SIEMENS

SITRANS T

Temperature transmitter SITRANS TH200/TH300

Operating Instructions

7NG3211-1*N00 SITRANS TH200 7NG3212-0*N00 SITRANS TH300

06/2010
A5E00393069-03

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

CAUTION

without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

NOTICE

indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation for the specific task, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be adhered to. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of the Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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order number: A5E00393069
℗ 10/2010

Table of contents

Introduction 1

1.1 Purpose of this documentation

These instructions contain all information that you will require to commission and use the device. Read these instructions carefully prior to installation and commissioning. In order to use the device correctly, first make yourself acquainted with its principle of operation.

The instructions are aimed both at persons mechanically installing the device, connecting it electronically, configuring the parameters and commissioning it as well as service and maintenance engineers.

1.2 History

This history establishes the correlation between the current documentation and the valid firmware of the device.

The documentation of this edition is applicable for the following firmware:

Edition	Firmware identifier nameplate	System integration	Installation path for PDM
01 06/2006	FW: 01.01.02 HW: 01.00	TH200: SIPROM T V1.07 TH300: PDM V6.0 DD Rev. 1.00	TH200: not relevant TH300: SITRANS TH300
02 03/2008	FW: 01.01.04 HW: 01.02	TH200: SIPROM T V1.2.1 TH300: PDM V6.0 DD Rev. 1.00	TH200: not relevant TH300: SITRANS TH300
03 06/2010			

The most important changes in the documentation when compared with the respective previous edition are given in the following table.

Edition	Remark
01 06/2006	First edition
02 03/2008	Revision of content and layout
03 06/2010	Further supplements on topic "Functional safety" Revised: Abbreviations and glossary.

1.3 Notes on warranty

The contents of this programming manual shall not become part of or modify any prior or existing agreement, commitment or legal relationship. All obligations on the part of Siemens AG are contained in the respective sales contract, which also contains the complete and solely applicable warranty conditions. Any statements on the device versions described in the programming manual do not create new warranties or modify the existing warranty.

The content reflects the technical status at the time of printing. We reserve the right to make technical changes in the course of further development.

See also

Contacts (http://www.siemens.com/processinstrumentation/contacts)

Product information on SITRANS T in the Internet (http://www.siemens.com/sitranst)

Instructions and Manuals (http://www.siemens.com/processinstrumentation/documentation)

1.4 Environmental protection

Recycling

Devices described in this programming manual can be recycled owing to the low content of noxious substances in their version.

Please contact a certified waste disposal company for eco-friendly recycling and to dispose of your old devices.

General safety notes 2

2.1 General information

This device left the factory free from safety problems. In order to maintain this status and to ensure safe operation of the device, please observe the safety information and warnings contained in these instructions.

Safety information and symbols must be observed without exception. They must not be removed and must be maintained in legible condition at all times.

2.2 Correct usage

The device may only be used for the purposes specified in these instructions.

Insofar as they are not expressly stated in these instructions, all changes to the device are the sole responsibility of the user.

2.3 Qualified Personnel

Qualified personnel are people who are familiar with the installation, mounting, commissioning, and operation of the product. These people have the following qualifications:

- They are authorized, trained or instructed in operating and maintaining devices and systems according to the safety regulations for electrical circuits, high pressures and aggressive as well as hazardous media.
- For explosion-proof devices: They are authorized, trained, or instructed in carrying out work on electrical circuits for hazardous systems.
- They are trained or instructed in maintenance and use of appropriate safety equipment according to the safety regulations.

2.4 Laws and directives

Observe the test certification, provisions and laws applicable in your country during connection, assembly and operation. These include, for example:

- National Electrical Code (NEC - NFPA 70) (USA)
- Canadian Electrical Code (CEC) (Canada)
- The working reliability regulation (Germany)

Further provisions for hazardous areas, these are for example:

- IEC 60079-14 (international)
- EN 60079-14 (formerly VDE 0165, T1) (EU, Germany)

See also

Certificates (http://www.siemens.com/processinstrumentation/certificates)

2.5 Precautions

In the interests of safety, the following precautions must be observed:

⚠ WARNING

"Intrinsic safety" type of protection

Connect the device only to certified, intrinsically safe circuits. These circuits must comply with the technical data specified on the nameplate or in the certificates and approvals. Should these circuits not match the details given in the certificates and approvals, then the safety required for the approval can no longer be guaranteed. The device's protection level "ia" is lowered to protection level "ib" if fail-safe circuits are connected with protection level "ib".

"Limited energy" type of protection ic/nL (Zone 2)

Devices of the protection type "limited energy" can be connected and disconnected during operation.

"Non-sparking" type of protection nA (Zone 2)

Devices of the protection type "non-sparking" may only be connected and disconnected when in a powered-down state.

⚠ CAUTION

Modules susceptible to electrical discharge

The device contains modules susceptible to electrical discharge. Modules susceptible to electrical discharge can be destroyed by voltages that fall far below the limits of human perception. These voltages even occur if you touch a component part or electrical connections of a module without being electrostatically discharged. The damage to a module caused by overvoltage cannot normally be detected immediately, it only becomes apparent after a longer period of operating time has elapsed.

Description

3

3.1 Application range

SITRANS TH200 and SITRANS TH300 transmitters can be used in all industries. Their compact size means that they can be installed in connection heads of type B, in accordance with DIN43729, or larger. Their input stage means that the following sensor and signal sources can be connected:

- Resistance thermometer
- Thermocouples
- Resistance-type transmitter/potentiometer
- DC voltage sources

The output signal is an output current of 4 to 20 mA that corresponds to the sensor characteristic curve.

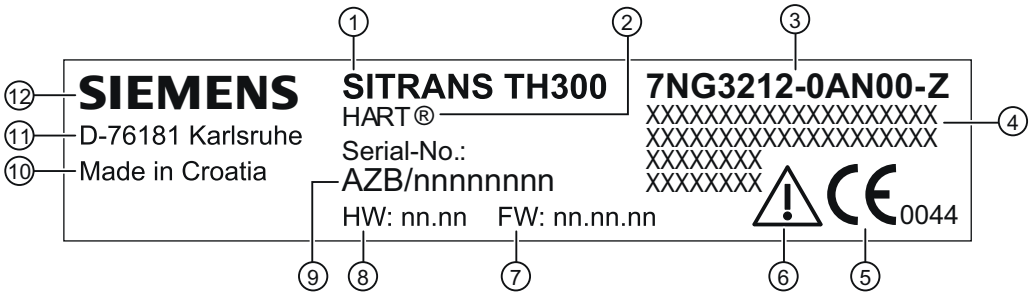
Explosion-proof transmitters can be installed and operated within potentially explosive atmospheres in compliance with the information given in the relevant certificates and approvals and in these Operating Instructions.

3.2 Product features

- Transmitter with two-wire technology
- Installation in connection heads of type B, in accordance with DIN 43729 or larger, or on a DIN rail
- With communications capability via the HART protocol rev. 5.9 in SITRANS TH300 or via a proprietary protocol in SITRANS TH200. This enables, for example, the sensor activation and measuring range to be programmed.
- Galvanic isolation
- Intrinsically-safe and non-sparking version for use in hazardous areas.
- Two additional test pins for connecting a multimeter make it possible to measure the current signal without interrupting the current loop.
- Indication of operating status: LED green, flashing red, or red
- Special characteristic curve
- Diagnostic functions in SITRANS TH300: Min/max pointer, runtime meter, simulation

3.3 Nameplate structure

The nameplate is located on the enclosure and carries the Order No. and other important product information; see following example.



①	Product name	②	Version
③	Order No.	④	Additional data
⑤	CE mark	⑥	Pay attention to the Operating Instructions
⑦	Firmware revision	⑧	Hardware revision
⑨	Serial number	⑩	Place of manufacture
⑪	Manufacturer's address	⑫	Manufacturer

Figure 3-1 Layout of the nameplate, SITRANS TR300 as example

Note

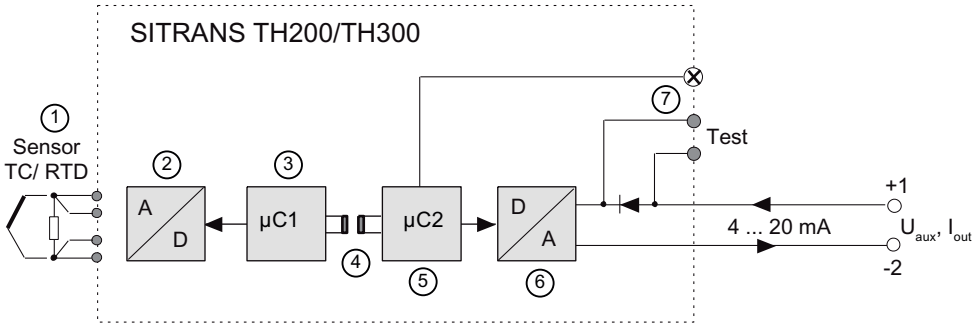
Information about explosion protection

With explosion-proof devices, the information about explosion protection is noted on an additional plate on the enclosure.

Information regarding the certified types of protection can be found in Chapter Technical data (Page 71):

3.4 How It works

Based on the function block diagram, the mode of operation is described below.



① Sensors such as the resistance thermometer, thermocouple, resistance-type transmitter, millivolt transmitter
② Analog-to-digital converter
③ Microcontroller secondary side
④ Galvanic isolation
⑤ Microcontroller primary side
⑥ Digital-to-analog converter
⑦ LED
U_{aux} Auxiliary power supply
I_{out} Output current
Test Test terminals for brief connection of an ammeter

Figure 3-2 Function block diagram for SITRANS TH200/TH300

How the transmitter works

- The sensor supplies an electrical signal ①.
- This signal is converted to a digital signal in an analog-to-digital converter ②.
- The digital signal is evaluated in a secondary-side microcontroller ③ and corrected in accordance with the sensor characteristic.
- The digital signal is transferred to the primary-side microcontroller ⑤ via the galvanic isolation ④.
- The analog output valve is calculated in the primary-side microcontroller ⑤. The functional status is indicated by LED ⑦, and the communications data are prepared.
- The digital-to-analog converter ⑥ then converts the signal into an output current of 4 to 20 mA.
- The source of auxiliary power supply is located in the output signal circuit.

3.5 Communication

3.5.1 Overview

SITRANS TH200

This device version does not have an interface to HART. Assigning the parameters to the SITRANS TH200 is only possible "offline" using the modem for SITRANS TH100/TH200/TR200.

SITRANS TH300

The device has a parameter assignment interface according to the HART specification. The parameter assignment interface permits access to all the functions of the device via a HART modem or a HART communicator. Connect the HART modem or the HART communicator in accordance with the Fig. "HART communication with supply from voltage source".

⚠ WARNING

Only operate intrinsically safe HART modems or HART communicators on intrinsically safe circuits. Be sure that the intrinsically safe parameters are observed.

See also

HART communication with supply from voltage source (Page 17)

3.5.2 HART communication with supply from voltage source

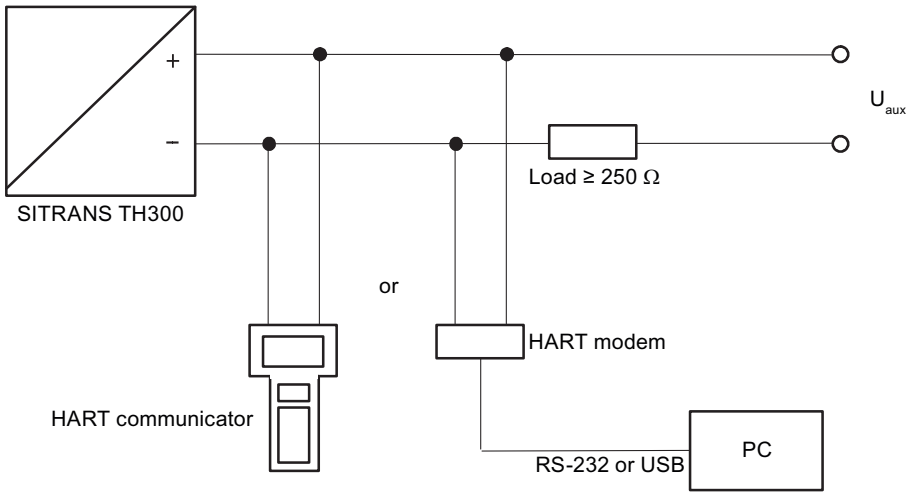
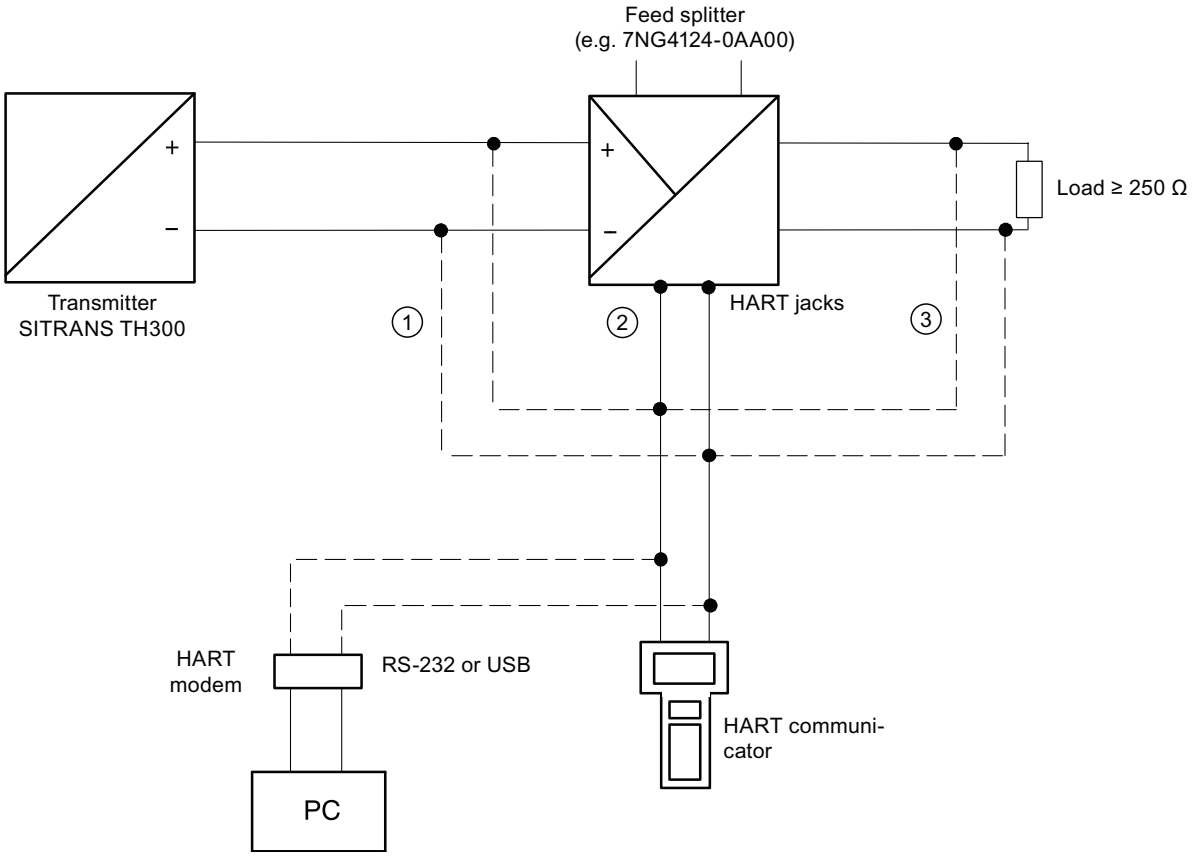


Figure 3-3 HART communication with supply from voltage source

3.5.3 HART communication with supply via feed splitter



① Only intrinsically safe HART communicators or HART modems are allowed to be used with an intrinsically safe supply.

② HART communication via HART jacks of the feed splitter

③ Load ≥ 250 Ω only relevant if HART communication takes place via this branch. Otherwise, load of 0 to 650 Ω for versions ① or ②

Figure 3-4 HART communication with supply via feed splitter

Installation 4

4.1 Safety information

CAUTION
Mounting in hazardous areas Make sure you observe the following information before installing the transmitter: • Install the transmitter in an enclosure appropriate for the envisaged application • In hazardous areas, also observe the requirements specified in the Ex certificates and approvals. • Comply with the ambient conditions specified in the technical data.

4.2 Installation in the connection head

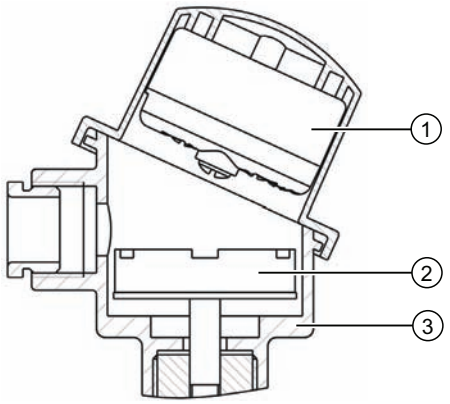
NOTICE
The transmitter is only designed for installation in a type B connection head or larger.

The transmitter is either secured in the base of the connection head or in the raised cover of the connection head.

Included in the transmitter's scope of delivery are:

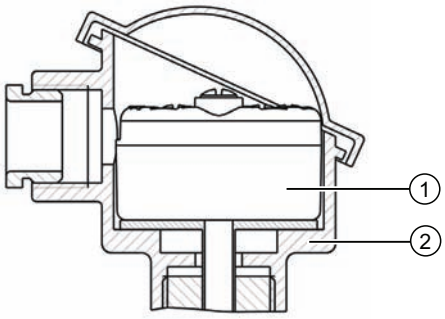
- Springs
- Fixing screws
- Lock washers for installation on the round plate

Securing the transmitter in the connection head cover



① Transmitter
② Ceramic base of the measuring element
③ Connection head

Securing the transmitter in the connection head base

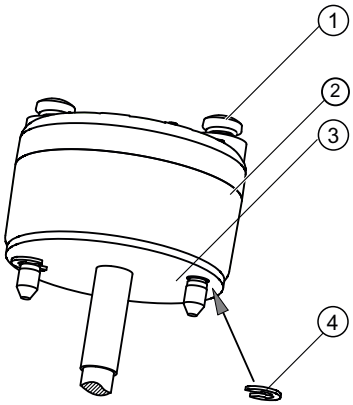


① Transmitter ② Connection head

Note

Using the lock washers

The lock washers ④ included in the delivery are only required for securely fastening the transmitter when the transmitter ② is directly installed on the round plate ③ for a temperature probe.



① Fixing screw M4x35 ② Transmitter
③ Round plate ④ Lock washer DIN 6799 - 3.2 A2

4.3 Installation on DIN rail and G rail

CAUTION
Electromagnetic compatibility If the sensor is installed outside a closed building, you must check the transmitter for correct functioning following a lightning stroke.

Note

Fixing rings

The fixing rings included in the scope of delivery for the transmitter are not required for the installation on DIN rails or G rails.

You can either install the transmitter on a 35 mm DIN rail or on a 32 mm G rail.
DIN EN 60715 applies to DIN rails and G rails in this context. The DIN rail adapter required for installation can be ordered as an accessory under the Order No. 7NG3092-8KA.

Adhere to the ambient conditions specified in the technical data.

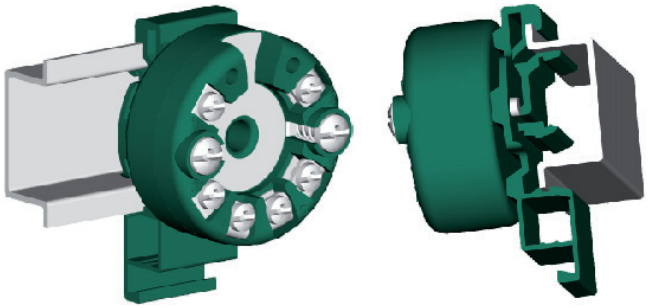


Figure 4-1 Securing the transmitter on DIN rails

Figure 4-2 Securing the transmitter on G rails

Connecting 5

5.1 Safety notes on the connection

5.1.1 General safety notes on the connection

Note

To improve the resistance:

- Lay signal cables separately from cables with voltages > 60 V.
- Use cables with twisted wires.
- Avoid getting too close to large electrical systems or use shielded cables.
- Use shielded cables to ensure the full specification according to HART, revision 5.9 in SITRANS TH300.
- Use only cable entries and covers that are approved for the relevant use.
- At an ambient temperature T ≥ 60°C, use heat-resistant cables approved for an ambient temperature of at least 20 K higher.
- Use cables with wires that have a maximum cross-sectional area of 2.5 mm^2.

5.1.2 Safety notes when connecting in hazardous areas

⚠ WARNING

Observe the degree of protection

The device must be connected to the supply and signal circuits named in the certificate or on the nameplate.

When installing the device in hazardous areas:

Use enclosures/connection heads with the degree of protection corresponding to the test certificate applicable in your country.

⚠ WARNING

Electrical connection in hazardous areas

The national directives and laws for hazardous areas valid in your country must be observed for electrical connection. In Germany these are, for example:

- The health and safety at work regulations
- The directive for "Installation of electrical systems in hazardous areas", DIN EN 60079-14 (previously VDE 0165, T1)
- The EC type examination certificate

When an auxiliary power supply is needed, check whether the auxiliary power supply matches that given on the nameplate and the inspection certificate valid in your country.

CAUTION

Limited range of use

If the device has been operated outside the ambient conditions specified for potentially explosive atmospheres, you may no longer operate the device in potentially explosive atmospheres. Make sure to permanently mask all Ex markings on the nameplate.

NOTICE

Loss of type of protection "Intrinsic safety"

If the transmitter is not operated with an intrinsically-safe power supply, the type of protection "Intrinsic safety" is no longer guaranteed and the intrinsically-safe approval may be revoked.

Permanently erase, therefore, the irrelevant types of protection on the nameplate before commissioning to ensure that erroneous deployment is avoided.

The 4 to 20 mA input and sensor circuits are electrically isolated and have been tested with a voltage of 1.5 kV DC/1 minute.

The sensor circuit is reliably galvanically isolated from the auxiliary power supply and signal circuit, up to a peak value of the rated voltage of 60 V. Be sure to observe the construction directives valid at the construction location for electrical resources in hazardous areas. In Europe, this is the standard EN 60079-14.

Zone 0 and Zone 1 in type of protection "i" - intrinsic safety

- Only connect the transmitter, in accordance with the certificate of compliance, to devices certified as intrinsically-safe.

Maximum values of the auxiliary power supply and signal circuits:		
U_i = 30 V DC	I_i = 100 mA	P_i = 750 mW
L_i = 106 µH	C_i = 13 nF	

Maximum values of the sensor circuit:				
U_0 = 6 V DC	**I_0 = 25 mA**		**P_0 = 37 mW**	
L_0 [mH]	50	10	1	0,1
C_0 [µF]	1	1,6	2,6	4,8

- If the connection head is made of aluminum, the requirements of EN 60079-26, section 4.3.3, must be observed for uses where the device category 1 G is required.

Zone 2 in type of protection "nL" or "ic" - limited energy resources

- Install the transmitter in an enclosure meeting the degree of protection IP54 per EN 60529, e.g. in a type B connection head per DIN 43729.
- Only connect the transmitter to devices that have at least been approved as "nL" or "ic" certified devices (limited energy resources) of Category 3.
- Be sure to observe the respective values.

Maximum values of the auxiliary power supply and signal circuits:		
U_i = 32 V DC	I_i = 100 mA	P_i = 750 mW
L_i = 106 µH	C_i = 13 nF	

Maximum values of the sensor circuit:				
U_0 = 6 V DC	**I_0 = 25 mA**		**P_0 = 37 mW**	
L_0 [mH]	50	10	1	0,1
C_0 [µF]	1,9	2,8	4,5	8,3

Zone 2 in type of protection "nA" - non-sparking resources

- Install the transmitter in an enclosure meeting the degree of protection IP54 per EN 60529, e.g. in a type B connection head per DIN 43729.
- Adhere to the conditions for installers applicable to this type of protection.
- The maximum approved input voltage is U_n = DC 32 V.
- Take measures to ensure that the supply voltage (including transients) does not rise above 140 % of the rated voltage.
- Maximum values of the sensor circuit:
  - U = 6 V DC
  - I = 25 mA
  - P = 37 mW

Additional requirements for use in dust explosion protected areas

Install the transmitter in an enclosure suitable for the respective type of dust and corresponding Zone in accordance with the inspection certificate valid in your country.

5.2 Connecting the auxiliary power supply

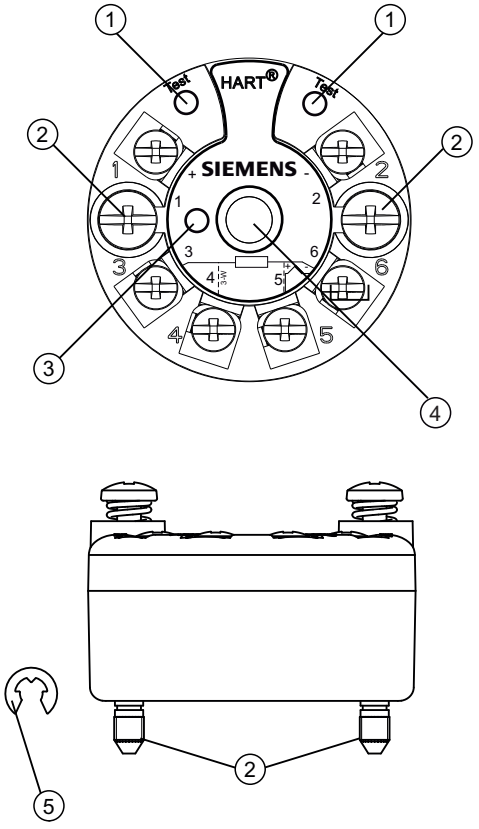
Procedure

Connect the wires for the auxiliary power supply to terminals "1"(+) and "2"(-). Ensure that the polarity is correct. The device is reverse polarity protected.

See also

Connection diagrams (Page 28)

5.3 Connection assignment



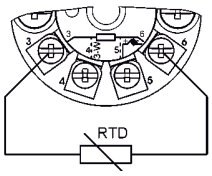
① Test terminal
② Fixing screw M4x35
③ LED
④ Internal diameter of center hole 6.3 mm (0.25")
⑤ Lock washer DIN 6799 - 3.2 A2

Connections: 1 (+) and 2 (-) Auxiliary power supply U_{aux}, output current I_{out}
3, 4, 5, and 6 Sensor connections

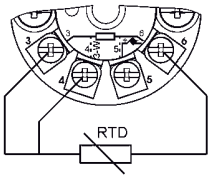
Figure 5-1 SITRANS TH200/TH300 connections

5.4 Connection diagrams

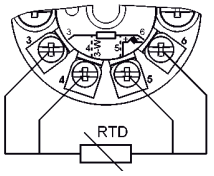
Resistance thermometer



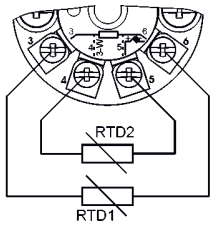
Two-wire connection 1)



Three-wire connection



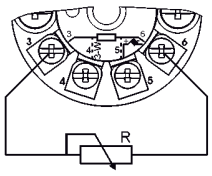
Four-wire connection



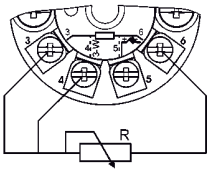
Averaging/determination of difference 1)

1) Line resistance for correction is programmable

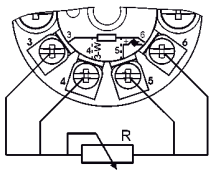
Resistor



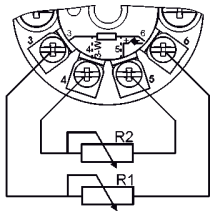
Two-wire connection 1)



Three-wire connection

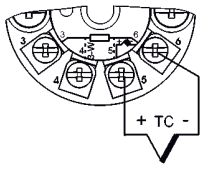


Four-wire connection

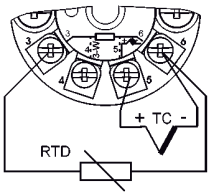


Averaging/determination of difference 1)

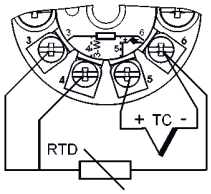
Thermocouple



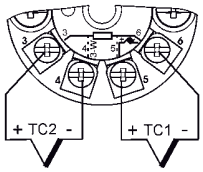
Cold junction compensation/fixed value



Cold junction compensation with external PT100 in two-wire connection 1)

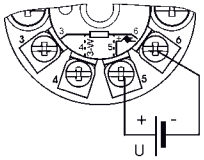


Cold junction compensation with external PT100 in three-wire connection 1)

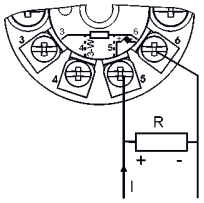


Averaging/determination of difference with internal cold junction compensation

Voltage measurement



Current measurement



Connection for auxiliary power (Uaux)

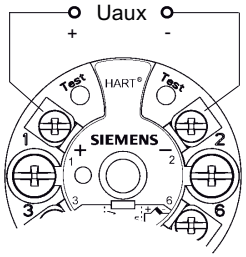


Figure 5-2 SITRANS TH200/TH300 connection diagrams

5.5 Notes on measuring current

Connect an external measuring resistor R to the transmitter connection terminals 5 and 6 if the transmitter is used for measuring current. The transmitter uses this resistor to perform the required current measurement as a voltage measurement. Therefore, the following instructions must be complied with in the parameterization software SIPROM T with SITRANS TH200 and SIMATIC PDM or HART communicator with SITRANS TH300:

- Sensor class selection = Millivolt transmitter
- Process value scale: Multiply the both the start of the scale value and the full scale value of the required current range with the resistance value R, which is connected externally to terminals 5 and 6 of the transmitter.
- **Example:** Measurement of a 0 to 20 mA current via an external resistance R of 10 Ohm
  Sensor class = Millivolt transmitter
  Process value scale:
  - *Start of scale value = 0 mA · 10 Ω = 0 mV*
  - *Full scale value = 20 mA · 10 Ω = 200 mV*

  The 4 to 20 mA output current now follows the profile of the sensor input, the 0 to 20 mA current signal.

If, for a current measurement, the measured values are called up via the digital interface, e.g. HART with SITRANS TH300, then the operating software displays the measurement data as a voltage signal in the unit mV. The voltage signal is scaled by the factor of the externally connected resistance value R.

5.6 Test terminals for output signal

The "Test +" and "Test -" test terminals are used for checking the 4 to 20mA current with an amperemeter. The voltage drop across the amperemeter must not exceed 0.4V for a 23mA output current.

Operation 6

6.1 Operating the SITRANS TH200/TH300 and assigning parameters to it

The PC is used to both assign the parameters and operate the SITRANS TH200 and SITRANS TH300. The PC is connected to the two-wire line using a suitable modem. The SITRANS TH300 can also be parameterized using a HART communicator. The signals needed for SITRANS TH300 communications in accordance with the HART protocol are superimposed on the output current in accordance with frequency shift keying. Frequency shift keying is also abbreviated to FSK.

Measurement transmitter data and data used to assign the parameters are stored in a non-volatile memory, the EEPROM.

Note

After the parameters have been assigned to the SITRANS TH200/TH300, do not switch the supply voltage for the transmitter off until the device's LED flashes red or lights constantly green.

6.2 Operation of the SITRANS TH200 with PC/laptop and modem

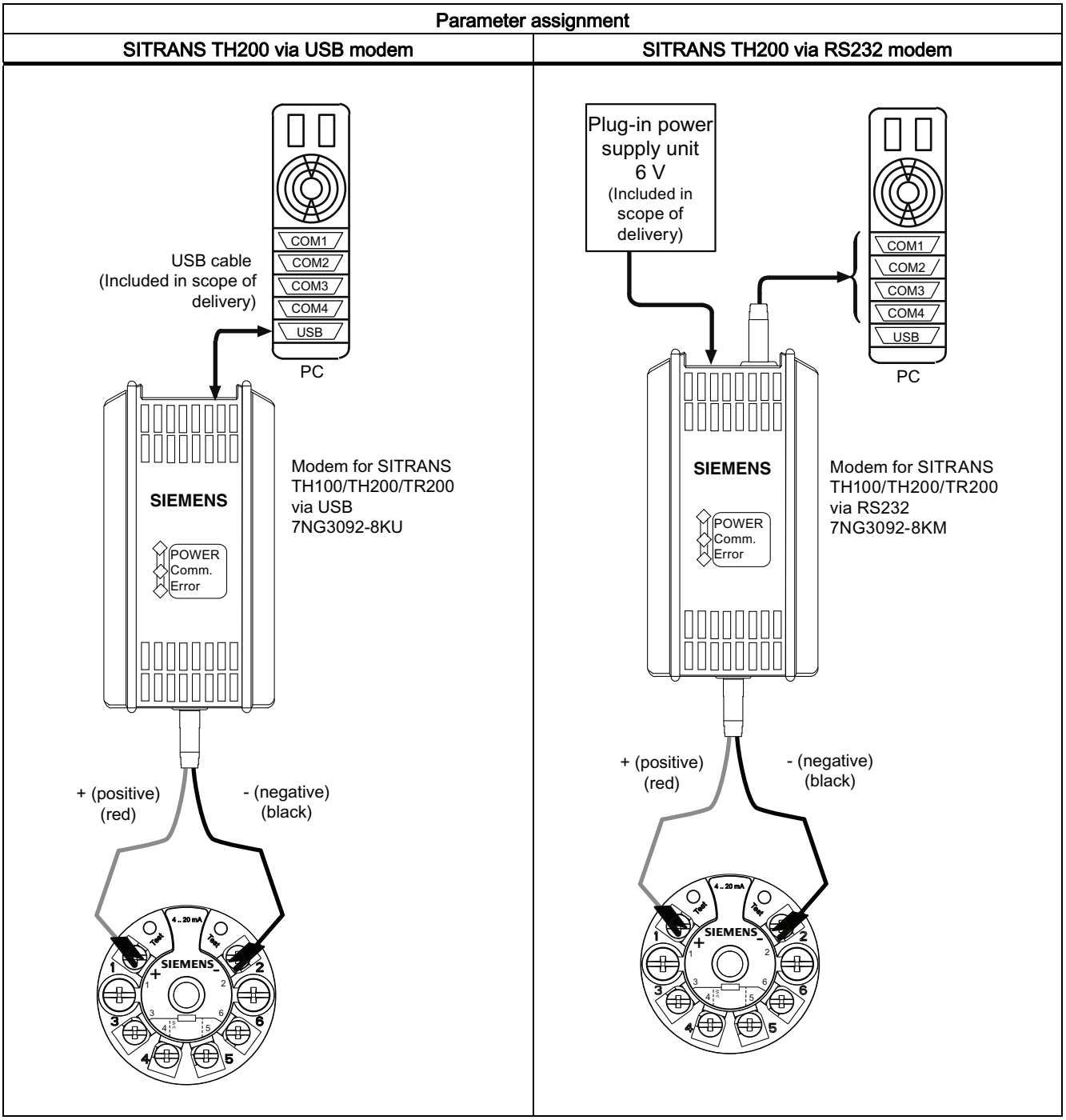
NOTICE
Parameters may only be assigned to the SITRANS TH200 when offline using the modem and the SIPROM T operating software. Any 4 to 20 mA current loop connected to the transmitter needs to be disconnected before parameters are assigned.

Procedure

1. To assign the parameters, connect the transmitter to a PC via the modem for SITRANS TH100/TH200/TR200.
2. Configure the transmitter using the SIPROM T parameterization software.

The power required by the transmitter is provided:

- By the USB port on the PC for the USB modem
- By an external plug-in auxiliary power supply for the RS232 modem



For more detailed information on assigning parameters to the transmitter, refer to the operating instructions for the following products:

- Modem for SITRANS TH100/TH200/TR200 and the SIPROM T parameterization software; Order No. 7NG3092-8KU
- CD "sitrans t - temperature transmitters", Order No. A5E00364512

6.3 Operation of the SITRANS TH300

6.3.1 Operation with the HART modem and SIMATIC PDM

You can both operate the transmitter and assign its parameters via the PC using the SIMATIC PDM parameterization software and the HART modem.

Procedure for commissioning

- The HART modem must be connected to the output circuit for this purpose.
- The transmitter's power supply must be switched on.
- The load in the circuit must be at least 250 Ω; to do this, refer to the circuit diagram of the Fig. in chapter HART communication with supply via feed splitter (Page 18)
- The parameterization software SIMATIC PDM is used for the operation.

See also

HART communication with supply via feed splitter (Page 18)

6.3.2 Operation with HART communicator

Action buttons

This button switches the HART communicator on and off. After switch-on, the hand-held terminal automatically establishes communication with the transmitter. The online menu appears on the display.

This button moves the cursor up through the menu bar. The selected menu line is indicated.

This button moves the cursor down through the menu bar. The selected menu line is indicated.

This button moves the cursor to the right through the menu bar or branches into a subroutine. The name of the selected subroutine is displayed at the top edge of the display.

This button moves the cursor to the left through the menu bar or exits a subroutine.

Function keys

Function keys F1 to F4 are located below the digital display. The various functions of the keys in the individual menus are displayed on the bottom edge of the display.

Alphanumeric button and shift buttons

Alphanumeric values can be entered using these buttons. The function (number or letter button) depends on the menu in question. Letters are selected by confirming the corresponding shift button first.

Refer to the operating instructions of the HART communicator for further information about operation and technical data.

Functional safety

7

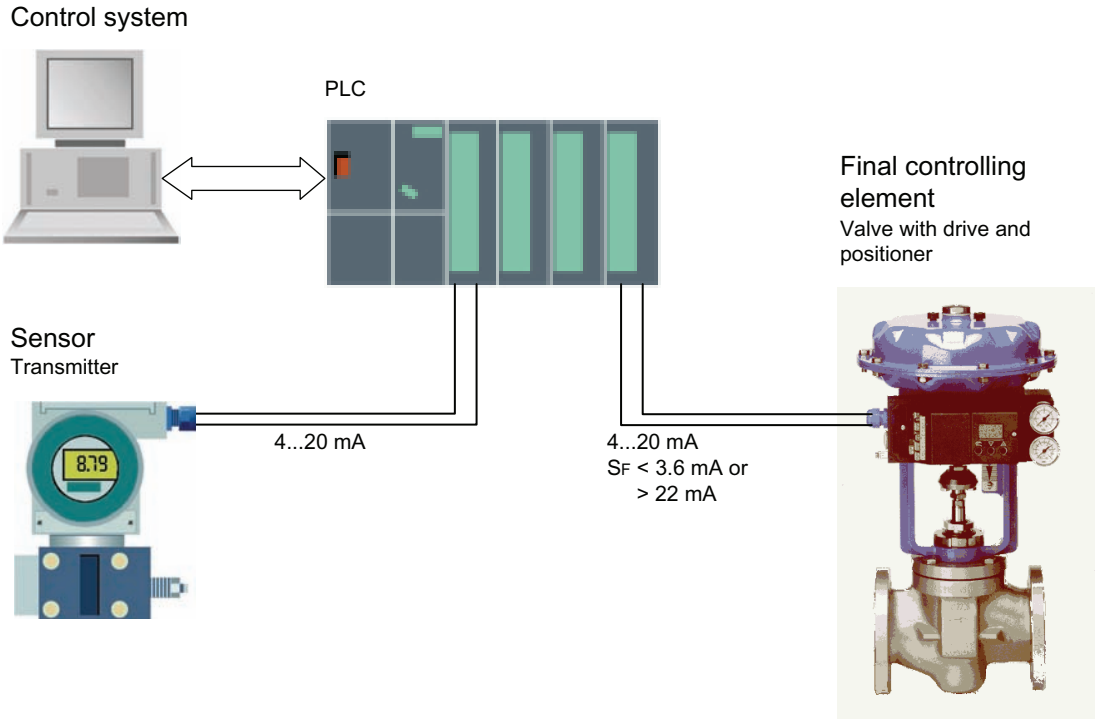
7.1 General safety information

7.1.1 Safety-instrumented system

This chapter describes the functional safety in general and not specific to a device. The devices in the examples are selected as representative examples. The device-specific information follows in the next chapter.

Description

The sensor, logic unit/control system and final controlling element combine to form a safety-instrumented system, which executes a safety function.



S_F Failure signal

Figure 7-1 Example of a safety-instrumented system

Functioning of the system as shown in the example

The transmitter generates a process-specific analog signal. The downstream control system monitors this signal to ensure that it does not fall below or exceed a set limit value. In case of a fault, the control system generates a failure signal of < 3.6 mA or > 22 mA for the connected positioner, which switches the associated valve to the specified safety position.

7.1.2 Safety Integrity Level (SIL)

The international standard IEC 61508 defines four discrete Safety Integrity Levels (SIL) from SIL 1 to SIL 4. Each level corresponds to the probability range for the failure of a safety function.

Description

The following table shows the dependency of the SIL on the "average probability of dangerous failures of a safety function of the entire safety-instrumented system" (PFD_{AVG}) The table deals with "Low demand mode", i.e. the safety function is required a maximum of once per year on average.

Table 7- 1 Safety Integrity Level

SIL	**Interval**
4	$10^{-5} \leq PFD_{AVG} < 10^{-4}$
3	$10^{-4} \leq PFD_{AVG} < 10^{-3}$
2	$10^{-3} \leq PFD_{AVG} < 10^{-2}$
1	$10^{-2} \leq PFD_{AVG} < 10^{-1}$

The "average probability of dangerous failures of the entire safety-instrumented system" (PFD_{AVG}) is normally split between the three sub-systems in the following figure.

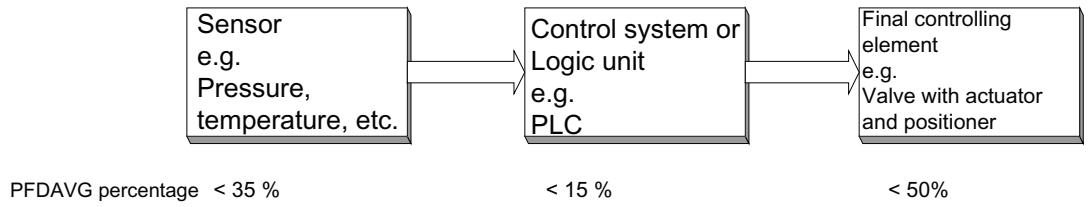


Figure 7-2 Example of PFD distribution

The following table shows the achievable Safety Integrity Level (SIL) for the entire safety-instrumented system for type B subsystems depending on the safe failure fraction (SFF) and the hardware fault tolerance (HFT). Type B subsystems include analog transmitters and shut-off valves without complex components, e.g. microprocessors (also see IEC 61508, Section 2).

SFF	**HFT**		
	0	**1 (0) [1)]**	**2 (1) [1)]**
< 60 %	Not permitted	SIL 1	SIL 2
60 to 90 %	SIL 1	SIL 2	SIL 3
90 to 99 %	SIL 2	SIL 3	SIL 4
> 99 %	SIL 3	SIL 4	SIL 4

[1)] As per IEC 61511-1, Section 11.4.4

According to IEC 61511-1, Section 11.4.4, the hardware fault tolerance (HFT) can be reduced by one (values in brackets) for sensors and final controlling elements with complex components if the following conditions are applicable for the device:

- The device is proven-in-use.
- The user can configure only the process-related parameters, e.g. control range, signal direction in case of a fault, limiting values, etc.
- The configuration level of the firmware is blocked against unauthorized operation.
- The function requires SIL of less than 4.

The device fulfills these conditions.

7.2 Device-specific safety instructions

7.2.1 Safety function

Measuring temperature is the safety function with the temperature transmitters.

It is applicable for output currents from 4 to 20 mA and ensures an accuracy of ± 2% in the maximum measurement range.

The output value will be updated at least every 620 ms (filter time constant of the electrical damping = 0 s).

The partial system is of type B. The calculations are valid for the operating mode with low demand rate in single-channel operation. The specific values are listed in the manufacturer declaration for the product (Declaration of Conformity, Functional Safety according to IEC 61508 and IEC 61511): Certificates / EC declaration of conformity (Page 85) .

7.2.2 Requirements

The temperature transmitter meets the following requirements:

- Functional safety to SIL 2 under IEC 61508 or IEC 61511-1, from firmware version FW: as of 1/1/2004 (with order option C20 only)
- Explosion protection for corresponding versions
- Electromagnetic compatibility in compliance with EN 61326
- EC Declaration of Conformity

7.2.3 Settings

⚠ CAUTION
Current sensor function / Simulation The use of the current sensor function and the simulation in safety applications can result in undesirable operating states. The use of both functions is not permitted in safety applications.

Operation/configuration

While operating/configuring, ensure that the technical data of the temperature transmitter are adhered to in their respective version.

Checking the safety function

We recommend that:

- You check the status for warnings and alarms.
- Check the upper and lower alarm current value.
- Perform a 2-point calibration.
- You check the measuring accuracy that must be in the range of ± 2% for the safety function. You check the measuring accuracy, for example, with a sensor calibration.

Note

Configuration changes in SITRANS TH300 not protected by passwords

If there is no password protection, you may have to deal with undesirable changes in the configuration of the device.

We recommend that you enable password protection for your device after checking the safety function.

7.2.4 Behavior in case of faults

Repairs

Defective devices should be sent in to the repair department with details of the fault and the cause. When ordering replacement devices, please specify the serial number of the original device. The serial number can be found on the rating plate.

The address of the responsible SIEMENS repair center, contacts, spare parts lists, etc. can be found on the Internet.

7.2.5 Maintenance/Checking

Interval

We recommend that the functioning of the temperature transmitter is checked at regular intervals of one year.

Checking the safety function

We recommend that:

- You check the status for warnings and alarms.
- Check the upper and lower alarm current value.
- Perform a 2-point calibration.
- You check the measuring accuracy that must be in the range of ± 2% for the safety function. You check the measuring accuracy, for example, with a sensor calibration.

Checking safety

You should regularly check the safety function of the entire safety circuit in line with IEC 61508/61511. The testing intervals are determined during the calculation for each individual safety circuit in a system (PFD_{AVG}).

7.2.6 Safety characteristics

The safety characteristics necessary for using the system are listed in the "SIL declaration of conformity". These values apply under the following conditions:

- The SITRANS TH200 / TH300 temperature transmitters are only used in applications with a low demand rate for the safety function (low demand mode).
- The communication is used for the following purposes only:
  - Device configuration
  - Reading diagnostic values
- The devices are operated differently:
  - SITRANS TH200: Operation via SIPROM T
  - SITRANS TH300: Operation via SIMATIC PDM or handheld communicator
- The safety function test has been concluded successfully.
- The transmitter is blocked against unwanted and unauthorized changes/operation.
- The following condition applies to the transmitter:
  - The current signal is evaluated by a safe system.
- The specified error rates apply to the typical demand of an industrial environment as in IEC 60654-1 class C. IEC 60654-1 class C means a protected place of application, with an average temperature of max. 40 °C for an extended period of time.
- The calculation of error rates is based on a MTTR of 72 hours.

The maximum application time of the SITRANS TH200 or TH300 in a safety application is 20 years. Replace the device after this time.

Commissioning 8

8.1 Commissioning

⚠ WARNING

Missing type of protection

If the transmitter is not operated with an intrinsically-safe power supply, the type of protection "Intrinsic safety" is no longer guaranteed and the intrinsically-safe approval may be revoked.

Permanently erase, therefore, the irrelevant types of protection on the nameplate before commissioning to ensure that erroneous deployment is avoided.

Procedure

1. Program the transmitter's operating data according to the actual requirements.

   If applicable, enter the changed operating data on the additional plate on the enclosure.
2. Assemble the transmitter.
3. Connect the sensor to the power supply, see Chapter Connecting (Page 23).
4. Turn on the auxiliary power supply.
5. Wait about 10 seconds. After this start-up time the transmitter is operational.

Note

Warming-up

To obtain exact measured values, the transmitter needs to be allowed to warm up for five minutes or so after the power supply has been switched on.

8.2 LED operating indicator

- Operating indicator does not light: No supply voltage
- Constant green light: Everything OK, normal error-free operating state
- Constant/flashing red light: Disrupted operation
  - Flashing (ca. 2 Hz) red light: Indication of faults independent of the device, e.g. wire break, sensor short circuit, violation of sensor limits
  - Constant red light: Indication of errors in the device, e.g. **RAM-, ROM-, EEPROM-, CHECKSUM-, WATCHDOG-, STACK error** or violation of the permitted ambient temperature limits and if the minimum supply voltage for the device is not reached.

Functions

9

9.1 General information

You can operate the SITRANS TH300 either via the SIMATIC PDM parameterization software or via the HART communicator. You can operate the SITRANS TH200 via the SIPROM T parameterization software.
The following functions are available to you when operating the SITRANS TH300/TH200:

- identification
  - Information on operational reliability: day, description, message, assembly number
- Device data; this information is read-only
  - Manufacturer and product name
  - Order number, device serial number
  - Revision numbers for firmware and hardware revision
- Information about the measuring procedure
  - Sensor class and sensor type, e.g. Pt100 resistance thermometer or thermocouple type B
  - Sensor factor
  - Sensor characteristic curve, e.g. linear temperature
  - Measuring range and measuring unit
- Information on measurement interface
  - Interface type: standard, differential or averaging circuit
  - Connection type/sensor connection: two-wire, three-wire or four-wire input with resistance-type transmitters
  - Resistors for line compensation
  - Offset to the measurement signal
  - Additional information for the cold junction in thermocouples: internal, external or fixed
  - Enable/disable of wire break or short circuit test
- Information about the output signal
  - Filter time constant for noise suppression attenuation
  - Output limit values: alarm and saturation limits
- Certificates and approvals
  - The following information is read-only: information on whether the transmitter is allowed to be operated in intrinsically safe mode or not. This function can only be performed using the SIMATIC PDM parameterization software or with the HART communicator.

- Free material parameters: boxes for describing the connected sensor in more detail
  - Type of sensor
  - Composition of the protective tube
  - Length of the protective tube
  - Screw thread / installation flange
  - Supplier / manufacturer
  - F no. of sensor
  - Order number
- Other functions that can be set in the parameters are:
  - Min/max pointer functions
  - Sensor calibration function with selectable trimming range within the limits of the measuring range
  - Trimming the analog output: from 4 to 16 mA with SITRANS TH200, from 4 to 20 mA with SITRANS TH300
  - Factory reset: resetting the operating data to the factory settings
  - Simulation of measurement input. Only in SITRANS TH300: electronics temperature and analog output.
  - Only in SITRANS TH300: individual password protection

The operating data are stored in a non-volatile memory, the EEPROM.

9.2 Broken wire monitoring

Broken wire monitoring on a specific measurement channel can be performed for thermocouples and millivolt transmitters. Break monitoring is permanently active in resistance thermometers and resistance-type transmitters. No reference temperature of the internal sensor which measures the electronics temperature can be obtained if there is a broken wire.

When broken wire monitoring is switched on, all sensor cables are permanently monitored for broken wires. The programmed fault current, 3.6mA to 23mA, is output in the event of an error.

Note

If a broken wire occurs when broken wire monitoring is switched off, invalid values may be obtained for the measured value and the internal electronics temperature in the min/max pointer pairs and their runtime meters.

9.3 Short-circuit monitoring

Short circuit monitoring on a specific measurement channel is only possible with resistance thermometers and resistance-type transmitters. The threshold value for the short circuit check can be set in the parameters.

The programmed fault current, 3.6mA to 23mA, is output in the event of a sensor short circuit.

9.4 Line compensation

Trimming the line resistance values can be performed in the following measurements:

- Resistance thermometer or resistance-type transmitter in two-wire connection
- Resistance thermometer or resistance-type transmitter for calculating differential value or mean value
- Thermocouple with external cold junction with Pt100 in two-wire connection

The trimming is performed by numerical preset of the measured line resistance. The line resistance is the combined total of sending and return conductors.

9.5 Type of characteristic curve (rising or falling)

The type of the characteristic curve at the 4 to 20 mA analog output can be selected (rising or falling). The characteristic curve type is defined as follows by setting the parameters for the start of scale value and full scale value:

- Rising characteristic: Full scale value is greater than start of scale value.
- Falling characteristic: Full scale value is less than start of scale value.

9.6 Measured value offset

An offset response on a specific measurement channel can be set in the parameters for applications in which the process variable to be measured cannot be measured directly at the measuring point.

9.7 Sensor factor

The sensor factor is used to adapt the characteristic curve when resistance thermometers are connected in series or parallel and when thermocouples are connected in series. You must multiply the sensor factor with the basic series of the resistance thermometer or thermocouple. Values from 0.25 to 10.0 can be set as the scaling factor in resistance thermometers, while values from 1 to 10 can be set for thermocouples.

Example 1: 3 x Pt500 parallel: Sensor factor= 5/3 = 1.67 (basis is Pt100)

Example 2: 4 x TC serial: Sensor factor = 4 x 1 = 4

9.8 Cold junction compensation with thermocouples

In order to measure the cold junction for thermocouples, you can choose between the following cold junction compensation versions:

- Internal: in this case, the thermocouple or the compensating line is directly connected to the transmitter. The cold junction temperature is obtained by an internal Pt100.
- External with fixed value: specify the external cold junction temperature, e.g. of a thermostat, as a fixed value. The transmitter then compensates according to this constant cold junction temperature.
- External with Pt100: an external Pt100 measures the cold junction temperature in this version. You can connect the Pt100 to the transmitter in two-wire or three-wire input. The cold junction is compensated on the basis of the current temperature of the external Pt100.

9.9 Calculation of differential value/mean value

The differential and averaging circuit interfaces have the following special features compared to the standard connection:

Setting the start of scale value and full scale value:

- Enter the start of scale value and full scale value for both individual sensors first. The start of scale value and full scale value are the same for both sensors. It is not possible to assign different measuring ranges for the individual sensors in the parameters. Tip: use the largest measuring range.
- Following this, assign the parameters for the start of scale value and full scale value for the differentiation or the average value measurements.

Sensor calibration:

- Trim the individual sensors at the selected limits of the measuring range. The differentiation or average set in the parameters cannot be trimmed.

9.10 Electrical damping

You can set the filter time constant of electrical damping to a point within a range from 0 to 30 s.

9.11 Current sensor function (only in SITRANS TH300)

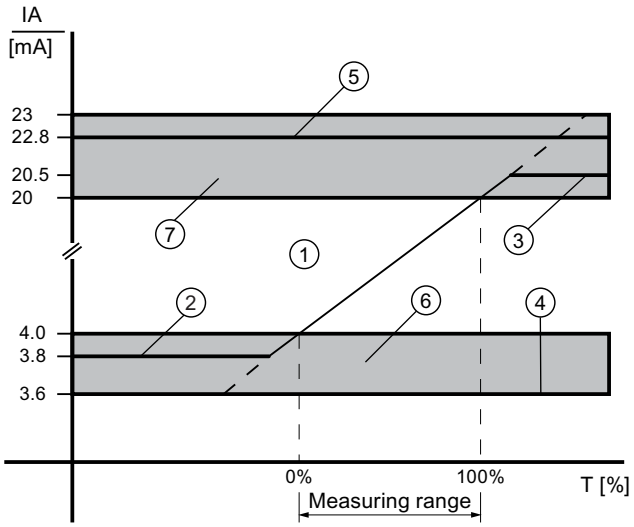
- You can switch the transmitter to constant current mode for test purposes. In that case, the output current no longer corresponds to the process variable.
- Using the operating software, you can set the value of the constant current for:
  - 4 mA
  - 20 mA
  - "Other value"; this value can be selected at will, the setting range is between 3.6 to 23 mA.

9.12 Alarm current

This function is used to set the magnitude of the alarm current. The alarm current signals a sensor fault or a hardware/firmware fault.

The intensity of the alarm current can be freely selected within the preset limits of the current control range of 3.6 mA to 23 mA. The upper and lower limit of the linear control range can also be freely selected within the preset limits of the current control range of 3.6 mA to 23 mA.

One example of this is shown in the following diagram. The specified accuracy values of the output signal only apply to the corresponding nominal ranges.



① Linear control range
② Lower limit of the control range (default value = 3.80 mA)
③ Upper limit of the control range (default value = 20.5 mA)
④ Lower fault current value (default value = 3.6 mA)
⑤ Upper fault current value (default value = 22.8 mA)
⑥ Recommended setting range for lower fault current range and lower control range limit
⑦ Recommended setting range for upper fault current range and upper control range limit

Figure 9-1 Current limits with output signal 4 to 20 mA

9.13 Sensor calibration

9.13.1 Sensor calibration (one point)

This function allows the characteristic curve of the sensor that is connected to be shifted to intersect the zero point. This allows calibration of the start of scale value of the input sensor. This does not affect the measuring span.

Entering a one point trim is equivalent to entering a sensor offset. The result of the one-point trim is saved in the "offset sensor" variables.

9.13.2 Sensor calibration (two point)

This function allows the characteristic curve of the sensor that is connected to be shifted to intersect two calibration points. The results are then correct measured values at the sensor trim points. A two point trim makes it possible to reduce the proportion of errors due to the characteristic curve.

Trimming the lower sensor trim point

With this function:

- You apply the process variable, e.g. temperature or resistance - on which the lower sensor calibration should be performed - to the transmitter input.
- You can use the operating software to instruct the transmitter to accept this process value. SITRANS TH200 uses the operating software SIPROM T; SITRANS TH300 uses the operating software SIMATIC PDM or the HART communicator.

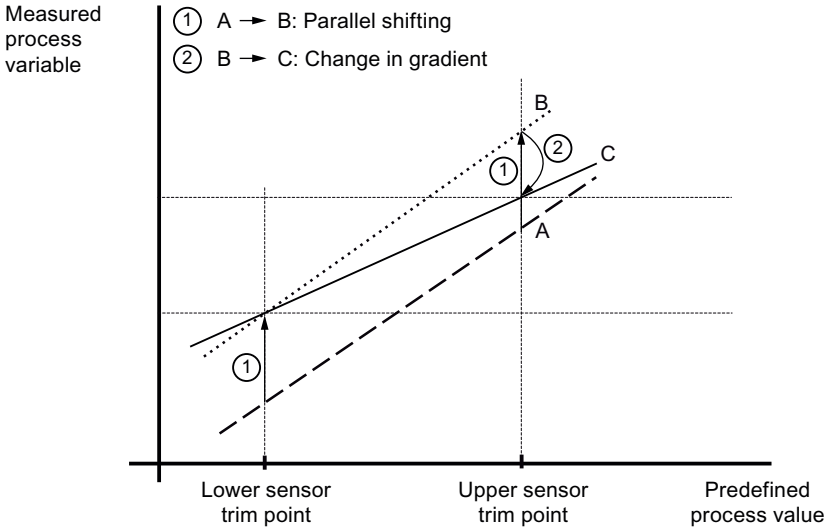
The acceptance of this process value is represented by an offset shift to the characteristic curve, see B in the "Sensor calibration" diagram.

Trimming the upper sensor trim point

With this function:

- You apply the process variable, e.g. temperature or resistance - on which the upper sensor calibration should be performed - to the transmitter input.
- You can use the operating software to instruct the transmitter to accept this process value.

The acceptance of this process value is represented by a gradient correction to the characteristic curve, see C in the "Sensor calibration" diagram. The lower sensor trim point is not affected by this.



A Output curve

B Characteristic curve after lower sensor calibration

C Characteristic curve after upper sensor calibration

Figure 9-2 Sensor calibration

Note

If any of the following device parameters is changed by re-parameterization, a double point sensor calibration of SITRANS TH200/TH300 performed specifically for a customer is automatically reset:

- Sensor class
- Sensor type
- Interface
- Sensor connection
- Sensor factor

A double point sensor calibration performed by the user is also reset if the device is restored to its factory settings.

The sensor calibration can be performed both for measurement channel 1 and for measurement channel 2 in the differentiation or averaging interface type.

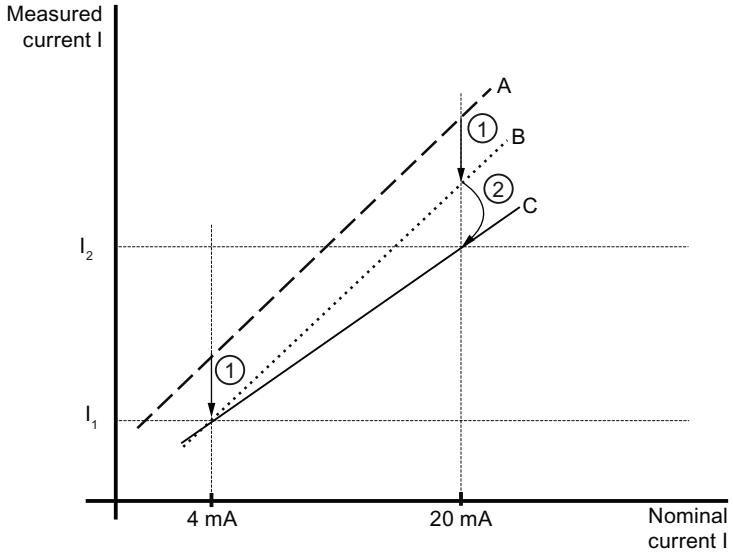
9.14 Current sensor calibration (digital-to-analog trim)

9.14.1 Function

This function allows you to calibrate the current output by the transmitter regardless of the sensor circuit. This function allows compensation of inaccuracies in the process chain downstream from the transmitter. The trim can only be performed as follows:

- Device version 200: at 4 mA and at 16 mA
- Device version 300: at 4 mA and at 20 mA

The following figure shows the principle of trimming using the example of the 4 to 20 mA current output.



O Output characteristic
B Characteristic curve after current transmitter trim 4 mA
C Characteristic curve after current transmitter trim 20 mA
① A→B: Parallel offset
② B→C: Change in gradient

Figure 9-3 Current transmitter trim

See also

Application example: Current input calibration at 4 mA and 20 mA (Page 54)

9.14.2 Application example: Current input calibration at 4 mA and 20 mA

NOTICE
The multimeter used must have a higher accuracy class than the transmitter.

Trim at 4 mA (offset correction)

1. Use the menu item D/A trim to assign 4 mA output to the transmitter.
2. Read the measured value at the ammeter.
3. Enter the measured current value using the operating software.
   The transmitter uses this value for offset correction of the current.

Trim at 20 mA (gradient correction)

1. Use the menu item D/A trim to assign 20 mA output to the transmitter.
2. Read the measured value at the ammeter.
3. Enter the measured current value using the operating software.
   The transmitter uses this value for gradient correction of the current.
   The value for 4 mA is not affected by this.

9.15 Special characteristic curve

The transmitter makes it possible to connect sensors to the device. Sensor characteristic curves valid for a large number of sensors are already programmed in the device.

Nevertheless, there are sensors, e.g. Cu100, for which this device does not offer sensor linearization as standard. In this case, however, it is possible to store a customer-specific special characteristic curve in the device. The sensor characteristic curve is then corrected by scaling the measured value output.

The transmitter requires pairs of values (x-values, y-values) for customer-specific characteristic curve correction. These pairs of values form sampling points and the output characteristic curve is generated in between these points by linear interpolation from the input characteristic curve. The maximum number of sampling points is restricted to 30 pairs of values. The individual pairs of values are entered as a percentage of the set measuring span.

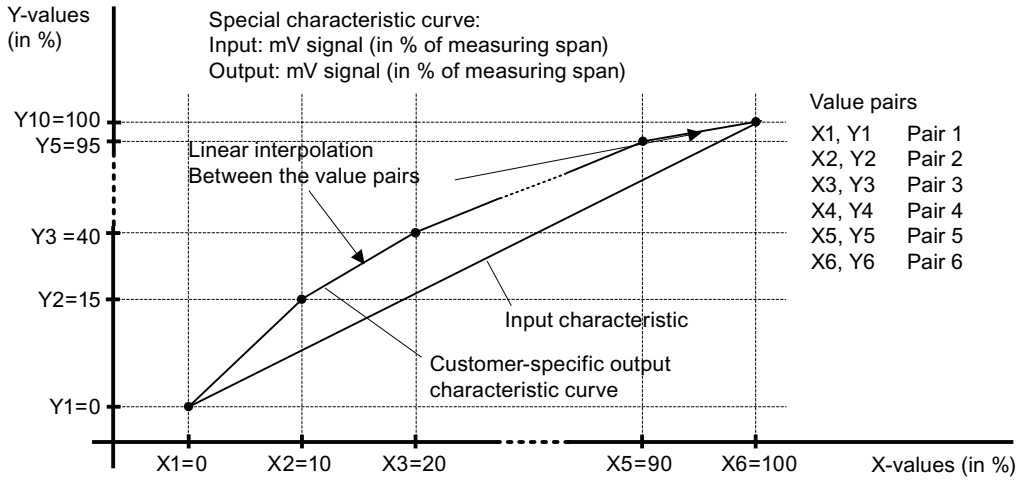


Figure 9-4 Principle of customer-specific characteristic curve correction

Notes on parameter assignment

Be sure to observe the following notes when assigning the parameters for the customer-specific special characteristic curve. These notes are irrespective of the parameter assignment software and apply to both device versions of the transmitter.

- The starting point of the characteristic curve correction is:
  - The resistance-type transmitter sensor class for the required special resistance thermometer;
  - The mV transmitter sensor class for the required special thermocouple.

  The sensor characteristic curve of the resistance-type transmitter or mV transmitter form the basis (0 to 100%) for the following characteristic curve correction.
- The individual pairs of values must always be specified in the unit % of the set measuring span.
- The first pair of values is always (X = 0 %; Y = 0 %). The last pair of values is always (X=100 %; Y=100 %). The first and last pairs of values are specified by the parameter assignment software and cannot be changed. If a correction of the first and last pair of values is required, this is only possible by means of a two point trim of the sensor.
- The x-values must rise monotonously when the characteristic curve is input, the y-values must rise or fall monotonously.
- The x-values do not have to be input in equidistant intervals.

Example

The transmitter is used for measuring a customer-specific thermocouple. The thermocouple supplies the following mV signals in this case:

- At the start of scale value: - 10 mV (equals -100 °C)
- At full scale value: 40 mV (equals +400 °C)

Proceed as follows

Note

It may be necessary to perform a sensor calibration at the start of scale value (-10 mV) and full scale value (40 mV) before the sensor characteristic is recorded and the correction values have been entered.

1. The mV transmitter sensor class is selected using the parameter assignment software SIPROM T or SIMATIC PDM.
2. Characteristic curve correction of the thermocouple should be performed across 6 pairs of values. The type of cold junction compensation is a fixed value = 0 °C.
3. Parameter entries

Sensor signal at transmitter input	Characteristic curve pair			Measured value [i] after characteristic curve correction
	Pair of values	X[i]	Y[i]	
-10 mV	i = 1	0 %	0 %	-100 °C
-5 mV	i = 2	10 %	15 %	-25 °C
0 mV	i = 3	20 %	20 %	0 °C
15 mV	i = 4	50 %	55 %	175 °C
35 mV	i = 5	90 %	95 %	375 °C
40 mV	i = 6	100 %	100 %	400 °C

Example for a parameter

Determining the pairs of values X[i] and Y[i] using, as an example, the pair of values i = 3 is explained below.

Calculation X[i=3]

$$\underline{\underline{X[3] =}} \frac{\text{Sensor signal [mV] - start of scale value [mV]}}{\text{Full scale value [mV] - start of scale value [mV]}} \cdot 100\% = \frac{\text{0 mV - (-10 mV)}}{\text{40 mV - (-10 mV)}} \cdot 100\% = \underline{\underline{20\%}}$$

The characteristic curve parameter X[3] = 0 mV corresponds with 20 % as a percentage in relation to
start of scale value = - 10 mV and full scale value = 40 mV.

Calculation Y[i=3]

$$\underline{\underline{Y[3] =}} \frac{\text{Temperature value [°C] - start of scale value [°C]}}{\text{Full scale value [°C] - start of scale value [°C]}} \cdot 100\% = \frac{\text{0°C - (-100°C)}}{\text{400°C - (-100°C)}} \cdot 100\% = \underline{\underline{20\%}}$$

The following pair of values must be transferred to the parameter assignment software for the characteristic curve correction of the pair of values i = 3: X[3] = 20 % and Y[3] = 20 %.

9.16 Factory parameters

Using the menu command **Device → Factory trim → Reset factory settings**, the configuration of the transmitter is reset to its default values.

Note

Factory reset

- The menu command **Device → Factory trim → Reset factory settings** always resets the parameters of the transmitter to the default values in the table listed below.
- This factory reset has the same effect for "devices supplied ex stock" or "devices set customer-specifically".
- Furthermore, resetting the transmitter to its default values also resets a customer-specific digital-to-analog converter trim and sensor calibration (one point trim or two point trim).

Once a factory reset has been performed, the transmitter has the following configuration:

Parameter	Reset to value
DAY	Is not reset
Description	Is not reset
Message	Is not reset
Serial number	Is not reset
Installation date (electronics)	Is not reset
Sensor class	Resistance thermometer
Sensor type	Pt100 DIN IEC 751
Interface	Standard connection
Sensor connection	Three-wire input
Sensor factor	1.00
Sensor offset 1	0.00 °C
Start of scale value	0 °C
Full scale value	100 °C
Unit	°C
Break monitoring	ON
Short circuit monitoring	ON
Short circuit limit	10 Ω
Lower end point analog output	Is not reset
Upper end point analog output	Is not reset
Alarm value	Is not reset
Linearization type	Linear to temperature
Attenuation	0.00 s
Runtime meters PV	Are all reset to 0 h

Parameter	Reset to value
Runtime meters, field device	Are not reset
Min/max pointers PV	Are all reset to 0
Min/max pointers for electronics temperature	Are not reset
Manufacturer data sensor	Are not reset

9.17 Diagnostics

9.17.1 Diagnostic functions

The diagnostic concept of the SITRANS TH200 and the SITRANS TH300 envisages that a diagnostic warning can be set in the parameters for diagnostic functions that are used for monitoring limit values. A diagnostic interrupt can be set in the parameters for diagnostic functions that are used for monitoring error conditions.

Diagnostics interrupts

Diagnostics interrupts can be output via:

- Analog output
- Operating indicator (LED)
- Only in SITRANS TH300: HART communication

The device goes into the alarm current state. In addition, the diagnostic event is made available via the operating software. The following table summarizes all the diagnostic functions that can be set in the parameters. If multiple errors occur simultaneously, the priority settings apply. Priority 1 is the highest priority.

Diagnostic function	Priority	HART [1]	Analog output	LED
Hardware/firmware defect				
RAM/ROM error	1	Status	On alarm value	Red
Flash/EEPROM error	1	Status	On alarm value	Red
Watchdog error	1	Status	On alarm value	Red
Electronics defect (hardware/firmware)	1	Status	On alarm value	Red
Electronics temperature outside limit [2]	1	Status	On alarm value	Red
Undershoot of min. supply voltage	1	-	< 3.6 mA	Red
Sensor error				
Sensor breakage	2	Status	On alarm value	Red 2 Hz
Sensor short circuit	2	Status	On alarm value	Red 2 Hz
Measured value (PV) outside the sensor limit [3]	2	Status	On alarm value	Red 2 Hz

1) Only in TH300

2) A diagnostics interrupt is not triggered unless the measured value is higher or lower than the limit value by 3 °C (5.40 °F).

3) A diagnostics warning is triggered immediately when the measured value exceeds the limit value. The diagnostic interrupt is triggered in any case if the limit value is exceeded by more than 2%.

Diagnostics warnings

Diagnostics warnings can be output via:

- Only in SITRANS TH300: HART communication

The device transmits the diagnostics event that has occurred via the operating software. The analog output value is unchanged.

Diagnostics function	Priority	HART [1]	Analog output	LED
Measured value out of the measuring range		Status	Unchanged	Green
Output saturation warning		Status	Unchanged	Green
Measured value (PV) outside the sensor limit		Status	Unchanged	Green
Electronics temperature outside the limit		Status	Unchanged	Green

[1] Only in TH300

9.17.2 Violations of specification

⚠ WARNING

Non-observance of Ex ambient conditions

If the device has been operated outside the ambient conditions specified for potentially explosive atmospheres, you may no longer operate the device in potentially explosive atmospheres.

Additionally make sure to permanently mask all Ex markings on the nameplate.

⚠ CAUTION

Operation outside the permissible temperature limits

If you use the transmitter outside the permissible temperature limits, it no longer corresponds to the specification. The transmitter then outputs the parameterized fault current.
The message "Ambient temperature error/electronics temperature error" remains set in the device even after the power supply has been switched off and on again.

Operate the transmitter within the permissible temperature limits again, and reset the message "Ambient temperature error/electronics temperature error".

Reset

If you have guaranteed by means of sensor and D/A trimming that the transmitter is working with a tolerable accuracy, you can reset the transmitter.

Use the software tool SIPROM T or SIMATIC PDM to carry out the reset:

- SIPROM T menu item for SITRANS TR200:
  Device ➞ **Device status** ➞ Device reset after ambient temperature error
- SIMATIC PDM menu item for SITRANS TR300:
  View ➞ **Device status** ➞ Device reset after ambient temperature error

Note

Incorrect configuration

The configuration will not be completely stored in the device if the supply voltage fails during a write operation to the device. The diagnostic bit "HW/FW error" is set via HART.

Faulty or incomplete configurations are signaled by continuous lighting-up of the red diagnostics LED on the device.

Repeat the loading procedure for the configuration. The device will then revert to working in accordance with the specifications.

9.18 Runtime meters in temperature classes

The SITRANS TH200 and the SITRANS TH300 offer various runtime meters. Runtime meters are used to monitor the connected process sequence.

1. Runtime meter for transmitter electronics

- Monitors the number of operating hours during which the transmitter remained in continuous operation, depending on the ambient temperature.
- The operating hours sequence of the transmitter is recorded in 9 ambient temperature ranges.
- Starts with the first commissioning at the factory.
- Runtime meter and temperature ranges cannot be reset or set by the user.
- The runtime meter is only updated if the device is in measuring mode. The runtime meter is not updated in simulation mode.

2. Runtime meter for process variable

- Monitors the sequence of the sensor connected to the transmitter in various process areas.
- The operating hours sequence of the process variable is recorded in 9 ranges. It is subdivided according to the connected sensor and its sensor limits. The user cannot set the ranges.
- The runtime meter is automatically reset if one of the following parameters is changed in the device:
  - Sensor class
  - Sensor type
  - Interface
  - Sensor connection
  - Sensor factor

The runtime meters can be read out using the parameterization software SIPROM T for SITRANS TH200 or SIMATIC PDM or HART communicator for SITRANS TH300. The runtime meters are automatically stored in the non-volatile memory once every hour. All runtime meters are available again after the next restart if the device is disconnected from its supply voltage.

9.19 Slave pointer

This device offers a total of two min/max pointer pairs by means of which the following measured variables can be monitored for the lowest and highest values:

- Min/max pointer pair for measured value (e.g. temperature differential T1-T2 with two resistance thermometers in a differential circuit)
- Min/max pointer pair for electronics temperature (cannot be reset)

Resetting the min/max pointer is only possible for the measured value. A reset is performed:

- At the user's request
- Automatically when any of the following parameters is changed in the device:
  - Sensor class
  - Sensor type
  - Interface
  - Sensor connection
  - Sensor factor

9.20 Simulation (only in SITRANS TH300)

The "Simulation" diagnostic function makes it possible to receive and process (quasi) measured data without a process value at the device. In this way, individual process sequences are run through in "cold" status to enable process statuses to be simulated. Furthermore, applying simulation values enables you to check the cable routing for the analog output.

The value to be simulated can be provided as a fixed value or in the form of a ramp function. The following simulations are possible for the measurement input and analog output:

- **Measurement input:**
  - Fixed value simulation or ramp simulation for primary process variable
  - Fixed value simulation or ramp simulation for electronics temperature
- **Measurement output:**
  - Fixed value simulation of the analog output

The simulation of the primary process variable, electronics temperature, and analog output is handled in the same way in terms of parameter assignment and function. For this reason, the following will only deal with the general simulation procedures "Fixed value" and "Ramp function", taking the example of the measurement input.

For reasons of safety, all simulation data is held only in the user memory. This means that when the device is restarted, any simulation that may be active will be shut down.

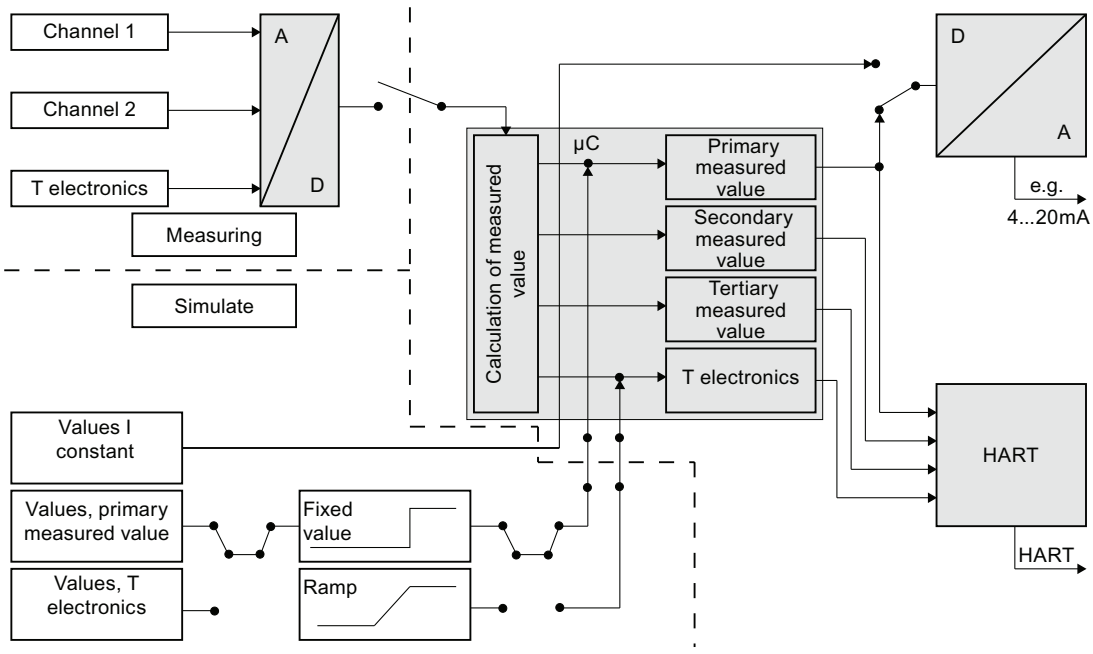


Figure 9-5 Block diagram of simulation

Simulation measurement input

Note

Simulation

- While simulation is activated, the transmitter will not react to changes in the sensor input signals.
- If the internal electronics temperature is to be simulated, the device parameters are not allowed to be set to "Thermocouple with internal cold junction compensation" for this purpose. In this case, the internal electronics temperature is a measured variable and cannot be replaced by a simulation value.

- Simulation as fixed value

  You can assign fixed simulation values in the parameters for both simulation paths (primary measured value and electronics temperature) by taking the physical unit into account. The analog output adopts a value according to the specification for the primary measured value.

- Simulation with a periodic ramp function

  As well as the adjustable fixed values, you can also assign a periodically recurring ramp function in the parameters for both simulation paths. Adjustable start-of-scale and full-scale values together determine the limits between which the simulation values move with a rising or falling tendency. You can calculate the step width with the step number, which is also adjustable.

  $$\text{Step width} = \frac{\text{Upper value} - \text{lower value}}{\text{Increment}}$$

  The duration between two successive simulation values is defined by the step duration. The analog output follows the simulated values in the simulation for the primary measured value.

9.21 Individual password protection (only in SITRANS TH300)

Description

The individual password protection prevents unauthorized write access to the device.

Note

Password protection

- Change the default password immediately after commissioning the device. You will then prevent write access to the device by unauthorized persons.
- Store your new password in a secure location.
- Consult the Siemens contact person in your region to receive your "super pin".
- When you activate the password protection in the device, write protection will be set automatically after the device has been switched on.

In the condition of goods delivered, every transmitter is set with the default password **2457**. Password protection is deactivated. If you reset the transmitter to the factory setting, the current password will not be reset to the default password. Should you no longer know your password, then the data in the device can only be altered using a "super pin", therefore not using the default password. The super pin can be obtained from your regional Siemens contact person.

Procedure for writing data in a password protected device

1. Select the "Deactivate password protection" menu in the parameterization software.
2. Enter your 4-digit password. Password protection is deactivated.
3. Change the values according to your application.
4. Select the "Activate password protection" menu in the parameterization software. The device is write protected again.

Service and maintenance

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The transmitter is maintenance-free.

Technical data

11

11.1 Technical data

Input point

Resistance thermometer input point	
Measured variable	Temperature
Sensor type	
• According to IEC 60751	Pt25 ... Pt1000
• According to JIS C 1604; a=0.00392 K^{-1}	Pt25 ... Pt1000
• According to IEC 60751	Ni25 ... Ni1000
• Special type	Via special characteristic curve (max. 30 points)
Sensor factor	0.25 ... 10 (adaptation of the basic type, e.g. Pt100, to version Pt25 ... Pt1000)
Units of measurement	°C or °F
Interface	
• Standard connection	1 resistance thermometer (RTD) in two-wire, three-wire or four-wire input
• Averaging	2 equal resistance thermometers in two-wire input for averaging the temperature
• Differentiation	2 equal resistance thermometers (RTD) in two-wire input (RTD 1 - RTD 2 or RTD 2 - RTD 1)
Connection	
• Two-wire input	Line resistance can be assigned in the parameters ≤100 Ω (loop resistance)
• Three-wire input	No trim necessary [1)]
• Four-wire input	No trim necessary
Sensor current	≤ 0.45 mA
Measuring cycle	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Always active (cannot be switched off)
Short circuit monitoring	Can be switched on/off (default value = ON)
Measuring range	Can be set in the parameters (see table in chapter Digital measuring error (Page 78))
Min. measuring span	10 °C (18 °F)
Characteristic curve	Linear to temperature or special characteristic curve

1) Prerequisites: same resistance for all three lines.

Resistance-type transmitter input point	
Measured variable	Ohmic resistance
Sensor type	Resistance, potentiometer
Units of measurement	Ω
Interface	
• Standard connection	1 resistance-type transmitter (R) in two-wire, three-wire or four-wire input
• Averaging	2 resistance-type transmitters in two-wire input for averaging
• Differentiation	2 resistance-type transmitters in two-wire input (R1 - R2 or R2 - R1)
Connection	
• Two-wire input	Line resistance can be assigned in the parameters ≤100 Ω (loop resistance)
• Three-wire input	No trim necessary [1)]
• Four-wire input	No trim necessary
Sensor current	≤ 0.45 mA
Measuring cycle	≤ 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	Setting range max. 0 ... 2200 Ω (see table in chapter Digital measuring error (Page 78))
Min. measuring span	5 ... 25 Ω (see table in chapter Digital measuring error (Page 78))
Characteristic curve	Linear to resistance or special characteristic curve

[1)] Prerequisites: same resistance for all three lines.

Thermocouples' input point	
Measured variable	Temperature
Sensor type (thermo pairs)	
• Type B	Pt30Rh-Pt6Rh according to DIN IEC 584
• Type C	W5%-Re according to ASTM 988
• Type D	W3%-Re according to ASTM 998
• Type E	NiCr-CuNi according to DIN IEC 584
• Type J	Fe-CuNi according to DIN IEC 584
• Type K	NiCr-Ni according to DIN IEC 584
• Type L	Fe-CuNi according to DIN 43710
• Type N	NiCrSi-NiSi according to DIN IEC 584
• Type R	Pt13Rh-Pt according to DIN IEC 584
• Type S	Pt10Rh-Pt according to DIN IEC 584
• Type T	Cu-CuNi according to DIN IEC 584
• Type U	Cu-CuNi according to DIN 43710
Units of measurement	°C or °F
Interface	
• Standard connection	1 thermocouple (TC)
• Averaging	2 equal thermocouples (TC)
• Differentiation	2 equal thermocouples (TC) (TC1 - TC2 or TC2 - TC1)
Measuring cycle	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Can be switched off
Cold junction compensation	
• Internal	With integrated resistance thermometer Pt100
• External	With external Pt100 IEC 60751 (two-wire or three-wire connection)
• External fixed	Cold junction temperature can be set as fixed value
Measuring range	Can be set in the parameters
Min. measuring span	Min. 40 ... 100 °C (72 ... 180 °F) (see table in chapter Digital measuring error (Page 78))
Characteristic curve	Linear to temperature or special characteristic curve

Millivolt transmitter input point	
Measured variable	DC voltage
Sensor type	DC voltage source (DC voltage source is possible via a resistor that is connected externally)
Units of measurement	mV
Measuring cycle	≤ 250 ms for 1 sensor with break monitoring
Break monitoring	Can be switched off
Measuring range	Setting range max. -100 ... 1100 mV
Min. measuring span	2 mV or 20 mV
Overload capacity of the input point	-1.5 ... 3.5 V DC
Input resistance	≥ 1 MΩ
Characteristic curve	Linear to voltage or special characteristic curve

Output

Output signal	4 ... 20 mA, two-wire line With SITRANS TH300, additionally with communication according to HART rev. 5.9
Auxiliary power supply	11 ... 35 V DC (to 30 V with Ex ia and ib; to 32 V with Ex nA / nL / ic)
Max. load	(U_{aux} -11 V)/0.023 A
Overrange	3.6 mA ... 23 mA continuously adjustable (default range: 3.80 mA to 20.50 mA)
Error signal (e.g. in case of sensor failure)	3.6 mA ... 23 mA continuously adjustable (default value: 22.8 mA)
Setting time:	
• Dead time	< 360 ms
• T63 (without electrical attenuation, without dead time)	< 260 ms
Attenuation	Software filter 1st order 0 ... 30 s (can be set in the parameters)
Protection	Against reverse polarity
Galvanic isolation	Input to output 1.5 kV DC (1.0 kV AC)

Measuring accuracy

The digital accuracy is the accuracy following analog-to-digital conversion including linearization and measured value calculation.

The 4 to 20 mA output current is subject to an additional error arising from the digital-to-analog conversion. This error is called a digital-to-analog error.

The overall error on the analog output under reference conditions is the total of the digital error and the digital-to-analog error. Where applicable, plus the cold junction error in the case of thermocouple measurements.

Measuring accuracy	
Reference conditions	
• Auxiliary power supply	24 V ±1 %
• Load	500 Ω
• Ambient temperature	23 °C
• Interfering fields	None
• Heat-up time	> 5 min
Digital measuring error	See table in chapter Digital measuring error (Page 78)
Analog output error (digital-to-analog error)	< 0.025 % of the output current span (16 mA)
Fault due to internal cold junction	< 0.5 °C (0.9 °F)
Ambient temperature influence	
• Analog measuring error	0.02 % of the output current span (16 mA)/ 10 °C (18 °F)
• Digital measuring error	
In resistance thermometers	0.06 °C (0.108 °F)/10 °C (18 °F)
In thermocouples	0.6 °C (1.08 °F)/10 °C (18 °F)
Influence of the auxiliary power supply	< 0.001 % of the output current span (16 mA)/V
Influence of load	< 0.002 % of the output current span (16 mA)/ 100 Ω
Long-term drift (start of scale value, measuring span)	• < 0.02 % of the measuring span in the first month • < 0.2 % of the measuring span after one year • < 0.3 % of the measuring span after five years

Rated conditions

Rated conditions	
Ambient conditions	
Ambient temperature	-40 ... +85 °C (-40 ... +185 °F)
Storage temperature	-40 ... +85 °C (-40 ... +185 °F)
Relative humidity	≤ 98 %, condensing
Electromagnetic compatibility	According to DIN EN 61326 and NAMUR recommendation NE21 See also Certificates / EC declaration of conformity (Page 85)
Errors under EMC influence [1)]	< 0.10 % of the measuring span

[1)] When assembled on a DIN rail, deviations <0.5% of the span may occur with radiated electromagnetic fields in accordance with EN 61000-4-3.

Construction

Construction	
Material	Plastic, potted
Weight	50 g (0.11 lb)
Dimensions	See chapter Dimension drawings (Page 81)
Cross section of the connecting cables	Max. 2.5 mm^2 (AWG 13)
Degree of protection according to IEC 60529	
• Housing	IP40
• Terminals	IP00

Certificates and approvals

Certificates and approvals	
Explosion protection ATEX and further approval authorities	
Only the technical data listed in the certificates, e.g. PTB 05 ATEX 2040 X, applies to applications in hazardous areas.	
"Intrinsic safety" type of protection	• II 1 G Ex ia IIC T6/T4 Ga • II (1) 2 G Ex ib [ia Ga] IIC T6/T4 Gb • II (1) 3 G Ex ic [ia Ga] IIC T6/T4 Gc • II 3 G Ex ic IIC T6/T4 Gc • II 1 D Ex ia IIIC T115°C Da
"Non-sparking resources" protection type	• II 3 G Ex nA IIC T6/T4 Gc • II 3 G Ex nA [ic] IIC T6/T4 Gc
Protection against explosion according to FM for USA	
Electrical data, operating conditions and installation instructions for operation in hazardous areas can be found in the FM Certificate of Compliance no. 3024169 as well as in the associated control drawing A5E02323665B.	
	• 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
Protection against explosion according to FM for Canada (cFMus)	
Electrical data, operating conditions and installation instructions for operation in hazardous areas can be found in the FM Certificate of Compliance no. 3024169C as well as in the associated control drawing A5E02323665B.	
	• 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

Factory setting

Factory setting	
Pt100 (IEC 751)	In three-wire input
Measuring range	0 ... 100 °C (32 ... 212 °F)
Fault current	22.8 mA
Sensor offset	0 °C (0 °F)
Attenuation	0.0 s

11.2 Digital measuring error

Digital measuring errors for resistance thermometers

Input point	Measuring range in °C (°F)	Minimum measuring span in °C (°F)	Digital accuracy in °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		10 (18)	
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)
Ni25 ... Ni1000	-60 ... +250 (-76 ... +482)	10 (18)	0,1 (0.18)

Digital measuring errors for resistance-type transmitters

Input point	Measuring range [Ω]	Minimum span in [Ω]	Digital accuracy [Ω]
Resistance	0 ... 390	5	0,05
Resistance	0 ... 2200	25	0,25

Digital measuring errors for thermocouples

Input point	Measuring range in °C (°F)	Minimum measuring span in °C (°F)	Digital accuracy in °C (°F)
Type B	+100 ... +1820 (212 ... 3308)	100 (180)	2 (3.6)
Type C (W5)	0 ... +2300 (32 ... 4172)	100 (180)	2 (3.6)
Type D (W3)	0 ... +2300 (32 ... 4172)	100 (180)	2 (3.6)
Type E	-200 ... +1000 (-328 ... +1832)	50 (90)	1 (1.8)
Type J	-210 ... +1200 (-346 ... +2192)	50 (90)	1 (1.8)
Type K	-230 ... +1370 (-382 ... +2498)	50 (90)	1 (1.8)
Type L	-200 ... +900 (-328 ... +1652)	50 (90)	1 (1.8)
Type N	-200 ... +1300 (-328 ... +2372)	50 (90)	1 (1.8)
Type R	-50 ... +1760 (-58 ... +3200)	100 (180)	2 (3.6)
Type S	-50 ... +1760 (-58 ... +3200)	100 (180)	2 (3.6)
Type T	-200 ... +400 (-328 ... +752)	40 (72)	1 (1.8)
Type U	-200 ... +600 (-328 ... +1112)	50 (90)	2 (3.6)

Digital measuring errors for millivolt transmitters

Input point	Measuring range in mV	Minimum measuring span in mV	Digital accuracy in µV
Millivolt transmitter	-10 ... +70	2	40
Millivolt transmitter	-100 ... +1100	20	400

Dimension drawings

12

12.1 Dimension drawing for SITRANS TH200/TH300

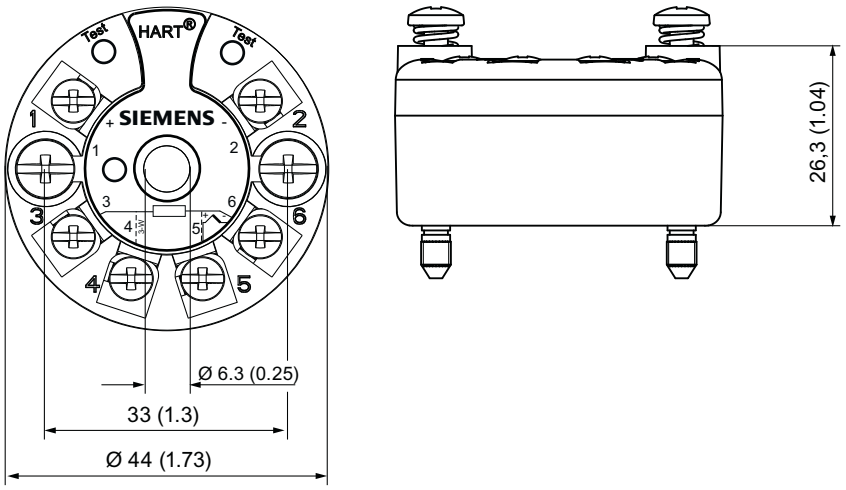


Figure 12-1 SITRANS TH200/TH300, dimensions in mm (inch)

12.2 Dimension drawing for the DIN rail adapter

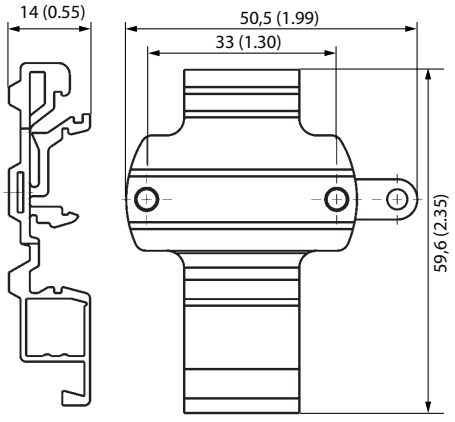


Figure 12-2 Dimensions of the DIN rail adapter (7NG3092-8KA)

Spare parts and accessories

13

Designation	Order number
Temperature transmitter SITRANS TH200 for installation in the connection head type B (DIN 43729), two-wire technology 4 to 20 mA, programmable, with galvanic isolation	
• Without protection against explosion	7NG3211-1NN00 [1]
• With protection against explosion according to: – ATEX and further approval authorities – FM ($_c$FM$_{US}$)	7NG3211-1AN00 [1] 7NG3211-1BN00 [1]
Temperature transmitter SITRANS TH300 for installation in the connection head type B (DIN 43729), two-wire technology 4 to 20 mA, communications capability according to HART Rev. 5.9, with electrical isolation	
• Without protection against explosion	7NG3212-0NN00 [1]
• With protection against explosion according to: – ATEX and further approval authorities – FM ($_c$FM$_{US}$)	7NG3212-0AN00 [1] 7NG3212-0BN00 [1]

Additional specifications Complete order no. with "-Z", add abbreviated specification	Abbreviated specification
Adjust operational data as desired (operational data should be described in plain text)	Y01
With test report (five measurement points)	C11
SIL 2 (functional safety)	C20

Designation	Order number
Modem for SITRANS TH100, TH200 and TR200, including SIPROM T parameterization software	
• With USB connection	7NG3092-8KU [1]
CD for temperature measuring instruments containing documentation in German, English, French, Spanish, Italian, Portuguese and the parameterization software **SIPROM T**	A5E00364512 [1]
HART modem	
• With RS232 serial port	7MF4997-1DA [1]
• With USB port	7MF4997-1DB [1]
DIN rail adapter **(packing unit = 5 pcs.)**	7NG3092-8KA [1]

[1] Can be supplied ex stock.

Appendix

A

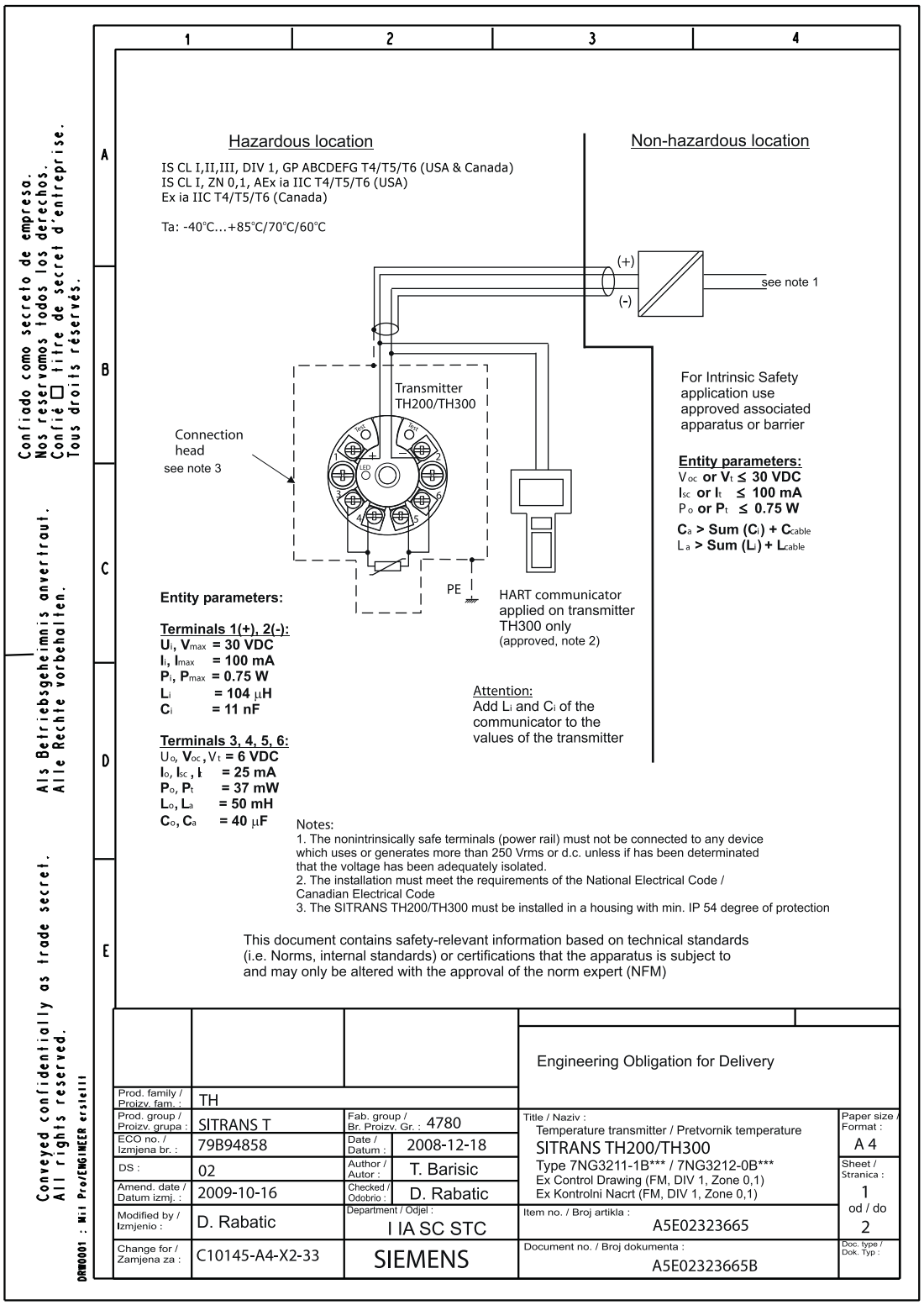
A.1 Certificates / EC declaration of conformity

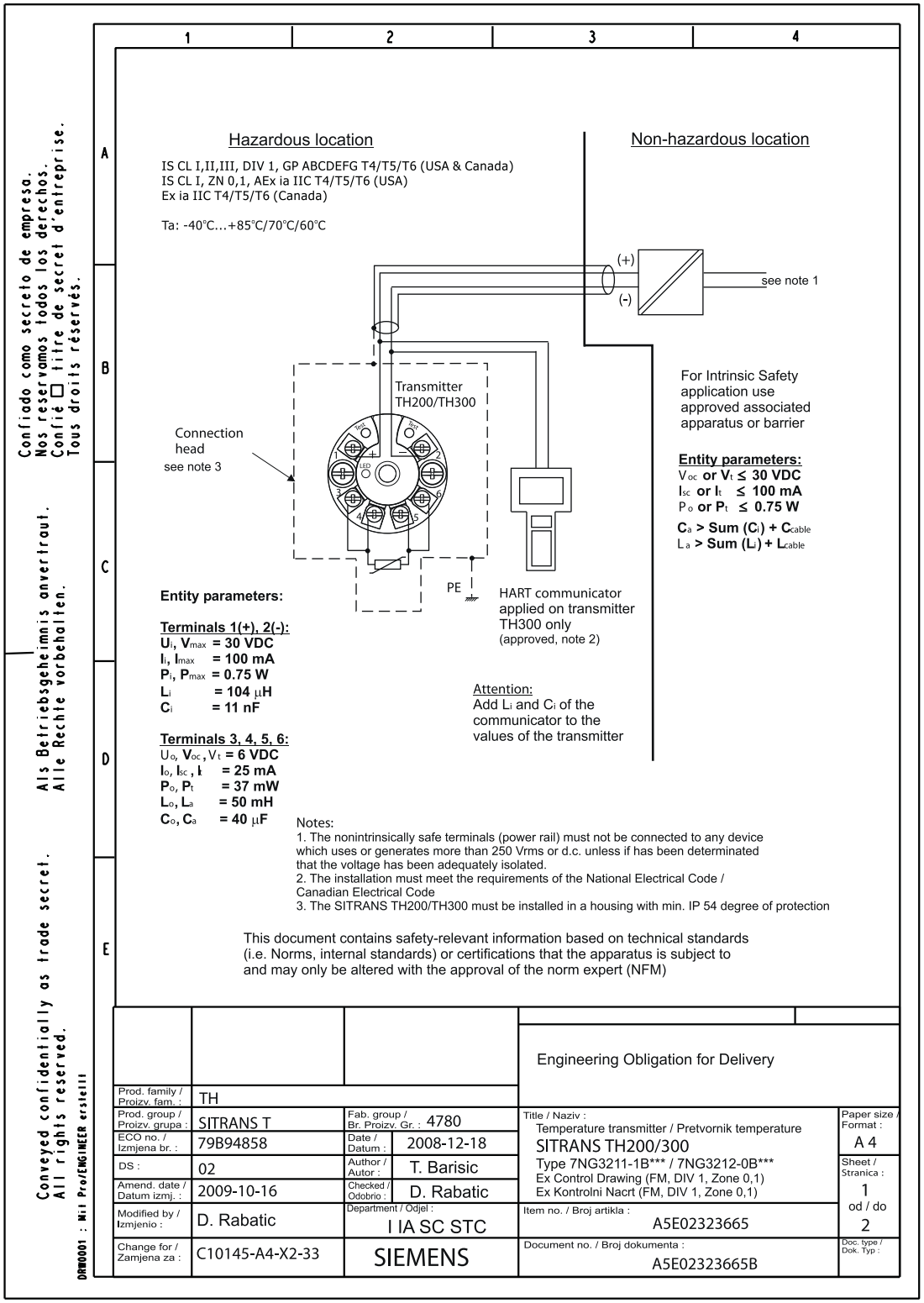
You can find the certificates and the EC declaration of conformity on the "sitrans t - temperature transmitters" CD (available separately, Order No. A5E00364512), and on the Internet.

See also

Certificates (http://www.siemens.com/processinstrumentation/certificates)

A.2 Control drawing




Hazardous location
IS CL I,II,III, DIV 1, GP ABCDEFG T4/T5/T6 (USA & Canada)
IS CL I, ZN 0,1, AEx ia IIC T4/T5/T6 (USA)
Ex ia IIC T4/T5/T6 (Canada)
Ta: -40°C...+85°C/70°C/60°C
Non-hazardous location
(+)
(-)
see note 1
Transmitter TH200/TH300
Connection head
see note 3
For Intrinsic Safety application use approved associated apparatus or barrier
Entity parameters:
Voc or Vt ≤ 30 VDC
Isc or It ≤ 100 mA
Po or Pt ≤ 0.75 W
Ca > Sum (Ci) + Ccable
La > Sum (Li) + Lcable
Entity parameters:
Terminals 1(+), 2(-):
Ui, Vmax = 30 VDC
Ii, Imax = 100 mA
Pi, Pmax = 0.75 W
Li = 104 µH
Ci = 11 nF
Terminals 3, 4, 5, 6:
Uo, Voc, Vt = 6 VDC
Io, Isc, It = 25 mA
Po, Pt = 37 mW
Lo, La = 50 mH
Co, Ca = 40 µF
PE
HART communicator applied on transmitter TH300 only (approved, note 2)
Attention:
Add Li and Ci of the communicator to the values of the transmitter
Notes:
1. The nonintrinsically safe terminals (power rail) must not be connected to any device which uses or generates more than 250 Vrms or d.c. unless if has been determinated that the voltage has been adequately isolated.
2. The installation must meet the requirements of the National Electrical Code / Canadian Electrical Code
3. The SITRANS TH200/TH300 must be installed in a housing with min. IP 54 degree of protection
This document contains safety-relevant information based on technical standards (i.e. Norms, internal standards) or certifications that the apparatus is subject to and may only be altered with the approval of the norm expert (NFM)
Engineering Obligation for Delivery
Prod. family / Proizv. fam. : TH
Prod. group / Proizv. grupa : SITRANS T
Fab. group / Br. Proizv. Gr. : 4780
ECO no. / Izmjena br. : 79B94858
Date / Datum : 2008-12-18
DS : 02
Author / Autor : T. Barisic
Amend. date / Datum izmj. : 2009-10-16
Checked / Odobrio : D. Rabatic
Modified by / Izmjenio : D. Rabatic
Department / Odjel : I IA SC STC
Change for / Zamjena za : C10145-A4-X2-33
SIEMENS
Title / Naziv : Temperature transmitter / Pretvornik temperature
SITRANS TH200/300
Type 7NG3211-1B*** / 7NG3212-0B***
Ex Control Drawing (FM, DIV 1, Zone 0,1)
Ex Kontrolni Nacrt (FM, DIV 1, Zone 0,1)
Item no. / Broj artikla : A5E02323665
Document no. / Broj dokumenta : A5E02323665B
Paper size / Format : A 4
Sheet / Stranica : 1 od / do 2
Doc. type / Dok. Typ :
Conveyed confidentially as trade secret.
All rights reserved.
Als Betriebsgeheimnis anvertraut.
Alle Rechte vorbehalten.
Confiado como secreto de empresa.
Nos reservamos todos los derechos.
Confié □ titre de secret d'entreprise.
Tous droits réservés.
DRW0001 : Nil Pro/ENGINEER erstellt

A.3 Technical support

Technical Support

You can contact Technical Support for all IA and DT products:

- Via the Internet using the **Support Request:**
  Support request (http://www.siemens.com/automation/support-request)
- E-mail (mailto:support.automation@siemens.com)
- **Phone:** +49 (0) 911 895 7 222
- **Fax:** +49 (0) 911 895 7 223

Further information about our technical support is available in the Internet at
Technical Support (http://www.siemens.com/automation/csi/service)

Service & Support on the Internet

In addition to our documentation, we offer a comprehensive knowledge base online on the Internet at:

Services & Support (http://www.siemens.com/automation/service&support)

There you will find:

- The latest product information, FAQs, downloads, tips and tricks.
- Our newsletter, providing you with the latest information about your products.
- A Knowledge Manager to find the right documents for you.
- Our bulletin board, where users and specialists share their knowledge worldwide.
- You can find your local contact partner for Industry Automation and Drives Technologies in our partner database.
- Information about field service, repairs, spare parts and lots more under "Services."

Additional Support

Please contact your local Siemens representative and offices if you have any questions about the products described in this manual and do not find the right answers.

Find your contact partner at:

Partner (http://www.automation.siemens.com/partner)

A signpost to the documentation of the various products and systems is available at:

Instructions and Manuals (http://www.siemens.com/processinstrumentation/documentation)

List of abbreviations

B

B.1 Abbreviations

Abbreviation	Full term in English	Meaning
FIT	Failure in Time	Frequency of failure Number of faults withing 10^9 hours
HFT	Hardware Fault Tolerance	Hardware fault tolerance: Capability of a function unit to continue executing a required function in the presence of faults or deviations.
MooN	"M out of N" voting	Classification and description of the safety-instrumented system in terms of redundancy and the selection procedures used. A safety-instrumented system or part that consists of "N" independent channels. The channels are connected to each other in such a way that "M" channels are in each case sufficient for the device to perform the safety instrumented function. Example: Pressure measurement: 1oo2 architecture. A safety-instrumented system decides that a specified pressure limit has been exceeded if one out of two pressure sensors reaches this limit. In a 1oo1 architecture, there is only one pressure sensor.
MTBF	Mean Time Between Failures	Average period between two failures
MTTR	Mean Time To Restoration	Average period between the occurrence of a fault in a device or system and restoration of functionality
PFD	Probability of Failure on Demand	Probability of dangerous failures of a safety function on demand
PFD_{AVG}	Average Probability of Failure on Demand	Average probability of dangerous failures of a safety function on demand
SFF	Safe Failure Fraction	Proportion of safe failures: Proportion of failures without the potential to bring the safety-instrumented system into a dangerous or non-permissible functional status.
SIL	Safety Integrity Level	The international standard IEC 61508 defines four discrete Safety Integrity Levels (SIL 1 to SIL 4). Each level corresponds to a range of probability for failure of a safety function. The higher the Safety Integrity Level of the safety-instrumented system, the lower the probability that it will not execute the required safety functions.
SIS	Safety Instrumented System	A safety-instrumented system (SIS) executes the safety functions that are required to achieve or maintain a safe status in a system. It consists of a sensor, logic unit/control system and final controlling element.
TI	Test Interval	Testing interval of the protective function

Glossary

Analog

One variable, e.g. voltage which is infinitely adjustable, in contrast to "Digital".

ATEX

ATEX is an abbreviation of the French term "Atmosphère explosible" (potentially explosive atmosphere). ATEX stands for both EC directives in the area of explosion protection: ATEX product directive 94/9/EC and ATEX operating directive 1999/92/EC.

Auxiliary power supply

Auxiliary power supply is an electrical supply voltage or reference voltage, such as many electrical circuits require in addition to the standard power supply.
The auxiliary power supply is specially stabilized, has a specific level and polarity and/or has other properties that are important for correct operation of circuit components.

Auxiliary voltage

→ *Auxiliary power supply*

CE

Communautés **E**uropéenes: European communities

Dangerous failure

Failure with the potential to bring the safety-instrumented system into a dangerous or non-functional status.

DC

Direct **C**urrent: Direct Current

Digital

Representation of a variable, e.g. time, in the form of characters or numbers. In its digital representation, this variable can be changed only in pre-defined steps. In contrast to "Analog".

DIN

Deutsches **I**nstitut für **N**ormung e. V. - German institute for standardization

EC low-voltage directive

The EC low voltage directive applies to electrical resources with rated voltages of:

- AC from 50 V to 1000 V;
- DC from 75 V to 1500 V.

EEPROM

Electrically **E**rasable **P**rogrammable **R**ead **O**nly **M**emory

EEPROMs are often used where individual bytes of data (e.g. configuration data or runtime meters) change over time and must be stored safely in the event of a mains power failure.

EMC

Electro**m**agnetic **c**ompatibility

Definition in accordance with EMC law:

EMC is the capability of a device to operate satisfactorily in an electromagnetic environment without itself emitting electromagnetic signals which interfere with other devices in that environment.

EN

Europäische **N**orm - European standard

EU

European **C**ommunity

Fail-safe

The capability of a control to maintain the safe state of the controlled device, e.g. machine, process, or to bring the device to a safe state even when faults/failures occur.

Failure/Fault

Failure:
A resource is no longer capable of executing a required function.

Fault:
Undesired state of a resource indicated by the incapability of executing a required function.

Fault

→ *Failure/Fault*

Fault tolerance

Fault tolerance N means that a device can execute the intended task even when N faults exist. The device fails to execute the intended function in case of N+1 faults.

Final controlling element

Converter that converts electrical signals into mechanical or other non-electrical variables.

Firmware

Firmware (FW) is software which is embedded in a chip in electronic devices – unlike software that is stored on hard drives, CD ROMs, or other media. These days, firmware is mostly stored in a flash memory or EEPROM.

Firmware usually contains the elementary functions for controlling the device, as well as input and output routines.

Frequency shift keying

Frequency shift keying in a simple form of modulation in which the digital values 0 and 1 are represented by two different frequencies.

Frequency Shift Keying (FSK)

→ *Frequency shift keying*

HART

HART (Highway Addressable Remote Transducer) is a standardized, widely used communications system used to structure industrial fieldbuses. The communications system provides digital communications for multiple participants (field devices) via a common databus. HART is based especially on the equally widely used 4/20 mA standard for the transfer of analog sensor signals. The cabling from existing older systems can be used directly and both systems operated in parallel.

HART specifies several protocol levels in the OSI model. It facilitates the transfer of process and diagnostics data and control signals between field devices and high-level control systems. Standardized parameter sets can be used for the manufacture-independent operation of all HART devices.

Typical applications include transmitters for measuring mechanical and electrical dimensions.

IP

International **P**rotection = international degree of protection

Microcontroller

Microcontrollers (also written µControllers, µC, MCU) are single-chip computer systems which have virtually all their components - such as main processor, program memory, working memory and the input/output interfaces - accommodated on a single chip.

Non-volatile memory

→ *EEPROM*

Risk

The combination of probability of a damage occurring and its magnitude.

RS -232

RS: **R**ecommended **S**tandard

A recognized industry standard for serial data transfer. For cable lengths shorter than 15 m. No differential evaluation. Transmit and receive on different lines.

Safety function

Defined function executed by a safety-instrumented system with the objective of achieving or maintaining a safe system status taking into account a defined dangerous occurrence.

Example:
Limit pressure monitoring

Safety Instrumented Function

→ *SIF*

Safety Integrity Level

→ *SIL*

Safety-instrumented system

A safety-instrumented system executes the safety functions that are required to achieve or maintain a safe status in a system. It consists of a sensor, logic unit/control system and final controlling element.

Example:
A safety-instrumented system is made up of a pressure transmitter, a limit signal sensor and a control valve.

Sensor

Converter that converts mechanical or other non-electrical variables into electrical signals.

Sensor

In electrical engineering, a sensor is a component that can qualitatively measure not only specific physical or chemical properties (such as heat radiation, temperature, humidity, pressure, excess pressure, sound, brightness, magnetism, acceleration, force) as well as the physical condition of its surroundings or register them as quantitatively measured variables.

SIF

A part/function of a safety-instrumented system that reduces the risk of a dangerous failure occurring.

SIL

The international standard IEC 61508 defines four discrete Safety Integrity Levels (SIL) from SIL 1 to SIL 4. Each level corresponds to the probability range for the failure of a safety function. The higher the SIL of the safety-instrumented system, the higher probability that the required safety function will work.

The achievable SIL is determined by the following safety characteristics:

- Average probability of dangerous failure of a safety function in case of demand (PFD_{AVG})
- Hardware fault tolerance (HFT)
- Safe failure fractions (SFF)

USB

The Universal Serial Bus (USB) is a serial bus system for connecting a PC/laptop to external devices such as: modems.

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