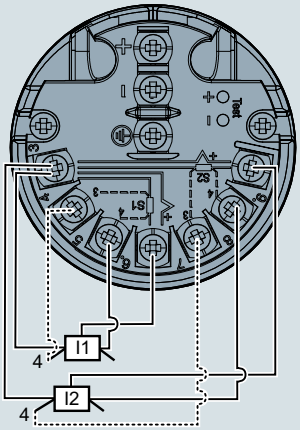
Input 1 (I1) and/or input 2 (I2):
TC (internal CJC or
external 2-wire, 3-wire or
4-wire CJC)



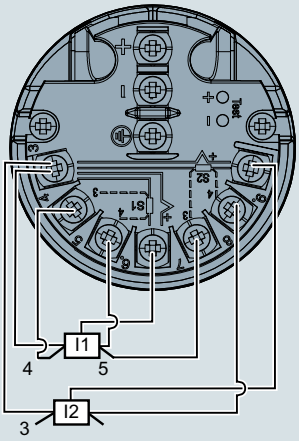
Input 1 (I1) and/or input 2 (I2):
Voltage input
(unipolar or bipolar)



Input 1: TC (internal CJC or
external 2-wire or 3-wire CJC)
Input 2: 2-wire, 3-wire or 4-wire RTD



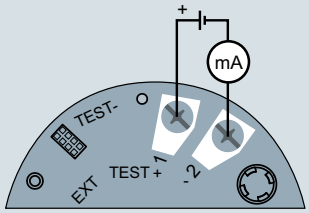
Input 1 (I1) and/or input 2 (I2):
3-wire or 4-wire potentiometer



Input 1 (I1): 5-wire potentiometer
Input 2 (I2): 3-wire potentiometer

SITRANS TF420 in dual chamber enclosure (7NG045*), input connection assignment

Output connection



SITRANS TF420 in single chamber enclosure (7NG044*), output connection assignment

Overview

SITRANS TO500 is a multipoint temperature transmitter for measuring temperatures and temperature profiles with fiber-optic multipoint measuring lances.

Benefits

- Evaluation of a large number of sensors (Fiber Bragg Grating (FBG)) in one temperature transmitter
- Low space requirements of the multipoint measuring lance
- 4 multipoint measuring lance channels per temperature transmitter
- Easy to install
- PROFIBUS DP - Simple integration into control system
- Fast response to temperature changes
- Exact, no recalibration required due to internal reference
- Also suitable for high process temperatures

Application

SITRANS TO500 is used for evaluating a high number of sensors that are arranged on a fiber-optic multipoint measuring lance.

Up to 4 multipoint measuring lances, each with as many as 48 sensors (Fiber Bragg Grating (FBG)), can be simultaneously processed by one SITRANS TO500.

Accurate and fast determination of temperature profiles enables process optimization in terms of service life, quality and output.

Locations of excessive temperature rise are quickly and accurately detected, thereby preventing damage to the process, equipment and environment.

Wherever temperature profiles must be determined and installation space is limited, the SITRANS TO500 with fiber-optic temperature measurement is the right choice.

Design

The SITRANS TO500 multipoint temperature transmitter is located in the control cabinet in a compact aluminum enclosure for mounting onto DIN rails.

The connectors are easy to access on the front:

- 4 x connector for multipoint measuring lances
- 1 x connector for power supply
- 1 x connector PROFIBUS DP
- 1 x connector Ethernet

The status displays are also located on the front.

Mode of operation

In the SITRANS TO500 multipoint temperature transmitter, light with a wavelength from 1 500 to 1 600 nm is generated with a continuously adjustable laser and decoupled to the multipoint measuring lance. Fiber Bragg Gratings (FBG) are mounted at freely defined points on the multipoint measuring lances. Each FBG reflects light of a defined wavelength. The wavelength reflected by the FBG varies depending on the temperature. The reflection at the FBGs is thus a measurement of the temperature at the corresponding measuring point. A maximum of 48 FBGs per channel can be evaluated, depending on the temperature range.

A gas cell with fixed absorption line serves as a reference in the SITRANS TO500 and the wavelength determination is continuously adjusted by it.

Function

The SITRANS TO500 has 4 channels which are evaluated simultaneously. The wavelength reflected at each sensor in the multipoint measuring lance depends on the temperature, and this wavelength is output in the multipoint temperature transmitter. All 4 channels are read at the same time and updated once per second. The temperature can be determined and displayed accurately at up to 48 sensors per channel. The positions of the sensors can be specified by the customer. This leads to a flexible and application-specific solution for the customer.

The measured temperatures are transferred to the control system by PROFIBUS DP. The parameters of the SITRANS TO500 are set via the integrated Ethernet interface.

SITRANS TO500, multipoint temperature transmitter

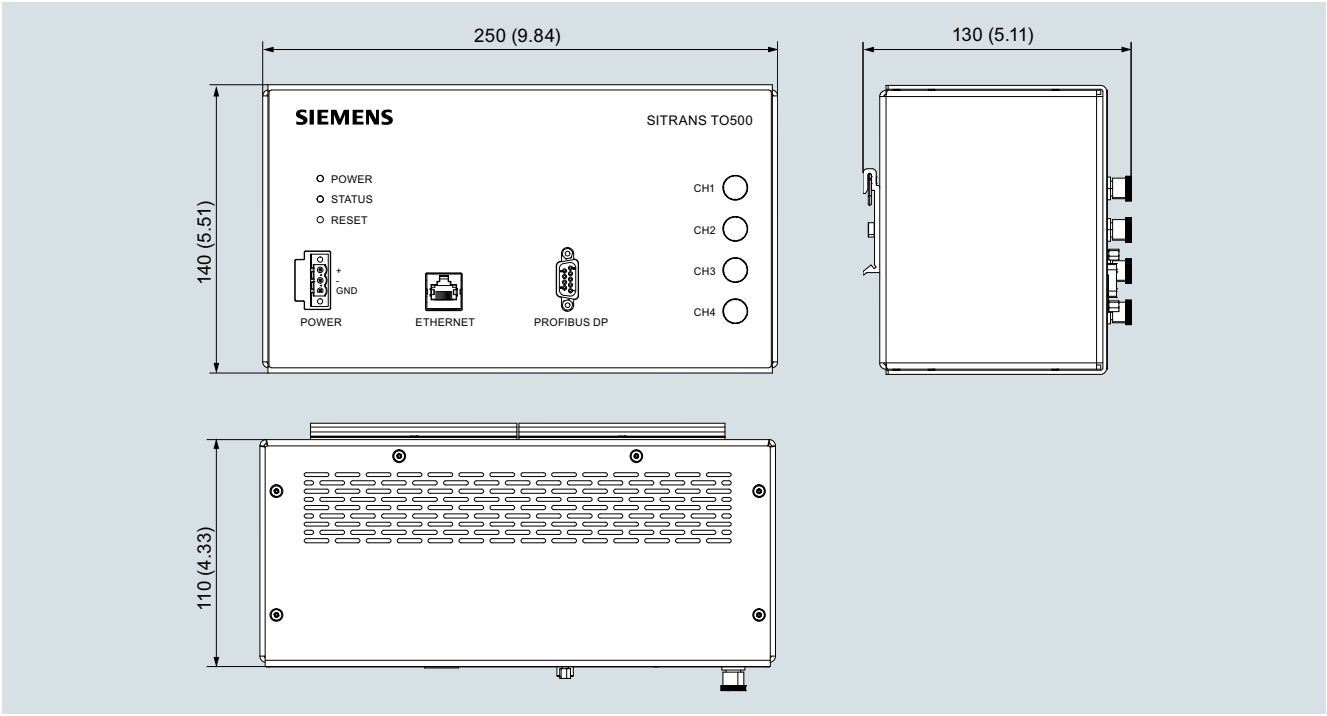
Technical specifications

Input	
Channels	4
Measured variable	Temperature
Input type	max. 48 sensors (FBGs) per channel
Characteristics	Temperature-linear
Resolution	0.1 K
Measuring accuracy	< 0.5 K
Repeatability	< 0.5 K
Measuring cycle	1 s
Measuring range	-180 ... +800 °C (-292 ... +1472 °F) depending on the multipoint measuring lance
Unit	°C
Power supply	24 V DC + 20%
Power consumption	Max. 15 W
Protection	Against reverse polarity
Measuring velocity	
• Measurement rate	1 Hz independent of the number of APCBs
Output	
Output signal	PROFIBUS DP
Optical power	≤ 1 mW per channel
Laser protection class	Class 1
Rated conditions	
Ambient conditions	
• Ambient temperature	0 ... 50 °C (32 ... 122 °F)
• Storage temperature	-40 ... +85 °C (-40 ... +185 °F)
• Relative humidity	< 80%, non condensing at 50 °C (122 °F)
• Electromagnetic compatibility	According to EN 61326 and NAMUR NE21
Degree of protection to EN 60529	
• Enclosure	IP20
Design	
Weight	2.4 kg (5.3 lb)
Dimensions	See "Dimensional drawings"
DIN rail adapter	Rear-mounted
Material	Aluminum
Displays and control elements	
LEDs	• "Power-on" (continuous light) • "Status" (flashing during startup; otherwise continuous light)
Pushbutton	"Reset" (system restart or address reset)

Selection and Ordering data

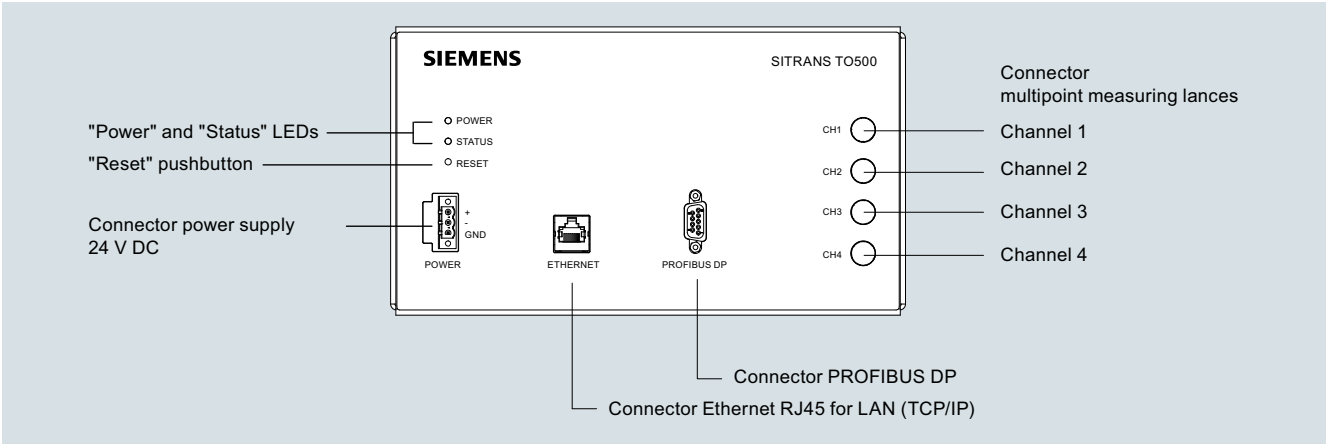
	Article No.
SITRANS TO500 **multipoint temperature transmitter** Communication: PROFIBUS DP Channels: 4 Power supply: 24 V DC Optical connection: FC/APC plug Enclosure: Aluminum, IP20	**7NG9551-4AA00-0AA0**

Dimensional drawings



SITRANS TO500, front, rear and side view; dimensions in mm (inch)

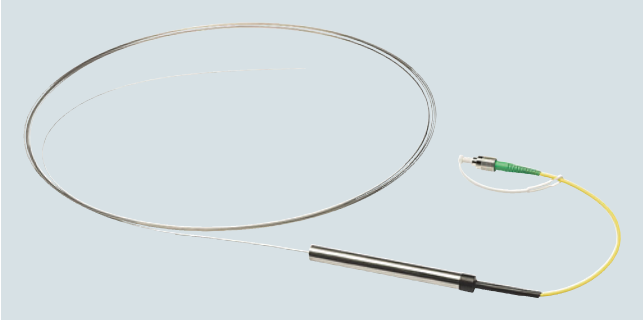
Circuit diagrams



SITRANS TO500, connector assignment

SITRANS TO, multipoint measuring lance

Overview



The SITRANS TO multipoint measuring lance for measuring temperatures and temperature profiles using fiber-optic Fiber Bragg Grating (FBG).

Benefits

- Fast response to temperature changes
- Easy to install
- Low space requirements
- Freely selectable sensor arrangement (≤ 20 sensors per multipoint measuring lance)
- Freely selectable measuring lance length (≤ 20 m/787 inch)
- Also suitable for high process temperatures (≤ 450 °C/842 °F)

Application

The SITRANS TO multipoint measuring lance is used for measuring temperatures determined using fiber-optic Fiber Bragg Gratings.

Up to 20 temperature sensors can be arranged on a multipoint measuring lance simultaneously. Depending on the process, the position of the sensor points can be freely selected; minimum distance is 50 mm (2 inch).

Design

The SITRANS TO multipoint measuring lance consists of an optical fiber to which the Fiber Bragg Grating has been applied with a laser.

The fiber is surrounded by a stainless steel capillary.

The multipoint measuring lance is inserted into the measurement environment in a thermowell on the process side, e.g. reactor, vessel.

Mode of operation

From the supplied light with a wavelength range of 1500 to 1600 nm, each grid in the fiber reflects a value that is specific for the position and the temperature. This specific value is evaluated in the SITRANS TO500 multi-point temperature transmitter.

Function

Accurate and fast determination of temperature profiles enables process optimization in terms of service life, quality and output.

Local overheating is detected quickly and precisely located, thereby preventing damage to the process, equipment and environment.

Wherever temperature profiles must be determined and installation space is limited, the SITRANS TO500 and fiber-optic temperature measurement are the right choice.

Integration

Connection to SITRANS TO500 is made via single-mode patch cable.

Technical specifications

Input	
Measured variable	Temperature
Measuring system	FBG sensors
Working area	1 500 ... 1 600 nm
Resolution	0.1 K
Measuring accuracy	< 1 K or 1% of measuring span; the larger value applies
Repeatability	< 0.5 K
Measuring range	-40 ... +450 °C (-40 ... +842 °F), other ranges on request
Number of sensors	1 ... 20; maximum number depending on the measuring range, numbers > 20 on request
Response time (T0.9)	
• Multipoint measuring lance without thermowell	< 2 s
• Multipoint measuring lance with thermowell, stainless steel, wall thickness 1 mm; example:	
- Outer diameter 3 mm	18 s
- Outer diameter 6 mm	43 s
Rated conditions	
Ambient conditions	
• Ambient temperature	-20 ... +80 °C (-4 ... +176 °F)
• Storage temperature	-40 ... +85 °C (-40 ... +185 °F)
• Operation	Vertically extended or horizontally (+1 K measuring error)
• Relative humidity	5 ... 95 %
• Condensing moisture	Not permitted
Bending radius of the multipoint measuring lance during transportation and installation	> 500 mm (19.7 inch); briefly 250 mm (9.8 inch)
Other conditions	Avoid direct contact of the sensor with aggressive and corroding chemicals such as halogens, NO_X and SO_X
IP degree of protection (handpiece and multipoint measuring lance without connectors)	IP67
Pigtail	
• Bending radius	> 60 mm (2.4 inch)
• Tensile force	< 5 N
Design	
Weight	60 g (0.13 lb) + 2 g/m + 0.0044 lb/m)
Connectors	FC/APC Clean with a suitable cleaning agent before connecting. Close with cap if not in use.
Capillary material	AISI 316L
Dimensions	See "Dimensional drawings"
• Length	0.1 … 20 m (3.9 … 787 inch)
• Diameter	0.8 mm (0.031 inch)
Thermowell inside diameter (recommended)	
• Measuring lance < 2 m (79 inch)	≥ 2 mm (0.0787 inch)
• Measuring lance < 5 m (197 inch)	≥ 3 mm (0.118 inch)
• Measuring lance < 10 m (394 inch)	≥ 4 mm (0.157 inch)
• Measuring lance > 10 m (394 inch)	≥ 6 mm (0.236 inch)
Distance from last sensor to tip of multipoint measuring lance	10 mm (0.39 inch)
Length of sensor point	6 mm (0.236 inch)
Positioning accuracy of sensor	±3 mm (0.118 inch)
Distance between 2 sensors	> 50 mm (2 inch); smaller on request
Length FOC connection to the transmitter	10 000 m (39 3701 inch)

Displays and control elements	
Displays and buttons	
• Without	
Installation instructions	
Mechanical shock	Avoid mechanical shocks to the multipoint measuring lance, such as: Falls from heights > 0.5 m (19.7 inch) or whipping and/or snapping of the capillaries.
Concentrated pressure	Avoid concentrated pressure on the capillaries. For example, do not hold with pliers or other similar tools. After several hours at an ambient temperature > 250 °C (482 °F), the steel loses its elasticity.
Removal and reinstallation	Extreme caution must be exercised during transport, storage and installation if removing or reinstalling. The multipoint measuring lance is irreversibly damaged at temperatures > 550 °C (1 022 °F).

SITRANS TO, multipoint measuring lance

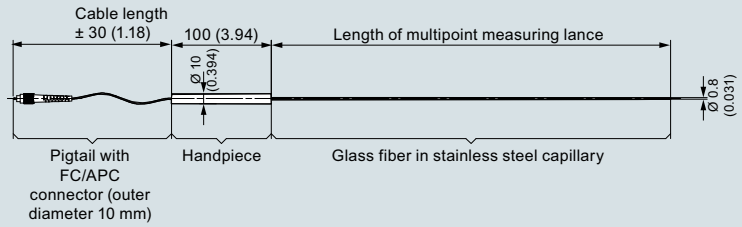
Selection and ordering data

	Article No.	Order code
SITRANS TO multipoint measuring lance (coating: stainless steel) ↗	**7MC7700-**	
↗ Click on the Article no. for the online configuration in the PIA Life Cycle Portal.		
Number of sensors		
1	**0 A**	
2	**0 B**	
3	**0 C**	
4	**0 D**	
5	**0 E**	
6	**0 F**	
7	**0 G**	
8	**0 H**	
9	**0 J**	
10	**0 K**	
11	**0 L**	
12	**0 M**	
13	**0 N**	
14	**0 P**	
15	**0 Q**	
16	**0 R**	
17	**0 S**	
18	**0 T**	
19	**0 U**	
20	**0 V**	
Customer-specific design: Add order code; enter number of sensors and high temperature limit in plain text.	**9 X**	**H 1 Y**
Installation length U; customer-specific		
0.1 m < U ≤ 2 m (4 inch < U ≤ 79 inch)	**A**	
2 m < U ≤ 4 m (79 inch < U ≤ 157.5 inch)	**B**	
4 m < U ≤ 6 m (157.5 inch < U ≤ 236 inch)	**C**	
6 m < U ≤ 8 m (236 inch < U ≤ 315 inch)	**D**	
8 m < U ≤ 10 m (315 inch < U ≤ 394 inch)	**E**	
10 m < U ≤ 12 m (394 inch < U ≤ 472 inch)	**F**	
12 m < U ≤ 14 m (472 inch < U ≤ 551 inch)	**G**	
14 m < U ≤ 16 m (551 inch < U ≤ 630 inch)	**H**	
16 m < U ≤ 18 m (630 inch < U ≤ 709 inch)	**J**	
18 m < U ≤ 20 m (709 inch < U ≤ 787 inch)	**K**	
Customer-specific design: Add order code and specify required length in plain text.	**X**	**Y 4 4**
High temperature limit		
100 °C (212 °F)	**1 0**	
150 °C (302 °F)	**1 1**	
200 °C (392 °F)	**1 2**	
250 °C (482 °F)	**1 3**	
300 °C (572 °F)	**1 4**	
350 °C (662 °F)	**1 5**	
400 °C (752 °F)	**1 6**	
450 °C (842 °F)	**1 7**	
Customer-specific design	**8 8**	

	Article No.	Order code
SITRANS TO multipoint measuring lance (coating: stainless steel)	**7MC7700-**	
Optical connector		
FC/APC connector	**0**	
Mechanically reinforced connector	**1**	
Connecting cable length LC		
LC = 200 mm for standard connection	**B**	
0.2 m < LC ≤ 2 m (define precise length in option Y45)	**C**	
Customer-specific design (LC > 2 m): Add order code and specify required length in plain text.	**Z**	**P 1 Y**
Temperature measurement range		
100 K	**A**	
150 K	**B**	
200 K	**C**	
250 K	**D**	
300 K	**E**	
350 K	**F**	
400 K	**G**	
500 K	**H**	
Customer-specific design: Add order code and specify required temperature measuring range in plain text.	**Z**	**Q 1 Y**
Wavelength bandwidth distribution		
Without (no color code; 1 multipoint measuring lance per channel)	**0**	
Dual split (2 multipoint measuring lances per channel) • 1 500 ... 1 550 nm (white color code; multipoint measuring lance 1 of 2)	**1**	
• 1 551 ... 1 600 nm (black color code; multipoint measuring lance 2 of 2)	**2**	
Quad split (4 multipoint measuring lances per channel) • 1 500 ... 1 525 nm (blue color code; multipoint measuring lance 1 of 4)	**3**	
• 1 526 ... 1 550 nm (red color code; multipoint measuring lance 2 of 4)	**4**	
• 1 551 ... 1 575 nm (green color code; multipoint measuring lance 3 of 4)	**5**	
• 1 576 ... 1 600 nm (yellow color code; multipoint measuring lance 4 of 4)	**6**	
Customer-specific design: Add order code and specify required number of multipoint measuring lances per channel in plain text.	**9**	**R 1 Y**

Options	Order code
Append suffix "**-Z**" to article no., add order code and plain text, if applicable.	
Sensors	
Working temperature of high temperature limit < 100 °C (212 °F)	**Y02**
Tag plate	
Tag plate	**Y15**
Lengths	
Customer-specific installation length (in m)	**Y44**
Customer-specific length of the connecting cable (in m)	**Y45**
Special versions	
Description of the special version	**Y98**
Reference/offer no. - application data sheet with sensor positioning	**Y99**

Dimensional drawings



SITRANS TO multipoint measuring lance with FC/APC connector, pigtail and handpiece; dimensions in mm (inch)

Further accessories for assembly, connection and transmitter configuration

Overview

Additional accessories for assembly, connection and transmitter configuration

- Transmitter configuration for SITRANS TH / TR / TF and SITRANS TS
- Cable glands and adapters for SITRANS TF and SITRANS TS
- Lightning protection for SITRANS TF (SITRANS TS on request)
- Connectors for SITRANS TF and SITRANS TS
- Indicator for SITRANS TS500
- Connection and mounting accessories for SITRANS TH
- Connection and mounting accessories for field transmitter SITRANS TF
- Measurement inserts for SITRANS TS500 Measurement inserts: see SITRANS TSinsert.
- Connection heads type B for SITRANS TS500 (accessory resistance thermometer)
- Enclosure gaskets for SITRANS TS500
- Connection heads type A and accessories for straight thermocouples
- Installation accessories for connection heads for straight thermocouples

Selection and ordering data

Transmitter configuration for SITRANS TH / TR / TF and SITRANS TS

	Article No.
Modems	
Modem with USB interface and SIPROM T software for; 4 ... 20 mA: • With USB connection • For SITRANS TH100, TH200, TH320, TR200, TR320, TF320, TF420 and TF, with TH200	**7NG3092-8KN**
Modem with USB interface for all HART devices: • With USB connection • For SITRANS TH300, TH320, TH420, TR300, TR320, TR420, TF320, TF420,TF in HART	**7MF4997-1DB**
SIMATIC PDM parameter assignment software for: SITRANS TH300, TR300, TH400, TF320, TF420, TF in HART / PROFIBUS PA / FOUNDATION Fieldbus	**siehe Kap. 8**

Cable glands and adapters for SITRANS TF and SITRANS TS

	Article No.
M20 x 1.5 nickel-plated brass; with Ex-d approval	**7MF4997-2FR**
½-NPT nickel-plated brass; with Ex-d approval	**7MF4997-2FU**
CAPRI screw connection M20 x 1.5 nickel-plated brass; with Ex-d approval	**7MF4997-2LA**
CAPRI screw connection, M20 x 1.5 stainless steel; with Ex-d approval	**7MF4997-2LB**
CAPRI screw connection ½-14 NPT nickel-plated brass; with Ex-d approval	**7MF4997-2LC**
CAPRI screw connection ½-14 NPT stainless steel; with Ex-d approval	**7MF4997-2LD**
Threaded adapter M20 x 1.5 (male thread) to ½-14 NPT (female thread)	**7MP1990-0BA00**
Threaded adapter M20 x 1.5 (male thread) to G½ (female thread)	**7MP1990-0BB00**

Lightning protection for SITRANS TF (SITRANS TS on request)

	Article No.
Transient protector M20 x 1.5 (lightning protection)	**7MF4997-2DU**
Transient protector ½-14 NPT (lightning protection)	**7MF4997-2DV**

Selection and ordering data

Plug for SITRANS TF and SITRANS TS

	Article No.
Han 7D plug made of plastic	**7MF4997-2FB**
Han 7D plug made of metal	**7MF4997-2FC**
M12 socket angled for 4 ... 6 mm cable diameter -25 ... +85 °C (-13 ... 185 °F)	**3RK1902-4CA00-4AA0**

Indicator for SITRANS TS500

	Article No.
Digital indicator loop-powered HW05 for SITRANS TS500	**A5E33119275**

Connection and mounting accessories for SITRANS TH

	Article No.
Mounting rail adapter for head transmitter (order quantity: 5 units)	**7NG3092-8KA**
Connecting cable 4-wire, 200 mm (7.87 inch), for input connections when using head transmitters in the high hinged cover (set with 5 units)	**7NG3092-8KC**

Connection and mounting accessories for field transmitter SITRANS TF

	Article No.
Mounting bracket and fastening parts	
Made of steel for 7NG313. -..B.. and 7MP1110	**7MF4997-1AC**
Made of steel for 7NG313 . -..C..	**7MF4997-1AB**
Made of stainless steel 304 for 7NG313. -..B.. and 7MP1110	**7MF4997-1AJ**
Made of stainless steel 304 for 7NG313. -..C..	**7MF4997-1AH**
Made of stainless steel 316L for 7NG313. -..B..	**7MF4997-1AQ**
Made of stainless steel 316L for 7NG313. -..C..	**7MF4997-1AP**
Digital indicator for SITRANS TF[1)]	**7MF4997-1BS**
Connection board for SITRANS TF	**A5E02391790**
Lid, die-cast aluminum, without inspection window	**7MF4997-1BB**
Lid, die-cast aluminum, with inspection window	**7MF4997-1BE**

[1)] Retrofitting not possible with Ex devices.

Selection and ordering data

Measuring inserts for SITRANS TS500

For measurement inserts, see SITRANS TSinsert page 2/100.

Connection heads type B for SITRANS TS500 (accessory resistance thermometer)

	Article No.
Degree of protection IP54	
Connection head type: similar to BA0; aluminum; flange cover	**7MC1907-1BA**
Connection head type: similar to BM0; plastic; screw cover	**7MC1907-1BK**
Degree of protection IP65	
Connection head type: similar to BB0; aluminum; small spring flap	**7MC1907-1BF**
Connection head type: similar to BC0; aluminum; high spring flap	**7MC1907-1BL**
Connection head type: B-VA, stainless steel	**7MC1907-1BV**
Quick-release lock for connection heads BB0, BC0, degree of protection of connection head reduced to IP20, weight: 0.02 kg (0.04 lb)	**7MC1907-1BS**

Spare parts/enclosure gaskets for SITRANS TF320/TF420 and SITRANS TS500

	Article No.
Lid gasket SITRANS TF320/TF420 single chamber enclosure as well as for SITRANS TS500 housing AG0, AV0, AU0, AV0	**7MF7901-3AB**

Connection heads type A and accessories for straight thermocouples

Metal thermowells for straight thermocouples according to EN 50446

	Article No.
X 10 CrAl 24, material no. 1.4762	
∅ 22 x 2 mm (∅ 0.87 x 0.08 inch), 0.55 ... 1.10 kg (1.21 ... 2.42 lb), dished	
Nominal length/thermowell length in mm (inch):	
• 500 (19.7)/520 (20.5)	**7MC2900-1DA**
• 710 (28.0)/730 (28.7)	**7MC2900-2DA**
• 1 000 (39.4)/1 020 (40.2)	**7MC2900-3DA**
X 18 CrN28, material no. 1.4749	
∅ 26 x 4 mm (∅ 1.02 x 0.16 inch), 1.25 ... 2.20 kg (2.76 ... 4.85 lb), dished	
Nominal length/thermowell length in mm (inch):	
• 500 (19.7)/520 (20.5)	**7MC2900-1EC**
• 710 (28.0)/730 (28.7)	**7MC2900-2EC**
• 1 000 (39.4)/1 020 (40.2)	**7MC2900-3EC**
X 15 CrNiSi 25 20, material no. 1.4841	
∅ 22 x 2 mm (∅ 0.87 x 0.08 inch), 1.05 kg (2.31 lb), dished	
Nominal length/thermowell length in mm (inch):	
• 1 000 (39.4)/1 020 (40.2)	**7MC2900-3FA**
CrAl 205 (Kantal AF), material no. 1.4767	
∅ 22 x 2 mm (∅ 0.87 x 0.05 inch), 0.55 ... 1.10 kg (1.21 ... 2.42 lb)	
Nominal length/thermowell length in mm (inch):	
• 500 (19.7)/520 (20.5)	**7MC2900-1HA**
• 710 (28.0)/730 (28.7)	**7MC2900-2HA**
• 1 000 (39.4)/1 020 (40.2)	**7MC2900-3HA**

Thermocouple elements for straight thermocouples according to EN 50446

	Article No.
Base thermocouple with isolating pipe	
Wire diameter 3 mm (0.12 inch) Ni Cr/Ni, up to 1 000 °C (max. 1 300 °C), (up to 1 832 °F (max. 2 372 °F)) 0.55 ... 2.10 kg (1.21 ... 4.63 lb)	
Nominal length *L1*/Thermowell length *L2* in mm (inch):	
• 500 (19.7)/540 (21.3)	**7MC2903-1CA**
• 710 (28.0)/750 (29.5)	**7MC2903-2CA**
• 1 000 (39.4)/1 040 (40.9)	**7MC2903-3CA**

Connection heads for straight thermocouples

	Article No.
Connection head, type A (without terminal base and terminals), 1 cable entry, degree of protection IP53, 0.35 kg (0.77 lb)	
Light metal casting, screw-on cover, for thermowell diameter in mm (inch) (hole = thermowell diameter +0.5 mm) (0.02 inch)	
• 22 (0.87)	**7MC2905-1AA**
• 26 (1.02)	**7MC2905-1BA**
Light metal, high spring flap, for thermowell diameter in mm (inch) (hole = thermowell diameter +0.5 mm) (0.02 inch)	
• 22 (0.87)	**7MC2905-4AA**
• 26 (1.02)	**7MC2905-4BA**

Installation accessories for connection heads for straight thermocouples

- Terminal base
- Terminal
- Sealing rings
- Washer
- Stop flange
- Threaded sleeve

	Article No.
Terminal base without terminals for base thermocouples; 0.06 kg (0.13 lb)	**7MC2998-1AA**
Terminal for base thermocouples; 0.01 kg (0.02 lb)	**7MC2998-1BA**
Set of sealing rings (100 units) for the lid of the connection head; 0.01 kg (0.02 lb)	**7MC2998-1CA**
Set of washers (100 units) for the terminal base; 0.01 kg (0.02 lb)	**7MC2998-1CB**
Stop flange, adjustable, from GTW	
For thermowell outer diameter 22 mm (0.87 inch); 0.35 kg (0.77 lb)	**7MC2998-2CB**
For thermowell outer diameter 26 mm (1.02 inch); 0.32 kg (0.71 lb)	**7MC2998-2CC**
Threaded sleeve, gas-tight up to 1 bar (14.5 psi), adjustable, material no. 1.0718, with seal; 0.40 kg (0.88 lb)	
For thermowell outer diameter 22 mm (0.87 inch), **G1**	**7MC2998-2DB**
For thermowell outer diameter 26 mm (1.02 inch), **G1**	**7MC2998-2DC**

Notes