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## **Temperature Measurement**



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You can download all instructions, catalogs and certificates for SITRANS T free of charge at the following Internet address:

www.usa.siemens.com/temperature

Product overview

	Туре	Description		Page	Software for parameterizatio
TRANS TS temperature ser	nsors				
	SITRANS TS500 Temperature Sensor Assemblies Include thermowell, sensor, head and transmitters	head and tra model numb	nowell, sensor, nsmitter in single er. ns include con-	2/6	-
	Application	Mounting of the Ex protection	ransmitter with	Page	Software for parameterizatio
		Transmitter	Sensor		
ompact and head transmitte	ers			-	
	SITRANS TH100 Slim			2/24	SIPROM T
	For temperature measurement in combination with Pt100 compact resistance thermometers			<i></i> 1	
	SITRANS TH100	Zone 2,	Zone 2,	2/27	SIPROM T
	<ul><li>4 to 20 mA</li><li>Transmitters for Pt100</li></ul>	zone 1, zone 0, zone 21, zone 20, DIV 1, DIV 2	zone 1, zone 0, zone 21, zone 20, DIV 1, DIV 2		
STATES	SITRANS TH200 Transmitters for connection to resistance thermometers, resis- tance-based sensors, thermocou- ples 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
SECTION AND AND AND AND AND AND AND AND AND AN	SITRANS TH300 Transmitters for connection to resistance thermometers, resis- tance-based sensors, thermocou- ples 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, resis- tance-based sensors, thermocou- ples 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

Product overview

				_	
	Application	Mounting of tra Ex protection	ansmitter with	Page	Software for parameterization
		Transmitter	Sensor		
	SITRANS TH320 2-wire head transmitter with and without HART communications interface. With 1 input for connec- tion 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 con- nection to resistance thermome- ters, 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 connec- tion 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 con- nection to resistance thermome- ters, 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

Product overview

	Application	Mounting of t Ex protection	ransmitter with	Page	Software for parameterization
		Transmitter	Sensor		
ield transmitters					
8215	SITRANS TF Transmitters for connection to resistance thermometers, resis- tance-based sensors, thermocou- ples and DC voltages up to 1.1 V	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
	<ul> <li>In field enclosure for heavy in- dustrial use</li> <li>4 to 20 mA</li> </ul>				
	• HART 5				
	Universal				
	SITRANS TF	Zone 2,	Zone 2	2/112	SIMATIC PDM for PROFIBUS F
	Fieldbus transmitters for connec- tion to resistance thermometers, resistance-based sensors, ther- mocouples and DC voltages up to 0.8 V • In field enclosure for heavy in-	zone 1; zone 21, DIV 1, DIV 2	zone 1, zone 0		
	dustrial use				
	PROFIBUS PA				
	FOUNDATION fieldbus				
	SITRANS TF320 NEW Transmitters for connection to resistance thermometers, resis- tance-based sensors, thermocou- ples and DC voltages up to 1.7 V	Zone 2, Zone 1, Zone 21, DIV 1,	Zone 2, Zone 1, Zone 21, DIV 1,	2/119	Local operation with buttons. SIMATIC PDM local with HART modem or SIPROM T (depending on SITRANS TH320 type used)
	<ul><li>In field enclosure for heavy industrial use</li><li>4 to 20 mA</li></ul>	DIV 2	DIV 2		
	• HART 7				
	• Universal				
	SIL2/3 according to IEC 61508				
	SITRANS TF420 NEW Transmitters for connection to resistance thermometers, resis- tance-based sensors, thermocou- ples and DC voltages up to 1.7 V	Zone 2, Zone 1, Zone 21, DIV 1,	Zone 2, Zone 1, Zone 21, DIV 1,	2/132	Local operation with buttons. SIMATIC PDM locally with HAF modem.
	<ul><li>In field enclosure for heavy industrial use</li><li>HART 7</li></ul>	DIV 2	DIV 2		
	• Universal				
	• SIL2/3 according to IEC 61508				
	High input availability			_	
Field indicator for 4 to 20 mA					
	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	-

Product overview

	Application	Mounting of tra Ex protection	ansmitter with	Page	Software for parameterization
		Transmitter	Sensor		
Fiber-optic temperature measu	rement				
	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.

SITRANS TS500

#### Overview

2



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

#### **Technical description**

#### 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)

SITRANS TS500

#### **Technical description**

#### 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.



Process NPT	OD1	OD2
1/2"	0.68"	5/8"
3⁄4"	7/8"	5/8"
1"	1 1/16"	5/8"
1 1⁄4"	1 1/8"	3⁄4"
1 1/2"	1 1/8"	3⁄4"

Temperature Measurement SITRANS TS500





Process NPT	OD1	
1/2"	0.68"	
3⁄4"	3⁄4"	
1"	7/8"	
1 1⁄4"	1 1/8"	
1 1⁄2"	1 1/8"	

Dimensions in inch



Process NPT	OD1	OD2
1/2"	0.68"	5/8"
3⁄4"	7/8"	5/8"
1"	1 1/16"	5/8"
1 1⁄4"	1 1/8"	3/4"
1 1/2"	1 1/8"	3⁄4"

SITRANS TS500

#### **Technical description**

## Step down flanged well assemblies



Dimensions in inch

Straight flanged well assemblies



Dimensions in inch

Temperature Measurement SITRANS TS500



Dimensions in inch

Step down socket well assemblies



SITRANS TS500

#### **Technical description**

## Straight socket well assemblies



Process NPT	OD1
1/2"	0.68"
3⁄4"	3/4 "
1"	7/8"
1 1⁄4"	1 1/8"
1 1⁄2"	1 1/8"

Dimensions in inch

Tapered socket well assemblies



Process NPT	OD1	OD2
1⁄2"	0.68"	5/8"
3⁄4"	7/8"	5/8"
1"	1 1/16"	5/8"
1 1⁄4"	1 1/8"	3⁄4"
1 1⁄2"	1 1/8"	3⁄4"

## **Temperature Measurement** SITRANS TS500

Technical description

# Barrow Conception

General purpose sensors



SITRANS TS500

#### Technical description

#### 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)]	
Туре К	-40 +1000 (-40 +1132)

Type K	-40 +1000 (-40 +1132)
Туре Ј	-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)]

Increased accuracy,

Class A

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)

-100 ... +450 (-148 ... +842)

#### Thermocouples

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

#### Catalog versions

Туре	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

Туре	Basic accuracy, Class 2	Increased accuracy, Class 1
Т	-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 ±0.004× t[°C]  (257 °F 662 °F ±0.004× 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

Туре	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 ×  t  (1112 °F 2912 °F±0.0025 ×  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)
В	600 °C 1700 °C±0.0025 x  t  (1112 °F 3092 °F±0.0025 x  t )	

SITRANS TS500

#### **Technical description**

#### 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  $1 \times Pt100$  devices. In the case of  $2 \times Pt100$  versions, two- and three-wire systems are also possible. For measurement-related reasons, we always recommend a  $1 \times four$ -wire or  $2 \times 3$ -wire connection.

#### **Technical description**

#### 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 c	lescriptions/Stan	dards comparison		Max. tem- perature [°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 stain- less steel	600 (1112)	Good acid resistance, resistant against grain boundary corro- sion	Chemical industry, waste treat- ment, paper and cellulose industry, food industry
2.4816	Inconel 600	NiCr15Fe	Nickel-Chrome alloy	1150 (2102)	Resistant at high tempera- tures, resistant against chlo- rine-induced cold crack corrosion	Chemical industry, petrochem- ical industry, food industry
1.4876	Incoloy 800	X10NiCrAlTi32-21	Austenitic heat- resistant stain- less steel	1100 (2012)	Excellent resistance against oxidation and carbonization at high temperatures, good cor- rosion resistance	O&G industry, waste gas treat- ment, power plants (steam boiler, heat exchanger), appli- cations using aggressive fluids
2.4819	Hastelloy C 276	NiMo16Cr15W	Nickel-Chrome- Molybdenum alloy	1100 (2012)	Resistant at high tempera- tures, in oxidizing and reduc- ing atmosphere, resistant against pitting and crevice cor- rosion, good corrosion resis- tance after welding	Chemicals industry, paper and cellulose industry, waste treat- ment, waste incinerators, emis- sions 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.

#### $R_{iso} \ge 100 M\Omega$

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:

• Ø Measuring insert 6 mm (0.24 in) 2.8  $\Omega$ /m or 44.78 (44.78 ) For this reason a connection to three- or four-wire systems is highly recommended.

SITRANS TS500

## Selection and Ordering data

Coloction and Ordening data	Article No.	Ord Code	<b>C</b> -
Selection and Ordering data SITRANS TS500	Article No. 7MC650	Ord. Code	Se SIT
Threaded sensor assembly (no thermowell)		- 0	Thi (no
Click on the Article No. for the online configuration in the PIA Life Cycle Portal.			<b>Co</b> Ca
Sheath Material	<u>_</u>		Ca Flip
316L Stainless Steel 310 Stainless Steel	2 4		Exp
Alloy 600	7		(FN
Form			Exp
Adjustable Compression Fitting	2		Wit A8
Fixed Welded Spring-Loaded	3 4		Oth
Process Connection Size			Se
½" NPT Insertion length (U-Length)	J		Sta
1"	PO		Pla
1.5"	P1		Cla Cla
2"	P2		Cla
2.5" 3"	P 3 P 4		Cla
3.5"	P 5		Cla Hig
4"	P 6		RTI
4.5"	P7		The
5"	P8		Sta
5.5" 6"	Q 0 Q 1		Тур
6.5"	Q 2		Тур Тур
7"	Q 3		Тур
7.5"	Q 4		Тур
8"	Q 5		Тур
8.5" 9"	Q 6 Q 7		Тур
9.5"	Q 8		Typ Oth
10"	R 0		01.
10.5" 11"	R 1 R 2		
11.5"	R 3		
12"	R 4		
12.5"	R 5		
13"	R 6		
13.5" 14"	R 7 R 8		
14.5"	S O		
15"	S 1		
15,5"	S 2		
16" 16.5"	S 3 S 4		
17"	S 5		
17.5"	S 6		
18"	S 7		
18.5" 19"	S 8 T 0		
19.5"	T 1		
20"	Т 2		
20.5"	Т 3		
21" 21.5"	T 4 T 5		
22"	T 6		
22.5"	Т 7		
23"	Т 8		
23.5"	U 0		
24" Other, specify U length	U 1 Z 0	K 1 Y	
Sensor Diameter		K I I	
1/4"	7		

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

## Temperature Measurement SITRANS TS500

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"	E02
cFMus intrinsic safety	E03
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	Т30
SITRANS TH300 ATEX (Ex ia, Ex n)	T31
SITRANS TH300 FM (IS)	Т33
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	
<i>Further options</i> SS tag plate - wired to sensor assembly (connection head only)	Y15

## **Temperature Measurement**

SITRANS TS500

#### Selection and Ordering data

Selection and Ordering data	Article No.	Ord. Code	Selection and Ordering data	Article No.	Ord	. Code
SITRANS TS500	7MC652		SITRANS TS500	7MC652		
Barstock Thermowell Assembly			Barstock Thermowell Assembly			
Click on the Article No. for the online configuration in the PIA Life Cycle Portal.			18.5" 19"	5 3 5 4		
Well Material			19.5"	5 5		
316 SS Special Version (Y99 required)	2		20" 20.5"	56 57		
Thermowell Process Connection Type			21"	6 0		
& Size Threaded Thermowell			21.5"	61		
1/2" NPT	1 J		22" 22.5"	6 2 6 3		
34" NPT 1" NPT	1 K 1 L		23"	64		
Flanged Thermowell			23.5" 24"	65 66		
1.0" 150# RF	2 E		24,5"	6 7		
1.0" 300# RF 1.5" 150# RF	2 F 2 G		Other, specify U length	Z 8 8		K 1 Y
1.5" 300# RF	2 H		Extension (A-length) None		0	
2.0" 150# RF 2.0" 300# RF	2 J 2 K		3" Hex nipple-union-nipple, SS (HUNS) 3" Nipple, SS (NS)		7 9	NOG
3.0" 150# RF 3.0" 300# RF	2 P 2 Q		3" Nipple-union-nipple, galv. steel (NUN) 3" Nipple-union-nipple, SS (NUNS)		9 9	N 0 M N 0 N
Socket Weld Thermowell <sup>3</sup> / <sub>4</sub> " Socket Weld	ок		6" Nipple-union-nipple, galv. steel (NUN)		9	N 9 M
1" Socket Weld Other design	0 L		6" Nipple-union-nipple, SS (NUNS) 6" Hex nipple-union-nipple, SS (HUNS) Other		9 9 9	N 9 N N 9 H N 8 Y
Customer-specified connection	9 X	H1Y	Connection Head	-	9	NOT
(Specify in plain text)			Cast Aluminum		J	
Thermowell Form Straight	s		Cast Stainless Steel Flip-Top Aluminum		S B	
Tapered Step-Down (Reduced)	TU		Explosion Proof Aluminum		G	
Other, Specify themowell form, U-length and T-Length	Z 8 8	К 1 Ү	(FM [XP]/CSA/ATEX [Ex d]) Explosion Proof SS Without Head (for TF/display, use option A80)		U N	
Insertion length (U-Length), with standard T-length (1.75")			Other		z	P 1 Y
2"	1 2		Sensor Type	-		
2.5" 3"	13 14		RTD Standard RTDs are 3-wire, 100 Ohm			
3.5"	15		Platinum, 500 F			
4" 4.5"	16 17		Class B Class A		A 1 A 2	
5"	2 0		Class AA (4-wire)		A 3	
5.5"	2 1		Class B Dual Class A Dual		A 5 A 6	
6" 6.5"	2 2 2 3		High Vibration RTD (900 F) - Class B		B 1	
7"	2 4		RTD high temp (900 F) - Class B		C 1	
7.5"	2 5		Thermocouple Standard thermocouples are ungrounded			
8" 8.5"	26 27		Type J		J 1 J 5	
9"	3 0		Type J dual Type K		K 1	
9.5" 10"	31 32		Type K dual		K 5	
10.5"	3 3		Type T Type T dual		T 1 T 5	
11"	34		Туре Е		E 1	
11.5" 12"	35 36		Type E dual		E 5	
12.5"	3 7		<u>Other Sensor</u> Other, Specify type (Q1Y =)		<b>z</b> 0	Q1Y
13" 13.5"	4 0 4 1		No Sensor			
14"	4 2		For well-only configurations		N O	
14.5" 15"	43 44					
15,5"	4 4 5					
16"	4 6					
16.5" 17"	47 50					
17.5"	5 1					
18"	5 2					

## Temperature Measurement SITRANS TS500

Selection and Ordering data

Selection and Ordering data	Order Co
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	Т30
SITRANS TH300 ATEX (Ex ia, Ex n)	T31
SITRANS TH300 FM (IS)	Т33
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 char- acters) 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

SITRANS TS500

## Schematics

## 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



#### 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.

Schematics

Intern Germa	ational any	1	North	Americ	a	UK/ Czech	Reput	olic	<b>Transn</b> In addit
Not int safe <sup>1)</sup>	rinsical	lly	Extens	ion lea	d <sup>2)</sup>	BS 184	43		other posons). N
Jacket	+	-	Jacket	+	-	Jacket	+	-	http://w
PN	PN	WH	OG	OG	RD	OG	OG	BU	
GN	GN	WH	YE	YE	RD	RD	BR	BU	
BK	BK	WH	BK	WH	RD	BK	YE	BU	

Т BR BR WH ΒU ΒU RD ΒU WH ΒU Е VT VT WH VT VT RD ΒU BR BR R+S OG OG WH ΒK RD GN WH ΒU В GΥ GΥ WH GΥ GY RD -\_ \_

1) With an intrinsically safe line as per IEC 584-3, the sheath is always blue.

<sup>2)</sup> For thermo lines as per ANSI MC96, the sheath is always blue.

Coun- try	Nethe	rlands		Japan	l		France	e	
Stan- dard	DIN 43714		ISC 1610-198		NF C42-323				
	Jacket	+	-	Jacket	+	-	Jacket	+	-
Ν	GN	RD	GN	BU	RD	WH	VT	VT	YE
К	BU	RD	BU	YE	RD	WH	BK	BK	YE
J	BR	RD	BR	BR	RD	WH	BU	BU	YE
Т	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	-	-	-
В	GN	RD	GN	BU	RD	WH	VT	VT	YE

#### Abbreviation for colors

Coun-try

Standard

Ν

Κ

J

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

#### mitters

lition, our transmitters also allow for a large number of possible connections (e.g. difference, average, two sen-More information can be obtained at: www.usa.siemens.com/temperature

Temperature transmitters Compact and head transmitters

#### 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

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- 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

Temperature transmitters Compact and head transmitters

## SITRANS TH100 Slim (Pt100)

#### 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 < 0.25 °C (0.45 °F) Measuring accuracy < 0.1 °C (0.18 °F) Repeatability Measuring current Approx. 0.4 mA Measuring cycle < 0.7 s -60 ... +160 °C (-76 ... +320 °F) Measuring range 25 ... 220 °C (45 ... 396 °F) Measuring span °C or °F Unit Programmable: -100 ... +100 °C (-180 ... +180 °F) Offset Wire resistance Max. 20 $\Omega$ (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) (U<sub>aux</sub> - 8.5 V)/0.023 A Max. load 3.6 ... 23 mA, infinitely adjustable Overrange (factory setting: 3.84 ... 20.5 mA) 3.6 ... 23 mA, infinitely adjustable (factory setting: 3.6 mA or 22.8 mA) Error signal (in the event of sensor breakage) 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 $\Omega$ • < 0.025% of the max. span in the</p> Long-term drift first month • < 0.035% of the max. span after one</p> 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 IP67 Enclosure

Technical specifications

Software requirements for SIPROM T				
PC operating system	Windows ME, 2000 and XP; also Win- dows 95, 98 and 98SE, but only in connection with RS232 modem			
Factory setting:				
<ul> <li>Pt100 (IEC 751) in the 3-wire connect</li> <li>Measuring range: 0 100 °C (32</li> <li>Fault current in the event of sensor b</li> <li>Sensor offset: 0 °C (0 °F)</li> <li>Damping 0.0 s</li> </ul> Selection and ordering data	212 °F)			
	Article No.			
SITRANS TH100 Slim temperature transmitters for Pt100 For welding to compact thermometers 2-wire system, 4 20 mA, program- mable, without galvanic isolation • Without explosion protection	7NG3150-0NN00			
Accessories				
Modem				

7NG3092-8KN

Modem with USB interface and

SIPROM T software

2/25

Temperature transmitters Compact and head transmitters

## SITRANS TH100 Slim (Pt100)



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Auxiliary power U SITRANS TH100 Slim, auxiliary power and sensor connection

U-

N. C.



SITRANS TH100 Slim, sensor connection assignment

#### Temperature measurement Temperature transmitters Compact and head transmitters

#### SITRANS TH100 (4 to 20 mA, Pt100)

#### 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

## SITRANS TH100 (4 to 20 mA, Pt100)

## Technical specifications

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Input		Certificates and approvals	
Resistance thermometer		Explosion protection ATEX	
Measured variable	Temperature	EC type-examination certificate	PTB 05 ATEX 2049X
Input type	Pt100 according to IEC 60751	<ul> <li>"Intrinsic gas safety" type of protec- tion</li> </ul>	II 1 G Ex ia IIC T6/T4 II (1) 2 G Ex ib [ia Ga] IIC T6/T4 Gb
Characteristic curve	Temperature-linear		II (1) 3 G Ex ic [ia Ga] IIC T6/T4 Gc
Type of connection	2, 3, 4-wire connection	<ul> <li>"Non-sparking" type of protection</li> </ul>	II 3 G Ex ic IIC T6/T4 Gc II 3 G Ex nA IIC T6/T4 Gc
Resolution	14 bit		II 3 G Ex nA [ic] IIC T6/T4 Gc
Measuring accuracy		<ul> <li>"Intrinsic dust safety" type of protec- tion</li> </ul>	II 1 D Ex ia IIIC T115 °C Da
• Span <250 °C (450 °F)	< 0.25 °C (0.45 °F)	Explosion protection: FM for USA	
• Span >250 °C (450 °F)	< 0.1% of measuring span	FM approval	FM 3024169
Repeatability	< 0.1 °C (0.18 °F)	<ul> <li>Degrees of protection</li> </ul>	IS / CI I, II, III / Div 1 / GP ABCDEFG T6, T5, T4
Measuring current	approx. 0.4 mA		CI I / ZN 0 / AEx ia IIC T6, T5, T4
Measuring cycle	< 0.7 s		NI / CI I / Div 2 / GP ABCDFG T6, T5, T4
Measuring range	-200 +850 °C (-328 +1562 °F)		NI / CI I / ZN 2 / IIC T6, T5, T4
Measuring span	25 1050 °C (77 1922 °F)	Explosion protection to FM for Canada	
Unit	°C or °F	( <sub>c</sub> FM <sub>US</sub> ) ● FM approval	FM 3024169C
Offset	Programmable: -100 +100 °C (-180 +180 °F)	Degrees of protection	IS / CI I, II, III / Div 1/ GP ABCDEFG T6, T5, T4
Wire resistance	Max. 20 $\Omega$ (total from feeder and return conductor)		NI / CI I / DIV 2 / GP ABCD T6, T5, T4 NIFW / CI I, II, III / DIV 2 / GP
Noise rejection	50 and 60 Hz		ABCDFG T6, T5, T4 DIP / CI II, III / Div 2 / GP FG T6, T5,
Output			T4
Output signal	4 20 mA, 2-wire		CI I / ZN 0 / Ex ia IIC T6, T5, T4 CI I / ZN 2 / Ex nA nL IIC T6, T5, T4
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)	Other certificates	EAC Ex(GOST), NEPSI
Max. load	(U <sub>aux</sub> – 8.5 V)/0.023 A	Software requirements for SIPROM T	
Overrange	3.6 23 mA, infinitely adjustable (default range: 3.84 20.5 mA)	PC operating system	Windows ME, 2000, XP, Win 7 and Win 8; in connection with RS 232 modem, also Windows 95, 98 and
Error signal (following sensor fault) (conforming to NE43)	3.6 23 mA, infinitely adjustable (default range: 3.6 mA or 22.8 mA)	Factory setting:	98SE
Damping time	030 s (default value: 0 s)	Pt100 (IEC 751) in the 3-wire connect	stion
Protection	Against reverse polarity	<ul> <li>Measuring range: 0 100 °C (32</li> <li>Fault current in the event of sensor b</li> </ul>	
Resolution	12 bit	<ul> <li>Sensor offset: 0 °C (0 °F)</li> </ul>	
Accuracy at 23 °C (73.4 °F)	< 0.1% of measuring span	• Damping 0.0 s	
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 $\Omega$		
Long-term drift	<ul> <li>&lt; 0.025% of the max. span in the first month</li> <li>&lt; 0.035% of the max. span after one year</li> <li>&lt; 0.05% of the max. span after 5 years</li> </ul>		
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 <sup>2</sup> (AWG 13)		
Degree of protection according to			
IEC 60529	10.40		
Enclosure	IP40		

IP40

IP00

EnclosureTerminals

#### SITRANS TH100 (4 to 20 mA, Pt100)

## 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, with- out galvanic isolation	
Without explosion protection	7NG3211-0NN00
With explosion protection "Intrinsic safety" type of protection and for zone 2	
<ul> <li>According to ATEX</li> <li>According to FM (CFMLIS)</li> </ul>	7NG3211-0AN00 7NG3211-0BN00
• According to FM (CFMUS)	/NG5211-0BN00
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 <sup>1)</sup>
Measuring point number (TAG) max. 8 charac- ters	Y17 <sup>2)</sup>
Measuring point description, max. 16 charac- ters	Y23 <sup>2)</sup>
Pt100 (IEC) 2-wire, $R_L = 0 \Omega$	U02 <sup>3)</sup>
Pt100 (IEC) 3-wire	U03 <sup>3)</sup>
Pt100 (IEC) 4-wire	U04 <sup>3)</sup>
Enter special deviating customer-specific set- ting in plain text	Y09 <sup>4)</sup>
Fault current 3.6 mA (instead of 22.8 mA)	U36 <sup>2)</sup>
43	

<sup>1)</sup> 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.

<sup>3)</sup> For this selection, Y01 must also be selected.

<sup>4)</sup> 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 soft- ware	7NG3092-8KN
Mounting rail adapter for head transmitter	7NG3092-8KA
(Quantity delivered: 5 units)	
Connecting cable	7NG3092-8KC
4-wire, 200 mm (7.87 inch), for sensor connec- tions when using head transmitters in the high hinged cover (set with 5 units)	
For supply units, see Catalog FI01 section ponents"	"Supplementary com-

#### 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

Temperature transmitters Compact and head transmitters

SITRANS TH100 (4 to 20 mA, Pt100)

## Dimensional drawings



Pt100 sensor (for connection, se sensor connection assignment)

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





4-wire connection



3-wire connection



SITRANS TH100, sensor connection assignment

#### Temperature measurement Temperature transmitters Compact and head transmitters

#### SITRANS TH200 (4 to 20 mA, universal)

#### 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.



SITRANS TH200 function diagram

#### SITRANS TH200 (4 to 20 mA, universal)

#### Technical specifications

recimical specifications			
Input		Thermocouples	
Resistance thermometer		Measured variable	Temperature
Measured variable	Temperature	Sensor type (thermocouples)	
Sensor type		• Туре В	Pt30Rh-Pt6Rh acc. to IEC 584
According to IEC 60751	Pt25 Pt1000	• Type C	W5%-Re acc. to ASTM 988
• Acc. to JIS C 1604; a = 0.00392 K <sup>-1</sup>	Pt25 Pt1000	• Type D	W3%-Re acc. to ASTM 988
<ul> <li>According to IEC 60751</li> </ul>	Ni25 Ni1000	• Type E	NiCr-CuNi acc. to IEC 584
Special type	Via special characteristic (max. 30	• Type J	Fe-CuNi acc. to IEC 584
	points)	• Type K	NiCr-Ni acc. to IEC 584
Sensor factor	0.25 10 (adaptation of the basic	<ul> <li>Type L</li> <li>Type N</li> </ul>	Fe-CuNi acc. to DIN 43710 NiCrSi-NiSi acc. to IEC 584
	type, e.g. Pt100 to version	• Type R	Pt13Rh-Pt acc. to IEC 584
	Pt25 1000)	• Type S	Pt10Rh-Pt acc. to IEC 584
Units	°C or °F	• Type T	Cu-CuNi acc. to IEC 584
Connection		• Type U	Cu-CuNi acc. to DIN 43710
<ul> <li>Standard connection</li> </ul>	1 resistance thermometer (RTD) in 2-	Units	°C or °F
	wire, 3-wire or 4-wire connection		
Averaging	2 identical resistance thermometers in 2-wire connection for generation of		
	average temperature	<ul> <li>Standard connection</li> <li>Averaging</li> </ul>	1 thermocouple (TC) 2 thermocouples (TC)
<ul> <li>Differentiation</li> </ul>	2 identical resistance thermometers	Differentiation	2 thermocouples (TC) (TC1 – TC2 or
	(RTD) in 2-wire connection (RTD 1 –	Differentiation	TC2 – TC1)
	RTD 2 or RTD 2 – RTD 1)	Response time	$\leq$ 250 ms for 1 sensor with break
Connection			monitoring
<ul> <li>2-wire connection</li> </ul>	Line resistance can be configured $\leq 100 \Omega$ (loop resistance)	Break monitoring	Can be switched off
<ul> <li>3-wire connection</li> </ul>	No trim necessary	Reference junction compensation	
4-wire connection	No trim necessary	Internal	With integrated Pt100 resistance ther-
Sensor current	≤ 0.45 mA	• Internal	mometer
		• External	With external Pt100 IEC 60751 (2-wire
Response time	≤ 250 ms for 1 sensor with break monitoring		or 3-wire connection)
Break monitoring	Always active (cannot be switched off)	<ul> <li>External fixed</li> </ul>	Reference junction temperature can be set as fixed value
0			
Short-circuit monitoring	Can be switched on/off (default value: ON)	Measuring range	Assignable (see "Digital measuring error" table)
Measuring range	Assignable (see "Digital measuring	Min. measuring span	Min. 40 100 °C (72 180 °F) (see
modouring range	error" table)		"Digital measuring error" table)
Min. measuring span	10 °C (18 °F)	Characteristic curve	Temperature-linear or special charac-
Characteristic curve	Temperature-linear or special charac-		teristic
	teristic	mV sensor	
Resistance-based sensor		Measured variable	DC voltage
Measured variable	Actual resistance	Sensor type	DC voltage source (DC voltage
	Resistance-based, potentiometers		source possible over an externally
Sensor type	71		connected resistor)
Units	Ω	Units	mV
Connection		Response time	≤ 250 ms for 1 sensor with break
<ul> <li>Standard connection</li> </ul>	1 resistance-based sensor (R) in 2-		monitoring
Averaging	wire, 3-wire or 4-wire connection 2 resistance-based sensors in 2-wire	Break monitoring	Can be switched off
- / wei aying	connection for averaging	Measuring range	-10 +70 mV
<ul> <li>Differentiation</li> </ul>	2 resistance thermometers in 2-wire	6 6	-100 +1100 mV
	connection (R1 – R2 or R2 – R1)	Min. measuring span	2 mV or 20 mV
Connection		Overload capability of the input	-1.5 +3.5 V DC
<ul> <li>2-wire connection</li> </ul>	Line resistance can be configured $\leq 100 \Omega$ (loop resistance)	Input resistance	$\geq 1 M\Omega$
<ul> <li>3-wire connection</li> </ul>	No trim necessary		
4-wire connection	No trim necessary	Characteristic curve	Voltage-linear or special characteris- tic
Sensor current	≤ 0.45 mA		
Response time	≤ 250 ms for 1 sensor with break monitoring		

Always active (cannot be switched

Can be switched on/off (default value: OFF)

Assignable max. 0 ... 2200  $\Omega$  (see "Digital measuring error" table)

 $5 \Omega \dots 25 \Omega$  (see "Digital measuring"

Resistance-linear or special charac-

off)

error" table)

teristic

Break monitoring

Measuring range

Min. measuring span

Characteristic curve

Short-circuit monitoring

Temperature transmitters Compact and head transmitters

Certificates and approvals

## SITRANS TH200 (4 to 20 mA, universal)

OutputOutput signal4 20 mA, 2-wireAuxiliary powerDC (to 30 V with Ex ia and ib; to 32 V with Ex nA/nL/ic)Max. load $(U_{aux} - 11 V)/0.023 A$ Overrange3.623 mA, infinitely adjustable (default range: 3.80 mA20.5 mA)Error signal (e.g. following sensor fault) (conforming to NE43)3.623 mA, infinitely adjustable (default value: 22.8 mA)Sample cycle0.25 s nominalDampingSoftware filter 1st order 030 s (parameterizable)ProtectionAgainst reverse polarityGalvanic isolationInput against output 2.12 kV DC (1.5 kVrms AC)Measuring accuracyInput against output 2.12 kV DC (1.5 kVrms AC)Digital measuring errorSee "Digital measuring error" tableReference conditions- Auxiliary powerAuxiliary power24 V $\pm$ 1 % S 00 $\Omega$ Ambient temperature23 °C• Warming-up time> 5 minError due to internal reference junction< 0.02 % of measuring span log converter)error due to internal reference junction< 0.02 % of meas. span/10 °C (18 °F) · 0.02 % of measuring span• Analog measuring error< 0.02 % of meas. span/10 °C (18 °F)• Warthing-up time< 0.02 % of measuring span• Atter one year< < 0.02 % of measuring span• Atter one year< < 0.02 % of measuring span• Atter one year< < 0.02 % of measuring span• Atter one year< < 0.02 % of measuring span• Atter one year< < 0.02 % of measuring span• Atter one year< < 0.02 % of me		
Auxiliary power11 35 V DC (to 30 V with Ex na AnL/ic)Max. load(U <sub>aux</sub> - 11 V)/0.023 AOverrange3.6 23 mA, infinitely adjustable (default value: 22.8 mA)Error signal (e.g. following sensor fault) (conforming to NE43)3.6 23 mA, infinitely adjustable (default value: 22.8 mA)Sample cycle0.25 s nominalDampingSoftware filter 1st order 0 30 s (parameterizable)ProtectionAgainst reverse polarityGalvanic isolationInput against output 2.12 kV DC (1.5 kV <sub>rms</sub> AC)Measuring accuracySee "Digital measuring error" tablePigital measuring errorSee "Digital measuring error" tableReference conditions- 4.xxiliary power- Auxiliary power24 V ± 1 %- Load500 Ω- Ambient temperature23 °C- Warming-up time> 5 minError in the analog output (digital/ana- tog converter)0.025 % of measuring span log converter)Error due to internal reference junction< 0.5 °C (0.9 °F)	Output	
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 $(3 23 mA, infinitely adjustable(default range: 3.80 mA 20.5 mA)Error signal (e.g. following sensor(auth) (conforming to NE43)3.6 23 mA, infinitely adjustable(default value: 22.8 mA)Sample cycle0.25 s nominalDampingSoftware filter 1st order 0 30 s(parameterizable)ProtectionAgainst reverse polarityGalvanic isolationInput against output 2.12 kV DC(1.5 kV_{rms} AC)Measuring accuracySee "Digital measuring error" tableReference conditions-4xxiliary power4 kV \pm 1 \%-Load500 \Omega\OmegaAuxiliary power24 V \pm 1 \%-Load500 \Omega\OmegaAuxiliary power2.6 \% 0.9 \%+Auxiliary power0.025 \% of measuring spanlog converter)Error in the analog output (digital/ana-0.025 \% of meas. span/10 °C (18 \%)-Malog measuring error0.02 \% of meas. span/10 °C (18 \%)-Muitary power effect< 0.020 \% of meas. span/10 \Omega-Muitary power effect< 0.020 \% of meas. span/100 \OmegaLong-term drift< 0.02 \% of measuring span-Atter to eyear< < 0.2 \% of measuring span-Atter to eyear< < 0.2 \% of measuring span-Atter to eyear< < 0.2 \% of measuring span-Atter to gears< < 0.2 \% of measuring span-Atter to gears< < 0.2 \% of measuring span-Atter to eyears< < 0.2 \% of mea$	Output signal	4 20 mA, 2-wire
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 <sub>rms</sub> AC)         Measuring accuracy       See "Digital measuring error" table         Pigital measuring error       See "Digital measuring error" table         Reference conditions       500 Ω         • Auxiliary power       24 V ± 1 %         • Load       500 Ω         • Ambient temperature       23 °C         • Warming-up time       > 5 min         Error due to internal reference junction       < 0.5 °C (0.9 °F)	Auxiliary power	DC (to 30 V with Ex ia and ib; to 32
(default range: 3.80 mA 20.5 mA)Error signal (e.g. following sensor fault) (conforming to NE43)3.623 mA, infinitely adjustable (default value: 22.8 mA)DampingSoftware filter 1st order 0 30 s (parameterizable)ProtectionAgainst reverse polarityGalvanic isolationInput against output 2.12 kV DC (1.5 kV <sub>rms</sub> AC)Measuring accuracySee "Digital measuring error" tablePigital measuring errorSee "Digital measuring error" tableReference conditions- Auxiliary power- Auxiliary power24 V ± 1 % 500 Ω- Ambient temperature23 °C• Warming-up time> 5 minError in the analog output (digital/ana- log converter)< 0.025 % of measuring span 0.02 % of meas. span/10 °C (18 °F)• Digital measuring error0.02 % of meas. span/10 °C (18 °F)• With resistance thermometers0.66 °C (0.11 °F)/10°C (18 °F)• with thermocouples0.6 °C (0.11 °F)/10°C (18 °F)• with thermocouples0.60 °C (0.11 °F)/10°C (18 °F)• with resistance thermometers0.02 % of meas. span/10 ΩLong-term drift• In the first month• < 0.02 % of measuring span	Max. load	(U <sub>aux</sub> – 11 V)/0.023 A
fault) (conforming to NE43)(default value: 22.8 mA)Sample cycle $0.25 \text{ s nominal}$ DampingSoftware filter 1st order $0 \dots 30 \text{ s}$ (parameterizable)ProtectionAgainst reverse polarityGalvanic isolationInput against output 2.12 kV DC ( $1.5 \text{ kV}_{rms} \text{ AC}$ )Measuring accuracySee "Digital measuring error" tableReference conditions $4 \times 1 \%$ • Auxiliary power $24 \text{ V} \pm 1 \%$ • Load $500 \ \Omega$ • Ambient temperature $23 \ ^{\circ}C$ • Warming-up time $> 5 \ ^{\circ}min$ Error in the analog output (digital/ana- log converter) $< 0.025 \ ^{\circ} \text{ of measuring span}$ Effect of ambient temperature $0.02 \ ^{\circ} \text{ of meas. span}/10 \ ^{\circ}C (18 \ ^{\circ}F)$ • bligital measuring error $0.06 \ ^{\circ}C (0.11 \ ^{\circ}F)/10^{\circ}C (18 \ ^{\circ}F)$ • with thermocouples $0.6 \ ^{\circ}C (1.1 \ ^{\circ}F)/10^{\circ}C (18 \ ^{\circ}F)$ Auxiliary power effect $< 0.001 \ ^{\circ} \text{ of meas. span}/10 \ \Omega$ Long-term drift $< 0.022 \ ^{\circ} \text{ of measuring span}$ • After one year $< 0.02 \ ^{\circ} \text{ of meas. span}/10 \ \Omega$ Long-term drift $< 0.022 \ ^{\circ} \text{ of measuring span}$ • After one year $< 0.02 \ ^{\circ} \text{ of measuring span}$ • After one year $< 0.02 \ ^{\circ} \text{ of measuring span}$ • After one year $< 0.02 \ ^{\circ} \text{ of measuring span}$ • After one year $< 0.02 \ ^{\circ} \text{ of measuring span}$ • After one year $< 0.02 \ ^{\circ} \text{ of measuring span}$ • After one year $< 0.3 \ ^{\circ} \text{ of measuring span}$ • After one year	Overrange	
DampingSoftware filter 1st order 0 30 s (parameterizable)ProtectionAgainst reverse polarityGalvanic isolationInput against output 2.12 kV DC (1.5 kVrms AC)Measuring accuracySee "Digital measuring error" tableBeference conditions $\leq$ 4V ± 1 %• Auxiliary power24 V ± 1 %• Load500 $\Omega$ • Ambient temperature23 °C• Warming-up time> 5 minError in the analog output (digital/ana- log converter)< 0.025 % of measuring span 0.02 % of meas. span/10 °C (18 °F)• Digital measuring error.0.02 % of meas. span/10 °C (18 °F)• with resistance thermometers • with thermocouples0.06 °C (0.11 °F)/10°C (18 °F)• Analog measuring error.0.02 % of meas. span/10 $\Omega$ • Load< 0.002 % of meas. span/10 $\Omega$ Long-term drift< < 0.002 % of meas. span/10 $\Omega$ • In the first month • < 0.02 % of measuring span • < 0.02 % of measuring span		
(parameterizable)(parameterizable)ProtectionAgainst reverse polarityGalvanic isolationInput against output 2.12 kV DC (1.5 kV <sub>rms</sub> AC)Measuring accuracySee "Digital measuring error" tableReference conditions-Auxiliary power24 V $\pm$ 1 %Load500 $\Omega$ Ambient temperature23 °CWarming-up time> 5 minError in the analog output (digital/ana- log converter)< 0.02 % of measuring span	Sample cycle	0.25 s nominal
Galvanic isolationInput against output 2.12 kV DC (1.5 kV <sub>rms</sub> AC)Measuring accuracySee "Digital measuring error" tableDigital measuring errorSee "Digital measuring error" tableReference conditions- Auxiliary power- Auxiliary power24 V ± 1 %- Load500 Ω- Ambient temperature23 °C• Warming-up time> 5 minError in the analog output (digital/ana- log converter)< 0.02 % of measuring span log converter)Erfor due to internal reference junction< 0.5 °C (0.9 °F)	Damping	
Instruction(1.5 kVrms AC)Measuring accuracySee "Digital measuring error" tableDigital measuring errorSee "Digital measuring error" tableReference conditions $4 V \pm 1 \%$ Load $500 \Omega$ Ambient temperature $23 °C$ Warming-up time> 5 minError in the analog output (digital/analog converter) $< 0.025 \%$ of measuring spanError due to internal reference junction $< 0.5 °C (0.9 °F)$ Effect of ambient temperature $0.02 \%$ of meas. span/10 °C (18 °F)• Analog measuring error $0.06 °C (0.11 °F)/10°C (18 °F)$ • with resistance thermometers $0.66 °C (1.1 °F)/10°C (18 °F)$ • with thermocouples $0.6 °C (0.11 °F)/10°C (18 °F)$ • with thermocouples $0.60 °C (0.11 °F)/10°C (18 °F)$ • with thermocouples $0.60 °C (0.11 °F)/10°C (18 °F)$ • Auxiliary power effect $< 0.002 \%$ of meas. span/10 $\Omega$ Long-term drift $< 0.022 \%$ of measuring span• After one year $< 0.02 \%$ of measuring span• After 5 years $< 0.02 \%$ of measuring span• After 5 years $< 0.02 \%$ of measuring span• After 5 years $< 0.02 \%$ of measuring span• After 5 years $< 0.02 \%$ of measuring span• After 5 years $< 0.02 \%$ of measuring span• After 5 years $< 0.02 \%$ of measuring span• After 5 years $< 0.02 \%$ of measuring span• After 5 years $< 0.02 \%$ of measuring span• After 5 years $< 0.02 \%$ of measuring span• Dirensions $< 0.02 \%$ of measuring span <t< td=""><td>Protection</td><td>Against reverse polarity</td></t<>	Protection	Against reverse polarity
Digital measuring errorSee "Digital measuring error" tableReference conditions $24 V \pm 1 \%$ • Load $500 \Omega$ • Ambient temperature $23 ° C$ • Warming-up time> 5 minError in the analog output (digital/ana- log converter) $< 0.025 \%$ of measuring spanEffect of ambient temperature $< 0.025 \%$ of meas. span/10 °C (18 °F)• with resistance thermometers $0.06 °C (0.11 °F)/10°C (18 °F)$ • with thermocouples $0.06 °C (0.11 °F)/10°C (18 °F)$ • with thermocouples $0.02 \%$ of meas. span/10 $\Omega$ Long-term drift $< 0.002 \%$ of meas. span/10 $\Omega$ • In the first month $< < 0.02 \%$ of measuring span• After one year $< 0.02 \%$ of measuring span• After one year $< 0.02 \%$ of measuring span• After one year $< 0.02 \%$ of measuring span• After one year $< 0.02 \%$ of measuring span• After one year $< 0.02 \%$ of measuring span• After one year $< 0.02 \%$ of measuring span• After one year $< 0.02 \%$ of measuring span• After one year $< 0.02 \%$ of measuring span• After one year $< 0.02 \%$ of measuring span• After is persture $-40 \dots +85 °C (-40 \dots +185 °F)$ Relative humidity $< 98 \%$ , with condensationElectromagnetic compatibilityacc. to EN 61326 and NE21DesignMaterialMaterialMolded plasticWeight $50 g (0.11 lb)$ DimensionsSee "Dimensional drawings"Cross-section of cablesMax. 2.5 mm² (AWG 13)<	Galvanic isolation	
Reference conditions $24 V \pm 1 \%$ • Load $500 \Omega$ • Ambient temperature $23 ° C$ • Warming-up time> 5 minError in the analog output (digital/ana- log converter)< 0.025 % of measuring span	Measuring accuracy	
• Auxiliary power $24 V \pm 1 \%$ • Load $500 \Omega$ • Ambient temperature $23 ° C$ • Warming-up time> 5 minError in the analog output (digital/ana- log converter) $< 0.025 \%$ of measuring spanBertor due to internal reference junction $< 0.5 ° C (0.9 ° F)$ Effect of ambient temperature $< 0.02 \%$ of 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 $0.6 ° C (1.1 ° F)/10° C (18 °F)$ Auxiliary power effect $< 0.002 \%$ of meas. span/VEffect of load impedance $< 0.02 \%$ of measuring span• After one year $< 0.02 \%$ of measuring span• After 5 years $< 0.02 \%$ of measuring span• After 5 years $< 0.02 \%$ of measuring spanAmbient conditions $< 0.02 \%$ of measuring spanAmbient temperature $< 0.02 \%$ of measuring span• After 5 years $< 0.02 \%$ of measuring spanBelative humidity $< 9.02 \%$ of measuring spanPated conditions $< 40 \dots + 85 °C (-40 \dots + 185 °F)$ Relative humidity $< 98 \%$ , with condensationElectromagnetic compatibilityacc. to EN 61326 and NE21DesignMaterialMaterialMolded plasticWeight $50 g (0.11 lb)$ DimensionsSee "Dimensional drawings"Cross-section of cablesMax. 2.5 mm² (AWG 13)Degree of protection according to IC 60529IP40	Digital measuring error	See "Digital measuring error" table
Error in the analog output (digital/analog converter)< 0.025 % of measuring spanlog converter)< 0.5 °C (0.9 °F)	<ul><li>Auxiliary power</li><li>Load</li><li>Ambient temperature</li></ul>	500 Ω 23 °C
Error due to internal reference junction< 0.5 °C (0.9 °F)Effect of ambient temperature0.02 % of meas. span/10 °C (18 °F)• Analog measuring error0.06 °C (0.11 °F)/10°C (18 °F)• with resistance thermometers0.06 °C (1.1 °F)/10°C (18 °F)• with thermocouples0.002 % of meas. span/VAuxiliary power effect< 0.001 % of meas. span/V	Error in the analog output (digital/ana-	< 0.025 % of measuring span
<ul> <li>Analog measuring error</li> <li>Digital measuring error</li> <li>with resistance thermometers</li> <li>with thermocouples</li> <li>0.06 °C (0.11 °F)/10°C (18 °F)</li> <li>0.6 °C (1.1 °F)/10°C (18 °F)</li> <li>Auxiliary power effect</li> <li>0.06 °C (0.11 °F)/10°C (18 °F)</li> <li>Auxiliary power effect</li> <li>0.002 % of meas. span/V</li> <li>Effect of load impedance</li> <li>0.002 % of meas. span/100 Ω</li> <li>Long-term drift</li> <li>In the first month</li> <li>&lt; 0.02 % of measuring span</li> <li>After one year</li> <li>&lt; 0.2 % of measuring span</li> <li>After one year</li> <li>&lt; 0.3 % of measuring span</li> <li>After 5 years</li> <li>&lt; &lt; 0.3 % of measuring span</li> <li>After 5 years</li> <li>&lt; &lt; 0.3 % of measuring span</li> <li>&lt; &lt; 0.2 % of measuring span</li> <li>&lt; &lt; &lt;</li></ul>	, ,	< 0.5 °C (0.9 °F)
- with thermocouples $0.6 \ ^{\circ}C (1.1 \ ^{\circ}F)/10 \ ^{\circ}C (18 \ ^{\circ}F)$ Auxiliary power effect $< 0.001 \ ^{\circ}$ of meas. span/V Effect of load impedance $< 0.002 \ ^{\circ}$ of meas. span/100 $\Omega$ Long-term drift - In the first month $< < 0.02 \ ^{\circ}$ of measuring span - After one year $< < 0.2 \ ^{\circ}$ of measuring span - After one year $< < 0.2 \ ^{\circ}$ of measuring span - After 5 years $< < 0.3 \ ^{\circ}$ of measuring span - After conditions Ambient conditions Ambient temperature $-40 \dots + 85 \ ^{\circ}C (-40 \dots + 185 \ ^{\circ}F)$ Storage temperature $-40 \dots + 85 \ ^{\circ}C (-40 \dots + 185 \ ^{\circ}F)$ Relative humidity $< 98 \ ^{\circ}$ , with condensation Electromagnetic compatibility acc. to EN 61326 and NE21 Design Material Molded plastic Weight $50 \ g (0.11 \ 1b)$ Dimensions See "Dimensional drawings" Cross-section of cables Max. 2.5 mm <sup>2</sup> (AWG 13) Degree of protection according to IEC 60529 - Enclosure IP40	<ul> <li>Analog measuring error</li> </ul>	0.02 % of meas. span/10 °C (18 °F)
Effect of load impedance< 0.002 % of meas. span/100 ΩLong-term drift•< 0.02 % of measuring span		
Long-term drift• < 0.02 % of measuring span• After one year• < 0.2 % of measuring span	Auxiliary power effect	< 0.001 % of meas. span/V
<ul> <li>In the first month</li> <li>After one year</li> <li>After one year</li> <li>After 5 years</li> <li>C 0.2 % of measuring span</li> <li>&lt; 0.2 % of measuring span</li> <li>&lt; 0.3 % of measuring span</li> <li>&lt; 0.4 + 85 °C (-40 + 185 °F)</li> <li></li> <li><td>Effect of load impedance</td><td>&lt; 0.002 % of meas. span/100 <math display="inline">\Omega</math></td></li></ul>	Effect of load impedance	< 0.002 % of meas. span/100 $\Omega$
Ambient conditionsAmbient conditionsAmbient temperature-40 +85 °C (-40 +185 °F)Storage temperature-40 +85 °C (-40 +185 °F)Relative humidity< 98 %, with condensation	<ul><li>In the first month</li><li>After one year</li></ul>	• < 0.2 % of measuring span
Ambient temperature-40 +85 °C (-40 +185 °F)Storage temperature-40 +85 °C (-40 +185 °F)Relative humidity< 98 %, with condensation	Rated conditions	
Storage temperature-40 +85 °C (-40 +185 °F)Relative humidity< 98 %, with condensation	Ambient conditions	
Relative humidity< 98 %, with condensation	Ambient temperature	-40 +85 °C (-40 +185 °F)
Electromagnetic compatibilityacc. to EN 61326 and NE21DesignMaterialMolded plasticMaterial50 g (0.11 lb)DimensionsSee "Dimensional drawings"Cross-section of cablesMax. 2.5 mm² (AWG 13)Degree of protection according to IEC 60529IP40	Storage temperature	-40 +85 °C (-40 +185 °F)
Design     Molded plastic       Material     Molded plastic       Weight     50 g (0.11 lb)       Dimensions     See "Dimensional drawings"       Cross-section of cables     Max. 2.5 mm² (AWG 13)       Degree of protection according to IEC 60529     IP40	Relative humidity	< 98 %, with condensation
MaterialMolded plasticWeight50 g (0.11 lb)DimensionsSee "Dimensional drawings"Cross-section of cablesMax. 2.5 mm² (AWG 13)Degree of protection according to IEC 60529IP40	Electromagnetic compatibility	acc. to EN 61326 and NE21
Weight50 g (0.11 lb)DimensionsSee "Dimensional drawings"Cross-section of cablesMax. 2.5 mm² (AWG 13)Degree of protection according to IEC 60529IP40	Design	
Dimensions     See "Dimensional drawings"       Cross-section of cables     Max. 2.5 mm² (AWG 13)       Degree of protection according to IEC 60529     IEC 60529       • Enclosure     IP40	Material	Molded plastic
Cross-section of cables Max. 2.5 mm <sup>2</sup> (AWG 13) Degree of protection according to IEC 60529 • Enclosure IP40	Weight	50 g (0.11 lb)
Degree of protection according to IEC 60529 • Enclosure IP40	Dimensions	See "Dimensional drawings"
■ Enclosure IP40	Cross-section of cables	Max. 2.5 mm <sup>2</sup> (AWG 13)
	IEC 60529	15.42

Explosion protection ATEX	
EC type-examination certificate • "Intrinsic safety" type of protection	PTB 05 ATEX 2040X 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
<ul> <li>"Non-sparking and energy-limited equipment" type of protection</li> </ul>	II 3 G Ex nL IIC T6/T4 II 3 G Ex nA IIC T6/T4
Explosion protection: FM for USA • FM approval • Degrees of protection	FM 3024169 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 $({}_{C}FM_{US})$	
<ul> <li>FM approval</li> <li>Degrees of protection</li> </ul>	FM 3024169C 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

Temperature transmitters Compact and head transmitters

## SITRANS TH200 (4 to 20 mA, universal)

#### Digital measuring error

#### Resistance thermometer

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

#### Thermocouples

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Input	Measuring range	Minimum measuring span		Digital accuracy	
	°C (°F)	°C	(°F)	°C	(°F)
Туре В	100 1820 (212 3308)	100	(180)	2 <sup>1)</sup>	(3.60) <sup>1)</sup>
Type C (W5)	0 2300 (32 4172)	100	(180)	2	(3.60)
Type D (W3)	0 2300 (32 4172)	100	(180)	1 <sup>2)</sup>	(1.80) <sup>2)</sup>
Туре Е	-200 +1000 (-328 +1832)	50	(90)	1	(1.80)
Туре Ј	-200 +1200 (-328 +2192)	50	(90)	1	(1.80)
Туре К	-200 +1370 (-328 +2498)	50	(90)	1	(1.80)
Type L	-200 +900 (-328 +1652)	50	(90)	1	(1.80)
Туре 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)
Туре Т	-200 +400 (-328 +752)	40	(72)	1	(1.80)
Туре 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).

<sup>2)</sup> 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	μ
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 TH200 (4 to 20 mA, universal)

#### Accessories Article No Article No. Head transmitter SITRANS TH200 For installation in connection head type B, Additional accessories for assembly, connec-2-wire system 4 ... 20 mA, programmable, with tion and transmitter configuration, see page galvanic isolation 2/154 Without explosion protection 7NG3211-1NN00 Modem With explosion protection Modem with USB interface and SIPROM T soft-7NG3092-8KN ware According to ATEX 7NG3211-1AN00 According to FM (<sub>C</sub>FM<sub>US</sub>) 7NG3211-1BN00 7NG3092-8KA Mounting rail adapter for head transmitter (Quantity delivered: 5 units) Options Order code Connecting cable 7NG3092-8KC Append suffix "-Z" to article no., add order code 4-wire, 200 mm (7.87 inch), for sensor connecand plain text, if applicable. tions when using head transmitters in the high hinged cover (set with 5 units) Test report (5 measuring points) C11 C20 Functional safety SIL2 For supply units, see Catalog FI01 section "Supplementary components" Functional safety SIL2/3 C23 Customer-specific programming Ordering example 1: Y01<sup>1)</sup> Measuring range to be set 7NG3211-1NN00-Z Y01+Y17+U03 Specify in plain text (max. 5 digits): Y01:... to ... °C, °F Y01: -10 ... +100 °C Y17: TICA123 Measuring point number (TAG) max. 8 charac-Y17<sup>2)</sup> ters Ordering example 2: Y23<sup>2)</sup> Measuring point description, max. 16 charac-7NG3211-1NN00-Z Y01+Y23+ U25 ters Y24<sup>2)</sup> Y01: -10 ... +100 °C Measuring point message, max. 32 characters Y23: TICA1234HEAT U02<sup>3)</sup> Pt100 (IEC) 2-wire, $R_I = 0 \Omega$ Pt100 (IEC) 3-wire U03<sup>3)</sup> Factory setting: U04<sup>3)</sup> • Pt100 (IEC 751); 3-wire connection Pt100 (IEC) 4-wire U203)4) Measuring range: 0 ... 100 °C (32 ... 212 °F) Type B thermocouple U21<sup>3)4)</sup> Fault current: 22.8 mA Type C thermocouple (W5) Type D thermocouple (W3) U22<sup>3)4)</sup> Sensor offset: 0 °C (0 °F) U23<sup>3)4)</sup> • Damping 0.0 s Type E thermocouple U24<sup>3)4)</sup> Type J thermocouple U25<sup>3)4)</sup> Type K thermocouple U26<sup>3)4)</sup> Type L thermocouple U27<sup>3)4)</sup> Type N thermocouple U28<sup>3)4)</sup> Type R thermocouple U29<sup>3)4)</sup> Type S thermocouple U30<sup>3)4)</sup> Type T thermocouple U31<sup>3)4)</sup> Type U thermocouple For TC: Cold junction compensation: external U41 (Pt100, 3-wire) For TC: Cold junction compensation: Y50 external with fixed value: specify in plain text Enter special deviating customer-specific set-Y09<sup>5)</sup> ting in plain text U36<sup>2)</sup> Fault current 3.6 mA (instead of 22.8 mA) Cable extension W01 Transmitter with installed cable extension 200 mm (7.87 inch), for Pt100 in 4-wire connection

<sup>1)</sup> For customer-specific programming for RTD and TC, the start value and the end value of the required measuring span must be specified here.

<sup>2)</sup> For this selection, Y01 or Y09 must also be selected.

<sup>3)</sup> For this selection, Y01 must also be selected.

Selection and ordering data

<sup>4)</sup> nternal reference junction compensation is selected as the default for TC.

<sup>5)</sup> 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.

Temperature transmitters Compact and head transmitters

## SITRANS TH200 (4 to 20 mA, universal)

## Dimensional drawings





1(+) and 2(-)	Auxiliary power supply U <sub>aux</sub> , output current I <sub>Out</sub>
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)
## **Temperature measurement** Temperature transmitters

Compact and head transmitters

+ TC

+ TC

SITRANS TH200 (4 to 20 mA, universal)

# Circuit diagrams



SITRANS TH200, sensor connection assignment



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Temperature transmitters Compact and head transmitters

#### 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.



SITRANS TH 300 function diagram

# **Temperature measurement** Temperature transmitters

Compact and head transmitters

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

# Technical specifications

Technical specifications			
Input		Thermocouples	
Resistance thermometer		Measured variable	Temperature
Measured variable	Temperature	Sensor type (thermocouples)	
Sensor type • According to IEC 60751 • Acc. to JIS C 1604; $a = 0.00392 \text{ K}^{-1}$ • According to IEC 60751 • Special type	Pt25 Pt1000 Pt25 Pt1000 Ni25 Ni1000 Via special characteristic (max. 30 points)	<ul> <li>Type B</li> <li>Type C</li> <li>Type D</li> <li>Type E</li> <li>Type J</li> <li>Type K</li> </ul>	Pt30Rh-Pt6Rh acc. to IEC 584 W5%-Re acc. to ASTM 988 W3%-Re acc. to ASTM 988 NiCr-CuNi acc. to IEC 584 Fe-CuNi acc. to IEC 584 NiCr-Ni acc. to IEC 584
Sensor factor	0.25 10 (adaptation of the basic type, e.g. Pt100 to version Pt25 1000)	• Type L • Type N • Type R	Fe-CuNi acc. to DIN 43710 NiCrSi-NiSi acc. to IEC 584 Pt13Rh-Pt acc. to IEC 584
Units	°C or °F	<ul><li>Type S</li><li>Type T</li></ul>	Pt10Rh-Pt acc. to IEC 584 Cu-CuNi acc. to IEC 584
<ul><li>Connection</li><li>Standard connection</li></ul>	1 resistance thermometer (RTD) in 2-	• Type U Units	Cu-CuNi acc. to DIN 43710 °C or °F
Averaging	wire, 3-wire or 4-wire connection 2 identical resistance thermometers in 2-wire connection for generation of average temperature	Connection • Standard connection • Averaging	1 thermocouple (TC) 2 thermocouples (TC)
Differentiation	2 identical resistance thermometers (RTD) in 2-wire connection (RTD 1 – RTD 2 or RTD 2 – RTD 1)	Differentiation	2 thermocouples (TC) (TC1 – TC2 or TC2 – TC1)
Connection		Response time	$\leq$ 250 ms for 1 sensor with break monitoring
2-wire connection	Line resistance can be configured $\leq 100 \Omega$ (loop resistance)	Break monitoring	Can be switched off
<ul><li> 3-wire connection</li><li> 4-wire connection</li></ul>	No trim necessary No trim necessary	Reference junction compensation <ul> <li>Internal</li> </ul>	With integrated Pt100 resistance ther-
Sensor current	≤ 0.45 mA	- montai	mometer
Response time	≤ 250 ms for 1 sensor with break monitoring	<ul><li>External</li><li>External fixed</li></ul>	With external Pt100 IEC 60751 (2-wire or 3-wire connection) Reference junction temperature can
Break monitoring	Always active (cannot be switched off)		be set as fixed value
Short-circuit monitoring	Can be switched on/off (default value: ON)	Measuring range	Assignable (see "Digital measuring error" table)
Measuring range	Assignable (see "Digital measuring error" table)	Min. measuring span	Min. 40 100 °C (72 180 °F) (see "Digital measuring error" table)
Min. measuring span	10 °C (18 °F)	Characteristic curve	Temperature-linear or special charac- teristic
Characteristic curve	Temperature-linear or special charac- teristic	mV sensor	
Resistance-based sensor		Measured variable	DC voltage
Measured variable Sensor type	Actual resistance Resistance-based, potentiometers	Sensor type	DC voltage source (DC voltage source possible over an externally connected resistor)
Units	Ω	Units	mV
Connection		Response time	< 250 ms for 1 sensor with break
Standard connection	1 resistance-based sensor (R) in 2- wire, 3-wire or 4-wire connection	Break monitoring	monitoring Can be switched off
Averaging	2 resistance-based sensors in 2-wire connection for averaging	Measuring range	-10 +70 mV -100 +1100 mV
Differentiation	2 resistance thermometers in 2-wire connection (R1 – R2 or R2 – R1)	Min. measuring span	2 mV or 20 mV
Connection	· · · ·	Overload capability of the input	-1.5 +3.5 V DC
2-wire connection	Line resistance can be configured	Input resistance	$\geq$ 1 M $\Omega$
<ul><li> 3-wire connection</li><li> 4-wire connection</li></ul>	≤100 Ω (loop resistance) No trim necessary No trim necessary	Characteristic curve	Voltage-linear or special characteris- tic
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 $\Omega$ (see "Digital measuring error" table)		
Min. measuring span	5 25 $\Omega$ (see "Digital measuring error" table)		

Resistance-linear or special charac-teristic

Characteristic curve

## **Temperature measurement** Temperature transmitters Compact and head transmitters

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

## Output

Output	
Output signal	4 20 mA, 2-wire with communica- tion 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 <sub>aux</sub> – 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 <sub>rms</sub> AC)
Measuring accuracy	
Digital measuring error	See "Digital measuring error" table
Reference conditions <ul> <li>Auxiliary power</li> <li>Load</li> <li>Ambient temperature</li> <li>Warming-up time</li> </ul>	24 V ± 1 % 500 Ω 23 °C > 5 min
Error in the analog output (digital/ana- log converter)	< 0.025 % of measuring span
Error due to internal reference junction	< 0.5 °C (0.9 °F)
Effect of ambient temperature <ul> <li>Analog measuring error</li> <li>Digital measuring error</li> </ul>	0.02 % of meas. span/10 °C (18 °F)
<ul> <li>with resistance thermometers</li> <li>with thermocouples</li> </ul>	0.06 °C (0.11 °F)/10°C (18 °F) 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 $\Omega$
Long-term drift • In the first month • After one year • After 5 years	< 0.02 % of measuring span < 0.2 % of measuring span < 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 <sup>2</sup> (AWG 13)
Degree of protection according to IEC 60529 • Enclosure	IP40

#### 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 II 3 G Ex nL IIC T6/T4 II 3 G Ex nA IIC T6/T4 • "Non-sparking and energy-limited equipment" type of protection Explosion protection: FM for USA FM 3024169 Degrees of protection IS / CI I, II, III / Div 1 / GP ABCDEFG T6, T5, T4 CI I / ZN 0 / AEx ia IIC T6, T5, T4 NI / CI I / Div 2 / GP ABCDFG T6, T5, T4 NI / CI I / ZN 2 / IIC T6, T5, T4 Explosion protection to FM for Canada FM 3024169C • Degrees of protection IS / CI I, II, III / Div 1/ GP ABCDEFG T6, T5, T4 NI / CI 1 / DIV 2 / GP ABCD T6, T5, T4 NIFW / CI 1, II, III / DIV 2 / GP ABCDFG T6, T5, T4 DIP / CI II, III / DIV 2 / GP FG T6, T5, T4 T4 CI I / ZN 0 / Ex ia IIC T6, T5, T4 CI I / ZN 2 / Ex nA nL IIC T6, T5, T4

LABS

EAC Ex(GOST), NEPSI, IEC, EXPO-

Other certificates

• FM approval

(cFMUS) FM approval

#### 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

Thermocouples

# Temperature measurement

Temperature transmitters Compact and head transmitters

#### SITRANS TH300 (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 Ni 1000	-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	

Input	Measuring range		m ing span		accuracy
	°C (°F)	°C	(°F)	°C	(°F)
Туре В	100 1820 (212 3308)	100	(180)	2 <sup>1)</sup>	(3.60) <sup>1)</sup>
Type C (W5)	0 2300 (32 4172)	100	(180)	2	(3.60)
Type D (W3)	0 2300 (32 4172)	100	(180)	1 <sup>2)</sup>	(1.80) <sup>2)</sup>
Туре Е	-200 +1000 (-328 +1832)	50	(90)	1	(1.80)
Туре Ј	-200 +1200 (-328 +2192)	50	(90)	1	(1.80)
Туре К	-200 +1370 (-328 +2498)	50	(90)	1	(1.80)
Type L	-200 +900 (-328 +1652)	50	(90)	1	(1.80)
Туре 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)
Туре Т	-200 +400 (-328 +752)	40	(72)	1	(1.80)
Туре U	-200 +600 (-328 +1112)	50	(90)	2	(3.60)

 $^{1)}$  The digital accuracy in the range 100 to 300  $^{\circ}\text{C}$  (212 to 572  $^{\circ}\text{F})$  is 3  $^{\circ}\text{C}$ 

(5.4 °F).
 <sup>2)</sup> 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	μ	
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).

Temperature transmitters Compact and head transmitters

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

Article No.

#### Selection and ordering data

	7 11010 1 10:
SITRANS TH300 head transmitter For installation in connection head type B, 2-wire system 4 20 mA, communication- capable according to HART, with galvanic iso- lation	
Without explosion protection	7NG3212-0NN00
With explosion protection	
According to ATEX	7NG3212-0AN00 7NG3212-0BN00
According to FM ( <sub>C</sub> FM <sub>US</sub> )	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	Y01 <sup>1)</sup>
Specify in plain text (max. 5 digits): Y01: to °C, °F	
Measuring point number (TAG) max. 8 charac- ters	Y17 <sup>2)</sup>
Measuring point description, max. 16 characters	Y23 <sup>2)</sup>
Measuring point message, max. 32 characters	Y24 <sup>2)</sup>
Pt100 (IEC) 2-wire, $R_L = 0 \ \Omega$	U02 <sup>3)</sup>
Pt100 (IEC) 3-wire	U03 <sup>3)</sup>
Pt100 (IEC) 4-wire	U04 <sup>3)</sup>
Type B thermocouple	U20 <sup>3)4)</sup>
Type C thermocouple (W5)	U21 <sup>3)4)</sup>
Type D thermocouple (W3)	U22 <sup>3)4)</sup>
Type E thermocouple	U23 <sup>3)4)</sup>
Type J thermocouple	U24 <sup>3)4)</sup>
Type K thermocouple	U25 <sup>3)4)</sup>
Type L thermocouple	U26 <sup>3)4)</sup>
Type N thermocouple	U27 <sup>3)4)</sup>
Type R thermocouple	U28 <sup>3)4)</sup>
Type S thermocouple	U29 <sup>3)4)</sup>
Type T thermocouple	U30 <sup>3)4)</sup>
Type U thermocouple	U31 <sup>3)4)</sup>
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 set- ting in plain text	Y09 <sup>5)</sup>
Fault current 3.6 mA (instead of 22.8 mA)	U36 <sup>2)</sup>
Cable extension Transmitter with installed cable extension 200 mm (7.87 inch), for Pt100 in 4-wire connec- tion	W01

#### Accessories

	Article No.
Additional accessories for assembly, connec- tion 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	7NG3092-8KA
(Quantity delivered: 5 units)	
Connecting cable	7NG3092-8KC
4-wire, 200 mm (7.87 inch), for sensor connections when using head transmitters in the high hinged cover (set with 5 units)	

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

<sup>1)</sup> For customer-specific programming for RTD and TC, the start value and the end value of the required measuring span must be specified here.

<sup>2)</sup> For this selection, Y01 or Y09 must also be selected.

 $^{\rm 3)}$  For this selection, Y01 must also be selected.

 $^{\rm 4)}$  Internal reference junction compensation is selected as the default for TC.

<sup>5)</sup> 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.

# Temperature measurement Temperature transmitters

Compact and head transmitters

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

# Dimensional drawings



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)

## **Temperature measurement** Temperature transmitters Compact and head transmitters

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

## Circuit diagrams



Resistance thermometer

2-wire connection 1)



3-wire connection



4-wire connection



Generation of average value / difference 1) <sup>1)</sup> Programmable line resistance for the purpose of correction.









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



2

## **Temperature measurement** Temperature transmitters Compact and head transmitters

#### SITRANS TH400, fieldbus transmitter

#### 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 transmitters

#### Versions:

Overview

- 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.

Temperature transmitters Compact and head transmitters

## SITRANS TH400, fieldbus transmitter

## System communication



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SITRANS TH400, communications interface

# Technical specifications

Input	
Analog-to-digital conversion <ul> <li>Measurement rate</li> <li>Resolution</li> </ul>	< 50 ms 24-bit
Resistance thermometer	
Pt25 Pt1000 acc. to IEC 60751/JIS C 1604	
<ul> <li>Measuring range</li> </ul>	-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 <b>Ω</b>
Sensor current	Nominal 0.2 mA
Sensor fault detection <ul> <li>Sensor break detection</li> <li>Sensor short-circuit detection</li> </ul>	Yes 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 <ul> <li>Sensor break detection</li> <li>Sensor short-circuit detection</li> </ul>	Yes Yes, < 15 Ω

Thermocouple		
According to IEC 584	Measuring range	
<ul> <li>Type B</li> <li>Type E</li> </ul>	400 1820 °C (75 -100 +1000 °C	
• Type J	-100 +1000 °C	
• Type K	-100 +1200 °C	,
• Type N	-180 +1300 °C	
• Type R	-50 +1760 °C (- -50 +1760 °C (-	
<ul><li>Type S</li><li>Type T</li></ul>	-200 +1700 °C (-	
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	
• Type W5	0 2300 °C (32	,
External reference junction compen- sation	-40 +135 °C (-4	0 +275 °F)
Sensor fault detection	¥	
<ul><li>Sensor break detection</li><li>Sensor short-circuit detection</li></ul>	Yes, < 3 mV	
Sensor current in the event of open-		
circuit monitoring	¢.	
mV sensor - voltage input	-800 +800 mV	
Measuring range		
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	$\leq \pm 0.05$ % 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	$\leq \pm 0.05 \ \Omega$	≤ ± 0.002 Ω/°C
Voltage source	$\leq$ ± 10 $\mu$ V	$\leq$ ± 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	
	30 s Min. 60 dB	
Warming-up time		82 °F)

Temperature transmitters Compact and head transmitters

# SITRANS TH400, fieldbus transmitter

Rated conditions		Communication
Ambient conditions		Parameterization i
Ambient temperature	-40 +85 °C (-40 +185 °F)	PROFIBUS PA c
Storage temperature	-40 +85 °C (-40 +185 °F)	<ul> <li>Protocol</li> <li>Address (for d</li> </ul>
Relative humidity	$\leq$ 98 %, with condensation	FOUNDATION F
Insulation strength	500 V/ A O fee 00 -	- Protocol
Test voltage	500 V AC for 60 s	<ul> <li>Functionality</li> <li>Version</li> </ul>
<ul> <li>Vibrations (DIN class B) to</li> </ul>	IEC 60068-2-6 and IEC 60068-2-64	<ul> <li>Version</li> <li>Function block</li> </ul>
	4 g/2 100 Hz	Factory setting
Electromagnetic compatibility		only for SITRANS
EMC noise voltage influence	< ± 0.1 % of span	Sensor
Extended EMC noise immunity: NAMUR NE 21, criterion A, Burst	< ± 1 % of span	Type of connection
EMC 2014/30/EU Emission and Noise Immunity according to	EN 61326	Unit Failure mode
Design		Filter time
Material	Molded plastic	PA address
Weight	55 g (0.12 lb)	PROFIBUS Ident N
Dimensions	See Dimensional drawings	only for SITRANS
Cross-section of cables	Max. 2.5 mm <sup>2</sup> (AWG 13)	Sensor
Degree of protection		Type of connection
<ul><li>Transmitter enclosure</li><li>Terminal</li></ul>	IP40 IP00	Unit
Auxiliary power	IFOU	Failure mode
Supply voltage		Filter time
<ul> <li>Standard, Ex "nA", Ex "nL", NI</li> </ul>	9.0 32 V DC	Node address
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 • "Intrinsic safety" type of protection	KEMA 06 ATEX 0264 II 1 G Ex ia IIC T4T6 II 2(1) G Ex ib[ia] IIC T4T6	
	II 1 D Ex iaD	
EC type-examination certificate • Type of protection for "equipment is non-arcing"	KEMA 06 ATEX 0263 X II 3 GD Ex nA[nL] IIC T4T6 II 3 GD Ex nL IIC T4T6 II 3 GD Ex nA[ic] IIC T4T6 II 3 GD Ex nA[ic] IIC T4T6 II 3 GD Ex ic IIC T4T6	
Type of protection for "equipment is non-arcing"     Explosion protection: FM for USA	KEMA 06 ATEX 0263 X II 3 GD Ex nA[nL] IIC T4T6 II 3 GD Ex nL IIC T4T6 II 3 GD Ex nA[ic] IIC T4T6	
<ul> <li>Type of protection for "equipment is non-arcing"</li> <li>Explosion protection: FM for USA</li> <li>FM approval</li> </ul>	KEMA 06 ATEX 0263 X II 3 GD Ex nA[nL] IIC T4T6 II 3 GD Ex nL IIC T4T6 II 3 GD Ex nL IIC T4T6 II 3 GD Ex nA[ic] IIC T4T6 II 3 GD Ex ic IIC T4T6 FM 3027985	
Type of protection for "equipment is non-arcing"     Explosion protection: FM for USA	KEMA 06 ATEX 0263 X II 3 GD Ex nA[nL] IIC T4T6 II 3 GD Ex nL IIC T4T6 II 3 GD Ex nA[ic] IIC T4T6 II 3 GD Ex ic IIC T4T6 II 3 GD Ex ic IIC T4T6 FM 3027985 • IS Class I, Div 1, Groups A, B, C, D T4/T5/T6, FISCO	
<ul> <li>Type of protection for "equipment is non-arcing"</li> <li>Explosion protection: FM for USA</li> <li>FM approval</li> </ul>	KEMA 06 ATEX 0263 X II 3 GD Ex nA[nL] IIC T4T6 II 3 GD Ex nL IIC T4T6 II 3 GD Ex nA[ic] IIC T4T6 II 3 GD Ex ic IIC T4T6 II 3 GD Ex ic IIC T4T6 FM 3027985 • IS Class I, Div 1, Groups A, B, C, D	
Type of protection for "equipment is non-arcing"     Explosion protection: FM for USA     FM approval	KEMA 06 ATEX 0263 X II 3 GD Ex nA[nL] IIC T4T6 II 3 GD Ex nL IIC T4T6 II 3 GD Ex nA[ic] IIC T4T6 II 3 GD Ex ic IIC T4T6 II 3 GD Ex ic IIC T4T6 FM 3027985 • IS Class I, Div 1, Groups A, B, C, D T4/T5/T6, FISCO • IS Class I, Zone 0, AEx ia, IIC	
<ul> <li>Type of protection for "equipment is non-arcing"</li> <li>Explosion protection: FM for USA</li> <li>FM approval</li> <li>Degrees of protection</li> <li>Explosion protection CSA for Canada</li> </ul>	KEMA 06 ATEX 0263 X II 3 GD Ex nA[nL] IIC T4T6 II 3 GD Ex nL IIC T4T6 II 3 GD Ex nL IIC T4T6 II 3 GD Ex ic IIC T4T6 FM 3027985 • IS Class I, Div 1, Groups A, B, C, D T4/T5/T6, FISCO • NI Class I, Div 2, Groups A, B, C, D T4/T5/T6, FNICO	
<ul> <li>Type of protection for "equipment is non-arcing"</li> <li>Explosion protection: FM for USA</li> <li>FM approval</li> <li>Degrees of protection</li> <li>Explosion protection CSA for Canada</li> <li>CSA approval</li> </ul>	KEMA 06 ATEX 0263 X II 3 GD Ex nA[nL] IIC T4T6 II 3 GD Ex nL IIC T4T6 II 3 GD Ex nL IIC T4T6 II 3 GD Ex ic IIC T4T6 IIC T4T6 II 3 GD Ex ic IIC T4T6 II 3 GD	
<ul> <li>Type of protection for "equipment is non-arcing"</li> <li>Explosion protection: FM for USA</li> <li>FM approval</li> <li>Degrees of protection</li> <li>Explosion protection CSA for Canada</li> </ul>	KEMA 06 ATEX 0263 X II 3 GD Ex nA[nL] IIC T4T6 II 3 GD Ex nA[ic] IIC T4T6 II 3 GD Ex nA[ic] IIC T4T6 II 3 GD Ex ic IIC T4T6 II 3 GD Ex ic IIC T4T6 FM 3027985 • IS Class I, Div 1, Groups A, B, C, D T4/T5/T6, FISCO • NI Class I, Div 2, Groups A, B, C, D T4/T5/T6, FNICO CSA 1861385 • IS Class I, Div 1, Groups A, B, C, D T4/T5/T6	
<ul> <li>Type of protection for "equipment is non-arcing"</li> <li>Explosion protection: FM for USA</li> <li>FM approval</li> <li>Degrees of protection</li> <li>Explosion protection CSA for Canada</li> <li>CSA approval</li> </ul>	KEMA 06 ATEX 0263 X II 3 GD Ex nA[nL] IIC T4T6 II 3 GD Ex nL IIC T4T6 II 3 GD Ex nA[ic] IIC T4T6 II 3 GD Ex ic IIC T4T6 II 3 GD Ex ic IIC T4T6 FM 3027985 • IS Class I, Div 1, Groups A, B, C, D T4/T5/T6, FISCO • NI Class I, Div 2, Groups A, B, C, D T4/T5/T6, FNICO CSA 1861385 • IS Class I, Div 1, Groups A, B, C, D T4/T5/T6 • IS Class I, Div 1, Groups A, B, C, D T4/T5/T6 • Ex ia IIC T4/T5/T6 and Ex ib [ia] IIC	
<ul> <li>Type of protection for "equipment is non-arcing"</li> <li>Explosion protection: FM for USA</li> <li>FM approval</li> <li>Degrees of protection</li> <li>Explosion protection CSA for Canada</li> <li>CSA approval</li> </ul>	KEMA 06 ATEX 0263 X II 3 GD Ex nA[nL] IIC T4T6 II 3 GD Ex nA[ic] IIC T4T6 II 3 GD Ex nA[ic] IIC T4T6 II 3 GD Ex ic IIC T4T6 FM 3027985 • 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 • IS Class I, Div 1, Groups A, B, C, D T4/T5/T6 • IS Class I, Div 1, Groups A, B, C, D T4/T5/T6 • IS Class I, Div 1, Groups A, B, C, D T4/T5/T6 • IS Class I, Div 2, Groups A, B, C, D T4/T5/T6 • NI Class I, Div 2, Groups A, B, C, D	
<ul> <li>Type of protection for "equipment is non-arcing"</li> <li>Explosion protection: FM for USA</li> <li>FM approval</li> <li>Degrees of protection</li> <li>Explosion protection CSA for Canada</li> <li>CSA approval</li> </ul>	KEMA 06 ATEX 0263 X II 3 GD Ex nA[nL] IIC T4T6 II 3 GD Ex nA[ic] IIC T4T6 II 3 GD Ex nA[ic] IIC T4T6 II 3 GD Ex ic IIC T4T6 FM 3027985 • 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 CSA 1861385 • 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	

Parameterization interface PROFIBUS PA connection	
<ul> <li>Protocol</li> <li>Address (for delivery)</li> <li>FOUNDATION Fieldbus connection</li> </ul>	Profile 3.0 126
<ul> <li>Protocol</li> <li>Functionality</li> <li>Version</li> <li>Function blocks</li> </ul>	FF protocol Basic or LAS ITK 4.6 2 x analog and 1 x PID
Factory setting	
only for SITRANS TH400 PA	
Sensor	Pt100 (IEC 751)
Type of connection	3-wire connection
Jnit	°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
Jnit	°C
Failure mode	Last valid value
Filter time	0 s
Node address	22

Temperature transmitters Compact and head transmitters

#### SITRANS TH400, fieldbus transmitter

	Article No.	Accessories	
Head transmitter SITRANS TH400			Article No.
For installation in connection head, with electri- cal isolation, operating instructions must be ordered separately.		Additional accessories for assembly, connec- tion and transmitter configuration, see page 2/154.	
<ul> <li>Bus-compatible to PROFIBUS PA</li> <li>No explosion protection or Zone 2/Div 2 according to ATEX/FM/CSA/IECEX/NEP-</li> </ul>	7NG3214-0NN00	SIMATIC PDM operating software	See Catalog FI01 section 8
SI/IECĔX/NEPSI		DIN rail adapters for head transmitters	7NG3092-8KA
<ul> <li>With explosion protection "Intrinsically safe according to ATEX/FM/CSA/IECEX/NEPSI"</li> </ul>	7NG3214-0AN00	(Quantity delivered: 5 units)	
Bus-compatible to FOUNDATION Fieldbus		Connecting cable	7NG3092-8KC
No explosion protection or Zone 2/Div 2 ac- cording to ATEX/FM/CSA/IECEX/NEPSI	7NG3215-0NN00	4-wire, 200 mm (7.87 inch), for sensor connec- tions when using head transmitters in the high hinged cover (set with 5 units)	
<ul> <li>With explosion protection "Intrinsically safe according to ATEX/FM/CSA/IECEX/NEPSI"</li> </ul>	7NG3215-0AN00	for additional PA components,	See Catalog IK PI
	Order code	Ordering example 1:	
Options	Order code	7NG3214-0NN00-Z Y01+Y17+U03	
Append suffix "-Z" to article no., add order code and plain text, if applicable.		Y01: 0100 °C	
Test report (5 measuring points)	C11 <sup>1)</sup>	Y17: TICA1234HEAT	
Customer-specific programming		Ordering example 2:	
Measuring range to be set Specify in plain text (max. 5 digits): Y01: to °C, °F	Y01 <sup>1)</sup>	7NG3214-0NN00-Z Y01+Y17+Y25+U25 Y01: 0500 °C	i
Measuring point number (TAG) max. 8 charac- ters	Y17 <sup>2)</sup>	Y17: TICA8HEAT	
Measuring point description, max. 16 charac-	Y23 <sup>2)</sup>	Y25: 33 Factory setting:	
ters Measuring point message, max. 32 characters	Y24 <sup>2)</sup>	For SITRANS TH400 PA:	
Specify bus address in plain text	Y25 <sup>2)</sup>	- Pt100 (IEC 751); 3-wire connection	
Pt100 (IEC) 2-wire, $R_I = 0 W$	U02 <sup>3)</sup>	- Unit: °C	
Pt100 (IEC) 2-wire	U03 <sup>3)</sup>	- Failure mode: Last valid value - Filter time: 0 s	
Pt100 (IEC) 4-wire	U04 <sup>3)</sup>	- PA address: 126	
Type B thermocouple	U20 <sup>3)4)</sup>	- PROFIBUS Ident No.: Manufacturer-	specific
Type C thermocouple (W5)	U21 <sup>3)4)</sup>	For SITRANS TH400 FF:     Pt100 (JEC 751): 2 wire connection	
Type D thermocouple (W3)	U22 <sup>3)4)</sup>	- Pt100 (IEC 751); 3-wire connection - Unit: °C	
Type E thermocouple	U23 <sup>3)4)</sup>	- Failure mode: Last valid value	
Type J thermocouple	U24 <sup>3)4)</sup>	- Filter time: 0 s - Node address: 22	
Type K thermocouple	U25 <sup>3)4)</sup>	- NUUE AUUIESS. 22	
Type L thermocouple	U26 <sup>3)4)</sup>		
Type N thermocouple	U27 <sup>3)4)</sup>		
Type R thermocouple	U28 <sup>3)4)</sup>		
Type S thermocouple	U29 <sup>3)4)</sup>		
Type T thermocouple	U30 <sup>3)4)</sup>		
Type U thermocouple	U31 <sup>3)4)</sup>		
For TC: Cold junction compensation: external	U41		
(Pt100, 3-wire) For TC: Cold junction compensation: external with fixed value: specify in plain text	Y50		
Enter special deviating customer-specific set- ting in plain text	Y09 <sup>5)</sup>		

Enter special deviating customer-specific setting in plain text

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.

<sup>3)</sup> For this selection, Y01 must also be selected.

<sup>4)</sup> nternal reference junction compensation is selected as the default for TC.

<sup>5)</sup> 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.

# Temperature measurement Temperature transmitters

Compact and head transmitters

SITRANS TH400, fieldbus transmitter

# Dimensional drawings



SITRANS TH400 dimensions in mm (inches) and connection diagram

#### Mounting on DIN rail



SITRANS TH400, mounting of transmitter on DIN rail



DIN rail adapter, dimensions in mm (inch)

## Circuit diagrams

Resistance thermometer

2-wire connection 1)



3-wire connection



4-wire connection



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



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

Thermocouple

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cold junction compensation



Cold junction compensation with external Pt100 in 2-wire connection <sup>1)</sup>



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 <sup>1</sup> 1 resistor in 3-wire connection

Voltage measurement



One voltage source



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

<sup>1)</sup> Programmable line resistance for the purpose of correction.

## Temperature measurement Temperature transmitters Compact and head transmitters

SITRANS TH320 (HART, universal)

## 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.

Temperature transmitters Compact and head transmitters

#### SITRANS TH320 (HART, universal)

# 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.



SITRANS TH320 function block diagram

Temperature transmitters Compact and head transmitters

IEC 60584-1

IEC 60584-1 IEC 60584-1 IEC 60584-1 DIN 43710 GOST 3044-84 IEC 60584-1 IEC 60584-1 IEC 60584-1 IEC 60584-1 DIN 43710 ASTM E988-96 ASTM E988-96 GOST 3044-84

#### SITRANS TH320 (HART, universal)

Constant, internal or external over Pt100 or Ni100 RTD

-50 ... +100 °C (-58 ... +212 °F)

-50 ... +135 °C (-58 ... +275 °F)

None, short-circuited, defective,

The short-circuited fault detection only applies to the CJC input. ≤ 75 ms (typically 70 ms)

short-circuited or defective

2-wire or 3-wire

< 0.002 Ω/Ω

< 0.15 mA

Max. 50 nF

Max. 10 k $\Omega$ 

≤ 2 000 ms

 $0 \ ... \ 100 \ k\Omega$  $25 \Omega$ 

Max. 50  $\Omega$ < 0.15 mA

 $< 0.002 \ \Omega/\Omega$ 

Max. 30 nF Max. 50 nF None, defective

 $10\ ...\ 100\ k\Omega$  $25 \Omega$ 3-wire or 4-wire Max. 50  $\Omega$ < 0.15 mA

 $< 0.002 \ \Omega/\Omega$ 

Max. 30 nF Max. 50 nF

2-wire, 3-wire or 4-wire

Note

 $50 \Omega$ 

General		Thermocouples (TC)
Supply voltage <sup>1) 2)</sup>		Input type
• Without explosion protection (non- Ex)	7.5 48 V DC	• B
<ul> <li>with explosion protection (Ex i)</li> </ul>	7.5 30 V DC	● E ● J
Additional minimum supply voltage when using test terminals	0.8 V	• K • L
Maximum power loss	≤ 850 mW	• Lr
Minimum load resistance at supply	(V <sub>supply</sub> - 37 V)/23 mA	• N
voltage > 37 V	(V <sub>supply</sub> - 57 V)/25 mA	• R • S
<ul><li>Insulation voltage, test/operation</li><li>Without explosion protection (non- Ex)</li></ul>	2.5 kV AC/55 V AC	• T • U • W3
<ul> <li>with explosion protection (Ex i)</li> </ul>	2.5 kV AC/42 V AC	• W3 • W5
Polarity protection	All inputs and outputs	• LR
Write protection	Open circuits or software	Cold junction compensation (CJC
Warming-up time	< 5 min	
Starting time	< 2.75 s	<ul> <li>Temperature range internal CJC</li> <li>Connection external CJC</li> </ul>
Programming	HART	<ul> <li>External CJC, line resistance per</li> </ul>
Signal-to-noise ratio	> 60 dB	wire (for 3-wire and 4-wire conn- tions)
Long-term stability	Better than: • ± 0.05% of measuring span/year • ± 0.18% of measuring span/5 years	<ul> <li>Effect of the line resistance (with wire and 4-wire connections)</li> <li>Input current external CJC</li> </ul>
Response time	4 20 mA: ≤ 55 ms	Temperature range external CJ(
	HART: $\leq$ 75 ms (typically 70 ms)	Cable, wire-wire capacity
Programmable damping	0 60 s	<ul><li>Total line resistance</li><li>Fault detection, programmable</li></ul>
Signal dynamic		
• Input	24 bit	
Output	18 bit	
Influence of change in supply voltage	< 0.005% of measuring span/V DC	<ul> <li>Fault detection time (TC)</li> </ul>
Input Resistance thermometer (RTD)		<ul> <li>Fault detection time, external Co (for 3-wire and 4-wire)</li> </ul>
Input type		Linear resistance
• Pt10 10000	• IEC 60751	Input range
	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> </ul>	Minimum measuring span
	Callendar-Van Dusen	Type of connection
• Ni10 10000	<ul> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> </ul>	Line resistance per wire
• Cu5 1000	Edison Copper Winding No. 15	Input current
Type of connection	• GOST 6651-2009/OIML R84:2003 2-wire, 3-wire or 4-wire	Effect of the line resistance (with 3 wire and 4-wire connections)
Line resistance per wire	Max. 50 Ω	Cable, wire-wire capacity
Input current	< 0.15 mA	• R > 400 Ω
Effect of the line resistance (with 3- wire and 4-wire connections)	< 0.002 Ω/Ω	• $R \le 400 \Omega$ Fault detection, programmable
Cable, wire-wire capacity	May 20 pF	Potentiometers
<ul> <li>Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8)</li> </ul>	Max. 30 nF	Input range
All other input types	Max. 50 nF	Minimum measuring span
Fault detection, programmable	None, short-circuited, defective,	Type of connection
	short-circuited or defective	Line resistance per wire
	Note	Input current
	When the low limit for the configured input type is below the constant detection limit for short-circuited	Effect of the line resistance (with 4 wire and 5-wire connections)
	inputs, the detection of short circuits	Cable, wire-wire capacity
	is disabled regardless of the configu- ration of the fault detection.	<ul> <li>R &gt; 400 Ω</li> <li>R ≤ 400 Ω</li> </ul>

≤ 75 ms (typically 70 ms)

Fault detection time (RTD)

wire)

Fault detection time (for 3-wire and 4-  $\leq$  2 000 ms

2

Temperature transmitters

Compact and head transmitters

# SITRANS TH320 (HART, universal)

Fault detection, programmable	None, short-circuited, defective,	Design	
	short-circuited or defective	Weight	50 g (0.11 lb)
	Note When the configured potentiometer	Maximum core cross-section	1 x 1.5 mm <sup>2</sup> (stranded wire)
	size is below the constant detection limit for short-circuited inputs, the	Tightening torque for clamping screws	0.4 Nm
	detection of short circuits is disabled regardless of the configuration of the	Vibrations	IEC 60068-2-6
	fault detection.	• 2 25 Hz	± 1.6 mm (0.07 inch)
Detection limit for short-circuited input	15 Ω	• 25 100 Hz	± 4 g
Fault detection time, wiper arm (no short-circuit detection)	≤ 75 ms (typically 70 ms)	Certificates and approvals Explosion protection ATEX/IECEx and	_
Fault detection time, element	≤ 2 000 ms	others	
Fault detection time (for 4-wire and 5- wire)	≤ 2 000 ms	Certificates <sup>3)</sup>	DEKRA 17ATEX0116 X IECEx DEK 17.0054X
Voltage input			A5E43700604A-2018X
Measuring range		"Intrinsic safety ia/ib" type of protec- tion	For use in Zone 0, 1, 2, 20, 21, 22
<ul><li>Unipolar</li><li>Bipolar</li></ul>	-100 1700 mV -800 +800 mV	• ATEX	II 1 G Ex ia IIC T6 T4 Ga
Minimum measuring span	2.5 mV		II 2(1) G Ex ib [ia Ga] IIC T6 T4 Gb
Input resistance	10 MΩ		II 1 D Ex ia IIIC Da I M1 Ex ia I Ma
Cable, wire-wire capacity		<ul> <li>IECEx and others</li> </ul>	Ex ia IIC T6 T4 Ga
<ul> <li>Input range: -100 1700 mV</li> <li>Input range: -20 100 mV</li> </ul>	Max. 30 nF Max. 50 nF		Ex ib [ia Ga] IIC T6 T4 Gb Ex ia IIIC Da Ex ia I Ma
Fault detection, programmable	None, defective	"Intrinsic safety ic" type of protection	For use in Zones 2 and 22
Fault detection time	≤ 75 ms (typically 70 ms)	• ATEX	II 2 G Ex ic IIC T6T4 Gc II 2 D Ex ic IIIC Dc
Output and HART communication		<ul> <li>IECEx and others</li> </ul>	Ex ic IIC T6 T4 Gc
Normal range, programmable	3.8 20.5 mA/20.5 3.8 mA		Ex ic IIIC Dc
Extended range (output limits), pro- grammable	3.5 23 mA/23 3.5 mA	"Non-sparking/increased safety nA/ec" type of protection	For use in Zones 2 and 22
Programmable input/output limits		• ATEX	II 2 G Ex nA IIC T6T4 Gc II 2 G Ex ec IIC T6T4 Gc
<ul> <li>Fault current</li> <li>Fault current setting</li> </ul>	Enable/disable 3.5 23 mA	<ul> <li>IECEx and others</li> </ul>	Ex nA IIC T6 T4 Gc
Update time	10 ms		Ex ec IIC T6 T4 Gc
Load (with current output)	$\leq$ (V <sub>Supply</sub> - 7.5)/0.023 $\Omega$	Explosion protection CSA/FM for Can- ada and USA	
Load stability	< 0.01% of meas. span/100 $\Omega$ (measuring span = currently selected range)	Certificates	CSA 1861385 FM18CA0024 FM18US0046
Input fault detection, programmable	3.5 23 mA	"Intrinsic safety ia" type of protection	IS, CL I, Div 1, GP ABCD, T6 T4
(detection of input short circuits is ignored with TC and voltage inputs)			Ex ia IIC T6 T4 Ga AEx ia IIC T6 T4 Ga or:
NAMUR NE43 Upscale	> 21 mA		Ex ib [ia Ga] IIC T6T4 Gb AEx ib [ia Ga] IIC T6T4 Gb
NAMUR NE43 Downscale	< 3.6 mA	"Non incendive field wiring NIEW" type	NIFW, CL I, Div 2, GP ABCD T6 T4
HART protocol versions	HART 7	of protection	
Measuring accuracy Input accuracy	See "Input accuracy" table	"Non incendive NI" type of protection	NI, CL I, Div 2, GP ABCD T6T4 Ex nA IIC T6 T4 Gc
Output accuracy	See "Output accuracy" table		AEx nA IIC T6 T4 GC
Rated conditions		<sup>1)</sup> Note that the minimum supply volta	ge must correspond to the value mea-
Ambient temperature	-50 +85 °C (-58 +185 °F)	sured at the terminals of the SITRAN All external voltage drops must be t	NS TH320.
Ambient temperature for devices with functional safety	· · · · · · · · · · · · · · · · · · ·	<b>9</b> 1	with the help of a suitable power sup-
Storage temperature	-50 +85 °C (-58 +185 °F)	<sup>3)</sup> Additional available certificates are	
Reference temperature for sensor cal- ibration	· · · · · ·	http://www.siemens.com/processins	su umentation/certificates
Relative humidity	< 99% (no condensation)		
Degree of protection			
<ul><li>Transmitter enclosure</li><li>Terminals</li></ul>	IP68 IP00		

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Temperature transmitters Compact and head transmitters

SITRANS TH320 (HART, universal)

#### Measuring ranges/Minimum measuring span

#### RTD

Input type	Standard	Measuring range in °C (°F)	α <sub>0</sub> in °C <sup>-1</sup> (°F <sup>-1</sup> )	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)
В	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)
К	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)
Ν	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)
Т	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 <sup>1)</sup>
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	$T_{max.} < 300 \text{ °C} (572 \text{ °F}) = \le \pm 0.08 \text{ °C} (0.144 \text{ °F})$ $T_{max.} > 300 \text{ °C} (572 \text{ °F}) = \le \pm 0.4 \text{ °C} (0.72 \text{ °F})$	≤ ±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)

Temperature coefficient<sup>1)</sup>

Temperature coefficient

 $\leq \pm 1.6 \ \mu$ A (0.01% of the full  $\leq \pm 0.48 \ \mu$ A/K ( $\leq \pm 0.003\%$  of output span) the full output span/K)

# **Temperature measurement**

Temperature transmitters Compact and head transmitters

## SITRANS TH320 (HART, universal)

Basic accuracy

Input type

input type	Basic accuracy	remperature coefficient?
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	$\leq \pm 40 \text{ m}\Omega$	$\leq \pm 2 \text{ m}\Omega/^{\circ}\text{C} (1.11 \text{ m}\Omega/^{\circ}\text{F})$
0 100 kΩ	$\leq \pm 4 \Omega$	$\leq \pm 0.2 \ \Omega/^{\circ}C \ (0.11 \ \Omega/^{\circ}F)$
Potentiometers		
0 100%	< 0.05%	< ± 0.005%
Voltage input		
mV: -20 100 mV	$\leq \pm 5 \mu V$	≤ ±0.2 μV/°C (0.11 μV/°F)
mV: -100 1700 mV	$\leq \pm 0.1 \text{ mV}$	$\leq \pm 36 \mu$ V/°C (20 $\mu$ V/°F)
mV: ± 800 mV	≤ ±0.1 mV	$\leq \pm 32 \mu\text{V/}^{\circ}\text{C} (17.8 \mu\text{V/}^{\circ}\text{F})$
тс		
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)
К	≤ ±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)
Т	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
U	< 0 °C (32 °F) ≤ ±0.8 °C (1.44 °F)	≤ ±0.025 °C/°C (°F/°F)
	≥ 0 °C (32 °F) ≤ ±0.4 °C (0.72 °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)	≤ ±0.1 °C/°C (°F/°F)
	$\geq$ 200 °C (392 °F) $\leq$ ±1 °C (1.8 °F)	
S	< 200 °C (392 °F) $\leq \pm 0.5$ °C (0.9 °F)	$\leq \pm 0.1 \text{ °C/°C} (\text{°F/°F})$
	≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F)	
W3	≤ ±0.6 °C (1.08 °F)	$\leq \pm 0.1 \text{ °C/°C (°F/°F)}$
W5	≤ ±0.4 °C (0.72 °F)	$\leq \pm 0.1 \text{ °C/°C} (\text{°F/°F})$
3 <sup>2)</sup>	≤ ±1 °C (1.8 °F)	$\leq \pm 0.1 \text{ °C/°C (°F/°F)}$
B <sub>3)</sub>	≤ ±3 °C (5.4 °F)	$\leq \pm 0.1 \text{ °C/°C (°F/°F)}$
34)	≤ ±8 °C (14.4 °F)	$\leq \pm 0.8 \text{ °C/°C} (\text{°F/°F})$
B <sup>5)</sup>	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)
CJC (external) <sup>1)</sup> Temperature coefficients co the input span, depending	prrespond to the specified values or 0.002% of <b>Output</b>	≤ ±0.002 °C/°C (°F/°F) ut accuracy

Output type

Analog output

**Basic accuracy** 

 $^{2)}$  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)

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

Options

cable, free text.

(IEC 60770-2)

N

0

Manufacturer declarations

Certificates for functional safety

Functional safety SIL2/3 (IEC 61508)

Append "-Z" to Article No., add order code and, if appli-

Quality inspection certificate, 5-point factory calibration

### **Temperature measurement** Temperature transmitters

Compact and head transmitters

#### SITRANS TH320 (HART, universal)

Order code

C11

C20

#### Selection and ordering data Article No. SITRANS TH320 head transmitter with 1 input 7NG031 -----↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal. Communication With HART 0 7 2-wire, 4 ... 20 mA Primary value output Input 1 0 Input 1, type RTD • Pt100 (IEC), 3-wire в C D • Pt100 (IEC), 4-wire • Pt1000 (IEC), 3-wire • Pt1000 (IEC), 4-wire Е TC • Type B F • Type E G • Type J н J • Type K • Type L κ L • Type N • Type R Ν Р • Type S • Type T Q Potentiometer, 4-wire R Input 1, type customer-specific Define customer-specific input configurations in V Y options Input 2, type Without input 2 Α 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 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)

Without

Local HMI Without display

Electrical connection/cable entry

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
Туре 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 $% \left( 1-\frac{1}{2}\right) =0$	V73
Ni x (GOST 6651-2009), 4-wire, define RTD factor x in option Y21 $% \left( 1-\frac{1}{2}\right) =0$	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

Temperature transmitters

Compact and head transmitters

## SITRANS TH320 (HART, universal)

Options	Order code
Append "-Z" to Article No., add order code and, if appli- cable, 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), adhe- sive 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 con- figuration, see page 2/154.	
Modems	
Modem with USB interface Modem with USB interface and SIPROM T software	7MF4997-1DB 7NG3092-8KN
SIMATIC PDM parameterization software	See Catalog FI 01 section 8
Mounting rail adapter for head transmitter	7NG3092-8KA
(Quantity delivered: 5 units)	
Connecting cable	7NG3092-8KC
4-wire, 200 mm (7.97 inch), for input connections when using head transmitters in the high hinged cover (set with 5 units)	

#### 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





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

Temperature transmitters Compact and head transmitters

SITRANS TH320 (HART, universal)

# Circuit diagrams

## Connections

Input connection



Output connection



SITRANS TH320, output connection assignment

Temperature transmitters Compact and head transmitters

#### 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.

Temperature measurement Temperature transmitters Compact and head transmitters

SITRANS TH420 (HART, universal)

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.



SITRANS TH420, function block diagram

Temperature transmitters Compact and head transmitters

# SITRANS TH420 (HART, universal)

# Technical specifications

General		Thermocouples (TC)	
Supply voltage <sup>1) 2)</sup>		Input type	
<ul> <li>Without explosion protection (non- Ex)</li> </ul>	7.5 48 V DC	• B • E	IEC 60584-1
<ul> <li>with explosion protection (Ex i)</li> </ul>	7.5 30 V DC	• E • J	IEC 60584-1 IEC 60584-1
Additional minimum supply voltage	0.8 V	• K	IEC 60584-1
when using test terminals		• L	DIN 43710
Maximum power loss	≤ 850 mW	• Lr • N	GOST 3044-84 IEC 60584-1
Minimum load resistance at supply	(V <sub>supply</sub> - 37 V)/23 mA	• R	IEC 60584-1
voltage > 37 V		• S	IEC 60584-1
<ul><li>Insulation voltage, test/operation</li><li>Without explosion protection (non-</li></ul>	2.5 kV AC/55 V AC	• T	IEC 60584-1
Ex)		• U • W3	DIN 43710 ASTM E988-96
<ul> <li>with explosion protection (Ex i)</li> </ul>	2.5 kV AC/42 V AC	• W5	ASTM E988-96
Polarity protection	All inputs and outputs	• LR	GOST 3044-84
Write protection	Open circuits or software	Cold junction compensation (CJC)	Constant, internal or external over Pt100 or Ni100 RTD
Warming-up time	< 5 min	<ul> <li>Temperature range internal CJC</li> </ul>	-50 +100 °C (-58 +212 °F)
Starting time	< 2.75 s	Connection external CJC	2-wire, 3-wire or 4-wire
Programming	HART	<ul> <li>External CJC, line resistance per wire (for 3-wire and 4-wire connec-</li> </ul>	50 Ω
Signal-to-noise ratio	> 60 dB	tions)	
Long-term stability	<ul> <li>Better than:</li> <li>± 0.05% of measuring span/year</li> </ul>	<ul> <li>Effect of the line resistance (with 3- wire and 4-wire connections)</li> </ul>	< 0.002 Ω/Ω
	<ul> <li>± 0.05% of measuring span/year</li> <li>± 0.18% of measuring span/5 years</li> </ul>	<ul> <li>Input current external CJC</li> </ul>	< 0.15 mA
Response time	$\leq$ 75 ms (typically 70 ms)	Temperature range external CJC	-50 +135 °C (-58 +275 °F)
Programmable damping	0 60 s	Cable, wire-wire capacity	Max. 50 nF
Signal dynamic		<ul> <li>Total line resistance</li> <li>Fault detection, programmable</li> </ul>	Max. 10 kΩ None, short-circuited, defective,
• Input	24 bit		short-circuited or defective
Output	18 bit		Note
Influence of change in supply voltage	< 0.005% of measuring span/V DC		The short-circuited fault detection only applies to the CJC input.
Input		<ul> <li>Fault detection time (TC)</li> </ul>	$\leq$ 75 ms (typically 70 ms)
Resistance thermometer (RTD)		<ul> <li>Fault detection time, external CJC</li> </ul>	≤ 2 000 ms
		(for 3-wire and 4-wire)	
Input type	• IEO 60761	(for 3-wire and 4-wire)	
Input type • Pt10 10000	• IEC 60751 • JIS C 1604-8	Linear resistance	0 100 kQ
	<ul><li>JIS C 1604-8</li><li>GOST 6651_2009</li></ul>	Linear resistance Input range	0 100 kΩ 25 Q
	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> </ul>	Linear resistance Input range Minimum measuring span	25 Ω
<ul><li>Pt10 10000</li><li>Ni10 10000</li></ul>	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> </ul>	Linear resistance Input range Minimum measuring span Type of connection	25 Ω 2-wire, 3-wire or 4-wire
• Pt10 10000	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> </ul>	Linear resistance Input range Minimum measuring span Type of connection Line resistance per wire	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω
<ul><li>Pt10 10000</li><li>Ni10 10000</li></ul>	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>Edison Copper Winding No. 15</li> </ul>	Linear resistance Input range Minimum measuring span Type of connection Line resistance per wire Input current	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> </ul>	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>Edison Copper Winding No. 15</li> <li>GOST 6651-2009/OIML R84:2003</li> </ul>	Linear resistance Input range Minimum measuring span Type of connection Line resistance per wire	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection</li> </ul>	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>Edison Copper Winding No. 15</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>2-wire, 3-wire or 4-wire</li> </ul>	Linear resistance Input range Minimum measuring span Type of connection Line resistance per wire Input current Effect of the line resistance (with 3-	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire</li> </ul>	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>Edison Copper Winding No. 15</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>2-wire, 3-wire or 4-wire</li> <li>Max. 50 Ω</li> </ul>	Linear resistance Input range Minimum measuring span Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections) Cable, wire-wire capacity • R > 400 Ω	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 Ω/Ω Max. 30 nF
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current</li> </ul>	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>Edison Copper Winding No. 15</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>2-wire, 3-wire or 4-wire</li> <li>Max. 50 Ω</li> <li>&lt; 0.15 mA</li> </ul>	$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 Ω/Ω Max. 30 nF Max. 50 nF
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current Effect of the line resistance (with 3-wire and 4-wire connections) Cable, wire-wire capacity</li></ul>	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>Edison Copper Winding No. 15</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>2-wire, 3-wire or 4-wire</li> <li>Max. 50 Ω</li> <li>0.15 mA</li> <li>0.002 Ω/Ω</li> </ul>	$\label{eq:linear} \frac{\text{Linear resistance}}{\text{Input range}} \\ \mbox{Minimum measuring span} \\ \mbox{Type of connection} \\ \mbox{Line resistance per wire} \\ \mbox{Input current} \\ \mbox{Effect of the line resistance (with 3-wire and 4-wire connections)} \\ \mbox{Cable, wire-wire capacity} \\ \mbox{e R} > 400 \ \Omega \\ \mbox{Fault detection, programmable} \\ \end{tabular}$	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 Ω/Ω Max. 30 nF
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections)</li> </ul>	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>Edison Copper Winding No. 15</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>2-wire, 3-wire or 4-wire</li> <li>Max. 50 Ω</li> <li>&lt; 0.15 mA</li> </ul>	$\label{eq:linear} \frac{\text{Linear resistance}}{\text{Input range}} \\ \mbox{Minimum measuring span} \\ \mbox{Type of connection} \\ \mbox{Line resistance per wire} \\ \mbox{Input current} \\ \mbox{Effect of the line resistance (with 3-wire and 4-wire connections)} \\ \mbox{Cable, wire-wire capacity} \\ \mbox{e R > 400 } \Omega \\ \mbox{Fault detection, programmable} \\ \mbox{Potentiometers} \\ \end{tabular}$	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 Ω/Ω Max. 30 nF Max. 50 nF None, defective
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current Effect of the line resistance (with 3-wire and 4-wire connections) Cable, wire-wire capacity Pt1000, Pt10000 (IEC 60751 and</li></ul>	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>Edison Copper Winding No. 15</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>2-wire, 3-wire or 4-wire</li> <li>Max. 50 Ω</li> <li>0.15 mA</li> <li>0.002 Ω/Ω</li> </ul>	$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 Ω/Ω Max. 30 nF Max. 50 nF None, defective 10 100 kΩ
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current Effect of the line resistance (with 3-wire and 4-wire connections) Cable, wire-wire capacity Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8)</li></ul>	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>Edison Copper Winding No. 15</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>2-wire, 3-wire or 4-wire</li> <li>Max. 50 Ω</li> <li>&lt; 0.15 mA</li> <li>&lt; 0.002 Ω/Ω</li> <li>Max. 30 nF</li> <li>Max. 50 nF</li> <li>None, short-circuited, defective,</li> </ul>	Linear resistanceInput rangeMinimum measuring spanType of connectionLine resistance per wireInput currentEffect of the line resistance (with 3-wire and 4-wire connections)Cable, wire-wire capacity• R > 400 $\Omega$ • R ≤ 400 $\Omega$ Fault detection, programmablePotentiometersInput rangeMinimum measuring span	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 Ω/Ω Max. 30 nF Max. 50 nF None, defective 10 100 kΩ 25 Ω
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections) Cable, wire-wire capacity</li> <li>Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8)</li> <li>All other input types</li> </ul>	• JIS C 1604-8 • GOST 6651_2009 • Callendar-Van Dusen • DIN 43760-1987 • GOST 6651-2009/OIML R84:2003 • Edison Copper Winding No. 15 • GOST 6651-2009/OIML R84:2003 2-wire, 3-wire or 4-wire Max. 50 $\Omega$ < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF Max. 50 nF None, short-circuited, defective, short-circuited or defective	Linear resistanceInput rangeMinimum measuring spanType of connectionLine resistance per wireInput currentEffect of the line resistance (with 3-wire and 4-wire connections)Cable, wire-wire capacity $R > 400 \Omega$ $R \le 400 \Omega$ Fault detection, programmablePotentiometersInput rangeMinimum measuring spanType of connection	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 Ω/Ω Max. 30 nF Max. 30 nF Max. 50 nF None, defective 10 100 kΩ 25 Ω 3-wire, 4-wire or 5-wire
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<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections) Cable, wire-wire capacity</li> <li>Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8)</li> <li>All other input types</li> </ul>	• JIS C 1604-8 • GOST 6651_2009 • Callendar-Van Dusen • DIN 43760-1987 • GOST 6651-2009/OIML R84:2003 • Edison Copper Winding No. 15 • GOST 6651-2009/OIML R84:2003 2-wire, 3-wire or 4-wire Max. 50 $\Omega$ < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF Max. 50 nF 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	$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF Max. 30 nF Max. 50 nF None, defective 10 100 kΩ 25 Ω 3-wire, 4-wire or 5-wire Max. 50 Ω
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections) Cable, wire-wire capacity</li> <li>Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8)</li> <li>All other input types</li> </ul>	• JIS C 1604-8 • GOST 6651_2009 • Callendar-Van Dusen • DIN 43760-1987 • GOST 6651-2009/OIML R84:2003 • Edison Copper Winding No. 15 • GOST 6651-2009/OIML R84:2003 2-wire, 3-wire or 4-wire Max. 50 $\Omega$ < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF Max. 50 nF 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	Linear resistanceInput rangeMinimum measuring spanType of connectionLine resistance per wireInput currentEffect of the line resistance (with 3- wire and 4-wire connections)Cable, wire-wire capacity• R > 400 $\Omega$ • R < 400 $\Omega$ Fault detection, programmablePotentiometersInput rangeMinimum measuring spanType of connectionLine resistance per wireInput currentEffect of the line resistance (with 4- wire and 5-wire connections)Cable, wire-wire capacity	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 Ω/Ω Max. 30 nF Max. 30 nF Max. 50 nF None, defective 10 100 kΩ 25 Ω 3-wire, 4-wire or 5-wire Max. 50 Ω < 0.15 mA < 0.002 Ω/Ω
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections) Cable, wire-wire capacity</li> <li>Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8)</li> <li>All other input types</li> </ul>	• JIS C 1604-8 • GOST 6651_2009 • Callendar-Van Dusen • DIN 43760-1987 • GOST 6651-2009/OIML R84:2003 • Edison Copper Winding No. 15 • GOST 6651-2009/OIML R84:2003 2-wire, 3-wire or 4-wire Max. 50 $\Omega$ < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF Max. 50 nF None, short-circuited, defective, short-circuited or defective Note When the low limit for the configured inputs, the detection of short circuits is disabled regardless of the configu- ration of the fault detection.	Linear resistance         Input range         Minimum measuring span         Type of connection         Line resistance per wire         Input current         Effect of the line resistance (with 3-wire and 4-wire connections)         Cable, wire-wire capacity         • R > 400 Ω         • R ≤ 400 Ω         Fault detection, programmable         Potentiometers         Input range         Minimum measuring span         Type of connection         Line resistance per wire         Input current         Effect of the line resistance (with 4-wire and 5-wire connections)         Cable, wire-wire capacity         • R > 400 Ω	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF Max. 30 nF Max. 50 nF None, defective 10 100 kΩ 25 Ω 3-wire, 4-wire or 5-wire Max. 50 Ω < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections) Cable, wire-wire capacity</li> <li>Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8)</li> <li>All other input types Fault detection, programmable</li> </ul>	• JIS C 1604-8 • GOST 6651_2009 • Callendar-Van Dusen • DIN 43760-1987 • GOST 6651-2009/OIML R84:2003 • Edison Copper Winding No. 15 • GOST 6651-2009/OIML R84:2003 2-wire, 3-wire or 4-wire Max. 50 $\Omega$ < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF Max. 50 nF None, short-circuited, defective, short-circuited or defective Note When the low limit for the configured inputs, the detection of short circuits is disabled regardless of the configu- ration of the fault detection.	Linear resistanceInput rangeMinimum measuring spanType of connectionLine resistance per wireInput currentEffect of the line resistance (with 3- wire and 4-wire connections)Cable, wire-wire capacity• R > 400 $\Omega$ • R < 400 $\Omega$ Fault detection, programmablePotentiometersInput rangeMinimum measuring spanType of connectionLine resistance per wireInput currentEffect of the line resistance (with 4- wire and 5-wire connections)Cable, wire-wire capacity	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 Ω/Ω Max. 30 nF Max. 30 nF Max. 50 nF None, defective 10 100 kΩ 25 Ω 3-wire, 4-wire or 5-wire Max. 50 Ω < 0.15 mA < 0.002 Ω/Ω
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections)</li> <li>Cable, wire-wire capacity</li> <li>Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8)</li> <li>All other input types Fault detection, programmable</li> </ul>	• JIS C 1604-8 • GOST 6651_2009 • Callendar-Van Dusen • DIN 43760-1987 • GOST 6651-2009/OIML R84:2003 • Edison Copper Winding No. 15 • GOST 6651-2009/OIML R84:2003 2-wire, 3-wire or 4-wire Max. 50 $\Omega$ < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF Max. 50 nF 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 configu- ration of the fault detection. t 15 $\Omega$ $\leq$ 75 ms (typically 70 ms)	Linear resistance         Input range         Minimum measuring span         Type of connection         Line resistance per wire         Input current         Effect of the line resistance (with 3-wire and 4-wire connections)         Cable, wire-wire capacity         • R > 400 Ω         • R ≤ 400 Ω         Fault detection, programmable         Potentiometers         Input range         Minimum measuring span         Type of connection         Line resistance per wire         Input current         Effect of the line resistance (with 4-wire and 5-wire connections)         Cable, wire-wire capacity         • R > 400 Ω	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF Max. 30 nF Max. 50 nF None, defective 10 100 kΩ 25 Ω 3-wire, 4-wire or 5-wire Max. 50 Ω < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF

Temperature transmitters Compact and head transmitters

# SITRANS TH420 (HART, universal)

Fault detection, programmable	None, short-circuited, defective,	Design	
r dan deteetion, programmable	short-circuited or defective	Weight	50 g (0.11 lb)
	Note	Maximum core cross-section	1 x 1.5 mm <sup>2</sup> (stranded wire)
	When the configured potentiometer size is below the constant detection limit for short-circuited inputs, the	Tightening torque for clamping screws	0.4 Nm
	detection of short circuits is disabled regardless of the configuration of the	Vibrations	IEC 60068-2-6
	fault detection.	• 2 25 Hz	± 1.6 mm (0.07 inch)
Detection limit for short-circuited input	15 Ω	• 25 100 Hz	± 4 g
Fault detection time, wiper arm (no short-circuit detection)	≤ 75 ms (typically 70 ms)	Certificates and approvals Explosion protection ATEX/IECEx and	
Fault detection time, element	≤ 2 000 ms	others 2)	
Fault detection time (for 4-wire and 5-wire)	≤ 2 000 ms	Certificates <sup>3)</sup>	DEKRA 17ATEX0116 X IECEx DEK 17.0054X
Voltage input			A5E43700604A-2018X
Measuring range • Unipolar • Bipolar	-100 1700 mV -800 +800 mV	"Intrinsic safety ia/ib" type of protection • ATEX	For use in Zone 0, 1, 2, 20, 21, 22 II 1 G Ex ia IIC T6 T4 Ga II 2(1) G Ex ib [ia Ga] IIC T6 T4 Gb
Minimum measuring span	2.5 mV		II 1 D Ex ia IIIC Da
Input resistance	10 MΩ	<ul> <li>IECEx and others</li> </ul>	l M1 Ex ia l Ma Ex ia IIC T6 T4 Ga
Cable, wire-wire capacity Input range: -100 1700 mV	Max. 30 nF Max. 50 nF		Ex ib [ia Ga] IIC T6 T4 Gb Ex ia IIC Da Ex ia I Ma
<ul> <li>Input range: -20 100 mV</li> <li>Fault detection, programmable</li> </ul>	None, defective	"Intrinsic safety ic" type of protection	For use in Zones 2 and 22
Fault detection, programmable	≤ 75 ms (typically 70 ms)	• ATEX	II 2 G Ex ic IIC T6T4 Gc II 2 D Ex ic IIIC Dc
Output and HART communication		<ul> <li>IECEx and others</li> </ul>	Ex ic IIC T6 T4 Gc
Normal range, programmable	3.8 20.5 mA/20.5 3.8 mA		Ex ic IIIC Dc
Extended range (output limits), pro- grammable	3.5 23 mA/23 3.5 mA	"Non-sparking/increased safety nA/ec" type of protection • ATEX	For use in Zones 2 and 22
Programmable input/output limits		• AIEA	II 2 G Ex ec IIC T6T4 Gc
<ul> <li>Fault current</li> <li>Fault current setting</li> </ul>	Enable/disable 3.5 23 mA	IECEx and others	Ex nA IIC T6 T4 Gc Ex ec IIC T6 T4 Gc
Update time	10 ms	Explosion protection CSA/FM for	
Load (with current output)	≤ (V <sub>Supply</sub> - 7.5)/0.023 Ω	Canada and USA	
Load stability	< 0.01% of meas. span/100 $\Omega$ (measuring span = currently selected	Certificates	CSA 1861385 FM18CA0024 FM18US0046
Input fault detection, programmable	range) 3.5 23 mA	"Intrinsic safety ia" type of protection	IS, CL I, Div 1, GP ABCD, T6 T4
(detection of input short circuits is ignored with TC and voltage inputs)			Ex ia IIC T6 T4 Ga AEx ia IIC T6 T4 Ga or: Ex ib [ia Ga] IIC T6T4 Gb
NAMUR NE43 Upscale	> 21 mA		AEx ib [ia Ga] IIC T6T4 Gb
NAMUR NE43 Downscale	< 3.6 mA	( ) · · · ·	NIFW, CL I, Div 2, GP ABCD T6 T4
HART protocol versions	HART 7	of protection "Non incendive NI" type of protection	NL CL L Div 2 GP ABCD T6 T4
Measuring accuracy			Ex nA IIC T6 T4 Gc
Input accuracy	See "Input accuracy" table	1)	AEx nA IIC T6 T4 Gc
Output accuracy Rated conditions	See "Output accuracy" table	<sup>1)</sup> Note that the minimum supply volta sured at the terminals of the SITRAN	ge must correspond to the value mea-
Ambient temperature	-50 +85 °C (-58 +185 °F)	All external voltage drops must be t	aken into consideration.
Ambient temperature for devices with functional safety	· · · · · · · · · · · · · · · · · · ·	<ul> <li>Protect the device from overvoltage ply or suitable overvoltage protection</li> </ul>	on equipment.
Storage temperature	-50 +85 °C (-58 +185 °F)	<li><sup>3)</sup> Additional available certificates are http://www.siemens.com/processing</li>	
Reference temperature for sensor cal- ibration	· · · · · · · · · · · · · · · · · · ·		
Relative humidity	< 99% (no condensation)		
Degree of protection			
Transmitter enclosure     Terminals	IP68 IP00		

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Temperature transmitters Compact and head transmitters

# SITRANS TH420 (HART, universal)

# Measuring ranges/Minimum measuring span

# RTD

Input type	Standard	Measuring range in °C (°F)	α <sub>0</sub> in °C <sup>-1</sup> (°F <sup>-1</sup> )	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)

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## TC

Input type	Standard	Measuring range in °C (°F)	Minimum measuring span in °C (°F)
В	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)
К	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)
Т	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 <sup>1)</sup>
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	$\begin{split} T_{max.} &< 180 \ ^{\circ}\text{C} \ (356 \ ^{\circ}\text{F}) = \le \pm 0.08 \ ^{\circ}\text{C} \ (0.144 \ ^{\circ}\text{F}) \\ T_{max.} &> 180 \ ^{\circ}\text{C} \ (356 \ ^{\circ}\text{F}) = \le \pm 0.16 \ ^{\circ}\text{C} \ (0.288 \ ^{\circ}\text{F}) \end{split}$	≤ ±0.002 °C/°C (°F/°F)
Pt1000	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt2000	$T_{max.} < 300 \text{ °C} (572 \text{ °F}) = \le \pm 0.08 \text{ °C} (0.144 \text{ °F})$ $T_{max.} > 300 \text{ °C} (572 \text{ °F}) = \le \pm 0.4 \text{ °C} (0.72 \text{ °F})$	≤ ±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)

Temperature transmitters Compact and head transmitters

## SITRANS TH420 (HART, universal)

Input type	Basic accuracy	Temperature coefficient <sup>1)</sup>
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	$\leq \pm 40 \text{ m}\Omega$	$\leq \pm 2 \text{ m}\Omega/^{\circ}\text{C} (1.11 \text{ m}\Omega/^{\circ}\text{F})$
0 100 kΩ	$\leq \pm 4 \ \Omega$	$\leq \pm 0.2 \ \Omega/^{\circ}C \ (0.11 \ \Omega/^{\circ}F)$
Potentiometers		
0 100%	< 0.05%	< ± 0.005%
Voltage input		
mV: -20 100 mV	$\leq \pm 5 \ \mu V$	$\leq \pm 0.2 \ \mu V/^{\circ}C \ (0.11 \ \mu V/^{\circ}F)$
mV: -100 1700 mV	$\leq \pm 0.1 \text{ mV}$	$\leq \pm 36 \ \mu\text{V/}^{\circ}\text{C} \ (20 \ \mu\text{V/}^{\circ}\text{F})$
mV: ± 800 mV	$\leq \pm 0.1 \text{ mV}$	$\leq \pm 32 \ \mu V/^{\circ}C \ (17.8 \ \mu V/^{\circ}F)$
тс		
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)
К	≤ ±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)
Ν	≤ ±0.4 °C (0.72 °F)	≤ ±0.025 °C/°C (°F/°F)
Т	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
U	< 0 °C (32 °F) ≤ ±0.8 °C (1.44 °F)	≤ ±0.025 °C/°C (°F/°F)
	≥ 0 °C (32 °F) ≤ ±0.4 °C (0.72 °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 <sup>2)</sup>	≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
B <sup>3)</sup>	≤ ±3 °C (5.4 °F)	≤ ±0.1 °C/°C (°F/°F)
B <sup>4)</sup>	≤ ±8 °C (14.4 °F)	≤ ±0.8 °C/°C (°F/°F)
B <sup>5)</sup>	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 correspon		

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<sup>1)</sup> 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 mea- surement	Sum of accuracy of input 1 and input 2	Sum of temperature coefficient of input 1 and input 2
Analog output	$\leq \pm 1.6~\mu A$ (0.01% of the full output span)	$\leq\pm0.48~\mu\text{A/K}~(\leq\pm0.003\%~\text{of}$ the full output span/K)

Temperature transmitters Compact and head transmitters

# SITRANS TH420 (HART, universal)

## Selection and ordering data

SITRANS TH420 Head transmitter with 2 inputs	7NG041		
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 H1A		
Maximum input 1 and input 2, without redundancy	9 H1B		
Average input 1 and input 2, without redundancy	9 H1C		
Input 2	9 H1D		
Input 1, type			
RTD • Pt100 (IEC), 3-wire • Pt100 (IEC), 4-wire • Pt1000 (IEC), 3-wire • Pt1000 (IEC), 4-wire	B C D E		
TC • Type B • Type E • Type J • Type K	F G H J		
<ul><li>Type L</li><li>Type N</li></ul>	K L		
• Type R	N		
• Type S	Р		
• Type T	Q		
Potentiometer, 4-wire	_ <b>R</b>		
Input 1, type customer-specific			
Define customer-specific input configura- tions in V options	Y		

Article No.

	Article No.	Order code
SITRANS TH420	7NG041	
Head transmitter with 2 inputs		- 0
Input 2, type		
Without input 2	A	
RTD		
Pt100 (IEC), 3-wire     Pt100 (IEC), 4-wire	В	
<ul> <li>Pt100 (IEC), 4-wire</li> <li>Pt1000 (IEC), 3-wire</li> </ul>	C	
• Pt1000 (IEC), 4-wire	E	
TC		
• Type B	F	
• Type E	G	
• Type J	н	
• Туре К	J	
• Type L	ĸ	
• Type N	L	
• Type R	N	
• Туре S • Туре T	Q	
Potentiometer, 4-wire	B	
Input 2, type customer-specific		
Define customer-specific input configura- tions 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		Α
Local HMI		
Without display		0

Order code

## **Temperature measurement** Temperature transmitters

Compact and head transmitters

## SITRANS TH420 (HART, universal)

Options	Order code
Append "-Z" to Article No., add order code and, if appli- cable, 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
Туре 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
Туре U	W03
Type Lr	W04

Options	Order code
Append "-Z" to Article No., add order code and, if appli- cable, 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), adhe- sive 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 con- figuration, 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	7NG3092-8KA
(Quantity delivered: 5 units)	
Connecting cable	7NG3092-8KC
4-wire, 200 mm (7.87 inch), for input connections when using head transmitters in the high hinged cover (set with 5 units)	

#### 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

Temperature transmitters Compact and head transmitters

## SITRANS TH420 (HART, universal)

## Dimensional drawings



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

Temperature transmitters Compact and head transmitters

SITRANS TH420 (HART, universal)

# Circuit diagrams

## Connections

Input connection



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



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

SITRANS TH420, input connection assignment

### Output connection



SITRANS TH420, output connection assignment



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: 3-wire or 4-wire potentiometer



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



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

Temperature transmitters Rail transmitters

#### 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.



### SITRANS TR200 function diagram

Temperature transmitters

**Rail transmitters** 

## SITRANS TR200 (4 to 20 mA, universal)

# Technical specifications

Break monitoring

Measuring range

Min. measuring span Characteristic curve

Short-circuit monitoring

Input		Thermocouples	
Resistance thermometer		Measured variable	Temperature
Measured variable	Temperature	Sensor type (thermocouples)	
Sensor type		• Type B	Pt30Rh-Pt6Rh acc. to IEC 584
<ul> <li>According to IEC 60751</li> </ul>	Pt25 Pt1000	• Type C	W5%-Re acc. to ASTM 988
Acc. to JIS C 1604; a=0.00392 K <sup>-1</sup>	Pt25 Pt1000	• Type D	W3%-Re acc. to ASTM 988
According to IEC 60751	Ni25 Ni1000	• Type E	NiCr-CuNi acc. to IEC 584
Special type	Via special characteristic (max. 30	<ul> <li>Type J</li> <li>Type K</li> </ul>	Fe-CuNi acc. to IEC 584 NiCr-Ni acc. to IEC 584
	points)	• Type L	Fe-CuNi acc. to DIN 43710
Sensor factor	0.25 10 (adaptation of the basic type, e.g. Pt100 to version Pt25	• Type N	NiCrSi-NiSi acc. to IEC 584
	1000)	• Type R	Pt13Rh-Pt acc. to IEC 584
Jnits	°C or °F	• Type S	Pt10Rh-Pt acc. to IEC 584
Connection		• Type T	Cu-CuNi acc. to IEC 584 Cu-CuNi acc. to DIN 43710
Standard connection	1 resistance thermometer (RTD) in 2-	• Type U	
	wire, 3-wire or 4-wire connection	Units	°C or °F
Averaging	2 resistance thermometers in 2-wire connection for generation of average	Connection	
	temperature	Standard connection	1 thermocouple (TC)
<ul> <li>Differentiation</li> </ul>	2 resistance thermometers (RTD) in	<ul><li>Averaging</li><li>Differentiation</li></ul>	2 thermocouples (TC) 2 thermocouples (TC) (TC1 – TC2 c
	2-wire connection (RTD 1 – RTD 2 or RTD 2 – RTD 1)		TC2 – TC1)
Connection		Response time T <sub>63</sub>	≤ 250 ms for 1 sensor with break
<ul> <li>2-wire connection</li> </ul>	Line resistance can be configured		monitoring
	$\leq 100 \Omega$ (loop resistance)	Break monitoring	Can be switched off
• 3-wire connection	No trim necessary	Reference junction compensation	
4-wire connection	No trim necessary	• Internal	With integrated Pt100 resistance th
Sensor current	≤ 0.45 mA	• External	mometer With external Pt100 IEC 60751 (2-w
Response time T <sub>63</sub>	≤ 250 ms for 1 sensor with break	External	or 3-wire connection)
	monitoring	<ul> <li>External fixed</li> </ul>	Reference junction temperature can be set as fixed value
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)
Measuring range	Assignable (see "Digital measuring error" table)	Min. measuring span	Min. 40 100 °C (72 180 °F) (se "Digital measuring error" table)
Min. measuring span	10 °C (18 °F)	Characteristic curve	Temperature-linear or special chara
Characteristic curve	Temperature-linear or special charac-		teristic
	teristic	mV sensor	
Resistance-based sensor		Measured variable	DC voltage
Measured variable	Actual resistance	Sensor type	DC voltage source (DC voltage source possible over an externally
Sensor type	Resistance-based, potentiometers		connected resistor)
Units	Ω	Units	mV
Connection <ul> <li>Standard connection</li> </ul>	1 resistance-based sensor (R) in 2-	Response time $T_{63}$	≤ 250 ms for 1 sensor with break monitoring
	wire, 3-wire or 4-wire connection	Break monitoring	Can be switched off
Averaging	2 resistance-based sensors in 2-wire connection for averaging	Measuring range	Assignable max100 1100 mV
<ul> <li>Differentiation</li> </ul>	2 resistance thermometers in 2-wire	Min. measuring span	2 mV or 20 mV
	connection (R1 – R2 or R2 – R1)	0 1	
Connection		Overload capability of the input	-1.5 +3.5 V DC
Connection <ul> <li>2-wire connection</li> </ul>	Line resistance can be configured	Input resistance	$\geq 1 M\Omega$
	$\leq 100 \Omega$ (loop resistance)	Characteristic curve	Voltage-linear or special characteri
<ul> <li>3-wire connection</li> </ul>	No trim necessary		10
4-wire connection	No trim necessary		
Sensor current	≤ 0.45 mA		
Response time T <sub>63</sub>	≤ 250 ms for 1 sensor with break		
	monitoring		

Always active (cannot be switched off) Can be switched on/off (default value: OFF)

Assignable max. 0 ... 2200  $\Omega$  (see "Digital measuring error" table)

 $5 \dots 25 \ \Omega$  (see "Digital measuring error" table)

teristic

Resistance-linear or special charac-

Temperature transmitters **Rail transmitters** 

SITRANS TR200 (4 to 20 mA, universal)

#### icates and approvals

SITRANS TR200 (4 to 20 m/	a, universal)		
Output		Certificates and approvals	
Output signal	4 20 mA, 2-wire	Explosion protection ATEX	
Auxiliary power	11 35 V DC (to 30 V with Ex i/ic; to 32 V with Ex nA)	EC type-examination certificate <ul> <li>"Intrinsic safety" type of protection</li> </ul>	
Max. load	(U <sub>aux</sub> – 11 V)/0.023 A		
Overrange	3.6 23 mA, infinitely adjustable (default range: 3.84 mA 20.5 mA)	<ul> <li>"Non-sparking equipment" type of</li> </ul>	
Error signal (e.g. following sensor fault) (conforming to NE43)	3.6 23 mA, infinitely adjustable (default value: 22.8 mA)	protection Other certificates	
Sample cycle	0.25 s nominal	Software requirements for SIPROM	
Damping	Software filter 1st order 0 30 s (parameterizable)	PC operating system	
Protection	Against reverse polarity		
Galvanic isolation	Input against output 2.12 kV DC (1.5 kV <sub>rms</sub> AC)		
Measuring accuracy		Factory setting:	
Digital measuring error	See "Digital measuring error" table	<ul> <li>Pt100 (IEC 751); 3-wire conr</li> </ul>	
Reference conditions • Auxiliary power • Load • Ambient temperature • Warming-up time	24 V ± 1 % 500 Ω 23 ℃ > 5 min	<ul> <li>Measuring range: 0 100</li> <li>Fault current: 22.8 mA</li> <li>Sensor offset: 0 °C (0 °F)</li> <li>Damping 0.0 s</li> </ul>	
Error in the analog output (digital/analog converter)			
Error due to internal reference junctio	n < 0.5 °C (0.9 °F)		
Effect of ambient temperature • Analog measuring error • Digital measuring error - With resistance thermometer - With thermocouples	0.02 % of meas. span/10 °C (18 °F) 0.06 °C (0.11 °F)/10 °C (18 °F) 0.6 °C (1.1 °F)/10 °C (18 °F)		
Auxiliary power effect	< 0.001 % of meas. span/V		
Effect of load impedance	< 0.002 % of meas. span/100 $\Omega$		
Long-term drift • In the first month • After one year • After 5 years	< 0.02 % of measuring span < 0.2 % of measuring span < 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		

See "Dimensional drawings"

Max. 2.5 mm<sup>2</sup> (AWG 13)

IP20

in our anouro	1 12 01 / 12/12/002/1
ype of protection uipment" type of	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 II 3 G Ex nA IIC T6/T4
	NEPSI and EAC Ex
ents for SIPROM T	
m	Windows ME, 2000, XP, Win 7 and Win 8; in connection with RS 232 modem, also Windows 95, 98 and 98SE

PTB 07 ATEX 2032X

## ory setting:

- 00 (IEC 751); 3-wire connection
- asuring range: 0 ... 100 °C (32 ... 212 °F)
- ult current: 22.8 mA
- nsor offset: 0 °C (0 °F)
- mping 0.0 s

Dimensions

IEC 60529 • Enclosure

Cross-section of cables Degree of protection according to
Thermocouples

Input

#### Temperature measurement

Temperature transmitters

Rail transmitters

Digital accuracy

#### SITRANS TR200 (4 to 20 mA, universal)

measuring span

#### Digital measuring error

#### Resistance thermometer

Resistance-based sensor

Measuring

range Ω

0 ... 390

0 ... 2200

Input

Resistance

Resistance

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)

Minimum

Ω

5

25

measuring span

#### °C °C °C (°F) (°F) (°F) 100 ... 1820 (212 ... 3308) 2<sup>1)</sup> (3.6)<sup>1)</sup> Туре В 100 (180) 0 ... 2300 (32 ... 4172) Type C (W5) 100 (180) 2 (3.6)0 ... 2300 (32 ... 4172) 12) (1.8)<sup>2)</sup> Type D (W3) 100 (180) -200 ... +1000 Type E 50 (90) 1 (1.8)(-328 ... +1832) Type J -200 ... +1200 50 (90) 1 (1.8) (-328 ... +2192) -200 ... +1370 (-328 ... +2498) Type K 50 (90) 1 (1.8)-200 ... +900 Type L 50 (90)1 (1.8) (-328 ... +1652) Type N -200 ... +1300 50 (90)1 (1.8)(-328 ... +2372) -50 ... +1760 (-58 ... +3200) Type R 100 (180) 2 (3.6) Type S -50 ... +1760 100 (180) 2 (3.6)(-58 ... +3200) -200 ... +400 Туре Т 40 (72)1 (1.8)(-328 ... +752) 2 Type U -200 ... +600 50 (90)(3.6)(-328 ... +1112)

Measuring range Minimum

<sup>1)</sup> 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

**Digital accuracy** 

Ω

0.05

0.25

Input	Measuring Minimum range measuring s		Digital accuracy pan		
	mV	mV	μ		
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). 2

Temperature transmitters **Rail transmitters** 

#### SITRANS TR200 (4 to 20 mA, universal)

#### Selection and ordering data

	Article No.	Accessories
SITRANS TR200 rail transmitter Installation on mounting rail 2-wire system, 4 to 20 mA, programmable, with galvanic isolation • Without explosion protection • With explosion protection according to ATEX	7NG3032-0JN00 7NG3032-1JN00	Article No Additional accessories for assembly, connec- tion and transmitter configuration, see page 2/154. Modem Modem Modem with USB interface and SIPROM T soft- 7NG3092-
Options	Order code	ware
Append suffix "-Z" to article no., add order code and plain text, if applicable.		For supply units, see Catalog FI01 section "Supple ponents"
With test report (5 measuring points)	C11	Ordering example 1:
Functional safety SIL2	C20	7NG3032-0JN00-Z Y01+Y17+Y29+U03
Functional safety SIL2/3	C23	Y01: -10 +100 °C
Customer-specific programming		Y17: TICA123
Measuring range to be set	Y01 <sup>1)</sup>	Y29: TICA123
Specify in plain text (max. 5 digits): Y01: to °C, °F		Ordering example 2:
Measuring point number (TAG) max. 8 charac- ters	Y17 <sup>2)</sup>	7NG3032-0JN00-Z Y01+Y17+Y23+Y29+U25
Measuring point description, max. 16 characters	Y23 <sup>2)</sup>	Y01: -10 +100 °C
Measuring point message, max. 32 characters	Y24 <sup>2)</sup>	Y17: TICA123
Text on front plate, max. 16 characters	Y29 <sup>2)3)</sup>	Y23: TICA123HEAT
Pt100 (IEC) 2-wire, R <sub>I</sub> = 0 W	U02 <sup>4)</sup>	Y29: TICA123HEAT
Pt100 (IEC) 3-wire	U03 <sup>4)</sup>	Factory setting:
Pt100 (IEC) 4-wire	U04 <sup>4)</sup>	<ul> <li>Pt100 (IEC 751); 3-wire connection</li> </ul>
Type B thermocouple	U20 <sup>4)5)</sup>	• Measuring range: 0 100 °C (32 212 °F)
Type C thermocouple (W5)	U21 <sup>4)5)</sup>	Fault current: 22.8 mA
Type D thermocouple (W3)	U22 <sup>4)5)</sup>	• Sensor offset: 0 °C (0 °F)
Type E thermocouple	U23 <sup>4)5)</sup>	• Damping 0.0 s
Type J thermocouple	U24 <sup>4)5)</sup>	
Type K thermocouple	U25 <sup>4)5)</sup>	
Type L thermocouple	U26 <sup>4)5)</sup>	
Type N thermocouple	U27 <sup>4)5)</sup>	
Type R thermocouple	U28 <sup>1)4)5)</sup>	
Type S thermocouple	U29 <sup>4)5)</sup>	
Type T thermocouple	U30 <sup>4)5)</sup>	
Type U thermocouple	U31 <sup>4)5)</sup>	
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 set- ting in plain text	Y09 <sup>6)</sup>	
Fault current 3.6 mA (instead of 22.8 mA)	U36 <sup>2)</sup>	

<sup>1)</sup> For customer-specific programming for RTD and TC, the start value and the end value of the required measuring span must be specified here.

<sup>2)</sup> For this selection, Y01 or Y09 must also be selected.

<sup>3)</sup> Text on front plate is not saved in the device.

<sup>4)</sup> For this selection, Y01 must also be selected.

<sup>5)</sup> Internal reference junction compensation is selected as the default for TC.

<sup>6)</sup> 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.

	Article No.
Additional accessories for assembly, connec- tion and transmitter configuration, see page 2/154.	
Modem Modem with USB interface and SIPROM T soft- ware	7NG3092-8KN
For supply units, see Catalog FI01 section ponents"	"Supplementary com-
Ordering example 1:	

Temperature transmitters Rail transmitters

SITRANS TR200 (4 to 20 mA, universal)



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 (-) 5, 6, 7 and 8	Power supply U <sub>aux</sub> , output current I <sub>out</sub> Sensor connection, see schematics

SITRANS TR200, connector assignment

Temperature transmitters Rail transmitters



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SITRANS TR200, sensor connection assignment

Temperature transmitters Rail transmitters

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

#### 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.



Temperature transmitters Rail transmitters

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

#### Technical specifications

2

Input		Thermocouples	
Resistance thermometer		Measured variable	Temperature
Measured variable	Temperature	Sensor type (thermocouples)	
Sensor type		• Type B	Pt30Rh-Pt6Rh acc. to IEC 584
According to IEC 60751	Pt25 Pt1000	• Type C	W5%-Re acc. to ASTM 988
• Acc. to JIS C 1604; a=0.00392 K <sup>-1</sup>	Pt25 Pt1000	• Type D	W3%-Re acc. to ASTM 988 NiCr-CuNi acc. to IEC 584
<ul> <li>According to IEC 60751</li> </ul>	Ni25 Ni1000	• Type E • Type J	Fe-CuNi acc. to IEC 584
<ul> <li>Special type</li> </ul>	Via special characteristic (max. 30	• Type J • Type K	NiCr-Ni acc. to IEC 584
	points)	• Type L	Fe-CuNi acc. to DIN 43710
Sensor factor	0.25 10 (adaptation of the basic	• Type N	NiCrSi-NiSi acc. to IEC 584
	type, e.g. Pt100 to version Pt25 1000)	• Type R	Pt13Rh-Pt acc. to IEC 584
11-3-	°C or °F	• Type S	Pt10Rh-Pt acc. to IEC 584
Units	°C or °F	• Type T	Cu-CuNi acc. to IEC 584
Connection		• Type U	Cu-CuNi acc. to DIN 43710
<ul> <li>Standard connection</li> </ul>	1 resistance thermometer (RTD) in 2- wire, 3-wire or 4-wire connection	Units	°C or °F
Averaging	2 identical resistance thermometers	Connection	
	in 2-wire connection for generation of average temperature	<ul> <li>Standard connection</li> </ul>	1 thermocouple (TC)
Differentiation	2 identical resistance thermometers	Averaging	2 thermocouples (TC)
Difformation	(RTD) in 2-wire connection (RTD 1 – RTD 2 or RTD 2 – RTD 1)	Differentiation	2 thermocouples (TC) (TC1 – TC2 c TC2 – TC1)
Connection		Response time $\mathrm{T}_{63}$	≤ 250 ms for 1 sensor with break monitoring
2-wire connection	Line resistance can be configured $\leq 100 \Omega$ (loop resistance)	Break monitoring	Can be switched off
3-wire connection	No trim necessary	Reference junction compensation	
4-wire connection	No trim necessary	Internal	With integrated Pt100 resistance the mometer
Sensor current	≤ 0.45 mA	External	With external Pt100 IEC 60751 (2-wi
Response time T <sub>63</sub>	≤ 250 ms for 1 sensor with break monitoring	External fixed	or 3-wire connection) Reference junction temperature car
Break monitoring	Always active (cannot be switched off)		be set as fixed value
Short-circuit monitoring	Can be switched on/off (default value: ON)	Measuring range	Assignable (see "Digital measuring error" table)
Measuring range	Assignable (see "Digital measuring error" table)	Min. measuring span	Min. 40 100 °C (72 180 °F) (se "Digital measuring error" table)
Min. measuring span	10 °C (18 °F)	Characteristic curve	Temperature-linear or special chara teristic
Characteristic curve	Temperature-linear or special charac- teristic	mV sensor	lensile
Resistance-based sensor		Measured variable	DC voltage
Measured variable	Actual resistance	Sensor type	DC voltage source (DC voltage
Sensor type	Resistance-based, potentiometers		source possible over an externally connected resistor)
Units	Ω	Units	mV
Connection <ul> <li>Standard connection</li> </ul>	1 resistance-based sensor (R) in 2-	Response time $\mathrm{T}_{63}$	≤ 250 ms for 1 sensor with break monitoring
Averaging	wire, 3-wire or 4-wire connection 2 resistance-based sensors in 2-wire	Break monitoring	Can be switched off
5 5	connection for averaging	Measuring range	Assignable max100 1100 mV
Differentiation	2 resistance thermometers in 2-wire connection	Min. measuring span	2 mV or 20 mV
	(R1 – R2 or R2 – R1)	Overload capability of the input	-1.5 +3.5 V DC
Connection		Input resistance	$\geq 1 M\Omega$
2-wire connection	Line resistance can be configured $\leq 100 \Omega$ (loop resistance)	Characteristic curve	Voltage-linear or special characteri
3-wire connection	No trim necessary		tic
4-wire connection	No trim necessary		
Sensor current	≤ 0.45 mA		
Response time T <sub>63</sub>	≤ 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

Min. measuring span

Characteristic curve

 $5 \hdots 25 \ensuremath{\Omega}$  (see "Digital measuring error" table) Resistance-linear or special charac-teristic

Assignable max. 0 ... 2200  $\Omega$  (see "Digital measuring error" table)

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Temperature transmitters

Rail transmitters

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

Output	
Output signal	4 20 mA, 2-wire with communica-
Auxiliary power	tion acc. to HART Rev. 5.9 11 35 V DC (to 30 V with Ex i/ic; to
	32 V with Ex nA)
Max. load	(U <sub>aux</sub> – 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 <sub>rms</sub> AC)
Measuring accuracy	
Digital measuring error	See "Digital measuring error" table
Reference conditions <ul> <li>Auxiliary power</li> </ul>	24 V ± 1 %
• Load	500 Ω
<ul><li>Ambient temperature</li><li>Warming-up time</li></ul>	23 °C > 5 min
Error in the analog output (digital/ana-	
log converter)	<b>.</b> .
Error due to internal reference junction	< 0.5 °C (0.9 °F)
Effect of ambient temperature • Analog measuring error of measur-	< 0.02% of max. meas. span/10 °C
<ul><li>ing span</li><li>Digital measuring error</li></ul>	(18 °F) 0.06 °C (0.11 °F)/10 °C (18 °F)
<ul> <li>With resistance thermometers</li> <li>With thermocouples</li> </ul>	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 $\Omega$
Long-term drift	
<ul><li>In the first month</li><li>After one year</li></ul>	< 0.02 % of measuring span < 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 <sup>2</sup> (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
<ul> <li>"Intrinsic safety" type of protection</li> </ul>	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
• "Non oparking aggingest" time of	II 2(1) D Ex iaD/ibD 20/21 T115 °C
<ul> <li>"Non-sparking equipment" type of protection</li> </ul>	II 3 G Ex nA IIC T6/T4
Other certificates	EAC Ex(GOST) and NEPSI

Factory setting:
• Pt100 (IEC 751); 3-wire connection

•	PLIOU (IEC 751), S-wire connection
•	Measuring range: 0 100 °C (32 212 °F)

- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

Temperature transmitters Rail transmitters

#### 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)

# Thermocouples

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Input	Measuring range	Minimum measuring span		Digital accuracy	
	°C (°F)	°C	(°F)	°C	(°F)
Туре В	100 1820 (212 3308)	100	(180)	2 <sup>1)</sup>	(3.6) <sup>1)</sup>
Type C (W5)	0 2300 (32 4172)	100	(180)	2	(3.6)
Type D (W3)	0 2300 (32 4172)	100	(180)	1 <sup>2)</sup>	(1.8) <sup>2)</sup>
Туре Е	-200 +1000 (-328 +1832)	50	(90)	1	(1.8)
Туре Ј	-200 +1200 (-328 +2192)	50	(90)	1	(1.8)
Туре К	-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)
Туре Т	-200 +400 (-328 +752)	40	(72)	1	(1.8)
Туре 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).

<sup>2)</sup> 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	μ
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).

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

Temperature transmitters

**Rail transmitters** 

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

	Article No.	Accessories	
SITRANS TR300 rail transmitter Installation on mounting rail			Article No
2-wire system, 4 20 mA, HART, with galvanic isolation		Additional accessories for assembly, connec- tion and transmitter configuration, see page 2/154.	
<ul> <li>Without explosion protection</li> </ul>	7NG3033-0JN00	Modem	
With explosion protection according to ATEX	7NG3033-1JN00	Modern with USB interface	7MF4997
Options	Order code	SIMATIC PDM operating software	See sect
Append suffix "-Z" to article no., add order code and plain text, if applicable.		For supply units, see Catalog FI01 sect	
With test report (5 measuring points)	C11	ponents"	
Functional safety SIL2	C20	Ordering example 1:	
Functional safety SIL2/3	C23	7NG3033-0JN00-Z Y01+Y17+Y29+U03	3
Customer-specific programming		Y01: -10 +100 °C	
Measuring range to be set	Y01 <sup>1)</sup>	Y17: TICA123	
Specify in plain text (max. 5 digits): Y01: to °C, °F		Y29: TICA123	
Measuring point number (TAG) max. 8 charac- ters	Y17 <sup>2)</sup>	Ordering example 2: 7NG3033-0JN00-Z Y01+Y17+Y23+Y29	9+U25
Measuring point description, max. 16 characters	Y23 <sup>2)</sup>	Y01: -10 +100 °C	
Measuring point message, max. 32 characters	Y24 <sup>2)</sup>	Y17: TICA123	
Text on front plate, max. 16 characters	Y29 <sup>2)3)</sup>	Y23: TICA123HEAT	
Pt100 (IEC) 2-wire, $R_L = 0 \Omega$	U02 <sup>4)</sup>	Y29: TICA123HEAT	
Pt100 (IEC) 3-wire	U03 <sup>4)</sup>	Factory setting:	
Pt100 (IEC) 4-wire	U04 <sup>4)</sup>	<ul> <li>Pt100 (IEC 751); 3-wire connection</li> </ul>	
Type B thermocouple	U20 <sup>4)5)</sup>	• Measuring range: 0 100 °C (32	212 °F)
Type C thermocouple (W5)	U21 <sup>4)5)</sup>	<ul> <li>Fault current in the event of sensor b</li> </ul>	,
Type D thermocouple (W3)	U22 <sup>4)5)</sup>	<ul> <li>Sensor offset: 0 °C (0 °F)</li> </ul>	
Type E thermocouple	U23 <sup>4)5)</sup>	Damping 0.0 s	
Type J thermocouple	U24 <sup>4)5)</sup>		
Type K thermocouple	U25 <sup>4)5)</sup>		
Type L thermocouple	U26 <sup>4)5)</sup>		
Type N thermocouple	U27 <sup>4)5)</sup>		
Type R thermocouple	U28 <sup>4)5)</sup>		
Type S thermocouple	U29 <sup>4)5)</sup>		
Type T thermocouple	U30 <sup>4)5)</sup>		
Type U thermocouple	U31 <sup>4)5)</sup>		
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 set- ting in plain text	Y09 <sup>6)</sup>		
Fault current 3.6 mA (instead of 22.8 mA)	U36 <sup>2)</sup>		
1)			

<sup>1)</sup> For customer-specific programming for RTD and TC, the start value and the end value of the required measuring span must be specified here.

<sup>2)</sup> For this selection, Y01 or Y09 must also be selected.

<sup>3)</sup> Text on front plate is not saved in the device.

Coloction and ordering date

<sup>4)</sup> For this selection, Y01 must also be selected.

<sup>5)</sup> Internal reference junction compensation is selected as the default for TC.

<sup>6)</sup> 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.

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

lementary com-

22.8 mA

Temperature transmitters **Rail transmitters** 

#### Dimensional drawings



## Circuit diagrams

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SITRANS TR300, connector assignment

SITRANS TR300, dimensions in mm (inch)

Temperature transmitters **Rail transmitters** 

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





Cold junction compensation internal/fixed value



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



Cold junction compensation with external Pt100 in 3-wire system



Generation of average value / difference with internal cold junction compensation







2-wire system 1)



3-wire system



4-wire system



Generation of average value/difference 1)

<sup>1)</sup> Programmable line resistance for the purpose of correction.



SITRANS TR300, sensor connection assignment

Resistance thermometer

RTD

2-wire system 1)

RTD

RTD

4-wire system

RTD1

Generation of average

value/difference 1)

3-wire system

Temperature transmitters Rail transmitters

#### 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)

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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.

Rail transmitters

SITRANS TR320 (HART, universal)

#### 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.



SITRANS TR320 function block diagram

#### Temperature transmitters Rail transmitters

## SITRANS TR320 (HART, universal)

## Technical specifications

General		Thermocouples (TC)	
Supply voltage <sup>1) 2)</sup>		Input type	
<ul> <li>Without explosion protection (non- Ex)</li> </ul>	7.5 48 V DC	• B	IEC 60584-1
<ul> <li>with explosion protection (Ex i)</li> </ul>	7.5 30 V DC	• E • J	IEC 60584-1 IEC 60584-1
Additional minimum supply voltage	0.8 V	• K	IEC 60584-1
when using test terminals		• L	DIN 43710
Maximum power loss	≤ 850 mW	• Lr • N	GOST 3044-84 IEC 60584-1
Minimum load resistance at supply	(V <sub>supply</sub> - 37 V)/23 mA	• R	IEC 60584-1
voltage > 37 V		• S	IEC 60584-1
<ul><li>Insulation voltage, test/operation</li><li>Without explosion protection (non-</li></ul>	2.5 kV AC/55 V AC	• T	IEC 60584-1
Ex)		• U • W3	DIN 43710 ASTM E988-96
<ul> <li>with explosion protection (Ex i)</li> </ul>	2.5 kV AC/42 V AC	• W5	ASTM E988-96
Polarity protection	All inputs and outputs	• LR	GOST 3044-84
Write protection	Open circuits or software	Cold junction compensation (CJC)	Constant, internal or external over Pt100 or Ni100 RTD
Warming-up time	< 5 min	Temperature range internal CJC	-50 +100 °C (-58 +212 °F)
Starting time	< 2.75 s	Connection external CJC	2-wire or 3-wire
Programming	HART	<ul> <li>External CJC, line resistance per wire (for 3-wire and 4-wire connec-</li> </ul>	50 Ω
Signal-to-noise ratio	> 60 dB	tions)	
Long-term stability	Better than: • ± 0.05% of measuring span/year	<ul> <li>Effect of the line resistance (with 3- wire and 4-wire connections)</li> </ul>	< 0.002 Ω/Ω
	<ul> <li>± 0.05% of measuring span/year</li> <li>± 0.18% of measuring span/5 years</li> </ul>	Input current external CJC	< 0.15 mA
Response time	4 20 mA: ≤ 55 ms	Temperature range external CJC	-50 +135 °C (-58 +275 °F)
	HART: ≤ 75 ms (typically 70 ms)	<ul> <li>Cable, wire-wire capacity</li> <li>Total line resistance</li> </ul>	Max. 50 nF Max. 10 kΩ
Programmable damping	0 60 s	<ul> <li>Fault detection, programmable</li> </ul>	None, short-circuited, defective,
Signal dynamic			short-circuited or defective
• Input	24 bit		Note
Output	18 bit		The short-circuited fault detection only applies to the CJC input.
Influence of change in supply voltage	< 0.005% of measuring span/v DC	<ul> <li>Fault detection time (TC)</li> </ul>	≤ 75 ms (typically 70 ms)
Input		<ul> <li>Fault detection time, external CJC (for 3-wire and 4-wire)</li> </ul>	≤ 2 000 ms
Resistance thermometer (RTD)		(	
loout two		Linear resistance	
Input type • Pt10 10000	• IEC 60751	Linear resistance	0 100 kQ
Input type • Pt10 10000	• IEC 60751 • JIS C 1604-8	Input range	0 100 kΩ 25 Ω
		Input range Minimum measuring span	25 Ω
	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> </ul>	Input range Minimum measuring span Type of connection	25 Ω 2-wire, 3-wire or 4-wire
• Pt10 10000 • Ni10 10000	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> </ul>	Input range Minimum measuring span Type of connection Line resistance per wire	25 $\Omega$ 2-wire, 3-wire or 4-wire Max. 50 $\Omega$
• Pt10 10000	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> </ul>	Input range Minimum measuring span Type of connection Line resistance per wire Input current	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA
• Pt10 10000 • Ni10 10000	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>Edison Copper Winding No. 15</li> </ul>	Input range Minimum measuring span Type of connection Line resistance per wire	25 $\Omega$ 2-wire, 3-wire or 4-wire Max. 50 $\Omega$
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> </ul>	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>Edison Copper Winding No. 15</li> <li>GOST 6651-2009/OIML R84:2003</li> </ul>	Input range Minimum measuring span Type of connection Line resistance per wire Input current Effect of the line resistance (with 3-	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 Ω/Ω
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection</li> </ul>	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>Edison Copper Winding No. 15</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>2-wire, 3-wire or 4-wire</li> </ul>	Input range Minimum measuring span Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections) Cable, wire-wire capacity • R > 400 Ω	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 Ω/Ω Max. 30 nF
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection</li> <li>Line resistance per wire</li> <li>Input current</li> <li>Effect of the line resistance (with 3-</li> </ul>	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>Edison Copper Winding No. 15</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>2-wire, 3-wire or 4-wire</li> <li>Max. 50 Ω</li> </ul>	Input range Minimum measuring span Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections) Cable, wire-wire capacity • $R > 400 \Omega$ • $R \le 400 \Omega$	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 Ω/Ω Max. 30 nF Max. 50 nF
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections)</li> </ul>	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>Edison Copper Winding No. 15</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>2-wire, 3-wire or 4-wire</li> <li>Max. 50 Ω</li> <li>&lt; 0.15 mA</li> </ul>	Input range Minimum measuring span Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections) Cable, wire-wire capacity • $R > 400 \Omega$ • $R \le 400 \Omega$ Fault detection, programmable	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 Ω/Ω Max. 30 nF
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current Effect of the line resistance (with 3-wire and 4-wire connections) Cable, wire-wire capacity</li></ul>	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>Edison Copper Winding No. 15</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>2-wire, 3-wire or 4-wire</li> <li>Max. 50 Ω</li> <li>&lt; 0.15 mA</li> <li>&lt; 0.002 Ω/Ω</li> </ul>	Input range Minimum measuring span Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections) Cable, wire-wire capacity • $R > 400 \Omega$ • $R \le 400 \Omega$ Fault detection, programmable Potentiometers	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 Ω/Ω Max. 30 nF Max. 50 nF None, defective
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections)</li> </ul>	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>Edison Copper Winding No. 15</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>2-wire, 3-wire or 4-wire</li> <li>Max. 50 Ω</li> <li>&lt; 0.15 mA</li> </ul>	Input range Minimum measuring span Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections) Cable, wire-wire capacity • $R > 400 \Omega$ • $R \le 400 \Omega$ Fault detection, programmable <u>Potentiometers</u> Input range	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 Ω/Ω Max. 30 nF Max. 50 nF None, defective 10 100 kΩ
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current Effect of the line resistance (with 3-wire and 4-wire connections) Cable, wire-wire capacity Pt1000, Pt10000 (IEC 60751 and</li></ul>	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>Edison Copper Winding No. 15</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>2-wire, 3-wire or 4-wire</li> <li>Max. 50 Ω</li> <li>&lt; 0.15 mA</li> <li>&lt; 0.002 Ω/Ω</li> </ul>	Input range Minimum measuring span Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections) Cable, wire-wire capacity • $R > 400 \Omega$ • $R \le 400 \Omega$ Fault detection, programmable <u>Potentiometers</u> Input range Minimum measuring span	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 Ω/Ω Max. 30 nF Max. 50 nF None, defective 10 100 kΩ 25 Ω
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current</li> <li>Effect of the line resistance (with 3- wire and 4-wire connections)</li> <li>Cable, wire-wire capacity</li> <li>Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8)</li> </ul>	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>Edison Copper Winding No. 15</li> <li>GOST 6651-2009/OIML R84:2003</li> <li>2-wire, 3-wire or 4-wire</li> <li>Max. 50 Ω</li> <li>&lt; 0.15 mA</li> <li>&lt; 0.002 Ω/Ω</li> <li>Max. 30 nF</li> <li>Max. 50 nF</li> <li>None, short-circuited, defective,</li> </ul>	Input range Minimum measuring span Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections) Cable, wire-wire capacity • $R > 400 \Omega$ • $R \le 400 \Omega$ Fault detection, programmable <u>Potentiometers</u> Input range Minimum measuring span Type of connection	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF Max. 30 nF Max. 50 nF None, defective 10 100 kΩ 25 Ω 3-wire or 4-wire
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current Effect of the line resistance (with 3-wire and 4-wire connections) Cable, wire-wire capacity Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8) All other input types</li></ul>	• JIS C 1604-8 • GOST 6651_2009 • Callendar-Van Dusen • DIN 43760-1987 • GOST 6651-2009/OIML R84:2003 • Edison Copper Winding No. 15 • GOST 6651-2009/OIML R84:2003 2-wire, 3-wire or 4-wire Max. 50 $\Omega$ < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF Max. 50 nF None, short-circuited, defective, short-circuited or defective	Input range Minimum measuring span Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections) Cable, wire-wire capacity • $R > 400 \Omega$ • $R \le 400 \Omega$ Fault detection, programmable <u>Potentiometers</u> Input range Minimum measuring span Type of connection Line resistance per wire	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF Max. 30 nF Max. 50 nF None, defective 10 100 kΩ 25 Ω 3-wire or 4-wire Max. 50 Ω
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<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current Effect of the line resistance (with 3-wire and 4-wire connections) Cable, wire-wire capacity Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8) All other input types</li></ul>	• JIS C 1604-8 • GOST 6651_2009 • Callendar-Van Dusen • DIN 43760-1987 • GOST 6651-2009/OIML R84:2003 • Edison Copper Winding No. 15 • GOST 6651-2009/OIML R84:2003 2-wire, 3-wire or 4-wire Max. 50 $\Omega$ < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF None, short-circuited, defective, short-circuited or defective Note When the low limit for the configured input type is below the constant	Input range Minimum measuring span Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections) Cable, wire-wire capacity • $R > 400 \Omega$ • $R \le 400 \Omega$ Fault detection, programmable <u>Potentiometers</u> Input range Minimum measuring span Type of connection Line resistance per wire Input current Effect of the line resistance (with 4-	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF Max. 30 nF Max. 50 nF None, defective 10 100 kΩ 25 Ω 3-wire or 4-wire Max. 50 Ω
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current Effect of the line resistance (with 3-wire and 4-wire connections) Cable, wire-wire capacity Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8) All other input types</li></ul>	• JIS C 1604-8 • GOST 6651_2009 • Callendar-Van Dusen • DIN 43760-1987 • GOST 6651-2009/OIML R84:2003 • Edison Copper Winding No. 15 • GOST 6651-2009/OIML R84:2003 2-wire, 3-wire or 4-wire Max. 50 $\Omega$ < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF Max. 30 nF None, short-circuited, defective, short-circuited or defective <b>Note</b> When the low limit for the configured input type is below the constant detection limit for short-circuited inputs, the detection of short circuits	Input range Minimum measuring span Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections) Cable, wire-wire capacity • $R > 400 \Omega$ • $R \le 400 \Omega$ Fault detection, programmable <u>Potentiometers</u> Input range Minimum measuring span Type of connection Line resistance per wire Input current Effect of the line resistance (with 4- wire and 5-wire connections)	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF Max. 50 nF None, defective 10 100 kΩ 25 Ω 3-wire or 4-wire Max. 50 Ω < 0.15 mA
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<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections)</li> <li>Cable, wire-wire capacity</li> <li>Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8)</li> <li>All other input types</li> <li>Fault detection, programmable</li> </ul>	• JIS C 1604-8 • GOST 6651_2009 • Callendar-Van Dusen • DIN 43760-1987 • GOST 6651-2009/OIML R84:2003 • Edison Copper Winding No. 15 • GOST 6651-2009/OIML R84:2003 2-wire, 3-wire or 4-wire Max. 50 $\Omega$ < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF 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 input, the detection of short circuits is disabled regardless of the configu- ration of the fault detection. 15 $\Omega$	Input range Minimum measuring span Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections) Cable, wire-wire capacity • $R > 400 \Omega$ • $R \le 400 \Omega$ Fault detection, programmable <u>Potentiometers</u> Input range Minimum measuring span Type of connection Line resistance per wire Input current Effect of the line resistance (with 4- wire and 5-wire connections) Cable, wire-wire capacity • $R > 400 \Omega$	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF Max. 30 nF Max. 50 nF None, defective 10 100 kΩ 25 Ω 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections) Cable, wire-wire capacity</li> <li>Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8)</li> <li>All other input types Fault detection, programmable</li> </ul> Detection limit for short-circuited input Fault detection time (RTD)	• JIS C 1604-8 • GOST 6651_2009 • Callendar-Van Dusen • DIN 43760-1987 • GOST 6651-2009/OIML R84:2003 • Edison Copper Winding No. 15 • GOST 6651-2009/OIML R84:2003 2-wire, 3-wire or 4-wire Max. 50 $\Omega$ < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF Max. 30 nF 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 configu- ration of the fault detection. 15 $\Omega$ $\leq$ 75 ms (typically 70 ms)	Input range Minimum measuring span Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections) Cable, wire-wire capacity • $R > 400 \Omega$ • $R \le 400 \Omega$ Fault detection, programmable <u>Potentiometers</u> Input range Minimum measuring span Type of connection Line resistance per wire Input current Effect of the line resistance (with 4- wire and 5-wire connections) Cable, wire-wire capacity • $R > 400 \Omega$	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF Max. 30 nF Max. 50 nF None, defective 10 100 kΩ 25 Ω 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF
<ul> <li>Pt10 10000</li> <li>Ni10 10000</li> <li>Cu5 1000</li> <li>Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections)</li> <li>Cable, wire-wire capacity</li> <li>Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8)</li> <li>All other input types</li> <li>Fault detection, programmable</li> </ul>	• JIS C 1604-8 • GOST 6651_2009 • Callendar-Van Dusen • DIN 43760-1987 • GOST 6651-2009/OIML R84:2003 • Edison Copper Winding No. 15 • GOST 6651-2009/OIML R84:2003 2-wire, 3-wire or 4-wire Max. 50 $\Omega$ < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF Max. 30 nF 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 configu- ration of the fault detection. 15 $\Omega$ $\leq$ 75 ms (typically 70 ms)	Input range Minimum measuring span Type of connection Line resistance per wire Input current Effect of the line resistance (with 3- wire and 4-wire connections) Cable, wire-wire capacity • $R > 400 \Omega$ • $R \le 400 \Omega$ Fault detection, programmable <u>Potentiometers</u> Input range Minimum measuring span Type of connection Line resistance per wire Input current Effect of the line resistance (with 4- wire and 5-wire connections) Cable, wire-wire capacity • $R > 400 \Omega$	25 Ω 2-wire, 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF Max. 30 nF Max. 50 nF None, defective 10 100 kΩ 25 Ω 3-wire or 4-wire Max. 50 Ω < 0.15 mA < 0.002 $\Omega/\Omega$ Max. 30 nF

2

SITRANS TR320 (HART, universal)

Temperature transmitters

Rail transmitters

		311.64	ANS THSZU (HANT, UNIVERSAI)
Fault detection, programmable	None, short-circuited, defective, short-circuited or defective	Design	
	Note	Weight	122 g (0.27 lb)
	When the configured potentiometer	Maximum core cross-section	2.5 mm <sup>2</sup> (AWG 13)
	size is below the constant detection limit for short-circuited inputs, the	Tightening torque for clamping screws	0.5 0.6 Nm
	detection of short circuits is disabled regardless of the configuration of the	Vibrations	IEC 60068-2-6
	fault detection.	• 2 25 Hz	± 1.6 mm (0.07 inch)
Detection limit for short-circuited input	15 Ω	• 25 100 Hz	± 4 g
Fault detection time, wiper arm (no short-circuit detection)	$\leq$ 75 ms (typically 70 ms)	Certificates and approvals Explosion protection ATEX/IECEx and	
Fault detection time, element	≤ 2 000 ms	others	
Fault detection time (for 4-wire and 5-wire)	≤ 2 000 ms	Certificates <sup>3)</sup>	DEKRA 17ATEX0116 X IECEx DEK 17.0054X
Voltage input			A5E43700604A-2018X
Measuring range		"Intrinsic safety ia/ib" type of protec-	For use in Zone 0, 1, 2, 20, 21, 22
<ul><li>Unipolar</li><li>Bipolar</li></ul>	-100 1700 mV -800 +800 mV	tion • ATEX	II 1 G Ex ia IIC T6 T4 Ga II 2(1) G Ex ib [ia Ga] IIC T6 T4
Minimum measuring span	2.5 mV		Gb
Input resistance	10 MΩ		II 1 D Ex ia IIIC Da I M1 Ex ia I Ma
Cable, wire-wire capacity		<ul> <li>IECEx and others</li> </ul>	Ex ia IIC T6 T4 Ga
<ul> <li>Input range: -100 1700 mV</li> <li>Input range: -20 100 mV</li> </ul>	Max. 30 nF Max. 50 nF		Ex ib [ia Ga] IIC T6 T4 Gb Ex ia IIIC Da Ex ia I Ma
Fault detection, programmable	None, defective	"Intrinsic safety ic" type of protection	For use in Zones 2 and 22
Fault detection time	≤ 75 ms (typically 70 ms)	• ATEX	II 2 G Ex ic IIC T6T4 Gc
Output and HART communication		<ul> <li>IECEx and others</li> </ul>	II 2 D Ex ic IIIC Dc Ex ic IIC T6 T4 Gc
Normal range, programmable	3.8 20.5 mA/20.5 3.8 mA		Ex ic IIIC Dc
Extended range (output limits), pro- grammable	3.5 23 mA/23 3.5 mA	"Non-sparking/increased safety nA/ec" type of protection	For use in Zones 2 and 22
Programmable input/output limits <ul> <li>Fault current</li> </ul>	Enable/disable	• ATEX	II 2 G Ex nA IIC T6T4 Gc II 2 G Ex ec IIC T6T4 Gc
<ul> <li>Fault current setting</li> </ul>	3.5 23 mA	<ul> <li>IECEx and others</li> </ul>	Ex nA IIC T6 T4 Gc Ex ec IIC T6 T4 Gc
Update time	10 ms		
Load (with current output)	≤ (V <sub>Supply</sub> - 7.5)/0.023 Ω	Explosion protection CSA/FM for Can- ada and USA	
Load stability	< 0.01% of meas. span/100 $\Omega$ (measuring span = currently selected range)	Certificates	CSA 1861385 FM18CA0024 FM18US0046
Input fault detection, programmable	3.5 23 mA	"Intrinsic safety ia" type of protection	IS, CL I, Div 1, GP ABCD, T6 T4
(detection of input short circuits is ignored with TC and voltage inputs)			Ex ia IIC T6 T4 Ga AEx ia IIC T6 T4 Ga or:
NAMUR NE43 Upscale	> 21 mA		Ex ib [ia Ga] IIC T6T4 Gb
NAMUR NE43 Downscale	< 3.6 mA	"Non incendive field wiring NIFW" type	AEx ib [ia Ga] IIC T6T4 Gb
HART protocol versions	HART 7	of protection	NIFW, CE I, DIV 2, GP ABCD 16 14
Measuring accuracy		"Non incendive NI" type of protection	NI, CL I, Div 2, GP ABCD T6T4
Input accuracy	See "Input accuracy" table		Ex nA IIC T6 T4 Gc AEx nA IIC T6 T4 Gc
Output accuracy	See "Output accuracy" table		
Rated conditions		<sup>1)</sup> Note that the minimum supply vol measured at the terminals of the SIT	
Ambient temperature	-50 +85 °C (-58 +185 °F)	All external voltage drops must be t	
Ambient temperature for devices with functional safety	-40 +80 °C (-40 +176 °F)	<sup>2)</sup> Protect the device from overvoltage supply or suitable overvoltage protection	ge with the help of a suitable power ection equipment.
Storage temperature	-50 +85 °C (-58 +185 °F)	<sup>3)</sup> Additional available certificates a	re listed on the Internet at
Reference temperature for sensor cal- ibration	24 °C ±1.0 °C (75.2 °F ±1.8 °F)	http://www.siemens.com/processins	
Relative humidity	< 99% (no condensation)		
Degree of protection			
<ul><li>Transmitter enclosure</li><li>Terminals</li></ul>	IP20 IP20		

Temperature transmitters Rail transmitters

## SITRANS TR320 (HART, universal)

#### Measuring ranges/Minimum measuring span

#### RTD

Input type	Standard	Measuring range in °C (°F)	α <sub>0</sub> in °C <sup>-1</sup> (°F <sup>-1</sup> )	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)
В	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)
<	IEC 60584-1	-180 +1 372 (-356 +2 502)	50 (122)
_	DIN 43710	-200 +900 (-392 +1 652)	50 (122)
_r	GOST 3044-84	-200 +800 (-392 +1 472)	50 (122)
N	IEC 60584-1	-180 +1 300 (-356 +2 372)	50 (122)
3	IEC 60584-1	-50 +1 760 (-122 +3 200)	100 (212)
6	IEC 60584-1	-50 +1 760 (-122 +3 200)	100 (212)
-	IEC 60584-1	-200 +400 (-392 +752)	50 (122)
J	DIN 43710	-200 +600 (-392 +1 112)	50 (122)
V3	ASTM E988-96	0 2 300 (32 4 172)	100 (212)
N5	ASTM E988-96	0 2 300 (32 4 172)	100 (212)
_R	GOST 3044-84	-200 +800 (-392 +1472)	50 (122)

#### Input accuracy

Basic values

Input type	Basic accuracy	Temperature coefficient <sup>1)</sup>
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	$\begin{split} T_{max.} &< 180 \ ^{\circ}\text{C} \ (356 \ ^{\circ}\text{F}) = \le \pm 0.08 \ ^{\circ}\text{C} \ (0.144 \ ^{\circ}\text{F}) \\ T_{max.} &> 180 \ ^{\circ}\text{C} \ (356 \ ^{\circ}\text{F}) = \le \pm 0.16 \ ^{\circ}\text{C} \ (0.288 \ ^{\circ}\text{F}) \end{split}$	≤ ±0.002 °C/°C (°F/°F)
Pt1000	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt2000	$\begin{split} T_{max.} &< 300 \ ^\circ C \ (572 \ ^\circ F) = \le \pm 0.08 \ ^\circ C \ (0.144 \ ^\circ F) \\ T_{max.} &> 300 \ ^\circ C \ (572 \ ^\circ F) = \le \pm 0.4 \ ^\circ C \ (0.72 \ ^\circ F) \end{split}$	≤ ±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)

Temperature transmitters

**Rail transmitters** 

#### SITRANS TR320 (HART, universal)

Input type	Basic accuracy	Temperature coefficient <sup>1)</sup>		
Ni2000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)		
Ni10000	≤ ±0.32 °C (0.576 °F)	$\leq \pm 0.002 \ ^{\circ}C/^{\circ}C \ (^{\circ}F/^{\circ}F)$		
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)	$\leq \pm 0.002 \ ^{\circ}C/^{\circ}C \ (^{\circ}F/^{\circ}F)$		
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	$\leq \pm 40 \text{ m}\Omega$	$\leq \pm 2 \text{ m}\Omega/^{\circ}\text{C} (1.11 \text{ m}\Omega/^{\circ}\text{F})$		
0 100 kΩ	$\leq \pm 4 \ \Omega$	$\leq \pm 0.2 \ \Omega/^{\circ}C \ (0.11 \ \Omega/^{\circ}F)$		
Potentiometers				
0 100%	< 0.05%	< ± 0.005%		
Voltage input				
mV: -20 100 mV	$\leq \pm 5 \mu V$	$\leq \pm 0.2 \ \mu V/^{\circ}C \ (0.11 \ \mu V/^{\circ}F)$		
mV: -100 1700 mV	≤ ±0.1 mV	$\leq \pm 36 \mu$ V/°C (20 $\mu$ V/°F)		
mV: ± 800 mV	≤ ±0.1 mV	$\leq \pm 32 \ \mu V/^{\circ}C \ (17.8 \ \mu V/^{\circ}F)$		
тс				
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)		
К	≤ ±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)		
Ν	≤ ±0.4 °C (0.72 °F)	≤ ±0.025 °C/°C (°F/°F)		
Т	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)		
U	< 0 °C (32 °F) ≤ ±0.8 °C (1.44 °F)	≤ ±0.025 °C/°C (°F/°F)		
	$\geq$ 0 °C (32 °F) $\leq$ ±0.4 °C (0.72 °F)			
Lr	≤ ±0.2 °C (0.36 °F)	$\leq \pm 0.1 \ ^{\circ}C/^{\circ}C \ (^{\circ}F/^{\circ}F)$		
R	< 200 °C (392 °F) ≤ ±0.5 °C (0.9 °F) ≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F)	$\leq \pm 0.1 ^{\circ}\text{C/}^{\circ}\text{C}  (^{\circ}\text{F/}^{\circ}\text{F})$		
S	< 200 °C (392 °F) ≤ ±0.5 °C (0.9 °F) ≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F)	$\leq \pm 0.1  ^{\circ}\text{C/}^{\circ}\text{C}  (^{\circ}\text{F/}^{\circ}\text{F})$		
W3	$\leq \pm 0.6 ^{\circ}\text{C}  (1.08 ^{\circ}\text{F})$	≤ ±0.1 °C/°C (°F/°F)		
W5	$\leq \pm 0.4 ^{\circ}$ C (0.72 $^{\circ}$ F)	$\leq \pm 0.1 \text{ °C/°C (°F/°F)}$		
B <sup>2)</sup>	≤ ±1 °C (1.8 °F)	$\leq \pm 0.1  ^{\circ} \text{C/}^{\circ} \text{C}  (^{\circ} \text{F/}^{\circ} \text{F})$		
B <sup>3)</sup>	≤ ±3 °C (5.4 °F)	$\leq \pm 0.1  ^{\circ} \text{C/}^{\circ} \text{C}  (^{\circ} \text{F/}^{\circ} \text{F})$		
B <sup>4)</sup>	$\leq \pm 8 ^{\circ} C  (14.4 ^{\circ} F)$	$\leq \pm 0.8 \text{ °C/°C} (°F/°F)$		
B <sup>5)</sup>	Not specified	Not specified		
CJC (internal)	< ±0.5 °C (0.9 °F)	Included in basic accuracy		
CJC (external)	$\leq \pm 0.08 ^{\circ}\text{C} (0.144 ^{\circ}\text{F})$	$\leq \pm 0.002 \text{ °C/°C (°F/°F)}$		
· · · · ·	· · · · · · · · · · · · · · · · · · ·	it accuracy		

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)

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

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

Output type Basic accuracy

Analog output

Temperature coefficient  $\begin{array}{ll} \leq \pm 1.6 \ \mu A \ (0.01\% \ of \ the \ full \\ \ output \ span) \end{array} \begin{array}{ll} \leq \pm 0.48 \ \mu A/K \ (\leq \pm 0.003\% \ of \\ \ the \ full \ output \ span/K) \end{array}$ 

Temperature transmitters Rail transmitters

## SITRANS TR320 (HART, universal)

#### Selection and ordering data

	Ar	ticle	e N	0			
SITRANS TR320 rail transmitter with 1 input	7N	IGO	32				
		-				- 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							
<ul> <li>Pt100 (IEC), 3-wire</li> <li>Pt100 (IEC), 4-wire</li> </ul>			B C				
• Pt1000 (IEC), 3-wire			D				
• Pt1000 (IEC), 4-wire			E				
TC							
• Туре В • Туре Е			F G				
• Type J			Н				
• Туре К			J				
• Type L			K L				
• Type N • Type R			N				
• Type S			Р				
• Туре Т			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			ł	١			
CJC configuration for TC							
Without CJC				0			
Internal CJC				1			
External CJC Pt100 (IEC), 2-wire, define line resis- tance 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						4	۹.
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)						٢	N
Electrical connection/cable entry							
Without							A
Local HMI							

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Options	Order code
Append "-Z" to Article No., add order code and, if appli-	
cable, free text.	
Manufacturer declarations Quality inspection certificate, 5-point factory calibration	C11
(IEC 60770-2)	011
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 D82
Jumper plug set on device for fault current > 21 mA (instead of < 3.6 mA) (only non-SIL)	D02
Input 1: TC	
Type C W5	V01
Type D W3	V02
Type U	V03
Type Lr	V04
Input 1: RTD	VC1
Pt x (IEC), 3-wire, define RTD factor x in option Y21 Pt x (IEC), 4-wire, define RTD factor x in option Y21	V61 V62
Pt x (IEC), 4-wire, define RTD factor x in option 121 Pt x (JIS C1604-81), 3-wire, define RTD factor x in option	V62 V64
Y21	104
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 $$	V70
Ni x (DIN 43760-87), 4-wire, define RTD factor x in option Y21 $% \left( 1-\frac{1}{2}\right) =0$	V71
Ni x (GOST 6651-2009), 3-wire, define RTD factor x in option Y21 $% \left( 1-\frac{1}{2}\right) =0$	V73
Ni x (GOST 6651-2009), 4-wire, define RTD factor x in option Y21 $% \left( 1-\frac{1}{2}\right) =0$	V74
Cu x (ECW-15), 2-wire, define line resistance value in option Y51 and RTD factor x in option Y21 $$	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 $% \left( 1-\frac{1}{2}\right) =0$	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), adhe- sive 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

Temperature transmitters

Rail transmitters

SITRANS TR320 (HART, universal)



SITRANS TR320, dimensions in mm (inch)

Temperature transmitters Rail transmitters

#### SITRANS TR320 (HART, universal)

## 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

Output and test connection

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SITRANS TR320, output connection assignment

Input connection

SITRANS TR320, connector assignment



2-wire, 3-wire or 4-wire RTD or linear resistance

SITRANS TR320, input connection assignment



TC (internal CJC or external 2-wire or 3-wire CJC)



## Temperature measurement Temperature transmitters

Rail transmitters

#### SITRANS TR420 (HART, universal)

#### 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.

Temperature transmitters Rail transmitters

#### 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.



SITRANS TR420, function block diagram

Temperature transmitters

**Rail transmitters** 

#### SITRANS TR420 (HART, universal)

IEC 60584-1

IEC 60584-1 IEC 60584-1 IEC 60584-1 DIN 43710 GOST 3044-84 IEC 60584-1 IEC 60584-1 IEC 60584-1 IEC 60584-1 DIN 43710 ASTM E988-96 ASTM E988-96 GOST 3044-84

•		
General		Thermocouples (TC)
Supply voltage <sup>1) 2)</sup>	7.5 (0)(00	Input type
<ul> <li>Without explosion protection (non- Ex)</li> </ul>	7.5 48 V DC	• B • E
<ul> <li>with explosion protection (Ex i)</li> </ul>	7.5 30 V DC	_ ل
Additional minimum supply voltage when using test terminals	0.8 V	• K • L
Maximum power loss	≤ 850 mW	• Lr
Minimum load resistance at supply voltage > 37 V	(V <sub>supply</sub> - 37 V)/23 mA	• N • R
Insulation voltage, test/operation • Without explosion protection (non- Ex)	2.5 kV AC/55 V AC	• S • T • U
<ul> <li>with explosion protection (Ex i)</li> </ul>	2.5 kV AC/42 V AC	• W3 • W5
Polarity protection	All inputs and outputs	• LR
Write protection	Open circuits or software	Cold junction compensation (CJC)
Warming-up time	< 5 min	T
Starting time	< 2.75 s	<ul> <li>Temperature range internal CJC</li> <li>Connection external CJC</li> </ul>
Programming	SIPROM T and HART	• External CJC, line resistance per
Signal-to-noise ratio	> 60 dB	wire (for 3-wire and 4-wire connec- tions)
Long-term stability	Better than: • ± 0.05% of measuring span/year • ± 0.18% of measuring span/5 years	<ul> <li>Effect of the line resistance (with 3- wire and 4-wire connections)</li> <li>Input current external CJC</li> </ul>
Response time	≤ 75 ms (typically 70 ms)	<ul> <li>Temperature range external CJC</li> </ul>
Programmable damping	0 60 s	<ul> <li>Cable, wire-wire capacity</li> <li>Total line resistance</li> </ul>
Signal dynamic		Fault detection, programmable
• Input	24 bit	
Output	18 bit	
Influence of change in supply voltage	< 0.005% of measuring span/V DC	
Input		<ul> <li>Fault detection time (TC)</li> </ul>
Resistance thermometer (RTD) Input type		<ul> <li>Fault detection time, external CJC (for 3-wire and 4-wire)</li> </ul>
• Pt10 10000	• IEC 60751	Linear resistance
	• JIS C 1604-8 • GOST 6651_2009	Input range
	Callendar-Van Dusen	Minimum measuring span
• Ni10 10000	<ul> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> </ul>	Type of connection
• Cu5 1000	Edison Copper Winding No. 15	Line resistance per wire
	• GOST 6651-2009/OIML R84:2003	Input current
Type of connection Line resistance per wire	2-wire, 3-wire or 4-wire Max. 50 Ω	Effect of the line resistance (with 3- wire and 4-wire connections)
Input current	< 0.15 mA	Cable, wire-wire capacity
Effect of the line resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω	• R > 400 $\Omega$ • R ≤ 400 $\Omega$
Cable, wire-wire capacity		Fault detection, programmable
<ul> <li>Pt1000, Pt10000 (IEC 60751 and JIS C 1604-8)</li> </ul>	Max. 30 nF	Potentiometers
All other input types	Max. 50 nF	Input range
Fault detection, programmable	None, short-circuited, defective, short-circuited or defective	Minimum measuring span Type of connection
	Note	Line resistance per wire
	When the low limit for the configured	Input current
	input type is below the constant detection limit for short-circuited inputs, the detection of short circuits	Effect of the line resistance (with 4- wire and 5-wire connections)
	is disabled regardless of the configu- ration of the fault detection.	Cable, wire-wire capacity • $R > 400 \Omega$

Detection limit for short-circuited input 15  $\Omega$ Fault detection time (RTD) ≤ 75 ms (typically 70 ms) Fault detection time (for 3-wire and 4-  $\leq$  2 000 ms wire)

Technical specifications

GOST 3044-84
Constant, internal or external over Pt100 or Ni100 RTD $^{-50}$ +100 °C (-58 +212 °F) 2-wire, 3-wire or 4-wire 50 $\Omega$
< 0.002 Ω/Ω
< 0.15 mA -50 +135 °C (-58 +275 °F) Max. 50 nF Max. 10 k $\Omega$ None, short-circuited, defective, short-circuited or defective
Note
Note The short-circuited fault detection only applies to the CJC input. ≤ 75 ms (typically 70 ms) ≤ 2 000 ms
The short-circuited fault detection only applies to the CJC input. ≤ 75 ms (typically 70 ms)
The short-circuited fault detection only applies to the CJC input. ≤ 75 ms (typically 70 ms)
The short-circuited fault detection only applies to the CJC input. ≤ 75 ms (typically 70 ms) ≤ 2 000 ms
The short-circuited fault detection only applies to the CJC input. $\leq$ 75 ms (typically 70 ms) $\leq$ 2 000 ms 0 100 k $\Omega$
The short-circuited fault detection only applies to the CJC input. ≤ 75 ms (typically 70 ms) ≤ 2 000 ms 0 100 kΩ 25 Ω
<ul> <li>The short-circuited fault detection only applies to the CJC input.</li> <li>≤ 75 ms (typically 70 ms)</li> <li>≤ 2 000 ms</li> <li>0 100 kΩ</li> <li>25 Ω</li> <li>2-wire, 3-wire or 4-wire</li> </ul>
The short-circuited fault detection only applies to the CJC input. $\leq$ 75 ms (typically 70 ms) $\leq$ 2 000 ms 0 100 k $\Omega$ 25 $\Omega$ 2-wire, 3-wire or 4-wire Max. 50 $\Omega$

Max. 30 nF Max. 50 nF None, defective

10 100 kΩ
25 Ω
3-wire, 4-wire or 5-wire
Max. 50 Ω

< 0.15 mA  $< 0.002 \ \Omega/\Omega$ 

Max. 30 nF Max. 50 nF

• R > 400 Ω

• R  $\leq$  400  $\Omega$ 

Temperature transmitters

## Rail transmitters

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SITRANS TR420 (HART, universal)

Fault detection, programmable	None, short-circuited, defective, short-circuited or defective	Design	
	Note	Weight	122 g (0.27 lb)
	When the configured potentiometer	Maximum core cross-section	2.5 mm <sup>2</sup> (AWG 13)
	size is below the constant detection limit for short-circuited inputs, the	Tightening torque for clamping screws	0.5 0.6 Nm
	detection of short circuits is disabled regardless of the configuration of the	Vibrations	IEC 60068-2-6
	fault detection.	• 2 25 Hz	± 1.6 mm (0.07 inch)
Detection limit for short-circuited input	15 Ω	• 25 100 Hz	± 4 g
Fault detection time, wiper arm (no short-circuit detection)	$\leq$ 75 ms (typically 70 ms)	Certificates and approvals Explosion protection ATEX/IECEx and	
Fault detection time, element	≤ 2 000 ms	others	
Fault detection time (for 4-wire and 5-wire)	≤ 2 000 ms	Certificates <sup>3)</sup>	DEKRA 17ATEX0116 X IECEx DEK 17.0054X
Voltage input			A5E43700604A-2018X
Measuring range		"Intrinsic safety ia/ib" type of protec- tion	For use in Zone 0, 1, 2, 20, 21, 22
<ul><li>Unipolar</li><li>Bipolar</li></ul>	-100 1700 mV -800 +800 mV	• ATEX	II 1 G Ex ia IIC T6 T4 Ga II 2(1) G Ex ib [ia Ga] IIC T6 T4
Minimum measuring span	2.5 mV		Gb
Input resistance	10 MΩ		II 1 D Ex ia IIIC Da I M1 Ex ia I Ma
Cable, wire-wire capacity		<ul> <li>IECEx and others</li> </ul>	Ex ia IIC T6 T4 Ga
<ul> <li>Input range: -100 1700 mV</li> <li>Input range: -20 100 mV</li> </ul>	Max. 30 nF Max. 50 nF		Ex ib [ia Ga] IIC T6 T4 Gb Ex ia IIIC Da Ex ia I Ma
Fault detection, programmable	None, defective	"Intrinsic safety ic" type of protection	
Fault detection time	≤ 75 ms (typically 70 ms)	ATEX	For use in Zones 2 and 22 II 2 G Ex ic IIC T6T4 Gc
Output and HART communication			II 2 D Ex ic IIIC Dc
Normal range, programmable	3.8 20.5 mA/20.5 3.8 mA	<ul> <li>IECEx and others</li> </ul>	Ex ic IIC T6 T4 Gc Ex ic IIIC Dc
Extended range (output limits), pro- grammable	3.5 23 mA/23 3.5 mA	"Non-sparking/increased safety nA/ec" type of protection	For use in Zones 2 and 22
Programmable input/output limits		• ATEX	II 2 G Ex nA IIC T6T4 Gc
Fault current	Enable/disable	<ul> <li>IECEx and others</li> </ul>	II 2 G Ex ec IIC T6T4 Gc Ex nA IIC T6 T4 Gc
<ul> <li>Fault current setting</li> </ul>	3.5 23 mA	• IECEX and others	Ex ec IIC T6 T4 Gc
Update time	10 ms	Explosion protection CSA/FM for Can-	
Load (with current output)	$\leq$ (V <sub>Supply</sub> - 7.5)/0.023 $\Omega$	ada and USA	
Load stability	< 0.01% of meas. span/100 $\Omega$ (measuring span = currently selected range)	Certificates	CSA 1861385 FM18CA0024 FM18US0046
Input fault detection, programmable (detection of input short circuits is	3.5 23 mA	"Intrinsic safety ia" type of protection	IS, CL I, Div 1, GP ABCD, T6 T4 Ex ia IIC T6 T4 Ga
ignored with TC and voltage inputs)			AEx ia IIC T6 T4 Ga or:
NAMUR NE43 Upscale	> 21 mA		Ex ib [ia Ga] IIC T6T4 Gb AEx ib [ia Ga] IIC T6T4 Gb
NAMUR NE43 Downscale	< 3.6 mA	"Non incendive field wiring NIFW" type	
HART protocol versions	HART 7	of protection	
Measuring accuracy		"Non incendive NI" type of protection	
Input accuracy	See "Input accuracy" table		Ex nA IIC T6 T4 Gc AEx nA IIC T6 T4 Gc
Output accuracy	See "Output accuracy" table	<sup>1)</sup> Note that the minimum supply voltage	ne must correspond to the value mea-
Rated conditions		sured at the terminals of the SITRAN	JS TR420.
Ambient temperature	-50 +85 °C (-58 +185 °F)	All external voltage drops must be t <sup>2)</sup> Protect the device from overvoltage	
Ambient temperature for devices with functional safety	-40 +80 °C (-40 +176 °F)	ply or suitable overvoltage protection	n equipment.
Storage temperature	-50 +85 °C (-58 +185 °F)	<li><sup>3)</sup> Additional available certificates are http://www.siemens.com/processins</li>	
Reference temperature for sensor cal- ibration	24 °C ±1.0 °C (75.2 °F ±1.8 °F)		
Relative humidity	< 99% (no condensation)		
Degree of protection			
<ul><li>Transmitter enclosure</li><li>Terminals</li></ul>	IP20 IP20		

Temperature transmitters Rail transmitters

SITRANS TR420 (HART, universal)

#### Measuring ranges/Minimum measuring span

#### RTD

Input type	Standard	Measuring range in °C (°F)	α <sub>0</sub> in °C <sup>-1</sup> (°F <sup>-1</sup> )	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)
В	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)
К	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)
Ν	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)
Т	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 <sup>1)</sup>
RTD		
Pt10	≤ ±0.8 °C (1.44 °F)	$\leq \pm 0.020 \ ^{\circ}\text{C/}^{\circ}\text{C} \ (^{\circ}\text{F/}^{\circ}\text{F})$
Pt20	≤ ±0.4 °C (0.72 °F)	≤ ±0.010 °C/°C (°F/°F)
Pt50	≤ ±0.16 °C (0.288 °F)	$\leq \pm 0.004 \text{ °C/°C} (\text{°F/°F})$
Pt100	≤ ±0.04 °C (0.072 °F)	$\leq \pm 0.002 \text{ °C/°C} (\text{°F/°F})$
Pt200	≤ ±0.08 °C (0.144 °F)	$\leq \pm 0.002 \text{ °C/°C} (\text{°F/°F})$
Pt500	$T_{max.} < 180 \text{ °C} (356 \text{ °F}) = \le \pm 0.08 \text{ °C} (0.144 \text{ °F})$ $T_{max.} > 180 \text{ °C} (356 \text{ °F}) = \le \pm 0.16 \text{ °C} (0.288 \text{ °F})$	≤ ±0.002 °C/°C (°F/°F)
Pt1000	$\leq \pm 0.08 \ ^{\circ}C \ (0.144 \ ^{\circ}F)$	≤ ±0.002 °C/°C (°F/°F)
Pt2000	$\begin{split} T_{max.} &< 300 \ ^{\circ}\text{C} \ (572 \ ^{\circ}\text{F}) = \le \pm 0.08 \ ^{\circ}\text{C} \ (0.144 \ ^{\circ}\text{F}) \\ T_{max.} &> 300 \ ^{\circ}\text{C} \ (572 \ ^{\circ}\text{F}) = \le \pm 0.4 \ ^{\circ}\text{C} \ (0.72 \ ^{\circ}\text{F}) \end{split}$	≤ ±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)	$\leq \pm 0.010 \ ^{\circ}\text{C}/^{\circ}\text{C} \ (^{\circ}\text{F}/^{\circ}\text{F})$
Ni50	≤ ±0.32 °C (0.576 °F)	$\leq \pm 0.004 \ ^{\circ}\text{C}/^{\circ}\text{C} \ (^{\circ}\text{F}/^{\circ}\text{F})$
Ni100	≤ ±0.16 °C (0.288 °F)	$\leq \pm 0.002 \ ^{\circ}\text{C}/^{\circ}\text{C} \ (^{\circ}\text{F}/^{\circ}\text{F})$
Ni120	≤ ±0.16 °C (0.288 °F)	$\leq \pm 0.002 \ ^{\circ}\text{C}/^{\circ}\text{C} \ (^{\circ}\text{F}/^{\circ}\text{F})$
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)

Temperature transmitters **Rail transmitters** 

#### SITRANS TR420 (HART, universal)

Input type	Basic accuracy	Temperature coefficient <sup>1)</sup>
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	$\leq \pm 40 \text{ m}\Omega$	$\leq \pm 2 \text{ m}\Omega/^{\circ}\text{C} (1.11 \text{ m}\Omega/^{\circ}\text{F})$
0 100 k <b>Ω</b>	$\leq \pm 4 \ \Omega$	$\leq \pm 0.2 \ \Omega/^{\circ}C \ (0.11 \ \Omega/^{\circ}F)$
Potentiometers		
0 100%	< 0.05%	< ± 0.005%
Voltage input		
mV: -20 100 mV	$\leq \pm 5 \ \mu V$	$\leq \pm 0.2 \ \mu V/^{\circ}C \ (0.11 \ \mu V/^{\circ}F)$
mV: -100 1700 mV	$\leq \pm 0.1 \text{ mV}$	$\leq \pm 36 \mu\text{V/°C}$ (20 $\mu\text{V/°F}$ )
mV: ± 800 mV	$\leq \pm 0.1 \text{ mV}$	$\leq \pm 32 \ \mu V/^{\circ}C \ (17.8 \ \mu V/^{\circ}F)$
тс		
E	≤ ±0.2 °C (0.36 °F)	$\leq \pm 0.025 \text{ °C/°C} (\text{°F/°F})$
J	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)
К	≤ ±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)
Ν	≤ ±0.4 °C (0.72 °F)	$\leq \pm 0.025 \text{ °C/°C} (\text{°F/°F})$
Т	≤ ±0.25 °C (0.45 °F)	$\leq \pm 0.025 \text{ °C/°C} (\text{°F/°F})$
U	< 0 °C (32 °F) ≤ ±0.8 °C (1.44 °F)	≤ ±0.025 °C/°C (°F/°F)
	$\geq 0 \ ^{\circ}C \ (32 \ ^{\circ}F) \leq \pm 0.4 \ ^{\circ}C \ (0.72 \ ^{\circ}F)$	
Lr	$\leq \pm 0.2 ^{\circ}$ C (0.36 $^{\circ}$ F)	$\leq \pm 0.1 \text{ °C/°C (°F/°F)}$
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)	$\leq \pm 0.1 \ ^{\circ}\text{C/}^{\circ}\text{C} \ (^{\circ}\text{F/}^{\circ}\text{F})$
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 <sup>2)</sup>	≤ ±1 °C (1.8 °F)	≤ ±0.1 °C/°C (°F/°F)
B <sup>3)</sup>	≤ ±3 °C (5.4 °F)	≤ ±0.1 °C/°C (°F/°F)
B <sup>4)</sup>	≤ ±8 °C (14.4 °F)	≤ ±0.8 °C/°C (°F/°F)
B <sup>5)</sup>	Not specified	Not specified
CJC (internal)	< ±0.5 °C (0.9 °F)	Included in basic accuracy
CJC (external)	$\leq \pm 0.08$ °C (0.144 °F)	$\leq \pm 0.002 \text{ °C/°C} (^{\circ}F/^{\circ}F)$

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)

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

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

<sup>5)</sup> 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 mea- surement	Sum of accuracy of input 1 and input 2	Sum of temperature coefficient of input 1 and input 2
Analog output	$\leq \pm 1.6~\mu A$ (0.01% of the full output span)	$\leq\pm0.48~\mu\text{A/K}~(\leq\pm0.003\%~\text{of}$ the full output span/K)

Temperature transmitters Rail transmitters

#### SITRANS TR420 (HART, universal)

#### Article No. Order code SITRANS TR420 7NG042 rail transmitter with 2 inputs ------↗ 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, 3 both as redundancy Minimum input 1 and input 2, 4 both as redundancy Maximum input 1 and input 2, 5 both as redundancy 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, 9 H1A without redundancy Maximum input 1 and input 2, without redundancy H1B 9 H1C Average input 1 and input 2, 9 without redundancy 9 H1D Input 2 Input 1, type RTD • Pt100 (IEC), 3-wire в C D • Pt100 (IEC), 4-wire • Pt1000 (IEC), 3-wire • Pt1000 (IEC), 4-wire Е TC F • Type B G • Type E H J • Type J • Туре К K L • Type L • Type N Ν • Type R Р • Type S Q • Type T Potentiometer, 4-wire R Input 1, type customer-specific Define customer-specific input configurations in V options

Selection and ordering data

	Article No.	Order code
SITRANS TR420	7NG042	
rail transmitter with 2 inputs	8-8-8-8-	0
Input 2, type		
Without input 2	A	
RTD		
<ul> <li>Pt100 (IEC), 3-wire</li> </ul>	В	
<ul> <li>Pt100 (IEC), 4-wire</li> </ul>	С	
• Pt1000 (IEC), 3-wire	D	
• Pt1000 (IEC), 4-wire	E	
TC		
• Type B	F	
• Type E	G	
<ul><li>Type J</li><li>Type K</li></ul>	H	
• Type L	ĸ	
• Type N	ï	
• Type R	N	
• Type S	Р	
• Туре Т	Q	
Potentiometer, 4-wire	R	
Input 2, type customer-specific		
Define customer-specific input configura- tions 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

## **Rail transmitters**

#### SITRANS TR420 (HART, universal)

Options	Order code
Append "-Z" to Article No., add order code and, if appli- cable, 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
Туре 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
Туре U	W03
Type Lr	W04

Options	Order code
Append "-Z" to Article No., add order code and, if appli- cable, 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), adhe- sive label	¥15
Measuring point description (device parameter, max. 32 characters), adhesive label	Y16
Input 1: RTD factor; e.g. factor "200" = Pt200, adhesive label	Y21
Accessories	

#### Accessories

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	Article No.
Additional accessories for assem- bly, connection and transmitter con- figuration, 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

Temperature transmitters **Rail transmitters** 

SITRANS TR420 (HART, universal)

Dimension drawings



SITRANS TR420, dimensions in mm (inch)

## Circuit diagrams

#### Connections



Test terminals for measurement of the output current with an amperemeter Output terminals Input 1 terminals 9, 10, 11 and 12 Input 2 terminals

SITRANS TR420, connector assignment

#### Output and test connection



SITRANS TR420, output connection assignment

Temperature transmitters Rail transmitters

#### SITRANS TR420 (HART, universal)

Input connection





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





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

SITRANS TR420, input connection assignment



Input 1 and/or input 2: TC (int. CJC or external 2-wire or 3-wire CJC)





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





Voltage input (unipolar or bipolar)



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

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

#### Overview



#### Our field devices for heavy industrial use

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

The temperature transmitter SITRANS TF works where others feel uncomfortable.

#### Benefits

- Universal use
  - as transmitter for resistance thermometer, thermocouple element,  $\boldsymbol{\Omega}$  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  $\Omega$  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.



Mode of operation of SITRANS TF with integrated SITRANS TH300 and digital display  $% \left( {{\rm SITRANS}} \right) = \left($ 

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

#### Technical specifications

Input		Thermocouples	
Resistance thermometer		Measured variable	Temperature
Measured variable	Temperature	Sensor type (thermocouples)	
Input type		• Type B	Pt30Rh-Pt6Rh acc. to IEC 584
<ul> <li>According to IEC 60751</li> </ul>	Pt25 Pt1000	• Type C • Type D	W5%-Re acc. to ASTM 988 W3%-Re acc. to ASTM 988
• Acc. to JIS C 1604; a=0.00392 K-1		• Type E	NiCr-CuNi acc. to IEC 584
According to IEC 60751	Ni25 Ni1000	• Type J	Fe-CuNi acc. to IEC 584
Units	°C and °F	• Туре К	NiCr-Ni acc. to IEC 584
	1 registeres thermometer (PTD) in 2	• Type L	Fe-CuNi acc. to DIN 43710
<ul> <li>Standard connection</li> </ul>	1 resistance thermometer (RTD) in 2- wire, 3-wire or 4-wire connection	<ul><li>Type N</li><li>Type R</li></ul>	NiCrSi-NiSi acc. to IEC 584 Pt13Rh-Pt acc. to IEC 584
Averaging	Series or parallel connection of sev-	• Type S	Pt10Rh-Pt acc. to IEC 584
	eral resistance thermometers in the 2- wire connection for the generation of	• Type T	Cu-CuNi acc. to IEC 584
	average temperatures or for adapta-	• Type U	Cu-CuNi acc. to DIN 43710
<ul> <li>Differentiation</li> </ul>	tion to other device types	Units	°C or °F
	2 resistance thermometers (RTD) in 2-wire connection (RTD 1 – RTD 2 or	Connection	
	RTD 2 – RTD 1)	Standard connection	1 thermocouple (TC)
Connection		<ul><li>Averaging</li><li>Differentiation</li></ul>	2 thermocouples (TC) 2 thermocouples (TC)
<ul> <li>2-wire connection</li> </ul>	Line resistance can be configured $\leq 100 \Omega$ (loop resistance)	Differentiation	(TC 1 - TC 2  or  TC 2 - TC 1)
3-wire connection	No trim necessary	Response time	≤ 250 ms for 1 sensor with break
4-wire connection	No trim necessary		monitoring
Sensor current	≤ 0.45 mA	Break monitoring	Can be switched off
Response time	≤ 250 ms for 1 sensor with break	Reference junction compensation	
	monitoring	<ul> <li>Internal</li> </ul>	With integrated Pt100 resistance ther- mometer
Break monitoring	Always active (cannot be switched off)	• External	With external Pt100 IEC 60751 (2-wire or 3-wire connection)
Short-circuit monitoring	Can be switched on/off (default value: ON)	External fixed	Reference junction temperature can be set as fixed value
Measuring range	Assignable (see "Digital measuring error" table)	Measuring range	Assignable (see "Digital measuring error" table)
Min. measuring span	10 °C (18 °F)	Min. measuring span	Min. 40 100 °C (72 180 °F) (see "Digital measuring error" table)
Characteristic curve	Temperature-linear or special charac- teristic	Characteristic curve	Temperature-linear or special charac- teristic
Resistance-based sensor			tensue
Measured variable	Actual resistance	mV sensor	
Sensor type	Resistance-based, potentiometers	Measured variable	DC voltage
Units	Ω	Sensor type	DC voltage source (DC voltage source possible over an externally
Connection			connected resistor)
<ul> <li>Standard connection</li> </ul>	1 resistance-based sensor (R) in 2- wire, 3-wire or 4-wire connection	Units	mV
Averaging	2 resistance-based sensors in 2-wire connection for averaging	Response time	≤ 250 ms for 1 sensor with break monitoring
Differentiation	2 resistance-based sensors in 2-wire	Break monitoring	Can be switched off
Connection	connection (R 1 – R 2 or R 2 – R 1)	Measuring range	-10 +70 mV -100 +1100 mV
<ul> <li>2-wire connection</li> </ul>	Line resistance can be configured	Min. measuring span	2 mV or 20 mV
<ul> <li>3-wire connection</li> </ul>	≤100 Ω (loop resistance) No trim necessary	Overload capability of the input	-1.5 +3.5 V DC
4-wire connection	No trim necessary	Input resistance	$\geq 1 M\Omega$
Sensor current	≤ 0.45 mA	Characteristic curve	Voltage-linear or special characteris-
Response time	≤ 250 ms for 1 sensor with break monitoring	Characteristic curve	tic
Break monitoring	Can be switched off		
Short-circuit monitoring	Can be switched off (value is adjust- able)		
Measuring range	Assignable max. 0 2200 $\Omega$ (see "Digital measuring error" table)		
Min. measuring span	5 25 $\Omega$ (see "Digital measuring error" table)		

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Characteristic curve

teristic

Resistance-linear or special charac-

## Temperature measurement Temperature transmitters

Field transmitters/Field indicator

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

Output Output light         Call DNA, 2 with Explain Indexing to ALRT Prev. 5.8         Certificates and approvals         Certificates and approvals           Digital Indexing Digital Indexing (pathon)         Incurrent loop         Home and the previous protection ALX Setting:         With digital display:           Digital Indexing (pathon)         Incurrent loop         Home (pathon)         Incurrent loop           Digital Indexing (pathon)         Max. 5 digits         Encordence (pathon)         Incurrent loop           Digital Indexing (pathon)         Max. 5 digits         Encordence (pathon)         Encordence (pathon)           Setting:         Setting:         Encordence (pathon)         Encordence (pathon)         Encordence (pathon)           Messuring security         Setting:         2.1 V         Encordence (pathon)		SITRANS IF - Transmitter,	2-wire system / SITRANS TF - F	-leid indicator for 4 to 20 mA
communication with SITMANE THEOR.         According to HART Rev. 5.9           Digital display         In current loop           Digital display         Max. 5 digits           Digital display         With digital display           Core output         Load voltage           Digital display         Using 3 buttors           Core output         S display           Digital display         S display           Digital display         S display           Digital display         Using 3 buttors           Digital display         S display           Digital display <td< td=""><td>Output</td><td></td><td>Certificates and approvals</td><td></td></td<>	Output		Certificates and approvals	
Contractional intervalue         Proceeding (p) (17.14 Gb)           Digital display (potenti)         in current loop           Max 5 digits         smm (10.37)           Display (max 5 thic)	Output signal	4 20 mA, 2-wire		
Digital display Digital display (provide) Digital display (provide) Max: is algobic Digital display (provide) Max: is algobic Digital display (provide) Max: is algobic Dipital varge 200 900 - 400 909 Amy (max: 5 chur)I = 20 Ex (provide) Max: is algobic 	Communication with SITRANS TH300	According to HART Rev. 5.9	<ul> <li>"Intrinsic safety" type of protection</li> </ul>	
Digital deglay (pto/mai)in ourmal (use)Digital deglay (pto/mai)more (use)Digital deglay (pto/mai)9 more (use)Digital deglay (pto/mai)9 more (use)Digital deglay (pto/mai)9 more (use)UnitalAny (max. 5 char.)Using 3 buttone2.1 VMeasuring accuracy2.1 VDigital measuring error (use)See "Digital measuring error" tablePailurence counditions2.1 VDigital measuring error (use)See "Digital measuring error" tableView may be address the more table of the avalage output (digitalization error)2.1 VDigital measuring error2.1 VDigital measuring error2.1 VDigital measuring error2.1 VUse address the more table of the avalage output (digitalization error)2.1 V + 1.8.View mining output (digitalization error)2.2 V + 1.8.View mining output (digitalization error)0.02 % of measuring spanColor (Color) To Color (1.8 TF)0.02 % of measuring spanView mining output (digitalization error)0.02 % of measuring spanAuxilary power effect0.02 % of measuring spanAuxilary power effect<	Digital display			II 2 G Ex ib IIC T4 Gb
Display     Mats. 5 digits     In 210 Feb in [6 Gi] ID Ta Gb       Display range     -99 989,	Digital display (optional)	In current loop		
Ling in Right Indian       9 100 (LIN S)       9 100 (LIN S)         Units       Any (max, 5 char)       Using 3 buttors.         Using Abuttors.       Using 3 buttors.       E.C type-examination certificate         Units (Link Sole value and unit Load value and		ů.		II 2 (1) G Ĕx ib [ia Gá] IIC T6 Gb
Units       Any (max. 5 char.)         Setting       Using 5 buttors         Setting       Setting         Measuring securate       Set 0 [Setting Converting         Polysit measuring error       Set 0 [Setting Converting         Auxiliary power       Set 2 [Setting Converting         Auxiliary power       Set 7				II 1D Ex ia IIIC T100 °C Da
Setting:       Care Union 2 Studies         Setting:       Using 3 Studies         Zees profit, full-scale value and unit       2.1 V         Lead voltage       2.1 V         Messuring sectoracy       See Topical measuring error         Splight measuring error       See Topical measuring error         - Auditary power       24 V ± 1 %         - Auditary power       24 V ± 1 %         - Auditary power       24 V ± 1 %         - So thin       See Topical measuring error         - Auditary power       29 °C (73.4 °F)         - Warming-up time       > 5 min         From in the angle opticul (digitalene.       < 0.02 % of measuring span 10 °C (18 °F)				
Zere Soft, full-scale value and unit       EC Spac-axamination curtificate         Lead voltage       2.1 V         Messuring accuracy       See 'Oigtal messuring error' table         Digital messuring error       See 'Oigtal messuring error'         Auxiliary power       2.4 V = 1%         Source of the analog output (digital/analog)       2.0 °C (13.4 °F)         Werning-up time       2.5 °C (0.9 °F)         Effect of ambient temperature       0.02 % of messuring span log convertion         0.02 % of messuring according error       0.02 % of messuring span log convertion         0.02 % of messuring span log convertion       0.02 % of messuring span log convertion         0.02 % of messuring span log convertion       0.02 % of messuring span log convertion         0.02 % of messuring span log convertion       0.02 % of messuring span log convertion         0.02 % of messuring span log convertion       0.02 % of messuring span log convertion         0.02 % of messuring span log convertion       0.02 % of messuring span log convertion         0.02 % of messuring span log convertion       0.02 % of messuring span log convertion         0.02 % of messuring span log convertion       0.02 % of messuring span log convertion         Andier messuring error       0.00 % of messuring span log convertion         Antier on end vertion       <0.00 % of messuring span log convertion		,	equipment for Zone 2" type of pro-	II 3 G Ex nA IIC T6/T4 Gc
Lead voitage       2.1 V         Messuring accuracy       See "Digital messuring error" table       2.1 V         Piglial messuring error       See "Digital messuring error" table       2.1 V         Processor       2.1 V       See "Digital messuring error" table         Piglial messuring error       2.1 V       See "Digital messuring error" table         Piglial messuring error       2.1 V       See "Digital messuring error" table         Piglial messuring error       2.2 °C (7.3 4°F)       See "Digital messuring error"         Viaming up time       > 5 min       See "Cigital" (1.1 %) (1.0 %) (		Using 3 buttons		
Measuring accuracy         See "Digital measuring error" table         C topical measuring error" table         C topical measuring error         C topical % of measuring error         C topic % of measuring error         C topic % of measuring er	Load voltage	2.1 V	<ul> <li>"Flameproof enclosure" type of pro-</li> </ul>	II 2 G Ex d IIC T6/T5 Gb
Digital measuring error       See "Digital measuring error" table         Advaluance constructions       24 V = 1 %         Auxiliary power       23 C(73 4 F)         Firer due to internal reference junction       0.02 % of measuring span         Analog measuring error       0.02 % of meas.span/V0 °C (18 °F)         Digital measuring error       0.02 % of meas.span/V0 °C (18 °F)         Auxiliary power effect       0.00 % of meas.span/V0 °C (18 °F)         Auxiliary power effect       0.00 % of meas.span/V0 °C (18 °F)         Auxiliary power effect       0.00 % of meas.span/V0 °C (18 °F)         Auxiliary power effect       0.00 % of measuring span         Anter ore year       <0.02 % of measuring span	Measuring accuracy			
- Auxiliary power       24 V ± 1 %         - Load       500 Δ         - Ambient temperature       25 °C (73.4 °F)         - Warming-up time       > 5 min         Error the the analog output (digital/ana- log converter)       > 0.5 °C (10.9 °F)         Effect of ambient temperature       - 0.025 % of measuring span       - 0.025 % of measuring span         - Analog measuring error       0.02 % of measuring span       - 0.02 % of measuring span         - With resistance thermonelers       0.05 °C (0.0 °F)         - With resistance thermonelers       0.06 °C (1.1 °F)(10° C (18 °F)         - With resistance thermonelers       0.06 °C (1.1 °F)(10° C (18 °F)         - With resistance thermonelers       - 0.01 % of measuring span         - After 5 years       < 0.02 % of measuring span	Digital measuring error	See "Digital measuring error" table		
<ul> <li>Lead</li></ul>				• XP/I/1/BCD/T5 Ta = 85 °C (185 °F),
- Antibent temperature       23 °C (73.4 °F)         - Warning-up time       > 5 min         Error in the analog output (digital/ana- log converter)       < 0.02 % of measuring span				
log converter)       Ender do internal reference junction       < 0.5 °C (0.9 °F)	<ul> <li>Ambient temperature</li> </ul>	23 °C (73.4 °F)		(185 °F), T6 Ta = 60 °C (140 °F),
Telect of ambient temperature <ul> <li>Analog measuring error <ul> <li>Ob % 0 (n eas. span/10 °C (18 °F)</li> <li>With resistance thermometers out in treastance thermometers out in the first mometers out in the first momth out in the first momth out is not first momth out in the first momth out is of 02 % of meas. span/10 02 cong-term drift out in the first momth out 2% of measuring span out is of out in the first momth out is of measuring span out is of measuring span determination lectors ableided solution Measuring range: out is of measuring span momtaction Measuring range: out is of measuring ran</li></ul></li></ul>		< 0.025 % of measuring span		
<ul> <li>Analog measuring error</li> <li>O.02 % of meas. span/10 °C (18 °F)</li> <li>With thermocouples</li> <li>O.6 °C (0.11 °F)/10°C (18 °F)</li> <li>Auxiliary power effect</li> <li>O.00 % of meas. span/10 Ω</li> <li>Cong-term drift</li> <li>In the first month</li> <li>O.02 % of measuring span</li> <li>After one year</li> <li>O.22 % of measuring span</li> <li>After of years</li> <li>O.22 % of measuring span</li> <li>After one year</li> <li>O.22 % of measuring span</li> <li>After of years</li> <li>O.22 % of measuring span</li> <li>After one year</li> <li>O.22 % of measuring span</li> <li>After one year</li> <li>O.23 % of measuring span</li> <li>After one year</li> <li>O.20 % of measuring span</li> <li>After one year</li> <li>Sensor offset: 0 °C (0 °F)</li> <li>Damping 0.0 s</li> </ul>	5	< 0.5 °C (0.9 °F)		
<ul> <li>With thermitochelers</li> <li>Obd<sup>+</sup> C (0.11 * P)(10<sup>+</sup> C (18 * P)</li> <li>Auxiliary power effect</li> <li>C 001 % of meas. span/V</li> <li>C 001 % of meas. span/V</li> <li>C 0002 % of meas. span/V</li> <li>C 0002 % of meas. span/V</li> <li>C 002 % of meas. span/V</li> <li>C 000 % Of MANUR</li> <li>Measuring range: 0 100 Ω</li> <li>C (2 212 %)</li> <li>C 2 % (10 %)</li> <li>C 2 % (10 %)</li> <li>C 2 % (10 %)</li> <li>C % 10 % (12 % mi)</li> <li>C % 10 % (</li></ul>	<ul> <li>Analog measuring error</li> </ul>	0.02 % of meas. span/10 °C (18 °F)		
Auxiliary power effect       < 0.001 % of meas. span/V		. , . ,		
Effect of lead impedance     < 0.02 % of measuring span				
Long-term drift       < 0.02 % of measuring span				PC with CD-ROM drive and USB
• In the first month       < 0.02 % of measuring span	·	< 0.002 % of meas. span/100 12	• PC operating overam	
• After S years       < 0.3 % of measuring span	0	< 0.02 % of measuring span	PC operating system	
Antient orgents       2.05 % of measuring span         Rated conditions       Ambient conditions         Ambient conditions       -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       Performance         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, polyestion         Electrical connection, sensor connection, sensor connection       Serew terminals, cable inlet via M20 x 1.5 rd %-14 NPT screwed gland         Munuing bracket (optional)       Steel, galvanized and chrome-plated or stainless steel         Without digital display       11 35 VD C(30 V with Ex ib; 32 V with Ex ic and Ex nA)         With digital display       13.1 35 VD C(30 V with Ex ib; 32 V with Ex ic and Ex nA)         With digital display       13.1 35 VD C(30 V with Ex ib; 32 V with Ex ic and Ex nA)         With digital display       13.1 35 VD C(30 V with Ex ib; 32 V with Ex ic and Ex nA)         Galvanic isolation       Between input and output		0,		
Ambient conductionsAmbient conditionsAmbient conditionsAmbient temperature-40+85 °C (-40+185 °F)CondensationPermissibleElectromagnetic compatibilityAccording to EN 61326 and NAMUR NE21Degree of protection acc. to EN 60529PosignWeightDimensionsSee "Dimensional drawings"Enclosure materialDie-cast aluminum, low in copper, (for Alart explanet)DimensionsSee "Dimensional drawings"Electrical connection, sensor connect itonList of StallersAuxiliary powerWithout digital displayWith digital displayWith digital displayMuth digital displayMuth digital displayCalvanic isolationBetween input and output		< 0.3 % of measuring span		
Ambient temperature-40 +85 °C (-40 +185 °F)Ambient temperature-40 +85 °C (-40 +185 °F)CondensationPermissibleElectromagnetic compatibilityAccording to EN 61326 and NAMUR NE21Degree of protection acc. toIP66/67/68Design				230 1100 Ω
CondensationPermissibleMulticode sineadIs to knit (0.50 mit)Electromagnetic compatibilityAccording to EN 61326 and NAMUR NE21ProtocolHART protocol, version 5.9Degree of protection acc. to EN 60529IP66/67/68Factory setting of the transmitter: • Pt100 (IEC 751); 3-wire connection • Measuring range: 0 100 °C (32 212 °F)DesignApprox. 1.5 kg (3.3 lb) without optionsSee "Dimensional drawings"DimensionsSee "Dimensional drawings"Enclosure materialDie-cast aluminum, low in copper, (GD-AISI 12 or stainless steel, polyes- ter-based lacquer, stainless steel, polyes- ter-based lacquer, stainless steel rat- ing plateElectrical connection, sensor connec- tionScrew terminals, cable inlet via M20 x 1.5 or ½-14 NPT screwed glandMounting bracket (optional)Steel, galvanized and chrome-plated or stainless steelAuxiliary power With digital display1135 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)With digital display1135 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)Galvanic isolationBetween input and output		-40 +85 °C (-40 +185 °E)		. ,
Electromagnetic compatibility       According to EN 61326 and NAMUR NE21         Degree of protection acc. to EN 60529       IP66/67/68         Design		· · · · · ·		· · · ·
Degree of protection acc. to EN 60529IP66/67/68• Pt100 (IEC 751); 3-wire connectionDesign• Pt100 (IEC 751); 3-wire connectionWeightApprox. 1.5 kg (3.3 lb) without options• Pt100 (IEC 751); 3-wire connectionDimensionsSee "Dimensional drawings"• Fault current: 22.8 mAEnclosure materialDie-cast aluminum, low in copper, GD-AISi 12 or stainless steel polyes- ter-based lacquer, stainless steel rat- ing plate• Design 0.0 sKeither ing plate• Crew terminals, cable inlet via M20 x 1.5 or ½-14 NPT screwed gland• Design 0.0 sMounting bracket (optional)Steel, galvanized and chrome-plated or stainless steel• Ci 30 V with Ex ib; 32 V with Ex ic and Ex nA)• Measuring range: 0 100 °C (0 °F) • Damping 0.0 sMuth digital display11 35 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)• Measuring range: 0 100 °C (0 °F) • Damping 0.0 sGalvanic isolationBetween input and output• Electrical connection, sensor connection• Measuring range: 0 100 °C (0 °F) • Damping 0.0 s		According to EN 61326 and NAMUR		
EN 60529Measuring range: 0 100 °C (32 212 °F)DesignApprox. 1.5 kg (3.3 lb) without optionsDimensionsSee *Dimensional drawings*Enclosure materialDie-cast aluminum, low in copper, GD-AlSi 12 or stainless steel, polyes- ter-based lacquer, stainless steel rat- ing plateElectrical connection, sensor connec- tionScrew terminals, cable inlet via M20 x 1.5 or ½-14 NPT screwed glandMounting bracket (optional)Steel, galvanized and chrome-plated or stainless steelAuxiliary powerV with Ex ic and Ex nA)With digital display13.1 35 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)Galvanic isolationBetween input and output	Degree of protection and to			
DesignImage: Provide the section of the s		1 00/07/08		
DimensionsSee "Dimensional drawings"Die-cast aluminum, low in copper, GD-AISi 12 or stainless steel, polyes- ter-based lacquer, stainless steel rat- ing plateDie-cast aluminum, low in copper, GD-AISi 12 or stainless steel rat- ing plateDie-cast aluminum, low in copper, GD-AISi 12 or stainless steel rat- ing plateDie-cast aluminum, low in copper, GD-AISi 12 or stainless steel rat- ing plateDie-cast aluminum, low in copper, GD-AISi 12 or stainless steel rat- ing plateDie-cast aluminum, low in copper, GD-AISi 12 or stainless steel rat- ing plateDie-cast aluminum, low in copper, GD-AISi 12 or stainless steel rat- ing plateDie-cast aluminum, low in copper, GD-AISi 12 or stainless steel rat- ing plateDie-cast aluminum, low in copper, GD-AISi 12 or stainless steel rat- ing plateDie-cast aluminum, low in copper, GD-AISi 12 or stainless steel rat- ing plateDie-cast aluminum, low in copper, GD-AISi 12 or stainless steel rat- ing plateDie-cast aluminum, low in copper, GD-AISi 12 or stainless steel rat- ing plateDie-cast aluminum, low in copper, GD-AISi 12 or stainless steelDie-cast aluminum, low in copper, AII in 35 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)Die-cast aluminum, low in the copper, GD-AISi 22 V with Ex ic and Ex nA)Die-cast aluminum, low in the copper, GD-AISi 22 V with Ex ic and Ex nA)Die-cast aluminum, low in the copper, <br< td=""><td>Design</td><td></td><td></td><td>· · · · ·</td></br<>	Design			· · · · ·
DimensionsSee "Dimensional drawings"• Damping 0.0 sEnclosure materialDie-cast aluminum, low in copper, GD-AlSi 12 or stainless steel, polyes- ter-based lacquer, stainless steel rat- ing plate• Damping 0.0 sElectrical connection, sensor connec- tionScrew terminals, cable inlet via M20 x 1.5 or ½-14 NPT screwed gland• Damping 0.0 sMounting bracket (optional)Steel, galvanized and chrome-plated or stainless steel• Oamping 0.0 sAuxiliary power• Oamping 0.0 sWithout digital display11 35 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)With digital display13.1 35 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)Galvanic isolationBetween input and output	Weight		<ul> <li>Sensor offset: 0 °C (0 °F)</li> </ul>	
Enclosure materialDie-cast aluminum, low in copper, GD-AISi 12 or stainless steel, polyes- ter-based lacquer, stainless steel rat- ing plateElectrical connection, sensor connec- tionScrew terminals, cable inlet via M20 x 1.5 or ½-14 NPT screwed glandMounting bracket (optional)Steel, galvanized and chrome-plated or stainless steelAuxiliary powerI1 35 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)Without digital display11 35 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)With digital display13.1 35 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)Galvanic isolationBetween input and output	Dimensione		Damping 0.0 s	
GD-AISi 12 or stainless steel, polyester-based lacquer, stainless steel rating plateElectrical connection, sensor connectionScrew terminals, cable inlet via M20 x 1.5 or ½-14 NPT screwed glandMounting bracket (optional)Steel, galvanized and chrome-plated or stainless steelAuxiliary powerI 135 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)Without digital display1135 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)With digital display13.135 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)Galvanic isolationBetween input and output		°,		
tion1.5 or ½-14 NPT screwed glandMounting bracket (optional)Steel, galvanized and chrome-plated or stainless steelAuxiliary powerWithout digital display11 35 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)With digital display13.1 35 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)With digital displayBetween input and output		GD-AlSi 12 or stainless steel, polyes- ter-based lacquer, stainless steel rat-		
Auxiliary powerWithout digital display11 35 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)With digital display13.1 35 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)With digital display13.1 35 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)Galvanic isolationBetween input and output				
Without digital display11 35 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)With digital display13.1 35 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)Galvanic isolationBetween input and output	Mounting bracket (optional)			
with Ex ic and Ex nA)With digital display13.1 35 V DC (30 V with Ex ib; 32 V with Ex ic and Ex nA)Galvanic isolationBetween input and output	Auxiliary power			
with Ex ic and Ex nA)       Galvanic isolation       Between input and output	Without digital display			
	With digital display			

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Temperature transmitters Field transmitters/Field indicator

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

#### Digital measuring error

#### Resistance thermometer

Input	Measuring range		Minimum measuring span		iccuracy
	°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)

#### measuring span °C °C °C (°F) (°F) (°F) (3.6) 1) 100 ... 1820 (212 ... 3308) 2 1) Туре В 100 (180) Type C (W5) 0 ... 2300 100 (180) 2 3.6 (32 ... 4172) 0 ... 2300 (32 ... 4172) 12) $(1.8)^{2}$ Type D (W3) 100 (180) -200 ... +1000 Type E 50 (90) 1 (1.8)(-328 ... +1832) -200 ... +1200 50 1 (1.8) Type J (90)(-328 ... +2192) -200 ... +1370 (-328 ... +2498) Type K 50 (90) 1 (1.8)-200 ... +900 (-328 ... +1652) (90) Type L 50 1 (1.8) Type N -200 ... +1300 50 (90)1 (1.8) (-328 ... +2372) Type R -50 ... +1760 100 (180) 2 (3.6)(-58 ... +3200) Type S -50 ... +1760 100 (180) 2 (3.6)(-58 ... +3200) -20 ... +400 (-328 ... +752) Туре Т 40 (72)1 (1.8)-200 ... +600 2 Type U 50 (90) (3.6)(-328 ... +1112)

Measuring range Minimum

**Digital accuracy** 

 $^{1)}$  The digital accuracy in the range 100 to 300 °C (212 to 572 °F) is 3 °C (5.4 °F)

<sup>2)</sup> 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	μ	
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).

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

#### **Temperature measurement** Temperature transmitters

Field transmitters/Field indicator

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

## Selection and ordering data

	Article No.				Options	Order code
Temperature transmitter in field enclosure 2-wire system 4 20 mA,				Append suffix "-Z" to article no., add order code and plain text, if applicable.		
with electrical isolation					Test report (5 measuring points)	C11
Click on the Article No. for the online configuration in the PIA Life Cycle Portal.					Functional safety SIL2	C20
Built-in transmitter					Functional safety SIL2/3	C23
SITRANS TH200, programmable • Without Ex protection • With Ex ia (ATEX + IECEx) • With Ex nAL for Zone 2 (ATEX + IECEx) • Total device SITRANS TF Ex d (ATEX + IECEx) <sup>1)</sup>	5 5 5 5	1 2			<ul> <li>Explosion protection</li> <li>Explosion protection Ex ia according to INMETRO (Brazil) (only for 7NG3131)</li> <li>Explosion protection Ex d according to INMETRO (Brazil) (only for 7NG3134)</li> </ul>	E25 <sup>1)</sup> E26 <sup>1)</sup> E27 <sup>1)</sup>
Total device SITRANS TF according to FM (XP, DIP, NI, S) <sup>1)</sup> SITRANS TH300, communication-capable according to HART V 5.9	5				<ul> <li>Explosion protection Ex nA according to INMETRO (Brazil) (only for 7NG3132)</li> <li>Explosion protection Ex i according to NEPS (China) (only for 7NG3131)</li> </ul>	E55 <sup>1)</sup>
<ul> <li>Without Ex protection</li> <li>With Ex ia (ATEX + IECEx)</li> <li>With Ex nAL for Zone 2 (ATEX + IECEx)</li> <li>Total device SITRANS TF Ex d (ATEX + IECEx)<sup>1)</sup></li> </ul>	6 6 6	1 2			<ul> <li>Explosion protection Ex d according to NEPS (China) (only for 7NG3134)</li> <li>Explosion protection Ex nA according to NEPSI (China) (only for 7NG3132)</li> <li>Explosion protection Ex d according to</li> </ul>	E56 <sup>1)</sup> E57 <sup>1)</sup> E70 <sup>1)</sup>
Total device STRANS TF EX d (ATEX + TECEX) <sup>47</sup> Total device SITRANS TF according to FM     (XP, DIP, NI, S) <sup>1)</sup> Enclosure	6				KOSHA (Korea) (only for 7NG3134) • Explosion protection Ex i according to EAC (Russia/Belarus/Kazahstan) (only for	E81 <sup>1)</sup>
Die-cast aluminum			Α		7NG3131) • Explosion protection Ex d according to EAC	E82 <sup>1)</sup>
Stainless steel precision casting			E		(Russia/Belarus/Kazahstan) (only for 7NG3134)	
Connections/cable inlet	-				Explosion protection Ex nA according to EAC	E83 <sup>1)</sup>
Screwed glands M20x1.5			в		(Russia/Belarus/Kazakhstan) (only for 7NG3132)	
1/2-14 NPT glands			С		Marine approvals	
Digital indicator	_				Det Norske Veritas Germanischer Lloyd (DNV GL)	D01
Without				0	Bureau Veritas (BV)	D02
With				1	Lloyd's Register of Shipping (LR)	D04
Mounting bracket and fastening parts	-				<ul> <li>American Bureau of Shipping (ABS)</li> </ul>	D05
Without				0	Two-layer coating of enclosure and cover (PU on epoxy)	G10
Made of steel				1	Transient protection	J01
Made of stainless steel				2	Cable gland CAPRI ½ NPT ADE 4F, nickel-	D57
<sup>1)</sup> Without cable gland.					plated brass (CAPRI 848694 and 810634)	57

included

Cable gland ½ NPT ADE 1F, cable diameter 6 ... 12 (CAPRI 818694 and 810534) included

Cable gland ½ NPT ADE 4F, Stainless steel (CAPRI 848699 and 810634) included

Cable gland ½ NPT ADE 1F, cable diameter 4 ... 8.5 (CAPRI 818674 and 810534) included

D58

D59

D60

#### **Temperature measurement** Temperature transmitters

Field transmitters/Field indicator

#### 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 <sup>2)</sup>
Measuring point number (TAG) max. 8 characters	Y17 <sup>3)</sup>
Measuring point description, max. 16 characters	Y23 <sup>4)</sup>
Measuring point description, max. 32 characters	Y24 <sup>4)</sup>
Labeling of measuring point plate only, specify in plain text: Measuring range	Y22 <sup>4)</sup>
Pt100 (IEC) 2-wire, $R_L = 0 \Omega$	U02 <sup>5)</sup>
Pt100 (IEC) 3-wire	U03 <sup>5)</sup>
Pt100 (IEC) 4-wire	U04 <sup>5)</sup>
Type B thermocouple	U20 <sup>5)6)</sup>
Type C thermocouple (W5)	U21 <sup>5)6)</sup>
Type D thermocouple (W3) <sup>5)6)</sup>	U22 <sup>5)6)</sup>
Type E thermocouple	U23 <sup>5)6)</sup>
Type J thermocouple	U24 <sup>5)6)</sup>
Type K thermocouple	U25 <sup>5)6)</sup>
Type L thermocouple	U26 <sup>5)6)</sup>
Type N thermocouple	U27 <sup>5)6)</sup>
Type R thermocouple	U28 <sup>5)6)</sup>
Type S thermocouple	U29 <sup>5)6)</sup>
Type T thermocouple	U30 <sup>5)6)</sup>
Type U thermocouple	U31 <sup>5)6)</sup>
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 set- ting in plain text	Y09 <sup>7)</sup>
Fault current 3.6 mA (instead of 22.8 mA)	U36 <sup>3)</sup>

- <sup>1)</sup> Option does not include ATEX/IECEx approval, only country-specific approval.
- <sup>2)</sup> 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.
- <sup>3)</sup> For this selection, Y01 or Y09 must also be selected. For specification on TAG plate, please select Y23.
- <sup>4)</sup> If only Y22, Y23 or Y24 is ordered and if the labeling is <u>only</u> noted on the measuring point plate, do not specify Y01.
- <sup>5)</sup> For this selection, Y01 must also be selected.
- <sup>6)</sup> Internal reference junction compensation is selected as the default for TC.
- <sup>7)</sup> 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, connec- tion and transmitter configuration, see page 2/154.	
Modems	
Modem with USB interface Modem with USB interface and SIPROM T soft- ware	7MF4997-1DB 7NG3092-8KN
SIMATIC PDM parameterization software Also for SITRANS TH300	See section 8
Mounting bracket and fastening parts	
Made of steel for 7NG313B	7MF4997-1AC
Made of steel for 7NG313C	7MF4997-1AB
Made of stainless steel for 7NG313B	7MF4997-1AJ
Made of stainless steel for 7NG313C	7MF4997-1AH
Made of stainless steel 316L for 7NG313B	7MF4997-1AQ
Made of stainless steel 316L for 7NG313C	7MF4997-1AP
Digital display <sup>1)</sup>	7MF4997-1BS
Connection board	A5E02226423

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

<sup>1)</sup> Retrofitting not possible with Ex devices. Ordering example 1

7NG3135-0AB11-Z Y01+Y23+U03 Y01: -10 ... +100 °C Y23: TICA1234HEAT <u>Ordering example 2</u> 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
Temperature transmitters Field transmitters/Field indicator

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

		Article N	о.					
SITRANS TF field indicator For 4 20 mA signals	7	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) <sup>1)</sup>				4			1	
Total device SITRANS TF according to FM (XP, DIP, NI, S) <sup>1)</sup>				5			1	
Enclosure								
Die-cast aluminum					A			
Stainless steel precision casting					Е			
Connections/cable inlet								
Screwed glands M20x1.5						в		
1/2-14 NPT glands						С		
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

Ontions	Orden e ele
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	
<ul> <li>Explosion protection Ex ia according to INMETRO (Brazil) (only for 7NG3131)</li> </ul>	E25 <sup>1)</sup>
<ul> <li>Explosion protection Ex d according to INMETRO (Brazil) (only for 7NG3134)</li> </ul>	E26 <sup>1)</sup>
<ul> <li>Explosion protection Ex nA according to INMETRO (Brazil) (only for 7NG3132)</li> </ul>	E27 <sup>1)</sup>
• Explosion protection Ex i according to NEPSI (China) (only for 7NG3131)	E55 <sup>1)</sup>
• Explosion protection Ex d according to NEPSI (China) (only for 7NG3134)	E56 <sup>1)</sup>
<ul> <li>Explosion protection Ex nA according to NEPSI (China) (only for 7NG3132)</li> </ul>	E57 <sup>1)</sup>
<ul> <li>Explosion protection Ex d according to KOSHA (Korea) (only for 7NG3134)</li> </ul>	E70 <sup>1)</sup>
<ul> <li>Explosion protection Ex i according to EAC (Russia/Belarus/Kazahstan) (only for 7NG3131)</li> </ul>	E81 <sup>1)</sup>
<ul> <li>Explosion protection Ex d according to EAC (Russia/Belarus/Kazahstan) (only for 7NG3134)</li> </ul>	E82 <sup>1)</sup>
• Explosion protection Ex nA according to EAC (Russia/Belarus/Kazakhstan) (only for 7NG3132)	E83 <sup>1)</sup>
Marine approvals	
Det Norske Veritas Germanischer Lloyd (DNV GL)	D01
Bureau Veritas (BV)	D02
Lloyd's Register of Shipping (LR)	D04
<ul> <li>American Bureau of Shipping (ABS)</li> </ul>	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 1/2 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	Y01 <sup>2)</sup>
Specify in plain text (max. 5 digits): Y01: to °C, °F	
Labeling of measuring point plate only, specify in plain text: Measuring range	Y22 <sup>3)</sup>
Measuring point description, max. 16 charac- ters	Y23 <sup>3)</sup>
Measuring point description, max. 32 charac- ters	Y24 <sup>3)</sup>
Enter special deviating customer-specific set- ting in plain text	Y09 <sup>4)</sup>

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

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

<sup>3)</sup> If only Y22, Y23 or Y24 is ordered and if the labeling is only noted on the measuring point plate, do not specify Y01.

<sup>4)</sup> 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.

<sup>5)</sup> Retrofitting not possible with Ex devices.

#### Accessories

Article No.
7MF4997-1AC
7MF4997-1AB
7MF4997-1AJ
7MF4997-1AH
7MF4997-1AQ
7MF4997-1AP
7MF4997-1BS
A5E02226423

### **Temperature measurement** Temperature transmitters Field transmitters/Field indicator

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

#### Dimensional drawings



- 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

Temperature transmitters Field transmitters/Field indicator

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

# Circuit diagrams





2-wire connection 1)



3-wire connection



4-wire connection



Generation of average value / difference 1) <sup>1)</sup> Programmable line resistance for the purpose of correction.



SITRANS TF, sensor connection assignment

Resistance



2-wire connection 1)



3-wire connection

4-wire connection



Generation of average value / difference 1)

R





Cold junction compensation Internal/fixed value



Cold junction compensation with external Pt100 in 2-wire connection <sup>1)</sup>



Cold junction compensation with external Pt100 in 3-wire connection



Generation of average value / difference with internal cold junction compensation

### 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,  $\Omega$  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

of protection, for Europe and USA

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

#### Application

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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 redundance

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

°F)

### Temperature measurement Temperature transmitters

Field transmitters/Field indicator

### SITRANS TF - Fieldbus transmitter



SITRANS TF with TH400, communication interface

#### Technical specifications

### Input

mput	
Analog/digital conversion • Measurement rate • Resolution	< 50 ms 24-bit
Resistance thermometer	
Pt25 Pt1000 acc. to IEC 60751/JIS C 1604	
<ul> <li>Measuring range</li> </ul>	-200 +850 °C (-328 +1562
Ni25 Ni1000 acc. to DIN 43760	-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 <ul> <li>Sensor break detection</li> <li>Sensor short-circuit detection</li> </ul>	Yes 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 • Sensor short-circuit detection	Yes Yes, < 15 Ω

Thermocouple				
According to IEC 584	Measuring range			
• Туре В	400 1820 °C (752 3308 °F)			
• Type E	-100 +1000 °C (-148 +1832 °F)			
• Type J	-100 +1000 °C (			
<ul><li>Type K</li><li>Type N</li></ul>	-100 +1200 °C ( -180 +1300 °C (			
• Type R	-50 +1760 °C (-	· ,		
• Type S	-50 +1760 °C (-			
• 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			
• Type W5	0 2300 °C (32			
External reference junction compen- sation	-40 +135 °C (-40 +275 °F)			
Sensor fault detection	X			
<ul> <li>Sensor break detection</li> <li>Sensor short-circuit detection</li> </ul>	Yes Yes, < 3 mV			
<ul> <li>Sensor short-circuit detection</li> <li>Sensor current in the event of open-</li> </ul>				
circuit monitoring	4 μΑ			
mV sensor - voltage input	2000 000 V			
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 val- ues.				
General values				
Type of input	Absolute	Temperature		
All	accuracy $\leq \pm 0.05$ % of the	coefficient $\leq \pm 0.002$ % of the		
	≤ ± 0.05 % of the measured value	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	$\leq \pm 0.2 \mu\text{V/°C}$		
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

Rated conditions	
Ambient conditions	
Ambient temperature	-40 +85 °C (-40 +185 °F)
Storage temperature	-40 +85 °C (-40 +185 °F)
Relative humidity	$\leq$ 98 %, with condensation
Insulation strength	
<ul> <li>Test voltage</li> </ul>	500 V AC for 60 s
<ul> <li>Continuous operation</li> </ul>	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	<ul> <li>Die-cast aluminum, low in copper, GD-AlSi 12 or stainless steel</li> <li>Polyester-based lacquer for GD AlSi 12 enclosure</li> <li>Stainless steel rating plate</li> </ul>
Electrical connection, sensor connection	<ul> <li>Screw terminals</li> <li>Cable inlet via M20 x 1.5 or ½-14 NPT screwed gland</li> <li>Bus connection with M12 device plug (optional)</li> </ul>
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	
<ul> <li>Standard, Ex "d", Ex "nA", Ex "nL", XP, NI</li> </ul>	10.0 32 V DC
• Ex "ia", Ex "ib"	10.0 30 V DC
<ul> <li>In FISCO/FNICO installations</li> </ul>	10.0 17.5 V DC

< 11 mA

Parameterization interface • PROFIBUS PA connection - Protocol - Protocol standard - Address (for delivery) - Function blocks • FOUNDATION Fieldbus connection - Protocol - Protocol standard - Functionality - Version - Function blocks	A&D profile, Version 3.0 EN 50170 Volume 2 126 2 x analog FF protocol FF design specifications Basic or LAS ITK 4.6 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

#### Certificates and approvals Ex

Max. increase in power consumption < 7 mA in the event of a fault

Power consumption

Certificates and approvals	
Explosion protection ATEX	
EC type-examination certificate • "Intrinsic safety" type of protection (version: 7NG313x-1xxxx)	ZELM 11 ATEX 0471 X 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 • "Non-sparking and energy-limited equipment" type of protection (version: 7NG313x-2xxxx)	ZELM 11 ATEX 0471 X 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 • "Flame-proof enclosure" type of pro- tection (version: 7NG313x-4xxxx)	ZELM 11 ATEX 0472 X 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 • Type of protection XP, DIP, NI and S (version 7NG313x-5xxxx)	FM 3017742 • 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

### 2/114

Options

Append suffix "-Z" to article no., add order code

# Temperature measurement

Temperature transmitters Field transmitters/Field indicator

### SITRANS TF - Fieldbus transmitter

Order code

	Article N	ю.			
Temperature transmitter in field enclosure With fieldbus communication and electrical isola- tion	7NG313	-			0
Click on the Article No. for the online configuration in the PIA Life Cycle Portal.					
Built-in transmitter					
<ul> <li>SITRANS TH400 with PROFIBUS PA</li> <li>Without Ex protection</li> <li>With Ex ia (ATEX)</li> <li>With Ex nAL for Zone 2 (ATEX)</li> <li>Total device SITRANS TF Ex d (ATEX + IECEx)<sup>1)</sup></li> <li>Total device SITRANS TF according to FM (XP, DIP, NI, S)<sup>1)</sup></li> </ul>		7 7 7 7 7	0 1 2 4 5		
SITRANS TH400, with FOUNDATION Fieldbus • Without Ex protection • With Ex ia (ATEX) • With Ex nAL for Zone 2 (ATEX) • Total device SITRANS TF Ex d (ATEX + IECEx) <sup>1)</sup> • Total device SITRANS TF according to FM (XP, DIP, NI, S) <sup>1)</sup>		8 8 8 8	0 1 2 4 5		
Enclosure	-				
Die-cast aluminum			1	A	
Stainless steel precision casting			,	Е	
Connections/cable inlet	-				
Screwed glands M20x1.5				в	3
1⁄2-14 NPT glands				С	;
Mounting bracket and fastening parts					
Without					
Made of steel					
Made of stainless steel					

and plain text, if applicable.	
Test report (5 measuring points)	C11
<ul> <li>Bus connection</li> <li>M12 device plug (metal) without mating connector</li> <li>M12 device plug (metal) with mating connector</li> </ul>	M00 <sup>1)</sup> M01 <sup>1)</sup>
Explosion protection	
<ul> <li>Explosion protection Ex ia according to INMETRO (Brazil) (only for 7NG3131)</li> </ul>	E25 <sup>2)</sup>
<ul> <li>Explosion protection Ex d according to INMETRO (Brazil) (only for 7NG3134)</li> </ul>	E26 <sup>2)</sup>
<ul> <li>Explosion protection Ex nA according to INMETRO (Brazil) (only for 7NG3132)</li> </ul>	E27 <sup>2)</sup>
• Explosion protection Ex i according to NEPSI (China) (only for 7NG3131)	E55 <sup>2)</sup>
<ul> <li>Explosion protection Ex d according to NEPSI (China) (only for 7NG3134)</li> <li>Evaluation protection Ex ad according to</li> </ul>	E56 <sup>2)</sup> E57 <sup>2)</sup>
<ul> <li>Explosion protection Ex nA according to NEPSI (China) (only for 7NG3132)</li> <li>Explosion protection Ex d according to</li> </ul>	E57 <sup>-7</sup>
KOSHA (Korea) (only for 7NG3134)	
<ul> <li>Explosion protection Ex i according to EAC (Russia/Belarus/Kazahstan) (only for 7NG3131)</li> </ul>	E81 <sup>2)</sup>
<ul> <li>Explosion protection Ex d according to EAC (Russia/Belarus/Kazahstan) (only for 7NG3134)</li> </ul>	E82 <sup>2)</sup>
• Explosion protection Ex nA according to EAC (Russia/Belarus/Kazakhstan) (only for 7NG3132)	E83 <sup>2)</sup>
Marine approvals	
<ul> <li>Det Norske Veritas Germanischer Lloyd (DNV GL)</li> </ul>	D01
Bureau Veritas (BV)	D02
<ul> <li>Lloyd's Register of Shipping (LR)</li> <li>American Bureau of Shipping (ABS)</li> </ul>	D04 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	D60

Cable gland ½ NPT ADE 1F, cable diameter 4 ... 8.5 (CAPRI 818674 and 810534) included

Temperature transmitters Field transmitters/Field indicator

#### **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 <sup>3)</sup>
Measuring point number (TAG) max. 8 charac- ters	Y15 <sup>4)</sup>
Measuring point description, max. 16 characters	Y23 <sup>4)</sup>
Measuring point description, max. 32 characters	Y24 <sup>5)</sup>
Specify bus address in plain text	Y25 <sup>4)</sup>
Pt100 (IEC) 2-wire, $R_L = 0 \ \Omega$	U02 <sup>6)</sup>
Pt100 (IEC) 3-wire	U03 <sup>6)</sup>
Pt100 (IEC) 4-wire	U04 <sup>6)</sup>
Type B thermocouple	U20 <sup>6)7)</sup>
Type C thermocouple (W5)	U21 <sup>6)7)</sup>
Type D thermocouple (W3)	U22 <sup>6)7)</sup>
Type E thermocouple	U23 <sup>6)7)</sup>
Type J thermocouple	U24 <sup>6)7)</sup>
Type K thermocouple	U25 <sup>6)7)</sup>
Type L thermocouple	U26 <sup>6)7)</sup>
Type N thermocouple	U27 <sup>6)7)</sup>
Type R thermocouple	U28 <sup>6)7)</sup>
Type S thermocouple	U29 <sup>6)7)</sup>
Type T thermocouple	U30 <sup>6)7)</sup>
Type U thermocouple	U31 <sup>6)7)</sup>
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 set-	Y09 <sup>8)</sup>

Enter special deviating customer-specific setting in plain text

<sup>1)</sup> Not possible with explosion protection Ex d or XP.

- <sup>2)</sup> Option does not include ATEX/IECEx approval, only country-specific approval. For specification on TAG plate, please select Y22.
- <sup>3)</sup> 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.
- <sup>4)</sup> If only Y15, Y23 or Y25 is ordered and if the labeling is <u>only</u> noted on the measuring point plate, do not specify Y01.
- <sup>5)</sup> For this selection, Y01 or Y09 must also be selected.
- <sup>6)</sup> For this selection, Y01 must also be selected.
- <sup>7)</sup> Internal reference junction compensation is selected as the default for TC.
   <sup>8)</sup> 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, connec- tion 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 7NG313B	7MF4997-1AC
Made of steel for 7NG313C	7MF4997-1AB
Made of stainless steel for 7NG313B	7MF4997-1AJ
Made of stainless steel for 7NG313C	7MF4997-1AH
Made of stainless steel 316L for 7NG313B	7MF4997-1AQ
Made of stainless steel 316L for 7NG313C	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 <u>Ordering example 2</u> 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

Temperature transmitters Field transmitters/Field indicator

### SITRANS TF - Fieldbus transmitter

# Dimensional drawings



3 Electrical connection (screwed plug M20x1.5 orr 1/2-14 NPT), optional M12 device plug

4 Terminal side, bus connection

SITRANS TF with TH400, dimensions in mm (inches)



- 6 Protective cover (without function)
- 7 Mounting bracket (optional) with clamp securing to a vertical or horizontal pipe

Temperature transmitters Field transmitters/Field indicator

### Circuit diagrams



2-wire connection <sup>1)</sup>



3-wire connection



4-wire connection



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



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

Thermocouple

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cold junction compensation



Cold junction compensation with external Pt100 in 2-wire connection <sup>1)</sup>



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 <sup>1)</sup>

<sup>1)</sup> Programmable line resistance for the purpose of correction.

#### Resistance



2-wire connection 1)



3-wire connection



4-wire connection



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

Voltage measurement



One voltage source



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

SITRANS TF with TH400, sensor connection assignment

### **Temperature measurement** Temperature transmitters Field transmitters/Field indicator

#### SITRANS TF320 (HART, universal)

### 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.

#### SITRANS TF320 (HART, universal)

#### 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),  $\Omega$  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

# rement

mitters dicator

#### iversal)

Technical specifications			
General			
Supply voltage <sup>1) 2)</sup>			
<ul> <li>Without explosion protection (nor</li> </ul>	า-		

JIS C 1604-8)

· All other input types

• Pt1000, Pt10000 (IEC 60751 and

Fault detection, programmable

Cable, wire-wire capacity

Max. 30 nF

Max. 50 nF

Note

None, short-circuited, defective, short-circuited or defective

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.

			nperature measure Temperature transr ansmitters/Field ind
		SITR	ANS TF320 (HART, uni
Technical specifications			
General		Detection limit for short-circuited input	15 Ω
	10.5 48 V DC	Fault detection time (RTD) Fault detection time (for 3-wire and 4-	$\leq$ 75 ms (typically 70 ms) $\leq$ 2 000 ms
<ul><li>Ex)</li><li>with explosion protection (Ex i)</li></ul>	10.5 30 V DC	wire)	
Additional minimum supply voltage when using test terminals	0.8 V	Thermocouples (TC) Input type	
Maximum power loss	≤ 850 mW	• B • E	IEC 60584-1 IEC 60584-1
Minimum load resistance at supply voltage > 37 V	(V <sub>supply</sub> - 37 V)/23 mA	• J • K	IEC 60584-1 IEC 60584-1 IEC 60584-1
<ul> <li>Insulation voltage, test/operation</li> <li>Without explosion protection (non- Ex)</li> </ul>	2.5 kV AC/55 V AC	• L • Lr • N	DIN 43710 GOST 3044-84 IEC 60584-1
	2.5 kV AC/42 V AC	• N • R	IEC 60584-1
Polarity protection	All inputs and outputs	• S	IEC 60584-1
	Wire jumper (transmitter), switch (on display) or software	• T • U • W2	IEC 60584-1 DIN 43710 ASTM E988-96
Warm-up time	< 5 min	• W3 • W5	ASTM E988-96
Starting time	< 2.75 s	• LR	GOST 3044-84
Programming	SIPROM T and HART	Cold junction compensation (CJC)	Constant, internal or external
Signal-to-noise ratio	> 60 dB	<ul> <li>Temperature range internal CJC</li> </ul>	Pt100 or Ni100 RTD -50 +100 °C (-58 +212 °
с ,	Better than: • ± 0.05% of measuring span/year • ± 0.18% of measuring span/5 years	<ul> <li>Connection external CJC</li> <li>External CJC, line resistance per wire (for 3-wire and 4-wire connec-</li> </ul>	2-wire or 3-wire 50 Ω
	4 20 mA: $\leq$ 55 ms HART: $\leq$ 75 ms (typically 70 ms)	<ul> <li>tions)</li> <li>Effect of the line resistance (with 3-wire and 4-wire connections)</li> </ul>	< 0.002 Ω/Ω
Programmable damping	0 60 s	Input current external CJC	< 0.15 mA
	24 bit 18 bit < 0.005% of measuring span/V DC	<ul> <li>Temperature range external CJC</li> <li>Cable, wire-wire capacity</li> <li>Total line resistance</li> <li>Fault detection, programmable</li> </ul>	-50 +135 °C (-58 +275 ° Max. 50 nF Max. 10 kΩ None, short-circuited, defect short-circuited or defective
Input			Note
	• IEC 60751	<ul> <li>Fault detection time (TC)</li> <li>Fault detection time, external CJC</li> </ul>	The short-circuited fault dete only applies to the CJC input $\leq$ 75 ms (typically 70 ms) $\leq$ 2 000 ms
	<ul> <li>JIS C 1604-8</li> <li>GOST 6651_2009</li> <li>Callendar-Van Dusen</li> </ul>	(for 3-wire and 4-wire) Linear resistance	<u> </u>
	<ul> <li>DIN 43760-1987</li> <li>GOST 6651-2009/OIML R84:2003</li> </ul>	Input range	0 100 kΩ
	<ul> <li>Edison Copper Winding No. 15</li> <li>GOST 6651-2009/OIML R84:2003</li> </ul>	Minimum measuring span	25 Ω
	2-wire, 3-wire or 4-wire	Type of connection	2-wire, 3-wire or 4-wire
	Max. 50 $\Omega$	Line resistance per wire	Max. 50 Ω
	< 0.15 mA	Input current	< 0.15 mA
	< 0.002 Ω/Ω	Effect of the line resistance (with 3- wire and 4-wire connections)	< 0.002 Ω/Ω
/		Cable, wire-wire capacity	

Cable, wire-wire capacity

• R > 400 Ω • R ≤ 400 Ω

Fault detection, programmable

al over 2 °F)

°F) ctive,

tection ut.

Max. 30 nF Max. 50 nF None, defective

### SITRANS TF320 (HART, universal)

Potentiometers		Rated conditions	
Input range	10 Ω 100 kΩ	Ambient temperature	
Minimum measuring span	25 Ω	<ul> <li>Without local operation in single chamber enclosure</li> </ul>	-50 +85 °C (-58 +185 °F)
Type of connection	2-wire, 3-wire or 4-wire	With local operation	-40 +85 °C (-40 +185 °F)
Line resistance per wire	Max. 50 Ω	<ul> <li>For transmitters with functional safety</li> </ul>	-40 +80 °C (-40 +176 °F)
Input current	< 0.15 mA	,	-50 +85 °C (-58 +185 °F)
Effect of the line resistance (with 4- wire and 5-wire connections)	< 0.002 Ω/Ω	Storage temperature Reference temperature for sensor calibration	24 °C ±1.0 °C (75.2 °F ±1.8 °F)
Cable, wire-wire capacity			
• R > 400 Ω	Max. 30 nF	Relative humidity	< 99% (no condensation)
• R ≤ 400 Ω	Max. 50 nF	<ul><li>Degree of protection</li><li>Temperature transmitter enclosure</li></ul>	IP66/IP67/IP68
Fault detection, programmable	None, short-circuited, defective, short-circuited or defective	Terminals	IP00
	Note	Mechanical construction	
	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.	Weight <ul> <li>Single chamber enclosure</li> <li>Dual chamber enclosure</li> </ul> Maximum core cross-section	0.85 kg (1.87 lb) • Aluminum: 1.3 kg (2.87 lb) • Stainless steel: 3.3 kg (7.28 lb)
Detection limit for short-circuited input		Single chamber enclosure	1.5 mm <sup>2</sup> (AWG 16)
Fault detection time, wiper arm	≤ 75 ms (typically 70 ms)	Dual chamber enclosure	2.5 mm <sup>2</sup> (AWG 14)
(no short-circuit detection) Fault detection time, element	≤ 2 000 ms	Tightening torque for clamping screws	0.5 0.6 Nm
Fault detection time (for 4-wire and 5-	≤ 2 000 ms	Vibrations	IEC 60068-2-6
wire)		• 2 25 Hz • 25 100 Hz	± 1.6 mm (0.07 inch) ± 4 g
Supply voltage		Certificates and approvals	
Measuring range	100 1700 mV	Explosion protection ATEX/IECEx and	
<ul><li>Unipolar</li><li>Bipolar</li></ul>	-100 1700 mV -800 +800 mV	others	
Minimum measuring span	2.5 mV	Certificates <sup>3)</sup>	IECEX DEK 19.0069X
Input resistance	10 MΩ		DEKRA 19ATEX0106 X (Category 1) DEKRA 19ATEX0107 X (Category 3)
Cable, wire-wire capacity		"Intrinsic safety ia/ib" type of protec-	For use in Zone 0, 1, 2
• Input range: -100 1700 mV	Max. 30 nF	tion	
<ul> <li>Input range: -20 100 mV</li> </ul>	Max. 50 nF	• ATEX	II 1 G Ex ia IIC T6 T4 Ga II 2(1) G Ex ib [ia Ga] IIC
Fault detection, programmable	None, defective		T6 T4 Gb
Fault detection time	≤ 75 ms (typically 70 ms)	<ul> <li>IECEx and others</li> </ul>	Ex ia IIC T6 T4 Ga Ex ib [ia Ga] IIC T6 T4 Gb
Output and HART communication		• EACEx	Ex ia IIC T6 T4 Ga
Normal range, programmable	3.8 20.5 mA/20.5 3.8 mA		Ex ib [ia Ga] IIC T6 T4 Gb
Extended range (output limits), pro- grammable	3.5 23 mA/23 3.5 mA	<ul> <li>Intrinsic safety ic" type of protection</li> <li>ATEX</li> </ul>	For use in Zones 2 II 2 G Ex ic IIC T6T4 Gc
Programmable input/output limits		<ul><li>IECEx and others</li><li>EACEx</li></ul>	Ex ic IIC T6 T4 Gc 2Ex ic IIC T6T4 Gc X
<ul> <li>Fault current</li> <li>Fault current setting</li> </ul>	Enable/disable 3.5 23 mA	"Non-sparking/increased safety	For use in Zones 2
Update time	10 ms	nA/ec" type of protection	
•		• ATEX	II 2 G Ex nA IIC T6T4 Gc II 2 G Ex ec IIC T6T4 Gc
Load (with current output)	$\leq$ (V <sub>Supply</sub> - 10.5)/0.023 $\Omega$	<ul> <li>IECEx and others</li> </ul>	Ex nA IIC T6 T4 Gc
Load stability	< 0.01% of measuring span/100 $\Omega$ (measuring span = currently selected range)	• EACEx	Ex ec IIC T6 T4 Gc 2Ex nA IIC T6T4 Gc
Input fault detection, programmable (detection of input short circuits is ignored with TC and voltage inputs)	3.5 23 mA	<ul> <li>"Flameproof enclosure db" type of protection</li> <li>ATEX</li> </ul>	For use in Zone 1
NAMUR NE43 Upscale	> 21 mA	<ul> <li>IECEx and others</li> <li>EACEx</li> </ul>	Ex db IIC T6 T4 Gb 1Ex d IIC T6T4 Gb X
NAMUR NE43 Downscale	< 3.6 mA	<ul> <li>"Protection by enclosure tb" type of</li> </ul>	For use in Zone 21
HART protocol versions	HART 7	protection • ATEX	
Measuring accuracy		<ul> <li>ATEX</li> <li>IECEx and others</li> </ul>	II 2 D Ex tb IIC T100°C Db Ex tb IIC T100°C Db
Input accuracy	See "Input accuracy" table	• EACEx	Ex tb IIC T100°C Db X
Output accuracy	See "Output accuracy" table		

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Temperature transmitters Field transmitters/Field indicator

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 T6T4 Ex nA IIC T6 T4 Gc AEx nA IIC T6 T4 Gc
"Explosion-proof XP" type of protec- tion	XP/ CL I / DIV1 / GP ABCD / T6T4 CL I / Zn1 / AEx/Ex d IIC T6T4 Gb
"Dust-protected DIP" type of protec- tion	DIP/ CL II, III / DIV 1 / GP EFG / T6T4 Zn21 / AEx/Ex tb IIIC T100°C Gb

 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.

<sup>2)</sup> 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 <sub>0</sub> in °C <sup>-1</sup> (°F <sup>-1</sup> )	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

nput type	Standard	Measuring range in °C (°F)	Minimum measuring span in °C (°F)
3	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)
	IEC 60584-1	-100 +1 200 (-212 +2 192)	50 (122)
	IEC 60584-1	-180 +1 372 (-356 +2 502)	50 (122)
	DIN 43710	-200 +900 (-392 +1 652)	50 (122)
r	GOST 3044-84	-200 +800 (-392 +1 472)	50 (122)
	IEC 60584-1	-180 +1 300 (-356 +2 372)	50 (122)
	IEC 60584-1	-50 +1 760 (-122 +3 200)	100 (212)
	IEC 60584-1	-50 +1 760 (-122 +3 200)	100 (212)
	IEC 60584-1	-200 +400 (-392 +752)	50 (122)
	DIN 43710	-200 +600 (-392 +1 112)	50 (122)
'3	ASTM E988-96	0 2 300 (32 4 172)	100 (212)
5	ASTM E988-96	0 2 300 (32 4 172)	100 (212)
7	GOST 3044-84	-200 +800 (-392 +1472)	50 (122)

2

# Temperature measurement

Temperature transmitters Field transmitters/Field indicator

# SITRANS TF320 (HART, universal)

### Input accuracy

Basic values

Input type	Basic accuracy	Temperature coefficient <sup>1)</sup>		
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)	$\leq \pm 0.002 ^{\circ}\text{C/}^{\circ}\text{C} ^{\circ}\text{F/}^{\circ}\text{F})$		
Pt200	$\leq \pm 0.08$ °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)		
Pt500	$T_{max.} < 180 \text{ °C} (356 \text{ °F}) = \le \pm 0.08 \text{ °C} (0.144 \text{ °F})$	≤ ±0.002 °C/°C (°F/°F)		
	$T_{max.} > 180 \text{ °C} (356 \text{ °F}) = \le \pm 0.16 \text{ °C} (0.288 \text{ °F})$			
Pt1000	≤ ±0.08 °C (0.144 °F)	≤ ±0.002 °C/°C (°F/°F)		
Pt2000	$T_{max.} < 300 \text{ °C} (572 \text{ °F}) = \le \pm 0.08 \text{ °C} (0.144 \text{ °F})$ $T_{max.} > 300 \text{ °C} (572 \text{ °F}) = \le \pm 0.4 \text{ °C} (0.72 \text{ °F})$	≤ ±0.002 °C/°C (°F/°F)		
Pt10000	≤ ±0.16 °C (0.288 °F)	$\leq \pm 0.002 \text{ °C/°C} (\text{°F/°F})$		
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)	$\leq \pm 0.002 \text{ °C/°C (°F/°F)}$		
Ni1000	$\leq \pm 0.16$ °C (0.288 °F)	$\leq \pm 0.002 \text{ °C/°C (°F/°F)}$		
Ni2000	$\leq \pm 0.16 ^{\circ}\text{C} (0.288 ^{\circ}\text{F})$	≤ ±0.002 °C/°C (°F/°F)		
Ni10000	$\leq \pm 0.32 \text{ °C} (0.576 \text{ °F})$	≤ ±0.002 °C/°C (°F/°F)		
Ni x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points		
Cu5	$\leq \pm 1.6 ^{\circ}$ C (2.88 $^{\circ}$ F)	$\leq \pm 0.040 \text{ °C/°C} (\text{°F/°F})$		
Cu10	$\leq \pm 0.8 \text{ °C} (1.44 \text{ °F})$	$\leq \pm 0.020$ °C/°C (°F/°F)		
Cu20	$\leq \pm 0.4 ^{\circ}\text{C}  (0.72 ^{\circ}\text{F})$	$\leq \pm 0.010 \text{ °C/°C} (\text{°F/°F})$		
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)	$\leq \pm 0.002 \text{ °C/°C} (\text{°F/°F})$		
Cux	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points		
Linear resistance				
0 400 Ω	$\leq \pm 40 \text{ m}\Omega$	$\leq \pm 2 \text{ m}\Omega/^{\circ}\text{C} (1.11 \text{ m}\Omega/^{\circ}\text{F})$		
0 100 kΩ	$\leq \pm 4 \ \Omega$	$\leq \pm 0.2 \ \Omega/^{\circ}C \ (0.11 \ \Omega/^{\circ}F)$		
Potentiometers				
0 100%	< 0.05%	< ± 0.005%		
Supply voltage				
mV: -20 100 mV	$\leq \pm 5 \ \mu V$	$\leq \pm 0.2 \ \mu$ V/°C (0.11 $\mu$ V/°F)		
mV: -100 1700 mV	$\leq \pm 0.1 \text{ mV}$	$\leq \pm 36 \ \mu V/^{\circ}C \ (20 \ \mu V/^{\circ}F)$		
mV: ± 800 mV	$\leq \pm 0.1 \text{ mV}$	$\leq \pm 32 \ \mu V/^{\circ}C \ (17.8 \ \mu V/^{\circ}F)$		
тс				
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)		
К	≤ ±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)		
Ν	≤ ±0.4 °C (0.72 °F)	≤ ±0.025 °C/°C (°F/°F)		
т	≤ ±0.25 °C (0.45 °F)	≤ ±0.025 °C/°C (°F/°F)		
U	$< 0 \degree C (32 \degree F) \le \pm 0.8 \degree C (1.44 \degree F)$	$\leq \pm 0.025 \text{ °C/°C (°F/°F)}$		
-	$\geq 0 \ ^{\circ}C \ (32 \ ^{\circ}F) \leq \pm 0.4 \ ^{\circ}C \ (0.72 \ ^{\circ}F)$			
Lr	$\leq \pm 0.2 ^{\circ}$ C (0.36 °F)	≤ ±0.1 °C/°C (°F/°F)		
R	$< 200 \degree C (392 \degree F) \le \pm 0.5 \degree C (0.9 \degree F)$	$\leq \pm 0.1 \text{ °C/°C} (\text{°F/°F})$		
	$\geq 200 \text{ °C} (392 \text{ °F}) \leq \pm 1 \text{ °C} (1.8 \text{ °F})$			
S	$< 200 \degree C (392 \degree F) \le \pm 0.5 \degree C (0.9 \degree F)$	< +0.1 °C/°C (°F/°F)		
-		≤ ±0.1 °C/°C (°F/°F)		

≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F)

Temperature transmitters Field transmitters/Field indicator

### SITRANS TF320 (HART, universal)

Input type	Basic accuracy	Temperature coefficient <sup>1)</sup>	
W3	≤ ±0.6 °C (1.08 °F)	$\leq \pm 0.1 \ ^{\circ}C/^{\circ}C \ (^{\circ}F/^{\circ}F)$	
W5	≤ ±0.4 °C (0.72 °F)	$\leq \pm 0.1 \text{ °C/°C} (\text{°F/°F})$	
B <sup>2)</sup>	≤ ±1 °C (1.8 °F)	$\leq \pm 0.1 \ ^{\circ}C/^{\circ}C \ (^{\circ}F/^{\circ}F)$	
B <sup>3)</sup>	$\leq \pm 3 \text{ °C} (5.4 \text{ °F})$	$\leq \pm 0.1 \text{ °C/°C} (\text{°F/°F})$	
B <sup>4)</sup>	≤ ±8 °C (14.4 °F)	$\leq \pm 0.8 \text{ °C/°C} (^{\circ}\text{F/°F})$	
B <sup>5)</sup>	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)	

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

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

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

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

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

#### Output accuracy

Output type	Basic accuracy	Temperature coefficient
Analog output	$\leq \pm 1.6~\mu A$ (0.01% of the full output span)	$\leq\pm0.48~\mu\text{A/K}~(\leq\pm0.003\%~\text{of}$ the full output span/K)

Article No.

# Temperature measurement

Temperature transmitters Field transmitters/Field indicator

# SITRANS TF320 (HART, universal)

### Selection and ordering data

### Single chamber enclosure

			ie i	-	_			_
SITRANS TF320 Temperature transmitter with single chamber enclosure for wall or pipe	7NG034							
mounting, one configurable input and a galvani- cally isolated 2-wire output.		-				- 0		
<ul> <li>Click on the Article No. for the online configuration in the PIA Life Cycle Portal.</li> </ul>								
Communication		_	-	-			-	
With HART (4 20 mA)	0							
Without HART (4 20 mA)	7							
Primary value output	- 1							
Input 1			,					
Input 1, type	-							
RTD								
• Pt100 (IEC 60751), 3-wire			в					
• Pt100 (IEC 60751), 4-wire			С					
<ul> <li>Pt1000 (IEC 60751), 3-wire</li> <li>Pt1000 (IEC 60751), 4-wire</li> </ul>			D E					
TC								
• Type B			F					
• Type E			G					
• Type J			н					
• Type K • Type L			J K					
• Type N			Ľ					
• Type R			N					
• Type S			P Q					
Type T			R					
Potentiometer, 4-wire	-		R					
Input 2, type				Α				
Without input 2	-		ľ	A				
CJC configuration for TC None CJC								
Internal CJC				0				
				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)						E	3	
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	5	
Electrical connection/cable entries								
2x M20 x 1.5							F	
2x ½'' NPT							м	
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

# Temperature measurement Temperature transmitters

Field transmitters/Field indicator

SITRANS TF320 (HART, universal)

# Selection and ordering data

#### Dual chamber enclosure

	A	rtic	ie r	٩O.				
SITRANS TF320 Temperature transmitter with dual chamber enclosure for wall or pipe mounting, one configurable input and a galvani- cally isolated 2-wire output.			035			- 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	L	C	)					
Input 1, type								
RTD	L							
<ul> <li>Pt100 (IEC 60751), 3-wire</li> </ul>	н		в					
• Pt100 (IEC 60751), 4-wire			C D					
<ul> <li>Pt1000 (IEC 60751), 3-wire</li> <li>Pt1000 (IEC 60751), 4-wire</li> </ul>	L		E					
TC	L							
• Туре В	L		F					
• Туре Е			G					
	н		н					
• Type K • Type L	н		J K					
• Type N	L		L					
• Туре R	L		N					
• Type S	н		P					
• Type T	L		Q					
Potentiometer, 4-wire	-		R					
Input 2, type	L							
Without input 2	-		Í	Α				
CJC configuration for TC	L							
Without CJC	L			0				
Internal CJC	L			1				
External CJC RTD Pt100 (IEC 60751), 3-wire	L			3				
External CJC RTD Ni100 (DIN 43760-87), 3-wire	_			6	5			
Material of non-wetted parts	L							
Die-cast aluminum enclosure	L				1			
Enclosure made of stainless steel precision casting CF3M/1.4409 (similar to 316L)					2			
Type of protection (Ex)	L							
General purpose	L					A		
Intrinsic safety (Ex i) / Non-incendive field wiring (NIFW)						E	3	
Flameproof enclosure (Ex d) / Explosion proof (XP)	L					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							м	۱
Local operation								
Without local operation								
Local operation (closed lid)								
1 1								

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 $\mu m$ 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

2

### SITRANS TF320 (HART, universal)

### Accessories

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D

	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, with- out glass window, with seal NBR	7MF7901-2AB
Closed lid stainless steel precision casting, with- out 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

Temperature transmitters Field transmitters/Field indicator

SITRANS TF320 (HART, universal)





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



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





Temperature transmitters Field transmitters/Field indicator

### SITRANS TF320 (HART, universal)

# Circuit diagrams

### Connections

Input connection



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

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# Temperature measurement

Temperature transmitters Field transmitters/Field indicator

SITRANS TF320 (HART, universal)



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



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

Temperature transmitters Field transmitters/Field indicator

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.

Temperature measurement Temperature transmitters Field transmitters/Field indicator

#### 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),  $\Omega$  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

Temperature transmitters Field transmitters/Field indicator

# SITRANS TF420 (HART, universal)

### Technical specifications

General		Detection limit for short circuited input	15.0
Supply voltage <sup>1) 2)</sup>		Detection limit for short-circuited input	
Without explosion protection (non-Ex)	10.5 48 V DC	Fault detection time (RTD) Fault detection time (for 3-wire and 4-	$\leq$ 75 ms (typically 70 ms) $\leq$ 2 000 ms
• with explosion protection (Ex i)	10.5 30 V DC	wire)	
Additional minimum supply voltage when using test terminals	0.8 V	Thermocouples (TC) Input type	
Maximum power loss	≤ 850 mW	• B • E	IEC 60584-1 IEC 60584-1
Minimum load resistance at supply voltage > 37 V	(V <sub>supply</sub> - 37 V)/23 mA	• L • J • K	IEC 60584-1 IEC 60584-1 IEC 60584-1
<ul> <li>Insulation voltage, test/operation</li> <li>Without explosion protection (non- Ex)</li> </ul>	2.5 kV AC/55 V AC	• L • Lr • N	DIN 43710 GOST 3044-84 IEC 60584-1
<ul> <li>with explosion protection (Ex i)</li> </ul>	2.5 kV AC/42 V AC	• R	IEC 60584-1
Polarity protection	All inputs and outputs	• S	IEC 60584-1
Write protection	Wire jumper (transmitter), switch (on display) or software	• T • U • W2	IEC 60584-1 DIN 43710
Warm-up time	< 5 min	• W3 • W5	ASTM E988-96 ASTM E988-96
Starting time	< 2.75 s	• LR	GOST 3044-84
Programming	HART	Cold junction compensation (CJC)	Constant, internal or external over
Signal-to-noise ratio	> 60 dB	Temperature range internal CJC	Pt100 or Ni100 RTD -50 +100 °C (-58 +212 °F)
Long-term stability	Better than: • ± 0.05% of measuring span/year • ± 0.18% of measuring span/5 years	<ul> <li>Connection external CJC</li> <li>External CJC, line resistance per wire (for 3-wire and 4-wire connec-</li> </ul>	2-wire or 3-wire 50 Ω
Response time	4 20 mA: ≤ 55 ms HART: ≤ 75 ms (typically 70 ms)	tions) <ul> <li>Effect of the line resistance (with 3-wire and 4-wire connections)</li> </ul>	< 0.002 Ω/Ω
Programmable damping	0 60 s	<ul> <li>Input current external CJC</li> </ul>	< 0.15 mA
Signal dynamic		Temperature range external CJC	-50 +135 °C (-58 +275 °F)
Input	24 bit	<ul><li>Cable, wire-wire capacity</li><li>Total line resistance</li></ul>	Max. 50 nF Max. 10 kΩ
Output     Influence of change in supply voltage	18 bit $< 0.005\%$ of measuring span/V DC	<ul> <li>Fault detection, programmable</li> </ul>	None, short-circuited, defective,
Input	< 0.000 % of measuring span, v DO		short-circuited or defective
Resistance thermometer (RTD)			Note The short-circuited fault detection
Input type			only applies to the CJC input.
• Pt10 10000	• IEC 60751 • JIS C 1604-8 • GOST 6651_2009	<ul> <li>Fault detection time (TC)</li> <li>Fault detection time, external CJC (for 3-wire and 4-wire)</li> </ul>	≤ 75 ms (typically 70 ms) ≤ 2 000 ms
• Ni10 10000	<ul><li>Callendar-Van Dusen</li><li>DIN 43760-1987</li></ul>	Linear resistance	
- 1110 10000	• GOST 6651-2009/OIML R84:2003	Input range	10 Ω 100 kΩ
• Cu5 1000	<ul> <li>Edison Copper Winding No. 15</li> <li>GOST 6651-2009/OIML R84:2003</li> </ul>	Minimum measuring span	25 Ω
Type of connection	2-wire, 3-wire or 4-wire	Type of connection	2-wire, 3-wire or 4-wire
Line resistance per wire	Max. 50 $\Omega$	Line resistance per wire	Max. 50 Ω
Input current	< 0.15 mA	Input current	< 0.15 mA
Effect of the line resistance (with 3- wire and 4-wire connections)	< 0.002 Ω/Ω	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) • All other input tupoe	Max. 30 nF	Cable, wire-wire capacity • R > 400 Ω • R ≤ 400 Ω Fault detection, programmable	Max. 30 nF Max. 50 nF None, defective
All other input types     Eault detection programmable	Max. 50 nF		,
Fault detection, programmable	None, short-circuited, defective, short-circuited or defective <b>Note</b> 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 configu- ration of the fault detection.		

Temperature transmitters Field transmitters/Field indicator

# SITRANS TF420 (HART, universal)

Potentiometers		Rated conditions
Input range	0 100 kΩ	Ambient temperatur
Minimum measuring span	25 Ω	<ul> <li>Without local oper single chamber er</li> </ul>
Type of connection	2-wire, 3-wire or 4-wire	With local operation
Line resistance per wire	Max. 50 Ω	<ul> <li>For transmitters w functional safety</li> </ul>
Input current	< 0.15 mA	Storage temperature
Effect of the line resistance (with 4- wire and 5-wire connections)	< 0.002 Ω/Ω	Reference temperation
Cable, wire-wire capacity	M 00 F	Relative humidity
<ul> <li>R &gt; 400 Ω</li> <li>R ≤ 400 Ω</li> </ul>	Max. 30 nF Max. 50 nF	Degree of protection
Fault detection, programmable	None, short-circuited, defective, short-circuited or defective	<ul><li>Temperature trans</li><li>Terminals</li></ul>
	Note	Mechanical constr
	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.	Weight <ul> <li>Single chamber e</li> <li>Dual chamber end</li> </ul>
Detection limit for short-circuited input		<ul> <li>Maximum core cros</li> <li>Single chamber e</li> </ul>
Fault detection time, wiper arm	≤ 75 ms (typically 70 ms)	Dual chamber end
(no short-circuit detection)		Tightening torque for clamping screws
Fault detection time, element	≤ 2 000 ms	Vibrations
Fault detection time (for 4-wire and 5- wire)	≤ 2 000 ms	• 2 25 Hz • 25 100 Hz
Supply voltage		Certificates and ap
Measuring range • Unipolar • Bipolar	-100 1700 mV -800 +800 mV	Explosion protection others
Minimum measuring span	2.5 mV	Certificates <sup>3)</sup>
Input resistance	10 MΩ	
Cable, wire-wire capacity		"Intrinsic safety ia/ib
<ul> <li>Input range: -100 1700 mV</li> <li>Input range: -20 100 mV</li> </ul>	Max. 30 nF Max. 50 nF	tion • ATEX
Fault detection, programmable	None, defective	
Fault detection time	$\leq$ 75 ms (typically 70 ms)	<ul> <li>IECEx and others</li> </ul>
Output and HART communication		• EACEx
Normal range, programmable	3.8 20.5 mA/20.5 3.8 mA	
Extended range (output limits), pro- grammable	3.5 23 mA/23 3.5 mA	<ul> <li>Intrinsic safety ic" t</li> <li>ATEX</li> <li>IECEx and others</li> </ul>
Programmable input/output limits		EACEX
<ul><li>Fault current</li><li>Fault current setting</li></ul>	Enable/disable 3.5 23 mA	"Non-sparking/incre
Update time	10 ms	nA/ec" type of prote • ATEX
Load (with current output)	≤ (V <sub>Supply</sub> - 10.5)/0.023 Ω	• ATEX
Load stability	< 0.01% of measuring span/100 $\Omega$ (measuring span = currently	<ul> <li>IECEx and others</li> <li>EACEx</li> </ul>
	selected range)	<ul> <li>"Flameproof enclo</li> </ul>
Input fault detection, programmable (detection of input short circuits is ignored with TC and voltage inputs)	3.5 23 mA	<ul><li>protection</li><li>ATEX</li></ul>
NAMUR NE43 Upscale	> 21 mA	<ul> <li>IECEx and others</li> <li>EACEx</li> </ul>
NAMUR NE43 Downscale	< 3.6 mA	<ul> <li>"Protection by end</li> </ul>
HART protocol versions	HART 7	protection • ATEX
Measuring accuracy		IECEx and others
Input accuracy	See "Input accuracy" table	• EACEx
Output accuracy	See "Output accuracy" table	

Rated conditions	
Ambient temperature • Without local operation in single chamber enclosure • With local operation • For transmitters with functional safety	-50 +85 °C (-58 +185 °F) -40 +85 °C (-40 +185 °F) -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 • Terminals	IP66/IP67/IP68 IP00
Mechanical construction	
Weight <ul> <li>Single chamber enclosure</li> <li>Dual chamber enclosure</li> </ul>	0.85 kg (1.87 lb) • Aluminum: 1.3 kg (2.87 lb) • Stainless steel: 3.3 kg (7.28 lb)
Maximum core cross-section <ul> <li>Single chamber enclosure</li> <li>Dual chamber enclosure</li> </ul>	1.5 mm² (AWG 16) 2.5 mm² (AWG 14)
Tightening torque for clamping screws	0.5 0.6 Nm
Vibrations • 2 25 Hz • 25 100 Hz	IEC 60068-2-6 ± 1.6 mm (0.07 inch) ± 4 g
Certificates and approvals	
Explosion protection ATEX/IECEx and others	
Certificates <sup>3)</sup>	IECEx DEK 19.0069X DEKRA 19ATEX0106 X (Category 1)
	DEKRA 19ATEX0107 X (Category 3)
"Intrinsic safety ia/ib" type of protec- tion	For use in Zone 0, 1, 2
tion • ATEX	For use in Zone 0, 1, 2 II 1 G Ex ia IIC T6 T4 Ga II 2(1) G Ex ib [ia Ga] IIC T6 T4 Gb
tion	For use in Zone 0, 1, 2 II 1 G Ex ia IIC T6 T4 Ga II 2(1) G Ex ib [ia Ga] IIC T6 T4 Gb Ex ia IIC T6 T4 Ga Ex ib [ia Ga] IIC T6 T4 Gb
<ul><li>ATEX</li><li>IECEx and others</li></ul>	For use in Zone 0, 1, 2 II 1 G Ex ia IIC T6 T4 Ga II 2(1) G Ex ib [ia Ga] IIC T6 T4 Gb Ex ia IIC T6 T4 Ga
<ul><li>ATEX</li><li>IECEx and others</li></ul>	For use in Zone 0, 1, 2 II 1 G Ex ia IIC T6 T4 Ga II 2(1) G Ex ib [ia Ga] IIC T6 T4 Gb Ex ia IIC T6 T4 Ga Ex ib [ia Ga] IIC T6 T4 Gb Ex ia IIC T6 T4 Ga
tion • ATEX • IECEx and others • EACEx "Intrinsic safety ic" type of protection • ATEX • IECEx and others • EACEx "Non-sparking/increased safety nA/ec" type of protection	For use in Zone 0, 1, 2 II 1 G Ex ia IIC T6 T4 Ga II 2(1) G Ex ib [ia Ga] IIC T6 T4 Gb Ex ia IIC T6 T4 Ga Ex ib [ia Ga] IIC T6 T4 Gb Ex ia IIC T6 T4 Ga Ex ib [ia Ga] IIC T6 T4 Gb For use in Zones 2 II 2 G Ex ic IIC T6 T4 Gc Ex ic IIC T6 T4 Gc 2Ex ic IIC T6 T4 Gc X For use in Zones 2
tion • ATEX • IECEx and others • EACEx "Intrinsic safety ic" type of protection • ATEX • IECEx and others • EACEx "Non-sparking/increased safety	For use in Zone 0, 1, 2 II 1 G Ex ia IIC T6 T4 Ga II 2(1) G Ex ib [ia Ga] IIC T6 T4 Gb Ex ia IIC T6 T4 Ga Ex ib [ia Ga] IIC T6 T4 Gb Ex ia IIC T6 T4 Ga Ex ib [ia Ga] IIC T6 T4 Gb For use in Zones 2 II 2 G Ex ic IIC T6 T4 Gc Ex ic IIC T6 T4 Gc ZEx ic IIC T6 T4 Gc X For use in Zones 2 II 2 G Ex nA IIC T6 T4 Gc II 2 G Ex nA IIC T6 T4 Gc
tion • ATEX • IECEx and others • EACEx "Intrinsic safety ic" type of protection • ATEX • IECEx and others • EACEx "Non-sparking/increased safety nA/ec" type of protection • ATEX • IECEx and others • EACEx • IECEx and others • EACEX • Flameproof enclosure db" type of protection	For use in Zone 0, 1, 2 II 1 G Ex ia IIC T6 T4 Ga II 2(1) G Ex ib [ia Ga] IIC T6 T4 Gb Ex ia IIC T6 T4 Ga Ex ib [ia Ga] IIC T6 T4 Gb Ex ia IIC T6 T4 Ga Ex ib [ia Ga] IIC T6 T4 Gb For use in Zones 2 II 2 G Ex ic IIC T6 T4 Gc Ex ic IIC T6 T4 Gc X For use in Zones 2 II 2 G Ex nA IIC T6 T4 Gc II 2 G Ex nA IIC T6 T4 Gc II 2 G Ex nA IIC T6 T4 Gc
tion • ATEX • IECEx and others • EACEx "Intrinsic safety ic" type of protection • ATEX • IECEx and others • EACEx "Non-sparking/increased safety nA/ec" type of protection • ATEX • IECEx and others • EACEx • Flameproof enclosure db" type of	For use in Zone 0, 1, 2 II 1 G Ex ia IIC T6 T4 Ga II 2(1) G Ex ib [ia Ga] IIC T6 T4 Gb Ex ia IIC T6 T4 Ga Ex ib [ia Ga] IIC T6 T4 Gb Ex ia IIC T6 T4 Ga Ex ib [ia Ga] IIC T6 T4 Gb For use in Zones 2 II 2 G Ex ic IIC T6 T4 Gc Ex ic IIC T6 T4 Gc ZEx ic IIC T6 T4 Gc II 2 G Ex nA IIC T6 T4 Gc II 2 G Ex ec IIC T6 T4 Gc II 2 G Ex ec IIC T6 T4 Gc Ex ec IIC T6 T4 Gc

Temperature transmitters Field transmitters/Field indicator

### SITRANS TF420 (HART, universal)

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 T6T4 Gb AEx ib [ia Ga] IIC T6T4 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 T6T4 Ex nA IIC T6 T4 Gc AEx nA IIC T6 T4 Gc
"Explosion-proof XP" type of protec- tion	XP/ CL I / DIV1 / GP ABCD / T6T4 CL I / Zn1 / AEx/Ex d IIC T6T4 Gb
"Dust-protected DIP" type of protec- tion	DIP/ CL II, III / DIV 1 / GP EFG / T6T4 Zn21 / AEx/Ex tb IIIC T100°C Gb

 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.

<sup>2)</sup> 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 <sub>0</sub> in °C <sup>-1</sup> (°F <sup>-1</sup> )	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)
В	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)
К	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)
Т	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)

Temperature transmitters Field transmitters/Field indicator

# SITRANS TF420 (HART, universal)

#### Input accuracy

Basic values

Input type	Basic accuracy	Temperature coefficient <sup>1)</sup>
RTD		
Pt10	≤ ±0.8 °C (1.44 °F)	≤ ±0.020 °C/°C (°F/°F)
Pt20	≤ ±0.0 °C (0.72 °F)	≤ ±0.010 °C/°C (°F/°F)
Pt50	≤ ±0.16 °C (0.288 °F)	≤ ±0.004 °C/°C (°F/°F)
Pt100	$\leq \pm 0.04 \text{ °C} (0.072 \text{ °F})$	$\leq \pm 0.002  ^{\circ}C/^{\circ}C  (^{\circ}F/^{\circ}F)$
Pt200	$\leq \pm 0.08 ^{\circ}\text{C}  (0.144 ^{\circ}\text{F})$	≤ ±0.002 °C/°C (°F/°F)
Pt500	$T_{max.} < 180 \ ^{\circ}\text{C} \ (356 \ ^{\circ}\text{F}) = \le \pm 0.08 \ ^{\circ}\text{C} \ (0.144 \ ^{\circ}\text{F})$ $T_{max.} > 180 \ ^{\circ}\text{C} \ (356 \ ^{\circ}\text{F}) = \le \pm 0.16 \ ^{\circ}\text{C} \ (0.288 \ ^{\circ}\text{F})$	≤ ±0.002 °C/°C (°F/°F)
Pt1000	≤ ±0.08 °C (0.144 °F)	$\leq \pm 0.002 \text{ °C/°C} (\text{°F/°F})$
Pt2000	$T_{max}$ < 300 °C (572 °F) = $\le \pm 0.08$ °C (0.144 °F) $T_{max}$ > 300 °C (572 °F) = $\le \pm 0.4$ °C (0.72 °F)	≤ ±0.002 °C/°C (°F/°F)
Pt10000	$\leq \pm 0.16 \text{ °C} (0.288 \text{ °F})$	≤ ±0.002 °C/°C (°F/°F)
Pt x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
li10	$\leq \pm 1.6 ^{\circ}\text{C}  (2.88 ^{\circ}\text{F})$	$\leq \pm 0.020 \text{ °C/°C (°F/°F)}$
li20	$\leq \pm 0.8 ^{\circ}\text{C}  (1.44 ^{\circ}\text{F})$	$\leq \pm 0.010 \text{ °C/°C} (\text{°F/°F})$
Ni50	≤ ±0.32 °C (0.576 °F)	≤ ±0.004 °C/°C (°F/°F)
Ji100	$\leq \pm 0.16 \ ^{\circ}C \ (0.288 \ ^{\circ}F)$	$\leq \pm 0.002 \text{ °C/°C} (\text{°F/°F})$
Ni120	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ji200	≤ ±0.16 °C (0.288 °F)	$\leq \pm 0.002 \text{ °C/°C} (\text{°F/°F})$
li500	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Ji1000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Vi2000	≤ ±0.16 °C (0.288 °F)	≤ ±0.002 °C/°C (°F/°F)
Vi10000	≤ ±0.32 °C (0.576 °F)	≤ ±0.002 °C/°C (°F/°F)
Vi 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	$\leq \pm 0.4 \text{ °C} (0.72 \text{ °F})$	≤ ±0.010 °C/°C (°F/°F)
Cu50	$\leq \pm 0.16$ °C (0.288 °F)	≤ ±0.004 °C/°C (°F/°F)
Cu100	$\leq \pm 0.08 ^{\circ}\text{C}  (0.144 ^{\circ}\text{F})$	$\leq \pm 0.002  ^{\circ}\text{C/}^{\circ}\text{C}  (^{\circ}\text{F/}^{\circ}\text{F})$
Cu200	$\leq \pm 0.08$ °C (0.144 °F)	$\leq \pm 0.002 \text{ °C/°C} (\text{°F/°F})$
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
inear resistance		
) 400 Ω	$\leq \pm 40 \text{ m}\Omega$	$\leq \pm 2 \text{ m}\Omega/^{\circ}\text{C} (1.11 \text{ m}\Omega/^{\circ}\text{F})$
) 100 kΩ	$\leq \pm 4 \Omega$	$\leq \pm 0.2 \ \Omega/^{\circ}C \ (0.11 \ \Omega/^{\circ}F)$
Potentiometers		
) 100%	< 0.05%	< ± 0.005%
Supply voltage		
nV: -20 100 mV	$\leq \pm 5 \mu V$	$\leq \pm 0.2 \mu$ V/°C (0.11 $\mu$ V/°F)
nV: -100 1700 mV	≤ ±0.1 mV	$\leq \pm 36 \mu\text{V/°C} (20 \mu\text{V/°F})$
nV: ± 800 mV	≤ ±0.1 mV	$\leq \pm 32 \mu\text{V/°C} (17.8 \mu\text{V/°F})$
TC		
• 		
	$\leq \pm 0.2$ °C (0.36 °F)	$\leq \pm 0.025 ^{\circ}\text{C/}^{\circ}\text{C}  (^{\circ}\text{F/}^{\circ}\text{F})$
	$\leq \pm 0.25 ^{\circ}\text{C}  (0.45 ^{\circ}\text{F})$	$\leq \pm 0.025  ^{\circ}\text{C/}^{\circ}\text{C}  (^{\circ}\text{F/}^{\circ}\text{F})$
	$\leq \pm 0.25 \text{ °C} (0.45 \text{ °F})$	$\leq \pm 0.025 \text{ °C/°C} (\text{°F/°F})$
-	$\leq \pm 0.35 \text{ °C} (0.63 \text{ °F})$	$\leq \pm 0.025 \text{ °C/°C} (\text{°F/°F})$
1	≤ ±0.4 °C (0.72 °F)	≤ ±0.025 °C/°C (°F/°F)
	≤ ±0.25 °C (0.45 °F)	$\leq \pm 0.025 \text{ °C/°C} (\text{°F/°F})$
J	< 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)
_r	≤ ±0.2 °C (0.36 °F)	$\leq \pm 0.1 \ ^{\circ}C/^{\circ}C \ (^{\circ}F/^{\circ}F)$
3	< 200 °C (392 °F) ≤ ±0.5 °C (0.9 °F)	$\leq \pm 0.1 ^{\circ}\text{C/}^{\circ}\text{C} (^{\circ}\text{F/}^{\circ}\text{F})$
	≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F)	
S	≥ 200 °C (392 °F) ≤ ±1 °C (1.8 °F) < 200 °C (392 °F) ≤ ±0.5 °C (0.9 °F)	≤ ±0.1 °C/°C (°F/°F)

Temperature transmitters Field transmitters/Field indicator

### SITRANS TF420 (HART, universal)

Input type	Basic accuracy	Temperature coefficient <sup>1)</sup>	
W3	≤ ±0.6 °C (1.08 °F)	$\leq \pm 0.1 \ ^{\circ}C/^{\circ}C \ (^{\circ}F/^{\circ}F)$	
W5	≤ ±0.4 °C (0.72 °F)	≤ ±0.1 °C/°C (°F/°F)	
3 <sup>2)</sup>	≤ ±1 °C (1.8 °F)	$\leq \pm 0.1 \ ^{\circ}C/^{\circ}C \ (^{\circ}F/^{\circ}F)$	
3 <sup>3)</sup>	≤ ±3 °C (5.4 °F)	≤ ±0.1 °C/°C (°F/°F)	
34)	≤ ±8 °C (14.4 °F)	$\leq \pm 0.8 \text{ °C/°C} (\text{°F/°F})$	
3 <sup>5)</sup>	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)	

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

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

- $^{3)}$  Accuracy of the specification range > 160 °C (320 °F) < 400 °C (752 °F)
- <sup>4)</sup> Accuracy of the specification range > 85 °C (185 °F) < 160 °C (320 °F)

<sup>5)</sup> 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 mea- surement	Sum of accuracy of input 1 and input 2	Sum of temperature coefficient of input 1 and input 2
Analog output	$\leq \pm 1.6 \mu\text{A}$ (0.01% of the full output span)	$\leq \pm 0.48 \ \mu$ A/K ( $\leq \pm 0.003\%$ of the full output span/K)

# **Temperature measurement** Temperature transmitters

Field transmitters/Field indicator

SITRANS TF420 (HART, universal)

# Selection and ordering data

### Single chamber enclosure

	Ar	ticle N	0.
SITRANS TF420 Temperature transmitter with	71	IG044	
single chamber enclosure for wall or pipe mounting, two separately configurable inputs and a galvanically isolated 2-wire output.		-	- 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		В	
<ul> <li>Pt100 (IEC 60751), 4-wire</li> <li>Pt1000 (IEC 60751), 3-wire</li> </ul>		CD	
• Pt1000 (IEC 60751), 3-wire		E	
TC			
• Type B		F	
• Type E		G	
• Type J		н	
• Type K		J	
• Type L		K	
• Type N • Type R		N	
• Type S		P	
• Type T		Q	
Potentiometer, 4-wire		R	
RTD			
• Pt100 (IEC 60751), 3-wire		в	
• Pt100 (IEC 60751), 4-wire		с	
• Pt1000 (IEC 60751), 3-wire		D	
• Pt1000 (IEC 60751), 4-wire		E	
TC			
• Туре В		F	
		G	
• Type J • Type K		H	
• Type L		ĸ	
• Type N		Ľ	
		N	
• Type R			
• Type R • Type S		Р	
• Type R		P	

	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
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)	В
Flameproof enclosure (Ex d) / Explosion proof (XP)	С
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	м
Local operation	
Without local operation	0
Local operation (closed lid)	1
Local operation (lid with glass window)	2

Temperature transmitters

Field transmitters/Field indicator

# 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

# Temperature measurement Temperature transmitters

Field transmitters/Field indicator

SITRANS TF420 (HART, universal)

# Selection and ordering data

#### Dual chamber enclosure

	Article No.
SITRANS TF420 Temperature transmitter with	7NG045
dual chamber enclosure for wall or pipe mount- ing, two separately configurable inputs and a galvanically isolated 2-wire output.	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         • Pt1000 (IEC 60751), 4-wire         • Pt1000 (IEC 60751), 4-wire         TC         • Type B         • Type J         • Type L         • Type S         • Type T         Potentiometer, 4-wire	B C D E F G H J K L N P Q R
Input 2, type	
Without input 2	A
RTD Pt100 (IEC 60751), 3-wire Pt100 (IEC 60751), 4-wire Pt1000 (IEC 60751), 3-wire Pt1000 (IEC 60751), 4-wire TC TC Type B Type E Type J	B C D E F G H
<ul> <li>Type J</li> <li>Type K</li> <li>Type L</li> <li>Type R</li> <li>Type S</li> <li>Type T</li> <li>Potentiometer, 4-wire</li> </ul>	H J K L N P Q R

	Article No.		
SITRANS TF420 Temperature transmitter with dual chamber enclosure for wall or pipe mount- ing, 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)		Α	
Intrinsic safety (Ex i) / Non-incendive field wiring (NIFW)		В	
Flameproof enclosure (Ex d) / Explosion proof (XP)		С	
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		r	N
Local operation			
Without local operation			0
Local operation (closed lid)			1
Local operation (lid with glass window)			2

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Temperature transmitters

Field transmitters/Field indicator

# 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 $\mu m$ 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 $\frac{1}{2}$ -14 NPT (female thread)	7MP1990-0BA00
Thread adapter M20x1.5 (male thread) to $G^{1\!\!/_2}$ (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 enclo- sure)	
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 enclo- sures)	
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.

# Temperature measurement

Temperature transmitters Field transmitters/Field indicator

### SITRANS TF420 (HART, universal)

#### Ordering example

SITRANS TF420	(single chamber	enclosure)
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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

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	
<b>9</b> ,	7MF7906-3AC
Overvoltage protection	7MF7906-3AC 7MF7906-3AD
Overvoltage protection Overvoltage protection up to 20 kV, M20	
Overvoltage protection Overvoltage protection up to 20 kV, M20 Overvoltage protection up to 20 kV, NPT	
Overvoltage protection Overvoltage protection up to 20 kV, M20 Overvoltage protection up to 20 kV, NPT Lid Closed lid aluminum, painted 2x, without glass win-	7MF7906-3AD
Overvoltage protection         Overvoltage protection up to 20 kV, M20         Overvoltage protection up to 20 kV, NPT         Lid         Closed lid aluminum, painted 2x, without glass window, with seal NBR         Closed lid aluminum, painted 2x, without glass window, with seal NBR	7MF7906-3AD 7MF7901-1BB
Overvoltage protection         Overvoltage protection up to 20 kV, M20         Overvoltage protection up to 20 kV, NPT         Lid         Closed lid aluminum, painted 2x, without glass window, with seal NBR         Closed lid aluminum, painted 2x, without glass window, with seal FVMQ         Lid aluminum 2x coated, with glass window, with	7MF7906-3AD 7MF7901-1BB 7MF7901-1BC
Overvoltage protection         Overvoltage protection up to 20 kV, M20         Overvoltage protection up to 20 kV, NPT         Lid         Closed lid aluminum, painted 2x, without glass window, with seal NBR         Closed lid aluminum, painted 2x, without glass window, with seal FVMQ         Lid aluminum 2x coated, with glass window, with seal NBR         Lid aluminum 2x coated, with glass window, with	7MF7906-3AD 7MF7901-1BB 7MF7901-1BC 7MF7901-1BG
Overvoltage protection         Overvoltage protection up to 20 kV, M20         Overvoltage protection up to 20 kV, NPT         Lid         Closed lid aluminum, painted 2x, without glass window, with seal NBR         Closed lid aluminum, painted 2x, without glass window, with seal FVMQ         Lid aluminum 2x coated, with glass window, with seal NBR         Lid aluminum 2x coated, with glass window, with seal FVMQ         Closed lid stainless steel precision casting, without	7MF7906-3AD 7MF7901-1BB 7MF7901-1BC 7MF7901-1BG 7MF7901-1BH
Overvoltage protection         Overvoltage protection up to 20 kV, M20         Overvoltage protection up to 20 kV, NPT         Lid         Closed lid aluminum, painted 2x, without glass window, with seal NBR         Closed lid aluminum, painted 2x, without glass window, with seal FVMQ         Lid aluminum 2x coated, with glass window, with seal NBR         Lid aluminum 2x coated, with glass window, with seal FVMQ         Closed lid stainless steel precision casting, without glass window, with seal FVMQ         Closed lid stainless steel precision casting, without glass window, with seal NBR	7MF7906-3AD 7MF7901-1BB 7MF7901-1BC 7MF7901-1BG 7MF7901-1BH 7MF7901-2AB
Overvoltage protection         Overvoltage protection up to 20 kV, M20         Overvoltage protection up to 20 kV, NPT         Lid         Closed lid aluminum, painted 2x, without glass window, with seal NBR         Closed lid aluminum, painted 2x, without glass window, with seal FVMQ         Lid aluminum 2x coated, with glass window, with seal NBR         Lid aluminum 2x coated, with glass window, with seal FVMQ         Closed lid stainless steel precision casting, without glass window, with seal FVMQ         Closed lid stainless steel precision casting, without glass window, with seal NBR         Closed lid stainless steel precision casting, without glass window, with seal FVMQ         Lid stainless steel precision casting, without glass window, with seal NBR	7MF7906-3AD 7MF7901-1BB 7MF7901-1BC 7MF7901-1BG 7MF7901-1BH 7MF7901-2AB 7MF7901-2AC

Plug and cable socket

Temperature transmitters Field transmitters/Field indicator

# SITRANS TF420 (HART, universal)

### Dimensional drawings



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



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


12

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:

3-wire or 4-wire potentiometer

12

## Temperature measurement

Temperature transmitters Field transmitters/Field indicator

SITRANS TF420 (HART, universal)

## Circuit diagrams

## Connections

Input connection



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



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

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



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



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

## **Temperature measurement** Temperature transmitters

Field transmitters/Field indicator

## SITRANS TF420 (HART, universal)



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



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



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



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



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

Temperature transmitters

Fiber-optic temperature measurement

SITRANS TO500, multipoint temperature transmitter

## 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

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

#### Benefits

Overview

- 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.

Temperature transmitters Fiber-optic temperature measurement

## 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 <ul> <li>Measurement rate</li> </ul>	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	
<ul> <li>Ambient conditions</li> <li>Ambient temperature</li> <li>Storage temperature</li> <li>Relative humidity</li> <li>Electromagnetic compatibility</li> </ul>	0 50 °C (32 122 °F) -40 +85 °C (-40 +185 °F) < 80%, non condensing at 50 °C (122 °F) According to EN 61326 and NAMUR NE21
Degree of protection to EN 60529	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	<ul> <li>"Power-on" (continuous light)</li> <li>"Status" (flashing during startup; otherwise continuous light)</li> </ul>
Pushbutton	"Reset" (system restart or address reset)

## Selection and Ordering data

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

Temperature transmitters Fiber-optic temperature measurement

SITRANS TO500, multipoint temperature transmitter

## Dimensional drawings



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

## Circuit diagrams



SITRANS TO500, connector assignment

Temperature transmitters Fiber-optic temperature measurement

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

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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

## **Temperature Measurement**

Temperature transmitters Fiber-optic temperature measurement

SITRANS TO, multipoint measuring lance

·····		<u></u>	
Input	T	Displays and control elements	
Measured variable	Temperature	Displays and buttons <ul> <li>Without</li> </ul>	
Measuring system	FBG sensors	Installation instructions	
Working area	1 500 1 600 nm	Mechanical shock	Avoid mechanical shocks to the mu
Resolution	0.1 K	Mechanical shock	point measuring lance, such as: Fal
Measuring accuracy	< 1 K or 1% of measuring span; the larger value applies		from heights > 0.5 m (19.7 inch) or whipping and/or snapping of the ca illaries.
Repeatability	< 0.5 K	Concentrated propulse	
Measuring range	-40 +450 °C (-40 +842 °F), other ranges on request	Concentrated pressure	Avoid concentrated pressure on the capillaries. For example, do not hold with pliers or other similar tools. After
Number of sensors	1 20; maximum number depending on the measuring range, numbers > 20 on request		several hours at an ambient tempera ture > 250 °C (482 °F), the steel lose its elasticity.
Response time (T0.9) • Multipoint measuring lance without thermowell	< 2 s	Removal and reinstallation	Extreme caution must be exercised during transport, storage and install tion if removing or reinstalling. The
<ul> <li>Multipoint measuring lance with thermowell, stainless steel, wall thickness 1 mm; example:</li> </ul>			multipoint measuring lance is irreven ibly damaged at temperatures > 550 °C (1 022 °F).
- Outer diameter 3 mm	18 s		
- Outer diameter 6 mm	43 s		
Rated conditions			
Ambient conditions			
Ambient temperature     Sterage temperature	-20 +80 °C (-4 +176 °F)		
<ul><li>Storage temperature</li><li>Operation</li></ul>	-40 +85 °C (-40 +185 °F) Vertically extended or horizontally		
	(+1 K measuring error)		
<ul><li>Relative humidity</li><li>Condensing moisture</li></ul>	5 95 % Not permitted		
Bending radius of the multipoint mea- suring lance during transportation and installation	<ul> <li>&gt; 500 mm (19.7 inch); briefly 250 mm (9.8 inch)</li> </ul>		
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 with- out 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     Diameter	0.1 20 m (3.9 787 inch) 0.8 mm (0.031 inch)		
Thermowell inside diameter (recom- mended)			
<ul> <li>Measuring lance &lt; 2 m (79 inch)</li> <li>Measuring lance &lt; 5 m (197 inch)</li> <li>Measuring lance &lt; 10 m (394 inch)</li> <li>Measuring lance &gt; 10 m (394 inch)</li> </ul>			
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 trans- mitter	10 000 m (39 3701 inch)		

Temperature transmitters

Fiber-optic temperature measurement

## SITRANS TO, multipoint measuring lance

## Selection and ordering data

-		
	Article No.	Order code
SITRANS TO multipoint measuring lance (coating: stainless steel)	7MC7700-	
(coating. stanless steel)		
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	0C	
4	00	
5	0 E	
6	0 E	
7	0G	
8	OH	
9	0 J	
10	OK	
11	0 L	
12	0 M	
13	0 N	
14	0 P	
15	0Q	
16	0 R	
17	05	
18	0Т	
19	00	
20	0 V	
Customer-specific design: Add order code; enter number of sensors and high temperature limit in plain text.	9 X	H1Y
Installation length U; customer-specific		
$0.1 \text{ m} < \text{U} \le 2 \text{ m} (4 \text{ inch} < \text{U} \le 79 \text{ inch})$	Α	
$2 \text{ m} < \text{U} \le 4 \text{ m}$ (79 inch $< \text{U} \le 157.5$ inch)	в	
4 m < U ≤ 6 m (157.5 inch < U ≤ 236 inch)	с	
$6 \text{ m} < \text{U} \le 8 \text{ m} (236 \text{ inch} < \text{U} \le 315 \text{ inch})$	D	
8 m < U $\leq$ 10 m (315 inch < U $\leq$ 394 inch)	Е	
10 m < U ≤ 12 m (394 inch < U ≤ 472 inch)	F	
$12 \text{ m} < \text{U} \le 14 \text{ m} (472 \text{ inch} < \text{U} \le 551 \text{ inch})$	G	
$14 \text{ m} < \text{U} \le 16 \text{ m} (551 \text{ inch} < \text{U} \le 630 \text{ inch})$	н	
16 m < U ≤ 18 m (630 inch < U ≤ 709 inch)	J	
$18 \text{ m} < \text{U} \le 20 \text{ m}$ (709 inch $< \text{U} \le 787$ inch)	к	
Customer-specific design: Add order code and specify required length in plain text.	x	Y 4 4
High temperature limit		
100 °C (212 °F)	10	
150 °C (302 °F)	11	
200 °C (392 °F)	12	
250 °C (482 °F)	13	
300 °C (572 °F)	14	
350 °C (662 °F)	15	
400 °C (752 °F)	16	
450 °C (842 °F)	17	
Customer-specific design	88	
aposino doorgin		

	Article No.		С	)rde	er c	0	de
SITRANS TO multipoint measuring lance	7MC7700-						
(coating: stainless steel)							
Optical connector							
FC/APC connector		0					
Mechanically reinforced connector		1					
Connecting cable length LC							
LC = 200 mm for standard connection			в				
0.2 m < LC $\leq$ 2 m (define precise length in option Y45)			С				
Customer-specific design (LC > 2 m): Add order code and specify required length in plain text.			z		Ρ	1	Y
Temperature measurement range							
100 K			A	۱.			
150 K			B	3			
200 K			C	;			
250 K			D	)			
300 K			E				
350 K			F				
400 K			G	1			
500 K			Н				
Customer-specific design: Add order code and specify required temperature measuring range in plain text.			z	2	Q	1	Y
Wavelength bandwidth distribution							
Without (no color code; 1 multipoint measuring lance per channel)				0			
<ul> <li>Dual split</li> <li>(2 multipoint measuring lances per channel)</li> <li>1 500 1 550 nm (white color code; multipoint measuring lance 1 of 2)</li> <li>1 551 1 600 nm (black color code; multipoint measuring lance 2 of 2)</li> </ul>				1 2			
<ul> <li>Quad split</li> <li>(4 multipoint measuring lances per channel)</li> <li>1 500 1 525 nm (blue color code; multipoint measuring lance 1 of 4)</li> <li>1 526 1 550 nm (red color code; multipoint measuring lance 2 of 4)</li> <li>1 551 1 575 nm (green color code; multipoint measuring lance 3 of 4)</li> <li>1 576 1 600 nm (yellow color code; multipoint measuring lance 4 of 4)</li> </ul>				3 4 5 6			
Customer-specific design: Add order code and specify required number of multipoint measur- ing lances per channel in plain text.				9	R	1	Y

Temperature transmitters Fiber-optic temperature measurement

SITRANS TO, multipoint measuring lance

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)

#### Accessories

## 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	
<ul> <li>Modem with USB interface and SIPROM T software for; 4 20 mA:</li> <li>With USB connection</li> <li>For SITRANS TH100, TH200, TH320, TR200, TR320, TF320, TF420 and TF, with TH200</li> </ul>	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
1/2-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 $^{1\!\!/_2}$ -14 NPT (female thread)	7MP1990-0BA00
Threaded adapter M20 x 1.5 (male thread) to $G^{1\!\!/_2}$ (female thread)	7MP1990-0BB00
Lightning protection for SITDANE TE	

# Lightning protection for SITRANS TF (SITRANS TS on request)

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

Article No

#### 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 7NG313B and 7MP1110	7MF4997-1AC
Made of steel for 7NG313C	7MF4997-1AB
Made of stainless steel 304 for 7NG313B and 7MP1110	7MF4997-1AJ
Made of stainless steel 304 for 7NG313C	7MF4997-1AH
Made of stainless steel 316L for 7NG313B	7MF4997-1AQ
Made of stainless steel 316L for 7NG313C	7MF4997-1AP
Digital indicator for SITRANS TF <sup>1)</sup>	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

<sup>1)</sup> Retrofitting not possible with Ex devices.

Further accessories for assembly, connection and transmitter configuration

## 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	
Ø 22 x 2 mm (Ø 0.87 x 0.08 inch),	
0.55 1.10 kg (1.21 2.42 lb), dished	
Nominal length/thermowell length in mm (inch):	7400000 404
<ul> <li>500 (19.7)/520 (20.5)</li> <li>710 (28.0)/730 (28.7)</li> </ul>	7MC2900-1DA 7MC2900-2DA
• 1 000 (39.4)/1 020 (40.2)	7MC2900-3DA
X 18 CrN28, material no. 1.4749	
$\emptyset$ 26 x 4 mm ( $\emptyset$ 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	
Ø 22 x 2 mm (Ø 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
CrAI 205 (Kantal AF), material no. 1.4767	
CrAl 205 (Kantal AF), material no. 1.4767 Ø 22 x 2 mm (Ø 0.87 x 0.05 inch), 0.55 1.10 kg (1.21 2.42 lb)	
Ø 22 x 2 mm (Ø 0.87 x 0.05 inch),	
Ø 22 x 2 mm (Ø 0.87 x 0.05 inch), 0.55 1.10 kg (1.21 2.42 lb)	7MC2900-1HA
Ø 22 x 2 mm (Ø 0.87 x 0.05 inch), 0.55 1.10 kg (1.21 2.42 lb) Nominal length/thermowell length in mm (inch):	

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 <i>L1</i> /Thermowell length <i>L2</i> 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) • 26 (1.02)	7MC2905-1AA 7MC2905-1BA
Light metal, high spring flap, for thermowell diame- ter in mm (inch) (hole = thermowell diameter +0.5 mm) (0.02 inch) • 22 (0.87) • 26 (1.02)	7MC2905-4AA 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 thermo- couples; 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 con- nection 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), <b>G1</b> For thermowell outer diameter 26 mm (1.02 inch), <b>G1</b>	7MC2998-2DB 7MC2998-2DC

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## **Temperature Measurement**

Notes