SITRANS T3K PA
with PROFIBUS PA connection

Overview

The bus-capable transmitter with Profibus PA interface in accordance with profile 3

You can use this bus-capable device with PROFIBUS PA interface in all branches and integrate it (like the SITRANS TK / TK-H) in keeping with the Totally Integrated Automation concept.

SITRANS T3K PA converts signals from resistance thermometers, resistance-based sensors, thermocouples and voltage sensors into digital signals. The measured value from the microprocessor is then made available with status as a quality specification and other parameters electrically isolated on PROFIBUS PA. Sensor, limit values, failure response etc. can be programmed. SITRANS T3K PA thus provides you with various diagnosis and simulation options.

Great safety

The current consumption amounts to less than 11 mA. For safety, the bus current is limited in the event of an error to less than 14 mA, and an EMC filter prevents malfunctions in the case of electromagnetic interference. Intrinsically safe versions are available for this device too. EEx ia and EEx ib.

Fast and error-free parameterization

SITRANS T3K PA fits in the connection head type B with raised cover. Parameterization is performed with the user-friendly software package SIMATIC PDM.

Application

The SITRANS T3K PA temperature transmitter can be used in all branches. The following sensors/signal sources can be connected via its universal input module:

- Resistance thermometer
- Thermocouple
- Resistance-based sensors/potentiometers
- DC voltage sources.

The useful data are provided on PROFIBUS PA.

SITRANS T3K PA with the "Non-incendive" type of protection can be mounted within potentially explosive atmospheres (zone 2).

SITRANS T3K PA with the "Intrinsically safe" type of protection can be mounted within potentially explosive atmospheres (zone 1) and used for feeding sensors in zone 0. The conformity declarations comply with the European standard (ATEX) or with the American standard (FM).

Function

Features

- Temperature transmitters with bus connection according to DIN 61158-2 and EN 50170, part 4
- Data transmission and transmitter supply via common bus link
- Assembly in connection head type B (or larger, DIN 43729) with raised cover
- Can communicate via PROFIBUS PA (profile B, version 3.0); sensor, measuring range and much more can therefore be programmed .
- Quality data for the measured values: Status and limit values
- Fixed bus current limiting in the event of an error
- Electrical isolation (test voltage 500 V AC)
- Intrinsically safe version for use in potentially explosive areas

Mode of operation
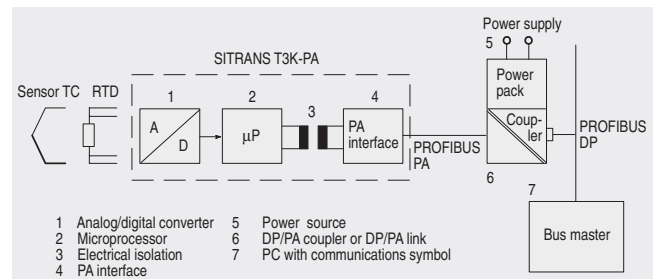
The signal supplied by a resistance-based sensor (two, three or four-wire circuit) or thermocouple element is amplified in the input stage. The voltage proportional to the input variable is then converted into digital signals by the analog/digital converter (1). The microprocessor (2) converts the digital signals in accordance with the sensor characteristic. Furthermore, the microprocessor interprets the bus commands, initiates device-internal actions and provides electrically-isolated (3) measured values, status and device data on the bus.

Integrated device protection functions:

- Electrical current limiting:
  avoids bus overloading in the event of a fault. the data traffic of the other, correctly operating nodes is maintained.
- Reverse polarity protection:
  allows the bus lines to be connected as required
- EMC filter:
  Prevents malfunctions in the case of electromagnetic interference

Parameterization
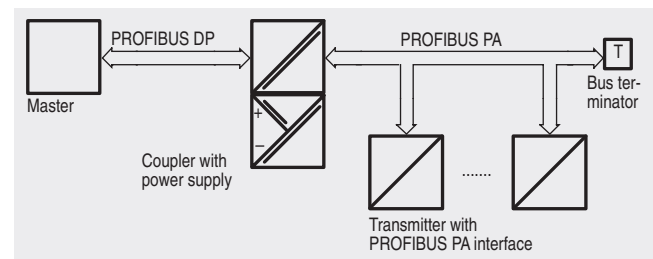
Communication via PROFIBUS PA interface

The parameterization of SITRANS T3K PA is performed by a master with the help of signals which are transmitted through PROFIBUS DP. These signals are converted by a SIMATIC DP/PA coupler with power supply (5, 6) into a signal for PROFIBUS PA. A bus terminator is required for cable lengths over 2 m. SIMATIC PDM is preferably used as parameterization software.

SITRANS T measuring instruments for temperature
SITRANS T transmitters for mounting in sensor head

Technical specifications

Input

Selectable filters to suppress the line frequency	Selectable for 50/60 Hz (also 10 Hz for special applications)

Resistance thermometer

Measured variable	Temperature
Measured range	Depending on type of connected sensor (defined sensor range)
Sensor type	
• Acc. to DIN IEC 751, DIN 43760, JIS C 1604-97, BS 1904	Pt10, Pt50, Pt100, Pt200, Pt1000
• Acc. to JIS C 1604-81	Pt10, Pt50, Pt100
• Acc. to DIN 43760	Ni50, Ni100, Ni120, Ni1000
Voltage measurement	Temperature-linear
Type of connection	Standard (logic channel 1), generation of average value or difference (of 2 channels)
Sensor current	≤ 0.55 mA

Resistance-based sensors

Measured variable	Ohmic impedance
Measured range	9 resistance measuring ranges can be selected:
	• 0 to 24 Ω
	• 0 to 47 Ω
	• 0 to 94 Ω
	• 0 to 188 Ω
	• 0 to 375 Ω
	• 0 to 750 Ω
	• 0 to 1500 Ω
	• 0 to 3000 Ω
	• 0 to 6000 Ω
Sensor type	Linear: 1 resistance-based senor in two, three or four-wire circuit
Voltage measurement	Resistance-linear
Type of connection	Standard (logic channel 1), generation of average value or difference (of 2 channels)
Sensor current	≤ 0.55 mA

Thermocouple elements

Measured variable	Temperature
Measured range	Depending on type of connected sensor (defined sensor range)
Sensor type	Thermocouples
	• Type B: Pt30Rh-Pt6Rh (DIN IEC 584)
	• Type C: W5-Re (ASTM 988)
	• Type D: W3-Re (ASTM 988)
	• Type E: NiCr-CuNi (DIN IEC 584)
	• Type J: Fe-CuNi (DIN IEC 584)
	• Type K: NiCr-Ni (DIN IEC 584)
	• Type L: Fe-CuNi (DIN 43710)
	• Type N: NiCrSi-NiSi (BS 4937 Part 2)
	• Type R: Pt13Rh-Pt (DIN IEC 584)
	• Type S: Pt10Rh-Pt (DIN IEC 584)
	• Type T: Cu-CuNi (DIN 43710)
	• Type U: Cu-CuNi (DIN 43710)

Voltage measurement	Temperature-linear
Type of connection	Standard with 1 thermocouple with cold junction compensation (logic channel 1) or generation of difference or average value
Cold junction compensation	Type specification for
	• No compensation (2 channels)
	• Internal acquisition with integrated or external sensor: a manufacturer-specific PA parameter must be set for the "external sensor" case (default value: internal sensor)
	• Externally specified cold junction temperature can be set as a fixed value

mV Sensor

Measured variable	DC voltage
Measured range	7 voltage measuring ranges can be selected:
	• - 1 to +16 mV
	• -3 to +32 mV
	• -7 to +65 mV
	• -15 to +131 mV
	• -31 to +262 mV
	• -63 to +525 mV
	• -120 to +1000 mV
Sensor type	Linear
Voltage measurement	Voltage-linear
Type of connection	Normal connection with 1 mV sensor (logic channel 1)
Overload capacity of the input	max. 3.5 mV
Input resistance	≥ 1 MΩ
Sensor current	180 µA

Output

Output	Digital bus signal
Bus voltage	• 9 to 32 V (without Ex protection)
	• 9 to 24 V for intrinsically safe operation (see Ex certificate) Active internal inductance L_i < 10 nH (acc. to FISCO model) Active internal capacitance C_i < 5 nF (acc. to FISCO model)
Communication	
• C2 connections	Four connections to master class 2 are supported; automatic connection setup 60 s after break in communication; response time to mater message typ. 10 ms
• Device profile	PROFIBUS PA profile B, version 3.0, more than 200 parameters
• Device address	126 when delivered
Temperature units	°C, °K, °F, °R parameterizable (°R (Rankine) = absolute °F)

**SITRANS T3K PA
with PROFIBUS PA connection**

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■ Technical specifications (continued)

Measuring accuracy

Influencing effects

• Error in the internal cold junction	< 0.25 °C (0.45 °F) ± 0.1%/10 °C (18 °F)
• Temperature drift	± 0.05%/10 °C (18 °F) FSR, 0.1% between -10 and 60 °C (14 and 140 °F)
• Influence of the power supply on the span	< 0.005%/V FSR
• Long-term drift	< 0.1%/year
• Measurement error	More information can be found in the table "Measurement error"

Rated conditions

Ambient conditions

Permitted temperatures

• Ambient temperature	
- at T4	-40 to +85 °C (-40 to +185 °F)
- With intrinsically-safe operation (T6)	-40 to +60 °C (-40 to +140 °F)
• Storage temperature	-40 to +95 °C (-40 to +203 °F)
Relative humidity	≤ 98%, with condensation

Electromagnetic compatibility

• Interference immunity	According to EN 50 082-2 and NAMUR NE21
• Emitted interference	According to EN 50 081-1

Design

Weight	250 g (0.55 lb)
Dimensions	see "Dimension drawings"
Enclosure material	Plastic PA6 (polyam., molded GF 20)
Electrical connection	Plug-in screw terminal, max. 2.5 mm² (0.01 inch²)

Power supply

Supply voltage	Bus infeed 9 to 32 V (9 to 24 for Ex version)
Current consumption of device	11 mA
Max. excess current in the event of a fault	I_{max} ≤ 3 mA
Electrical isolation	Input and output are electrically isolated
Test voltage	500 V AC, 50 Hz, 1 min.

Certificate and approvals

ATEX

• "Intrinsic. safe" type of protection	II (1) 2G EEx ia IIB/IIC T4/T5/T6 II (1) 2G EEx ib IIB/IIC T4/T5/T6
• EC-Type Examination Certificate	ZELM 99 ATEX 0001

FM

• Explosion protection to FM	IS/I/1/ABCD/T6, I/O/AEx ia /IIC/T6, NI/I/2/ABCD/T6

Factory setting:
- Pt100 (IEC 751) with three-wire circuit
- PROFIBUS address: 126

Measurement error

Resistance thermometer

Input	Measured range	Max. parameterizable line resistance	Measurement error
	°C (°F)	Ω	°C (°F)
IEC 751, DIN 43760, JIS C 1604-97, MS 1904			
• Pt10 DIN-IEC	-200 ... +850 (-328 ... +1562)	2.35	1.5 (2.7)
• Pt50 DIN-IEC	-200 ... +850 (-328 ... +1562)	9.4	0.3 (0.54)
• Pt100 DIN-IEC	-200 ... +850 (-328 ... +1562)	18.75	0.15 (0.27)
• Pt200 DIN-IEC	-200 ... +850 (-328 ... +1562)	37.,5	0.3 (0.54)
• Pt500 DIN-IEC	-200 ... +850 (-328 ... +1562)	37.5	0.5 (0.9)
• Pt1000 DIN-IEC	-200 ... +850 (-328 ... +1562)	300	0.5 (0.9)
JIS C 1604-81			
• Pt10	-200 ... +649 (-328 ... +1200)	2.35	1.5 (2.7)
• Pt50	-200 ... +649 (-328 ... +1200)	9,4	0.3 (0.54)
• Pt100	-200 ... +649 (-328 ... +1200)	18.75	0.15 (0.27)
DIN 43 760			
• Ni50	-60 ... +250 (-76 ... +482)	9.4	0.15 (0.27)
• Ni100	-60 ... +250 (-76 ... +482)	18.75	0.15 (0.27)
• Ni120	-60 ... +250 (-76 ... +482)	18.75	0.15 (0.27)
• Ni1000	-60 ... +250 (-76 ... +482)	150	0.15 (0.27)

Resistance-based sensors

Input	Measured range	Max. parameterizable line resistance	Measurement error
	Ω	Ω	Ω
Resistance	0 ... 24	1.2	0.04
	0 ... 47	2.35	0.03
	0 ... 94	4.7	0.03
	0 ... 188	9.4	0.04
	0 ... 375	18.75	0.05
	0 ... 750	37.5	0.1
	0 ... 1500	75	0.7
	0 ... 3000	150	0.4
	0 ... 6000	300	1.2

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Technical specifications (continued)

Thermocouple elements

Input	Measured range		Measurement error [1]	
	°C	(°F)	°C	(°F)
Type B	100 ... +1820	(+212 ... +3308)	3	(5.4)
Type C	0 ... +2300	(+32 ... +4172)	2	(3.6)
Type D	0 ... +2300	(+32 ... +4172)	1	(1.8)
Type E	-200 ... +1000	(-328 ... +1832)	1	(1.8)
Type J	-210 ... +800	(-346 ... +1472)	1	(1.8)
Type K	-200 ... +1372	(-328 ... +2502)	1	(1.8)
Type L	-200 ... +900	(-328 ... +1652)	2	(3.6)
Type N	-200 ... +1300	(-328 ... +2372)	1	(1.8)
Type R	-50 ... +1760	(-58 ... +3200)	2	(3.6)
Type S	-50 ... +1760	(-58 ... +3200)	2	(3.6)
Type T	-200 ... +400	(-328 ... +752)	1	(1.8)
Type U	-200 ... +600	(-328 ... +1112)	2	(3.6)

[1] Specified accuracy value refers to the largest error of the total measuring range.
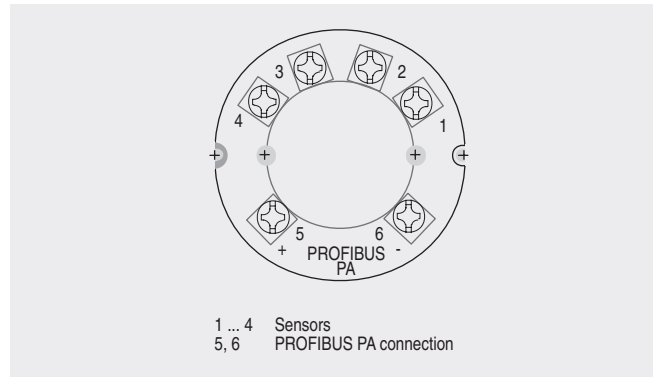
Voltage/current sources

Input	Measuring range	Measurement error
	mV	µV
mV Sensor	-1 ... +16	10
	-3 ... +32	10
	-7 ... +65	10
	-15 ... +131	25
	-31 ... +262	50
	-63 ... +525	100
	-120 ... +1000	150

Dimensional drawings
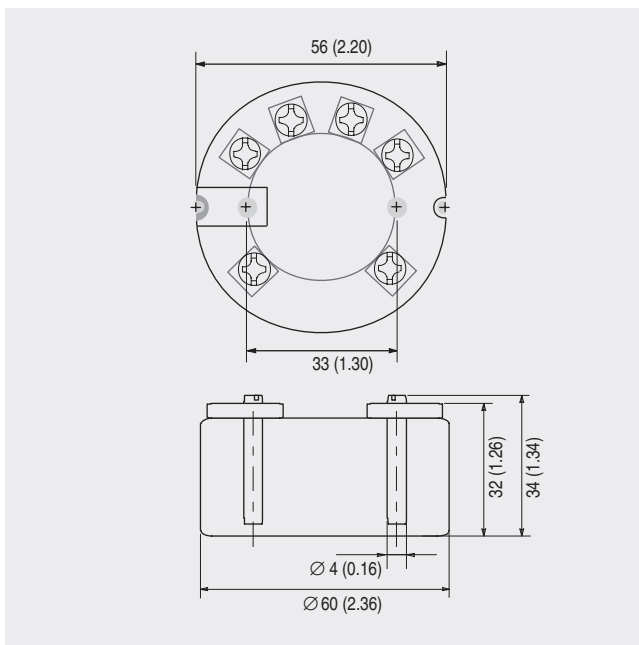
SITRANS T3K PA, dimensions in mm (inches)

Schematics

1 ... 4	Sensors
5, 6	PROFIBUS PA connection

Connection diagram

Selection and ordering data	Order No.
Temperature transmitter SITRANS T3K PA with PROFIBUS PA for installation in the sensor head, with electrical isolation (order instruction manual separately).	
• without explosion protection ▶	**7NG3213-0NN00**
• with explosion protection EEx ia/ib (ATEX) ▶	**7NG3213-1NN00**
• with explosion protection EEx n for zone 2 (available soon)	**7NG3213-2NN00**
• with explosion protection (FM) intrinsic safety ▶	**7NG3213-3NN00**
Further designs Please add "**-Z**" to Order No. and specify Order code(s) and plain text.	**Order code**
• Customer-specific setting of operating data	**Y01**

Accessories	Order No.
Instruction manual for SITRANS T3K PA ▶ (German/English)	**C79000-B7174-C55**
SIMATIC PDM operating software	**see Chapter 9**
for additional PA components,	**see Catalog IK PI**

▶ Available ex stock.

■ Schematics (continued)

Resistance	Resistance thermometer	Thermocouple

1)

R

Two-wire circuit: resistor
can be programmed
for line compensation

1)

R

Three-wire circuit

R

Four-wire circuit

1)

R2   R1

Difference/average value circuit:
2 resistors can be programmed
for line compensation

1)

RTD

Two-wire circuit: resistor
can be programmed
for line compensation

1)

RTD

Three-wire circuit

RTD

Four-wire circuit

1)

RTD2   RTD1

Difference/average value circuit
2 resistors can be programmed
for line compensation

1)

- TC +

Determination of cold junction
temperature with built-in Pt100
or external reference temperature

1)

- +
Pt100

Determination of cold junction
temperature with external Pt100
resistor can be programmed
for line compensation

1)

- TC1 +

- TC2 +

Difference/average value circuit
with internal cold junction temperature

mV sensor

1)

- +

Two-wire circuit

1) **Important !**
Fit short-circuit jumpers on site.

Sensor connection assignment